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Topic:

Managing chaos effects in long-term economic forecasts by applying the example of financial forecasts and valuation

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Preface

Starting point for this dissertation was Prof. Dr. Grabinski's interdisciplinary research: In particular he strived to find out the underlying reasons why planned values of long-term forecasts and actual ones deviate often by significant margins, which are neither foreseeable nor replicable. To solve this task he introduced to the world of business and economics the concept of chaos (in the mathematical sense). He found out that focusing on Conserved Quantities (*the* reference values in natural sciences) is the means to an end of excluding chaos effects in managerial economics (cf. Grabinski (2004), (2007) as well as (2008)). To perpetuate his work, in 2010, Prof. Dr. Grabinski created at the Hochschule Neu-Ulm University ("HNU"), Neu-Ulm/ Germany, a research program dealing with chaos in long-term planning named "Chaos in langen Planungsketten" ("CLPK").

The Wissenschaftsministerium der Bayerischen Staatsregierung, Munich/ Germany (= Ministry of Science of the Bavarian Government), supports the program by a generous grant. Besides Prof. Dr. Grabinski, who is the director and supervisory professor, there are four research associates – the author of this dissertation is the first one to adapt the concepts of chaos and Conserved Quantities to the special subjects of finance and economics. Prof. Beatriz Adriana Romaniello, PhD, who teaches and researches at the Universidad Rey Juan Carlos ("URJC"), Madrid/ Spain, kindly agreed to officiate as second supervisor of this dissertation.

At this occasion I would like to take the chance to say "Many thanks!" to all of the above, who allowed for the CLPK research program and contributed to the realization of this dissertation.

In particular I would like to thank sincerely Prof. Dr. Michael Grabinski: He was available and dedicated at all times and I very much appreciate the discussions I was allowed to hold with him, his suggestions as well as the manifold support and encouragement he provided during the previous years.

Thanks a lot also to the Universidad Rey Juan Carlos, Madrid/ Spain, and particularly to Prof. Beatriz Adriana Romaniello, PhD, for the good cooperation.

My employer for many years, goetzpartners Management Consultants GmbH, Munich/ Germany, kindly exempted me for the composition of this dissertation and provided notably technical support, for which I also want to thank very much.

Furthermore I would like to thank very much my parents for their long-standing support: They motivated and encouraged me throughout my whole life and I count myself lucky that I always can rely on their help with words and deeds. They have greatly contributed to my ability to study and finally write this dissertation in the way I did. Therefore this dissertation is dedicated to them.

Dominik Philipp Appel | Neu-Ulm, January 20, 2012

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LIST OF ABBREVIATIONS

Accounting Research Bulletin (“ARB”)

And the following (“ff.”)

Balance Sheet (“B/S”)

Billion (“bn”)

Calculative Cash Outflow (“CCO”)

Capital asset pricing model (“CAPM“)

Capital expenditure (“CAPEX”)

Cashflow (“C/F”)

Central Intelligence Agency (“CIA”)

Chaos exposure (“C/E”)

Chaos in langen Planungsketten (“CLPK”)

Chief executive officer (“CEO”)

Chief operating officer (“COO”)

Celsius (“C”)

Conserved Quantity Accounting Principles (“CQAP”)

Cost (“C”)

Costs of goods sold (“COGS”)

Commodity Futures Trading Commission (“CFTC”)

Compound annual growth rate (“CAGR”)

Conserved Value Based Accounting Principles (“CVBAP”)

Continuous improvement process (“CIP”)

Depreciation and amortization (“D&A”)

Deutscher Aktienindex (“DAX”)

Deutsche Physikalische Gesellschaft (“DPG”)

Discounted cashflow (“DCF”)

Doctor of Philosophy (“PhD”)

Earnings before interest and taxes (“EBIT”)

Earnings before interest, taxes, depreciation and amortization (“EBITDA”)

Earnings before taxes (“EBT”)

Economic value added (“EVA”)

Employee (“e”)

Enterprise resource planning (“ERP”)

Financial Accounting Standards Board (“FASB”)

Financial Accounting Standards Board’s standard number 157 (“FAS 157”)

Financial year (“FY”)

Free cashflow to the firm (“FCFF”)

Food and Agriculture Organization of the United Nations (“FAO”)

Free cashflow to the firm for calculating discounted cashflow (“FCFF DCF”)

Functional Value (“F/V”)

Functional Value of capital assets (“v_a”)

Functional Value of human labor (“v_l”)

Functional Value of new experiences and knowledge (“v_e“)

Functional Value of products (“v_p”)

Functional Value of resources (“v_r”)

Generally Accepted Accounting Principles (“GAAP”)

German Democratic Republic (“GDR”)

Gesellschaft mit begrenzter Haftung (“GmbH”)

Gross domestic product (“GDP”)

Group of 8 major economies (“G8”)

Group of 20 major economies (“G20”)

Hochschule Neu-Ulm University (“HNU”)

Incorporated (“Inc.”)

Information technology (“IT”)

International Financial Reporting Standards (“IFRS”)

International Food Policy Research Institute (“IFPRI”)

Lower of cost or market (“LCM”)

Market price (“M/P”)

Massachusetts Institute of Technology (“MIT”)

Mergers and acquisitions (“M&A”)

Million (“m”)

National Association of Securities Dealers Automated Quotations (“NASDAQ”)

Not applicable (“n/a”)

Notional cash expenditure (“NCE”)

Operational expenditure (“OPEX”)

Original equipment manufacturer (“OEM”)

Per annum (“p.a.”)

Percentage points (“%-pts.”)

Political, economic, sociological, technological, legal, or environmental (“PESTLE”)

Price-to-earnings (“P/E”)

Price-to-sales (“P/S”)

Profit-and-loss (“P&L”)

Research and development (“R&D”)

Revenue (“r”)

Selling, general and administrative expenses (“SG&A”)

Strength, weaknesses, opportunities, threats (“SWOT”)

Swiss franc (“CHF”)

Temperature (“T”)

United Kingdom (“UK”)

United States (“US”)

United States Generally Accepted Accounting Principles (“US-GAAP”)

United States of America (“USA”)

Universidad Rey Juan Carlos (“URJC”)

Securities and Exchange Commission (“SEC”)

Strategic Analysis and Design Technique (“SADT”)

Value (“v”)

Value Tag (“V/T”)

Versus (“vs.”)

Volkswagen (“VW”)

Weighted average costs of capital (“WACC”)

Winner-minus-loser (“WML”)

LIST OF IDIOSYNCRATIC PROPER NOUNS

Calculative Cash Outflow

Chaos Exposure

Conserved Balance Sheet

Conserved Cash

Conserved Cashflow

Conserved Quantity

Conserved Quantity Accounting

Conserved Quantity Approach

Conserved Tax Balance Sheet

Functional Firm Valuation

Functional Firm Value

Functional Requirement

Functional Valuable

Functional Valuation

Functional Value

Functional Valueless

Holistic Functional Value Analysis

Natural Threshold of Robustness

Required Functions

Significant Influencing Factor

Strict Conservation Law in Business

Value Tag

CHAPTER I

INTRODUCTION

1 Initial situation

“Technology stocks had become collector’s items” – market analysts tried explaining therewith the collapsing stock prices as the “dot.com-bubble”-burst started in spring 2000 (cf. Grabinski (2007)). Most people knew intuitively what that expressed: Awhile, a group of persons eagerly looked for opportunities to buy “something” – irrespective of its intrinsic utility or real value. Though the “dot.com-era” was a worldwide phenomenon, for related technology venture’s shares, the biggest market was the American “National Association of Securities Dealers Automated Quotations” (“NASDAQ”). And exactly this stock exchange turned out to show results like overheated art trades: Figure 1 shows the market’s stunning rise in about 6 years by a factor bigger than 6x and its dramatic fall within about 2.5 years by a factor bigger than 4x. The inevitable question then is: Have the changes in underlying stocks’ values anything to do with changes in the real economy, which consequently must bear about the same magnitude? Probably not! Analysts’ approach to explain the (irrational) development of (seemingly fictive) prices then could have been funded more on economic facts.

Figure 1: "Dot.com-bubble"-showcase: Materialization of the bubble's growth and burst at the NASDAQ (cf. NASDAQ (2011))

Collector's items markets provide diverse showcases of price developments, which were as unforeseeable as back then those of the NASDAQ: For example, everybody may know the world's most valuable stamp, the "Blue Mauritius". But what is its real value? The stamp's postage value still is 2 pence. So following its issue date in September 1847, the post office was committed to perform services having a countervalue of 2 pence. This means: The stamp "did something" by allowing a client to apply the post's network to a limited extend corresponding to the stamp's postage value – therefore it is valid to claim that the stamp's functional value ("Functional Value") was 2 pence, too. And therefore presumably everybody back then would have agreed that the Blue Mauritius' real value amounted to its Functional Value namely 2 pence!

Valuing the Blue Mauritius is not that easy anymore nowadays: The stamp has changed from being an object of utility only to being primary a collector's item. As of today, the Functional Value of this blue-printed piece of paper is next to nothing. Interestingly since 1847 its market value took off nonetheless: In 1993 an unused Blue Mauritius was sold at a price of about Swiss francs ("CHF") 1,725,000, which was about €1,100,000. In October 2008 an unused second series' exemplar from the year 1848 was sold for US$85,000, which was about €65,000. And in January 2010 a not yet used Blue Mauritius was sold in Klagenfurt comparatively cheap for €25,000 (cf. Wikipedia (2011b), OANDA (2011)). Against the background that nobody would stick any Blue Mauritius on a letter anymore and require the postman to deliver it, these are remarkable amounts of money for something whose Functional Value even may be used up completely yet. And in addition to the (seemingly fictive) market values, it is also remarkable how much these price points varied irrespective of the underlying stamp's remained usability.

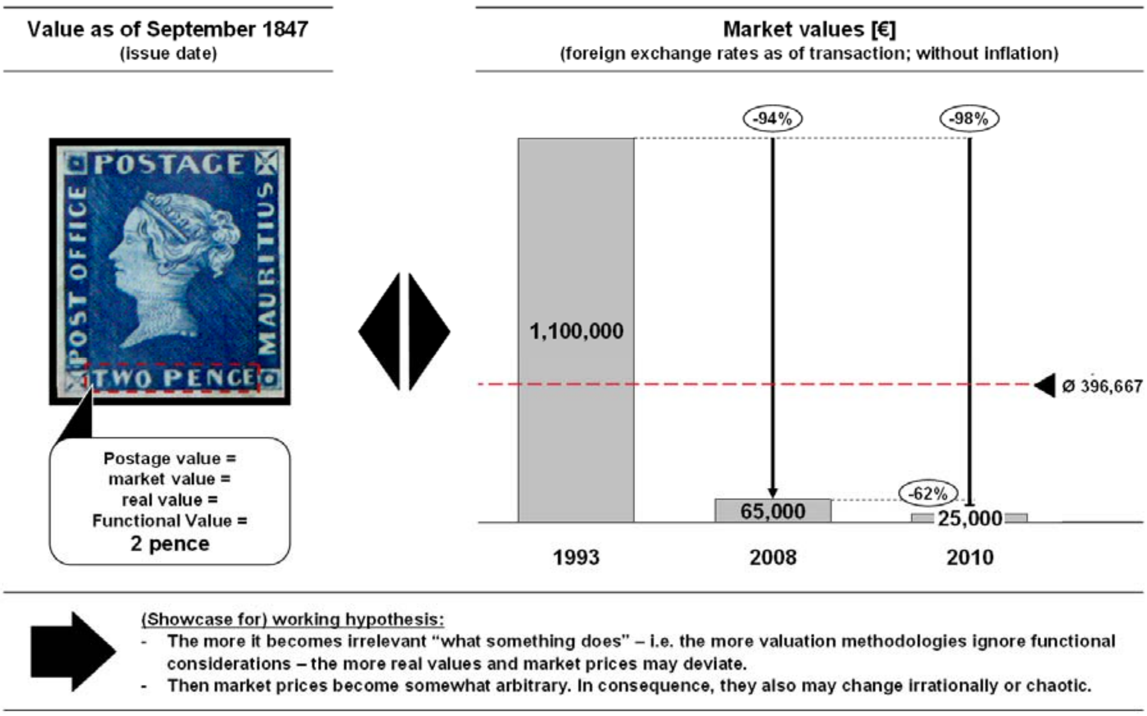


Figure 2: Blue Mauritius-showcase: What is "something's" real value? How is it related to market price? (cf. Wikipedia (2011a), OANDA (2011))

This dissertation will show that stock market values of companies like those listed at the NASDAQ as well as the market values called and realized in sales of e.g. Blue Mauritius-stamps may be particular obvious showcases for market distortions – i.e. deviations between any asset's price (= "market value") and its real value (= here: Functional Value). Examples that falsify related finance theory's so-called "efficient market hypothesis" are not at all rare (cf. "efficient market hypothesis"). In fact reality produced seemingly more examples against than for it. But given markets were efficient indeed, their participants tried to figure out the real value of something as of today against the background of all available information – which implicitly comprises (potential) future events, too. Hence efficient market hypothesis' point of view is also forward-oriented. So irrespective of the fact whether or not market participants are able to judge related information – for example the computers that perform up to 40% of the stock trades in Europe and up to 60% in the United States of America ("USA") cannot (cf. Seith (2010)) –, one thing definitively becomes clear: In order to value something as of today better than done by current methodologies, the tasks of precise *(long-term) forecasts* and determining *real values* must be linked procedurally!

2 Key considerations

Needless to say that stocks and collector's items – like stamps – are completely different items. Finally they should satisfy different customers' diverse functional requirements ("Functional Requirements"): Stock owners focus completely on the return of their investment in a specific company (coming from dividends and/ or resale). None of them buys current stocks just to enjoy their documents' art. In contrast, presumably some philatelists buy a Blue Mauritius in order to enjoy it only. Yet some may acquire the stamp also in order to apply it like an investment. Irrespective of their individual motivations, at some point in time before signing the purchase agreements, all the buyers (and sellers) – not only but also in the examples above – will face the same questions, in particular:

1. What is the item's *real value*?

2. What *criteria* substantiate this real value?

3. Against that background, how will the *value performance* be in 1, 2 or 10, etc. years? So is the purchase potentially justifiable not only emotionally but also economically by being a good investment (irrespective of whether or not the item shall be resold indeed)?

The primary issue is that characteristics of "real value" to date could not be defined easily – and maybe due to this reason – were not defined consistently. (Up to the author's knowledge the issue traces back to Karl Marx's publication "Capital I" (1887)). So given there is no qualified definition of real value, nobody can provide qualified answers to any of the above. Therefore so-called "Functional Valuation" is developed in this dissertation; it is evidentially capable to answer all of the questions 1 to 3. It demonstrates its explanatory power particularly in view of the 3rd question, i.e. *"forecasting real value performance (long-term)"* (cf. Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012)). This is most important because: As stated yet not only former periods' technology stocks or stamps showed wildly varying prices and price trends that changed from one day to another. Such developments are commonly observable for market values. On its own, this already contradicts the investors' – respectively buyers' – requirement for predictability. But things are even worse: Market values (often) act erratic, i.e. they change irreproducible though in parallel the real world remained (comparatively) unchanged. And as will be shown herein, too, today's well established exchanges for shares or resources and even (less liquid) markets for everyday items – like real estate – are vulnerable for such distortions more than ever before.

3 Dissertation's objectives and structure

This dissertation aims to prove that spontaneous shifts in market value – which are unforeseeable in terms of direction, magnitude and point in time and furthermore cannot be reproduced – can be traced back always to one single phenomenon. Natural scientists termed it "chaos": Over a specific period of time it affects the development of so-called "non-conserved quantities" much more severely. To verify this statement, herein it will be shown why market values must be deemed "non-conserved". As the logical consequence the author strives developing an universally valid methodology to value any kind of company, asset or product (including services) by applying nothing but conserved quantities ("Conserved Quantities"). He will prove that only Conserved Quantities are qualified to react properly with respect to microeconomic and macroeconomic changes. That distinguishes them from potentially chaotic market values. Therefore by accounting for changes in Conserved Quantities, the author's approach shall be qualified for forecasting the real value performance (= Functional Value) long-term. This objective will be challenged not only logically but also tested quantitatively. Thus it will be assured that Functional Values fulfill indeed the requirements of a value that develops non-chaotic ("robust" in the mathematical sense) for any length of time. This means: The author consciously takes an economic, fact-based point of view of a thoroughly analyzing (value) investor. His approach as well as the results generated therewith will be opposed to the completely contradicting concept of (marked price-focused) speculation. Diverse quantitative examples should help to sensibilize the reader for the (often) large speculative content in market values. Implicitly this entails: Current finance theory's hypothesis of so-called "efficient markets" – which result in price equilibria having explanatory power in view of an asset's real value performance – is challenged herein. Finally the author claims having found a standard procedure, which allows calculating the speculative content in *all* markets. To be more precise, he argues that efficient markets exist under special conditions – so they are exceptions and not the rule. But the interlinked concepts of chaos and (conserved) Functional Value do not simply contradict established finance theory's school of thought: They enhance it when forecasting long-term real value performance of any company as well as of the assets it has on its balance sheet. But before it becomes clear how that enhancement is possible the similarities, distinctions and connecting factors between the natural scientific understanding of "chaos" and "(non-)Conserved Quantities" and the finance community's interpretation of "risk", "pricing" and "valuation" must be clarified. Finally e.g. both chaos and risk describe in the broadest sense "uncertainty" of future results – but they address distinct levels of it.

Over and above as soon as a form of robust value is found (= here: Functional Value), new rules and regulations for accounting and taxation should be defined. This is the prerequisite for realizing Functional Values' advantages in total – i.e. not only on the microeconomic level by managers and private or institutional investors but also on the macroeconomic level by general governments and superior political institutions. Then maybe (at least) deciders at the interface of economics and politics may not be misguided anymore by a *wrong* definition of value. In this context please consider the recent so-called "financial crisis" starting in summer 2007: Many people discussed the diverse reasons and tried finding out how to avoid such events in the future. Some regulations have been suggested, mainly in the sense of a Tobin (1978) tax. But while the causes of the crisis are debated still, its effect never has been questioned. It may be seen as the very definition of financial crisis that "values" collapse rapidly. In this case market values of stocks and derivatives of mortgages decreased indeed. And with them the market and accounting values of companies and real estate diminished, too. But did the underlying assets – e.g. real estate – in actuality loose real value (= Functional Value) due to the crisis? While there is no doubt that market values went down, the author severely objects to a decrease in real (Functual) Value. However if real values did not deteriorate, there was no crisis. And given it became obvious for people that there were no reasons for a real crisis, they may have taken different – potentially better – decisions. But how did this devastating misperception start in the first place? The answer is simple: Because people tend to equate the market value (of stocks, derivatives, etc.) with the underlying real value (of the companies, houses, etc.). Obviously they defined "value" as *market value.* And the equation "market value = real value" is propagated not only by (parts of) established finance theory but also by organizations that establish financial accounting and reporting standards, in particular the Financial Accounting Standards Board ("FASB" (2008)). It is a possible and common definition of value – nevertheless it can be very misleading as the introductory examples show. In consequence companies' balance sheets should not be based on it (cf. Grabinski (2007), Appel and Grabinski (2011)).

In order to treat all these issues in depth and solve all the tasks named above – and thereby finally reach the dissertation's objectives in a structured way – this publication is subsumed in six higher ranking (self-explanatory) Chapters:

Chapter I: Introduction

Chapter II: Approaching to chaos in economic sciences by learning from chaos in natural sciences

Chapter III: Fighting chaos in economic sciences at its outset by Conserved Quantity Approach

Chapter IV: Applying Conserved Quantity Approach to selected quantitative examples

Chapter V: Assembling of generally applicable Conserved (Tax) Balance Sheets

Chapter VI: Summary of results

CHAPTER II

APPROACHING TO CHAOS IN ECONOMIC SCIENCES BY LEARNING FROM CHAOS IN NATURAL SCIENCES

1 Chaos in economic sciences: Symptoms and related considerations

Financial forecasting and valuation is complex, time consuming and costly: At companies lots of internal employees' capacities are bound; increasingly complicated software tools are self-developed and/ or purchased and must be maintained regularly to be able to consolidate, analyze and predict the development of the companies' financials; consultancies are mandated regularly to provide additional external support. Irrespective of the related costs and efforts, companies in both the industry sector (i.e. manufacturers) and in the service sector (e.g. banks and investment funds) increased successively the scope, the level of detail and/ or the number of planning and review cycles per year. But still their forecasting and valuation quality often does not even come close to reality's outcomes. In the past resultant negative effects not only remained on the level of individual companies. The misallocation of invested resources repeatedly proved to cause severe economic crises, which affected one or more countries in parallel (e.g. the crisis following the "dot.com-bubble"-burst in 2000 or the financial meltdown caused by the collapse of the real estate market that started in the United States ("US") in mid 2007). So there seem to be two sources of economic inefficiencies here:

1. When established financial forecasting and valuation approaches (and assistant frameworks) are applied, at a certain point, forecasts' explanatory power cannot be

improved anymore. Given companies ignore this “break-even-point” all the money and effort spent afterwards are wasted.

2. If (inefficient) forecasting approaches resulted in false valuations and wrong (dis-)investment decisions, the related funds are not allocated at the best.

The reason why simply “trying harder” does not lead to “better forecasts” and/ or “better valuations”, which have more explanatory power to enable “better (dis-)investment decisions” is: The variables that shall be forecasted currently are largely threatened to be affected by chaos. So in this Chapter II first and foremost a general understanding of causes and effects of chaos shall be gained. Afterwards potential solutions to manage chaos are discussed – all of them are used in selected areas of natural sciences and/ or managerial economics already. Based thereon the author will judge at the end of the respective Sub-Chapter whether or not these established approaches are useful for the special case of financial forecasting and valuation. A final conclusion as well as a summary of insights will also be provided at the end of this Chapter II. (Then Chapter III and the following (“ff.”) can be dedicated to the most qualified solution to handle respectively avoid chaos).

2 Etymologic meaning of chaos

The word “chaos” has its root in the Greek word “Χαοσ”. Its initial meaning was something like “empty space” or “void”. The Roman influence later modified its meaning to “disordered mass”. In the Christian mythology, either meaning can be found: In the book of Genesis, for example, it is written that God created heaven and earth from chaos (cf. Grabinski (2007)). The prophet Isaiah (45, 18) tells: “He [God] created the heavens and earth and put everything in place. He made the world to be lived in, not to be a place of empty chaos”.

3 Definition of chaos in natural sciences

The theory of chaos covers the study of phenomena varying with time (cf. "dynamic systems theory") and the study of nonlinear movement or evolution (cf. "nonlinear dynamics"). It assumes the existence of an enormous number of interrelations and involves multiple interactions. Therefore it may be easy to imagine why chaos suggests the existence of an unwanted chance, turbulence or disorder (cf. Filipe et al. (2010), Williams (1997)). *Chaos* affects *nonlinear deterministic dynamic systems*, which meet two essential conditions:

1. Each small variation of the outset *enforces itself* continuously.

2. A fixed *values margin* is never left. (Therefore Grabinski (2004) and (2007) advises to consider always an appropriate *margin of error* in order to differentiate between a system that is actually chaotic and a system that is just set-up incorrectly).

Given the 1st *and* 2nd condition apply to the system, under certain conditions, they will show accidentally looking movements that develop irregular and unpredictable. The behavior of gas may be a good example for it: Today's word "gas" also has its origin in Χαοσ because its molecules move around chaotically (in the mathematical sense). In a cubic centimeter of air there are roughly $3 \cdot 10^{20}$ molecules. Each time one molecule hits another, the hit increases the deviation from the molecules' initial trajectories. The deviations do not develop linearly, i.e. there are (nonlinear) step-ups. Therefore the information on the molecules' initial courses will be completely lost soon. Nonetheless the deviations will be always within 360° compared to their initial trajectories (cf. Deutsche Physikalische Gesellschaft ("DPG") (2000)). So here the margin of error is 360°. To provide another enlightening example on chaotically changing systems, Grabinski (2007) relates chaos to the development of an (initially) smoothly flowing river: Such flow is easy to understand and can be described with quantities like the flow velocity. But such smooth (non-chaotic) flow can become turbulent or chaotic, too. This happens when the flow velocity reaches a certain point, e.g. because of a waterfall. In a smoothly flowing river the flow velocity at any point can be forecasted by applying straight forward mathematical equations. In a waterfall there is a flow velocity at any given point, too. But calculating it involves chaos. This means: In such a chaotic situation the river's flow velocity at a particular point and at a particular time depends heavily on little events, e.g. somebody who threw some pebbles into the water a minute earlier. Simply due to practical reasons such (chaotic) flows appear to be unpredictable:

1. Nobody can know all events that (potentially) can change the initial situation.

2. Irrespective thereof using increasingly high-powered computers to take into account each and every little change or disturbance is definitely the wrong approach: Such a computer must be very big (and presumably would be very expensive). Even today's super computers are not sufficient for it.

3. The result would be useless anyway because it would take the form: Billions of initial conditions at a certain point in time result in billions of flow velocities (at billions of points within the river or of billions of water molecules) a second later. Obviously such flood of information would be as useful as no information at all (cf. Grabinski (2007)).

Such side-effects of chaos limited Edward Lorenz's work in the early 1960s, too. Back then he found something striking when working on weather forecasts at the Massachusetts Institute of Technology ("MIT"): As he changed in his forecasting model today's weather data (e.g. temperature ("T") = 20 °Celsius ("C")) very slightly (e.g. T = 20.02 °C), the prediction for say 10 days ahead changed completely. Following diverse test cycles Lorenz concluded that chaos was the mathematical reason why his equations of motion behaved in such a way "crazy", i.e. that marginal changes at the outset had drastic effects on final outcomes. Consequently he had to know the system's initial conditions very exactly. And since all systems that are threatened to be affected by chaos – like his long-term weather forecast – tend to step-up over time under certain conditions, even the smallest *change* of initial conditions must be taken into account to get valid predictions (within a reasonable margin of error). Therefore Lorenz coined the term "butterfly wing effect" (cf. "butterfly wing effect"): It expresses that the little eddies of the butterflies, which are flying e.g. in Munich right now, have a severe influence on whether or not it will rain in Madrid at ten o'clock in the morning in ten days. Of course nobody knows how the butterflies are flying today. And it is even worse: Nobody knows how much bigger animals or people, etc. are moving around and breathing right now, which over the long-run may result in even stronger deflections in weather forecasts. Hence the "butterfly wing effect" is not limited to butterflies' behavior. It is a symbol for all marginally small changes in initial conditions that can lead to chaotic developments of those systems, which are extremely sensitive to changes in initial conditions – then these systems show step-ups in their forecasts that seem "crazy" because they are neither predictable nor reproducible. Therefore in theory long-term weather forecasts may be possible – finally the underlying system is deterministic so that it is representable mathematically. But the initial conditions must be known precisely to such an extend that even the butterflies' flight paths must be taken into account. That is far from being realistic. The final conclusion in view of chaos therefore is:

1. Chaos does *not* mean that the principle of determinism or causality is violated.

2. Given one knew *all* initial conditions of a deterministic system *exactly* one could make accurate forecasts for an arbitrarily long time.

3. But the problem is: Though the formulas for describing the dynamics of the system may be understood in principal and be relatively trivial, and though the system's initial condition(s) may be known, the biggest computer in the world (in general) will be hindered by performance issues – i.e. they cannot forecast the potentially chaotic system's future states. So the primary issues in handling chaos effectively relate to *limitations in data acquisition and data processing*.

Therefore systems that may turn chaotic – like weather forecasting models – do not allow predictions that are valid long-term due to practical hurdles that *cannot* be overcome. Against this background it is amusing that some managers would like to have a very long-term weather forecast: Revenues in e.g. the ice cream industry depend heavily on temperature and precipitation. And some companies are paying meteorology departments for creating models for long-term weather forecasts just because of the widespread believe that money can buy everything. But these efforts are completely worthless because of chaos. Maybe it is like astrology or crystal ball gazing – some people believe in it, they pay money for it and are happy (cf. Grabinski (2004), (2007) and (2008)). However no matter how hard the fortunetellers try with their established "tools" – like in case of chaos – the forecasts will not improve due to *principle problems*. Further considerations to be taken when forecasting in the (interrelated) fields of business and economics are: Mathematics proves that chaos develops only if there is a (strong) nonlinearity. Nonlinearity means that input and output are not directly proportional, i.e. that a change in one variable does not produce a proportional change or reaction in the related variable(s). Since the compound interest-effect enforces each small variation of the outset continuously, it is an archetypal example for nonlinearity in economics: This example shows how important it is to know chaos' *outset* exactly – finally even the smallest initial difference in value will become big after a long period of time. Mathematically spoken the reason is that a difference in the initial state may grow exponentially in time (or faster). Exponential growth means that there is a certain fixed time period over which the growing object doubles (e.g. every 9 years the invested capital will double given the interest rate is 7.7% per annum ("p.a.")). Besides that (almost) no exact mathematical formula exists in business or economics. Yet that does not mean that chaos is not present here: So-called *"if-then-decisions"* often occur in business. They result in analogous outcomes like strong nonlinearities in mathematical formulas. Over and above the more if-then-decisions a system has the more complex it is – and the more complex a system is the more likely it is that the system becomes chaotic, too (due to purely statistical reasons). The magnitude of an if-then-decision is determined heavily by the difference between its two choices. For example please consider a project whose final results shall be presented at an annual fair that has a fixed submission deadline: If you are on time you can speak to the guests already this year. But if you are just one second too late to hand in your application, you may have to wait for one additional year. This is a typical chaotic situation because a very small change in the initial conditions affects the outcome drastically (cf. Grabinski (2004) and (2008)).

In summary chaos occurs in systems that are deterministic, dynamic and (most important) nonlinear. These systems are extremely sensitive to initial conditions at an initial point in time. Given one or more of these initial conditions change just marginally it may lead to drastic changes of the final result. Such step-up is a materialization of chaos. In this sense chaos stresses that the world does not necessarily work as a linear relationship with perfectly defined or direct relationships in terms of expected proportions between causes and effects (cf. Grabinski (2004) and (2008) as well as Filipe et al. (2010)).

4 Existent solutions to chaos in natural sciences and economic sciences

Decision makers in the economic context generally try to optimize the value performance of their asset(s). For it a valuation methodology is essential, which has explanatory power (= whose results remain within a reasonable margin of error) for any planning period. Valuation is often based on economic forecasts. That makes both – valuation and forecasting – key tasks of higher-ranking mangers as well as of private and institutional investors. Over and above the decisions they derive therefrom may have drastic consequences beyond their microeconomic level, too. Against this background it is important having understood the connecting points between means and ways in taking economic decision, in performing natural scientific predictions as well as their explanatory power respectively: At large *all* forecasts are generated by taking as initial conditions historic data in combination with assumptions regarding influencing factors that affect the future state of the system under consideration. In economic sciences there are initial conditions as of today – such as supply and demand –, which e.g. will determine the market prices companies have to pay tomorrow (to their employees and/ or their suppliers) to keep their operational value creation up and running. And tomorrow's proceeds from liquidating assets reported on these companies' balance sheets – e.g. by selling finished products to (end-) customers – depend on changes in today's general economic and living conditions. So these (simplified) inputs are used in some sort of mathematical forecasting models to come to economic prognoses. This process is *not* fundamentally different from forecasts in natural sciences, which are often strongly affected by chaos. Consequently it is advisable to expect chaos effects in economic forecasts, too! As soon as planning periods get sufficiently long-term forecasting systems for business and/ or economic predictions may become unmanageable due to chaos that is fostered by all their inherent interrelationships. So given these little variations wind each other up more and more over time, both the forecasts and the resultant values must not be taken for granted. Therefore forecasts that develop *robust* (= non-chaotic) are essential in either case as soon as a future-oriented point of view is needed for any kind of decision taking.

Much of chaos theory's progress was revealed just since the 1970s – hence many facets of "chaos" are distant from being determined or understood yet (cf. Filipe at al. (2010)). Simple patterns can be found and approximated, complex ones are another matter. In any case please bear in mind that one cannot just grab a set of data and declare "chaos" or "not chaos" (cf. Williams (1997)). Hence it seems sensible to approach successively to chaotic phenomena: At first chaos' manifestations in forecasting systems in general are discussed. Then current approaches to tackle chaos are introduced – the calculative ones have their origin in natural sciences. Thereafter the author explains why these yet established methods are or are not, respectively applicable for the special subject of (interrelated) financial forecasting and valuation.

4.1 Identifying chaos in quantitative forecasting systems

Chaos can be spotted hardly by looking just at a system's outcomes without having additional information in particular on the system's outset. When explaining how chaos can be identified in computer-based business forecasting systems Grabinski (2004), (2007) and (2008) considers these underlying interrelationships. (Please note that his approach in principle is valid for any kind of calculative forecasting). For testing such systems, Grabinski advises to enter as initial data not single numbers but *distributions* (e.g. a Gaussian distribution). The reason is: Even in the case of chaos exact input data will lead to exact outputs. Only the distribution in input data compared to the distribution in output data makes chaos visible. This means: The inputs' distribution determines the outcome's appropriate margin of error! To apply this test all initial conditions must vary independently and all parameters – such as capacities or costs – are considered as elements of initial conditions. Then the forecasting system produces a final result for something like a finishing date (of a project) or total costs (of a product). In view of chaos two outcomes are possible here:

1. Even if the initial conditions vary just slightly, the final result has a substantially different distribution, in the extreme case a random one. This indicates *chaotic behavior*, which can have two reasons:

    1.1 Reality is chaotic. Therefore even if the computer model used for forecasting is sufficiently robust it is useless because it does not describe what it should (= here: reality's chaos). And if it would the computer model would be impractical (cf. chaotic flow of water-example in Chapter I, 3).

    1.2 The reality is non-chaotic. The computer model makes it appear chaotic though. Assuming that all models used by computer systems are quite accurate in describing the reality – at least in theory – a solution exists by amending the model to be closer to the non-chaotic (= robust) reality. Most likely if-then-decisions are responsible for the apparent chaos. Therefore each of them in the computer model should be compared with the underlying reality. If reality is less strict the decisions should be softened accordingly (by reducing the differences between the if-then-decisions that constitute to their magnitude and/ or by reducing the number of if-then-decisions if applicable).

In practice the core issue is that often it is next to impossible to distinguish between these two reasons. Therefore it may just look like being possible to resolve computer-based forecasting system's chaotic behavior yet it is actually not.

2. The distributions of the initial conditions and of the result are essentially equal. Then the case can be closed easily – the computer model is *not chaotic (= robust)*.

Being sure that a computer-based forecasting system cannot become chaotic is important. But it is insufficient to declare whether or not the system works properly indeed: All initial conditions bear a *margin of error* or variation so also the final result will have one. That is why Grabinski (2007) and (2008) recommends applying the width of the distribution of the initial conditions as typical margin of error (cf. above). Then the width of the distribution of the final result again has to amount to this typical margin of error. If the results show a sufficiently small margin of error everything is fine. If the margin of error is huge there may be a problem. For example: The total costs of executing an order in an industry varies between €70 and €80. The company under consideration has to pay €76. A simulation shows that an amended order process would result in new total costs between €69 and €82. Though the simulation does not show chaotic behavior, from its final results, no conclusion can be drawn due to a too big margin of error (compared to the industry's distribution).

4.2 Learning from hydrodynamic descriptions of chaotic systems

Changes inside of chaotic systems are complex and paradoxical. But when being observed from the outside, chaotic systems typically seem to develop in a smooth and ordered way (cf. Williams (1997)). This observation depicts the starting point for hydrodynamics, which is a concept known from physics (cf. "hydrodynamics"): It strives for a *macroscopic* description of a system's (global) behavior, for which one not necessarily needs to derive formulas for the underlying *microscopic* movements. A valid hydrodynamic description's practical implication is that realistic forecasts on the macroscopic level can be performed by applying *averaged quantities*. That is the reason why it is possible to describe the dynamics of e.g. a flow of water: Its hydrodynamic flow velocity (on the macroscopic level) is equal to the underlying molecules' average flow velocities (on the microscopic level). The individual water molecules move around chaotically. Nonetheless the flow of water's *global* movement can be described. And for it the *underlying* molecules' (chaotic) moves need not be taken into account – else chaos would make it impossible to find any (hydrodynamic) description of the (macroscopic) observable flow of water. Though this classic example deals with water, applying hydrodynamic equations is not limited to fluids. Please reconsider the example of gas, too: Its *individual* molecules move around very chaotically. In most situations gas' *global* behavior is describable nonetheless. And there are also hydrodynamic equations to describe changes in more solid bodies like ice or a piece of wood. Given hydrodynamics could be applied to business and/ or economic forecasts, too, such kind of forecasting by averaged quantities – respectively by averaged values – may provide efficiently results that may be good enough for managers, investors, etc. for their decision taking. Hence hydrodynamics should be examined in view of their practicability to get a handle at least on *some* of the chaos effects that occur here (cf. Grabinski (2004), (2007) and (2008)). Therefore starting with this Chapter and ending with Chapter I, 4.4.3 not only hydrodynamics' general prerequisites but also potential applications in economic sciences-related areas are both suggested and judged.

Three prerequisites must be fulfilled for a valid hydrodynamic description of any kind of potentially chaotic system:

1. A complete set of macroscopic (= directly observable) variables has to exist: *"Complete"* means that systems showing the same values in all these variables are *undistinguishable* on the macroscopic scale. For example: Two flows of water are indistinguishable given they have the same momentum vector, mass and energy.

   In economics diverse researchers tried to bring some order in the chaos of the capital markets. But things become tricky here when applying hydrodynamics. The reason is: From time to time stocks show the same value but not everything else is equal. This means: Stock values on their own do not conform to the requirements of a complete set of macroscopic variables. Other macroscopic variables – like profit per share – are to be included into the considerations. Though finding a complete set of variables will be strenuous, from a pure hydrodynamics point of view, there is no principal issue so far. But there is another principle obstacle: Grabinski (2007) alludes that stock values are market prices and therefore non-conserved quantities. That makes them the *least reasonable quantity* to describe a system on the macroscopic level in any case. (His point of view is proven quantitatively herein as well as in diverse publications and teamworks (cf. Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012) as well as Grabinski (2011a), (2011b) and (2011c)).

2. A clear-cut *difference* between the microscopic and macroscopic (= hydrodynamic) scale must exist: This condition implies that a hydrodynamic description is impossible given the macroscopic (time) scale is reduced so much that it is (nearly) as short as the microscopic one. Thereby the earliest point in time is determined for which a forecast can be generated in form of a hydrodynamic description. For example: On the microscopic scale water molecules move back and forth in roughly a trillionth of a second. On the macroscopic scale the flow of water therefore can be predicted only in intervals of say a billionth of a second – which is clearly longer but still a quite short time period. But there is an issue as soon as there are turbulences: Please note that "turbulence" is a macroeconomic effect. Here one considers a hydrodynamic description thereof. In some sense it is a "macro-macro description" or a "hydrodynamic description of a hydrodynamic description", which turned to be turbulent. In any case turbulences occur as soon as the flow velocity exceeded a certain threshold. Then the formerly smooth flow pattern becomes a chaotic one. In case of turbulences, on the microscopic scale, some water droplets may swing back and forth on a time scale of some seconds or less. Then a macroscopic description will give at best an average over many seconds – which is already a much stronger restriction. So it must be admitted that chaos limits forecasts performed by hydrodynamics, too.

Reconsidering the stock market the microscopic scale is the time span until a new stock price is set e.g. every couple of minutes. (Nowadays it is often less than a second dependent on the exchanges' computer infrastructure. Yet for the principal understanding this is irrelevant). The macroscopic scale would be a day or a week, etc. Forecasts of an average stock value within a week therefore may become possible but predictions on a minute-base (or even a second base or less) are unrealistic. Admittedly this is a certain limitation. Nonetheless such result would still be of great interest – at last investors would know e.g. whether or not they shall place today calls or puts for selected stocks for the next week.

3. *Interactions* go only from the macro- to the microscopic level – not vice versa! This is the strongest restriction: A practical test would be to present a movie, which shows nothing else then the system's development over time. Given the viewer(s) could distinguish clearly whether or not the movie is running for- or backward, the third requirement is fulfilled. For example: For a flow of water – in the absence of turbulences – the judgment of such movie would be very easy. Finally any difference in vertical height (macroscopic level) may influence directly the motion of a particular molecule (microscopic level) but not vice versa. Please note that such test requires some additional *knowledge* about the principal development a system may take. Here e.g. the viewer(s) must know that water does never flow uphill. And for a flow of water – in the presence of turbulences – judgment is even harder: As soon as turbulences set in the interactions become almost symmetric between the macro- and the microscopic level. Then the macroscopic flow is changing the microscopic turbulences from time to time (= allowed development) and there are points in time at which the microscopic turbulences change the macroscopic flow (= forbidden development). Therefore no simple hydrodynamic description exists when (chaotic) turbulences are in place. Even worse there is also no physical law stating that all the microscopic motions of particular water molecules cannot add up to a spontaneous macroscopic flow. So from pure theory the viewer(s) cannot be sure whether or not the macroscopic level was spontaneously moved by a microscopic wave. But calculations proved that such effect is so unlikely that even the universe's age is a far too short time period to observe it once (cf. Grabinski (2004), (2007) and (2008)).

So hydrodynamics works for applications in physics (with some reservations/ additional knowledge). But please reconsider "Prerequisite 3" in the context of the stock market example: Could anybody tell whether or not a movie is running for- or backward given it shows e.g. the development over time of a stock market index like the Dow Jones or the NASDAQ? Probably not! And that is the main problem from a purely hydrodynamics point of view with attempts to apply hydrodynamic descriptions to capital markets. (Chapter II, 4.4.2 is dedicated to it because of its potentially far-reaching consequences. There is still another main problem but it will arise only if the variable(s) under consideration is (are) non-conserved. This is a general matter though, which must be considered not only when describing a system by hydrodynamics (cf. “Prerequisite 1” and Chapter III ff.)).

4.3 Are hydrodynamics inevitable for calculative solutions?

Researchers overwhelmingly try to calculate solutions for chaotic systems. The three natural scientific approaches, which were also given a chance in business and economics, are discussed in the following Sub-Chapters.

4.3.1 Hydrodynamics and the validity of “general formulas”

The “Generalized 3-step-approach” to establish and successively refine a mathematical formula, which describes a system that is observable in reality (= on its macroscopic level), dates from Grabinski (2007); it was adopted by Ferreira et al. (2010) as well as Filipe et al. (2010):

1. Write down the formula in its most *general form*: To see what that means, please think about a company’s value (“v”). Let us assume we face a service company like a management consultancy. Then it may be appropriate to calculate v as a function of revenues (“r”) and number of employees (“e”) only:

$$v(r, e) = v_0 + a_{10} \cdot r + a_{01} \cdot e + a_{11} \cdot r \cdot e + a_{20}\, r^2 + a_{02} \cdot e^2 + \ldots$$

The a_{ij} are general parameters. For r = 0 (no revenue) or e = 0 (no employees) there is no company so that v = 0. Therefore quite some terms in the formula above must be excluded ($v_0 = a_{10} = a_{01} = a_{20} = a_{02} = \ldots = 0$). Thereafter the general formula will look like the following one:

$$v(r, e) = a_{11} \cdot r \cdot e + a_{21} \cdot r^2 \cdot e + a_{12} \cdot r \cdot e^2 + a_{22} \cdot r^2 \cdot e^2 + \ldots$$

2. *Symmetry considerations* have to be tested: Though it seems odd, revenue and number of employees could become negative – at least if just costs are considered. In a "real life" business situation a negative employee would pay in order to be allowed to work and negative revenue means the company would pay customers for demanding its service(s). Obviously one would not expect such situation in a consulting company. But mathematically spoken, v must become negative given r and e change signs simultaneously (because the formula must remain general). Therefore only terms are allowed, whose sum of the powers of r and e amounts to an even number (higher powers may be skipped because the approach is good up to a certain scale only). Thereafter the general formula becomes:

$$v(r, e) = a_{11} \cdot r \cdot e + a_{22} \cdot r^2 \cdot e^2 + \ldots$$

3. The general formula has to be tested: Grabinski (2007) argues that companies' values in "real life" may show developments, which cannot be described with the function v(r, e). But he asks to consider, too, that the proceeding how the general formula was developed is not falsified thereby. The one thing that (maybe) could be proven wrong here is just the *initial assumption* that v is a function of r and e only. This implies: The most obvious variables may not be the reasonable ones alone (cf. Chapter III, 2.1.4).

Grabinski's (2007) argumentation is totally right and another two (implicit) assumptions must be tested: In his book he explains that the starting point of the general formula of v(r, e) is a *Taylor expansion* and admits that critics might opine that such description is only possible for analytic functions. But the function v(r, e) hypothesis a hydrodynamic description that is valid up to a certain scale only – and up to a certain scale even non-analytic functions can be written in a Taylor series. Hence a Taylor expansion is applicable here. The crux of the matter occurs however already one step before developing a hydrodynamic equation: The critical question is whether or not a *hydrodynamic description* is feasible at all to describe and forecast business situations and/ or economic developments. Grabinski (2004), (2007) and (2008) – who initially recommended using the physical concept of hydrodynamics in business to manage chaos effects – already requires to keep in mind that finding hydrodynamic equations in business is by far harder (and maybe less useful) than in physics. This suggests: A qualified answer regarding hydrodynamics' applicability (and explanatory power) in business as well as in economics can be given *case-based* only – therefore a more differentiated picture in view of diverse business forecasting applications will be provided later (cf. Chapter I, 4.4). For now the (interim) conclusion that can be drawn yet in view of calculative attempts to forecast (potentially chaotic) nonlinear deterministic dynamic systems is:

1. Chaos occurs in *deterministic* systems – this militates in favor for mathematical solutions. This means: Given *all* data on *all* influencing factors of the system could be collected and included in formulas that are manageable by computers' (limited) performance, chaotic situations became calculable in any case.

2. There are practical limitations in data acquisition and data processing – that hinders robust forecasts of deterministic systems' developments in the presence of chaos in almost all cases. This means:

 2.1 On the one hand it may be barely realistic to know all the initial conditions a system may have.

 2.2 On the other hand the *complexity* within the system (= on its microscopic level) makes it utterly unrealistic to determine exactly all the interrelations and their development over time as soon as chaos is induced. In addition the infinity of interrelated factors necessitates overly complex formulas, which overstrain all high-performance computers (cf. Filipe et al. (2010), Grabinski (2007)). These are the real problems in absence of hydrodynamics!

3. Since *hydrodynamic descriptions* allow ignoring the interrelations underlying a deterministic system they help to overcome complexity in some cases.

That means: Hydrodynamics of course is not valid for each and every case. But given the three prerequisites are met, hydrodynamic descriptions are helpful because they allow for calculating forecasts (in presence of chaos) by applying averaged quantities that are directly observable (on the macroscopic level) – this *relaxes considerably the practical limitations* in considering chaos effects calculatively (cf. Grabinski (2007))!

4.3.2 Are there alternatives to hydrodynamics?

Besides hydrodynamics other calculative attempts to describe potentially chaotic systems and predict their outcome respectively had been adopted from natural sciences. But related efforts seem to be hopeless to date:

1. The *theory of relativity* or *quantum mechanics* gave rise to many mystic stories (cf. "quantum mechanics"). In this context often two interrelated arguments are presented: In quantum mechanics' microscopic world the uncertainty principle makes the world non-deterministic. And because of chaos similar things appear in daily life's macroscopic world, too. Both statements are not only not helpful but also wrong: If one departs from thinking in variables such as three dimensional coordinates or positions and molecules' velocities, any attempt to adopt such theory is completely resolved. In the case of chaotic systems one however inevitably has to deal with things like molecules, due dates or financial figures, which change their position, date or value over time. So the theory of relativity or quantum mechanics cannot be applied here (cf. Grabinski (2004)). This leads to point 2.

2. One may account for the different rates or *frequencies of a system's changes* instead of looking for e.g. a value as a function of time: The set of frequencies can be displayed as a function, too. It is called "Fourier transformed" of the original function (cf. "Fourier transformed"). There is even a simple formula to calculate the Fourier transformed of a given velocity field. Even a backward transformation is simple. Therefore understanding the Fourier transformed world is as useful as understanding the "real world". Unfortunately the Fourier transformed of a turbulent flow looks as "ugly" as the original function. Researchers tried hard to get some simple information out of it by using very sophisticated tools – up to now the progress is pretty limited though.

Please note that approaches quite similar to hydrodynamics as well as working with Fourier transformed were utilized in order to better understand and foresee the stock markets' potentially chaotic motions – the results are similarly disappointing in either case (cf. Grabinski (2007), Chapters III, 3 and III, 3.2.2.2 as well as Chapter IV, 2).

4.3.3 Reasoning on hydrodynamics' applicability in economic sciences

The final conclusion of Chapter I, 4.3 in view of "forecasting chaos effects calculatively" remains the same as the interim one yet noted at the end of Chapter I, 4.3.1: Given any kind of system tends towards (chaotic) step-ups over time, relying on hydrodynamics is *inevitable* for calculating solutions. Given there is no hydrodynamic description, there is also no solution or *calculative* forecast (at least up to this dissertation's approach). So the unanswered questions are still:

1. What are the specific cases in which hydrodynamic descriptions exist in the fields of microeconomic (= business) and/ or macroeconomic forecasts?

2. What about the forecasts' explanatory power respectively?

Please refer to Chapters I, 4.4 to I, 4.4.2 – here selected examples are provided and discussed in order to provide well-founded answers.

4.4 Examples on hydrodynamic descriptions in economic sciences

Looking for hydrodynamic (= macroscopic) descriptions is a promising way to handle chaos in natural sciences. But do valid hydrodynamic descriptions exist in other potential areas of application like forecasting in economic contexts, too? At least some attempts were started here. In order to judge whether or not they are able to result in long-term robust forecasts – irrespective of the presents of chaos –, which also have explanatory power, selected cases of business planning and forecasting are opposed to the three hydrodynamic prerequisites (cf. Chapter I, 4.2). In order to recall the prerequisites better the classic and relatively easy example of a flow of water is also included into Figure 3; the business- respectively economy-related examples are detailed in dedicated Chapters respectively:

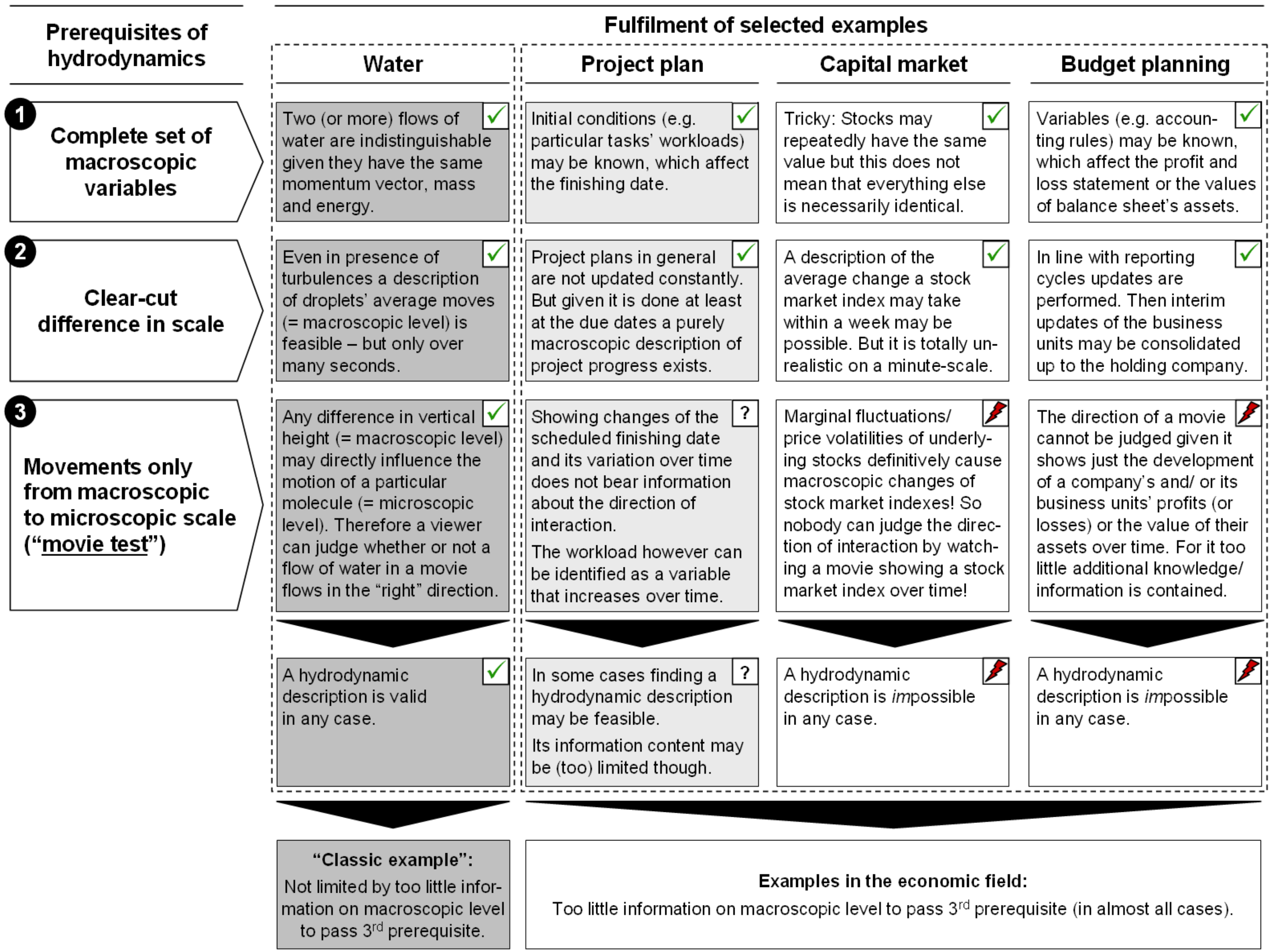


Figure 3: Hydrodynamic descriptions' three prerequisites – fulfillment by selected business examples (cf. Grabinski (2004), (2007))

4.4.1 Hydrodynamics' limited enhancement for chaotic project plans

Hydrodynamics may be fine for managing a *project plan*, whose (outcome) variables move around chaotically – such as the finishing date –, though the initial conditions are changing just marginally – such as particular tasks' workloads. A project plan that tends to chaotic step-ups can be constructed easily: It has many if-then-decisions and the affiliated parallel work streams have different length respectively. The critical path then regularly can shift strongly (cf. "critical path"): As soon as initial conditions are changed just a little bit – e.g. the decision to perform "Task A" instead of "Task B" at a certain point in time –, a completely different picture is created. This means – irrespective of the fact whether or not "Task B" is performed later –, the end date may shift in the desired direction or in the opposite one. In such cases the *1st hydrodynamic prerequisite* (= complete set of macroscopic variables) as well as the *2nd prerequisite* (= difference in scales) may be fulfilled. But the 3rd prerequisite (= direction of interaction) may or may not be fulfilled: This becomes clear given one imagines a movie that shows the scheduled end date and especially its variation over time. Nobody will be able to tell whether or not such a movie is running for- or backward. Therefore a hydrodynamic description is impossible here – any attempt to manage such a project is a pure waste of resources! Nonetheless the situation is not hopeless completely. There are two alternative solutions:

1. Take only those variables as a complete set, which *honor the 3rd prerequisite*: The workload is Conserved Quantity – that is why it works with it (cf. Chapter III, 2.1.2). Hence the workload performed as a function of time would be a possible solution. One knows that this is an ever increasing variable – therefore it is clear in what direction a movie runs, which shows nothing but the variable "workload". Here the drawback is: Getting a robust forecast of nothing else than the workload over time is far from being enough for most purposes. In summary this means:

   1.1 Hydrodynamics for project plans may be feasible (with some constraints).

   1.2 Their explanatory power however may be too limited to control the (timely) progress of a project's diverse tasks.

2. All *if-then-decisions* increase a project plan's complexity and thereby its tendency to develop chaotically. As a logical consequence, given complexity could be reduced by working on the if-then-decisions, the project plan would become more robust (cf. Grabinski (2007)).

Please note that "Alternative 2" will be treated separately in Chapter I, 4.5 so that the yet available (potential) solutions to chaos are address in a more structured way.

4.4.2 Hydrodynamics are "false friends" in calculating chaos in capital markets

Diverse researchers tried to bring some order in capital markets' chaos. This is tricky however when using hydrodynamics: From time to time e.g. stocks show the same value though not everything else is necessarily equal. Therefore additional variables are required to describe the system (= here: the stock market), e.g. profit per share. Though finding a complete set of variables will be strenuous, there is no principal obstacle from the point of view of the *1st hydrodynamic prerequisite*. (But according to Grabinski's (e.g. 2007) interpretation of Gutenberg's (1998) systemic approach it is completely senseless to describe a system by non-conserved quantities (cf. "systemic approach", e.g. in Chapter III, 2.1.1). And stock values – which are nothing else than market prices for interests in a company – were proven repeatedly to be the archetype of non-conserved quantities in economic sciences (cf. Grabinski (2007) as well as Chapter IV, 2). Let us come back to the stock market case namely to the *2nd hydrodynamic prerequisite*: The microscopic scale is the time until a new stock value is set, e.g. every couple of minutes. The macroscopic scale would be a day or a week, etc. So forecasts of an average stock value within a week may become possible, on a minute-base they are unrealistic. Though this is a certain limitation such result would still be of great interest. Regrettably any capital market – i.e. also the stock market – clearly fails the *3rd prerequisite*, i.e. the "movie test": Everybody knows that a stock index's value can be observed to go both up and down over time. The issue is that the summing up of the underlying stocks' little wiggles (microscopic level) may cause a massive fall in the Dow Jones, the NASDAQ or any other index (macroscopic level). Changes in indexes are rarely due to huge effects that are *clearly identifiable* on a macroscopic level, e.g. takeovers of companies. In other words in capital markets *marginal fluctuations* of underlying assets' values – such as stock values – can cause huge macroscopic changes of an index, too. And it is even worse: A huge macroscopic change on the level of an index appears most often when the little fluctuations of the underlying assets' values *reinforced* each other before. That is why predictions on the level of e.g. single stocks are impossible, too. (Please note the continuous issues that arise just because *parts* of the system show no clear-cut division line between microscopic and macroscopic motions). Therefore the 3rd prerequisite is definitively *not* met here!

Naturally *all* of hydrodynamics' three prerequisites must be fulfilled. Just then it is allowed to apply formulas that describe systems solely by averaged quantities, which can be observed directly on the system's macroscopic level. Otherwise an unambiguous macroscopic description of the system is *im*possible, i.e. potentially *misleading* – like in the capital markets example where hydrodynamic descriptions provide no support regarding forecasts of (average) values that stocks, stock indexes or any other asset traded at today's well-established exchanges may take over time. (As an example for the results of misguided algorithms in computer-based stock trading cf. Chapter III, 3.2.2.2). Therefore it would be a pure waste of resources to look any further for a non-chaotic (= robust) capital markets model that works by hydrodynamics – there is no such thing (cf. Grabinski (2004), (2007) and (2008))! Nonetheless Grabinski (2004) sees a positive aspect in the attempts to compare the chaotic systems in nature with those in business. It is of an educational nature: "For example one may use a chaotic system known from science to create a computer program simulating different stock markets. It can be used by stockbrokers like flight simulators by pilots. In doing so one can gain some *'feeling'*, which is often more useful than understanding. But it is neither an understanding nor a prediction."

4.4.3 Hydrodynamics' constraints in managing chaos in budget planning

For financial business planning, typically mathematical models are programmed, which integrate (historic and future) profit-and-loss ("P&L") statements, balance sheets ("B/S") and cashflow ("C/F") statements. Here the (missing) applicability of hydrodynamics can be diagnosed analogous to the capital markets case: The initial variables (including accounting rules) may be known – they affect the outcome stated in the P&L, the values of the assets accounted to the B/S and thereby the C/F. Any company's reporting cycle demands regular updates of its single business units' financials, which are consolidated up to the level of the holding company (at least at the end of a financial year ("FY")). The *1st and 2nd prerequisite* therefore may be fulfilled. So given the *3rd prerequisite* would also be met, a hydrodynamic description existed. Then the financial figures of the P&L, B/S and C/F could be forecasted by using averaged quantities, e.g. for each quarter, but forecasts on a daily-base would be impossible still. However financial forecasting systems cannot comply with the *3rd hydrodynamic prerequisite*: Nobody can declare whether or not a movie is running for- or backward given nothing else is shown than a chart mapping e.g. the company's profit over time. The same is true for certain assets' values accounted to the B/S:

1. On the one hand given *fair value accounting* is used to determine the values of e.g. the company's real estate its value may go either up or down over time (cf. "fair value accounting"). Here the movie test *cannot* be passed successfully because the swings of the global and/ or regional real estate market may feed back on the company's balance sheet values. (Whether or not fair values respectively non-conserved market values are qualified to reflect real values (= here: Functional Values) is still another matter (cf. Chapter V, 7).

2. On the other hand depreciation and amortization ("D&A") could be used to determine *"calculative market values"* as of a certain future due date. Then it is assumed that assets' balances are declining always over time – this would make it easy to pass the "movie test". But given there is sustaining demand for a certain asset, its real value and/ or its market value may have been fixed or even been risen above the price for which it had been acquired initially. (The differentiation between real value (= here: Functional Value) and market value by conserved and non-conserved parts of demand is explained separately (cf. Chapters IV, 2 to IV, 3.5 – in particular Chapter IV, 3.1)). So the problem with D&A is that though robust hydrodynamic descriptions of B/S values may be feasible, the result may have *next to none explanatory power* in view of the underlying assets' real values!

From everything that has been written yet on hydrodynamics in the context of financial forecasts and valuation in economic sciences, the following conclusions can be drawn:

1. The budget planning example does *not* conform to the 3rd hydrodynamic prerequisite (like the capital markets example). Against this background *trying harder does not help* in either case – e.g. reworking the general formula that aims to describe the respective system would be senseless. It just would waste (scarce) resources in terms of one's own time, employees' capacities, money, etc.

2. The reason why hydrodynamic descriptions were given a chance at all is: In natural sciences they circumvent problems, which result from practical limitations in the acquisition and processing of the comprehensive data volumes that come along with chaotic systems. A logical consequence from the above is: An *alternative path* must be found for financial forecasting and valuation (of companies' stocks, assets stated in their B/S, etc.), which is able to realize *comparable advantage in data handling*.

3. Hence two of the most important questions to be answered going forward are:

   3.1 What *kind of inputs* should be used in robust forecasting systems for business and/ or economic applications? And in this context:

   3.2 Why are the resultant *descriptions of reality* reliable and valid? Or to be more precise: Which reasons guarantee that the combination of these inputs and forecasting systems provide repeatedly prognoses, which are not only *robust* but also have *explanatory power* (though their potential inputs had to be narrowed down before).

The theoretical background for the "alternative path", which on the one hand is applicable to get a handle on chaos in quantitative economic sciences and on the other hand works independent of hydrodynamics' strict prerequisites, can be found in Chapter III, 2.1.

Its Sub-Chapters III, 2.1.1 and III, 2.1.4. as well as Chapter V address directly issues related to the questions 3.1. and 3.2.

4.5 Reduce complexity to limit the threat of chaos

As hinted yet there is still another approach of tackling chaos in business planning systems (cf. Chapter I, 3.4.1). It is helpful in particular for (non-quantitative) organizational and process management purposes but will be explained briefly nonetheless:

1. *Reduce if-then-decisions*: They are the nonlinearities that cause chaotic shifts of the final result e.g. in process plans.

2. *Reduce parallel workstreams*: This is done "automatically" because the 1st and 2nd step are interlinked. The important thing to note here is that the critical path has fewer options to take as soon as the 1st step was implemented. Therefore the critical path cannot shift that wildly anymore as compared to cases in which there are more parallel workstreams, which may have considerably *different length*.

3. The final result of the above is a plan that bears *less nonlinearities* and *less complexity*. Therefore statistics can show that the system itself became more robust (= less prone to chaos), too.

This approach to tackle chaos however does not come free of charge: On the one hand it could get projects under control whose end dates move around chaotically. On the other hand by applying it, an organization will not meet its optimum anymore in view of e.g. the shortest duration or the lowest workload (cf. Grabinski (2007)).

5 Conclusion: Economic sciences need a new solution to avoid chaos at its outset

Until now the author explains what chaos is, whereby it can be caused hence where it should be expected and how to prove its actual existence. In addition established approaches to handle chaos in natural sciences and the (interrelated) fields of economics and in particular of business were introduced. The author also commented on their qualification for this dissertation's purpose, namely bettering long-term financial forecasts and valuation. Taking everything into account this Chapter's conclusion fully agrees with Grabinski (2007): "because chaos makes things unpredictable, one should try to *avoid* it. And this is definitely the best advice how to "handle" chaos. But it is not always possible to stay out of chaotic situations." Please note that this statement – in particular in view of the attempt to "stay out of chaotic situations" – is the guideline for the following Chapters on Conserved Quantity approach ("Conserved Quantity Approach"). Please note also that the author based this approach on the work of Grabinski (2007), who derived it from the pure or traditional way natural scientists handle chaos very elegantly. Its advantage is the parallel fulfillment of two goals:

1. The goal of *effectiveness* (= "doing the right things") is reached by describing any economic system (on the micro- and/ or macroeconomic level) by Conserved Quantities only (cf. Chapter III, 2.1.1). This leads in particular to:

    1.1 (Robust) forecasting and valuation systems, which remain non-chaotic for any time period no matter how long it will become.

    1.2 Resultant forecasts have explanatory power in that they reflect the development of real economic values (= here: Functional Values) over time.

2. The goal of *efficiency* (= "doing the right things right" respectively "realizing the 'goal of effectiveness' with minimum efforts") is reached because: Only (changes in) significant influencing factors ("Significant Influencing Factors") are

used as inputs (cf. Chapter III, 2.1.4). Thereby Conserved Quantity Approach relieves practical limitations in view of data acquisition and data processing, too.

In this sense the cornerstones of the upcoming Chapters are: “Robust” (in the mathematical sense) is the antonym to “chaos” (in the mathematical sense), i.e. robust = non-chaotic. That makes robustness a primary goal in economic planning, in particular in the form of (quantitative) long-term financial forecasting. Robustness can be gained at best by relying on Conserved Quantities’ characteristics. Over and above no other approach has the same explanatory power in view of long-term validity when describing a company’s, an asset’s or a product’s, etc. real value (= here: Functional Value). Therefore not only managers and investors but also public institutions (= here: Ministry of Finance and Department of Commerce) would be better off to challenge their (long-term) strategies by it. Figure 4 provides an outlook on this “alternative path” to chaos resolution.

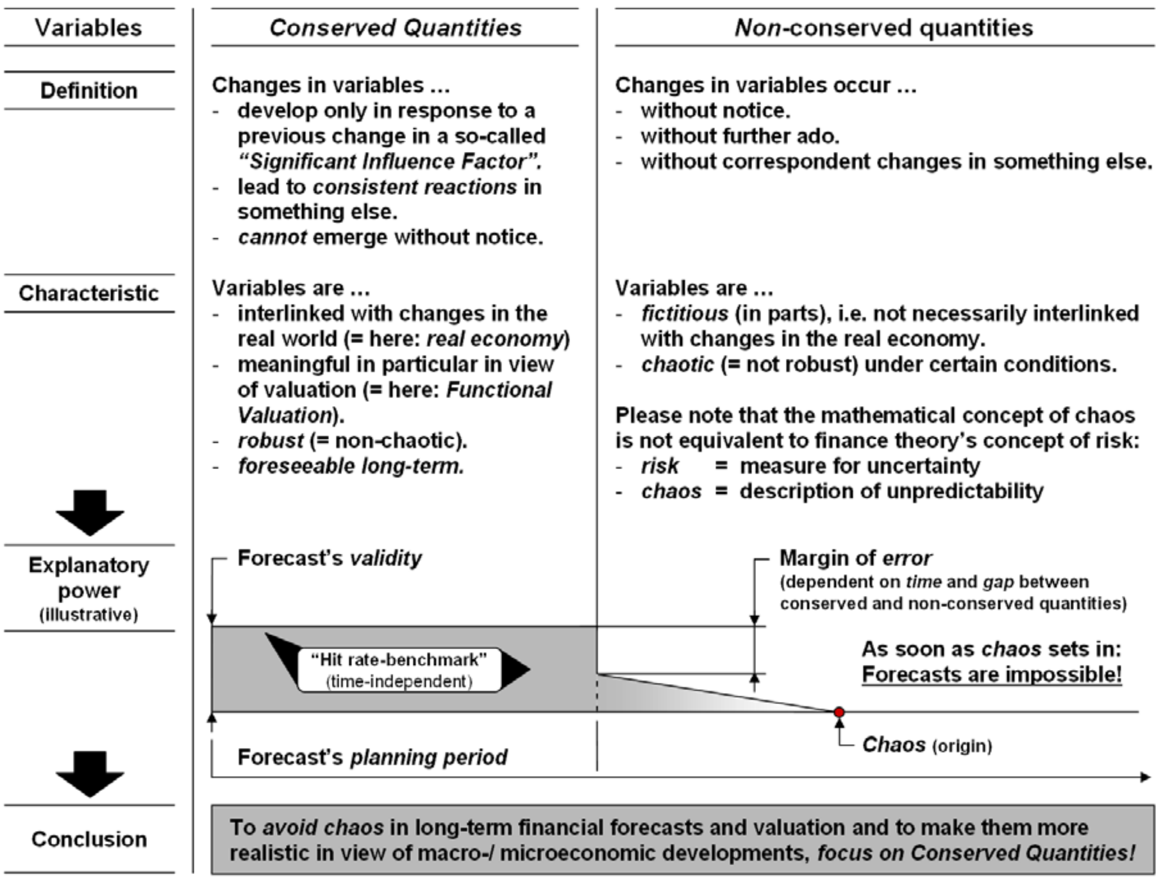


Figure 4: Robust Conserved Quantities vs. potentially chaotic non-conserved quantities

CHAPTER III

FIGHTING CHAOS IN ECONOMIC SCIENCES AT ITS OUTSET BY CONSERVED QUANTITY APPROACH

1 Introduction

The concepts of “Conserved Quantity Approach” and “Functional Value” are as inseparable as the requirements of “*robust* long-term forecasts” and “*meaningful* valuations” in order to take sound long-term valid decisions in the business and/ or economic context. Thereby an antipole to short-term market orientation is established to avoid losses – respectively sub-optimal resource allocation – when investing money, time and any kind of other (scarce) resources. In particular this Chapter provides the principal frameworks as well as selected examples that shall help to become a better decider – irrespective of potentially chaotic market moods – by applying Conserved Quantity Approach. In this sense it argues in line with Williams (1938), the inventor of an investment concept called “fundamental analysis” (cf. “fundamental analysis”; “investment value” as well as Chapter III, 2.2.2). He claims there are two ways to allocate (scarce) resources:

1. *Investment*: This means resource allocation that is *well-founded* based on *economic facts*. It strives to predict the future development of some kind of intrinsic value (= here: *Functional Value* (cf. Chapter III, 2.2.2 and III, 2.2.3)). The most obvious advantage is that potential returns become foreseeable long-term (because Functional Value is Conserved Quantity). The most obvious disadvantage may be that related approaches require much analysis and calculations.

2. *Speculation*: This means *betting* on *short-term market trends* either in line with market participants' herding behavior or against it. The most obvious advantage is that potential returns may be relatively higher if assets' market values overshoot at the exchanges *chaotically* in the respectively "right" direction. The two most obvious disadvantages are that also the losses may be relatively higher, too, if the market values overreact *chaotically* in the respectively "wrong" direction and that chaos is an omnipresent threat when betting on future developments of non-conserved quantities (= here: market values). Please note that *chaos evolves over time* – hence the longer a speculator's holding period becomes, the more luck is involved because nobody can foresee as of today whether or not the "right" chaos effect exists at the point in time at which the speculator plans to resell his/ her assets.

Admittedly at first it may look unwarranted to equalize (long-term) market value forecasts with speculation, betting and luck. This may be the case particularly when assuming efficient markets – that is one reason why the author challenges finance theory's "efficient market hypothesis" herein. Consequently he will provide theoretical reasons as well as quantitative examples, which both suggest this disbelief (cf. for example Chapter III, 3.2.2). Against the background of the above there is another parallel between Conserved Quantity approach and the one of Williams (1938). The two basic rules of investments are:

1. Consciously ignore short-term market trends.

2. Understand the underlying business of a company because that is where the money of an investment comes from.

The 1st rule predominantly requires self-control. The 2nd one however calls for theory as well as frameworks deduced therefrom, which are at best applicable in practice. The current Chapter therefore develops a definition of Conserved Quantities by referring to their natural scientific manifestations. But this working definition is also applicable to the diverse fields of economic sciences. Then Functional Value is defined, it is explained why it can be declared "Conserved Quantity" indeed and why the market value (in general) must be deemed "non-conserved" instead. To make clear the (often) huge gap between

Functional Value and market value – and thereby the (oftentimes) significant difference in potential outcome between following either an investment or a speculation approach –, selected examples that apply this Chapter's fundamentals were calculated and are presented hereafter (cf. Chapters IV, 2 and IV, 3 – including their Sub-Chapters).

2 Development of conserved Functional Value

Researching chaos in management or economics is relatively new (cf. Ferreira et al. (2010), Filipe et al. (2010)). The initiator who firstly looked for chaos – according to the mathematical definition – in business plans, financial forecasting and valuation systems was Grabinski (2004), (2007) and (2008). He also adapted from natural sciences Conserved Quantity Approach: It is a way to exclude chaos at its outset by selecting the right (= conserved) input variables, which develop robust even in the long run. Based thereon Grabinski (2007) identified the market or exchange value as the archetype of an economic non-conserved quantity. This explains why markets – under certain conditions – may shift (chaotically) by significant margins. And implicitly it suggests that decisions – in particular long-term ones – should not blindly rely on market values' *asserted* explanatory power. Karl Marx (1887) came to similar conclusions: In consequence he advices in his scientific work on political economics to differentiate between "exchange value" (= here: market value) and some sort of intrinsic value (= here: Functional Value (cf. Chapter III, 2.2.3)). Marx's differentiation prevailed in financial analysis to date:

1. *Exchange value* respectively market value is something directly observable. Grabinski (2007) adds: "The exchange value is a non conserved quantity. It may take any value in an arbitrarily short period of time."

2. *Intrinsic value* in contrast is not directly observable. Grabinski (2007) continues: "It is some underlying value. Only if the underlying thing changes this value may change. Therefore it is a conserved quantity."

About 130 years passed since Marx's (1887) thought-provoking publication. But it is still highly disputable how to calculate intrinsic value exactly. The only thing some yet by far not all intrinsic valuation approaches have in common is: They apply some kind of discounted cashflow ("DCF") model (cf. Chapter III, 2.2.2). The author agrees to a large extend, however: To get intrinsic values whose forecasts are able to reflect the real value of the underlying company, asset, product, etc. (= here: Functional Value) and develop robust long-term, the cashflow must be adjusted for potentially chaotic (= non-conserved) quantities before. So the first step to avoid chaos effects in economic sciences right at their outset – namely to discriminate Conserved Quantities from non-conserved ones – is explained hereafter in Chapter III, 2.1 and its Sub-Chapters (cf. Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012)).

2.1 Conserved Quantity Approach

Natural scientists consciously embrace *their own* Conserved Quantity Approach: It allows (robust) prognoses in view of the future states of certain (conserved) variables within a closed system; these forecasts *repeatedly* remain within an appropriate margin of error (cf. Grabinski (2007)). To get access to these advantages, natural scientific Conserved Quantity Approach shall be explained and reworked in this dissertation. Needless to say that the following prerequisites have to be considered thereby:

1. On the one hand Conserved Quantity Approach must be applicable to the different field of economic sciences.

2. On the other hand its fundamental naturally scientific principles must be kept – in the end they guarantee Conserved Quantity Approach's advantageousness.

For the particular ways and means how this can be realized please refer to the following Sub-Chapters III, 2.1.1 to III, 2.1.4.2 – there *economic* Conserved Quantity Approach is introduced and refined step-wise. That creates the base for the unambiguous definition of (conserved) Functional Value – its derivation can be found hereafter (cf. Chapter III, 2).

2.1.1 Background from natural sciences: Gutenberg's systemic approach

The systemic approach of Gutenberg (1998) has its origin in natural sciences (cf. "systemic approach"). In essence it opines that business situations are describable as functions of *certain* variables, too. The link between the systemic approach and this dissertation's proposal for solution – which focuses on Conserved Quantities – is: Given the wrong (= here: non-conserved) variables are applied as inputs even mathematically sophisticated forecasting and valuation systems are (at best) of very little use. This link was established by Grabinski (e.g. 2007). Therefore the terms "systemic approach" or "systemic approach of Gutenberg" are used hereafter mostly as a purely linguistic shortening of the term "*Grabinski's interpretation* of the systemic approach of Gutenberg". Please note this is most important because: Gutenberg (1998) – in contrast to Grabinski (e.g. 2007) – never advised to discriminate between Conserved Quantities and non-conserved ones. So Grabinski's interpretation of the systemic approach should be taken into consideration here; its three ingredients are:

1. The *existence of a function is hypothesized*, which has the potential to reflect the outcome of the system (= here: business and/ or economics).

2. *Proper variables* (= here: Conserved Quantities) must be found.

3. Given the 1st *and* the 2nd step are fulfilled one may try to *find the function and discuss its behavior*. This step is business sciences' main subject – arguably it is its very definition.

The 1st step just can be assumed. The 2nd one – identifying *proper variables* – needs further investigation. Up to the author's knowledge, this issue was initially addressed in business sciences by Appel and Grabinski (2011): *Conserved Quantities* were proven the only variables, which are qualified to describe the system performance – no matter whether or not its characteristic is natural scientific or managerial. *Non-conserved quantities* were shown to be unqualified instead – the reason is an effect called *"chaos"* (cf. Schuster (1984)): Non-conserved quantities may change unpredictably (and non-reproducibly) though their development over time is completely deterministic (from a purely mathematical point of view). The threat that non-conserved quantities – like market values – may shift in this sense chaotically is omnipresent. At a moment's notice, under certain conditions, they may step-up. Then marginal changes at the outset are amplified throughout the system and result regularly in drastic deviations towards the expected outcome. Therefore systems that apply non-conserved quantities will provide outcomes that are never reliable (and often wrong). In consequence non-conserved quantities are *improper* for describing anything (cf. Appel and Grabinski (2011), Appel et al. (2012) as well as Grabinski (2007)).

To see the point more clearly please let us look to natural sciences where Gutenberg (1998) took his core insights from: Thermodynamics' second law (cf. Callen (1970)) is closest to Gutenberg's approach. In the 1st step the existence of a function called "entropy" is predicted here (cf. "entropy"). Then natural scientists had to find proper variables in the 2nd step: Energy and number of particles are the proper ones according to thermodynamics' first law. These are far from being arbitrary choices! In view of pure mathematics there are many more sets of variables describing the system completely and uniquely. But almost all of them are irrelevant for most practical purposes. Only *Conserved Quantities* have any meaning for describing the system. The following explicates why: Consider a flubber ball, which bounces back and forth within a small room (= here: the system). The ball's energy is a reasonable variable for describing the system. Knowing the energy yields the ball's maximum velocity and height. Furthermore forecasts are feasible in view of how long the ball will bounce (given also the rate of dissipation is known). The ball's energy changes slowly and very predictable. The reason is: *Energy is Conserved Quantity – if the ball's energy decreases it must be transferred to somewhere else*. (Here it is transferred from the ball to the heat inside the room). There is no alternative – the (conserved) energy cannot just appear or disappear without notice and further ado and consequently it also cannot change without changing something else! As one may know from basic science lessons, energy is the sum of kinetic energy (essentially velocity squared) and potential energy (essentially the height above ground plus the stress of the ball here). Factoring in two addends separately should be more precise than considering the sum of them (at least from pure mathematics). But here considering two addends – kinetic energy and potential energy – proves to be a complete mess: Assuming the description of a system of many (say 100) bouncing balls this becomes particularly clear: The 100 balls' *total* energy can be predicted easily at each point in time. But trying to predict the (total) kinetic *and* potential energy separately at any given time will be tedious. The practical reason is: For the assumed system of 100 balls one can prove that not only the friction of the 100 balls and the air but also the gravitational effect of the 100 balls under each other and even the gravitational effect of an observer have strong influences. Obviously nobody can include all this small influencing factors and their interrelationships into a forecasting model. Therefore the system's future state appears to be unpredictable though it is completely deterministic when considered purely mathematically. This shows clearly what chaos means for people working on any kind of forecast: At best all input variables may be known but they cannot be computed accurately due to the system's *complexity*. That is the reason for the impossibility to predict the weather for a long period of time, too (cf. Chapter II, 3). And it makes the calculation of next week's lottery drawing – which follows the same technical principle as the bouncing balls – unrealistic as well. Nonetheless there are people claiming they are able to forecast lottery numbers. They rely on something like a mathematical system and some (yet very few) may even hit the jack pot. But the existence of luck proves nothing. Only fools call it a business to *guess* the number of next week's lottery drawing in order to create a profit (cf. Appel and Grabinski (2011)).

These results from natural sciences have clear consequences for this dissertation: Changes in business and economic conditions underlie *complex interrelationships*. And non-conserved quantities may change unpredictably within complex systems. Therefore building an (alleged) business on observing and predicting *non-conserved quantities* – in particular market values – is as ludicrous as the (alleged) business of calculating next week's lottery numbers. In contrast *Conserved Quantity Approach* allows for well-justified decision taking by forecasts of Conserved Quantities that are computed to (conserved) Functional Values; both account for the economic system's long-term development with highest possible accuracy (cf. Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012)) as well as Grabinski (2007), (2011a), (2011b) and (2011c)).

2.1.2 Working definition of Conserved Quantities

This dissertation stresses the magnitude of *resource constraints*, which require *consistent* changes as soon as the system moves to a new state. Conserved Quantities are the only quantities that react in such a manner (cf. Chapter III, 2.1.3.2). Therefore herein is implicitly asked continuously one key question any wise investor may consider: “Where could the cash really come from, which accounts for the gains (= here: increase in Functional Value) of any transaction?” In this sense *Functional Valuation* consciously embraces Conserved Quantity Approach, which was introduced to business sciences by Grabinski (2007). He describes the observation that initiated its development as follows: “[…] My urgent advice is to use conserved quantities for judgment only. And the value is especially tricky. […] During the end of the 1990s I had personally contact to CEOs of newly established technology companies. They made (at least temporarily) real money. But they could not explain in simple words were it came from. The eventual source of it was entirely from buying and selling stocks or performing initial public offerings (an exchange of collectors’ items). […] Some of these CEOs had a higher business degree. Especially they got fooled. They had learnt accounting rules and used them eagerly. The only mistake was to take them at face value. People without formal business education had an advantage. They only believed in profit if the underlying operation produced a positive cashflow. They took the very good advice to understand what is going on rather then barely calculating it. So my advice to every CFO is to *understand* what is going on.”

In order to explain what Conserved Quantities are Grabinski (2007) refers to their origins in physics: Here a conservation law exists in view of the energy introduced into a system. *This does not mean that the energy remains constant everywhere!* But (at least one) *consistent change in something else* must exist in order to change the energy: Given the energy was lowered in some place, in consequence some kind of energy, heat, etc. must go up in another one (cf. Chapter III, 2.1.1). Else an infinite drain (which consumes energy out of the system) or – in an alternative set-up – an infinite source of energy (which sends additional impulses) would be inevitable. But for Conserved Quantities – like energy – phenomena of infinity cannot be observed (cf. "perpetual motion machine" as an antipodal concept). By generalizing the insights from this natural scientific example any variable – like the net cashflow – can be declared *"conserved"* or not based on two prerequisites (cf. "conversation law of energy", e.g. in Chapter IV, 2.2 or Figures 40, 50 and 57):

1. There is (at least) one *cause* (= here: Significant Influencing Factor) for any change of the variable under consideration.

2. There is a *simultaneous reaction* in (at least) one Conserved Quantity: If there is a change without a simultaneous reaction this change is non-conserved and – in economic sciences' context – reflects presumably just a rather short-term market mood that can reverse again without notice. But if there is a reaction the related changes are conserved: They indicate – in the economic sense – a reorientation within the economic system that is "bought" by actively deciding against something else (e.g. consumption of another product, investment in another asset, forgoing both by saving). This reorientation is forced by resource constraints, which are immanent in any system (cf. above). That has two implications especially for economic systems:

   2.1 Resource misallocation – in particular in its strongest form namely economic bubbles and related crisis (following their reversal) – become detectable by Conserved Quantity Approach right at their beginning. Hence resource misallocation can be avoided before potentially severe consequences materialize (cf. Chapter III, 3 and Chapter V).

   2.2. Given a change in Significant Influencing Factor results in conserved changes of at least two Conserved Quantities, the *real* economic system will adjust. And it will remain that way until the same or another Significant Influencing Factor changes again. Please note such real economic changes relate to changes in *operational value creation* and marketing its products. Due to the underlying processes – in contrast to non-conserved market values – such things cannot shift without notice and they cannot shift without further ado. This means: Significant Influencing Factors are indicators for future changes within the relatively inert *real* economic system. That makes forecasts by Conserved Quantities not only robust bust also more realistic long-term because: They always keep track of economic changes but they never overreact on interim market volatilities (cf. Chapter III, 3.2.3 as well as Chapters IV, 2 and IV, 3 – including their Sub-Chapters).

Against the background of the 1st and 2nd prerequisite it becomes clear why managers, investors and if applicable also political deciders must understand, which Significant Influencing Factors exist that may affect customers' Functional Requirements for certain products (and/ or economies' Functional Requirements for regulation to keep certain products accessible (cf. Chapter IV, 3.5)). And these deciders must become able to *check for potential side-effects* in order to judge whether or not economic changes are conserved and therefore will show long-term reliable (= here: robust) developments (cf. Chapter III, 2.1.4).

Given Conserved Quantities' two prerequisites are fulfilled, this means in summary: Proper variables have been found in line with the 2nd step of Grabinski's (e.g. 2007) interpretation of the systemic approach of Gutenberg (1998). They are qualified to describe real economic scientific systems because: These conserved variables will not shift chaotically; instead they will develop foreseeably just in response to – and with an appropriate rate to – real economic changes. To render more precisely what that means in view of Conserved Quantity Approach in long-term financial forecasting and valuation please allow for an example, which outlines the general analysis roadmap suggested in this dissertation: There are *macroenvironmental* Significant Influencing Factors, which can be divided further into political, economical, sociocultural, technological, legal and ecological factors (cf. ("PESTLE") framework e.g. in Hax and Majluf (1984) as well as Chapter V, 5). Given they changed before, Functional Requirements, which justify factually the acquisition of any item – and thereby the conserved part within the total economic cashflow ("Conserved Cashflow") – will change, too. (Because any company's net Conserved Cashflow over time accrues to its Functional Value ("Functional Firm Value"), the amount of Functional Firm Value will adjust correspondingly). Since herein is focused on Conserved Quantities, analysis has to check: What are *specific* Significant Influencing Factors for a particular company (or a particular industry)? *Whereto* does the cash flow exactly – and is this cash reallocation justifiable by changes in specific Significant Influencing Factors? *Wherefrom* (= here: direct competitors, innovative substitutes, savings, etc.) does the cash flow away – and is this cash reallocation justifiable by the same changes in specific Significant Influencing Factors? Do the sums of these directly opposite cashflows (round about) *even out* each other? If so they are 100% Conserved Cashflows. If not one has missed one or more specific Significant Influencing Factor(s), which must be identified case based in order to describe the system properly. (Please note that Significant Influencing Factors always must be determined case-based. The constraint "specific" therefore will not be named in this context anymore). Here (company-internal) *microenvironmental* Significant Influencing Factors were ignored so far. Analyzing their potential effects in principle works like for the macroenvironmental ones: They must change before – only then there is a purely economic justification for changes in Conserved Cashflows, Functional Firm Values and/ or Functional Values of B/S assets (that partly account for Functional Firm Value). But there are still more company-internal issues: They relate e.g. to changes in Functional Requirements for existing production assets in course of investments in additional machinery and equipment. Over and above microenvironmental Significant Influencing Factors that belong to one particular company – e.g. its innovations – may feedback on the macroenvironmental level. Hence this example shows: When considering conserved changes only, on *diverse levels* of the real economic system – which includes the companies operating therein –, value performance can be foreseen realistically (cf. Appel and Grabinski (2010), Appel and Grabinski (2011), Appel et al. (2012) as well as Grabinski (2007), (2011a), (2011b) and (2011c))). By relying on such "conserved forecasts" deciders can successfully disengage themselves from those market trends, which have disputable economic lifetime. (At this point the author however would like to confess, too, that finding economic Conserved Quantities is not as easy in practice as in this introductory example: To sensibilize first and foremost for the potentially conserved interrelationships between the macro- and microenvironmental level, it was simplified and assumes there is nothing else than Conserved Quantities – of course this is not true. For more detailed real life examples please refer in particular to Chapter III, 3 and Chapter IV. Based on the insights deduced therefrom it becomes possible to finally suggest in Chapter V rules for Conserved Quantity accounting ("Conserved Quantity Accounting") and Functional Valuation, which are generally applicable in view of complex real life conditions). For now the important thing to keep in mind is: Conserved Quantity Approach calls for *holistic* Functional Value analysis ("Holistic Functional Value Analysis"), which includes the macroenvironment, the companies – i.e. not only the one under consideration –, these companies' products, their material and immaterial assets as well as their employees' capabilities because:

1. Significant Influencing Factors that are preconditioned by changes in the macroenvironment *and* that can be influenced by companies (= microenvironmental ones) can change *economic Conserved Cashflow allocation*.

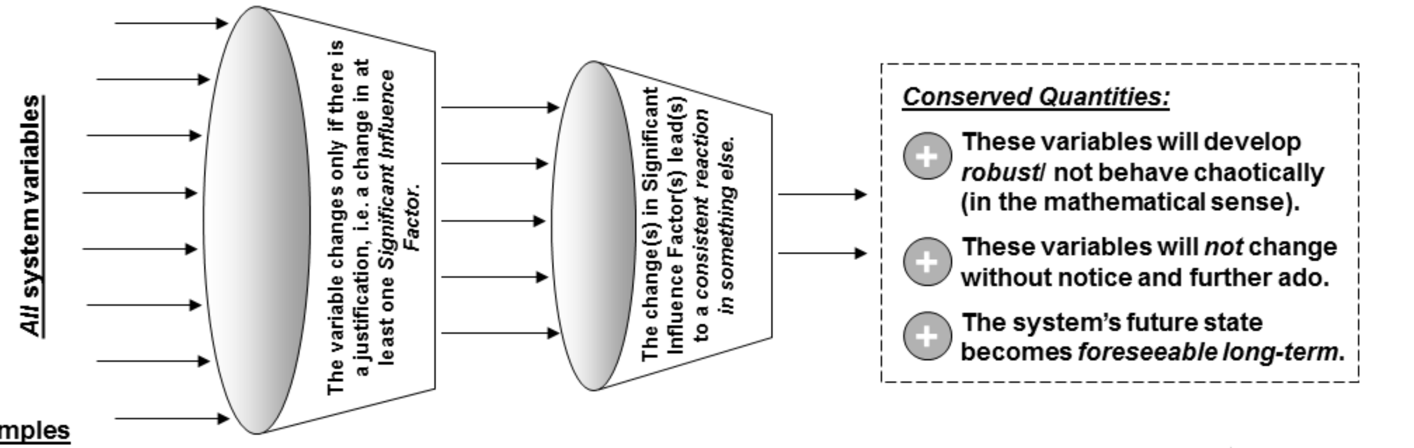
2. To find microenvironmental Significant Influencing Factor please note: Financial forecasting and valuation are not only inseparable here but also they must be linked with companies' *strategic and operational planning*. Thereby they address *the* two core issues of any company, which strives to exist long-term:

   2.1 Which (conserved) sales are expectable in the future – and what (conserved) changes must be implemented before?

   2.2 Which (conserved) costs are expectable in the future – and what (conserved) changes must be implemented before?

However please do not confuse "*holistic* Functional Value Analysis" with "including everything into the forecasting and valuation system" – that counters Grabinski's (e.g. 2007) interpretation of Gutenberg's systemic approach (1998) and leads to an unjustifiable pseudo-accuracy (cf. Chapter III, 2.1.4.1). Nothing else than (changes in) Conserved Quantities must be accounted for! But in order to "understand what is going on", i.e. to see whereby the conserved changes may be caused, at first it is often helpful to get a "big picture" of everything that relates to a company's business model (or to an industry). Then one understands better the magnitudes of diverse influencing factors on Conserved Quantities – this helps to sort out Significant Influencing Factors and insignificant ones (without the risk of overseeing a significant one). After this pre-selection of inputs one finally can perform the 3rd step of Gutenberg's systemic approach: The function can be discussed in form of a forecasting and valuation system. So it can be tested if it describes (within a reasonable margin of error) the *consistent* changes in a real economic system like: *Transfer* of client base from "Company A" to "Company B", *transfer* of sales from "Old Product C" to "New Product D", *transfer* of asset utilization from "Old Machine E" to "New Machine F", etc. (cf. particularly Chapter V, 5.1).

To close this Sub-Chapter Figure 5 on the following page depicts the working definition of Conserved Quantities and applies it to selected examples (cf. Appel and Grabinski (2011), Grabinski (2007)). Thereby it becomes obvious that the goal of keeping Conserved Quantity Approach's fundamental naturally scientific principles – and thereby its advantages – is realized though the applicability to economic contexts is secured at the same time, too.



Examples

Input	1st prerequisite	2nd prerequisite	Result	
General conservation law in physics	Going into and out of the system there is a difference in energy ("E"), which equals the net energy current ("Q"). ✓	Inside the system any change in energy E must be identical to the net energy current Q. ✓	The energy E can neither change spontaneously without a change in Q nor continuously. Else an infinite energy current, being impossible, is needed. The system is *foreseeable* by looking at Q. ✓	Energy E is *conserved*. ✓
Example on exchange of mechanical energies	Someone lets a ball dump down. ✓	With every difference in height the ball covers it looses potential energy. Concurrently it gains kinetic energy. ✓	The ball cannot stop at once. It will jump around until friction let dissipate all kinetic energy into thermal one. This is a *foreseeable process*. ✓	Mechanical energies are *conserved*. ✓
Example on demand shift	Innovation enables miniaturization of performable digital portable music devices, which do not require optical data carriers. ✓	Sales of walkmen and CD-players decreased in response to increased sales of mp3-compatible mobile music devices. ✓	Mobile music devices' techniques changed. That led to a *foreseeable* re-allocation of cash spent for accessing the function "mobile music" to mp3-players. ✓	Cashflow for "mobile music" is *conserved*. ✓
Example on stock market values	There is a crash, which halves the stock values of 1,000 publicly listed companies. ✓	The companies' operational value creation processes (almost) did not change. ✗	Market swings can step-up and non-trivially affect stock values of (maybe) uninvolved companies at short notice. ✗	Stock values are *non*-conserved. ✗

Please note: "Ceteris paribus"-situations were assumed in which only one change led to the system's future state. In reality far more influencing factors would have to be considered and selected based on their significance on the system's outcome. However that would be beyond this introductory Sub-Chapter's scope.

Figure 5: Conserved Quantities: Prerequisites and advantages by selected examples

2.1.3 Substantiating Conserved Quantities' key aspects by selected examples

To gain more security in finding "proper variables" (= here: Conserved Quantities) the reader may like to get additional background information and more examples like those summarized in Figure 5. In this case please refer to the following more detailed explanations of Conserved Quantity Approach's key aspects – they form the basic conditions to get in practice variables that support robust long-term forecasting and valuation systems. For your convenience a summary thereof is also provided at a later part of this Sub-Chapter, which is finally closed by an addendum that links Conserved Quantity Approach to Levitt's (1975) classic paper "marketing myopia" because: From the author's point of view Levitt's work contains principles of strategic business planning that should – and actually are – also respected herein in order to become more "farsighted".

2.1.3.1 Not all system variables are conserved

The conservation law in mechanics postulates that within a closed system the sum of the potential and kinetic energy is constant over time. Therefore energy cannot simply occur or fade away. Instead it needs a reason for any change, e.g.: If a ball was dropped the reason for the successive change in potential energy – i.e. the falling down – as well as the effect on the (potentially) Conserved Quantity under consideration – i.e. the reduction of potential energy – can be observed. Furthermore an increase in kinetic energy is observable. Hence there is a consistent reaction in another (potentially) Conserved Quantity – i.e. the increase of kinetic energy. Both *changes* of energy have the *same amount* yet the opposite algebraic sign and result from the *same specific Significant Influencing Factor* – i.e. the letting loose of the ball. These observations render the potential and the kinetic energy not just potentially Conserved Quantities. They prove these energies to be Conserved Quantities indeed. Over and above the transfer of the potential to the kinetic energy cannot be stopped at once. Rather the ball has to come to rest slowly. For it the friction, which originates from the ball jumping on the ground, lets all kinetic energy dissipate into thermal one. When knowing the rate of dissipation one can compute this transfer of kinetic to thermal energy, too (cf. "rate of dissipation"). Hence the prerequisites of Conserved Quantities are also fulfilled in the latest case – though the Significant Influencing Factor is another one here. This means the total energy within this mechanical system – as well as its split-up in potential, kinetic and thermal one – reflect “proper variables” in the sense of Grabinski’s interpretation of the systemic approach, i.e.: These variables are Conserved Quantities and in consequence are qualified to describe the system’s state at any point in time. Please note the parallels this example shows regarding *economic* Conserved Quantities: Conserved Quantities that keep the diverse processes within the mechanical system alive are the total energy as well as its parts that are allocable to potential, kinetic and thermal energy; *Conserved Quantities that keep the diverse processes within the economic system alive are total Conserved Cashflow as well as its parts that are spent for products having (conserved) required Functions (“Required Functions” (cf. below)).*

For any change of the energy within this mechanical system there needs to be at least one underlying reason. The respective reason cannot affect the system several times or continuously, i.e. it can affect the system just *once*. Otherwise the system would be affected by an infinite source of Significant Influencing Factors, which is not realistic. This suggests the following: A person can dump down a ball once (= 1st Significant Influencing Factor) and admittedly he/ she could pick it up and let it fall repeatedly. The energy within the system would be affected by dumping down the ball for the 1st time: During the fall the sum of the energies within the system remains unchanged but the potential energy is transferred to kinetic one simultaneously to every difference in height that the ball has covered. If the person picked up the ball for a 2nd time this would reflect a new reason for a change (= 2nd Significant Influencing Factor): Thereby the ball’s potential energy would be increased once again. This however would require additional work, i.e. the potential energy would not simply occur. The work for lifting the ball in turn requires some source respectively consumes some energy. Due to omnipresent resource constraints the person could not lift up the ball forevermore (= ∞ Significant Influencing Factors are unrealistic). Instead he/ she would get tired, run out of time for other things, etc. This means: The conservation law would be fulfilled in any case. Please note the implications this example conveys for *economic* Conserved Quantities: People are also Significant Influencing Factors on the economic system in that they work (= here: add Functional Value to products by generating Required Functions from customers’ point of view) and in that they consume and/ or invest (= here: collectively "buying behavior"). But it is also true that people cannot influence the economic system endlessly because in real life they face the same resource constraints like in the example above. Without debt financing the conserved magnitude a person has on the economic system at any point in time equals exactly this person's (retained) Functional Value of Work ("Functional Value of Work") – it reflects Conserved Cashflow he/ she is able to spend to become Significant Influencing Factor in terms of buying behavior. In the presence of debt the situation is similar. Yet one has to check whether or not the debt is Conserved Quantity. This applies only given the debt is used for something that has Functional Value – like in the "equity only case" – *and* given the debt can be repaid by somebody's Functional Value of Work, i.e. by Conserved Cashflows. This may become clear when considering the following all-embracing business case: Given an (alleged) investor built a residential house – which turned out to be vacant all time – *and* given more and more potential occupants are leaving the place *and* given the building costs were paid in parts by debt – which was provided by a bank – *and* given the debt cannot be repaid, there is no Conserved Quantity and no Functional Value for anybody! The only person who potentially had *luck* – given he/ she was paid fully yet – may have been the developer of the house. But luck is nothing foreseeable and of course it cannot fulfill Conserved Quantities' two prerequisites! Furthermore, in view of the bad prospects at this particular location, the developer for sure should *not* include building additional houses there into his/ her long-term forecasts – finally a residential house without residents cannot have Functional Value! So the funds spent for the (Functional) Valueless house – no matter whether or not they were equity or debt – reflect non-conserved cashflows. (Needless to say that it is impossible to spend Conserved Cashflow for something that has no Functional Value). That fact becomes clear in particular on the levels of the investor and the bank: The investor must recognize that he/ she spent not only but also equity for a dead article – naturally this cashflow is non-conserved. (Here the most likely chance of recovery is again luck but not that Functional Value can be realized in the future by renting or reselling the house to residents that are willing to pay at least the building costs). And the bank must recognize that the investor's Functional Value of Work in total is too low to repay the debt (not to speak of the interest), i.e. here the investor is also unable to repay them by cash he/ she generated with other maybe more successful ventures. The consequences from these examples are: In the end nobody can regularly consume and/ or invest more than his/ her (conserved) Functional Value of Work without misbalancing the real economic system. Due to one's own resource constraints one's Functional Value of Work cannot be increased endlessly – neither by dept nor by any other means. *This makes Functional Value of Work the only existing source of Conserved Cashflow, which guarantees keeping the economic system alive long-term!* Everything else is a manifestation of non-conserved cash reallocation due to luck (or bad luck dependent on whose perspective you take). And the developer of the house is not the only person who should hesitate to build a business on luck or fortune. (For additional effects of Functional Value of Work cf. Chapter V, 5.1.1).

Let's come back to the mechanical system: Naturally the total amount of energy contained therein can be forecasted since it is Conserved Quantity. The same applies to the state of the energy as long as the ball rests in the person's hand, during its fall and when it lies on the ground. The potential energy increases with every difference in height the ball is lifted, the kinetic energy increases with every difference in height the ball falls down, etc. *But the result of the test arrangement in parts is subject to chaos, too!* Here it becomes clear that a system does not necessarily have to comprise nothing but Conserved Quantities just because it contains one or more of them, e.g.: The horizontal coordinates of the place where the ball comes to rest cannot be predicted. Infinitely small changes like a small twist of the ball originated from bouncing on the ground can lead to unexpected large deviations from the place where it came to rest in a previous test cycle or where it was expected to come to rest in the current one (= chaos effect). This shows how important it is to analyze and understand a system *holistically* in order to become able to separate all Conserved Quantities – as well as all of their Significant Influencing Factors – from non-conserved quantities: Needless to say that the mechanical system's state at any point in time could not have been described given e.g. the kinetic energy was omitted. And given one tried to foresee non-conserved horizontal coordinates, such attempts legitimately could be called a complete waste of scarce resources of all involved persons (and if applicable of their employer)! Please note here are also parallels to *economic* Conserved Quantities: Products may have functions, which are conserved because they satisfy Functional Requirements from customers' point of view – these are Required Functions and they are the only ones that bear Functional Values, which are also determined from customers' point of view. But the same products may have functions, too, which must be deemed "non-conserved" hence

"Functionally Valueless". These non-conserved/ non-Required Functions relate to product features whose right for existence cannot be related to – or even contradict – Significant Influencing Factors. Naturally also any company's Functional Firm Value must relate to its products' Functional Values hence its products' Required Functions (a company's non-conserved market value often lacks this explanatory power though). Yet mentioned examples where this causal chain indicates a considerable gap between an item's Functional Value, its building costs and/ or market value are: The vacant residential house that was build in an increasingly desolate location (cf. above); the decision to buy or "invest" in something due to *purely* seasonal design features and/ or (mostly) short-term herding behavior like in case of collector's items or alleged "growth shares" (cf. Chapter I, 1 – in particular Figures 1 and 2). Additional examples are provided throughout this work at hand (cf. Chapter III, 3, Chapter IV, 2 – in particular Table 2, Table 3 and Figures 26, Chapter IV, 3 – in particular Figures 28, 29, 34, 37 as well as Chapter V, 5.2.1.1 as well as Chapters V, 5.1.4.1 and 5.1.4.2).

2.1.3.2 Resource constraints require consistent change in something else

The consistent (conserved) change in something else is forced by omnipresent resource constraints. They prevail not only in mechanical systems but also constrain customers' and investors' decisions and thereby whole economies at any point in time. Therefore it is improbable that in real life new markets can be created and developed without influencing already existing ones: "New markets" most likely will cannibalize – and in the long run will lead to a collapse of – the demand in already existing "old markets". (Please note that the conserved part of demand is called "Functional Requirement" – it relates to (conserved) demand for Required Functions only. Demand for non-conserved/ non-Required Functions instead relates to product features whose right for existence and economic lifetime is dubious (cf. end of Chapter III, 2.1.3.1)). In line with the above it is unlikely, too, that an innovator is able to create new *net* employment indeed – irrespective of whether or not his/ her business is growing: It may be the case that new employment is created at the innovator's company under consideration. But it is also likely that – particularly in the long run – employment is reduced in turn at least at one competitor because the innovator will absorb (some of) the existent companies' (conserved) sales potential. (Due to their resource constraints members of an economy simply cannot continue by "buying everything"). Hence in either case there would not be a "creation of something new without side-effects". Instead there would be (conserved) transfers of Conserved Quantities in terms of demand, employees, etc. – i.e. a "consistent change in something else". Please note that skeptics might have two objections here, which must be evaluated in view of Conserved Quantities, too:

1. Particularly (some) politics and (some) lobbyists – dependent on their respective school of thought and/ or self-interests – opine that states could issue *government bonds* in order to get fresh money and thereby overcome resource constraints. Yet this approach works out well long-term only if all citizens' Functional Value of Work can be used (via taxes and dues) to repay all of the dept one day. And it will not work out well if Functional Value of Work is too low and/ or if the state did not take care to actually *invest* the debt: If the state invested (= here: provided funds to organizations that create Functional Value) and given the state's debt ratio is not too high to be repaid by the resultant Conserved Cash inflow, everybody will be better off. If the state however just consumed the funds, there will be no long-term robust Conserved Cash inflows to repay the dept. (So in principle all parties here face the same problems like those doing business with the "unsuccessful real estate investor" (cf. Chapter III, 2.1.3.1) – though the economic dimension may become much more threatening here).

2. (Some) politics and (some) lobbyists – interestingly round about the same group of people that are also uncritical in view of using government bonds for diverse purposes – opine that problems of "resource constraints" can be served easily by central banks: They only would have to *"print fresh money"*. But the volume of money in circulation is macroenvironmental Significant Influencing Factor on inflation (cf. "monetarism" in context of inflation). To make a long story short: Also here are Conserved Quantities at work, which result in "consistent change in something else". Hence – within the economic system (= here: monetary area) – there must be (enough) Functional Value of Work to outbalance an increasing volume of

money. Otherwise inflation will get out of control and the respective economic area will foreseeably develop like those researched by Reinhard and Rogoff (2010); in a nutshell they found out: Inflation is national bankruptcy by installment.

Therefore – against a purely economic scientific background – the unremovable principle remains: *In reality economic Conserved Quantities develop long-term only corresponding to Functional Value of Work – thereby limits in national economies' (scarce) resources are determined!* Therefore: *If Functional Value of Work does not increase as much as the propensity to consume, consistent changes in use of (scarce) resources are inevitable in the long run!* (Otherwise bankruptcy is inevitable at the respective economic level). Within economic systems there are however *not only constraints in terms of monetary resources.* There are also other resource constraints that lead to comparable situations, which are characterized by markets and market sub-segments, which influence each other by forcing consistent changes in the sense of Conserved Quantities: The sports market bears goods examples because exercising for most people is just feasible in their scarce free time, e.g.: Paragliding and mountain biking both were invented over the last decades and became increasingly popular. More and more people spent scarce resources in terms of money *and* free time to practice these sports. They however could not use the same e.g. weekend once again to experience another thrill and/ or use the same e.g. Euro to purchase other equipment. Therefore they had to take decisions like practicing parachuting or paragliding; acquire another road bike for their training or a more modern mountain bike. Hence there are interdependencies between different segments of one total market (= here: sports market) so that an increase in a new segment leads to a decrease in another established one (cf. above). And the consistent (conserved) changes were not only stipulated by monetary but also by *time constraints* – in this sense both are Conserved Quantities here. And the definition of the term "resource constraints" should be taken even further: For a business model to work the *available users, members, habitants, residents etc.* can become scarce resources, too! Finally they must be captured from competitors, other residential areas, etc. in the first place (cf. "critical mass"). For clarification allow to consider the market for real estate again: In Germany the general government managed to subsidize by diverse means the acquisition of real estate in the former German Democratic Republic ("GDR"). At first glance the business model seemed attractive in particular for wealthy private persons: Buy real estate cheaply, use easily available and tax-deductible debt for it, profit from leases and – over and above – have a homestead for family members, which might move to the New Laender someday, or alternatively resale the real estate more expensively as soon as the New Laender became a boom region. At second glance the real issue becomes apparent though (too late for most "investors" or more precise speculators): There were Conserved Quantities but they worked *against* the new real estate owners in most cases! Due to problems in view of macroenvironmental Significant Influencing Factors (overwhelmingly economical and socio-cultural ones) lots of citizens left the former GDR in order to move in particular to Western Germany. So for a lot of people there was at least one Significant Influencing Factor to change their habitation – therefore they moved away from the former GDR. In addition there was no Significant Influencing Factor for a countermovement of in particular Western Germans, which at least could have outbalanced this migration. That led to a consistent (conserved) change: Functional Requirements for real estate in the former GDR shrunk by less potential residents so that Functional Values as well as market values fell here; Functional Requirements for real estate in Western Germany increased by the migrants from the former GDR so that Functional Values as well as market values rose there. Though it seems ridiculous speculators of those days often did not even ask things like "who will live in the houses". They did not even consider that too many (vacant) properties might be available for too little people. (Some of the buyers did not even visit their houses before the acquisition. Instead they simply mandated a bank or a consultancy to "invest" for them). But what could generate Functional Value for e.g. an apartment house if there is nobody who pays for getting the right to live there (= here: 1st generic source of Conserved Cashflow) and if Functional Requirements by other potential local habitants and thereby potential earnings from resale (= here: 2nd generic source of Conserved Cashflow) decreased since closing of the acquisition? Nothing! These facts made habitants (= here: potential residents) a scarce resource. Over and above they are Conserved Quantities here – finally habitants' moves are *the* manifestations of the "consistent change in something else". Therefore three general conclusions can be drawn for this Sub-Chapter:

1. For all kind of investments it is crucial considering scarce resources *beyond* the purely monetary level – all of them have the potential to become Conserved Quan-

tities that let the economic system change. The ones that are relevant for specific business models and/ or industries must be determined case-based (cf. Chapter V, 5.1 – particularly the summary by Figure 40).

2. Conserved Cashflow in this sense is not the only scarce resource but it is *always* the one that measures all conserved changes in the economic system in the end!

3. Business models that generate Functional Value will earn Conserved Cash inflow anyway; businesses that do not bear Functional Value should be shunned always (irrespective of any subsidy or tax deduction program).

2.1.3.3 Customers acquire not products but want to access Required Functions

Particularly in markets for consumer goods changes in customer behavior can be very clear-cut and relatively faster lead to the disappearance of total markets – respectively of total market segments – by the absorbance of complete customer groups. The underlying reasons become more apparent – and also better foreseeable – when defining markets not as "product markets" but as *"markets for functions"*. This is because functions can be related better to Significant Influencing Factors that determine the future state of economic systems (cf. Appel and Grabinski (2011) as well as Appel et al. (2012); the authors use the term "utility" equally as "function"). Consider for example the market for mp3-players, which strongly grew over the last years: apple Incorporated ("Inc.") did not create a new market by launching the iPod at the end of 2001 – though there were no such players at the end of the 20th century. They rather took over the customers, which were not satisfied anymore with the performance of a portable CD-player or a portable cassette player like the classic walkman, which once was invented by Sony Inc. about 30 years ago. In this sense the customers that got captured by apple's mp3-based iPod switched from an old segment of the market for the function "mobile music" to a new one for the function "mobile music". Hence the technical means and ways how to provide this function – which materialize in specific products – were not decisive for customers' buying behavior. The only thing decisive here was becoming able to access the function "mobile music" as good as possible. For forecasting the conserved part of the market demand (= Functional Requirement) this means: The changes the market passed through over time were foreseeable in particular by a set of *interrelated* Significant Influencing Factors on both customers' Functional Requirements and products' Required Functions (cf. "fit" or "strategic fit"; for implications of (strategic) fit in context of Conserved Quantity Approach cf. Chapters V, 5.1.1 and V, 5.1.2)[1]:

1. Customers became increasingly mobile and active – both in their professional and in their private lifes (= initiating macroenvironmental/ socio-cultural Significant Influencing Factor).

2. Sony introduced the first mobile music device called "walkman" (= 1st microenvironmental/ technological Significant Influencing Factor). It was cassette-based and had mediocre sound quality. Nonetheless people appreciated this music device very much because it was the only one that was mobile hence could accompany them wherever they were going and whatever they were doing there (= here: 1st strategic fit).

3. Customers after a while got used to the once innovative function "mobile music". In parallel innovations in the adjacent market segment for the function "home music" lead to the market launch of the CD player. It provided considerably higher sound quality than any cassette player (= 2nd microenvironmental/ technological Significant Influencing Factor). Taking both factors together the customers that were looking for "something" to serve their Required Function "mobile music" became more demanding and in parallel were shown the possibility that their Functional Requirement could be fulfilled by a technically more sophisticated mobile CD player. Furthermore technical miniaturization in general became more and more advanced (= 3rd microenvironmental/ technological Significant Influencing Factor). In consequence large parts of the total customer group switched to mobile

[1] In order to keep it simple Functional Value of mobile music is used here only. However especially the iPod has Functual Value of "being a membership card for a certain club of people" just like a branded t-shirt or handbag. The iPod took this kind of (Functional) Value away from other posh accessories (cf. Chapter V, 5.1.4 including its Sub-Chapters).

CD players upon their market launch (= here: 2nd strategic fit). This development was reinforced as soon as mobile CD devices became cheaper over time (cf. "economies of scale" and "economies of scope" = here: 4th and 5th microenvironmental Significant Influencing Factors). Please note that up to here the example shows two important lessons:

3.1. *(Strategic) fit* between customers' Functional Requirements and any products' Required Function(s) is *not fixed*; it must be *reviewed regularly*. It can be changed by macroenvironmental Significant Influencing Factors, which change customers' Functional Requirements. (In particular this is the case given solutions that serve customers' Functional Requirements are existing already – and maybe were marketed already – but were not yet required my major parts of the total group of potential customers). And fit can be changed by microenvironmental Significant Influencing Factors that may feed back on the macroenvironmental ones, too. (In particular this addresses a company's innovation that became an industry standard – like audio cassette formats, the CD format or the mp3 format. Industry standards in most cases have positive and negative side-effects – they increase compatibility and are accessible relatively cheaply but they also increase the costs of switching to another solution that may be more powerful (cf. "lock-in-effect")). So there are definitively connecting points between the micro- and the macroenvironmental Significant Influencing Factors and their effects on customers' buying behavior.

3.2 Customers did *not* base their buying decisions on a *particular product*. They were willing to buy "something" – no matter whether or not it used a cassette, CD, etc. –, which served their function "mobile music". Not surprisingly there was no such thing as a "new market for a new product": Upon another market launch of something that solved the function "mobile music" better, customers did *not* buy a mobile cassette player *plus* a CD player, etc. Mentally they were not parts of the markets for "product walkman", "product portable CD player", etc. Over and above resource constraints again came into play in terms of private purchasing power. In consequence customers forwent alternative technical solutions and shifted (foreseeably) to something that fulfilled their Required Function better from their point of view. Therefore the newer product respectively cannibalized the yet existing one(s). This development is perfectly in line with Conserved Quantity Approach! And it exemplifies why *Holistic Functional Value Analysis* is that important: It strives to identify the underlying (conserved) Functional Requirements of customers. Thereby it automatically abstracts from the levels of particular market segments, companies and/ or products. Thereby it trains in particular managers and investors to look beyond their current business activities and industry by "thinking outside the box" – which definitively helps "to get a big picture of what is going on". (Interestingly the last sentence summarizes one of the key benefits, which so-called "*strategic* management consultancies" often claim for them). Holistic Functional Value Analysis' widened scope avoids falling for short-term market trends: *It challenges companies' current (product focused) strategies in that markets are defined much wider.* Thereby it ascertains that economic deciders act on their customers' desires and Functional Requirements instead of banking on their products' presumed longevity. In parallel Holistic Functional Value Analysis' wider view helps deciders to see less obvious strategic opportunities once they adopted its *functional* perspective. (Whether or not these opportunities should be implemented indeed must be analyzed case-based. For calculative examples on Functional Valuation please cf. Chapters IV, 2 and IV, 3; for generally applicable rules and assistant frameworks please cf. Chapter V).

4. Let's come back to the "mobile music" market and consider forecasts for mp3 players: When learning from the past, it was clear that the introduction of the mp3 format – which resulted in the development of the iPod – was to result in a comparable transfer of customers like the one back then as the CD format was introduced. Finally there was no reason for customers to change their functional perspective meanwhile. So when looking at Significant Influencing Factors in the core market of a company under consideration (= here: "mobile music") *and* at Significant Influencing Factors on a more global *functional* level that considers comparable and/ or compatible solutions (= here: "data storage technologies"), at least two Con-

served Quantities become foreseeable long-term, namely: the conserved transfer of customers (which led to increasing/ shrinking market segments respectively); the conserved transfer of customers' Conserved Cashflow (which measures the change of the economic system on the highest level).

Please note the parallels between the *economic* system here and a *natural scientific* one – like a mechanical system (cf. Chapter III, 2.1.3.1): In the "mobile music" example Conserved Quantities (= here: customers as well as Conserved Cashflows spent by them) did *not* remain constant everywhere over time. But they also did *not* change as long as there was no change before in sociocultural, technical, etc. Significant Influencing Factors. However as soon as any Significant Influencing Factor changed – in combination with omnipresent resource constraints – the result was a "consistent change in something else". In this sense the total cashflow spent in the market for the function "mobile music" as well as cashflows spent in its sub-segments are Conserved Quantities indeed. In the mechanical system the total energy as well as its elements at any point in time, namely "potential energy", "kinetic energy" and "thermal energy" are Conserved Quantities. As such they also are neither fixed and they also do not change spontaneously. The question however is how to recognize the underlying Significant Influencing Factors for a change in particular in the economic context, i.e. to understand "what is going on" here: First and foremost managers (and their financial sponsors) should recognize that looking for the respectively relevant reasons for a change on the *product* market level (often) may be too *short-sighted* because: *Neither products nor cashflows spent for certain products can be conserved!* Finally the fact that customers of mobile music devices became more mobile and active during the last three decades did not tell anyone of them "buy a walkman". Instead they decided to "get something for entertainment" while they are away on business (e.g. by train or airplane), doing sports, etc. Over and above no consumer electronics company would have been able to exist long-term in the market (howsoever it is defined) given it did nothing else during the last three decades than trying harder and harder to optimize its yet existing cassette-based mobile music devices. (Reality seems to support this hypothesis: Sony Inc. was the first entry in the market and still manages to be one of the leading companies in portable consumer electronics. But they succeeded by becoming digital, too. As of today their international homepage does not even mention anymore the cassette-based product "walkman"

– in contrast to Sony’s large portfolio of high-performance digital music players aiming to rival apple’s iPod (cf. BBC (2004), faz.net (2004), news.de (2009) and Sony (2010))). Against this background products like “walkman”, “CD player”, “mp3 player”, etc. are never proper variables to describe the economic system of their market: Products simply are unqualified to describe what is required from customers’ point of view at any point in time. *Needless to say that functions are predestined to describe what is required from customers’ point of view as of today:* They not necessarily need to be (conserved) Required Functions but at least they have the potential for it. The (simplified) test for conserved functions is: Given the existence of a product’s function traces back to a change in Significant Influencing Factor it is declarable “conserved” respectively “Required Function” (for more details cf. Chapter V). For example the function “mobile music” can be related to changes in macroenvironmental/ socio-cultural Significant Influencing Factors, namely “increased travel behavior” and “increased free time activity”. (In the previous real estate example Required Functions are “closeness to workplaces”, “closeness to renowned schools and/ or universities”, “existence of leisure time facilities”, etc. – finally they account for the lion’s share of the migration movement of the Conserved Quantity “habitants” (cf. Chapter III, 2.1.3.2))). In the opposite case, i.e. if a function does neither relate nor react correspondingly to changes in any Significant Influencing Factor, the function’s right to exist traces back to more airy things: Often it is nothing but a (short-term) market mood, trend or speculation, which makes people (temporarily) willing to spend (non-conserved) cash for things that have no factual justification. For long-term forecasting and valuation this suggests: *Account for changes in Significant Influencing Factors because they directly affect customers Functional Requirements hence products’ Required Functions at any point in time!* Thereby it can be gauged long-term *whereto* Conserved Cash flows and *wherefrom* it flows away in terms of an economies’ diverse members (comprising companies, groups of customer, groups of employees, etc. and finally – via tax and duties – the national governments).

2.1.3.4 Summary of key insights

To ease application of Concept Quantity Approach in business and economics going forward the key insights from the past examples are summarized by Figure 6:

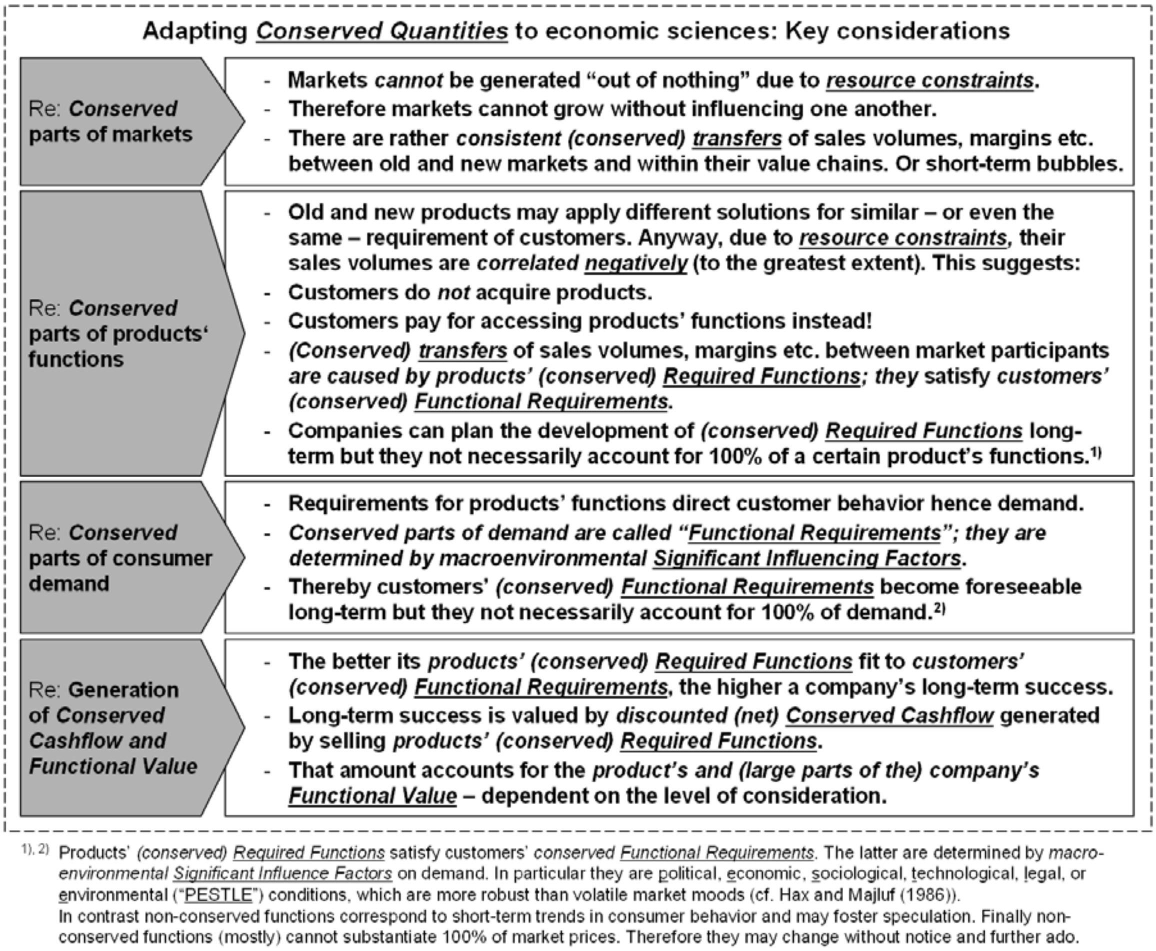


Figure 6: Key considerations to adapting Conserved Quantity Approach to economics

2.1.3.5 Addendum: How Conserved Quantity Approach fights myopia in business

Admittedly the purpose of Chapter III is still an introductory one. But idiosyncratic terms had to be used already like "Significant Influencing Factors", customers' "Functional Requirements" and respectively fitting "Required Functions" that should be provided by products – finally all of them describe *conserved* parts of the economic system. Therefore they must all be considered in Holistic Functional Value Analysis. The previous examples were aimed to be intuitively understandable so that they go without generally applicable definitions and rules for Functional Valuation and Conserved Quantity Accounting. (This allows on the one hand concentrating all constitutional definitions and rules in one higher ranking Chapter, namely Chapter V, and on the other hand allows limiting the duplication of content). Therefore bearing the key considerations from the previous examples in mind – which are also summarized in Chapter 2.1.3.4 for your convenience – should be enough to follow everything that follows hereafter. Nonetheless the author would like to provide some additional explanations and comments right away. They relate Conserved Quantity Approach – which traces back to natural sciences – to economic sciences' advices in view of successful long-term planning. Thereby these subsequent thoughts describe core *pre-requisites* the author had in mind when detailing Conserved Quantity Approach in a way that it could be used for Functional Valuation and Conserved Quantity Accounting. These prerequisites of something the author would like to call *"good principles of strategic business planning"* are implicitly taken into account in Holistic Functional Value Analysis – thereby it continues a path that Levitt (1975) sketched by his classic paper "marketing myopia". But Levitt did not write about things related to chaos, financial forecasts or real value (= here: Functional Value) so that the realization of his quintessences by Conserved Quantity Approach may not be that obvious. Therefore please allow for some subsequent thoughts on Levitt's marketing paper in the context robust long-term financial forecasts and Functional Valuation. For it five of Levitt's (1975) quintessences are commented in the following:

1. *Define industries broadly to take advantages of growth opportunities:* This is done implicitly herein by defining markets and/ or industries by functions that are required by customers (= Required Functions), i.e. markets and/ or industries are not defined in terms of products. This leads to the Levitt's 2nd quintessence.

2. *Do not be product-oriented; be customer-oriented instead*: This dissertation does not only adhere to Levitt's suggestion but it takes it to the next level. It opines that customers' buying behavior (often) is determined by one or more Significant

Influencing Factor, which stems from their macroenvironment. Analysis of customers' buying behavior on the product level may consider all of these factors in an aggregated way. But the outcome may be too imprecise to identify, understand and finally forecast Significant Influencing Factors' future effects on customers' buying behavior and thereby a specific company's share of Conserved Cashflow within an industry. (More detailed methods like the conjoint analysis somewhat try to address this impreciseness, too (cf. "conjoint analysis"). But they are not helpful here because they fail to check for Conserved Quantities' two prerequisites – the cause for the economic system's change (= here: cause for change in buying behavior) in form of Significant Influencing Factors and in particular the simultaneous reaction in something else). Therefore this dissertation suggests disaggregating the product into its diverse *functions* in order to check which of them will lead to Conserved Cashflows. For it all product functions must be compared with Significant Influencing Factors – in cases where a fit can be diagnosed the function has the potential to generate Conserved Cashflow as long as the Significant Influencing Factors remains as it is. Given there is information that the relevant Significant Influencing Factors will change in the future, Conserved Cashflow allocation within the market respectively industry will change, too. Both cases can be foreseen by Holistic Functional Value Analysis because it compares macro- with microenvironmental (= company-internal) Significant Influencing Factors in order declare whether or not there is a "fit". Therefore it seems fair to claim that Holistic Functional Value Analysis, which works on the level of underlying product functions, is a good means to the end of becoming customer- instead of product-oriented (cf. Chapter V, 5.1.1 and 5.1.2).

3. *What companies offer for sale should be determined not by the seller but by the buyer:* The concept of "strategic fit" or in brief "fit" is used herein to comply with Levitt. In contrast to existing interpretations of this concept the author however suggests to focus on *conserved* fit in order to differentiate between (non-conserved) product functions that comply with short-term market trends only in contrast to (conserved) Required Functions of products, which are able to generate long-term (Conserved) Cash inflow for companies (cf. above). When following this concept

the functions that will be included into products will become increasingly the ones that are Required Functions from *customers' point of view*. Please note: These (conserved) Required Functions are the only ones that bear Functional Value. All other functions cannot be linked to macroenvironmental Significant Influencing Factors – therefore they are non-conserved and cannot increase and/ or guarantee customers' (conserved) willingness to pay long-term. This implies two aspects of Functional Valuation: Whether or not a product has Functional Value is determined always from customers' point of view. In order to optimize companies' Functional Firm Value they must optimize "conserved fit" of their products. For deciders it is therefore important to optimizing this "conserved fit" because: As soon as competitors become able to differentiate between (conserved) Required Functions and non-conserved ones that may be nothing more than just "nice-to-have" from customers' point of view, competitors of course can optimize their products' "fit", too. This in turn will redirect more of the industry's Conserved Cashflow to them, which will be missed at another company in consequence. Therefore optimizing Functional Firm Value by providing products with the respectively "right" functions is a mean to the end of "letting the buyer decide what should be offered for sale" (cf. Chapters V, 5.1.3 to 5.1.4.2).

4. *Companies should not think of itself as producing goods and services but customer satisfactions:* This is realized herein because the author abstracts absolutely from the product level in order to find out what in actuality leads to customers' preferences. He claims that preferences are not satisfied by products but by their underlying functions, in particular (conserved) Required Functions. This means: There are Significant Influencing Factors, which lead to customers' Functional Requirements. And given a product has functions that fit these Functional Requirements (= Required Functions) better that other products they will be preferred. In this sense Required Functions are *decisive* for "customer satisfaction". Due to this chain of causes and effects – from initiating Significant Influencing Factors to Functional Requirements to products having Required Functions – the Conserved Cashflow that is spent for related products can be foreseen. And since Required Functions are decisive hence will lead to changes in the market and/ or industry as

soon as they become available and/ or optimized, they lead to corresponding changes in something else. (Like above the migration away from the New Laender that changed the real estate in Germany in total (cf. Chapter III, 2.1.3.2) or the development from cassette-based mobile devises that successively became extinct as the market for better CD based devices flourished etc. (cf. Chapter III, 2.1.3.3)) *Therefore Functional Requirements and Required Functions are two sides of the same coin: Both are Conserved Quantities and both must fit together in order to provoke "customer satisfaction".*

In contrast the remaining non-required functions cannot lead to such consistent changes in something else because they are not decisive from customers' point of view in the long run. Consequently they are non-conserved, bear no Functional Value (from customers' point of view) and may be left aside without harming "customer satisfaction". The reason for it is quite simple: *If there is a demand for (non-conserved) things that are actually not required, this part of the market may exist today but it also may collapse without notice and without further ado.* Whether or not such non-conserved "thing" is provided then becomes irrelevant for "customer satisfaction". Therefore today's "flavor of the month" should not be accounted for in long-term financial forecasts and valuation (cf. Chapter V, 5.1.2).

5. *Organizations must learn to think of itself not as producing goods or services but as buying customers:* Two concepts suggested herein support this advice – Strict Conservation Law in Business and in line with it Functional Value. As explained above a product's Functional Value must be determined from customers' point of view (which is reflected by macroenvironmental Significant Influencing Factors). And companies must focus on providing products that have Required Functions – thereby they use their scarce resources as effective and as efficient as possible, which optimizes their Functional Firm Value. Yet to provide products is not free of charge for companies – their scarce resources are consumed thereby (in parts). Hence it is fair to state: Resources applied in production loose Functional Value, which is transferred to products' Required Functions. Thereby products' Required Functions gain Functional Value. Finally Functional Value (in form of

Required Functions) can be provided to a customer as (conserved) countervalue for his/ her (Conserved) Cashflow. So given a sale contract is closed there will be a conserved transfer of Functional Value – not only in monetary terms but also in terms of a product's Required Function(s) (cf. Chapter V, 2.2 and 5.2). Against this background it seems fair to state that a company, which captured customers that way, "bought" customers indeed.

The line of reasoning above explains how the design of Conserved Quantity Approach as suggested herein took into consideration Levitt's (1975) quintessences 1 to 5. Therefore Conserved Quantity Approach also should allow taking strategic decisions that are *not myopic* but *far sighted* – for it deciders have to check their long-term planning regarding effects on Functional (Firm) Values.

2.1.4 Conserved Quantities and Significant Influencing Factors

Non-conserved quantities may change without notice, without further ado and without consistent changes in something else. Hence they may vary chaotically in the mathematical sense, i.e. though their changes are deterministic they appear to be random. Therefore non-conserved quantities are mostly unsuitable to describe anything. (Just like the drawing of lottery numbers: It is a strictly deterministic system in principle but it shows random results in practice (cf. end of Chapter III, 2.1.1)). In contrast a non-infinite system can be described given one applies just Conserved Quantities (cf. Grabinski (2007)). Over and above forecasting its future state becomes possible given the underlying causes for the changes in Conserved Quantities could be identified. Therefore the differentiation between a negligible "background noise" and a potential cause for a change (= Significant Influencing Factor) is treated in the following two Sub-Chapters.

2.1.4.1 Considering Natural Threshold of Robustness

Conserved Quantities develop *robust* over time. The reason is: Changes in Conserved Quantities' values are *not* dominated by mutual accelerations of arbitrarily small changes of any kind of influencing factor. Changes in non-conserved quantities' values however may be determined thereby under certain conditions, which leads to huge non-reproducible deviations from expected results (cf. the mathematical definitions of "robust" and "chaos", e.g. in Chapters I, 3 and II, 3). This implies: For a change in any Conserved Quantity's value, there must have been an influencing factors, whose magnitude was strong enough to be decisive for the outcome of the change – that shall be indicated by the word "significant" in the term "*Significant* Influencing Factor". Such factors form the assumptions, which must be incorporated into financial models for long-term forecasting and valuation.

Please consider once more a mechanical system's development (= here: a *billiard game*) in order to envision what it means that an influencing factor is significant in view of a system's outcome: If a set of basic parameters concerning the ball at rest are known, the friction on the table can be calculated and the strength of the initial impact can be gauged, it is rather easy to predict what will happen at the 1st hit. The 2nd impact becomes more complicated to be foreseen but it is possible though more precision is necessary. The problem is that the gravitational pull of someone standing next to the table must be taken into account in order to calculate correctly the 9th impact. (The underlying calculations were performed firstly by Berry (1978); he assumed a modest weight of less than 150 pounds). To compute the 5th to 6th impact every single elementary particle in the universe needs to be considered by the assumptions of the forecasting model. Even an electron at the edge of the universe must be included into the calculations because it exerts a meaningful effect on the outcome – even if it is separated from the billiard table by 10 billion light-years. The interactions of such influencing factors among each other and with other ones that affect the move of the balls on the table, too, cannot be incorporate into any forecast of the system's outcome. In consequence billiard moves can be performed so exactly that the ball hits its target after a few collisions. For it one has to consider a set of basic parameters, which for sure lead to the desired outcome of the 1st and 2nd collision – like the balls' positions at rest, the strength respectively energy of the impact and the resistance of the table.

But these basic parameters are neither decisive for the ball's movement after the following collisions nor for the final outcome – until then other arbitrarily small influencing factors increasingly redirect the path of the triggered billiard ball(s). This means: The more collisions take place, the more the development of the total system becomes subject to *chaos*. Then the *causality* between the observable set of basic parameters and the final outcome is not valid anymore – the moves of the billiard ball(s) become erratic though their path(s) in principle is (are) strictly deterministic (cf. Taleb (2010)). So against the background of the above the key insights for becoming a successful billiards player in presence of chaos are:

1. Know the *natural threshold of robustness* ("Natural Threshold of Robustness"), i.e. the conditions that lead to chaotic and non-foreseeable developments of the system (here: billiard moves having more than 3 impacts).

2. Respect, i.e. try to achieve better results *within* a system that develops robust in any case (= here: billiard moves having less than 3 impacts). In contrasts trying to defer Natural Threshold of Robustness would be a complete waste of scarce resources e.g. in terms of lifetime (= here: trying to perfect billiard moves having more than 3 impacts). Such system's outcome always will be determined more by luck or fortune than by skills and training.

3. *Account for Conserved Quantities* (= here: the energy induced into the system via the 1st impact; it determines the 1st balls' maximum velocity and path) *and consider Significant Influencing Factors* (= here: the balls' positions at rest, the angle of the 1st impact and those following it, the friction on the table, etc.) on the outcome of the billiard move. Accomplish your moves accordingly. This makes luck less decisive for the outcome of single billiard moves and whole billiard games. Hence a good player can forecast with sufficient accuracy at least some moves – namely those within Natural Threshold of Robustness. This is already a great help!

Translated to the *economic context*, i.e. for managers and investors, who try to forecast companies', products' and/ or assets' values with sufficient accuracy long-term, the billiard example implies: First and foremost find out and respect the general limits of foreseeability. In systems that use non-conserved quantities Natural Threshold of Robustness is *minimal.* Such systems are potentially chaotic hence should be excluded from the process of future-oriented decision making right from the beginning. (For related examples on forecasts of non-conserved market values in equity markets, which were falsified oftentimes, cf. Chapter III, 3.2.2). Given there are variables that pass Conserved Quantities' two prerequisites (cf. Chapter III, 2.1.2), describe therewith the economic system's state as of today. Then account for Significant Influencing Factors thereon. In each and every case question how long the Significant Influencing Factors are decisive on the future outcome of the economic activity, which the forecasting system describes – thereby the *maximum* forecasting horizon is defined, which limits Natural Threshold of Robustness here. After this point in time, given there exist no Significant Influencing Factors anymore that could drive business activities' outcomes in the one or in the other direction, related "forecasts" become nothing more than crystal ball-reading, luck or speculation. (In this sense the maximum forecasting horizon is comparable to "billiard moves having more than 3 impacts" (cf. above)). Please do not forget to test the economic system's description in form of a quantitative model in order to judge whether or not the magnitudes ascribed to Significant Influencing Factors are valid in view of economic reality and whether or not the model's outcome remains within an acceptable *margin of error* (cf. Chapter II, 4.1)). Given such test indicates room for improvement, remain within the Natural Threshold of Robustness when optimizing the system's description, i.e.: Neither waste own time, money and/ or human resources to foresee all influencing factors irrespective of their significance on the respective system's final results nor try to perform prognoses after there is no Significant Influencing Factor anymore!

All things considered the billiard example shows very nicely how to phrase a working definition of Significant Influencing Factors: These are the underlying reasons, which *outbalance* any other potentially influencing factor, so that they lead Conserved Quantities foreseeably to move within a system from "State 1" to "State 2". (Hence they work in the sense of causes within *unambiguous* cause-and-effect-chains). This suggests:

1. Significant Influencing Factors are the determinants of a system's outcome.

2. All other (insignificant) influencing factors can be ignored without risking results that bear too big margins of error (for more details cf. Chapter III, 2.1.4.2).

3. If there are no Significant Influencing Factors anymore, a system's future development cannot be forecasted unambiguously anymore. (Such limitation is apparent when trying to foresee billiard moves with more than 3 impacts).

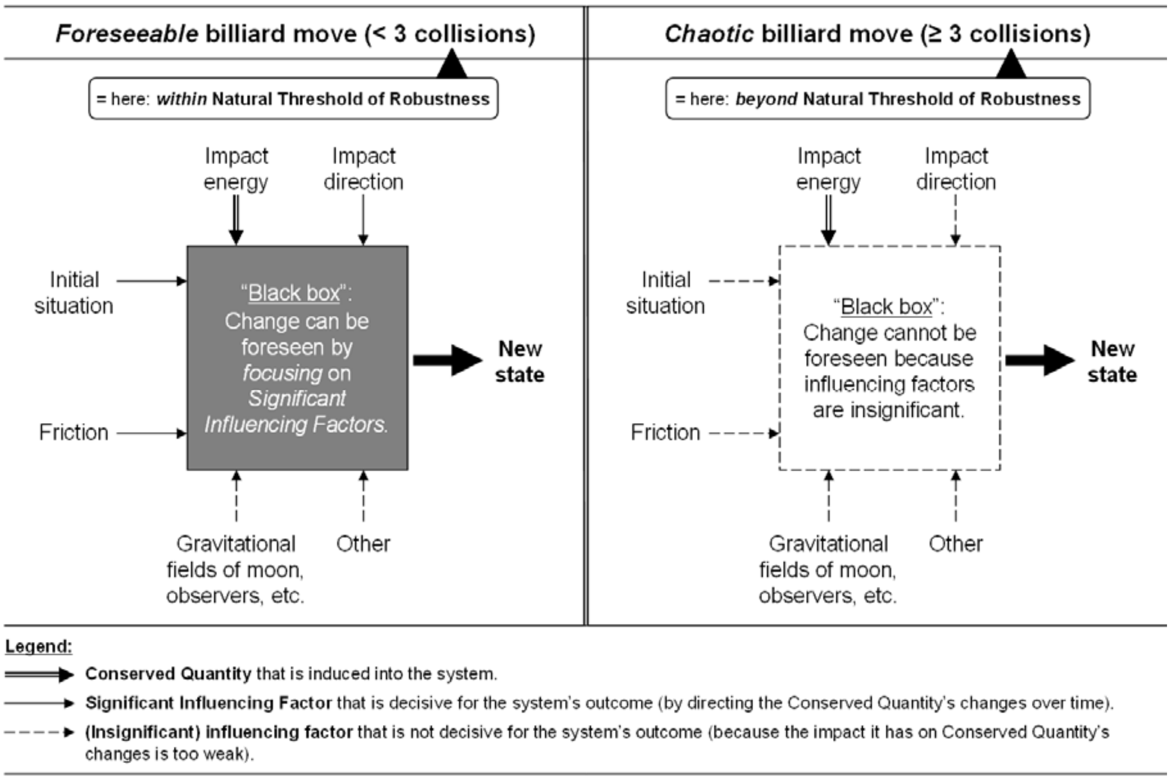


Figure 7: Foreseeability of a system's future state in view of influencing factors' decreasing significance (illustration applying the example of billiard)

2.1.4.2 Significant Influencing Factors describe systems' dynamics adequately

By including Significant Influencing Factors into the description of a system's state – which in turn is accomplished by Conserved Quantities – the system becomes dynamic. But why remain results of long-term forecasting system within an adequately small margin of error given insignificant influencing factors are left? And what are they at all? To answer these questions examples from daily life and past research are presented, which deal with insignificant influencing factors (according to the author's definition). Thereafter general conclusions are drawn, which shall assist in identifying those factors which make forecasting and valuation systems just more complex instead of more robust.

Diverse approaches exist to describe and forecast a company's performance e.g. in terms of "customer satisfaction", "door-to-door time" and finally "financial results". Some approaches incorporate not only qualitative but also quantitative influencing factors: For instance when developing an incentive scheme, which aims at increasing the motivation of the employees in order to optimize the company's performance, the responsible managers (and if applicable external consultants) always must keep in mind the related costs. For the incentive scheme to work effectively, it must be guaranteed that the expected result improvement that traces back directly to it must be higher than the company's total costs for it. (For valid cost-benefit-calculations both the directly allocable result improvement and the directly allocable costs must be adjusted to reflect their time value (cf. "time value of money" as well as Chapter III, 3.2.2.2)). Such kind of approaches may be powerful in certain cases and relatively easy calculable by using computer-based models. Yet please bear in mind: It is possible (in most cases) to incorporate selected influencing factors into a forecasting model but it is impossible (in most cases) to incorporate all of them. One reason is that a company as well as the economy as such form *no closed systems*: Peoples' mood, performance at work as well as decisions to buy and invest may be interrelated non-trivially by general factors, which have nothing to do with fundamental economic facts – examples are the weather or lunar cycles (cf. "weather effect" in context of stock trading). Good weather can verifiably raise the trading turnover in shopping streets (cf. diePresse.com (2010)). To some degree this seems intuitively reasonable because it is more convenient to saunter on a sunny day than on a rainy one. However some business media argue that this weather effect also increases the turnover at stock exchanges (cf. n-tv.de (2009)). Researchers like Saunders (1993) present evidence regarding the relationship between Wall Street weather and average daily security returns. The author finds that the weather in New York City has a long history of statistically significant correlation with major stock indexes. Therefrom he follows:

1. Investors' psychology – which of course is no such thing as an economic fact – influences asset prices.

2. This finding casts doubt on the hypothesis of entirely rational security markets (cf. in particular Chapter III, 3.2.2).

Hirshleifer and Shumway (2001) replicate Saunders' study (1993) and extend it to the 26 major stock markets around the world. Their research also supports the presence of a significant cloud cover influence. Over and above Dichev and James (2001) and Yuan, et al. (2001) both find that investors are affected by lunar cycles. (These examples presumably depict also some of the reasons why experts on psychological employee selection advise applicants to claim being not meteorosensitive (cf. Schuler (2000)). Over and above market participants – no matter whether they take the role of a private customer, a private or institutional investor and/ or a manager – have private lives and interests beyond the different fields of economy. Thereby peoples' individual emotions for sure are influenced, too, so that events that they must pass through as individuals may feed back indirectly to the economic level in terms of work performance, buying behavior and speculative arrogance etc. While (historically based) statistics, which account for such effects, might seem implausible at first, researchers cite convincing evidence from the psychological literature, which documents at least how the weather and the moon can affect human psyche. But given decisions of investors (or more precise: speculators) are based rather on moods and emotions and not upon economic reasoning, this suggests three things about the formation process of *market values*:

1. Mood may affect individual market participants' decisions: Manifestations of it are speculations and short-term trends because they are driven psychologically or by mood and emotion, too – many people simply cannot resist their *"herd instinct"* (cf. for instance Chapter III, 3.2.1).

2. More important: Mood affects decisions of the *marginal investor* (or better: marginal speculator) – unfortunately this is the person who sets an item's market value!

3. Taken together these findings cast doubt on the explanatory power of market values in general. In parallel they argue for the implementation of a new form of *fact-based real value* like Functional Value (cf. for instance Chapter III, 3.2.2 as well as Chapters IV, 2 and IV, 3).

Practitioners who lead teams or even complete companies place emphasis on small confessions regarding individual interests because they know it may boost employees' mood and thereby *motivation on the job*: Dieter Zetsche, chief executive officer ("CEO") at the German automotive corporation Daimler AG, therefore allowed the workforce at the German plants to stop working in order to watch the semi-finale of the European Soccer Cup in 2008 (cf. n24.de (2008)). Germany won this match but lost 0:1 in the finale against Spain. One can only *speculate* what effects this result had on the motivation and performance of both the German and the Spanish workforce! Yet one could not have forecasted these effects e.g. in form of a scenario model in order to suggest Dieter Zetsche specific procedures for the case that Germany wins as opposed to the case that Germany loses the semi-finale. So when reconsidering all of this Chapter's examples it becomes clear that they have the following in common:

1. Influencing factors on economic systems not necessarily need to be Significant Influencing Factors, which are strong enough to determine the outcome long-term. They also may be small, not directly related to economic facts but nonetheless may affect people's decisions and measurable economic performance *indirectly*.

2. Such small influencing factors' magnitudes may develop nonlinearly – hence they may have non-foreseeable results in form of (mathematic) *chaos effects*.

3. In this sense all influencing factors, which are *not* directly related to economic facts – like those exemplified in this Chapter – are *insignificant* influencing factors. They can be *excluded* from long-term financial forecasting and valuation systems due to three reasons:

3.1 Insignificant influencing factors relate to real life's chaos but they provide no description of chaos – irrespective of the fact that descriptions of chaos are *impractical* in any case (cf. Grabinski (2007) and Chapter II, 4.1). This leads to 3.2:

3.2 Anything that leads to chaos effects *cannot* describe real economic value creation over time because: Such "things" will *not* result in changes of the real economic system that *persist* in view of *Conserved Quantities' two prerequisites* (cf. Chapter III, 2.1.2).

To avoid confusion please note what this assertion means precisely: Whether or not there are changes in the "real economic system" depends on how the term is defined. Even if one considers non-conserved changes – which may be manifestations of chaos effects in the most extreme case – such changes may lead to real (non-conserved) cashflows making some people permanently rich or poor. Nevertheless it is *useless trying to forecast such (non-conserved) events* and resultant (non-conserved) cashflows (cf. Appel and Grabinski (2011) as well as Chapter III, 3.2.1.1). Therefore, i.e. in order to become able to predict at least the part of the total cashflow that is reallocated not by luck, psychology or finally chaos but by changes in fundamental economic facts, the author agrees with Grabinski (2007) in that only Conserved Quantities are qualified to describe any system's development over time. Consequently "real economic system" herein must be defined by the operational value creation of companies, employees, investors, etc. that is traceable back to changes in fundamental economic facts so that it complies with Conserved Quantities' two prerequisites – naturally this part of the real economy is unaffected by chaos (cf. above). That leads to 3.3:

3.3. Insignificant influencing factors are detached from fundamental real economic facts. They relate to more psychological concepts like *mood*, *emotions* and/ or *fads* and *fashion*. Their manifestations spoken in economic terms are: *Short-term market trends* and *speculations*.

> Not surprisingly chaos effects due to insignificant influencing factors *vanish into thin air* soon – they are too minor to be decisive an economic system's future state in the long run. (E.g. the sun will not shine always on Wall Street. And at the day of the semi-finale and maybe also some time thereafter Daimler AG's average operational value creation may have been affected. But when comparing the average operational value creation per year – e.g. within a 10-year timeframe – the event's effect may not be cognizable at all. For additional examples cf. in particular Chapter III, 3.2.3 as well as Chapters IV, 2 and IV, 3 and their Sub-Chapters respectively).

To see the connection to Conserved Quantity Approach more clearly please recall why it was chosen consciously herein: Its advantage is that it allows describing a system's state at any point in time by excluding chaos. That makes it qualified for financial forecasts and valuation, which intend to overcome *airy things* like psychology, mood or emotions and/ or fads and fashion (= *insignificant* influencing factors) in form of speculation and short-term market trends – finally such things may develop non-linearly respectively chaotic! Conserved Quantity Approach allows using *Significant* Influencing Factors only because they are part of a clear cause-and-effect chain, i.e. they are the initiating changes that foreseeably determine an economic system's end result long-term. This means they trace back to economic facts and thereby their respective magnitude is strong enough to outbalance short-lived insignificant influencing factors. So the underlying assumption here is: *Rationality – in form of Functional Requirements and Significant Influencing Factors thereon – outlasts irrationality in form of economic decisions – respectively market distortions – that were directed by psychology, mood or emotions and/ or fads and fashion.* Thereby *Significant* Influencing Factors can determine an economic system's *future* state long-term (cf. Chapter V, 5). Hence purely descriptive economic systems can become dynamic – in the sense of forecasts – when including *Significant* Influencing Factors and in parallel they can keep their robustness and remain within a reasonable margin of error in view of (real) Functional Value.

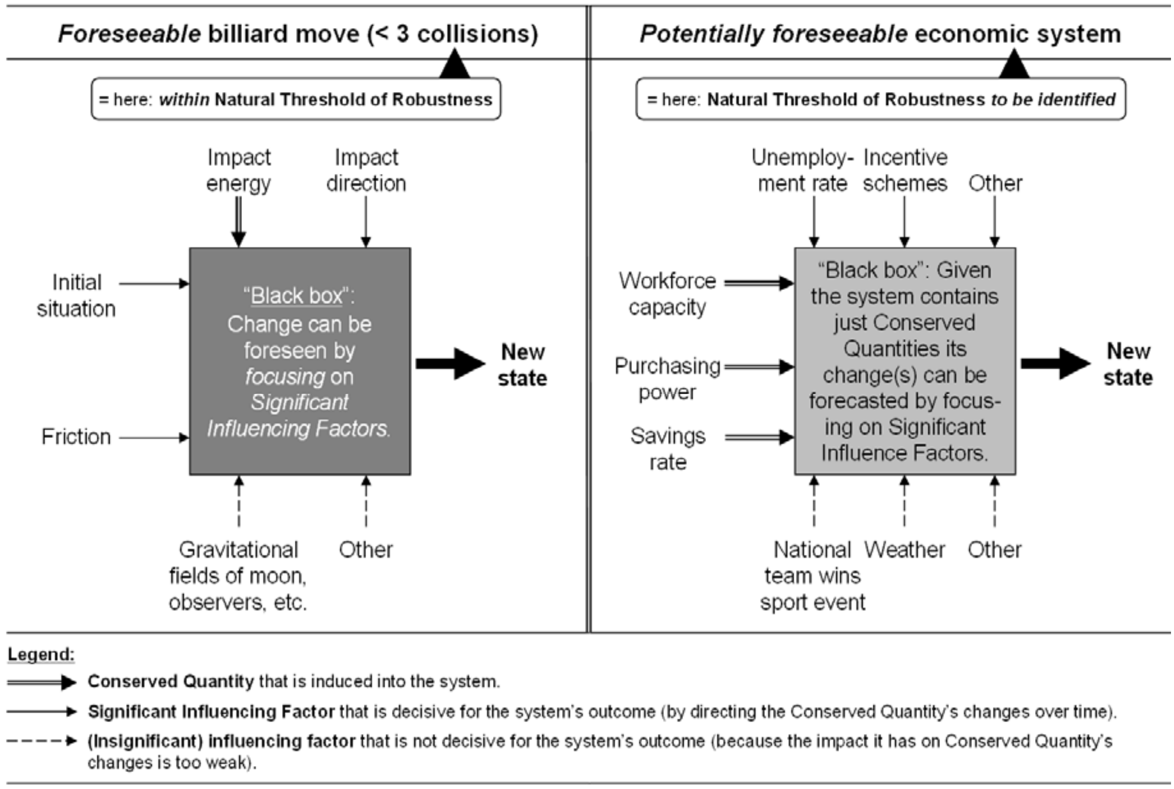


Figure 8: Systems within Threshold of Robustness are foreseeable by accounting for Significant Influencing Factors (illustration)

In summary: Chaos occurs if arbitrarily small changes at a system's outset lead to huge effects regarding the system's outcome. So in presence of chaos there *seems* to be no direct cause-and-effect chain from an initial change at the outset to the diverse factors leading to its acceleration within the system and finally to the system's unexpected result. Nevertheless causality is valid here. However – within any measuring accuracy – *it looks as if there is no causality*. In view of robust forecasts, which are based on nothing but Conserved Quantities, it also seems appropriate to *assume* there is *"no direct cause-and-effect chain"* because: Given a system's outset was changed and it starts to develop chaotically the underlying interrelationships, which are immanent to any system, as well as their respective magnitude on the chaotic end result (= here: collectively "causality") can *neither* be measured *nor* forecasted. (This is due to practical purposes in view of data acquisition and data processing, which were explained in detail yet (cf. Chapters II, 3 and II, 4.3.1 as well as Chapter II, 5). Finally no direct cause-and-effect chain – respectively no quantifiable cause-and-effect chain – means there are just *insignificant* (short-lived) influencing factors. In this case, i.e. given there are *no* Significant Influencing Factors on Conserved Quantities' future allocation within the system, the best advice is to stop developing any forecasting system. To continue instead would be nothing else than an unavailing attempt to foresee a chaotic reality by using a chaotic system – this bears no practical use. In contrast, i.e. given there *are* Significant Influencing Factors, it is possible to program a financial forecasting and valuation system, which realizes the goal of *"effectiveness"* simultaneously to the goal of *"efficiency"* (cf. Chapter II, 5). Ultimately Significant Influencing Factors are the means to the end of giving *dynamic* to the forecasting system – for this purpose one must consider how a change in Significant Influencing Factor changes allocation of Conserved Quantities within the system. The rationale for this approach is the existence of a link between Conserved Quantities' properties and Significant Influencing Factors:

1. Conserved Quantities are by definition quantities, which change only if there is a corresponding outside change – e.g. value in the sense of market price is generally not conserved (cf. Grabinski (2007), Chapter I, 1 as well as Chapters III, 3 and IV including their Sub-Chapters).

2. One may define a conserved value by saying that it only changes if value flows from somewhere else in. The classical example is raw material. Work (= inflow of conserved value) will transform it in something much more valuable. Herein such (transfer of) conserved value is measured in monetary terms by Functional Value. The driver of the change in the allocation of conserved value is always at least one change in Significant Influencing Factors – e.g. changing from two shift operation to three shift operation will change the amount of raw material that work can transform in something more valuable (cf. Chapter III, 2.2 and its Sub-Chapters).

3. It may be possible that such a definition of conserved value differs significantly from the common sense definition of value. However – due to chaos – the "common sense value" is a useless thing to describe something (cf. Grabinski (2007)).

To create a *meaningful* description of a (dynamic) economic system instead three rules for future-oriented assumptions should be followed:

1. In any case include only those influencing factors into a forecasting system, which are decisive regarding its outcome in the long run (= *Significant Influencing Factors*).

2. In case of sales and costs figures – which are converted to reflect better *Functional Values* of resources, purchased parts and (semi-finished) products – double-check whether or not you have chosen the respectively "right" assumptions. These are Significant Influencing Factors, which determine the *allocation of Conserved Cashflow* within the economic system, i.e. the *parties* among which Conserved Quantities will be transferred going forward and the *volumes* of Conserved Quantities that will be transferred going forward. (Please note this relates to Levitt's (1975) quintessences 3 to 5 (cf. Chapter III, 2.1.3.5). How to implement these rules in Functional Valuation is exemplified in particular by valuing resources (cf. Chapter IV, 3 and its Sub-Chapters). Subsequent thoughts are provided throughout Chapter V and particularly in Chapter V, 5.1).

3. In case of *Conserved Quantity Accounting* of capital assets' Functional Values double-check whether or not you have chosen the respectively "right" assumptions. These are Significant Influencing Factors, which determine the *utilization* of a company's individual assets going forward. (cf. Chapter V, 5.2.1.3).

Please note that Chapter V contains all formulas and frameworks for Functional Valuation; Figure 40 in Sub-Chapter V, 5.1 summarizes Significant Influencing Factors.

2.2 Functional Valuation

Determining Functional Value, which is "intrinsic" to an asset (or liability), works in principal like an elaborated DCF valuation of *assets in kind*. (Similar approaches may be known yet from mergers and acquisitions ("M&A") cases, which comprise collectively acquisitions and alliances. Here the value of an asset is determined in order to exchange it – instead of money or cash – against some equity stake in another company). But in order to get more robust (= non-chaotic) and long-term realistic values, non-conserved and Conserved Cashflow must be discriminated before. And to get Functional Value as of a certain due date, just Conserved Cashflow must be taken and discounted ("Functional Valuation").

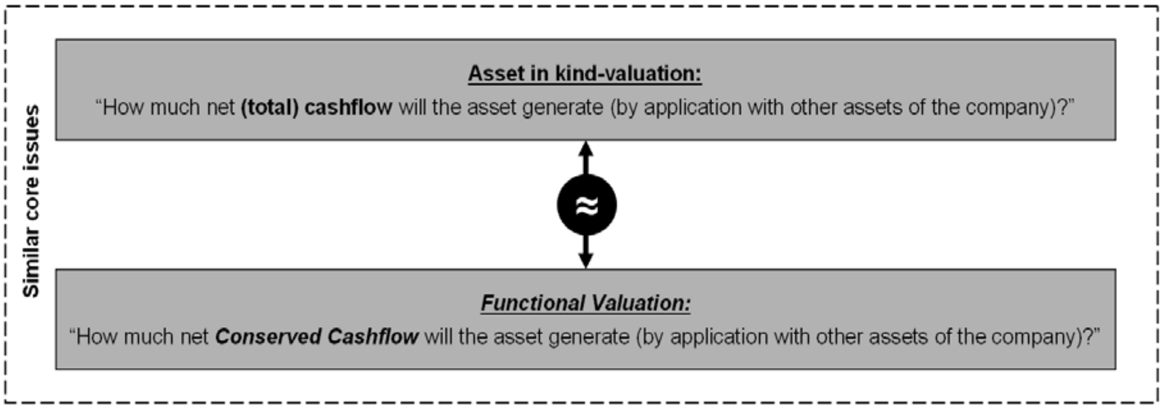


Figure 9: Similarity of asset in kind valuation and Functional Valuation

Treating financial statements like a set of assets in kind – which must generate Conserved Cashflows in order to have any (intrinsic) conserved Functional Value –, is the path that will be followed going forward. In this sense Functional Value is comparable to an *account with bank*, on which a (nearly) fixed income accrues in form of net Conserved Cashflow. Please note the reason for the infix "nearly": There is *"base case" Conserved Cashflow*; which is the best possible forecast of the company's operational value creation. The related Conserved Cashflow will accrue in all likelihood given short-term market trends and speculations are left aside. Over and above there might be an upside due to chaos effects. In practice this is often termed *"force majeure"* (French for "act of God"). It describes things beyond investors', managers', employees', etc. control. For example: Given "Company A" is able to generate additional net Conserved Cashflow just because the plant of "Company B" burned down and "Company A" could absorb some of the customers of "Company B" in course of this misfortune, this leads to an unpredictable upside for "Company A" (the term *"best case"* seems inappropriate here). And it is logical that "force majeure" against the own company cannot be foreseen, too (except for an investor acting like an insurance fraudster). Hence there is also no use in considering such a downside-threat in form of a *"worst case"*. Please note that the possibility of "force majeure" does not at all limit the explanatory power of Functional Value: It was proven to be the *most accurate* cashflow forecast – adjusted for the time value of money –, which will be realized by future application of a company's assets (cf. Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012) as well as Grabinski (2011a), (2011b) and (2011c)). Beyond that no wise (and law-abiding) investor or manager would have a stake in any asset, given it is profitable enough only if the own or a competitor's properties burn down (or get damaged in any other way)!

2.2.1 Etymology of (intrinsic) Functional Value

Except of the fact that it considers Conserved Quantities only, Functional Value can be related to the concept of intrinsic value by Graham and Dodd (1934). In their investing compendium "Security Analysis" they stated: "In general terms, it [intrinsic value] is understood to be that value which is determined by the *facts*, e.g., the assets, earnings, dividends, definite prospects, as distinctly, let us say, from market quotations." In short intrinsic value is the value of a company's business, not its stocks (Carbonara (1999)). The author agrees – in particular because first and foremost Grabinski (2007) evidenced that market values are non-conserved, potentially chaotic quantities. Against this background Functional Value could be termed "economic intrinsic *conserved* value", too.

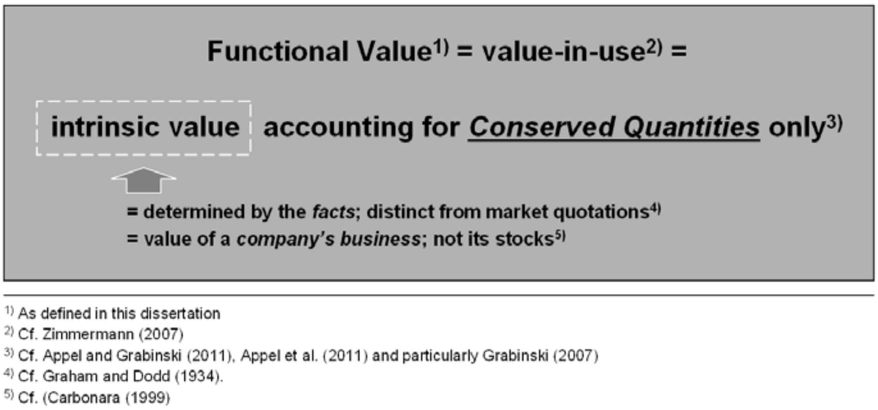


Figure 10: Functional Value's conceptional heritage

Please note that far more interpretations of intrinsic value were generated over the time span of nearly 125 years since it was firstly mentioned by Marx (1887). To avoid confusion the term "Functional Value" was coined here. To gain more insights thereon, the similarities and disparities of the most common intrinsic value approaches are summarized and opposed to Functional Valuation in the following (cf. Chapter III, 2.2.2). Afterwards, for the sake of convenience, the working definition of Functional Value is summarized in one dedicated Chapter (cf. Chapter III, 2.2.1).

2.2.2 Common definitions of intrinsic value

Selected common valuation techniques – which at first glance may be mixed up with (intrinsic) Functional Valuation that bases on Conserved Quantity Approach –, will be discussed briefly herein. Thereby parallels and deviations between them should become more obvious:

1. *"Relative value pricing"* relates a company's financials to (stock) market values of presumed peers. For example price-to-earnings ("P/E") or price-to-sales ("P/S") ratios are frequently used by practitioners to compare companies' values and to value companies (cf. Kamstra (2003), Matchett (2003)).

This is the most severe deviation from Functional Valuation of any valuation techniques referred to as "intrinsic": (Stock) market values for sure are *non-conserved quantities*, i.e. they can react chaotically, which increases the quality of any "value" forecast by no means! Moreover accounting figures like earnings – or any other variable taken from any company's financial statements – not necessarily have to be conserved. (The reasoning becomes even clearer when looking at the examples in Chapters IV, 2 and IV, 3 and the generalized rules for Conserved Quantity Accounting described in Chapter V as well as the dedicated Chapter V, 7 on its deviations to currently applied Generally Accepted Accounting Principles ("GAAP")):

2. *"Discounted dividend models"* were made popular in particular by Williams (1938) by the publication of his thesis named "The Theory of Investment Value". He argues that stockholders tend to be the most optimistic investors. Therefore stocks are typically overvalued by the winner's curse (cf. "winner's curse" in context of pricing and/ or M&A). To evade this curse Williams suggests taking decisions by the so-called "investment value": It is defined as the present worth of future dividends or of future coupons and principal. This value is said being the critical one above which no asset can be bought or hold without added risk. According to Williams, if someone bought a security below its investment value, he will never have to bear a loss: Even if prices fell at once, the asset could still be held for income to get a return above normal on the acquisition price. However if someone bought at prices above the investment value, the only hope of avoiding a loss is to sell to someone else, who must in turn take the loss in the form of insufficient income. In consequence all those who do not feel able to foresee the swings of the market and do not wish to speculate on mere changes in price are well-off if they estimated the investment value as guideline for their buying and selling decisions.

Though Williams' (1938) work provides seminal insights as well as thought-provoking impulses, he never addressed Conserved Quantities – particularly not in his *"law of the conservation of investment value"*: Instead he argued that an enterprise's value consists of the "present worth" of all its future distributions, no matter whether they are interest or dividends, and therefore it "in no [way] depends on what the company's *capitalization* is". This means Williams anticipated the theorem later formalized by Modigliani and Miller (1958), which states that, under certain market conditions, a company's value is unaffected by how it is financed.

Though this theorem is not at all disputed here, to avoid getting puzzled, it still should be pointed out that it has nothing to do with "conservation laws" in natural sciences, which Grabinski (2007) initially adapted to business and economics as guideline for identifying and analyzing conserved cashflows. And the way Grabinski applied *natural scientific conservation laws* is decisive for finding Conserved Quantities contributing to Functional Value.

3. *"Gordon growth model"*, being a variant of the discounted dividend model, is intended to value a stock or a business. There are two core assumptions: Both the discount rate and the growth rate of the dividends are constants. Then the valuation formula is simply a ratio involving the average dividend *growth* rate and the average discount rate, multiplied by the most recent dividends (cf. Gordon (1959)).

Though Functional Valuation suggests applying some kind of DCF, too, there are two objections with Gordon (and other authors using non-constant growth rates to adjust their models):

3.1 Dividends might get paid though *too low* Conserved Cashflow-generation would actually suggest otherwise. Examples are dividends paid (partly) by debt in order to satisfy and calm down (irresponsible) investors (cf. Chapter V, 5.2.2.3).

3.2 More important: What makes the dividend *growth* rate predictable, given there is no analysis of the company's underlying business? In the case of the Gordon growth model and its successors (cf. Yao (1997)), it is just the simplifying – and according to Appel and Grabinski (2011) unsatisfying – assumption, that earnings will grow constantly in perpetuity. Also Kamstra (2003) concludes in his review and test of algorithmic valuation techniques by historic company and stock data that “[they] provide, at best, a rough starting point for firm valuation”.

In summary even in the marked-off fields of finance and economics, there is no common understanding of the term “intrinsic value”. Instead there are diverse interpretations, whose most common thread is that there is some kind of fundamental, i.e. economic metrics-generated income stream, which must be discounted often to consider the time value of money and the risk associated with an investment. (Therefore the terms “fundamental value” and “investment value” are also customary). But all established intrinsic valuation approaches face the common criticism that they use forecasts, which may be unreliable, as Kamstra (2003) concludes. The author agrees on principle with this critique. To counter the issue, which mostly traces back to unreliable market moods – respectively long-term *insignificant* influencing factors (cf. Chapter III, 2.1.4.2) – he advises to apply a valuation approach based on Grabinski’s (e.g. 2007) suggestion to use Conserved Quantities only. Please note this approach is more detailed in view of the treatment of B/S-assets (and -liabilities) but it is perfectly in line with the constitutive works of Appel and Grabinski (2011), Appel and Grabinski (2010), Appel et al. (2012) and in particular Grabinski (2007). This implicates that the work at hand – together with the last-mentioned publications – challenges variables, which authors considered “intrinsic” or “fundamental” before. The working definition of the concept opposed herein, namely (intrinsic) Functional Value, is provided in the following. (For this Chapter please also cf. Appel and Grabinski (2011)).

2.2.3 Working definition of Functional Value by Conserved Quantities

Taking on the yet established terminology Functional Value of a company, its “assets” – including intangibles and human resources – as well as its products is an “economic intrinsic *conserved* value”, which ignores non-conserved parts of both market demand and market values (cf. Chapters III, 2.2.1 and V, 5.2). Beyond that it should be clear by now that it is a special case of intrinsic value, which must not be confused with a philosophic sense, where the intrinsic value of something (or someone) is said to be the value it (or the person) has "in itself", or "for its own sake", or "as such", or "in its own right", and extrinsic value is value being "not intrinsic" (cf. Zimmermann (2007)). Instead Functional Value should be understood in an economic sense namely as *"value in-use"*, which is the discounted net *Conserved* Cashflow realizable in course of the acquisition and application of any item's *conserved* Required Functions, adjusted for the expected risk, uncertainty, inflation, currency exchange rates (if applicable) and the item's obsolescence during its period of use. ("Acquisition" is used in the broadest sense here; it also contains contractual arrangements allowing *access* to certain items' or licenses' functions via royalty payments, etc.). An item's (conserved) Functional Value therefore may be individual for diverse proprietors, dependent on the context in which it is used, the synergies arising from a management team's capabilities, or even the regional spread a company covers (cf. Appel and Grabinski (2011); for issues related to risk and uncertainty as opposed to chaos and unpredictability cf. Chapter III, 3.2.2.2; for Conserved Quantity Accounting of human resources and intangibles – like synergies – cf. Chapter V, 5.2.3).

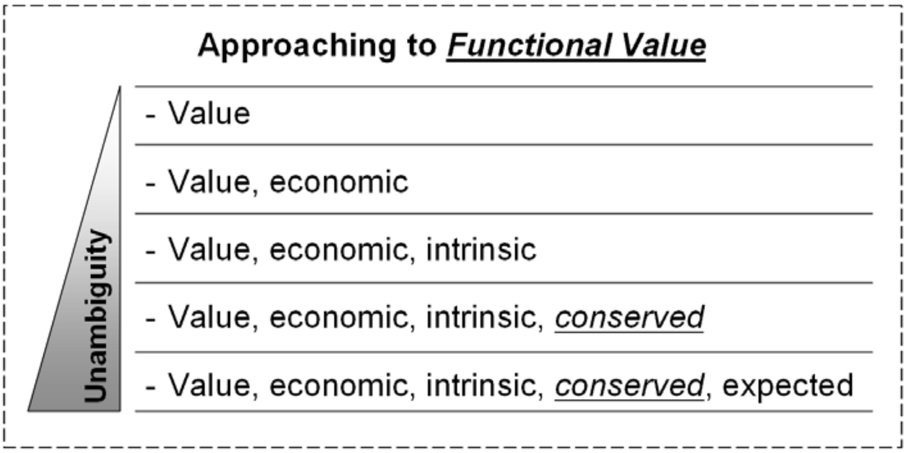


Figure 11: Functional Value's progressive refinement
(cf. Appel and Grabinski (2011))

To compute an economic "value in-use", which is conserved hence cannot shift without notice and further ado, the actual requirement for the respective item's utility or function must be explored – therefore the following terms seemed to be tellingly (and thus could be alluded herein before):

1. Customers' *Functional Requirement(s)*;

2. Assets' or products' *Required Function(s)* that fit *Functional Requirement(s);*

3. Companies', assets' or products' *Functional Value(s)*, which can be realized by providing items that have *Required Function(s)* from customers' point of view. (For Functional Valuation it is in principle irrelevant whether or not the item or product under consideration is something material or an (immaterial) service. Therefore both terms – "item" and "product" – comprise services, too).

Please note that Functional Requirements – in line with the understanding of Appel and Grabinski (2011) – are by no means restricted to technical applications. In contrast also *"soft functions"*, which are examined by sociocultural studies oftentimes, are included consciously in macroenvironmental Significant Influencing Factors. For example: Given a company is able to ask for premium prices because their products are appreciated for their environmental friendliness, their modern design, their expression for wealth, etc., the respective price premium has at least the *potential* to add some Functional Value to both the related products and the company that provides them. But it is inevitable to proof *case-based* whether or not customers' demand for any "soft function" is Functional Requirement indeed – if so it conforms to Conserved Quantities' two prerequisites (cf. Chapter III, 2.1.2 as well as Chapter V, 5 – in particular Chapter V, 5.1.4.2).

Please also note that there are lines of reasoning in marketing and strategic management, which are similar to the *cause-and-effect chain* from point 1 to 3 (cf. above). They however will *not* lead to identical results because:

1. *Functional Requirements (often) deviate considerably from market demand!* For it the reason is simple: Speculators usually demand an asset just in order to resell it – not because they have any *Functional Requirement* to *apply* it. That is why e.g. periodic trade volumes of resources like gold or agricultural products are regularly larger than the total volumes required by all further processing companies

(and end-customers). This suggests: Given there is no Functional Requirement to apply something, which can be reasoned based on facts (= Significant Influencing Factors), and trading is performed nonetheless just because market participants are guessing that the market value(s) of the traded item(s) may rise or fall in the future, such kind of *speculative* trading could be stopped at once. No foregoing cause is needed (= no Significant Influencing Factors must change before) and no consistent reaction in something else is expectable (= no transfer of Conserved Quantities will happen). And therefore market demand may be non-conserved in parts and thereby may become larger than Functional Requirement. Furthermore the example hints to the reason why market values are non-conserved in parts, too. This leads to point 2.

2. *Market values are set by so-called "supply and demand functions"* (cf. "supply and demand function"): Given the market demand is higher than Functional Requirement the market value consequently must be higher than Functional Value, too. One could also state rightly: *Inflated* (non-conserved) demand leads to *inflated* (non-conserved) market values. The so-called "value gap" ("Value Gap") measures the difference between market value and Functional Value (cf. Chapter III, 3.2.1.3).

Considering point 1 and 2 in combination makes clear why this dissertation has to distinguish between (non-conserved) speculations and (conserved) investments (cf. Chapter III, 1): *Speculators* aim to capture from other market participants some (non-conserved) return by buying and reselling items based on their own *guesses* regarding the respective item's *short-term change in Value Gap.* And the reason why speculators can hope to make a fast buck this way is: Value Gap equals a market value's non-conserved part hence may shift at short notice without requiring related proportional changes in the real economy before (= chaos effect). In contrast *investors* aim to provide funds that are used to add *Functional Value* to items, which are *needed factually* – in view of Significant Influencing Factors – and consequently will be acquired, taken off the market and used by (end-)customers. So here there is *operational work* involved – the (conserved) returns come from providing items that were amended physically before and/ or from providing services. Consequently the items and/ or human resources applied in such operational processes are also needed factually (= they fit Functional Requirements). The related items must be taken off the market before they can be further processed and/ or plugged. Then the same items cannot be used for other things anymore – which parallels natural scientific conservation laws respectively Conserved Quantity Approach (cf. also Chapters V, 2.2 and V, 5.2.1.1). Thereby the related trade volumes are reduced strongly, which in turn limits the threat of speculative bubbles considerably (cf. Chapter IV, 3)! And the person who provides a service, which fits a customer's Functional Requirement, cannot provide e.g. his advice to another customer at the same time – so here there are Conserved Quantities, too (cf. Chapter IV, 4). This shows quite plainly: Given trading of items and/ or provision of services stopped in presence of Functional Requirements for them, this would result in severe cuts in economic value chains – maybe production at some facilities and/ or selling at some stores even would have to be stopped for a while. Consequently consistent changes in more than one Conserved Quantity would appear in the (conserved) Functional Requirement case. This expresses why Functional Requirements – and thereby also Functional Values – are more robust than the (often inflated) market demand and market values: Functional Requirements are Conserved Quantities indeed in that they *react* foreseeably hence non-chaotic on changes that occur in the macroenvironment. These changes feed back on Functional Requirements within the related value chains in that they *reallocate* Conserved Quantities – e.g. in case of a product from the producers of initial resources to the further processing companies to the (end-)customers (and vice versa by Conserved Cashflow). Thereby respective companies' operational value creation potential (= Functional Firm Value) is changed, too – that is *the* decisive criterion for investor's decision making!

The generalization of this introductory example shows the connecting link between Conserved Quantities' two prerequisites (cf. Chapter III, 2.1.2) and Functional (Firm) Values more clearly:

1. Companies' future earnings, which can be realized by satisfying customers' Functional Requirements, equal their net Conserved Cashflow forecasts. They will remain unaltered until Significant Influencing Factors on Functional Requirements changed before (= 1st prerequisite: "There is a *cause* for any change of the variable under consideration"). These "catalysts" for a conserved change are in particular of macroenvironmental nature and comprise the PESTLE factors, i.e. political, eco-

nomic, sociological, technological, legal and environmental conditions – needless to say that they cannot change without notice and without further ado (cf. Hax and Majluf (1984))! Analyzing changes in such Significant Influencing Factors is inevitable in order to understand the "big picture", which in turn is crucial in order to see "whereto the (Conserved) Cash could flow" within the economy going forward. (Williams (1938) stresses this point implicitly by describing his experiences as a security analyst: "How to estimate the fair value was a puzzle indeed […]. And to be a good *investment analyst*, one needs to be an expert in *economics* also").

2. The ultimate test whether or not some part of the total cashflow is conserved works as follows: Given the cashflow changes at market participant "A", (i) there is however no according change of the cashflow at another market participant "B", "C", "D", etc. and (ii) the change of the cashflow at "A" occurred ad hoc, i.e. without any previous change of Significant Influencing Factor(s), then the change at "A" cannot be conserved. But if there is a change in (at least one) Significant Influencing Factor, which justifies a "shift" in the cashflow allocation *away* from (at least one) of the market participants "B", "C", "D", etc. and *toward* "A", the according values are conserved (= 2nd prerequisite: "There is a *simultaneous reaction* in another conserved quantity").

3. Given the 1st and 2nd Conserved Quantity prerequisite are fulfilled, one has found Conserved Cashflow; discounting *net* Conserved Cashflow that accrues over time equals conserved Functional (Firm) Value (cf. Appel and Grabinski (2011), Appel et al. (2012)).

In the context of Functional Firm Valuation please beware because: Revenue is always the product of two factors – demand and market value (respectively price). And a product's Functional Value is (often) considerably lower than its market value in that Functional Value originates from *Functional Requirements* for *Required Functions*, which are (mostly) lower than *total* demand for *all* product functions (cf. above). For Functional Valuation it is therefore *not* sufficient to deduct from the total demand the parts that are speculative and/ or short-term trend related in order to get something like "conserved demand" – finally market value's non-conserved part creates revenue, too! However this part of total revenues may change without any outside change. In consequence one must also compute something that reflects the "conserved part of the market value" of traded items – which is nothing else than Functional Value. Against this background the standard procedure to calculate *conserved revenues* – which accrue on the top-line of Functional Firm Value calculation – is in summary:

1. Consider the *market demand's conserved part* only (= Functional Requirement from customers' point of view = factual needs that cannot just occur, disappear or change without a previous change in Significant Influencing Factors).

2. Consider the *market value's conserved part* only (= product's Functional Value from customers' point of view = conserved part of customers' willingness to pay): It can be gauged by differentiating between amounts customers are willing to pay in order to access just a product's Required Functions (= market value's conserved part) and the remaining amount of the market value (= non-conserved part). Spending the former (conserved) part of the market value can be justified by facts: Thereby customers can satisfy their actual Functional Requirements caused by Significant Influencing Factors, which almost always have macroenvironmental roots (except of company-internal innovations as well as economies of scale and scope). Spending the latter (non-conserved) amount of market value cannot be justified by such facts – it is related to psychological reasons like emotions and mood, fads and fashion and finally speculation. This part of total market value may persist only as long as its right for existence – namely just short-term (consider e.g. regular markdowns in consumer markets or frequent market value shifts in equity markets). The non-conserved part of the market value however must be paid inevitably at some point in time, because customers must pay either for the total of one, several or none product – i.e. they are not allowed to pay just for their actually Required Function, which they strive to access by the acquisition of the product (cf. Chapter V, 5.1.3). And of course the non-conserved part of the market value must be paid inevitably at some point in time in equity markets, too, because both speculators and investors must pay either for the total of one, several or no e.g. company stock

– i.e. they are not allowed to pay just for the respective company's Functional Firm Value that traces back to its production and/ or marketing of products' Required Functions. (For further explanations on Value Gap between market value and Functional Value – in combination with quantitative examples – please cf. Chapter IV, 2 and particularly Chapter IV, 3)).

This *conserved* cause-and-effect chain to come to Functional (Firm) Value was excogitated by always bearing two concepts in mind: Grabinski's (e.g. 2007) interpretation of the systemic approach and Grabinski's subsequent thoughts on the pure or traditional way natural scientists manage chaos – namely by focusing on Conserved Quantities. Thereby economic scientific systems can be described robust and in principle the conserved cause-and-effect chain is still valid for natural scientific systems – for illustration the *identical* prerequisites are applied in the following confrontation in form of Figure 12. As a logical consequence it seems fair to state that Functional Value – as defined herein – benefits indeed from the explanatory power, which stems from Grabinski's suggestion to take Conserved Quantities as "proper variables" in the sense of the systemic approach! On this occasion please note that the fulfillment of Conserved Quantities' 2nd prerequisite is *most critical* for discriminating Conserved Quantities from non-conserved ones – it addresses the system-immanent, indispensible *resource constraints* (cf. Chapter III, 2.1.3.2).

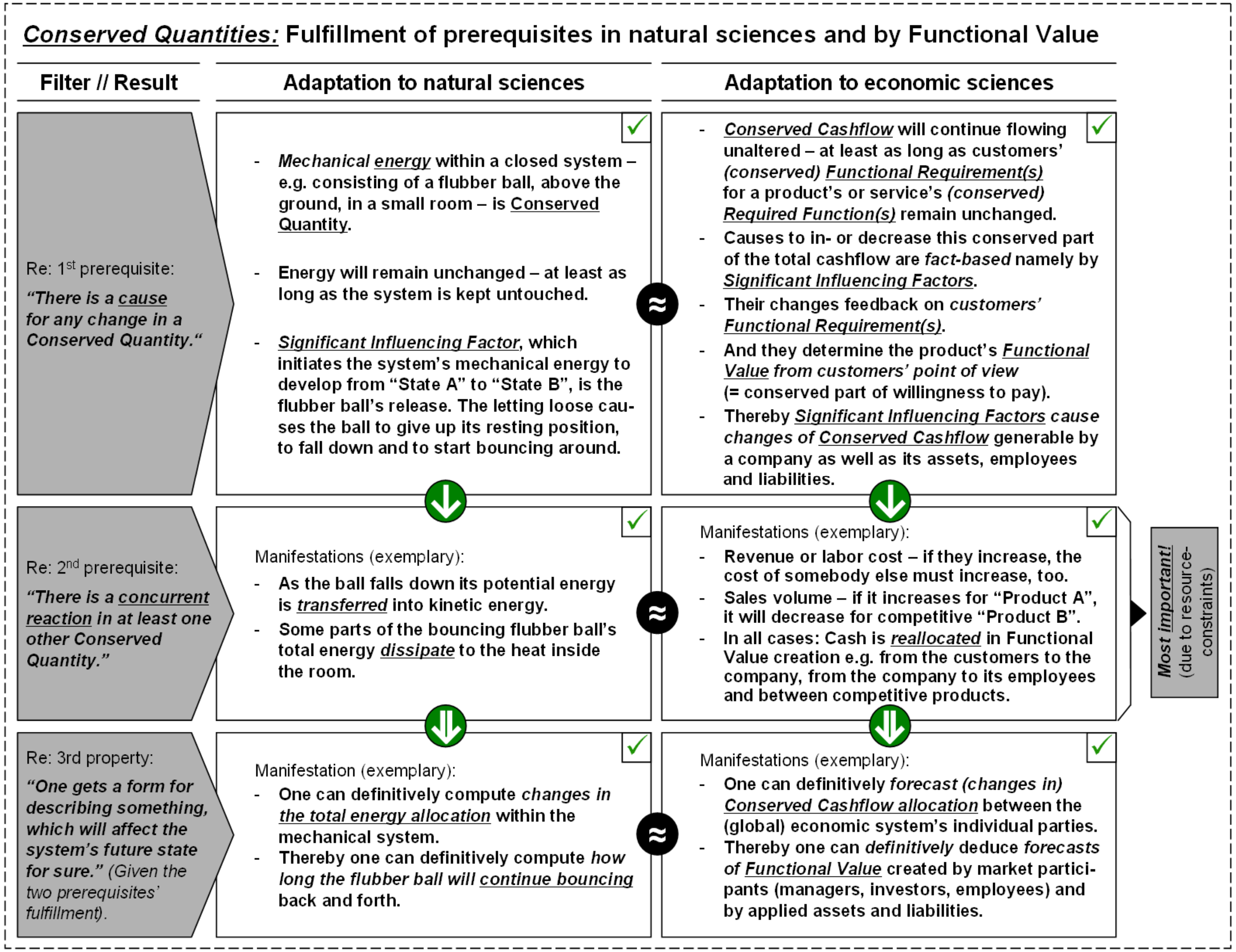


Figure 12: Conserved Quantity Approach adapted to natural and economic sciences (cf. Appel and Grabinski (2011), Grabinski (2007))

3 Non-conserved market value versus Functional Value

Valuation is rather unimportant as long as an asset is applied by a private person only. But as soon as a company has to set-up a balance sheet or a price for transaction has to be determined the related parties must agree on some valuation approach. Fatally enough (non-conserved) transaction or market values are considered usually as the most reliable guide to "value". That is also the reason why trading as well as transaction multiples are common among practitioners in the M&A business (cf. "trading multiples" and "transaction multiples" in the context of firm valuation). To use "market value" synonymously with "value" is a possible definition yet it is very misleading! Nonetheless the tendency to rely on market value's disputable explanatory power in view of *real* value is advocated also by organizations, which establish financial accounting and reporting standards, in particular the Financial Accounting Standards Board ("FASB" (2008); cf. also Chapter V, 7.6). Market and intrinsic value respectively Functional Value by far are not two sides of the same coin. Therefore they cannot be treated equally and/ or used for any purpose – for that their properties are too *un*equal. Grabinski (2007) puts the issue most clearly and concisely: "In the business world, one has conserved and non-conserved quantities […]. Conserved means here that they cannot change without a change in something else. […] because business is mostly occupied with numbers in currency units, one may conclude that one deals with conserved quantities only. But this is not the case. The [market] value of something is not a conserved quantity. It may change without notice. Exactly this is the problem with the stock market. A crash may half the value of 1,000 companies within an hour. Though observing the life inside these companies during this hour will show almost no change. Therefore the value of a particular stock is *completely* unsuited to describe how the company is running."

Stock market values stand exemplary for any market value, which bears a non-conserved Value Gap – then it is at *variance* with real economic facts that are reflected by (conserved) Functional Value. The issue with non-conserved parts of any system is that they may change chaotically in the mathematical sense *under certain circumstances*. Therefore the conclusion is valid that the chaos exposure ("Chaos Exposure") of a business, market, industry and/ or economy increases the lower the traded items' Functional Values are compared to their market values, i.e. the higher non-conserved Value Gaps are respectively (cf. Chapters III, 3.1 and V, 6). In potentially chaotic economic scientific systems "certain circumstances" describe first and foremost situations wherein Value Gap grew so large that it rightly can be called "bubble" (= economic bubble = speculative bubble). Then change(s) in any market value(s) – no matter how arbitrarily small it is (they are) – may lead some other market value(s) to step-up in either positive or negative direction. Thereby total markets may be contaminated in ways, which are not justifiable by any forecast of *operational value creation* of the related businesses, industries and/ or economies, which are measured by *Functional Values*. This is what typically happens at the start of economic crisis (= financial crisis) – it is called "bubble burst". From that two core insights are:

1. The *explanatory power* of market values diminish as they deviate more and more from (conserved) Functional Values (= Value Gap).

2. The threat of chaotic market behavior grows – which means *Chaos Exposure* – the larger (non-conserved) Value Gap becomes.

At this occasion please note that the values are not aligned most of the time: Even worse Functional Value, which equals market value's conserved part, is generally much lower than the non-conserved one, i.e. Value Gap (cf. Chapter IV, 2 – in particular Tables 1, 2 and Figure 25 – as well as Chapter IV, 3 – in particular Table 4). This suggests that in most cases there are actually not even market values but just market *prices* (cf. Appel and Grabinski (2011), Appel et al. (2012), Grabinski (2007))! These are also the reasons why it seems appropriate to use the linguistic shortened term "non-conserved market value" instead of lengthy descriptions like "non-conserved Value Gap that accounts mostly for the bigger part of market value".

3.1 Potential distortions to market value

The market is *not* a weighing machine on which the value of each item is recorded by an exact and impersonal mechanism in accordance with its specific qualities. Hence it is not efficient. It is rather a voting machine. This means it is subject to fads and fashions, whereon countless individuals register choices, which are the product partly of reason and partly of emotion (cf. Graham and Dodd (1934) cited by Lehman (1991)). Therefore today's markets may show short-lived trends that get falsified and reversed oftentimes. Market values arise predominantly from non-conserved supply and demand in view of products that bear functions, which to a large extend need not be Required Functions in actuality. Yet it is highly speculative what happens to items in the long run, which are in this sense "overvalued" or even "valueless" but nonetheless demanded and bought at market values as of today: Will they be demanded still in the same, higher or lower volumes (e.g. per year)? For this reason will they sell at the same, higher or lower prices? And what exact values will all these non-conserved quantities take respectively? Trying to forecast them is as reasonable as attempts to calculate next week's lottery numbers because in either case there are no clear-cut *conserved* cause-and-effect relationships with the rest of the respective mechanical or economic system.

Please note that this line of argument is true for equity or stock markets, too: Here there also may be Value Gaps, which in actuality cannot be closed by Functional Values that customers' ascribe to the companies' offerings – then the companies may be overvalued, too. But speculators do not ask the decisive question "Where could the cash really come from, which accounts for the gains of any transaction" (cf. Chapter III, 2.1.2). So trends appear regularly also on equity markets' agendas given speculators are responsible largely for closed transactions. These trends may take rising as well as falling directions. But irrespective thereof most of them last in the short run only due to their *lack of sound logical reasoning*. This lack of "sound logical reasoning", which ignores economic facts, accounts presumably for most of the cases wherein market values are distorted (= are unequal to Functional Values). Nonetheless Appel and Grabinski (2011) as well as Grabinski (2007) could identify further business situations that foster such non-conserved Value

Gaps – mostly in positive but also in negative direction. In any case transaction values are no reliable approximation to real value here:

1. *Distortions* – like price agreements or speculations – may undermine any validity of market values. Here Conserved Quantity Approach is annulled either by market participants' behavior that is liable for trial in a court of justice or by market participants who perform market transactions just because they (wrongly) considered (non-conserved) market values – and forecasts of it – as "real" or "realistic". In either case economic scientific facts – like those described herein – are disregarded (cf. Chapters IV, 2 and IV, 3 as well as the related Sub-Chapters).

2. *Illiquid assets* – like licenses or shares of non-listed companies – may be traded in opaque markets. Here non-transparency and thereby the threat of distortions to market values are particularly high. In addition one would have to refer to trades of comparables in order to find historic market values. But in nontransparent markets, who is able to tell whether or not there are (good) comparables?

3. *Assets bought at forced sales* – like auctions in course of insolvency – may be acquired below their respective Functional Value. Hence Value Gap may become *negative* here. Please note that calculative examples suggest that negative Value Gaps are rare in reality (cf. Appel and Grabinski (2011), (2010), Appel et al. (2012) as well as Chapters IV, 2 and IV, 3 including the Sub-Chapters respectively).

4. *Collector's items* – like pieces of art, postage stamps, etc. – regularly inveigle people to pay more than any Functional Value (cf. Chapter I, 1).

As indicated before not all cash generated in course of sale purchase agreements (respectively service agreements) is conserved, i.e. not all cash adds to Functional Value. The most general reasons can be found in the 1st and 4th case: Distortions may be falsified, so that market values rise or plummet like card houses. Collectors may get bored in the short run and switch to another trendy item or none at all. This does not necessarily mean that no cashflow at all can be generated anymore. It just means that (some of) the Value

Gap towards Functional Value is equalized, i.e. that people's buying decisions adjust to a more rational, (Required) Function-based scheme. And since there was no real need to over- or underpay before such adjustment can occur progressively fast. Or in the language of science: *No conservation law forces a slow transfer of value* (cf. Appel and Grabinski (2011) as well as Chapters III, 3.2.1.1 to III, 3.2.1.3)!

In conclusion valuation as of today is never reliable when being based upon market values – *neither* in case of valuation using *historic* ones (e.g. by market or transaction multiples) *nor* in case of long-term financial *forecasts* for valuation that simply extrapolate non-conserved market trends and/ or apply prognosis of overwhelmingly non-conserved demand and market values. (Needless to say that "non-conserved" here means that the two prerequisites of Conserved Quantities cannot be met (cf. Chapter III, 2.1.2)). In either case the threat of distortions regarding real value in form of Value Gap, which fosters Chaos Exposure, are manifold and more likely than not. Therefore chaotic rises and then chaotic collapses of firstly demand and secondly market values arising therefrom may reverse Value Gaps abruptly so to say tomorrow. As an antipole to that Functional Value was developed: It *"weighs" real values* based on economic facts that *"tip the scale" in form of Conserved Quantities*, which may become (re-)allocated correspondent to changes in Significant Influencing Factors.

3.2 Selected examples for distortions to non-conserved market value

The more market participants are involved the higher chaos' scale and scope may become because also the second and ultimate ingredient for economic chaos exists here, namely *high trading volumes*: In combination with market transactions performed due to the extrapolation of positive or negative historic market value trends, high trading volumes mean a *concentration of if-then-decisions* based on non-conserved quantities – this mixture is the strongest driver of chaos (cf. Chapters II, 3 and II 4.5)! In such situations chaos' consequences may become maximal for individual persons' and companies' wealth as well as for whole economies. Finally the latter are reliant on continuous purchasing power and tax income of their citizens and companies (cf. Chapters IV, 2.3, IV, 5, V, 1 and V, 8 as well as Chapter VI). “Chaos’ consequences” then manifest in the yet mentioned *bubbles* respectively *bubble bursts* – that may be followed by *financial crisis* – as well as in *momentum* respectively *momentum reversal* (cf. Appel and Grabinski (2011), Appel et al. (2012), Grabinski (2007)). These phenomena are treated in more detail hereafter with the objective to derive suggestions for avoiding and/ or at least foregoing them as an individual investor in the future.

3.2.1 Economic bubbles applying the example of tulipmania

The first reported and maybe best known real example for an economic bubble is the so-called “great tulipmania”, “tulipmania” or simply “mania”. It took place in Holland in the 1630’s. The mania became a popular reference again during the “dot.com-bubble” taking place between 1995 and 2001. Journalists also compare it to the recent subprime mortgage crisis, which started in summer 2007 (cf. Goldgar (2008)). By using the example of tulipmania in conjunction with Conserved Quantity Approach an alternative explanation for economic bubbles and crisis as well as related advices to deal with these omnipresent threats are derived in the following three Sub-Chapters.

3.2.1.1 Typical growth and burst of economic bubbles

Tulip bulbs were firstly imported to Holland at the end of the 16th century. The flower rapidly became a status symbol and thereby a coveted luxury item, i.e. a *collector’s item*. A profusion of varieties were reared like the “couleren tulips”, which were plain tulips of red, yellow or white. But the most popular ones were the multicolored “rosen tulips” with red or pink patterns on white background, “violetten tulips” with purple or lilac patterns on white background and to a lesser extent the “bizarden tulips” with red, brown or purple patterns on yellow background. The tulip bulbs out of which the spectacular flowers would grow with vivid colors, lines and flames on the petals were sought-after highly. According to nowadays' status of knowledge the coloring was caused by an infection with a type of mosaic virus, the tulip breaking virus (cf. Dash (1999), Garber (1990)). Professional growers paid increasingly higher market values for bulbs with this virus in response to tulips' growing popularity. Yet *speculators* entered the market not before 1634; then they joined successively in parts as a result of more demand coming from France (cf. Garber (1989)). Two years later, in 1636, the Dutch created a type of formal futures market in order to trade contracts entitled to acquiring tulip bulbs at the end of the season. Since no bulbs actually changed hands until then the Dutch derogatively called this contract trading *"windhandel"* (cf. Goldgar (2008) as well as Chapter IV, 3 for nowadays' manifestations of windhandel). Traders met at taverns and buyers were required to pay a 2.5% "wine money fee" up to a maximum of three florins per trade. All contracts were closed directly with the individual counterparties, i.e. not with the respective exchange. No party paid an initial margin or a mark-to-market margin (cf. Garber (2000)).

Throughout 1636 *rare* bulbs' contract prices (= market values for futures contracts) rose continuously. Finally in November 1636 *all* contract prices began to rise – i.e. also the ones of common bulbs that lacked the valuable tulip breaking virus. At the latest this fact indicated the effect of the mania – it *overheated* the total market (cf. "collective punishment" in context of equity markets, e.g. in Chapter IV, 2)! Not surprisingly just about three month later the tulip market collapsed in February 1637: Traders could no longer find new buyers, who were willing to pay the bulbs' more and more inflated market values. The trading was stopped virtually. The market demand's crash was accompanied by market value's collapse. In consequence some traders were left with futures contracts to purchase tulip bulbs at market values that were 10x greater than those on the then current open market. Others found themselves in possession of bulbs that now, after the bubble burst, were worth only a fraction of the market value they had paid initially (cf. Garber (1989)). And because of that market collapse no deliveries were ever made to fulfill the already closed contracts in actuality (cf. Garber (2000)).

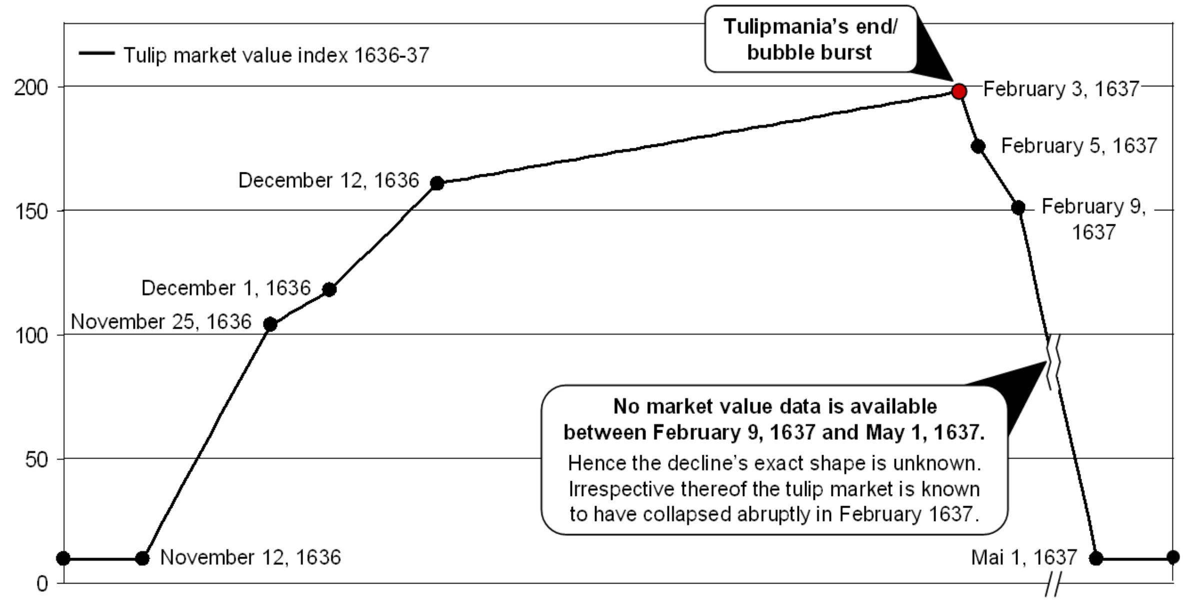


Figure 13: Tulip market value index from 1636 to 1637
(cf. Appel and Grabinski (2011), Thomson (2006))

Both the windhandel principle and the growing divergence between the bulbs' market value and Functional Value may have accounted for the swelling of the bubble: The higher market values rose people did not purchase and exchange tulip bulbs anymore for planting them in order to grow nice flowers (= tulip bulbs' primary function). Instead people intended to hold futures contracts and/ or tulip bulbs just temporarily in order to resell them later for a profit. Hence they guessed or better betted that historically rising market trends will continue in the future, too. For an item, which serves next to *no Required Function*, this is nothing but pure *speculation*! Such a scheme cannot last and pay out (positive amounts) unless any person is ultimately willing to pay the high market values and take possession of the bulbs. But who would take possession of an enormously expensive, overvalued bulb in order to grow flowers given this means a severe financial loss? There simply was no reason to do so because there was actually no Functional Requirement to plant the bulbs – given one accepts that enjoying a beautiful blossom is nice but not obligatory. In consequence no one was willing to enjoy this rather negligible (non-required) function against the background of ever rising market values – and thereby potentially increasing profits when guessing the right exit point (shortly before the bubble bursts). For sure people back then did not think about Functional Requirements, did not gauge Functional

Values hence also did not compare them with tulips' and/ or tulip bulbs' market values. But though they had no precise calculations at hand it should have been clear that the positive market trend cannot continue and most likely will reverse soon because: At February 3, 1637 – the peak of tulipmania – some single tulip bulbs sold for more than 10x of a skilled craftsman's annual income or more than a furnished luxury house's market value in 17th century Amsterdam (cf. Thomson (2006)). That said though Functional Value of the bulbs and the contracts were not calculated exactly those days, the market values obviously were far above any kind of real or realistic value that could be justified by economic facts! So finally the demand and with it the market values ended in smoke without any outside change within just a few days (cf. Kindleberger and Robert (2005), Shiller (2005)). At February 5, 1637 – the bubble's last day – unjustifiable and wildly varying prices were recorded (= chaos effects). In total 98 sales were closed using several market mechanisms – futures trading at the taverns, spot sales and notarized futures sales by growers as well as estate sales. The available market value data therefore is a "blend of apples and oranges" to a great extent. Nonetheless the market values dropped without notice and further ado in February 1637. And non-surprisingly the fall in market values was faster and more drastic than the rise because as foreclosed in the introduction: "No conservation law forces a slow transfer of value" (cf. Chapter III, 3.1). Though sales data largely disappeared after the tulip market's collapse some data points available on bulb prices show that the loss in market values continued for decades after tulipmania (cf. Garber (2000), Thompson (2007)). This maintains the view advanced herein that the properties of collector's items – tulip bulbs were collector's items back then – support the (temporary) existence of Value Gap as compared to collector's items (relatively) negligible Required Functions and (relatively) negligible Functional Value that goes along therewith. At this occasion please note that Conserved Quantity Approach may conflict with other researchers'' opinions on trading of collector's items: From e.g. Hazlehurst's (2006) point of view "[by trading collector's items] value is created when intrinsically valueless objects are transferred by irrational desire." However even if real cash is gained by trading a collector's item the corresponding change in "value" is not conserved. It does *not* lead to an increase in intrinsic or Functional Value in the definition taken here! Translating Hazlehurst's (2006) case to natural sciences shows why he is wrong: He claims: It is possible to generate Conserved Quantity from nothing. But translated back to physics this would mean: It is possible to generate energy out of nothing. And of course that is utterly impossible in reality (cf. Appel and Grabinski (2011) as well as Chapters V, 2.2 and 5.2.1.1)! Please note also another property of this example: It shows what could make it particularly challenging to set-up a balance sheet containing nothing but Conserved Quantities. The way the cash was generated must be examined in any case. And – at least in principle – the reason why things could be sold to *individual* customers must be taken into account, too. Given this is not realistic in this absoluteness, Conserved Quantity-accountants should be allowed to focus on more *general economic* reasoning of the *average* customers' buying behavior by macroenvironmental Significant Influencing Factors (cf. Chapter V).

3.2.1.2 Reasoning for economic bubbles by Conserved Quantity Approach

The market value index of Figure 13 shows a clear rise in market value and a severe fall – in particular the latter happened within a dramatically short period of time. Not only (non-conserved) market value but naturally also the underlying (non-conserved) demand collapsed at short notice. Therefore people started comparing that kind of economic change with bursting bubbles. But is this indeed a typical development of bubbles after their peak has been passed? Or to put the question more general: How can economic deciders identify – at the earliest possible stage – the difference between a potentially conserved demand shift, a bursting economic bubble and the disappearance of non-conserved asset "values" that follows the latter? Reconsidering tulipmania shall help to come to an answer. Here the following aspects argue for a bursting economic bubble, which diminished (non-conserved) Value Gap – please note that this exemplary line of argument is universally valid, too:

1. Values changed *without* any outside change and *without* notice *(= 1st prerequisite of Conserved Quantities failed).*

2. There was *no* such thing as a *consistent change* in terms of demand. Therefore no acquisition of large volumes of any substitute is reported that could directly detach tulips – respectively their bulbs – as luxury collector's item *(= 2nd prerequisite*

of Conserved Quantities failed). This means there was no conserved demand shift in response to the abrupt disinterest for tulips or their bulbs. Instead it was not before the beginning of the 19th century as particularly the hyacinth replaced the tulip as "the" fashionable flower. Interestingly also hyacinth's market brought about a similar pattern – in either case a flower's negligibly small Functional Value of being just something nice to look at could not substantiate its (overvalued) market value long-term (cf. Garber (1989)). So values did not at all reflect Conserved Quantities here!

3. Please note that literature on the great tulipmania shows very well that at least some people "felt" the difference between market values and real (Functional) Values *(= Value Gap)* and that they did not consider it being a good thing:

   3.1 In the 17th century most people could not imagine something as common as a flower that has a (market) value so much bigger than the money most people earned within a year. Therefore the idea that market values of flowers, which grow in the summer only, could fluctuate so wildly in the winter, threw into chaos the people's understanding of "value" (cf. Goldgar (2008)).

   3.2 Even though the financial crisis after tulipmania affected very few people only – in particular wealthy traders and craftsmen – the shock it generated was considerable. A whole network of values was thrown into doubt: Retrospectively, in the 1780's, the author Johann Beckmann described the mania and the resultant shake up by comparing it to the failing lotteries of this time (cf. Goldgar (2008), Tobias (2008)) – both possibly could make a few people richer yet *without* providing any equivalent countervalue before. This contradicts Conserved Quantity Approach respectively Strict Conservation Law in Business (= 1st and 2nd prerequisite of Conserved Quantities failed once more).

For taking better investment decisions by evading speculative losses it is helpful being able to discriminate between conserved market shifts and non-conserved collapses of Value Gaps (respectively bubbles bursts if Value Gaps grew to an economic dimension).

To understand the underlying reasons for both makes it finally easier to foresee the conserved respectively non-conserved change before it happens – though only the magnitude of the conserved ones can be gauged. The above line of reasoning, which applies Conserved Quantity Approach's two perquisites, should be the method of choice for it. To substantiate this statement selected researchers' reasoning on economic bubbles are also discussed (and refuted) in the following. Collectively these researchers question whether or not tulipmania was actually fostered by speculations because there might have been rational explanations for the rise and fall in tulip contract prices, too. Their two most prominent arguments are concretely:

1. The high market values also may have been driven by expectations of a parliamentary decree that futures contracts on tulip bulbs could be voided for small cost. Such decree would have changed the contracts' nature – yet it could *not* change the traded goods' Functional Value: Without the decree the purchaser always had to pay the full contracted price and assume the bulb. With the decree – if tulips' current market value fell – the purchaser could opt to pay a penalty of 3.5% (or about 1/30th) of the contract price and forgo the receipt of the bulb. This means in modern finance terms: The decree would have transformed futures contracts into options contracts (cf. "option pricing" or "option" in the financial context). Thereby the traders' risk would have been minimized to the relatively low penalty. Thus traders, who expected the decree would become effective, may have been willing to sign increasingly expensive contracts (cf. Thomson (2006)).

2. The rise in market values occurred after bulbs were planted for the year. Therefore growers had no chance to increase production in response to (short-term) rising market values (cf. Garber (1989)).

So in the 1st case a kind of *insurance* for tulip traders might have been implemented by the parliament via an ancient form of an option price contracting. If this actually affected the traders' behavior it would mean nothing else than both parliament and traders assumed insurance against falling market value was needed. And the most obvious reason why traders would have needed it is: Someone recognized that Functional Requirement for tulips and thereby tulips' real (Functional) Value on their own could not justify the prevailing high demand and market values. Or to put it the other way round: Someone recognized that the market demand and thereby the market value of tulips were dominated by short-term trends and speculations – which resulted in Value Gap – that may collapse without any outside change at short notice. Of course then no other "countermeasure" could be taken anymore by involved parties then just relying on a previously closed "insurance contract". In contrast if the tulips' market value and their Functional Value would have been equal (roughly), there would have been no (large) Value Gap that could easily collapse. In consequence no insurance against Value Gap's collapse would have been required: Traders would not have had a reason to fear being unable to find new buyers without making considerable concessions regarding resale prices because then the flowers' (low) Required Functions and Functional Value would have justified the (low) market value. This argumentation is accordable with the one of Burghof (2010): He opines that – in context with speculations – issues arise if market participants are liable only limitedly for their losses but participate unrestrictedly from profits. Following his argument – and reconsidering that the decree did not at all change real (Functional) Values accountable to the bulbs – one again should opt rather for than against a speculative bubble here. In this context Thomson (2006) argues that traders would have acted *rational* given they speculated on the implementation of the decree, i.e. on a very limited downside risk (that is known for the worst case) in relation to a huge upside potential (that is non-foreseeable though). Implicitly something like overvalued market values or Value Gap – and the threat of losses that goes along therewith – would have been assumed here, too. Maybe this considerations phrase one additional reason why people soon felt tulipmania being a lesson in morality (cf. Galbraith (1990) and Goldgar (2008)). Interestingly even such speculative traders acted somewhat like this dissertation suggests in view of Functional Valuation – yet *only* at the first glance: They included the decree into their financial forecast, i.e. they considered a change in a macroenvironmental influencing factor. So far so good. But they made a culpable mistake: *They referred to the wrong variable!* Tulipmania is a good example because it shows that forecasts of non-conserved quantities are not good for anything at all! Traders planned how they could apply the decree to participate in market values' upswing without being exposed to a (large) downside risk instead of forecasting the decree's effect on Functional Requirements for tulips and thereby on tulips' Functional Value (= *no* effect). Hence they focused on market value prognoses and how they could limit negative effects given their guesses on the future development of this non-conserved quantity turns out to be wrong. Yet focusing on forecasts of non-conserved quantities is the wrong base to take economic decisions. In actuality the only way to increase any item's Functional Value is to find new ways for its application, which have to serve long-term requirements (= *new* Functional Requirements). In case of tulips (and later hyacinths) it is hard to find a real example – that is the reason for the related speculative bubbles that consequently had to crash someday near-term. But assuming someone found that the flowers' extracts could e.g. cure a wide-spread disease, this for sure would be a *new* Functional Requirement that would raise justifiably their Functional Value. In summary for the 1st case this means: Rationalism is *not* the appropriate criterion to identify speculation, bubbles and the threat of economic crisis. The correct one is whether or not "proper variables" were taken for decision making. These are the ones that prevent Value Gap at its root, i.e. the ones that fulfill Conserved Quantities' two prerequisites. This leads to the 2nd case.

Following the argument of the 2nd case the market value simply would have reacted to increasing demand for a limited good (= here: tulip bulbs). This mechanism is indeed rationally comprehensible. But whether or not the *function* of supply and demand leads to market value adjustments is *not* the primary issue in the context of speculative bubbles. Instead the question is whether or not this function is able at all to lead to realistic values that cannot change chaotically. For it "proper variables" must be found again *before* discussing the function, namely (conserved) Functional Requirements for tulip bulbs instead of (non-conserved) demand for them. The supply-demand-*function* would lead to a reasonable value only if market demand can be substantiated by Functional Requirements for those Required Functions of tulip bulbs, which give reasons for their existence. As discussed yet the actually Required Functions are however too minor here: Tulip bulbs were nice to have luxury items. Accessing their function (= growing a nice flower) was and is not at all badly required. And because there was no actual Functional Requirement for tulips or their bulbs, there was no actual Functional Requirement for acquiring a comparable substitute. Please remember: Nearly 200 years passed until another flower, the hyacinth, became similarly popular. In consequence it seems valid to conclude that the high market values were paid *not* to apply the (actually very limited) functionality of the tulip bulbs but just to rip-off profits from the market place without performing any value creating activity before resale. Hence the rising market values during the traders' respective holding period clearly contradict Conserved Quantities' 2nd prerequisite hence Strict Conservation Law in business. (For contrary examples on traders' Functional Value please cf. Chapter IV, 4). So tulipmania teaches that speculation, economic bubbles and market values that react rationally by the relationship or function of supply and demand can coexist. But it does *not* necessarily mean that markets are efficient in terms of attaching the "right" or "real" value to an item. So – like in the examples above – also in the 2nd case the market developments can be explained at best by Conserved Quantity Approach, i.e. concretely the failing of at least one of its two prerequisites. (At this occasion please note that particularly liquid markets are due to another principal reason often *in*efficient in view of their estimations of any item's real Functional Value. Otherwise – after a while – traders would have found *the* consensus and stopped buying and selling. Something comparable is however not observable, i.e. trading in general continuous *without* related outside changes. Consequently there must be inefficiencies that inevitably cause Value Gaps that continuously in- or decrease over time (cf. Lange (2011) as well as Chapters III, 3.2.2.2 and IV, 3.5).

In summary examining the line of argument in the 1st and 2nd case clarified that speculation and rationalism of the tulip traders – not of the parliament if it actually issued the decree – need not be mutually exclusive. However it may be questioned whether or not the term "mania" is still appropriate for the tulip case. And by following the explanations above it should have become obvious why *non-conserved Value Gaps* remain *the* constitutional element indeed for inflated market values, economic bubbles and financial crisis following their reversal. This is also the reason why Appel and Grabinski (2011) headlined their first paper on short-lived economic trends "The origin of financial crisis: A wrong definition of value".

3.2.1.3 Working definition of economic bubbles and crises by non-conserved Value Gap

Functional Value is a special form of intrinsic value, which was shown by Appel and Grabinski (2011) and (2010) as well as Appel et al. (2012) to account at the best for an item's or company's real value – that qualifies Functional Value as *benchmark* to identify inflated market values (cf. Chapters IV, 2 and IV, 3 – particular Chapter IV, 3.5). These findings provide the starting point for a working definition of economic bubbles, which is also conformable with other research results on this topic: An economic or speculative bubble refers to trading of high volumes (cf. Chapter III, 3.2) at market values, which are considerably at variance to so-called "intrinsic values". This means products are traded at inflated values (cf. King et al. (1993), Lahart (2008)). Also Thomson (2006) agrees that market values have to become unhinged from intrinsic ones to form a bubble. Herein this phenomenon is called *"Value Gap"*. In view of the above line of reasoning Value Gap also could have been called *"speculation premium"* – in particular in equity markets: Finally it exists only due to acquirers' willingness to overpay for an interest in any asset irrespective of current and future Functional Value that is intrinsic to it.

Even a *dramatic rise and fall in market values* does not necessarily show the growing and bursting of an economic or speculative bubble – at least according to Thomson (2006). This restriction corresponds with conceptions of researchers like King et al. (1993) and Lahart (2008). But it is *debatable* against the background of non-conserved Value Gap: To begin with the common ground there seems to be no doubt that large Value Gap advances economic bubbles. The fact that intrinsic values – like Functional Values – increasingly are left behind market values suggests: Of course at least the *tumble* of the market values can be drastic and fast in the existence of Value Gap. The items' Required Function(s) cannot sustain the positive market trends long-term. In the end customers have too less or maybe even no Functional Requirements for them – in particular after the speculation or trend to acquire them nonetheless has stopped. That makes not only related products and/ or services but also the providing companies and their stocks increasingly unattractive. As natural reaction market participants evade products and try to get rid of assets – like stocks – as soon as they realize that the expectations in view of the related items' demand and market value cannot be sustained going forward. If this is done coincidentally on a wide base bubbles burst and threaten to infect whole economies. In consequence market values, which became unhinged from Functional Values before, of course can collapse at a moment's notice! Yet it may take relatively longer to let the bubble grow so that it becomes large enough to bear economic relevance.

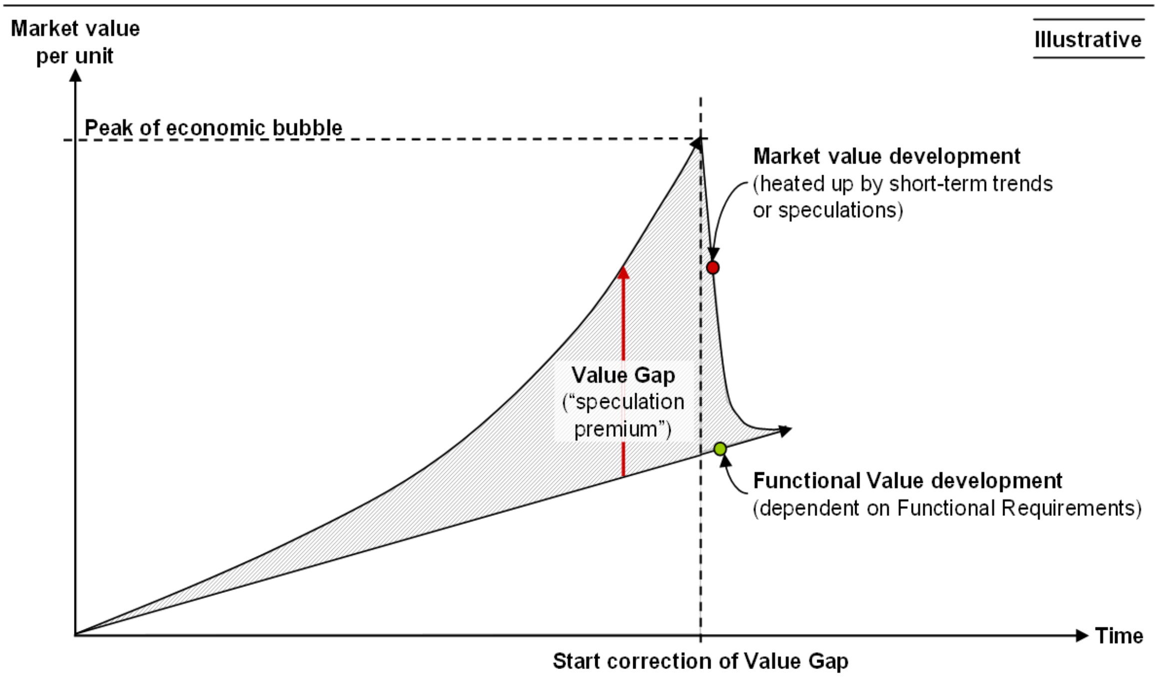


Figure 14: Growths and collapse of Value Gap (illustration)

With respect to economic bubbles, in the context of Conserved Quantities, this dissertation therefore argues as follows:

1. Value Gap is not the cause but the manifestation of an economic bubble. It shows market values considerably exceeding the value, which is intrinsic to the traded product's (or asset's) Required Functions. The reason for it is overshooting demand as compared to Functional Requirements (ceteris paribus).

2. As soon as there is no reasonable relation between market value and Functional Value anymore there is Value Gap. Within this Value Gap it may fluctuate chaotically. And given the bubble bursts market values of items, producing companies

and related assets – like stocks – adjust to Functional Requirements that exist in deed in view of the items that were traded eagerly before. Hence the burst corrects Value Gap.

3. Demand-shifts are *potentially* conserved and unequal to bursting economic bubbles, which *always* are manifestations of non-conserved quantities' mechanism:

3.1 If a product is not acquired anymore but a competing product is acquired in high volumes to outbalance the market shift, this indicates that the initial product provided (at least) one Required Function that substantiated its demand. And this Required Function still seems to be required! Then the diminishing demand and market value for the initially applied product is accountable to a conserved change in Significant Influencing Factors – they seemingly triggered a transfer of *conserved* parts of the product's demand and market value hence its market share (2^{nd} prerequisite of Conserved Quantities). Such kind of demand shift is in line with Conserved Quantity Approach so that no bubble can be diagnosed here.

3.2 In the contrary case given *no* large volumes of substitutes are acquired, which can provide (at least) one similar function, this indicates that the initial product's function(s) was (were) not at all required in actuality! Hence the product's non-required function(s) may not be worth to spend money those days. Then a drastic fall in the product's demand and market value would most likely be caused by the correction of (non-conserved) Value Gap.

Given Value Gap did not only affect some specific (and minor important) products but had an economic dimension, its correction means nothing less than a *bursting bubble*: In such a situation people probably will rethink their buying behavior and try to save more of their disposable money (= Functional Value of Work) e.g. because they have lost money by speculation with a temporarily coveted item or they fear to be negatively affected by the dropping demand (by loosing the job and/ or social acceptance, etc.). So there may be a change in the *savings rate* here but not a positive change in the *sales volume of substitutes*. Then larger parts of purchasing power are simply put to rest and trading is cut down – at least for a while. Again this implies that large volumes of the products, which were traded eagerly before, respectively their function(s), were actually not required (to the previous extent) but dispensable (largely) because: Stand-alone the potential to cut spending from one day to another at a large scale shows that there must have been lots of *non-conserved* hence *non-required trading* before! And given major parts of market participants are able to consciously hold back their cash and (temporarily) forego consume and investments a bubble burst indeed can grow into an *economic crisis* (= financial crisis). (Please note this is the reason why the author argues in line with the first publication of Appel and Grabinski (2011): Public authorities should apply the sole *prophylactic* measures available – they should amend the rules and regulations for accounting and taxation so that they show robust Conserved Quantities only. That helps indeed to see "what is going on" within the economic system (cf. Chapter IV, 5 as well as Chapters V and VI)). Consequently an unambiguous reasoning for the source of economic or financial crisis is:

Figure 15: Working definition of economic crisis (cf. Appel and Grabinski (2011))

Everything else, i.e. before the lack of investment and consume does not reach and throttle the *real* economy, is just a correction of Value Gap but no economic crisis. But under the circumstances summarized by Figure 15, companies – in particular those that were comparatively weak yet – indeed would have reasons to fear the continuity of their businesses. In consequence employees would question their job security and presumably save even more. This vicious circle is a *real* and potentially long-running thread in the *real* economy, which would affect assets' Functional Values, too. But – as yet mentioned – everything else could be just a simple market swing or the manifestation of market values (partly) adjusting towards Functional Values, which may reverse as quickly as it came. And reality often provides good showcases for it – in particular the equity markets: Swings of e.g. companies' stock values do not (strongly) affect operational respectively Functional Value creation within an economy – the term "economic crisis" therefore must be challenged case-based in view of its definition (cf. Figure 15): For example during the latest crisis, i.e. from summer 2007 going forward, the term "*real* economy" was used often by German media to express the diverging developments of stock markets, banking activities and the progress of the real operational value creation by production companies and service providers (cf. Appel and Grabinski (2011)). A top-level *indicator* thereof is the comparison of the changes of a stock market index over time, e.g. the German Deutscher Aktienindex ("DAX"), with the relatively moderate and quickly reversed downturn in Germany's gross domestic product ("GDP"), which is *not yet* adjusted for non-conserved quantities though. Nonetheless – given the comparison looks like the one below – it really seems like there was no economic crisis in Germany but just a focus on wrongly defined values at the DAX:

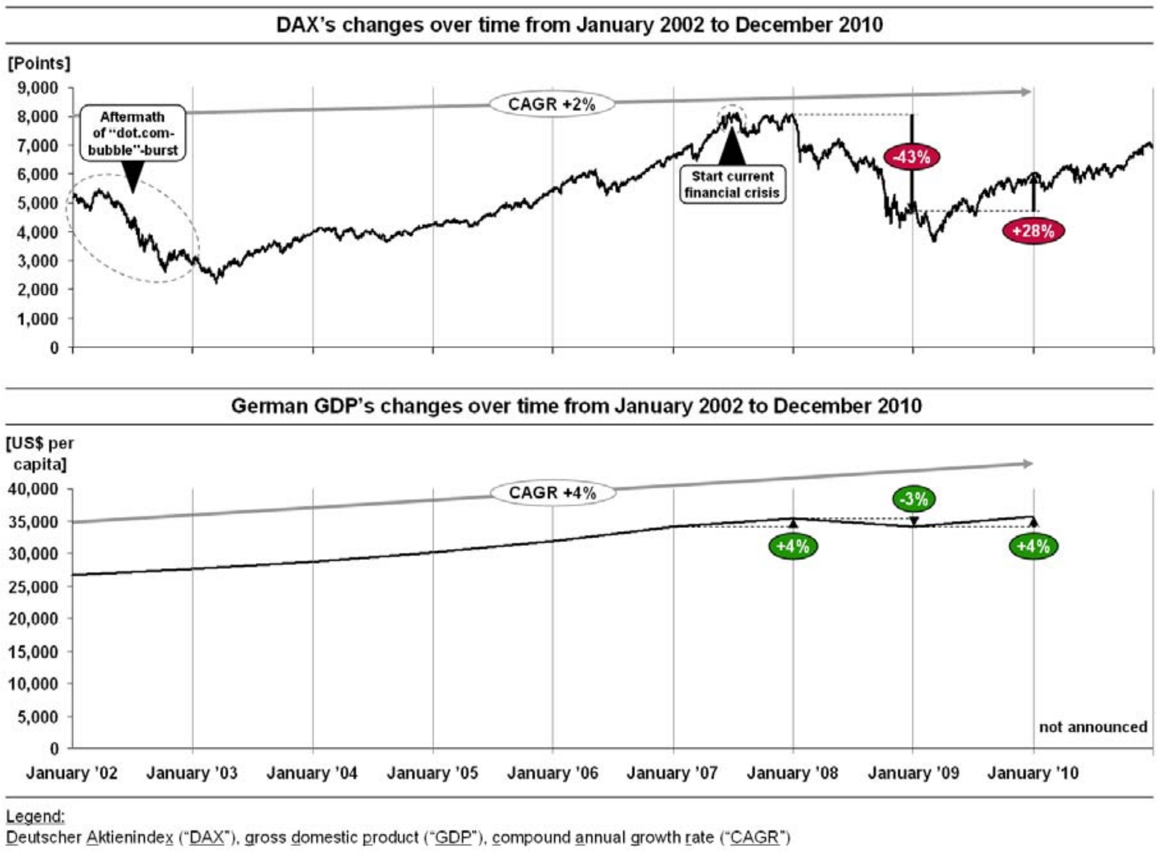


Figure 16: Development of German DAX vs. German GDP
(cf. Deutsche Börse Group (2011), indexmundi (2011))

3.2.2 Momentum and reversal: Example for distortion in equity markets

One of the tenets of finance theory is the *efficient market hypothesis*. In its strongest form it postulates that historic market value developments should give no useful information about future ones. Therefore investors should have no logical reason to prefer the winners to the losers of any period because both should be valued fairly already (cf. Dimson et al. (2008)). The efficient market hypothesis applies the classical competition theories to finance by claiming that market values are determined by competition among rational investors so that they reflect the consensus estimate of fair value in the light of all available information. It has remained the dominant paradigm in finance – irrespective of growing evidence on market distortions in forms of e.g. systematic mispricing, periodic market value bubbles and collapses thereof and levels of volatility that are vastly greater than the underlying dividend streams (cf. Vayanos and Wooley (2009) and Chapter III, 3.2.2.2). But the latest capital market booms and crashes, which (regionally) culminated in socially costly economic crisis like the one starting in summer 2007, have discredited the idea that markets are efficient. Consequently the perception that market values reflect fair values must be questioned (cf. Vayanos and Wooley (2010)).

"Momentum" is the name of the phenomenon, which directly *contradicts* the efficient market hypothesis. It is the commonly observed propensity for trends in market values. In brief the term tries to visualize that there is something, which carries forward historic (stock) value developments. Then a stock would perform well in the future given it behaved already well in the past. At this occasion please note that momentum in its most extreme form leads to economic bubbles and – at times of major reversal – crashes. But there is one key difference to economic bubbles: Momentum can work on the level of single products respectively assets, too. Please also note that in natural sciences there is a comparable (temporary) continuation of a massive body's movement (though the initiating interaction is finished yet) – it is termed "moment of inertia" (cf. "moment of inertia"). So simply picking last year's best performing stocks would be a good advice given there is actually a comparable phenomenon in stock markets. Obviously this contradicts the standard advice of choosing undervalued stocks, which in all likelihood performed lousy recently. Therefore Conserved Quantity Approach is applied to shed additional light on the issue but from an alternative perspective. (For this Chapter as well as the following ones please also cf. Appel et al. (2012)).

3.2.2.1 Removing the mystery from momentum by non-conserved quantities

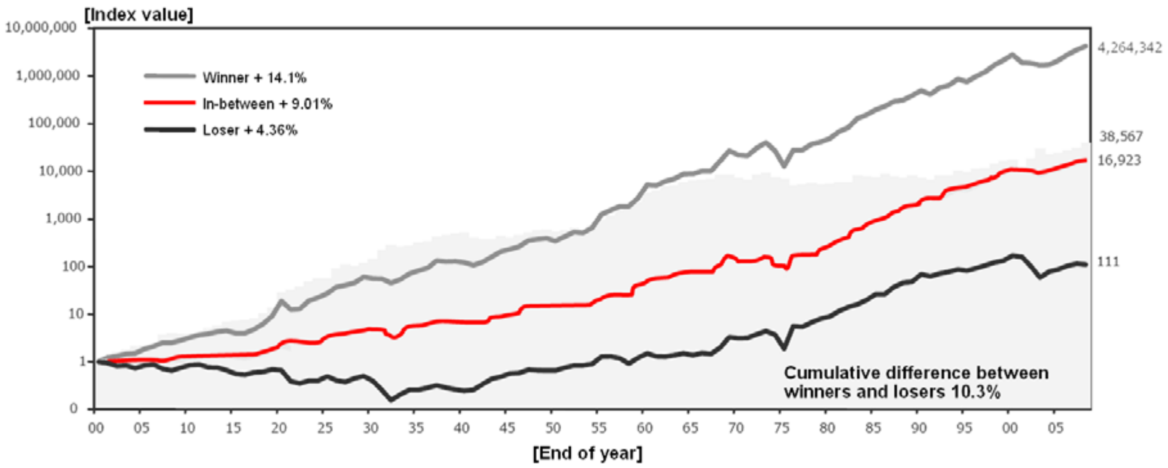
Momentum is one of finance theory's conundrums. The reason is that, according to theory, stock values' past performance should be no guide to the future one; practice proves otherwise yet. Because of that momentum even has been labeled as asset pricing's *"premier unexplained anomaly"* (cf. Fama and French (1993), The Economist (2011a)). Pure momentum strategies involve sorting stocks into winners and losers based on past returns over a ranking period. Then winners are bought and losers are sold over a holding period. Lately Dimson et al. (2008) performed a very thorough analysis of momentum effects in equity markets. In many different stock markets the authors simulated the following: Each month the stock market was separated into three classes based on the underlying stocks' last 12 month-performance:

1. *Winners*, i.e. the 20% best performing stocks.

2. *In-betweens*, i.e. the 60% of medium performing stocks.

3. *Losers*, i.e. the 20 % worst performing stocks.

From each of these classes only the best performers (of the last 12 month) were bought. After a holding period of one month the three stocks were resold and three new ones bought – again by choosing the best performers from the three classes and so forth. Doing that (in simulation) for many years (sometimes over a hundred years) luck or coincidence could have been excluded. The results were impressive: The three classes' returns in almost all cases showed the same pattern – winners performed excellently, in-betweens performed mediocre and the rest performed lousy. Assuming a well-functioning hence "efficient" market it should have been impossible to rip-off profits simply from smart timing of buying and selling assets dependent on their past performance. However – in view of these results of today's most comprehensive momentum study – Dimson et al. (2008) seem to provide extensive evidence for profits by trading on momentum that were large, pervasive and traceable across time and markets: Covering over 108 years of the top 100 stocks – which at today's measure amount to ca. 85% of world's equity market capitalization –, winners' return verifiably beats losers' return by about 10%-points ("%-pts.") p.a. Starting 1900 by investing £1 in the winners, more than £4¼ million ("m") could have been gained, which would have accounted for 14.1% p.a. Investing £1 in the losers would have grown to just £111 (4.36% p.a.). The in-between 60% show 9.01% growth p.a. Therefore the spread between the medium performers to best 20% ones is around 4%-pts. only.



Notes:
- Chart shows value-weighted returns of winner and loser portfolios among the top 100 equities, defined with breakpoints at the 20th and 80th percentiles.
- Shaded area is the cumulative difference between winners and losers. It measures the value of a long-short Winner-Minus Loser ("WML") portfolio.
- Momentum process here is 12/1/1.

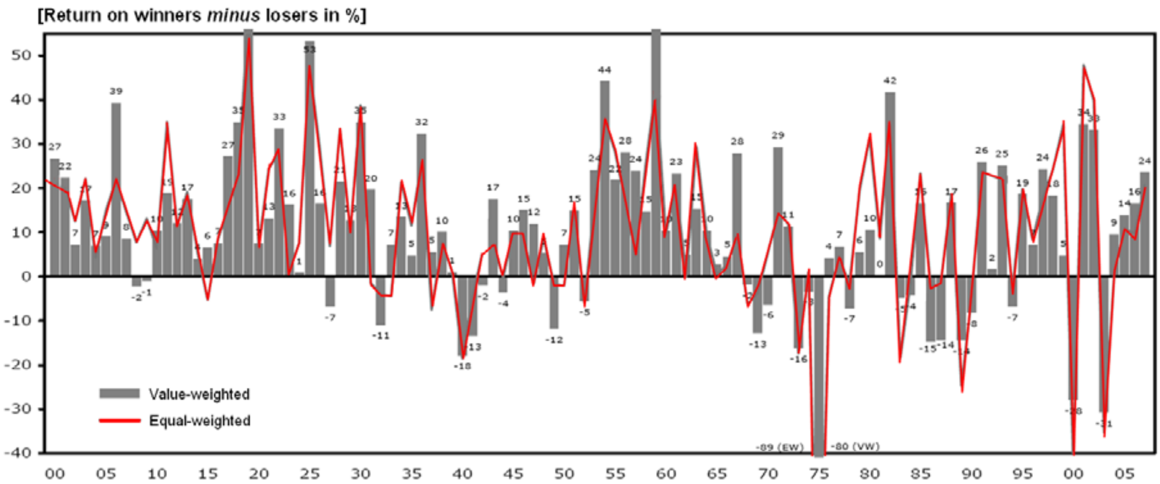
Figure 17: Value weighted momentum portfolio returns for the top 100 UK equities, annually from 1900 to 2007 (cf. Appel et al. (2012), Dimson et al. (2008))

The study's result is puzzling at first glance: Seemingly it proves the existence of something like a *"moment of inertia"* in stock values. Being mathematical savvy one may even find the optimum observation period, e.g. observing for just 10 months and buying and selling every 25 days. From this one may get something like a "fictive mass". Then one may create something like a "Newtonian equation of value" similar to the real Newtonian equation for the position of a mass point (cf. "Newton's laws of motion"). But reality is more complex than any (unavoidably) simplifying mathematical model. Therefore market values would adjust due to many people's buying and selling activities here. So Dimson et al. (2008) did not discover an easily applicable recipe for becoming rich by trading on momentum. And there are two material *limitations* not yet mentioned:

1. *Transactions costs* can seriously dent returns because with rebalancing the asset turnover can become very high. For example a "12/1/1 strategy" ranks returns over the past 12 months, waits 1 month and then holds for 1 month until rebalancing. Then turnover of winners and losers averaged 31% and 33% per month.

Please note there is also an opposing impact of frequent rebalancing (cf. "average cost effect"). It delivers extra money, which is (usually) consumed by trading fees though. *Average cost effect* is a purely statistical explanation for the results of the experiment of buying and selling stocks based on their last performances: Each time a stock is bought it is not bought in a fixed number. Instead a fixed amount of money buys as many stocks as possible. At each transaction the investor gains due to the average cost effect – this extra gain is proportional to the square of market values' fluctuations. The fluctuations of good performing (interesting) stocks tend to be much higher than the fluctuations of low performing (boring) ones. That is the reason why Appel et al. (2012) argue that the results of Dimson et al. (2008) can be explained by this special version of the well-known average cost effect, too – at least in parts.

2. *Winners underperformed losers* in numerous periods – sometimes by a drastic margin (cf. Dimson et al. (2008), The Economist (2011a)).



Notes:
- Chart shows value-weighted Winner-Minus Loser ("WML") returns based on portfolios with momentum breakpoints at the 20th and 80th percentiles.
- Momentum process here is 12/1/1.

Figure 18: Return on winners minus losers for top 100 UK equities, annually from 1900 to 2007 (cf. cf. Appel et al. (2012), Dimson et al. (2008))

The most astonishing thing, which finally turns momentum into the conundrum mentioned above, is related to one constitutional element of any (publicly traded) interest in a firm: *A stock is a piece of a company!* Real companies consist of a very complicated network of developing, buying, producing and selling. In the end it (hopefully) delivers worth, i.e. added (Functional) Value. And all this can be condensed in the above mentioned Newtonian-like equation? Economic sciences on the one hand try to do so. They map all the complicated arrangements into even more complicated equations. Due to complexity their success is pretty limited though. On the other hand there is the simple – yet proven – premise that stock values, which rose recently, will likely keep on doing so – at least for an exploitable while. Indeed that looks like standing in the eve of discovering something as fundamental as quantum mechanics (cf. Chapter II, 4.3.2). This justifies people's (rash) enthusiasm when seeing hints for momentum effects. But against the background of the above one should recognize that the efficient market hypothesis is subject to one fundamentally wrong assumption: It supposes that the stock value and the underlying company's operational performance are correlated well (at least in the long run). *But there is no such correlation!* Appel and Grabinski (2011) showed it clearly in a recent paper: There is Functional Value, which is Conserved Quantity. Essentially it is given by the company's future Conserved Cashflow generation. In addition there is market value. Being a non-conserved quantity it may fluctuate chaotically under certain circumstances. This implies that – when following value investors' advice to acquire stocks bearing low market values compared to the underlying companies' intrinsic values – a large part of this "value portfolio" is at variance to fair value at any one time (cf. Bright (2009)). And momentum's mystery vanishes without a trace as soon as one realizes that non-conserved stock values are distinct from their conserved countervalues (= Functional Firm Value)! If (future-oriented) investment decisions are based on (historic) market values that are non-conserved, hence can fluctuate chaotically (in a mathematical sense), momentum obviously is easily explained as a big *self-fulfilling prophecy*: For centuries people bet on the lately winning horse – this is especially true for the stock market, too. There are even so called finance consultants advertising such strategies.

The lack of *correlation in value* – as explained above – is finally the reason why momentum strategies were reversed not surprisingly and falsified numerously. Over and above the losses that had to be taken in each episode of turbulence in the worst affected market were disastrous. Interestingly the three great bear markets damaged the "value" – or rather the price – of the world equity portfolio far more than the world wars (cf. Dimson et al. (2008)). Given that the world wars resulted for sure in more severe breaks of companies' real or operational (Functional) Value creation, it is completely unreasonable to assume that any bear market could result in more severe value destruction!

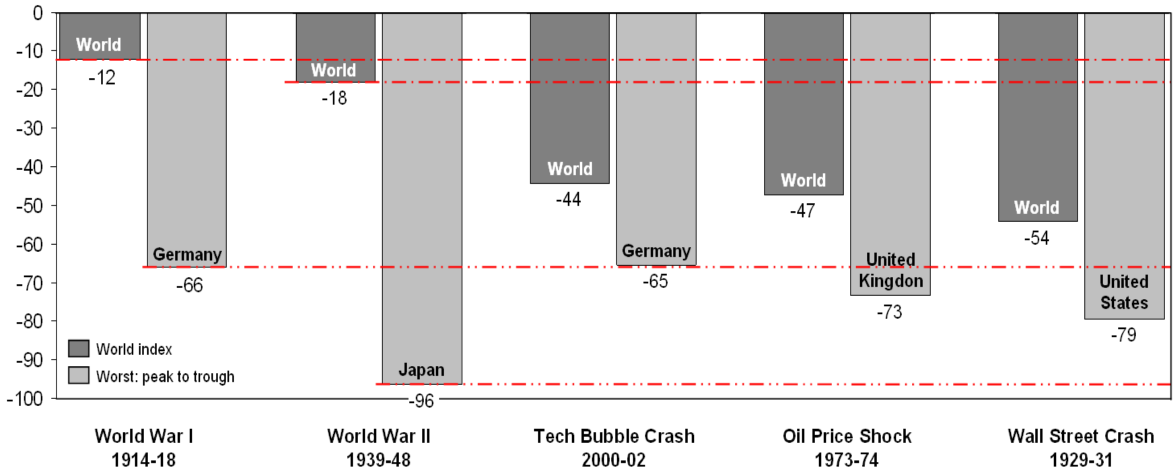


Figure 19: Extremes of equity market history from 1900 to 2007 (cf. Appel et al. (2012), Dimson et al. (2008))

In summary the large performance gap between winners and losers *and* the striking pattern of "value" destruction in turbulent periods are explicable by (temporary) movements of (potentially chaotic) non-conserved quantities. The Figures 18 and 19 show examples for their unforeseeable changes and irrational step-ups. The seminal findings of Appel and Grabinski (2011) already proved it: Accepting the observation and prediction of (trends in) market values as investment is as ludicrous as accepting the calculation of next week's lottery numbers as a business. Thus the alternative explanation to momentum is:

1. *Fundamentals* – like Conserved Cashflow from companies' businesses and Significant Influencing Factors thereon – result in the amount of Functional Firm Value. Dependent on the market's mood and expectations they however not necessarily add the *same* amount to market values. (Non-conserved) stock values therefore trade regularly above (conserved) Functional Values.

2. Given *speculations* drove a stock value far beyond its Functional Value, the stock value has lost any fundamental fixture (= traceability by economic fundamentals). Naturally in such cases the market price can shift chaotically in either direction by a huge margin.

3. The winner portfolio's outperformance therefore can be explained mostly by the spreads – i.e. *Value Gaps* – between stock values and Functional Values. After all they regularly leave ample room for chaotic behavior (cf. Chapter III, 3.2.3 as well as Chapters IV, 2 and IV, 3)! And since market trends may continue unreasonably, value investors' rational advice to any tradesman to buy only if market values are comparatively low may be obsolete for momentum traders. Yet in the short run only – as substantiated by the Figures 18 and 19.

In view of the above it becomes clear that momentum traders, who outperform value investors, can advocate it ultimately to just one thing: Good luck in view of timing! (If not stated otherwise, for this Chapter please cf. Appel and Grabinski (2011), Appel et al. (2012) as well as Grabinski (2007)).

3.2.2.2 The concept of uncertainty "risk" and the concept of unpredictability "chaos"

Managers and investors must deal with uncertainty on a daily base. But chaos is a word – most likely consciously – used just very seldom in the context of their financial forecasts and valuation systems. This may be because "chaos" is beyond the established concept of "risk"; it does not only describe "uncertainty" but "unpredictability"! Dealing with something unforeseeable feels inconvenient and is hard to communicate to stakeholders. Maybe that is one – admittedly very human – reason why the financial community overwhelmingly applies the concept of "risk" only. At least risk could be included in theoretical models to-date in order to explain and/ or facilitate rational decision making. But being easier to handle in fact means nothing in view of risk's actual explanatory power!

To show what natural sciences' Conserved Quantity Approach can add to finance theory a common ground must be settled with respect to the similarities and discrepancies of "risk" and "chaos". Both can cause deviations between expected outcomes and actual results. Outcomes are not even reproducible in the prevalence of chaos; constitutional for it is the step-up within a system in response to marginally small changes at the outset (Grabinski (2007)). Risk is generally measured as variance (or standard deviation) of an asset's historic returns according to the portfolio theory (cf. "portfolio theory") – to what extend historic returns actually reflect the variance of future ones seems questionable though (cf. previous Chapter III, 3.2.2.1). In addition (future) expected returns are defined as averages of historic ones – this is questionable, too. The reason is a principal one: Common portfolio theory assumes normally distributed returns; the author argues there is one or more Significant Influencing Factor per asset that as well may change returns *beyond* that range over time. In any case portfolio theory applies the capital asset pricing model ("CAPM") to differentiate between two kinds of risk:

1. The *specific risk* (= unsystematic risk) affects individual companies and eventually their direct competitors. When assembling a portfolio – according to theory – specific risk can be reduced by investing in assets, whose returns are as much as possible not positively correlated, i.e. by increasing the degree of diversification.

   Please note that this part of portfolio theory seems to be valid just for *diversification strategies* of security portfolios: The more recent empiricism of Lubatkin and Chatterjee (1994) namely falsified this assumption for companies' diversification strategies based on data of 246 "Fortune 500"-firms. The researchers found out that focused companies, whose divisions manufacture similar products with similar production and marketing technologies, bear lower risk than very broadly diversified ones. This finding contradicts drastically the portfolio theory, which was originally developed in view of investing in securities though (cf. Eschen (2000)). Probably the reason is one of portfolio theory's implicit assumptions: It expects a passive management that can combine yet not alter cashflows. But in reality a management team can actively control as well the risk by optimizing the company's competitive position (cf. Lubatkin and Chatterjee (1994)).

2. The remaining *not-diversifiable risk* (= systematic risk) reflects the market risk. It describes how sensitive a company's return responds to *general economic forces* (cf. Brealey et al. (2006), Ross et al. (2006)).

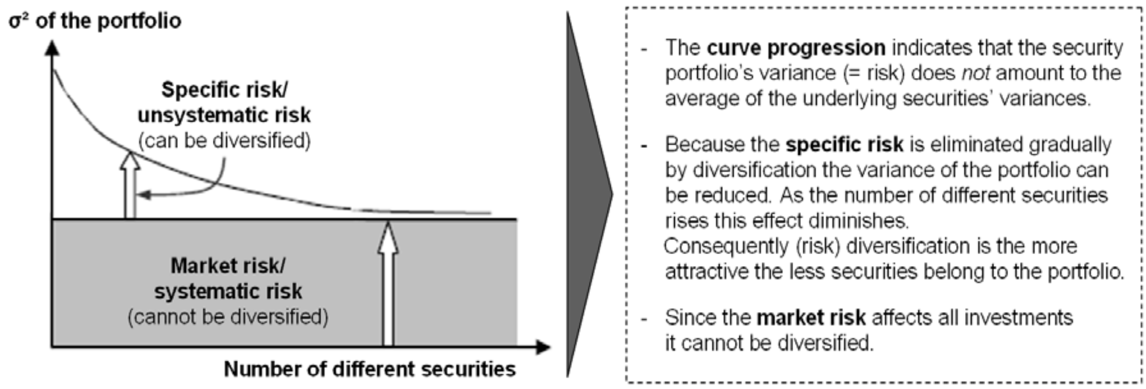


Figure 20: Risk diversification dependent on risk category and number of securities (cf. Brealey et al. (2006), Stratman (1987))

The primary issue with finance theory – in particular the portfolio theory – is the efficient markets hypothesis: It is a mandatory assumption here to claim that market values reflect the equity market's consensus estimate of an asset's value (as of today), assessed by rational investors (that are risk-averse and have homogenous expectations), in view of all available information. In reality this cannot be confirmed. Instead particularly the non-conserved stock market values are unhinged (at large) from real (Functional) Values (cf. Chapters III, 3.2.2.1 and IV, 2). Hence stock values need not reflect the underlying asset's past, present or future value generation (= returns). Thereby risk can easily become a non-conserved quantity's variance. So chaos can superpose risk at short notice! In the pure or traditional world of finance theory – i.e. *without* being able to rely on Conserved Quantity Approach – to avoid chaos and gain market efficiency indeed in particular four implicit assumptions of the portfolio theory would be required to be fulfilled at the same time:

1. *All investors* accept higher risk only if their return increases disproportionately thereby (= *risk-aversion*).

2. *All information* relevant for asset pricing (i.e. valuation) can be *accessed* by *every (rational) investor*.

3. *All information* relevant for asset pricing (i.e. valuation) can be *processed* *properly* by *every (rational) investor*.

4. *All investors* end up with *homogenous expectations*.

As a result portfolio theory implies that investors are able somehow to forecast and assess the returns and their volatility (= risk) going along with assets traded in the equity market (cf. Brealey et al. (2006), Ross et al. (2006) and Stratman (1987)). At least investors must be able to foresee whether or not the assumption of normally distributed returns still holds going forward (cf. above). Otherwise – with regard to the 1st assumption – they would be unable to take any investment (or disinvestment) decision. But in reality this is *im*possible due to principal reasons: Chaos would not exist in equity markets given the assumptions 1 to 4 could be fulfilled, i.e. given markets were efficient at any time. But efficient markets are a (falsifiable) chimera in particular due to the *large data volumes*, their inherent *complexity* as well as *speculations*, which affect demand and market vales by pure *guesses* on changes in market values hence non-conserved quantities. In addition – due to the same reasons – chaos can be neither explained nor avoided by pure finance theory (cf. Chapters II, 3 and II, 4.3.1). So the following effects often manifest distortions of then *in*efficient markets:

1. Asset prices need *not* reflect real (Functional) Values; they may develop independently.

2. Risk therefore needs *not* reflect volatility of assets' real returns (= Functional Value added); it may develop independently, too!

3. Over and above: If the 4th assumption regarding "homogenous expectations" was true indeed, there soon would be no trading anymore but a static equilibrium (cf. Lange (2011)).

Luckily – in contrast to the portfolio theory – the concept of chaos works independent of the efficient market hypothesis. To be more precise: It assumes there is too many information that is *not* properly considered by traders in equity market – first and foremost due to the mass of data that has to be acquired and assessed, the complexity that hinders it as well as speculations, etc. In view of the 1st to 4th assumption this seems to summarize excessive demands of investors perfectly (cf. above)! Market inefficiencies (= *Value Gaps*) arise thereof. At this occasion please note that the author does *not* argue that current finance theory is useless but it is unsatisfactory on its own since the portfolio theory and the underlying efficient market hypothesis and the CAPM focus on risk and totally leave out chaos. Admittedly other researchers addressed issues related to chaos in capital markets, too (cf. Peters (1996)). But instead of relying on the robustness of Conserved Quantities inappropriate approaches based on non-conserved market values seem to prevail. And market values – as noted several times and as will be shown calculatively later several times more – are prone to chaos hence unforeseeable (cf. e.g. Chapter III, 3.2.3 as well as Chapters IV, 2 and IV, 3). Recent developments of the stock market structure seem to support the author's point of view: So-called *"algo-traders"* perform increasingly more transactions (cf. "algorithmic trading"). Largely autonomous acting computers execute e.g. in Europe about 40% and in the USA already about 60% of stock trades. The issue is: They do not take decisions based on underlying assets' expected (future) returns but based on historic market value movements only. Hence they do not place orders based on well-founded analysis of any conserved and/ or non-conserved cashflow. This means: The computer algorithms do not consider any criterion directly related to the companies' current and future business potential, which (potentially) affects products' Functional Values and thereby finally Functional Firm Value. Instead the algorithms react purely on movements and disparities of market values. According to Nanex, a company mandated to analyze the "black Thursday 2.0", such computer-trading led to the bizarre slide of the Dow Jones by nearly 1,000 points as of May 6, 2010. In course of this intermediate disorder the stock market lost about thousand millions of Euros. Even strong quoted consumption shares lost 40% – e.g. the ones of Procter and Gamble Corporation. Evidentially the plunge had nothing to do with any value based logic to invest or disinvest. The whole issue was speculative, pure market price-driven trading, which in the end led to the unforeseeable (chaotic) step-up (cf. Seith (2010)). One of the insights that can be derived therefrom is: Presumably nobody would deny that *more efficient markets* could be gained by *transparency*, *trust* and in the end stability in form of *robust* (= non-chaotic) Conserved Cashflows. But if Conserved Cashflow, which is the “lifeline” of both companies and whole economies, is left aside in the market place, what other criterion or tool could indicate whether or not there is robust economic development long-term? Maybe the answer can be read between the lines of the famous statement of English economist John Maynard Keynes: “The market can stay irrational longer than you can stay solvent” (cf. Chapter IV, 3.5). Thereby he expresses: While (Functional) Value based investment may win long-term, in the short run (Functional) Value stocks can nonetheless fall even further in a bear market and vice versa in a bull market (cf. Appel and Grabinski (2011)).

So there is chaos (in the mathematical sense) in equity markets and traditional finance theory *on its own* is insufficient to counter it: Chaos manifests in market swings that are not only far beyond the usual systematic and non-systematic volatility (= collectively called “risk”) but are also not in line with forecasts of the underlying asset’s fundamentals (= net Conserved Cashflow accruing to Functional Firm Value) as well as its determinants (= Significant Influencing Factors). Consequently chaos as well as its corrective – the focus on Conserved Quantities – should be consciously considered *in addition* to pure finance theory. Up to the author’s knowledge to date only Appel and Grabinski (2011) and (2010), Appel et al. (2012) and Grabinski (2007) applied the combination of finance theory and Conserved Quantity Approach to enhance long-term financial forecasts and valuation (cf. Chapter III, 3.2.3 as well as Chapters IV, 2 and IV, 3). But *independent* empiric data from research on momentum matches their line of argument, too, and thereby support the point of view taken in this dissertation. Momentum namely leads to particularly good showcases because: It is a follower-strategy for trading assets just based on *past* movements of *non*-conserved quantities. So each order to buy or sell is nothing else than the execution of an *if-then-decision*, which depends on the previous move of a (non-conserved) stock value. Being nonlinear such decisions are enough to make a system (= here: the equity market) develop chaotically. The more often they are taken the system’s step-up will become even stronger. And since momentum strategies typically involve *high asset-turnover*, chaos effects should be highest here. The following observations relate to it:

1. Momentum-portfolios are subject to a very high level of *volatility* (cf. Dimson et al. (2008), The Economist (2011a)).

2. (Trends in) market values may be irrational. Sudden peaks' and drops' *magnitudes* need not be related to commonly observable returns by (Functional) Value added or risk (cf. Chapter III, 3.2.2.1 – in particular Figure 19).

3. Momentum strategies – not surprisingly – were falsified oftentimes (cf. Chapter III, 3.2.2.1 – in particular Figure 18). This proves past market value changes are (often) *decoupled* from underlying assets' returns by (Functional) Value added and over and above they are *no* reliable indicators for future market value changes and future returns!

Over and above empiricism showed that the better performance of momentum stocks is *not* merely a reflection of higher risk: It persisted even though hedge fund analysts adjusted the underlying data for company size (taken as equivalent to diversification) and value (defined as price-to-book criteria)! But in traditional finance theory returns are nontrivially linked and positively correlated to the volatility of an asset's returns (= risk). Therefore – if finance theory was right – higher momentum returns would simply reflect the higher risk of this strategy. But the hedge fund analysts disproved it. Thus new insights – additional to pure finance theory – are needed to explain momentum strategies' returns (cf. The Economist (2011a)). For it Conserved Quantity Approach is suggested going forward: Conserved Cashflow was proven to lead to well-founded forecasts based on economic facts that develop robust over time and are most realistic in view of the real values, which are intrinsic to the respective item under consideration (= Functional Value). Thereby chaos is excluded as far as possible at its outset. But Conserved Cashflow on its own does not allow for *multi-period Functional Valuation*. Here the concept of risk comes into play again in form of (risk-adjusted) interest rates. It is required to account for the *time value of money* of future net Conserved Cashflows as of today. At this point maybe the following questions arise: Is there a contradiction against the line of argument above? Is there an actual requirement to consider chaos in financial forecasts given the concept of risk will be applied going forward, too? The answer is: Yes, there is an actual requirement for it in order to manage chaos by Conserved Quantity Approach! And the reason is: Risk is unequal to chaos – risk describes uncertainty whereas chaos describes unpredictability. *Only if unforeseeable (chaotic) elements are excluded as far as possible from future cashflows in the first step, discounting them leads to reasonable (Functional) Values as of today in the second one!* If however the first step is left chaotic elements still can snatch any explanatory power from cashflows. Discounting them via risk-adjusted interest rates then leads to nothing but potentially chaotic values (as of today). Such approach does not at all help to come to robust forecasts and values, which are in line with real economic Functional Value creation! This point may be elaborated most clearly by the following examples provided herein:

1. Market behavior that suggests e.g. “real” value could be damaged more by bear markets than by the world wars (cf. Chapters III, 3.2.2.1).

2. The questionable capers of Volkswagen’s stock (cf. Chapter III, 3.2.3).

3. The (unsuccessful) calculative attempts to match swings in SAP’s market capitalization by adjusting Functional Value drivers (cf. Chapter IV, 2)

4. The influence on market values of trading e.g. gold or agricultural resources that do not even exist in such large volumes (cf. Chapter IV, 3 – in particular Chapter IV, 3.5).

But if traders considered the concept of chaos in addition to risk – hence if they took decisions to invest and disinvest Conserved Quantity-based – they would become able to trade nonetheless based on economic facts and succeed long-term even in such a chaotic market environment! (If not stated otherwise, for this Chapter please cf. Appel and Grabinski (2011) and (2010), Appel et al. (2012) as well as Grabinski (2007)).

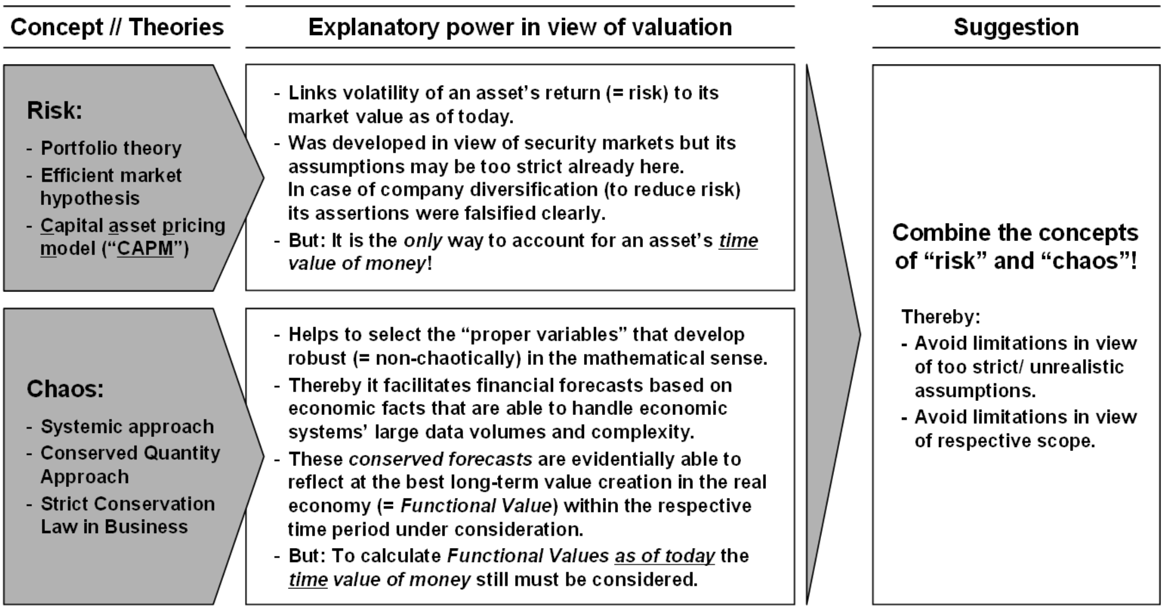


Figure 21: Reasoning why risk and chaos must be considered in combination (summary)

3.2.3 Chaos in single stock trading applying the example of Volkswagen AG

Naturally not only equity portfolios' market values but also the ones of the underlying assets (= here: single stock values) encounter distortions. But risk diversification – in portfolio theory's sense – is not possible for single stocks. Therefore volatility is expected to be relatively high anyway. Nonetheless also in the "single stock case" there are still shifts in market values that on the one hand cannot be justified by any Significant Influencing Factors and on the other hand cannot be explained solely by "higher volatility in returns of underlying assets". Instead they manifest step-ups due to market participants, who (overwhelmingly) take decisions by speculating on changes in the (wrong) non-conserved variable. The stock of Volkswagen ("VW") AG, a German automotive company, is a good example for it: On October 28, 2008 VW's market value was €305 billion ("bn") – the highest one ever. Only days before and thereafter its market value was less than half of it! And this is not only a "paper value" of a non-functioning stock market. Instead there was heavy trading. It led to e.g. approximately €1bn additional cash inflow to Porsche, a German sports car manufacturer, and a similar loss for Adolf Merckle, a German entrepreneur.

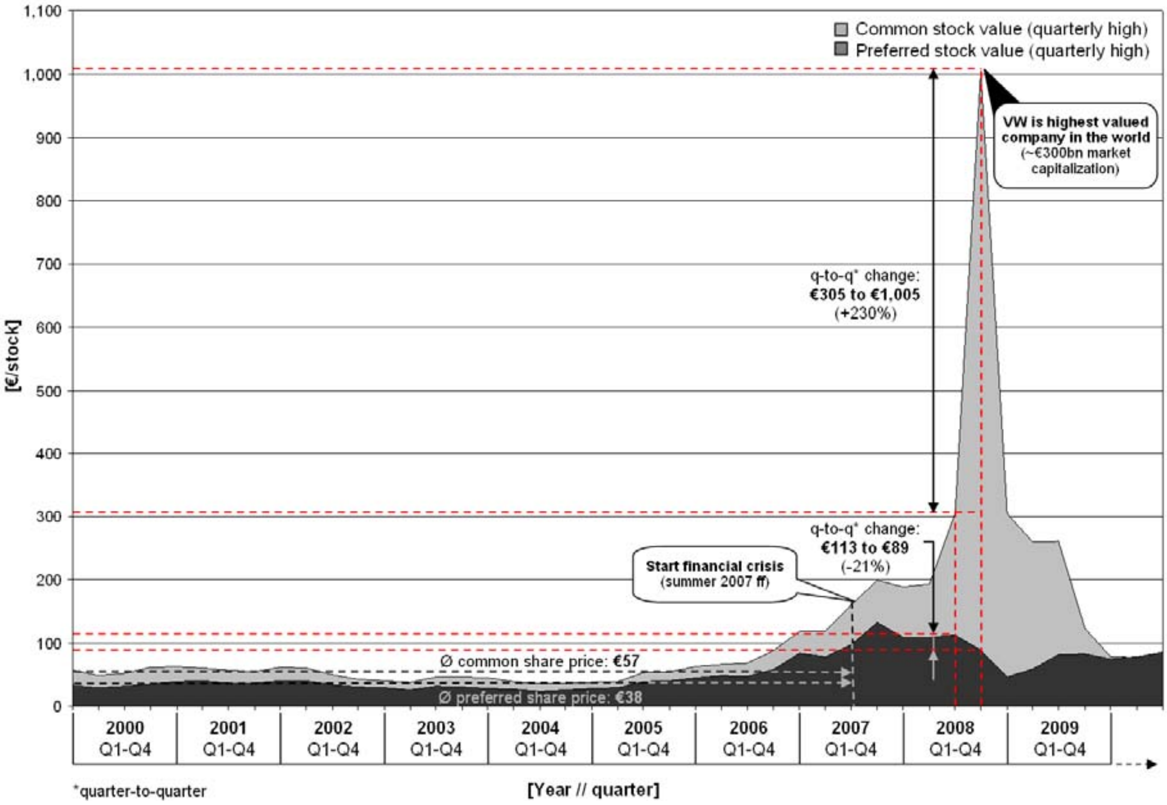


Figure 22: 10-year market values of VW's common and preferred stocks (cf. VW (2010))

Could VW's (current and forecasted) figures of operational value creation like production and sales numbers within the week of October 28, 2008 justify the stock values' strong reciprocal motion? No, there was hardly any change! Due to its competitive advantages the group performed constantly well overall though the depressing economy. Its outlook was cautious yet positive. But compared to the change in stock market value everything remained boringly similar (cf. VW (2008)). Obviously VW's (non-conserved) market value was the worst property to describe the change of the company's (valuation-relevant) business activities! (Not only for the late Adolf Merckle who tried to make a fortune). Yet not only the out-of-scale and abrupt rise in common shares' market value but also the simultaneous drop in preferred stocks' market value suggest that investment decisions were not (Functional) Value based here. Instead most of this phenomenon seems accountable to (potentially justifiable) market distortions and speculations in course of Porsche's intent of a hostile takeover of VW. In the end it was however VW that succeeded by a reverse takeover of Porsche (cf. Appel and Grabinski (2011) and (2010) as well as Freitag and Katzensteiner (2010)). In this context please remember that in previous discussions on intrinsic valuation actually materialized cashflows – like the €1bn to Porsche by VW stock-trading – were considered "value adding" (cf. Hazlehurst (2006)). But since they resulted from (disparities in) non-conserved quantities they cannot contribute to Functional Value (cf. Chapter III, 3.2.1.1 as well as Chapter V).

Since this is the end of Chapter III, 3, which reasons why investment decisions should be taken always by considering Functional Values whereas potentially chaotic and therewith non-foreseeable speculations on changes in non-conserved market values should be resisted, Figure 23 summarizes the differences between the two approaches. (The next step – calculating Functional Values to gauge Value Gap quantitatively – is exemplified throughout Chapter IV. The key insights therefrom will be provided in Chapter V in form of generally applicable rules, formulas and assistant frameworks for valuation and accounting of Conserved Quantities).

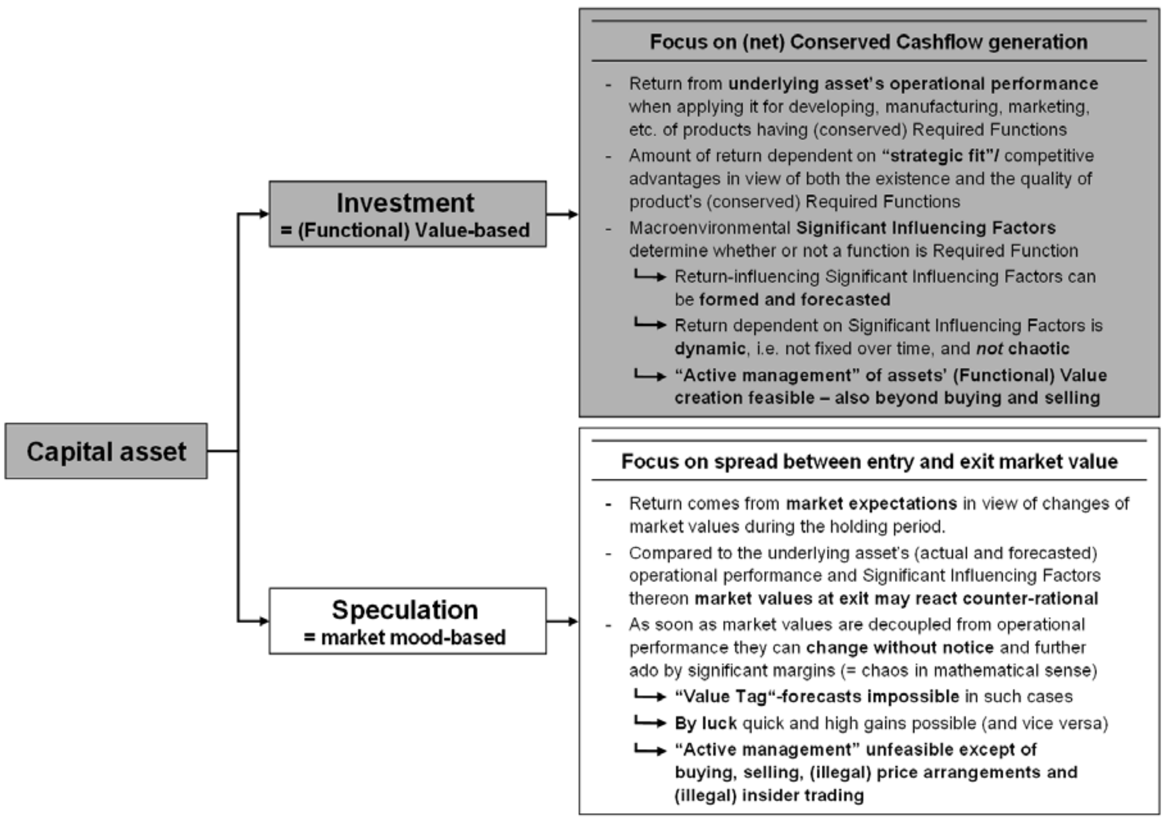


Figure 23: Differences between (conserved) investments and (non-conserved) speculations

CHAPTER IV

APPLYING CONSERVED QUANTITY APPROACH TO SELECTED QUANTITATIVE EXAMPLES

1 Implication of adjusting market value to Functional Value

The raison d'être of calculating an economic intrinsic *conserved* value (= Functional Value) is the a priori premise of non-identity between "price" and "value": "In other words, the market is not a weighing machine, on which the value of each issue is recorded by an exact and impersonal mechanism in accordance with its specific qualities [i.e. it is not efficient]. Rather should we say that the market is a voting machine [i.e. subject to fads and fashions], whereon countless individuals register choices which are the product partly of reason and partly of emotion" (cf. Graham and Dodd (1934) cited by Lehman (1991)). So finally in this Chapter IV it is shown quantitatively what magnitude it has to *"weigh" real values* based on economic facts that *"tip the scale" in form of Conserved Quantities*, which may become *(re-)allocated correspondent to changes in Significant Influencing Factors*.

Conserved Quantity Approach abstracts from specific products (cf. Chapters III, 2.1.3.3 and III, 2.1.3.5). That is the reason why it values only products' Required Functions, which are decisive for customers' buying decisions in the long run. The author argues this method serves at the best the task of an "exact and impersonal mechanism [that value any item] in accordance with its specific qualities". Thereby Conserved Quantity Approach shall be to the least possible degree "subject to fads and fashions" (cf. Chapters III, 2.1.3 and III, 2.1.4 as well as Chapter III, 3.1). Please note this is most important in long-term financial forecasting and valuation because: Pure *"fads and fashion"* are not restricted to consumer markets but in principle may capture every product market and thereby also distort equity markets whereon e.g. stocks of related producing companies are traded (cf. Chapters III, 3.1 and III, 3.2.2.1). Hence "fads and fashion" are the drivers of Value Gap that distort market value, i.e. deviates it from real Functional Value, in that they *deflect* the view of market participants from real economic facts. Needless to say that in these situations, i.e. without focus on real economic (Functional) Requirements and without considering Significant Influencing Factors thereon, *no* well-founded financial forecast and *no* realistic valuation is possible. Consequently people, who want to buy a product or invest in any kind of capital asset, may easily get fooled by recent market trends, e.g. when simply extrapolating them. But simply relying on market trends is neither a requirements analysis nor an investment analysis! It is a *bet* whose outcome is determined by luck or fortune because – without analyzing economic facts and factual requirements arising therefrom – speculators can only guess to what degree the *herd behavior* will continue in the future. Yet they cannot forecast it. This fact makes speculators in equity markets reliant to "fads and fashion", too.

Like explained yet nobody should rely on rather psychological concepts like "fads and fashion" that result in herd behavior and the guesses of speculators that bet for or against it (cf. Chapter III, 2.1.4.2). Maybe it would have been nice though if it worked out well because often next to no analysis is involved (e.g. when simply relying on financial consultants that sell "attractive" financial products on a large scale) and maybe even no calculation is involved (given one leaves algorithmic trading e.g. on momentum). Yet all the manifestations of speculation mentioned above just heat up further – and in parallel are dependent on – the self-fulfilling prophecy that the more people performed an action in the past – like the acquisition of a specific stock – the more correct it presumably will be going forward. But herd behavior is not reliable at all and peoples' opinions – which cannot be substantiated by (Functional) Requirement analysis and Significant Influencing Factors thereon – are (often) nothing more than short-lived trends. So no one should perform long-term (dis-)investment decisions due to these forms of "fads and fashion". These are the reasons why *economic Conserved Quantity Approach* first and foremost *excludes short-term trends and speculations* – starting from the analysis of consumer good markets to finally equity markets.

All these claims – as well as the explanatory power that accompanies Conserved Quantity Approach – are finally demonstrated quantitatively throughout this Chapter IV. For that Conserved Cashflow generation of listed companies and the one of a precious metal business was analyzed (cf. Appel and Grabinski (2010) and (2011)). In addition Conserved Quantity Approach is applied as an alternative explanation for – and to suggest related countermeasures against – nowadays' (speculative) bubbles in agricultural markets. Over and above, since all the examples unmask market distortions – in particular in form of large volumes of non-conserved trading – this Chapter IV closes with an excursus on trading's (potential) Functional Value. Thereby a more differentiated view shall be established. Finally trading of *conserved* volumes – maybe in combination with services that add Functional Value to the merchandise – is not at all bad but economically beneficial!

2 The example of SAP to depict Functional Firm Valuation

Without its property of being conserved, Functional Value's explanatory power in view of an asset's real value would parallel the one of erratic market values – it would have no meaning at all. The discrimination of non-conserved and Conserved Quantities was tested particularly by analyzing the cash generation of several listed companies to calculate their historic Functional Firm Value. It was compared with their historic stock values respectively. The stock of the SAP AG, worldwide the number 4 and biggest European software company, was part of the sample. It showed the typical development of figures: Over time the stock's market value rose and dropped considerably. In parallel *Functional Firm Value* followed a quite *robust trend* over time *without significant breaks*. In the long run the (stock) market value seldom followed – and never fully matched – Functional Firm Value. These characteristics are manifestations for the distortions that regularly drive (non-conserved) market values above or even far beyond Functional (Firm) Values (cf. Chapter III, 3.1). Such forces make market participants counter-intuitively willing to buy or sell assets – like stocks – independently of their respective over- or under-valuation as compared to intrinsic Functional Values. They are generally called "market expectations" or "speculations" if it had come to transactions (cf. Appel and Grabinski (2011)). Against this background the introductory statement of Graham and Dodd (1934) seems to be correct (cf. Chapter IV, 1).

Please note that SAP is a good showcase for the distorting effects on real value, which market expectations respectively speculations (mostly) cause, because:

1. SAP has the advantage of being *big enough* to attract speculators.

2. Changes in value are *not distorted* by big outfits of machinery and equipment or *non-operational* reasons.

3. SAP's Functional Firm Value therefore is given essentially by its future Conserved Cashflow, which is determined by customers' Functional Requirements for the software's conserved Required Functions. The reason for it is that SAP's customers are real economic companies, which really need the company's enterprise resource planning ("ERP") systems to manage their operational value chains. And in reality (nearly) no one buys an ERP system due to speculations or short-term market trends. Instead companies without much doubt do not want to bear the costs and risks of amending their ERP system – and maybe in course of that even their accounting department's structure – as long as it is not actually required. (Please note that restructuring the accounting department is a manifestation of the (conserved) "consistent reaction in something else" (cf. Figure 5)).

So SAP is a good example to quantify the magnitude of Functional Firm Valuation as opposed to market estimates because it is a special case of a big, publicly listed capital goods company, which is less affected by investment and D&A in machinery and equipment than e.g. the producer of an automatic assembly line or one of its customers, i.e. an automotive company like VW or Porsche. Figure 24 indicates the interdependency between generic markets' structures and the conserved part of market demand that drives Functional Value respectively.

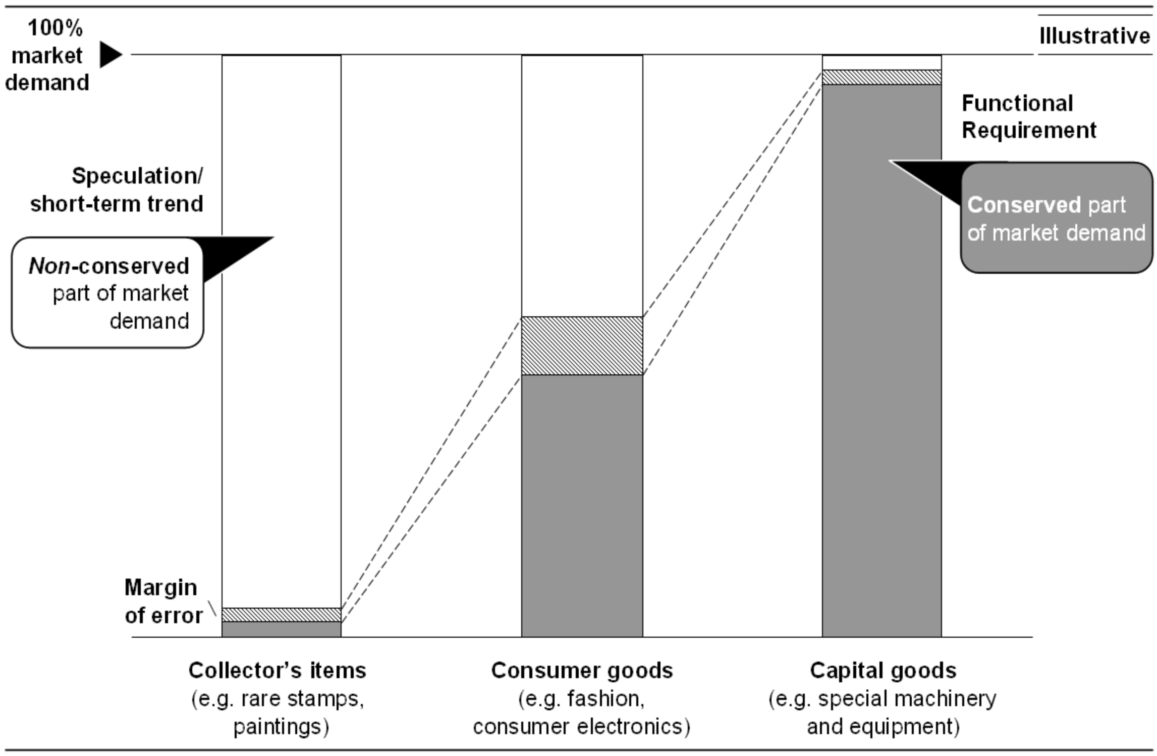


Figure 24: Breakdown of total market demand for generic market

Please note that the author verified the relationships indicated by Figure 24 also in the more trend-driven automotive market. Since automobiles are (overwhelmingly) no collector's items and also no capital goods – but nonetheless bought not only because of pure Functional Requirements (particularly not in the passenger cars segment) – he opts to assign the automotive market a similar structure like generic markets for consumer goods (cf. Appel and Grabinski (2010)). In addition this dissertation contains the example of the collector's item "rare stamp" in form of the Blue Mauritius (cf. Chapter I, 1), which also suggests the rightness of the illustration. Over and above the speculative and highly trend-driven market for precious metal, which shows a similar pattern than the market for collector's items, seems to confirm the relationships suggested by Figure 24, too (cf. Chapter IV, 3 – including its Sub-Chapters).

2.1 Reconciliation of conserved parts of SAP's financial statements

Any investor has to pay (most likely overvalued) market values. Hence comparing them with intrinsic respectively Functional Values of the underlying stocks, which are thoroughly derived from economic facts, is inevitable in order to detect stocks that are in actuality cheap (cf. Appel and Grabinski (2011), The Economist (2011a)). The outcome of the comparison determines both the acquisition date as well as the holding period. In the SAP example stockholders were assumed being able to hold their interest in the company in the long run. Because there is no urge to sell – and it is suggested additionally that there is no more attractive investment opportunity – the timing for Functional Value based selling and re-buying of SAP's stock would be determined by the spread between the market capitalization (driven by the stock value) and Functional Firm Value. A ten year forecasting period was considered being enough to analyze SAP's long-term Functional Value creation potential. Meanwhile conserved part of the free cashflow to the firm ("FCFF") was forecasted. It was carried over to a (conserved) discounted cashflow ("FCFF DCF"), which finally equals Functional Firm Value (cf. Table 1).

The task of being the basic parameter underlying Functional Firm Value is fulfilled at best by conserved FCFF because: (Conserved) FCFF is a metric to determine a company's financial health and profitability by measuring how much cash is available for all claim holders in the firm – including both debt and stock holders – after all taxes and needs for reinvestment have been met. Positive (conserved) FCFF implies that there is sufficient cash to service either the debt holders – through interest payments or principal repayments – and/ or to service the equity holders – through dividends or stock repurchases. Negative (conserved) FCFF indicates that the company failed to generate sufficient (conserved) revenues to cover its costs and will have to raise more cash. In particular given the company cannot increase (conserved) revenues and/ or reduce costs going forward cash can be raised through issuing more debt or selling more equity, too (cf. goetzpartners (2007)).

Table 1: Reconciliation of conserved line items from GAAP reporting to measure Functional Firm Value (cf. goetzpartners (2007), Matchett (2003))

Reconciliation of conserved parts of net income/ loss and free cashflow to the firm ("FCFF")

Cost of sales format: Operator	Cost of sales format: Line item	Total expenditure format: Operator	Total expenditure format: Line item	Notes
	Net sales operating	(=)	**Net sales operating**	
		+	**Work performed by enterprise & capitalized**	To reflect ***conserved part of market value*** and to guarantee consistency with ***Conserved Balance Sheet*** apply products' Functional Values (cf. Chapter V, 5 -- in particular Chapter V, 5.2.1.2).
		+/ -	**In-/ decrease in inventories** (of semi-finished and finished goods)	
=	**Total revenues**	=	**Total revenues**	
+	**Other operating income**	+	**Other operating income**	
=	**Total operating income**	=	**Total operating income**	
-	**Costs of goods sold ("COGS")** (= Sum of all material and personnel expenses that occured by generating the products or services sold)			
=	**Gross profit**			
-	**Selling, general and administrative expenses ("SG&A")** (= Sum of all expenses, including personnel expenses, related to selling the products or services, research and development ("R&D") and administration)	-	Material expenses	
		-	General expenses	
		-	Personnel expenses	
		-	Expenses for external services	
		-	Other operating expenses	
-	**Other operating expenses**	*[Subtotal]*	**Operating expenditures ("OPEX")**	
=	**Operating income**	(=) =	**Operating income**	= ***adjusted*** **EBITDA**
		+	Other income	
		-	Other expenses	
		[Subtotal]	**Extraordinary result**	
		=	**Earnings before interest, taxes, depreciation and amortization ("EBITDA")**	
		-	Depreciation	To retain consistency with ***Conserved Balance Sheet*** account for changes in Functional Values (cf. Chapter V, 5.2).
		-	Amortization	
		=	**Earnings before interest and taxes ("EBIT")**	
		+	Interest income	
		-	Interest expenses	
		[Subtotal]	**Net interest**	
		+	Other financial income	
		-	Other financial expenses	
		[Subtotal]	**Net financial result**	
		=	**Earnings before taxes ("EBT")**	
		-	Taxes on income	
		-	Other taxes (affecting net income)	
		[Subtotal]	**Total taxes**	
		=	**Net income/ loss**	
		+	Depreciation	To retain consistency with ***Conserved Balance Sheet*** account for changes in Functional Values -- instead of using deprecration and amortization -- and account for changes in working capital that are measured by Functional Values only (cf. Chapter V, 5.2).
		+	Amortization	
		+/ -	In-/ decrease in accruals	
		+/ -	In-/ decrease in other non-cash items	
		=	**Gross cashflow**	
		-/ +	In-/ decrease in inventories	
		-/ +	In-/ decrease in trade accounts receivables	
		-/ +	In-/ decrease in other accounts receivables (to affiliated companies, etc.)	
		+/ -	In-/ decrease in trade payables and related accounts	
		+/ -	In-/ decrease in other payables (to affiliated companies, etc.)	
		+/ -	In-/ decrease in customer deposits and advances	
		[Subtotal]	**Net cashflow from Δ working capital**	
		=	**Cashflow from operations**	
		-	Investments (= capital expenditures ("CAPEX"))	
		+	Disinvestments	
		[Subtotal]	**Net cashflow from (dis-) invesmtents**	
		=	**Cashflow after investing activities (= free cashflow to the firm ("FCFF")**	**Free cashflow to the firm** equals the cash available to all of the firm's investors (including common and preferred stockholders as well as bondholders), after the firm bought and/or produced and sold products, provided services, paid its operating expenses and performed short and long-term investments.
		+	Interest expenses	
		=	**FCFF to compute discounted cashflow ("FCFF DCF"), applying the weighted average cost of capital ("WACC")**	Applied for calculation of ***Functional Firm Value***. The ***costs of debt*** (= interest expenses) are accounted for by the WACC. Therefore interest expenses must be added-back before discounting the FCFF DCF. Otherwise the cost of debt would be considered twice.

Functional Firm Value was calculated per day. It has two addends, namely a discounted *3,650 days rolling cashflow* plus a *terminal value*. All quantities accounted for conform to Conserved Quantities' two prerequisites (cf. Chapter III, 2.1.2). The terminal value is calculated by applying the rolling average of the previous ten years' Conserved Cashflows. The period is long enough in order to "balance" one-time effects and SAP's merger and acquisition activities, which two times led to negative (actual and forecasted) Conserved Cashflows in the closing year and a positive (actual and forecasted) Conserved Cashflow peak in the following one. This means: SAP successfully "bought" Conserved Cashflows by its acquisitions. In view of any potential margin of error, please note that the long forecasting period effectively counters another potential issue, too: Conserved Quantities prohibit accounting for changes that occurred without a simultaneous change in something else. In addition there must be a previous change in at least one Significant Influencing Factor. Due to practical reasons changes in individual Significant Influencing Factors are considered during the forecasting period only. But any terminal value must be discounted over this more or less long period (= here: over ten years) – thereby the potential margin of error becomes negligibly small. Taken together these facts justify an "average terminal value approach" in case of long-term financial forecasting.

Table 2 points out the huge divergence between SAP's market capitalization and Functional Firm Value:

1. On average market capitalization's conserved part (= Functional Firm Value) amounted to just 24.5% of the total market capitalization; it ranged from 7.2% to 68.4%. In other words: The "market value / Functional Value"-multiple ranged from 1.5x to 14.0x.

   For clarification: The calculation applies actual data of twelve years; afterwards forecasts begin. This means in the first two years, Functional Firm Value is computed by nothing else than yet realized Conserved Cashflow. Nonetheless the multiple ranges from 4.5x to 11.8x here. Please note that the wide range does *not* suggest that Functional Firm Value formula does work out badly. Instead, since it is also reproducible by historic financial figures, it manifests that speculations were regularly far off any rational justification in view of SAP's actual performance!

2. Over and above Functional Firm Value never showed such extreme turning points as the market capitalization. In between the stock values often followed considerable up- and downward trends, which were long enough to be exploited. But at the exemplary dates no Functional Value showed such extreme turning points as the market capitalization. Consequently it seems appropriate to conclude that SAP's operations could not match the speculators' expectations.

In brief: Here is no such thing as a market value but just market *prices* (cf. Chapter III, 3)!

Table 2: Market capitalization vs. Functional Firm Value applying the example of SAP (cf. Appel and Grabinski (2011), Appel et al. (2012))

SAP: Divergence of market capitalization and Functional Firm Value			
Exemplary dates	**Market capitalization [€m]**	**Functional Firm Value [€m]**	**Market capitalization / Functional Firm Value [%]**
December 29, 2000	42,713	5,944	7.2x
January 2, 2001*	33,844	5,929	5.7x
Change:			
[%]	-20.76%	-0.25%	N/A
[€m; x]	-8,869	-15	N/A
October 16, 2002	17,306	8,964	1.9x
October 17, 2002	21,709	8,966	2.4x
Change:			
[%]	25.44%	0.02%	N/A
[€m; x]	4,403	2	N/A
Average within review period [€m; x]***	43,697	10,052	5.0x
Median within review period [€m; x]***	42,535	9,098	3.7x

*Due to banking holidays no trading was performed between December 29, 2000 and January 2, 2001.
***At January 1, 1989 the rolling 3,650 days Functional Firm Value calculation starts based on historic actual values. From January 1, 2010 going forward Conserved Cashflows are forecasted by applying growth assumptions with respect to SAP's latest acquisition of Sybase (in Q3/ 2010) and a long-term "steady state" growth rate equal to Germany's ten year average inflation rate.

2.2 Attempts to match market value swings by changes in determinants of Functional Firm Value

Market capitalization's turning points from trading-day-to-trading-day, i.e. its extreme ad hoc rises and falls, would be even harder to match for SAP's operations than any average market capitalization: For example from December 29, 2000 to January 2, 2001 SAP's market capitalization lost €8,869m (20.76%). From October 16 to 17, 2002 the market capitalization gained €4,403m (25.44%). If there would have been something like an efficient market, what kind of key information could have been hidden before respectively? What kind of information justifies a *real* company's value to shoot up or fall down by up to ¼ within one day (cf. Lehmann on the inefficiency of equity markets (1991))?

Table 3 summarizes selected calculative examples of matching swings in SAP's market capitalization: For example to decrease SAP's Functional Firm Value by 20.76% the company's annual conserved FCFF would have to decrease accordingly. Alternatively, within the review period's first year, there must have been an additional Conserved Cash outflow of €961m. In order to match the market capitalization's fall of €8,869m the annual conserved FCFF even would have to decrease by 149.2%. This would be equivalent to a one-off Conserved Cash outflow of €6,906m in the first year. In contrast, in order to increase Functional Firm Value by 25.44%, the annual conserved FCFF must increase accordingly. Alternatively an additional Conserved Cash inflow of €1,776m in the review period's first year would have been required. The adjustments to balance the absolute trading-day-to-trading-day market capitalization swings would be even more unrealistic: An additional one-off Conserved Cash inflow of €3,429m, a growth of annual conserved FCFF by 49.12%, an increase of the growing perpetuity of 4.78%-pts. or a decrease of the weighted average costs of capital ("WACC") by about -2.95% would have been necessary.

Research did not provide any information that could justify the extreme breaking in the numbers: All cashflow adjustments seem unrealistic given that the historic average cashflow to the firm from 1998 to 2009 was just €705m. And since SAP is established yet it is strongly dependant on the growth of their huge customer base, which contains both big internationals as well as medium-sized businesses. Therefore growth rates to perpetuity, which are beyond the ones of the whole economy, seem unrealistic as well. Against the background that the initially applied real WACC, which amounts to 10.4%, bears comparison with actual market expectations, it seems like (most of) the volatility of SAP's stock value was *not* well-founded, i.e. not thoroughly derived from economic facts (= changes in Significant Influencing Factors), but just of purely speculative nature. In other words: Over time SAP's market value changed repeatedly and developed independently of its actual operational performance, its (reasonably) forecasted operational potential, i.e. stand-alone of its Functional Firm Value, which can be viewed as a summary thereof. (Please note that Functional Firm Value's compound annual growth rate ("CAGR") was 10.2% p.a. and that the one of the market capitalization was just 3.4% p.a. Therefore SAP's Functional Firm Value might even match the "linearized" market capitalization in the middle of June 2022. But since market values cannot be forecasted due to principal reasons such calculation is nothing more than just a "nice" mathematical example without any actual application).

Table 3: Matching market capitalization swings by adjustments of Functional Firm Value determinants applying the example of SAP (cf. Appel and Grabinski (2011), Appel et al. (2012))

SAP: Adjustments to balance market capitalization swings by Functional Firm Value influence factors				
Exemplary market capitalization changes	Maximal trading-day-to-trading-day market capitalization decrease (December 29, 2000 to January 2, 2001)*		Maximal trading-day-to-trading-day market capitalization increase (October 16 to October 17, 2002)	
Magnitude of market capitalization changes (= target values to be met by Functional Firm Value)	-20.76%	-€8,869m	+25.44%	+€4,403m
Functional Firm Value adjustments				
Cashflow -- single pay-out/ -in (within respective first year)	-€961m	-€6,906m	€1,776m	€3,429m
Cashflow -- equal de-/ increase per year (within forecasting period**)	-20,76%	-149,20%	25,44%	49,12%
Growth rate of cashflow -- de-/ increase (after forecasting period**)	-10.44%-pts.	Market capitalization drop cannot be met: Even a reduction of 1,000,000%-pts. is still too low, a reduction of 10,000,000%-pts. affects only the 2nd position after the decimal point.	3.33%-pts.	4.78%-pts.
WACC -- equal de-/ increase (within and after forecasting period**)	2.80%-pts.	Market capitalization drop cannot be met: Even at an increase of about 5,000%-pts. Functional Firm Value is still positive. At an increase of about 5,230%-pts. Functional Firm Value becomes €0, which -- in this case -- is the lowest possible value.	-1.81%-pts.	-2.95%-pts.

*Due to banking holidays no trading was performed between December 29, 2000 and January 2, 2001.
**At January 1, 1989 the rolling 3,650 days Functional Firm Value calculation starts based on historic actual values. From January 1, 2010 going forward Conserved Cashflows are forecasted by applying growth assumptions with respect to SAP's latest acquisition of Sybase (in Q3/ 2010) and a long-term "steady state" growth rate equal to Germany's ten year average inflation rate.

Value Gap between SAP's market capitalization and its fundamental financial figures – which are determined by economic facts respectively Significant Influencing Factors thereon – is not closable. (For Value Gap please cf. III, 3.2.1.3; for Significant Influencing Factors please cf. Chapters III, 2.1.4 as well as Figure 40 in Chapter V, 5.1). It may be explained though, namely by the way speculators take trading decisions: For it analysis should not only focus on the company under consideration (= here: SAP and related (company-internal) microenvironmental Significant Influencing Factors) and the market environment (= macroenvironmental Significant Influencing Factors). To explain stock traders' behavior it is sometimes even more important to consider disclosures of companies, which could be considered as peers: Stock values are not seldom taken into *"collective punishment"* as soon as one peer does perform up to expectations respectively does not perform up to them. The question whether or not this practice is sensible has to be answered case based. In view of Strict Conservation Law in Business (cf. Chapters V, 2.2 and V, 5.2.1.1) it is confirmable only if Significant Influencing Factors favor – respectively penalize – the peer group in the *same* way and by the *comparatively same* magnitude. ("Comparatively" here means that the nominal influence may deviate from the percentaged one due to differences in company size). But then again the question must be answered, too, where the *"(conserved) reaction in something else"* got to! For now please note that already Williams (1938) pointed out that growth per se does not always create value for stock owners: "That a non-growing industry can be profitable is shown […], and that a fast-growing industry can be unprofitable is shown […]". And also within industries profitability can differ significantly (cf. Ghemawat and Rivkin (1998)). Therefore looking at peers or whole industries in general does *not* say anything about a specific company's ability to generate above average returns – no matter whether or not they are conserved or not.

Figure 25 is the last one on SAP – it provides a graphical summary of the previous reasoning: The upper curve shows SAP's market value, essentially stock value multiplied by number of stocks (adjusted for stock splits and issue of stock dividends). It fluctuates rapidly. Almost everybody will agree that at least some of these fluctuations are due to speculative trading. (Selected drivers that potentially fostered speculations are included, too). The lower curve or shaded area contrasts SAP's Functional Firm Value. It is calculated from (historic and forecasted) Conserved Cashflows as described in detail above. Compared to the upper curve (market value) the lower one (Functional Value) shows two particularities:

1. Functional Firm Value is much smaller than market value at almost all times. Though Functional Value depends on the interest rate assumed the basic massage stays the same for any reasonable interest rate: The huge gap between the two value curves is the premium that is paid due to speculation (= Value Gap). The *"speculation premium"* – respectively Value Gap – fluctuates rapidly. This brings us to the 2nd particularity.

2. *Functional Firm Value* is an almost boringly smooth function while the market value fluctuates rapidly. This result is reasonable of course: There have not been any changes within SAP during the last two decades, which were drastic enough for justifying any changes as indicated by the upper market value curve.

At this occasion please note that Functional Firm Value – though it is a pretty smooth function – is *not constant*: The underlying Conserved Cashflow may (slightly) swing as well – dependent on changes in Significant Influencing Factors. However there are no major day-to-day jumps. And since Functional Firm Value describes a conserved part within the economic system it changes only if *something else changed before* – like the energy that changes the development of a mechanical system (cf. Chapters III, 2.1.3 and III, 2.1.4). In either case this "something else" must be something flowing in or out. And – in view of economic systems – there are two major possibilities:

1. Investments (or disinvestments) and

2. Market changes.

Please note that "investment" is defined very broadly here: The ordinary *investment* is the archetype of a conserved change in Functional Value. Money is removed from somewhere (= decrease in Functional Value) and it is pumped into the company (= increase in Functional Value). But also things like *innovations* are considered investment here. Instead of money an idea or something alike – say a patent – is invested in the company (cf. Chapters V, 5.2.1.3 and V, 5.2.3.2). The *market change* is also a conserved effect from SAP's point of view: The customers (from outside) requiring more or less lead to the corresponding change inside of SAP. As an example one may assume that SAP's customers are buying more (or less) from a typical competitor like Oracle. If customers are buying more from Oracle its Functional Firm Value increases while the one of SAP decreases correspondingly. Such kinds of substitution can be more complicated in reality but they are always leading to perfectly (conserved) transfers of Functional Values. There may be the case where a company has no ERP system yet but 100 traditional accountants instead. Buying an ERP system from SAP will increase SAP's Functional Firm Value. The customer is now able to lay off (a good portion of) its 100 accountants. So the customer's Functional Firm Value will also increase (hopefully). But the poor accountants' Functional Value of Work will decrease. Even in this example there are just Conserved Quantities!

While the market change will always lead to something conserved from SAP's point of view it can be tricky if one considers SAP, its competitors such as Oracle, any of its customers as well as the accountants on an *aggregated level* as one company. Then the examples above will show no change in Functional Value because the diverse changes balance each other – which is perfectly fine though. However one may consider Porsche as a customer, too: In October 2008 the company made around €1bn from speculation with VW stocks (cf. Chapter III, 3.2.3). Naturally such increase in "value" is not based on Conserved Quantities. Assuming that Porsche celebrated its gain in money by buying things like a brand new ERP system from SAP there are corresponding changes in SAP's financials – i.e. its balance sheet will show an accounting exchange on the asset side and its profit and loss statement as well as someday its cashflow statement will be affected positively (assuming SAP can provide the ERP system at least break-even). But the related increases are not originated by any Conserved Quantity! However when adding the late Adolf Merckle to SAP and its customer (= here: Porsche) everything is fine again on the *aggregated* level: By his speculation with VW stocks Merckle lost at about the same time the approximately same amount that Porsche gained (cf. Chapter III, 3.2.3). So when taking also Merckle into account the non-conserved cashflows would balance out. But – as described above – in reality almost nobody will buy an SAP system just because he or she made some money from speculation or gambling. That is the reason why SAP's Functional Firm Value did not chance very much in actuality though the rest of the world – in particular the equity markets – lived through many *speculative* changes.

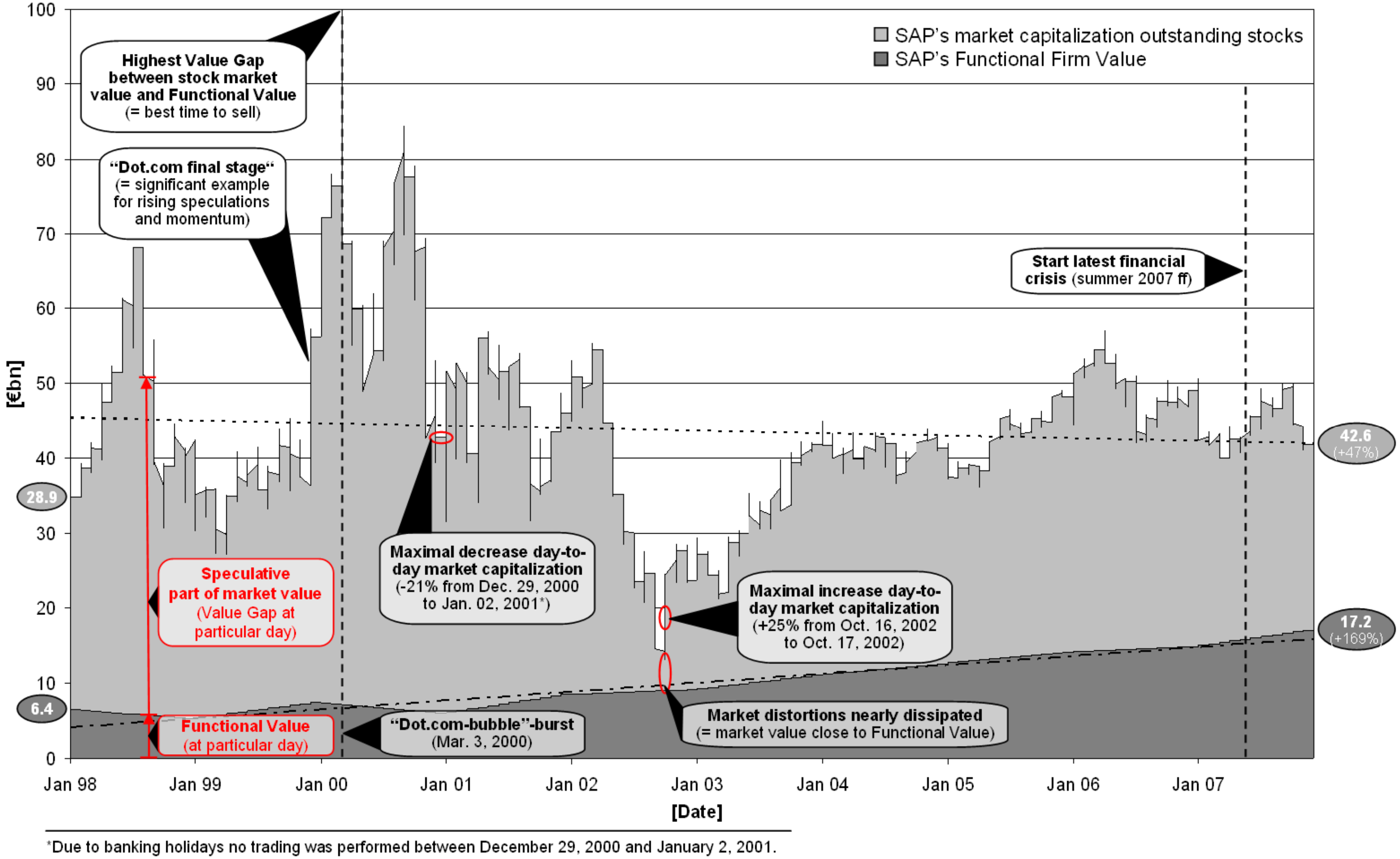


Figure 25: Market capitalization vs. Functional Firm Value of SAP (cf. Appel and Grabinski (2011), Appel et al. (2012))

2.3 Addendum: Managing economic beneficial resource allocation

Figure 25 makes apparent the huge magnitude of the non-conserved Value Gap, i.e. the *"speculation premium"*, which SAP's stockholders were willing to overpay at any day during the valuation period. In comparison to Functional Firm Value its multiple ranges from 1.5x to 14.0x! And it can be seen easily that the market value of SAP's stock respectively its non-conserved part (= Value Gap) – in contrast to Functional Firm Value – developed over time not at all robust but chaotic. Three things should be learned therefrom to evade real economic issues, which potentially arise therefrom:

1. *Re planning and usage of national budgets:* Not only managers and investors but also fiscal authorities must recognize that chances to gain and threats to loose by betting on the realization of (non-conserved) Value Gap may be round about equal in the future – finally Value Gap's magnitude is not justifiable by foreseeable Significant Influencing Factors at no point in time. And not only the potential gains but also the potential losses, which are determined by the spread of entry and exit market values respectively, can be huge – here from 1.5x to 14.0x of "invested" capital. Hence also *national budgets* – respectively the persons that decide thereon – must not take speculative businesses' income for granted! Instead only changes in Functional Values should be considered in order to determine a robust and thereby well-foreseeable tax load (cf. Chapters IV, 5 and VI)!

   At this occasion please think about the case that speculators actually lost money on a large scale. Then national governments and/ or eventually superior committees must start bail-outs to rescue them in order to hinder collateral damages in the real economy (cf. "system relevance" in context of economic crises as well as Chapter III, 3.2.1.3 for the working definition of "economic crisis"). In such a case public authorities must waste even more funds, which also could have been used for Functional Value adding purposes, in order to limit speculations' negative side effects (cf. the latest financial crisis' news coverage from 2007 going forward). In consequence funds for *important* future-oriented (conserved) investments will be cut and reallocated to in all likelihood non-conserved yet (seemingly) *pressing* bail-outs. Over and above (some) companies' taxable income will be missing the initially expected speculative part, so that the actual tax income will be much lower than initially forecasted. This harms the national budget even further – yet this time not the expenses but the income. Then one can only hope that during prosperity (large enough) reserve funds were filled to finance all bail-outs as well as state-run projects (particularly those adding to the conserved part of the national product)! Otherwise public debt must be increased, which may be too much for citizens' Functional Value of Work (cf. Appel and Grabinski (2011), Grabinski (2011c) as well as Chapters III, 2.1.3.1 and III, 2.1.3.2). This leads to the 2nd concern.

2. *Re amendment of industry policy:* In view of the above it should be allowed to question whether or not it was actually sensible that public authorities attracted businesses in the past, which bore high Chaos Exposure, by mutual undercutting of trading rules, regulations or subsidies for non-required things having no Functional Value at all. (Consider e.g. departments in the banking and finance business like proprietary trading or Germany's subsidy of non-required real estate in the former GDR, which on a large scale lacks occupants to date (cf. Chapter III, 2.1.3.2)). Youngest history showed that attracting and maintaining "any" business can be rewarding on the national economic level in view of higher tax income, lowered unemployment, etc. (≈ social wealth) – but only in the short run. In the long run *undifferentiated* state support often necessitates bail-outs that become even more costly for all citizens and over and above lead to harmful cuts in investments required for robust future growth and economic wealth (≈ direct and indirect *"social costs"*)! In this sense it seems hardly rebuttable that consciously leaving businesses with high Chaos Exposure on the other side of the border in general results in less social costs and – in the long run – higher *net* Functional Value of Work and thereby higher *net* national budgets. This leads to the 3rd concern.

3. *Re over- and underfunding of privately-owned businesses:* Speculation at equity markets (often) leads to inefficiencies in that funds are transferred whereto they cannot be applied Functional Value adding. From an economic point of view the

non-conserved cash, which is tied-up in Value Gap respectively speculation premium, is literally *valueless*. No one can use it a second time for investments in "projects", which are actually Functional Value adding – e.g. in the areas of research and development ("R&D"), facilities for products that actually bear Required Functions, schools or universities. (For Functional Value of new things – like innovations – please cf. Chapter V, 5.2.3.2).

At this occasion please note that Functional Firm Value amounts to net Conserved Cashflow and thereby accounts for investments, too. But this does *not* imply that just providing more money to any company – like SAP – does necessarily lead to increased sales of product that have (more) Required Functions (= gain in Functional Firm Value): The company under consideration simply could spend the money for anything being non-required, non-conserved, i.e. non-Functional Value adding. In this sense SAP was *overfunded* most of the time. And the company's stock buybacks, which were even beyond its agreed stock option plan, affirm this hypothesis (cf. aktiencheck (2010), faz.net (2009), n-tv.de (2011), SAP (2001 – 2007)). In contrast, given SAP had planned more Functional Value adding projects, the company could have used the funds from the stockholders for realizing them. But further Functional Value adding projects – beyond the ones that were already launched and funded – were seemingly missing at SAP.

Given investors behaved like the author suggests SAP would have lacked the funds from the speculation premium respectively Value Gap. Then the company may not have had enough money for the stock buybacks – but they were (functional) valueless anyway. In return investors may have provided the funds to other companies, which could have grown their Functional Value adding businesses instead. (In particular institutional investors do not want to carry "idle money" since it does neither bear management fees nor generate operating income. Therefore they are continuously searching for (re-)investment opportunities). Over and above the tax income from actually Functional Value adding businesses can be assumed being more robust hence foreseeable than the ones from SAP's proprietary stock trading!

The core problem that underlies the considerations 1 to 3 is always the same: At first glance, i.e. when looking only at companies' market capitalization and/ or GAAP figures, nobody can declare "what is going on". This means the financial figures may look good – and maybe even exceed expectations – but there is (often) no indication where the money actually came from. To phrase it more concretely: Neither market capitalization nor GAAP financial statements reflect real values (= Functional Values) – therefore they cannot reveal additional information on Value Gap, related Chaos Exposure and cashflows' robust development over time. That is the reason why alternative accounting principles were developed to set-up B/S's that show nothing else than *conserved volumes* and *Functional Values* per asset category ("Conserved Balance Sheet"). To link the microeconomic reallocation of Conserved Cashflows between companies, employees, entrepreneurs and customers with the macroeconomic reallocation of Conserved Cashflows by taxes and duties, Conserved Balance Sheets were aimed to be applicable as *conserved tax balances* ("Conserved Tax Balance Sheet"), too. The advantages hereof should be obvious: Given Conserved (Tax) Balance Sheets were implemented nobody in the private economy and state apparatus, who is responsible for far-reaching decisions on investments, business development and/ or industry policy, can be surprised anymore by economic swings (cf. Chapters V and VI). Over and above the common tactic of (reactive) economic "fire fighting" by bail-outs became less pressing because: Developing national economic strategies, which actively foster Functional Value adding businesses and employment, could be identified much easier. And their development over time could be understood much better given companies' financial statements showed Conserved Quantities only. Then everybody – not only savvy analysts – could perceive at first glance the financial performance of *conserved businesses*, which are the only source of citizens' Functional Value of Work hence *robust national budgets*! This gain in transparency is the best mean to *selectively* manage and assist Significant Influencing Factors that account for robust income, economic growth and thereby foreseeable inflows to the respective national budget. Needless to say that strong growth of *any* market or economy – potentially above experts' expectations – is of course pleasant today. But blindly relying on market developments was proven repeatedly to be neither effective nor efficient but non-foreseeable and potentially chaotic (cf. Appel and Grabinski (2011) and (2011), Appel et al. (2012) and Grabinski (2007) as well as e.g. Chapter I, 1, Chapter III, 3.2 and Chapter IV 2.2).

Against this background it seems wiser indeed to identify and *assist* only Significant Influencing Factors for maybe comparatively moderate but guaranteed non-chaotic long-term growth by Functional Value creation. In consequence the author argues it is much more *effective* in the long run to allocate funds only to products, investment opportunities, state initiatives, etc., which meet Conserved Quantity Approach's two prerequisites (cf. Chapter III, 2.1.2). Thereby Chaos Exposure would be limited also on the national economic level (cf. Chapter V, 6). To increase *efficiency* of applied (scarce) national resources, the money required to assist these conserved businesses should be taken from those areas, which cannot meet Conserved Quantities' two prerequisites, i.e. government spending should be cut down in these non-conserved areas. (The reason why shrinking a non-required economic area is not harmful is in principle the same as the one of leaving a non-required product function (cf. Chapter V, 5.1.3)). At the same time amendments in view of e.g. trading rules and regulations may assist the economic transformation to more Functional Value orientation (cf. Chapter IV, 3.5 as well as Chapter VI). The protests by representatives of the affected sectors are foreseeable. But given the suggested refocusing in economic strategy would be implemented by governments in actuality, resources would be allocated both more effective and more efficient. Needless to say this would not harm but befit Functional Value of Work and thereby the conserved part of the national budget. At the same time the threat of (unforeseeable) economic crises would be minimized. Thereby the respective state's capacity to act long-term in view of "*important* (future-oriented) conserved investments" would be strengthened (cf. above). These facts should be enough to rethink current industry policy! Over and above related changes in national economic strategies need not be implemented without a transition period so that potential magnitudes of side-effects – that can be assumed being relatively short-lived in any case – can be limited.

This is the end of Chapter IV, 2, which introduces Functional Firm Value concept by the example of SAP. Please note that further details are left here only in order to avoid redundancies as far as possible in view of Chapter V – there Functional Firm Value is refined to the level of classes of B/S assets and liabilities. So Chapter V provides complementary approaches to differentiate between Value Gap and Functional Value in view of the diverse applications, for which more or less similar assets and liabilities may be used.

Over and above – in view of the concerns raised in this Sub-Chapter IV, 2.3 – Chapter V shows why Functional Firm Value respectively Functional Value of the firm's assets and liabilities has *universal validity* for diverse businesses, companies and industries. This is inevitable for the implementation of *Conserved Balance Sheets* – in particular if they should be utilized for determining robust and thereby *well foreseeable tax loads* as well as for *optimizing investment strategies* and *amending current industry political strategies*. Of course those general approaches were applied for SAP's Functional Firm Value calculation, too. (For the total SAP example from Chapter VI, 2 going forward, if not stated otherwise, cf. Appel and Grabinski (2011) as well as Appel et al. (2012)).

3 The example of gold to derive resources' Functional Value

As long as a resource, end product, machinery and equipment or any other asset is hold and applied by a private person only, valuation is rather unimportant. But as soon as market values have to be determined for a transaction or a company has to set-up a (tax) balance sheet, the related parties must agree on some valuation approach. For that the prevailing school of thought is to rely more and more on market values respectively transaction prices. This trend is not only but also advocated by organizations that establish financial accounting and reporting standards, in particular the FASB (2006). Here – as recently proven – the core problem is: The market "value" is no Conserved Quantity because (in almost all cases) it lacks fundamental fixtures. This means markets' moods – in form of short-term trends and speculations – decide on the amounts of market "values". And concepts like "moods", "fads and fashion" and the likes neither need to be interlinked with (conserved) Functional Requirements for the traded products (= conserved part of market demand) nor need the traded products' functions be (conserved) Required Functions (cf. Chapters III, 2.1.4 and IV, 1). This makes market "values" arbitrary, so that predicting them (at large) is as reasonable as trying to calculate next week's lottery numbers. In consequence market "values" are no reliable inputs for long-term planning (e.g. for business cases and/ or investment appraisals) and are unqualified for accounting and taxation. But these problems were not approached yet: So against today's legal background, balance sheets that adopt GAAP accounting may suggest there are "values", which in actuality do not exist (anymore). Or they may show "values", which are too low compared to Conserved Cashflow respectively generable by applying or (re-)selling them. In either case GAAP "values" are too high or too low to mach the respective asset's Functional Value, which is verifiable the long-term most realistic one (cf. Appel and Grabinski (2011), Appel et al. (2012), Grabinski (2011a), (2011b) and (2011c)). In the end this leads to an odd situation: Even down-to-earth companies, which operate rather "boring" businesses, run the risk of having highly speculative (tax) balance sheets (cf. "fair value accounting" according to FASB's standard number 157 ("FAS 157"), "lower of cost or market" ("LCM") rule according to United States Generally Accepted Accounting Principles ("US-GAAP") Accounting Research Bulletin ("ARB") No. 43, "net asset value" ("NAV") method, "multiple valuation" as well as Chapters V, 5.2.1.1 and V, 7 as well as Chapter V, 8).

Since this dissertation strives to suggest ways and means to determine products' and assets' values better than done currently the findings stated above lead to the key questions of this Chapter IV, 3: What if a company has "something" on its balance sheet, whose market value changed drastically compared to the one as of the acquisition date? This can occur quickly in particular for "liquid assets", which are traded frequently on well-established exchanges – the best examples may be those of (versatile) resources. To quantify the magnitude of adjusting *not yet further processed* resources' market prices to Functional Values – and to suggest a generally applicable valuation approach so that they become accountable to Conserved (Tax) Balance Sheets – the example of *gold* is used. ("Not yet further processed" is an important infix here because: Given a company used the resource in production yet it became either a semi-finished or a finished product. Then Functional Values must be determined differently (cf. Chapter V, 5.2.1.1 vs. Chapter V, 5.2.1.2). Gold is a precious metal, which can be used for diverse purposes in the industry (e.g. for coating circuits), for healthcare applications (e.g. by dentists), by jewelers or as presumable save haven for capital. Consequently – due to its wide range of applications – gold's Functional Value may vary considerably, too. That is nothing special at all – finally Functional Values of (most) assets a company may hold (= current assets, capital assets, financial assets as well as human resources) depend on the context of use. But for resources – not only but also for gold – additional consideration must be taken. And to narrow down potential approaches to converge increasingly to some kind of realistic (Functional) Value – in the first step – current economics' school of though are reconsidered. And it is shown why it must be rejected here. In the second step an alternative approach is introduced for gold's (Functional) Valuation. In the third step the author argues why this approach is universally applicable for any kind of resource. And finally in the fourth step he shows how to extract the relevant conserved financial figures from GAAP-financial reporting – either in the cost of sales- and/ or the total expenditures-formats – which may be diluted be a lot of non-conserved figures. (The addendum is beyond this dissertation's scope. Yet it was included to discuss Functional Valuation in another context, namely market regulation. And it was intended to start a discussion dealing with small amendments – or relaxations – to the basic Conserved Quantity Approach, which might increase its range of application considerably).

3.1 Problems of reasoning market values by supply-demand-functions

Supply-demand-functions in economics are used often to explain how to come to market values (cf. "efficient market hypothesis" e.g. in Chapter III, 3.2.2, "equilibrium price" or "market equilibrium"). Though they are *not* helpful for (Functional) Valuation they admittedly can be helpful for explaining the principle setting of market values respectively of market prices. In case of gold the demand can be reasoned manifold as indicated by Figure 26.

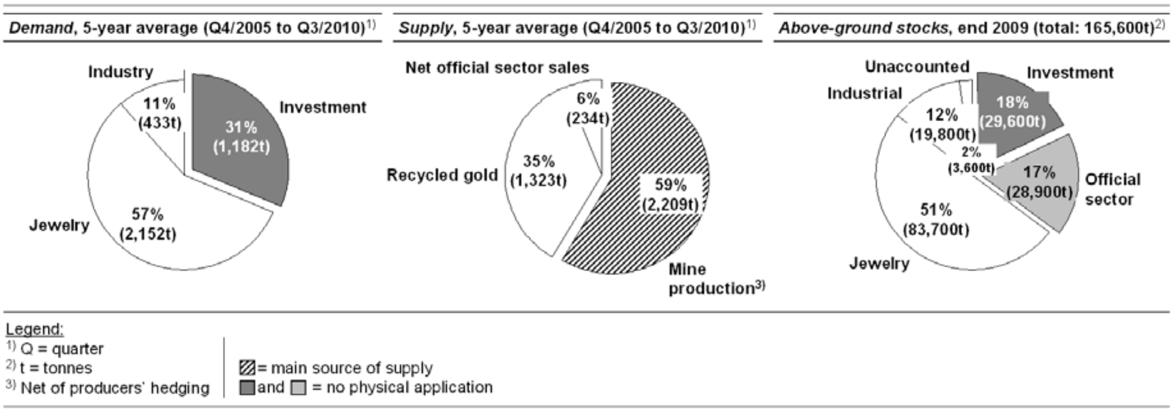


Figure 26: Gold's demand, supply and above-ground stocks
(cf. World Gold Council (2011))

Compared to other resources – in particular those that are not precious metals – *gold's demand* is far beyond its physical application: "Gold is generally considered a slice of good luck. Owning it however is a sign that you fear the worst. Some people buy the yellow stuff because they think it looks pretty to be sure. But the quintessential gold bug is an investor who expects every form of paper wealth to collapse along with civilization itself. Gold is not like other commodities. The demand for iron ore depends on down-to-earth things such as how many steel grinders Chinese builders are using. The demand for gold depends on airier considerations […]" (The Economist (2011b)). "Gold is one of the better investments to be in when the economy is troubled […]. Put simply, when times are tough, people would prefer to invest in things rather than in concepts" (Clapperton (2010)). That is why *economic crisis and rising gold prices* not mandatorily – yet very – often accompany each other as Figure 27 suggests:

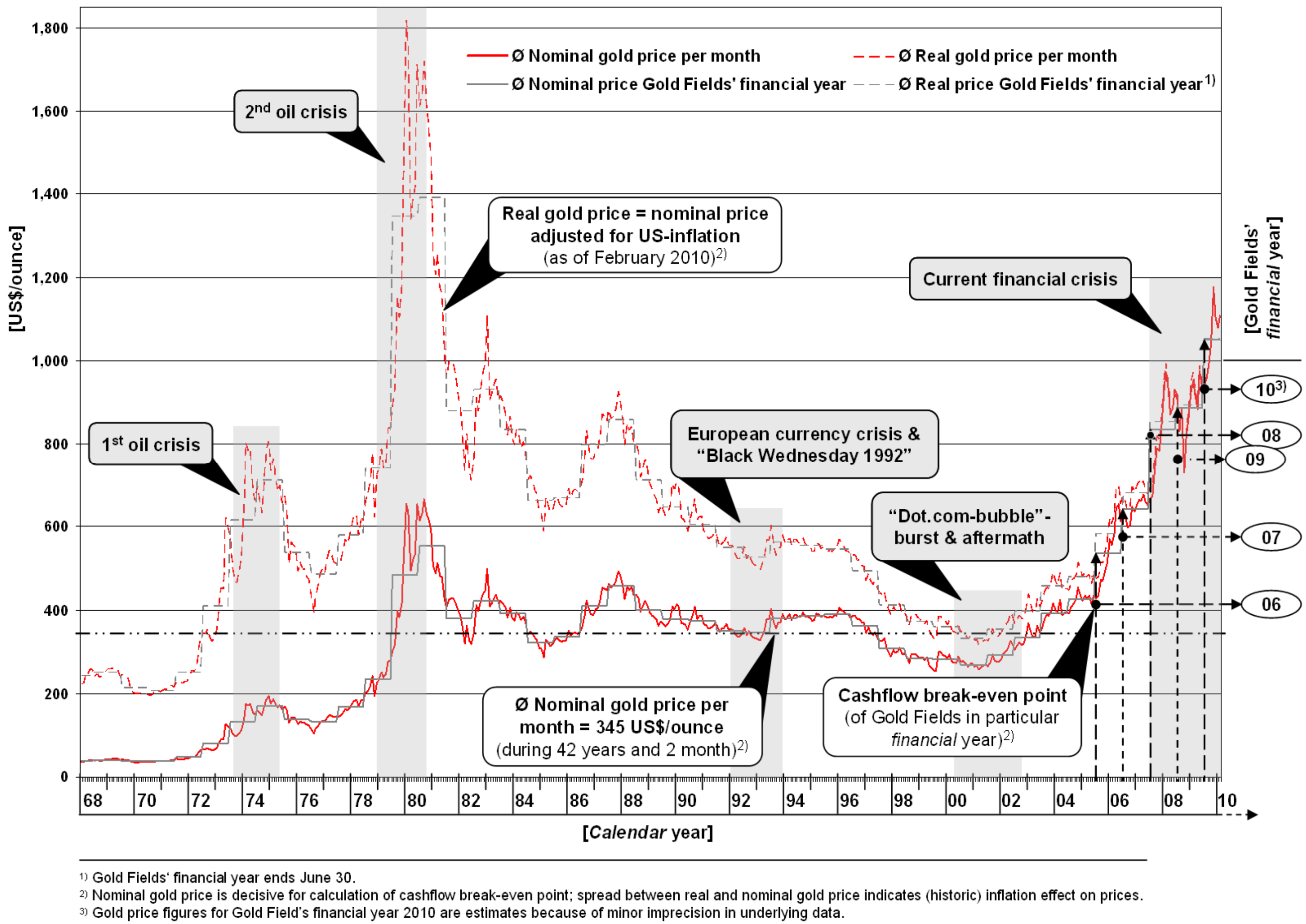


Figure 27: Gold price average from January 1968 to February 2010 per month and per Gold Fields' financial year (ending June 30) (cf. Gold Fields (2006-10), U.S. Department of Labor (2011) and Comex (2011))

In view of the *diverse average gold prices* (= market values), which are charted in Figure 27, please note: There are average gold prices by financial year and there are average gold prices by recent financial years of the mining company “Gold Fields PLC”. Being the world’s fourth-largest gold producer the company is one of the significant players in the gold sector. And it has initiated a thought-provoking discussion about *all-in cost accounting*, which – as argued later herein – is relevant not only for mining gold but also for the resource sector in general. In view of common GAAP terminology, to avoid confusion, it seems noteworthy betimes that the term “all-in costs” here consciously comprises not only current costs but also investments (cf. Creamer (2008), Gold Fields (2010), J.P. Morgan (2010)). In principle this is accordable with the author’s suggestion for resources’ Functional Valuation. Yet – in contrast to Gold Fields, etc. – he advises to account for the *conserved part* of all-in costs only. Nonetheless by applying financial and operating figures from Gold Field’s annual financial statements, a conserved non-GAAP figure the author named “Calculative Cash Outflow” (“CCO”) can be reconciled easily. This is important twofold because:

1. Calculative Cash Outflow measures *any* resource’s Functional Value by accounting for its *conserved* all-in costs. (To distinguish conserved from non-conserved costs the focus of the analysis must be laid on all-in cost’s respective causation, i.e. whether or not they are related to a resource producer’s *operating (core) business*. Later in this Chapter the author describes how to perform this task and come to results that are unambiguous and traceable for third parties).

2. *Market values feedback on resources’ Calculative Cash Outflow (at large).* To put it mathematically: There is a positive correlation, i.e. given market values rose, Calculative Cash Outflow will follow promptly. This is because: A company’s economic break-even point is defined in particular by the difference between the respective resource’s market value and the Calculative Cash Outflow to produce it. In this context please note that in all financial years Gold Field’s Calculative Cash Outflow break-even point is always lower than – or at least equal to – market values. (To exemplify it Figure 27 and Table 4 show average gold market values not only but also by the producer Gold Fields’ financial year).

So after this excursus on idiosyncrasy of gold markets' supply and demand – which is aimed to avoid misunderstandings betimes – let's come back to *general supply-demand-functions' problems.* What in particular forecloses their use for Functional Valuation is: Demand is *not* mandatorily equal to (conserved) Functional Requirements. In actuality these two figures deviate often (by a large margin). For example as indicated below by the data of the U.S. Commodity Futures Trading Commission ("CFTC"; (2011)). The part of average daily gold trading, which can be traced back to (conserved) Functional Requirements, amounts to just about 11 to 12%:

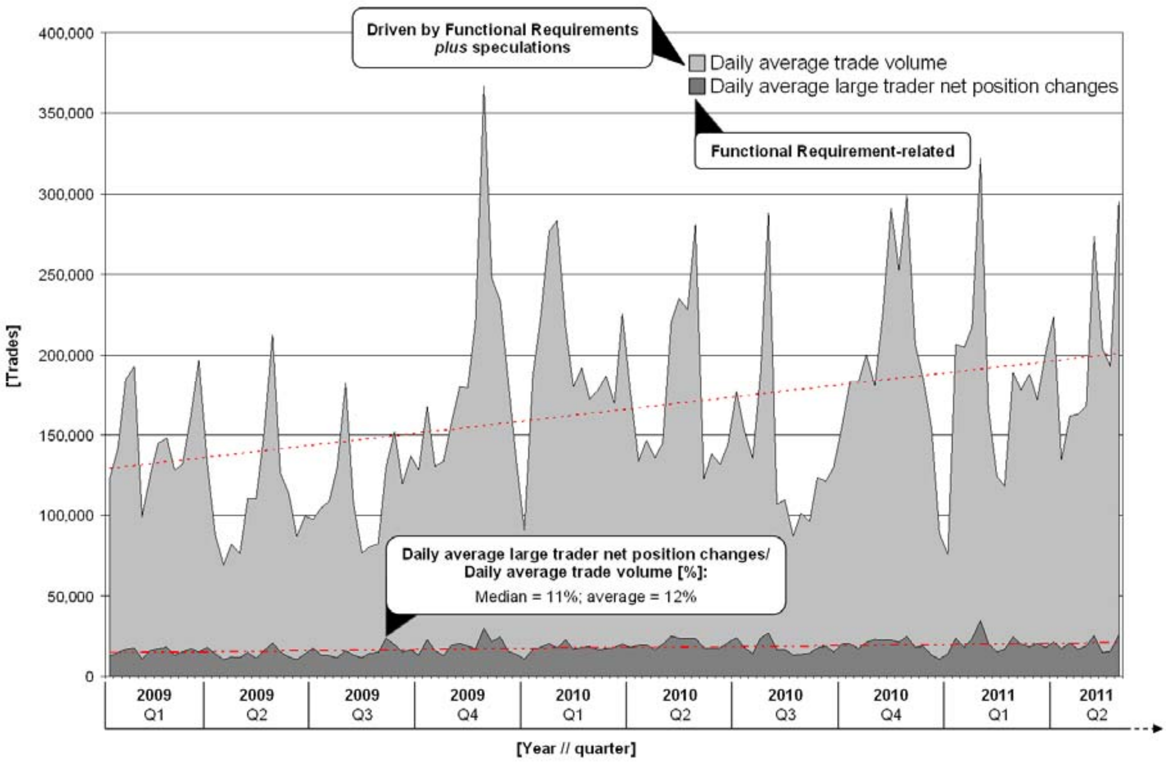


Figure 28: Average trade volume vs. average large traders' net position changes per day applying the example of gold (cf. CFTC (2011))

To interpret CFTC's (2011) data correctly please note the following: The data set contains trades that *change* or create an end-of-day position (= "daily average large trader net position *changes*") as contrasted with trades that do *not* change a trader's end-of-day net position such as spread or day trading (= speculative trading on short-term market trends). Taken together they equal all orders to buy and sell gold, which large traders on average placed *in total* per day (= "daily average trade volume"). But the ratio is imbalanced: On average – per day – purely (non-conserved) speculative gold trading dominates (conserved) Functional Requirement-related one by factors of about 7x to 8x! And speculative trading – being not related to Functional Requirements – is the *first underlying issue* that leads to the deviation between total market demand and its conserved part (= Functional Requirements) and thereby Value Gap between total market value and its conserved part (= Functional Value).[2] In contrast there is the non-speculative part of daily trading: It must reflect *changes* in a resource's actual Functional Requirements. For it the indicator is the "daily average large trader net position *changes*". Therefore *changes* in traders' net positions mirror *changes* in the daily conserved part of trading. Or explained alternatively: At the beginning of the day the average trader gauges how much more – respectively how much less – gold he/ she has to provide to his/ her principal(s). For it in particular *changes* in macroenvironmental Significant Influencing Factors, which precede *changes* in Functional Requirements (= conserved part of market demand) must be taken into account (cf. Chapter III, 2.1.4 as well as Chapter V, 5.1 – in particular Figure 40). Dependent on that – and in view of the long- and short-positions he/ she has on hand (= trader's net position at the beginning of the day) – the trader buys or sells gold in order to *retain being able to deliver*. He also may speculate during the day in order to capitalize on short-term market value volatility. But the related orders are non-conserved because they are not decisive on whether or not he/ she will be able to deliver to the principal(s) at the end of the day. Decisive however are the orders, which *change* the trader's net position until the end of the day

[2] The *second underlying issue* leading to Value Gaps is not decisive for understanding CFTC's data. But it is decisive for resources' Functional Valuation hence it is addressed here, too: Any traded products' functions are not necessarily 100% related to Functional Requirements, i.e. not all functions are actually Required Functions. And since margins for *non-Required Functions* may call for cutting of prices respectively market values on short notice – and without further ado – these margins are non-conserved. Consequently they should not be included in long-term financial forecasts covering periods of e.g. 10 years. The author suggests to realize it by attaching no margin (= no Value Tag) to non-conserved functions (= *non*-Required Functions). Please recapitulate that any kind of not yet further processed resource bears no margin whose conserved form is value tag ("Value Tag"). Instead any resource is to be valued by *conserved* all-in costs only (= Calculative Cash Outflow). Therefore market's two underlying issues that can lead to both – *inflated demand and/ or inflated market values* – can be *managed effectively by the diverse asset-specific Functional Valuation-approaches* suggested in this dissertation (cf. particularly Chapters V, 5.1.3 and V, 5.2.1.1).

– these are the conserved ones that aim to adjust the stipulated volume of gold to principals' (conserved) Functional Requirements. (Admittedly, due to operational misalignment, changes in the conserved part of trading and changes in principals' Functional Requirements for the resource (= here: gold) need not be absolutely equal – at least not per day: Starting from the initiating order of any resource-requiring product (= gold-coated circuit, gold-jewelry, bars of gold, etc.) by the end-customers, inventories throughout the total supply chain may lead to deviating figures. In addition there may be time lags and information asymmetries throughout the total supply chain that foster the deviation between Functional Requirements for a resource and its supply (cf. "bullwhip effect"). Irrespective of that CFTC's (2011) figures provide a good approximation for the conserved part in gold trading respectively changes in the gold market demand's conserved part, which can be traced back to raising or decreasing Functional-Requirements. And after all the Conserved Quantity Approach advocates a long-term perspective – e.g. 10 years – within daily wiggles in order management are really insignificant).

Summarizing the above leads to the realization: The *lower the share of "daily average large trader net position changes"* is compared to their total average trade volume per day (= "daily average trade volume") the more often large traders placed orders that were speculative. So these orders were *not required* to match any additional or obsolete Functional Requirement (that responded to changes in Significant Influencing Factors). Not surprisingly such purely speculative orders were intended to have no consequence on the large traders' net positions beyond the respective day (= *not* more or less gold contracts are hold by large traders at the end of the day). In contrast the *higher the share of "daily average large trader net position changes"* is the more often traders placed orders that were actually *required* for retaining being able to deliver (by fitting the amount of traders' positions to changes in Significant Influencing Factors). Not surprisingly such orders are intended to be meaningful beyond the respective day (= more or less gold would change hands given the contracts were fulfilled right away). So going forward these (conserved) *changes* in large traders' net positions can be used to satisfy additional Functional Requirements – e.g. by finally providing more gold to people looking for a (alleged) safe haven for their capital, a company that applies it for creating jewelry or a company that uses it for coating circuits. Or such orders can be used to meet declining Functional Requirements on the part of the traders' principals. Therefore given the share of "daily average large trader net position changes" amounted to 100% of their total "daily average trade volume" all traded gold would change hands based on Functional Requirements. (The potential margin of error due to operational misalignment of the supply chain is assumed being insignificant (cf. above)). Then all long positions would be assumed by the ultimate buyers, who would *take the gold off the market* – otherwise it could not be applied for further processing or (presumable) maintenance of asset value (= potential Functional Requirements for gold on the highest aggregated level). Naturally – given any of the Functional Requirements for gold should be fulfilled – the related resource volumes cannot be traded anymore for the time being. In consequence these transactions can be declared perfectly "conserved".

3.2 Functional Valuation of resources by Calculative Cash Outflow

So by CFTC's gold market data the magnitude can be appraised of non-conserved as opposed to conserved resource *trading*. But given a company intends to set-up a robust (= non-chaotic) balance sheet showing nothing else than Conserved Quantities analysis must not be finished here on no account. The reason is: Values of all balance sheet-line items – no matter what the valuation approach was respectively – are determined always by the same simple formula:

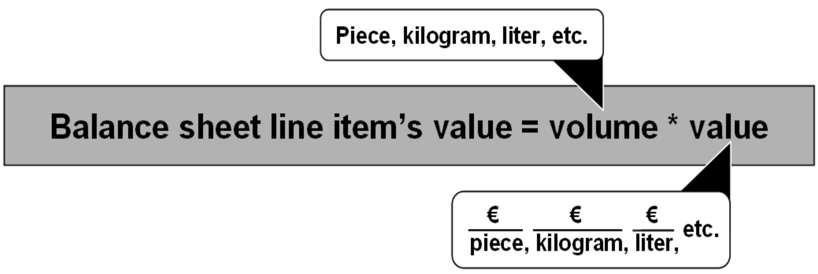


Figure 29: Generic formula for valuing line items in a balance sheet

And assuming a company's procurement department performed an order only if there was Functional Requirement for it (= 100% conserved trading) this just means that the respective item's *volume* is fully accountable to Conserved Balance Sheet (cf. Chapter V). The conserved (Functional) *Value* still has to be determined though. For resources the author suggests to generally apply the approach summarized in Figure 30 (which is detailed below in Table 5 as well as reconsidered in Chapter V, 5.2.1.1). (Please note that Figure 30 assumes the company under consideration performs accounting in the *GAAP total expenditure format.* In order to come to a comparable Calculative Cash Outflow by figures stated in the GAAP cost of sales format additional explanation is needed – which would break the line of reasoning here. Therefore GAAP accounting issues are postponed to a later part of this Chapter).

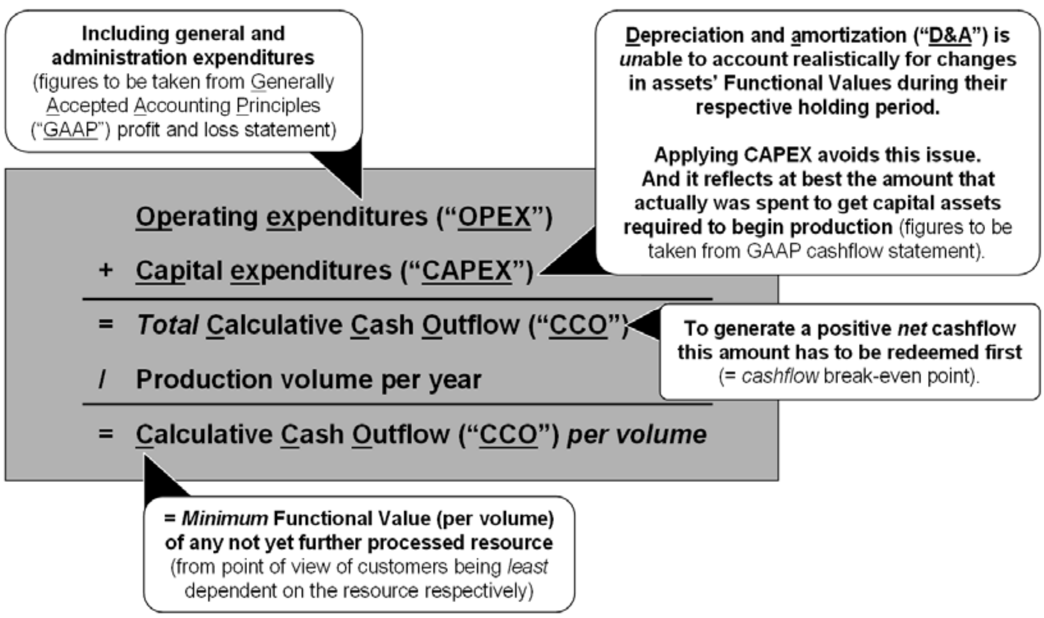


Figure 30: Resources' Functional Value measured by Calculative Cash Outflow (cf. Table 5 for more detailed calculations dependent on the GAAP format)

In Conserved (Tax) Balance Sheets *not yet further processed* resources are valued and accounted for without any margin or Value Tag, i.e. just at the amount of their Calculative Cash Outflow (cf. Chapters V, 5.1.3 and V, 5.2.1.1). This is a non-GAAP figure defined by the author. Five core assumptions are taken consciously:

1. No resource manufacturer would start production if there is no customer willing to pay *at least* an amount equivalent to the ordered volumes' *all-in costs* (= all current costs and expenses plus all replacement and capital-widening investments accruing at the respective manufacturer's total value chain). In this sense all-in costs are viable approximations for *minimum* Functional Values of any not yet further processed resource, which are assessed from the point of view of the customer(s) being least dependent on them. So from a purely economic point of view – and given the resource manufacturer has the relevant funds available – the company is able to *start* production as soon as the long-term financial forecast shows that the all-in costs can be amortized when generating a realistic sales volume. Then the manufacturer will be able to amortize all his current costs, expenses and investments – respectively (conserved) Calculative Cash Outflow – because they will equal future Conserved Cash inflow exactly. (If the manufacturer had to forego a better investment opportunity in order to produce the resource his resource allocation may be inefficient though (cf. "opportunity cost"). Decisive for it is whether or not the manufacturer will be able to realize a risk-equivalent premium in addition to Calculative Cash Outflow). In contrast, given the long-term financial forecast shows that Calculative Cash Outflow cannot be amortized, from a purely economic point of view, the issue is clear-cut, too: Any wise manufacturer would leave production of course. ("Realistic" in view of a specific manufacturer's sales forecast denotes here: The share of the forecasted total resource market volume – that is equal to long-term forecasts of total Functional Requirements –, which the company probably can capture from competitors and serve by its value chain when considering related company-external and company-internal Significant Influencing Factors (cf. Chapter V, 5.1 – in particular Figure 40)).

2. *No margin respectively no Value Tag* is accounted to (conserved) Calculative Cash Outflow. The reason is resources' manifold potential applications: They allow for a broad range of Functional Value upsides. So valuation became somewhat arbitrary given any of these upsides were considered. But leaving them retains *universality* of not yet further processed resources' Functional Values. And finally that is one major requirement in order to be able to account them to Conserved (Tax)

Balance Sheets of companies, which presumably may participate in different industries and apply the resources for manifold purposes respectively!

3. D&A is (often) *un*able to mirror changes in Functional Values of capital assets (= here: including mines and claims), which are required to produce the resources. Taking a closer look it becomes obvious that this GAAP figure should be ignored because it is speculative – or at least arbitrary – threefold:

3.1 Dependent on the respective national GAAP's specific principles and the sector the company operates in there are (often) options allowing to either capitalize investments – which would lead to D&A during the respective asset's period of use – or to book investments in total into the year of purchase – then they would be treated like costs and *no* D&A would be reported at all. Naturally such window dressing has nothing to do with investments in capital assets respectively their Functional Values. In consequence to come to *actual* all-in costs without overseeing anything (= total Calculative Cash Outflow) the (non-capitalized) current costs and expenses – that are reported in GAAP profit and loss statements – must be added to the (capitalized) investments – whose total sum can be read from GAAP cashflow statements (cf. Figure 30 and below).

3.2 D&A's amount assumes the (calculative) loss of an asset's non-conserved (market) value per time period. By now it should be clear that the explanatory power of (calculative) market values is more often than not very limited. Furthermore during an asset's holding period its *(Functional) Value not necessarily needs to decrease*. In some cases, it may increase as well – given Functional Requirements for the asset under consideration rose. (Real estate in locations that became increasingly attractive over the years is one typical example, which is known even in GAAP accounting. Another example from my practical experience is an old production facility in the chemical industry: Its output had unparalleled high quality so that customers insisted to be supplied by it going forward, too. In the past this kind of production facility was not scarce at all. But nowadays, at least in Germany, no one could get an approval of operation for a new facility. And the already existing ones became increasingly scarce due to defects. These facts increased Functional Requirements for the remaining old facilities. In consequence they gained Functional Value over time).

3.3 D&A's schedule allocates the *calculative* loss in assets' non-conserved *market values* during their period of use. But portioning non-conserved quantities cannot solve their core problem of being *detached* from changes in asset's Functional Values. So in the end – after say 10 years – some manufacturing equipment still may be valuable and used in production daily though it is 100% depreciated already (cf. above). Therefore – when applying D&A to gauge assets' values for e.g. GAAP balance sheets – these purely calculative values in all likelihood will deviate from realistic Functional Values (cf. Creamer (2008), Ohlson et al. (2010), Penman (2009)).

To solve these problems – instead of D&A – *total investments* (= capital expenditures; "CAPEX") per year should be applied to measure the Conserved Cash Outflow, which had to be spent for the capital assets – particularly the machinery and equipment – that provide the *Required Functions for resource production*. In the long run potential imbalances in view of varying yearly investment levels will be evened out: So after 10-years – which is equivalent to "long-term" in this dissertation – CAPEX mirrors best the average amount of money to be spent per year for required capital assets like manufacturing equipment; no accounting rules and regulations distort the amount actually paid for them as in contrast to applying D&A. (Admittedly the CAPEX of one specific year is not necessarily equal to the cash that was paid for investments in that year. The reason is: Companies can settle their investments at once (= one-off cash payment) and they (often) are allowed to postpone parts of the settlement (= building up of liabilities), too. But in the long run, in the going-concern case, companies must discharge their liabilities, right? Therefore within the long-term 10 year-period average CAPEX will be a viable measure for the (calculative) Conserved Cash outflow, which must be spent for investments in a "normal" financial year).

4. The all-in costs respectively (conserved) Calculative Cash Outflow of the *most common source of supply* should be accounted for when gauging a not yet further processed resource's Functional Value. Nowadays not only but also for gold – mining is most common still (cf. Figure 26). Therefore Calculative Cash Outflow for *initial* production is to be applied here. However recycling may become more important for many resources in the future – in particular with declining natural deposits and rising mining costs. This means: To get at best generally accepted values for Conserved (Tax) Balance Sheets – in the 1st step – public authorities must agree on a rule defining when all-in cost of one, two or more sources of supply should be considered to calculate generally accountable Calculative Cash Outflow (cf. Chapter V, 5.2.1.1). In the 2nd step they must decide, which peer companies' figures to be taken – this leads us to point 5.

5. Calculative Cash Outflow presumably cannot be generally accepted if calculated by one company's figures only. So from an accounting point of view it may bear a margin of error (like all calculative figures do though). Possible reasons are here: Organizational structures, processes, production technologies, "general" infrastructure (e.g. availability and quality of workers or availability, quality and length of transportation routes) determining both operating and capital expenditures that vary by company, region, over time, etc. But the margin of error can be limited by taking averages of diverse resource manufacturers. Hence the most pressing question is here: What is the decisive criterion for choosing the *"right" peers* for Calculative Cash Outflow benchmarking?

To answer this question an excursus on Calculative Cash Outflow's Significant Influencing Factors is needed. At best this can be accomplished by investigating a "one-company case". So directly hereafter Gold Field's Calculative Cash Outflow over time is examined. After this excursus there should be enough common ground to go into details of Calculative Cash Outflow benchmarking being both effective (= here: accurately enough to be generally accepted for accounting and taxation) and efficient (= here: realizable with manageable efforts).

Table 4: Calculative Cash Outflow following gold's nominal market value exemplified by Gold Fields' financial and operating figures (cf. Comex (2011), Gold Fields (2006-10))

Gold Fields Calculative Cash Outflow ("CCO") vs. gold's nominal market price

Financial year // financial line items	Unit	Division: South Africa – Driefontein	Kloof	Beatrix	South Deep[1]	Ghana – Tarkwa	Damang	Peru – Cerro Corona	Australia – St Ives/ Agnew	Corporate and other	Group consolidated ("a")	Unit	Ø Nominal gold price per Gold Fields' financial year ("b")[4]	Group's *nominal* calculative cash margin ("c") = b ./. a	Group's *percentaged* calculative cash margin ("d") = c / a
2010															
Operating expenditures ("OPEX") before depreciation and amortization ("D&A")	US$m	505.6	451.8	299.9	220.9	387.0	130.7	135.0	399.2	0.0	2,530.1	--	--	--	--
+ **Capital expenditures ("CAPEX")**	US$m	150.3	145.7	85.8	212.8	148.6	29.8	85.6	158.2	4.5	1,021.3	--	--	--	--
= ***Total* Calculative Cash Outflow ("CCO")**	US$m	655.9	597.5	385.7	433.7	535.6	160.5	220.6	557.4	4.5	3,551.4	--	--	--	--
/ **Gold production volume**	ounce t[2]	710.0	567.0	392.0	265.0	721.0	207.0	393.0	586.0	n/a	3,841.0	--	--	--	--
= **Calculative Cash Outflow ("CCO") per ounce** (= notional cash expenditure; "NCE")[3]	US$/ ounce	923.8	1,053.8	983.9	1,636.6	742.9	775.4	561.3	951.2	n/a	924.6	US$/ ounce	1,049.6	125.0	14%
Change to previous financial year	US$/ ounce	313.4	356.0	226.6	235.5	-138.2	28.9	-366.5	258.0	n/a	158.1	--			--
	%	*51%*	*51%*	*30%*	*17%*	*-16%*	*4%*	*-40%*	*37%*	*n/a*	*21%*	--	--	--	--
2009	**Unit**	**Driefontein**	**Kloof**	**Beatrix**	**South Deep**	**Tarkwa**	**Damang**	**Cerro Corona**	**St Ives/ Agnew**	**Corporate and other**	**Group consolidated ("a")**	**Unit**	**Ø Nominal gold price per Gold Fields' financial year ("b")**	**Group's *nominal* calculative cash margin ("c") = b ./. a**	**Group's *percentaged* calculative cash margin ("d") = c / a**
Operating expenditures before depreciation and amortization	US$m	391.8	342.3	226.2	131.9	338.1	132.4	86.4	330.2	0.0	1,979.3	--	--	--	--
+ **Capital expenditures**	US$m	114.8	106.4	69.9	113.3	201.1	16.9	116.8	99.6	10.3	849.1	--	--	--	--
= ***Total* Calculative Cash Outflow**	US$m	506.6	448.7	296.1	245.2	539.2	149.3	203.2	429.8	10.3	2,828.4	--	--	--	--
/ **Gold production volume**	ounce t	830.0	643.0	391.0	175.0	612.0	200.0	219.0	620.0	n/a	3,690.0	--	--	--	--
= **Calculative Cash Outflow per ounce** (= notional cash expenditure)	US$/ ounce	610.4	697.8	757.3	1,401.1	881.0	746.5	927.9	693.2	n/a	766.5	US$/ ounce	885.6	119.1	16%
Change to previous financial year	US$/ ounce	25.0	96.7	34.7	186.9	114.5	-7.1	n/a	-54.2	n/a	-45.0	--	--	--	--
	%	*4%*	*16%*	*5%*	*15%*	*15%*	*-1%*	*n/a*	*-7%*	*n/a*	*-6%*	--	--	--	--
2008	**Unit**	**Driefontein**	**Kloof**	**Beatrix**	**South Deep**	**Tarkwa**	**Damang**	**Cerro Corona**	**St Ives/ Agnew**	**Corporate and other**	**Group consolidated ("a")**	**Unit**	**Ø Nominal gold price per Gold Fields' financial year ("b")**	**Group's *nominal* calculative cash margin ("c") = b ./. a**	**Group's *percentaged* calculative cash margin ("d") = c / a**
Operating expenditures before depreciation and amortization	US$m	403.4	370.0	237.2	173.8	283.2	118.1	0.0	323.9	0.0	1,909.6	--	--	--	--
+ **Capital expenditures**	US$m	139.8	123.5	79.3	107.9	212.0	28.1	348.4	141.0	59.9	1,239.9	--	--	--	--
= ***Total* Calculative Cash Outflow**	US$m	543.2	493.5	316.5	281.7	495.2	146.2	348.4	464.9	59.9	3,149.5	--	--	--	--
/ **Gold production volume**	ounce t	928.0	821.0	438.0	232.0	646.0	194.0	0.0	622.0	n/a	3,881.0	--	--	--	--
= **Calculative Cash Outflow per ounce** (= notional cash expenditure)	US$/ ounce	585.3	601.1	722.6	1,214.2	766.6	753.6	n/a	747.4	n/a	811.5	--	833.8	22.3	3%
Change to previous financial year	US$/ ounce	109.2	102.7	174.4	359.0	254.9	116.9	n/a	200.5	n/a	236.7	--	--	--	--
	%	*23%*	*21%*	*32%*	*42%*	*50%*	*18%*	*n/a*	*37%*	*n/a*	*41%*	--	--	--	--

= ***minimum*** **Functional Value** (for resources)

Gold producers' Calculative Cash Outflow (= here: Gold Field) follows nominal market values though the figures do *not* parallel each other perfectly (e.g. financial years 2010-09 and 2007).

2007	Unit	South Africa				Ghana		*Venezuela*	*Australia*	Corporate and other	Group consolidated ("a")	Unit	Ø Nominal gold price per Gold Fields' financial year ("b")	Group's *nominal* calculative cash margin ("c") = b ./. a	Group's *percentaged* calculative cash margin ("d") = c / a
		Driefontein	Kloof	Beatrix	South Deep	Tarkwa	Damang	*Choco 10*	*St Ives/ Agnew*						
Operating expenditures before depreciation and amortization	US$m	**371.0**	**352.2**	**215.4**	**100.0**	**248.9**	**88.0**	**40.1**	**277.9**	**0.0**	**1,693.5**	--	--	--	--
+ **Capital expenditures**	US$m	**113.2**	**107.8**	**82.3**	**39.4**	**107.7**	**31.7**	**233.9**	**104.4**	**26.4**	**846.8**	--	--	--	--
= ***Total*** **Calculative Cash Outflow**	US$m	**484.2**	**460.0**	**297.7**	**139.4**	**356.6**	**119.7**	**274.0**	**382.3**	**26.4**	**2,540.3**	--	--	--	--
/ **Gold production volume**	ounce t	**1,017.0**	**923.0**	**543.0**	**163.0**	**697.0**	**188.0**	**189.0**	**699.0**	**n/a**	**4,419.0**	--	--	--	--
= **Calculative Cash Outflow per ounce** (= notional cash expenditure)	US$/ ounce	**476.1**	**498.4**	**548.3**	**855.2**	**511.6**	**636.7**	**1,449.7**	**546.9**	**n/a**	**574.9**	--	**642.0**	**67.2**	12%
Change to previous financial year	US$/ ounce	73.5	26.1	62.7	n/a	147.0	197.6	1,390.0	118.9	n/a	157.7	--	--	--	--
	%	*18%*	*6%*	*13%*	*n/a*	*40%*	*45%*	*2327%*	*28%*	*n/a*	*38%*	--	--	--	--

2006	Unit	Driefontein	Kloof	Beatrix	South Deep	Tarkwa	Damang	Choco 10	St Ives/ Agnew	Corporate and other	Group consolidated ("a")	Unit	Ø Nominal gold price per Gold Fields' financial year ("b")	Group's *nominal* calculative cash margin ("c") = b ./. a	Group's *percentaged* calculative cash margin ("d") = c / a
Operating expenditures before depreciation and amortization	US$m	**378.1**	**356.3**	**219.5**	**0.0**	**211.7**	**77.6**	**8.8**	**236.3**	**0.0**	**1,488.3**	--	--	--	--
+ **Capital expenditures**	US$m	**84.9**	**75.4**	**69.9**	**0.0**	**46.8**	**25.6**	**5.3**	**71.0**	**34.0**	**412.9**	--	--	--	--
= ***Total*** **Calculative Cash Outflow**	US$m	**463.0**	**431.7**	**289.4**	**0.0**	**258.5**	**103.2**	**14.1**	**307.3**	**34.0**	**1,901.2**	--	--	--	--
/ **Gold production volume**	ounce t	**1,150.0**	**914.0**	**596.0**	**n/a**	**709.0**	**235.0**	**236.0**	**718.0**	**n/a**	**4,558.0**	--	--	--	--
= **Calculative Cash Outflow per ounce** (= notional cash expenditure)	US$/ ounce	**402.6**	**472.3**	**485.6**	**n/a**	**364.6**	**439.1**	**59.7**	**428.0**	**n/a**	**417.1**	--	**536.0**	**118.9**	**29%**

[1] Only due to limitations in data availability costs shown are purely operational in case of South Deep, i.e. they are net of purchase price allocation.
[2] t = thousand
[3] Notional cash expenditure was created by Gold Fields as key figure for measuring the Group's and ist subsidiaries' operational performance. Please note that there may be minor deviations towards financial year reports due to mathematical rounding.
[4] Gold price figures for Gold Field's financial year 2010 are estimates because of minor imprecision in underlying data.

A synchronism between a resource's market value and its minimum Functional Value (= Calculative Cash Outflow) can be proven by applying the example of gold. Above please find a showcase based on Gold Fields' financial and operating figures from 2006 to 2010 (cf. Table 4). The figures are correlated positively because: *Market values are Significant Influencing Factors on Calculative Cash Outflows!* So given gold market values rose current costs and expenses for gold production as well as investments in mines, machinery and equipment, etc. soon will follow rising, too (cf. Focus (2009), Gold Fields (2010), WirtschaftsWoche (2010)). As stated above supply-demand-functions interlink a resource's market value with its supply. And – from an "investment appraisal point of view" – it seems logical to conclude that rising (or falling) market values can lead to rising (or falling) investments to participate in this market, too. Thus the conclusion seems valid that: In the 1st step largest resource manufacturers' supplies influence market values most significantly (because resources' market values are negatively correlated to their supply). Thereby in the 2nd step largest resource manufacturers influence most significantly (average) Calculative Cash Outflow spent in the respective resource sector in the future. So reconsidering the starting point – "narrow down margins of error in resources' Functional Valuation by taking averages" – in order get at best generally accepted values for Conserved Quantity Accounting, the interim results are:

1. Calculative Cash Outflows are neither equal for each manufacturer nor static over time. But for Conserved Balance Sheets – particularly if they should be taken to determine tax loads – they must become generally accepted as far as possible for diverse companies in manifold industries.

2. Taking averages is suggested to solve the issue; they must be measured by Calculative Cash Outflow benchmarking. So for each resource sector fiscal authorities need to assemble a statistically relevant peer group of (largest) manufacturers (cf. below).

3. The *right peers* for such Calculative Cash Outflow benchmarking can be found by agreeing on rules that define *thresholds for the company size* (e.g. by sales volumes or revenues). Since size determines resource supply and thereby influences

the market values, which feedbacks on Calculative Cash Outflow, the selection criterion "size" can be declared "effective". Over and above it limits benchmarking efforts to the top players by each resource segment. Presumably they are better equipped in view of operational and financial controlling – these two arguments suggest the selection criterion "size" can be declared "efficient", too.

Please note the practical implication of the author's line of argument: *Neither* the particular size *nor* the number of companies to be taken into consideration should be fixed equally for all resource sectors. It must be determined sector-wise instead, dependent on the respective resource market's segmentation. Given benchmarking should – as advised – incorporate the largest companies that – *taken together* – are able to influence market values and thereby economic break-even points, which let companies accept increasingly higher Calculative Cash Outflow (per volume), the following related parties should determine *sector-specific company sizes*:

3.1 *Public authorities*, who on the one hand decide on reforms of taxation rules and regulations, and on the other hand their colleagues that must apply them later.

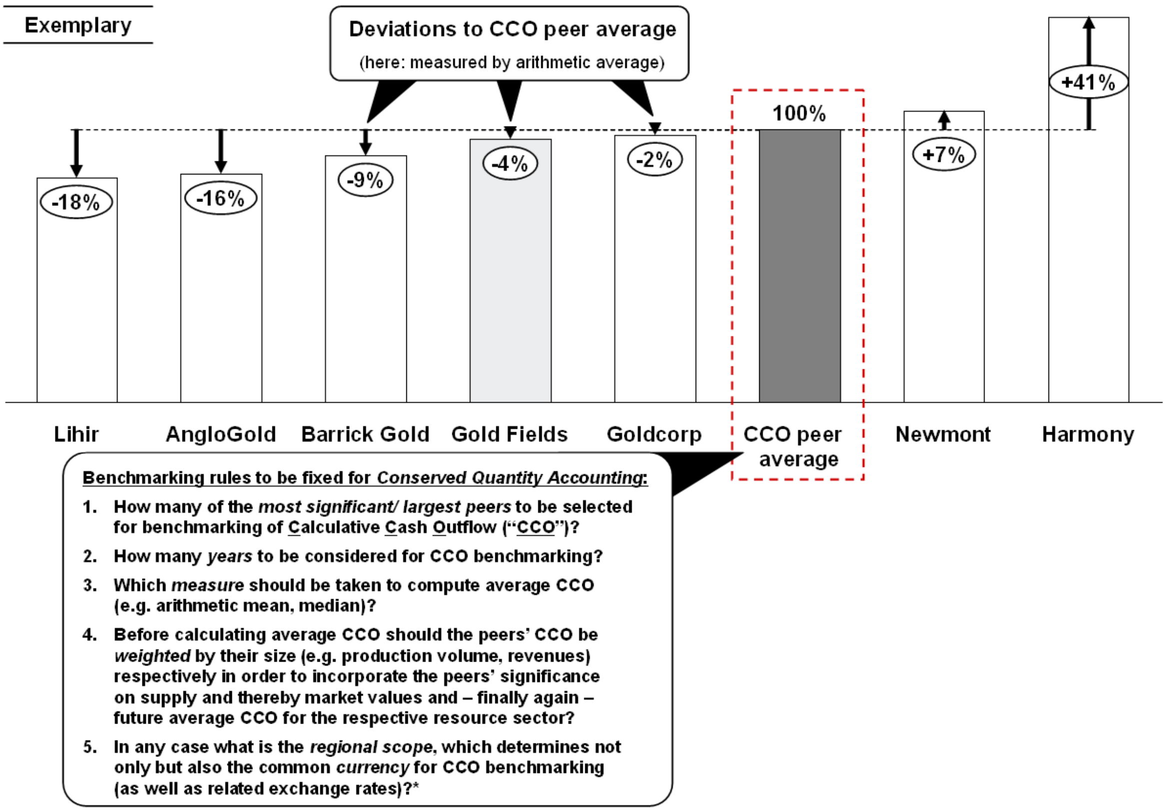
3.2 *Practitioners* in the fields of accounting and valuation, in particular accounting companies that audit annual accounts and consultancies that create valuation reports for that purpose as well as for M&A transactions (cf. "fairness opinions", "due diligence" in business transactions and corporate finance).

3.3 *Academia* in particular to determine the "optimal" company size based not solely on practical considerations but also based on well-founded economic theory. (In this context as a starting point reviews of the currently existing economic theory on competitive pricing as well as nowadays competition laws – e.g. on the European level – are suggested). In addition since academia is not involved operational strongly it could take a kind of "outside view" to challenge practices of Calculative Cash Outflow benchmarking (given it got implemented actually) to initiate a continuous improvement process ("CIP").

In view of resources' Functional Values determined by the suggested Calculative Cash Outflow benchmarking, their potential margin of error and the *general acceptance* that is attended by it, please note: Admittedly the larger the companies within the peer group are the higher their operational efficiency and the lower their total current costs, operating expenditures ("OPEX") and capital expenditure ("CAPEX") may become *per volume* (cf. "economies of scale" and "economies of scope"). But that does *not* disprove the principle approach suggested here: Given a company is too small and therefore its costs etc. are too high to produce profitably it will neither influence market values (significantly) nor participate in the respective resource sector in the long run. That makes such kind of company negligible here. And the middle-sized companies, which are able to compete long-term, are logically able to supply at the market values and still make profit (though their profit *on average* may be lower than the one of largest manufacturers). But please remember: Not yet further processed resources' Functional Values are measured by Calculative Cash Outflow (= operating expenditures + capital expenditure (in terms of the GAAP total expenditure format)). So they are *not* measured by anything else like sales volumes, revenues or profits. Therefore the suggested Functional Valuation approach is viewed being valid; it will result in generally acceptable Functional Values best possible (= requisite for effectiveness fulfilled indeed).

And in view of *practicability* of Conserved Cash Outflow-benchmarking please note that comparable large-scale benchmarking processes were performed yet – e.g. in the German energy sector: The state-run Bundesnetzagentur (= in English: Federal Network Agency; (2007)) required energy suppliers, which operated electricity and/ or gas pipeline networks in Germany, to submit financial and operating data related to them. These figures were used to simulate competition in the network-bound electricity and gas sectors in order to determine upper price-limits applicable throughout Germany. Of course accuracy was most relevant in this case, too, for the benchmarks to be accepted! Therefore the data sets the peer companies had to assemble respectively were very detailed and comprehensive in scope. Finally experience showed that both the processes of data submission and the one of benchmark calculation could be realized with manageable efforts and nonetheless adequate accuracy. Hence not only in theory – as argued above – but also in practice the requirement for efficient benchmarking seems realizable!

A summary of the considerations and tasks to be taken in order to come to a generally accepted (average) Calculative Cash Outflow is provided by Figure 31: It reconsiders the example of gold in order to indicate quantitatively the necessity for benchmarking – it is reflected in the "deviations to CCO peer average". Nonetheless the comments on (most important) benchmarking rules to be fixed apply for all kind of resource sectors, too. Given the tasks stated therein are performed one gets resources' Functional Values that can be declares sufficiently accurate for not only valuing a single mining company (and its gold on stock) from the point of view of a *(Functional) Value investor* but also for *Conserved Quantity Accounting* at large, e.g. if gold should be accounted – at its Functional Value – to Conserved (Tax) Balance Sheet of one specific mining company, one of its peers or any of their customers. Since these balance sheets will show consistently the same Functional Value per volume they naturally can be used for *determining tax loads*, too!



*Please note: There will be a follow-up dissertation in course of the research program the author participated in. It is concerned with his suggestions on Conserved Quantity Accounting applicable for taxation. Therefore he was asked to leave out related issues. But for the sake of completeness and because he intended to provide a more balanced view on his approach himself the author nonetheless summarized the – from his point of view – most important tasks for further research (cf. also Chapter V, 9).

Figure 31: Golds' average CCO by selected peer companies and related tasks (cf. company reports – in particular Gold Fields (2006-10), J.P. Morgan (2010))

3.3 Arguing Calculative Cash Outflow’s universal applicability

As adumbrated yet this Chapter IV, 3 applies (first and foremost) the example of gold but aims to develop ways and means viable for Functional Valuation of *any* not yet further processed resource. Therefore after arguing the practicability of Calculative Cash Outflow benchmarking for gold, at this point, the scope of analysis must be widened to Calculative Cash Outflow benchmarking for *any* other resource. In this context the positive correlation between market value and Calculative Cash Outflow, which is observable for gold (cf. Table 4), is essential: In case of gold largest players’ resource supplies are Significant Influencing Factors on market value because of the underlying supply-demand-function. And thereby largest players’ resource supplies become Significant Influencing Factors on the gold sector’s average Calculative Cash Outflow. By these interrelationships the right peer group of companies to submit their financial and operational data for benchmarking can be determined. But does this conclusion hold for all other resource sectors, too? To provide the author’s position right away: Yes, due to principle reasons, the suggestions made so far are valid *commonly* in view of the principal approach of resources’ Functional Valuation by Calculative Cash Outflow *and* in view of assembling a benchmarking peer group to get at best generally accepted Functional Values that – in consequence – are accountable to Conserved (Tax) Balance Sheets of diverse companies in many different industries. The line of reasoning for a *commonly* positive correlation between market prices and Calculative Cash Outflow is:

1. *Re resource supply:* In former periods it was relatively easier to get resources in large volumes by comparably cheap near-surface mining. By trend – after decades of intense mining – these “low hanging fruits” are nowadays “harvested” to a large extend. Yet the remaining “higher hanging fruits” were not touched yet at large scale. This means “scarcity” in the resources’ supply does *not yet* express limits in *absolute* availability; it must be evaluated *relative* to the costs of accessibility instead. So there are still capacious deposits for alleged “scarce resource”– most of them just were not drawn extensively yet because they are accessible relatively costlier. This brings us to the 2nd point.

2. *Re economical feasibility:* Whether or not resource deposits are accessible and drawn as of today is foremost a question of economical feasibility. The machinery and equipment fitting the Functional Requirements of e.g. more challenging deeper underground and offshore mining is available yet. So finally resource production can be widened, given the 3rd point is fulfilled.

3. *Re break-even point:* So both resource deposits and more sophisticated technical equipment are available (at large) today. The only thing yet missing for initiating operations therefore becomes “economic feasibility”. It begins as soon as the break-even point is passed. Here it is defined by the market value *per volume*, which guarantees the amortization of Calculative Cash Outflow *per volume* (= Calculative Cash Outflow break-even). Given the market value raised above this threshold – and given long-term financial forecasts suggest it will not drop below it in the future – resource producers will start accessing the deposits being harder to draw (cf. Focus (2009), Gold Fields (2010), WirtschaftsWoche (2010)).

4. *Re economic considerations = Significant Influencing Factors:* Higher market value rises resource production’s Calculative Cash Outflow break-even point *by all means* – no matter if gold, steel or noble earths, etc. are drawn. And if natural deposits are actually absolutely emptied someday in the future, given there are still Functional Requirements for resources, the break even point for any kind of production still will be decisive. But then production costs of recycled resources presumably must be taken into account increasingly. Therefore technically considerations that may be specific to certain kinds of resources like gold are negligibly here.

5. *Conclusion – Calculative Cash Outflow benchmarking is valid universally:* Taking points 1. to 4. collectively into consideration market value seems to be Significant Influencing Factor on both availability – respectively resource supply by manufacturers – and average Calculative Cash Outflow for the resource sector on the whole. In consequence a valid means to the end of getting resources’ Functional Values respectively are Calculative Cash Outflow benchmarks considering from each resource sector the largest producers’ financial and operating figures.

The bottom-line result is that Calculative Cash Outflow is qualified for Functional Valuation of *all* not yet further processed resources because: It measures the (Conserved) Cashflow break-even point at which it becomes economically sensible for the average resource manufacturer to provide any resource to customers. And the all-in costs that are summed to come to Calculative Cash Outflow are Conserved Quantities because: With respect to company-*ex*ternal Significant Influencing Factors the Functional Requirement for any resource (= conserved part of total market demand) can be forecasted long-term. And by taking the company-*in*ternal Significant Influencing Factors into consideration, too, any resource manufacturer can gauge how much of the total (conserved) market volume can be captured. Then for the average resource manufacturer the break-even point is determined by the two remaining variables: Market value per volume and his *conserved* all-in costs (= Calculative Cash Outflow) per volume. Given every customer's perception is that a resource's Functional Value is below its market value they (at large) will not buy – and the average manufacturer would stop production and supply in order to end making losses. In this sense given that the average manufacturer is able to find (enough) customers that want to be supplied at his *conserved* all-in costs (= Calculative Cash Outflow) – potentially plus a non-conserved, volatile and potentially chaotic market premium – *Calculative Cash Outflow becomes the conserved part of the resource's market value!* That qualifies Calculative Cash Outflow to be robust (= non-chaotic) Conserved Quantity to be applied for (verification of) long-term financial forecasts – finally the market value will not fall below it. (Please note that the author accepts that lower all-in costs may increase the share of (conserved) market volume any manufacturer may capture (and vice versa). And – as noted above yet – higher market shares may lead to lower all-in costs per volume. But this does *not* falsify the line of reasoning here; it just requires any manufacturer under consideration to perform the business case calculations iteratively).

3.4 Calculative Cash Outflow reconciliation by diverse GAAP formats

Given it is sensible to apply average resource manufacturer's Calculative Cash Outflow going forward – like the above line of reasoning suggests – the remaining question here is how to calculate Calculative Cash Outflow unambiguously. It is namely a non-GAAP figure – hence there may be misperceptions what its addends "operating expenditures" and "capital expenditures" mean from Conserved Quantity Accounting's point of view. In addition this Chapter IV, 3 favored implicitly the GAAP total expenditure format until now; how to compute Calculative Cash Outflow based on the GAAP cost of sales format must be explained yet. But to finally come to "average Calculative Cash Outflow" by resource, which is accountable to Conserved (Tax) Balance Sheets of diverse companies in many different industries – i.e. at best generally accepted –, allocation of relevant current costs and expenditures, replacement investments and capital-widening investments must be well-defined. Naturally in this context any kind of accounting options should be minimized. Then (conserved) Calculative Cash Outflow can be computed unambiguously and compared over time and between peer companies – as required for benchmarking. To reach this goal the general rule is to account for resource manufacturers' total current costs respectively operating expenditures, which accrue by *providing* resources to customers. "Providing" stands for a resource manufacturer's ordinary course of business here (= all Required Functions the company must fulfill properly for going-concern long-term). Please note that this is *beyond* physical production. Dependent on the value chain of the most common source of supply (e.g. initial production or recycling), current costs and expenses of every step that adds to the resource's Functional Value must be incorporated, from research and exploration to final delivery. In this sense "providing" means everything, which adds to a resource manufacturer's Functional *Firm* Value, except of things that are not related to his core business. (If there are nonetheless imbalances in the value chains' scope within one and the same resource sector, on the financial level, they are evened-out appropriately by taking averages of leading companies' all-in costs).

The following three Sub-Chapters dwell on the identification of line items from *either* GAAP financial statement format, which must be treated with care to guarantee that (conserved) Calculative Cash Outflows are comparable indeed. (For your convenience the findings are taken up and listed well-arranged in Table 5):

3.4.1 Finding conserved operating expenditures in GAAP profit and loss statements

All operating expenditures respectively current costs, which occur in the *ordinary* course of business must be summed from the very 1st production stage (e.g. exploration for mining companies), over "physical" production (e.g. mining or recycling) to sales and final delivery. They form the essential part of expenses and costs that lead to Calculative Cash Outflow. In terms of the GAAP total expenditure format this means: All expenses must be accounted for, which collectively result in the line item "operating expenditures". In terms of the GAAP cost of sales format this means: All current costs and expenses adding to the line items "costs of goods sold" ("COGS"), "selling, general and administrative expenses" ("SG&A") as well as "other operating expenses" must be accounted for.

For either GAAP reporting format it turned out being sensible to check how the so-called "other operating expenses" contributed to resource manufacturers' Functional Firm Value creation by providing resources to customers. The other operating expenses should be accounted to Calculative Cash Outflow only if they affected the production and/ or sales volume indeed). So the universal "financial accounting rule" for proponents of either GAAP format is: *In order to account for Calculative Cash Outflow's essential current costs and expenses add all GAAP line items above operating income, which show costs or expenses.* "Essential" denotes that there are exceptions: Selected line-items below operating income also must be summed to Calculative Cash Outflow given they enhance the production and/ or sales volume (cf. below)). In any case deducting these current costs and operating expenses from total revenues equals operating income, which in GAAP terms is also called *adjusted* earnings before interest, taxes, depreciation and amortization ("EBITDA"). To reconcile these GAAP figures one must set up the following equation: *Operating* income = *adjusted* EBITDA = (unadjusted) EBITDA – of extraordinary result = (unadjusted) EBITDA – *other income* + *other expenses*.

At this point, the author would like to explain his universal “financial accounting rule” for Calculative Cash Outflow in more detail, to oblige potential critics right away. They might take up two things here:

1. Why addressing earnings and income given that Calculative Cash Outflow considers all-in *costs* only? The answer is: The author intends to provide “accounting rules” for Calculative Cash Outflow, which can be applied by anyone irrespective of the GAAP format he/she is accustomed. By definition Calculative Cash Outflow must consider not only but also all current costs accruing in a resource manufacturer’s ordinary (= operating) course of business. And operating income does not only measure a manufacturer’s operating performance but also it is like the “lowest common denominator”: Above it the GAAP formats show different line items having different amounts respectively and below it everything is equal totally. (The assumption implicitly taken here is that inventories are valued by applying the same criteria in either GAAP format). Therefore – no matter which GAAP format is on hand – operating income (= *adjusted* EBITDA) is a good starting point to reconcile operating expenditures that are relevant to gauge Calculative Cash Outflow.

2. In core the author’s “accounting rule” suggests: Reconcile all operating expenditures – which is a line item known GAAP *total expenditure* accounting – or all current costs and expenses stated in the GAAP cost of sales format and you get the essential costs to compute (total) Calculative Cash Outflow. But in course of reconciliation GAAP total expenditure accounting naturally is put on a level with GAAP cost of sales accounting. This is possible yet it might be confusing (at least at first glance) because: On the one hand operating income (= *adjusted* EBITDA) must show the same monetary amount independent of the GAAP format. On the other hand revenues as well as operating expenditures, current costs and expenses are entered in the books by different criteria: GAAP total expenditure format allocates expenditures to cost categories (material expenses, general expenses, personnel expenses, expenses for external services and other operating expenses); GAAP cost of sales format allocates expenditures to areas of operation (accounts aggregated to costs of goods sold and selling, general and administrative expenses as well other

operating expenses). Though these differences are conspicuous they are minor important here. More important is: The amount of *total revenues* and the amount of *total expenses*, which must be considered to come to operating income, are *une*-qual. The reason is: As indicated by the name the GAAP total expenditure format reports *total* expenses of operations within an accounting period (= here: financial year). But costs of production and revenues of selling one and the same resource *volume* not necessarily occur within the same period. Therefore *changes in inventory* must be accounted for here, too. (In the GAAP total expenditure format decreases in inventory are entered in the books like expenses and increases in inventory are entered in the books like income. This is performed above the line item "total revenues"). The same principle applies to *work performed by enterprise that must be capitalized*, i.e. work performed and used up (internally) by one and the same company; it must be added to total revenues. Therefore *total revenues* and *total expenses* are (most likely) higher in the GAAP total *expenditures* format than in the GAAP cost of sales format. After all the GAAP cost of sales format shows revenues, current costs and expenses that accrued within *one and the same* accounting period. This means: Only those costs and expenses are reported, which accrued for the products that were in actuality sold to customers within this period. Consequently changes in inventory and capitalized work performed by enterprise must not be considered here.

So the tricky issue that must not be overseen is: There are different perceptions in particular regarding a company's so-called "allocation of revenues and expenses to appropriate accounting period". Therefore – dependent on the GAAP format at hand – there are *different line items* (above operating income) showing *different amounts of money* that must be charged to get Calculative Cash Outflow respectively. But is this a reason for criticism; does this really harm unambiguous Calculative Cash Outflow calculation for one or more company as needed for benchmarking? The author opines: Not at all! He reasons: The differences regarding revenues and operating expenditures as opposed to current costs and expenses were explained yet (cf. above). The bottom-line for working with any company's financial figures is: When adding in the GAAP total expenditure format line items, which show expenses above operating income, one gets *total* operating expenditures for *total* Calculative Cash Outflow related to *total production volume* of the accounting period. When adding in the GAAP cost of sales format line items, which show current costs and expenses above operating income, one gets *total* operating Calculative Cash Outflow related only to *sales volume* of the respective accounting period. Naturally these (parts of) *total* Calculative Cash Outflows have unequal amounts (irrespective of the fact that capital expenditures must be added still); the first one's amount is higher in all likelihood. But this is completely irrelevant for Calculative Cash Outflow benchmarking and Conserved Quantity Accounting: Common sense suggests that Calculative Cash Outflow *per volume* is the decisive figure in either case – everything else is just an interim result. (For Calculative Cash Outflow benchmarking a ratio (= here: "per volume") must be applied in order to balance largest resource manufacturers' differences in size. Otherwise the largest company – by production volume and/ or sales volume – most likely reports the highest *total* Calculative Cash Outflow though it may produce more efficiently compared to its peers (= here: at lower all-in cost *per volume* = at lower Calculative Cash Outflow *per volume*)). Logically there is just one "operating accounting rule" remaining, which must not be forgotten: *Account consistently for resource volumes!* In case of GAAP total expenditure reporting apply the respective resource's *total production volume* per accounting period (irrespective of whether or not it was sold in total yet or changed inventory). And in case of GAAP *cost of sales* reporting take the respective resource's *sales volume* per accounting period. Then – irrespective of the GAAP reporting format that served as starting point – there are *no* deviations on the level of Calculative Cash Outflow *per volume*!

In summary the solution to manage effectively differences in GAAP formats is: Add operating expenses or current costs above operating income dependent on the GAAP format at hand. Then divide the sum consistently by the related resource volume. Thereby you definitively get the *lion's share* of the operating expenses required to come to Calculative Cash Outflow *per volume*. So in the end the solution is nothing but applying the "operating accounting rule" dependent on the line items and their reference period, which both are defined by the "financial accounting rule". This seems straight forward and easily applicable. Therefore – given the "technical" issues regarding the two GAAP reporting formats are understood – potential criticism may be charmed away.

The excursus above became relevant because – in order to facilitate Conserved Quantity Accounting with respect to any resource's Functional Value – GAAP figures must be taken as starting point. Now it should be clear how to get the "right" financial and operating figures respectively. As a result most of the relevant current costs and expenses should be identifiable unambiguously by now. There is just one exemption; it relates to either GAAP format's interpretation of current cost, operating expenses and the line item "other expenses": Both (unadjusted) EBITDA as well as *adjusted* EBITDA (= *operating* income) are intended to quantify a company's *operating* performance *before* investments. Therefore – when beginning Calculative Cash Outflow calculation by adding the costs respectively expenses that lead to such kind of figures –, replacement and capital-widening investments must be added definitively (cf. 2. below). But there is another issue in particular regarding (unadjusted) EBITDA: It contains the so called *"extraordinary result"* (= net of other income and other expenses). And what events are "extraordinary" may be disputable from a purely GAAP point of view. Over and above analysis from Conserved Quantity point of view may lead to a divergent result. So another approach is advised:

1. In the first step account for the current costs and expenses that are essential for Calculative Cash Outflow: One could also advice to account for the lion's share of costs and expenses accruing in a resource manufacturer's value chain due to operations during a *"normal"* financial year. For it current costs and expenses being part of the *adjusted* EBITDA (= EBITDA net of extraordinary result = *operating* income) should be taken; thereby one gets at best the actual operating costs and expenses in course of providing resources to customers. But also this definition is not unambiguous yet: In practice companies may take the bait of polishing the figures. So they may perform window dressing by allocating as much as possible to alleged "extraordinary" other expenses – then also *adjusted* EBITDA looks better (at least given further analysis is omitted). Naturally this is not leading to the desired result here (= calculate resource manufacturers' actual *operating* current costs and ex-

penses unambiguously so that they are comparable between peers and over time). In this sense for “correct” accounting the decisive question is therefore: Do costs and expenses occur in course of providing customers self-produced resources (= source of Functional Firm Value creation in this case)? If so they must be declared “operating” indeed and consequently must be added to Calculative Cash Outflow. Therefore also less-obvious GAAP line items e.g. for mining-royalties (often payable in the resource sector) as well as costs for pollution rights (if applicable) must be included. To phrase the accounting rule implied herein more universally: *Into Calculative Cash Outflow all operating costs and expenses must be included except of those one-off activities that result in other expenses, whose origin and/ or purpose are of non-operative nature respectively (e.g. litigations and financial settlements)!*

2. In the second step account for remaining operating costs and expenses during an “*ab*normal” financial year: In this context special cases to be treated with care are *closed* M&A transactions: In GAAP profit and loss statements a company that bought another one (probably) allocates M&A-related one-off costs (e.g. consulting and legal advisory costs, financial settlement and restructuring costs) to other expenses. However these costs also must be added to Calculative Cash Outflow because: For Functional Value creation it is *ir*relevant in the end whether a resource manufacturer had built its business from scratch by acquiring all relevant assets and hiring all relevant workers by itself over time or whether it had leapfrogged the build-up phase by acquiring another company (= target) owning a yet established resource-producing business. In both cases the buying company does nothing else than acquiring assets, which confirm the Required Functions “produce resources” and/ or “sell resources”, right? In this sense from the buyer’s point of view the M&A-related costs are one-off costs indeed. But they are of *operating* nature from a Conserved Quantity Accounting point of view because they bear comparison with *“regular” capital-widening investments*! In consequence M&A-related costs are to be added to Calculative Cash Outflow. (Looking at the seller the matter is different though: If a resource producer sells one of its businesses the income generated thereby is definitively extraordinary: After all the company’s core business is nei-

ther asset trading nor investment banking). Please note to account for *closed* M&A transactions only – costs for e.g. due diligences that never resulted in an acquisition do not confirm to a resource manufacturer's Required Functions "produce resources" and/ or "sell resources", are therefore not comparable to capital-widening investments and consequently must not be added to Calculative Cash Outflow. (Please note also that in a *closed* M&A case the buyer admittedly pays not only for the target's capital and current assets, the order book, etc. as of the signing date. The buyer pays for the cashflow generable in the future by applying the target's assets *plus* a premium. But the fact that a premium must be paid does not harm the above line of reasoning: Let us assume the buyer tried to establish from scratch by itself the same business as the target – then the buyer must pay his workers for it and invest in capital and current assets, too. In addition the buyer looses time (cf. "time value of money") and probably has to spend and invest more than the target had to spend before (cf. "first mover advantage"). These additional costs and expenses of "do-it yourself build-up from scratch" should even-out the premium; the comparison to closed M&A transactions therefore seems to be valid).

In summary, in order to get from current GAAP reports all inputs for Calculative Cash Outflow calculation, add-up the following: All operating expenses, current costs and expenses leading to *adjusted* EBITDA (= essential part of Calculative Cash Outflow within a "normal" financial year) and M&A-related one-off costs (= remaining part of Calculative Cash Outflow accruing in an "*ab*normal" financial year). Then divide this interim result either by total production volume – given financial figures were copied from a GAAP total expenditure reporting – or by sales volume – given financial figures were copied from a GAAP cost of sales reporting. The result – a resource's Calculative Cash Outflow *per volume* – expresses the impact of the *operational efficiency* of a manufacturer's value chain on its financial performance – and thereby finally its Functional Firm Value – by considering all current costs, expenses and investments accruing in the regular course of business as well as *closed* M&A transactions that parallel capital-widening investments. (Except of costs of *closed* M&A transactions no other expenses are considered here due to their non-operating origin). And by starting accounting "everything" above *adjusted* EBITDA other important assumptions are realized implicitly already: *No interest* is considered because a company's pattern of finance (= ratio of equity to dept or vice versa) has nothing to do with operating activities within a company's value chain. *No D&A* is considered – it has too limited explanatory power for manufacturing equipment's changes in course of Functional Value creation. (And accounting options minor D&A's explanatory power even further and thereby would harm the comparability of Calculative Cash Outflows given D&A would not left out). The same arguments hold for taxes on income – they are not related to operational efficiency in course of Functional Value creation. Instead accounting options as well as tax shields may dilute companies' actual operational efficiency and expenditures. Over and above taxes vary by country and/ or region. Therefore *taxes on income are left out*, too. So the remainder equals the operating costs and expenses deductible from total revenues to get *adjusted* EBITDA (= *operating* income). And given Calculative Cash Outflow also comprises these remaining GAAP line items – plus investments – the thereby expressed amount would be traceable, comparable between companies and therefore applicable for Calculative Cash Outflow benchmarking. (If not otherwise stated cf. goetzpartners (2007) and Matchett (2003) for this Chapter IV, 3.4.1).

3.4.2 Finding conserved investments in GAAP cashflow statements

All replacement and capital-widening investments along a resource manufacturer's value chain – i.e. from those of the 1st production stage to those of the final delivery stage (before external logistics set in) – must be considered for a resource's Functional Valuation. Therefore Calculative Cash Outflow is defined in the broadest sense here. The author claims there are good reasons for it: Before a company can decide whether or not it is economically sensible to produce anything it has to determine the all-in costs. And by definition they comprise investments, too. So the (conserved) all-in costs equal the amount of money, which the company must amortize by its resource business under consideration in order to start generating profit. Therefore a financial statement of all-in costs must not stop on the production level. Instead all investments the company has to incur if it wants to be able to *provide* its resource to customers must be summed-up. Consequently all replacement and capital-widening investments paid to acquire and maintain a company's infrastructure and manufacturing equipment with performance good enough to compete successfully must be added to Calculative Cash Outflow. Please note that these investments may not be capitalized though dependent on the specific GAAP. This means: They may be entered to the books as costs in the GAAP profit and loss statement. (For example in course of the implementation of the second stage of the revenue-cap regulation of the German Bundesnetzagentur (2007), for some utility companies, there was a strong incentive to book investments as maintenance costs meanwhile. Thereby they could optimize their capital lockup. And since that procedure was legal for a while in Germany analogous proceedings may be legal still elsewhere). In any case, following the author's advises regarding costs and expenses that are relevant for Calculative Cash Outflow, the costs – that are investments in capital assets in actuality – will be accounted for correctly, too. (If not otherwise stated cf. goetzpartners (2007) and Matchett (2003) for this Chapter IV, 3.4.2).

3.4.3 Summary: Enhanced reconciliation of conserved line items by GAAP reports

In conclusion it is *irrelevant* whether or not parts of the workforce or any of the current and capital assets (e.g. the IT-system) are "applied" in the production, controlling or sales department: The related current costs and operating expenditures as well as the related capital expenses that had to be spent in order to get, retain and maintain them must be added to Calculative Cash Outflow given there are Functional Requirements to apply the workers and assets anywhere to finally *provide* a resource to the customer(s) that have Functional Requirements for it. And "provide" is beyond physical production; it includes each Functional Firm Value adding step from research and/ or exploration to selling.

Table 5: Enhanced reconciliation of conserved line items from GAAP reporting (cf. Table 1 as well as Creamer (2008), goetzpartners (2007), Matchett (2003))

Reconciliation of conserved parts of net income/ loss, free cashflow to the firm ("FCFF") and Calculative Cash Outflow ("CCO")

Cost of sales format: Operator	Cost of sales format: Line item	Total expenditure format: Operator	Total expenditure format: Line item
	Net sales operating	(=)	**Net sales operating**
		+	**Work performed by enterprise & capitalized**
		+/ -	**In-/ decrease in inventories** (of semi-finished and finished goods)
=	**Total revenues**	=	**Total revenues**
+	**Other operating income**	+	**Other operating income**
=	**Total operating income**	=	**Total operating income**
-	**Costs of goods sold ("COGS")** (= Sum of all material and personnel expenses that occured by generating the products or services sold)		
=	**Gross profit**		
-	**Selling, general and administrative expenses ("SG&A")** (= Sum of all expenses, including personnel expenses, related to selling the products or services, research and development ("R&D") and administration)	-	Material expenses
		-	General expenses
		-	Personnel expenses
		-	Expenses for external services
		-	Other operating expenses
-	**Other operating expenses**	*[Subtotal]*	**Operating expenditures ("OPEX")**
=	**Operating income**	(=) =	**Operating income**
		+	Other income
		-	Other expenses
		[Subtotal]	**Extraordinary result**
		=	**Earnings before interest, taxes, depreciation and amortization ("EBITDA")**
		-	Depreciation
		-	Amortization
		=	**Earnings before interest and taxes ("EBIT")**
		+	Interest income
		-	Interest expenses
		[Subtotal]	**Net interest**
		+	Other financial income
		-	Other financial expenses
		[Subtotal]	**Net financial result**
		=	**Earnings before taxes ("EBT")**
		-	Taxes on income
		-	Other taxes (affecting net income)
		[Subtotal]	**Total taxes**
		=	**Net income/ loss**
		+	Depreciation
		+	Amortization
		+/ -	In-/ decrease in accruals
		+/ -	In-/ decrease in other non-cash items
		=	**Gross cashflow**
		-/ +	In-/ decrease in inventories
		-/ +	In-/ decrease in trade accounts receivables
		-/ +	In-/ decrease in other accounts receivables (to affiliated companies, etc.)
		+/ -	In-/ decrease in trade payables and related accounts
		+/ -	In-/ decrease in other payables (to affiliated companies, etc.)
		+/ -	In-/ decrease in customer deposits and advances
		[Subtotal]	**Net cashflow from Δ working capital**
		=	**Cashflow from operations**
		-	Investments (= capital expenditures ("CAPEX"))
		+	Disinvestments
		[Subtotal]	**Net cashflow from (dis-) invesmtents**
		=	**Cashflow after investing activities (= free cashflow to the firm ("FCFF")**
		+	Interest expenses
		=	**FCFF to compute discounted cashflow ("FCFF DCF"), applying the weighted average cost of capital ("WACC")**

To reflect *conserved part of market value* and to guarantee consistency with *Conserved Balance Sheet*, apply products' Functional Values (cf. Chapter V, 5 -- in particular Chapter V, 5.2.1.2).

= *adjusted* **EBITDA**

To retain consistency with *Conserved Balance Sheet* account for changes in Functional Values (cf. Chapter V, 5.2).

(+) ***Total* Calculative Cash Outflow (related to *production* volume)**

(+) ***Total* Calculative Cash Outflow ("CCO") (related to *sales* volume)**

In either GAAP-format, to compute ***total Calculative Cash Outflow***, it is *not* relevant where the money is spent (either in the current cost budget or in the capital budget). In the end it is spent nonetheless! Consequently -- to measure *total* Calculative Cash Outflow correctly -- the sum of non-capitalized and capitalized costs that occured in a resource manufacturer's ordinary course of business must be summed (= either: COGS + SG&A + CAPEX or: OPEX + CAPEX). If other expenses enhanced the core business -- like capital investments would do -- they must be added, too. For resources, which are not yet further processed, **Calculative Cash Outflow *per volume*** (per ounce, per kg, etc.) measures ***Functional Values***. Please apply either sales or production volume dependent on the GAAP-format taken for *total* Calculative Cash Outflow-calculation.

To retain consistency with ***Conserved Balance Sheet*** account for changes in Functional Values -- instead of using deprecration and amortization -- and account for changes in working capital that are measured by Functional Values only (cf. Chapter V, 5.2).

Free cashflow to the firm equals the cash available to all of the firm's investors (including common and preferred stockholders as well as bondholders), after the firm bought and/or produced and sold products, provided services, paid its operating expenses and performed short and long-term investments.

Applied for calculation of ***Functional Firm Value***.

The ***costs of debt*** (= interest expenses) are accounted for by the WACC. Therefore interest expenses must be added-back before discounting the FCFF DCF. Otherwise the cost of debt would be considered twice.

Finally this Chapter IV, 3 shall be closed by referring to a new school of thought in mining sector's accounting that is compatible with the author's Functional Valuation approach for resources: In practice there are financial figures *similar* to Calculative Cash Outflow – however they do not account for all elements of *conserved* all-in costs (cf. Chapter V, 2.2 – in particular Figure 46 – that depicts the terms and conditions of Strict Conservation Law in Business). The common deviations relate to mining royalties, greenfield exploration costs and/ or one-off costs such as purchase price allocations due to closed M&A transactions. To consider resource manufacturers' *conserved* all-in costs for all value chain steps and assets, whose Required Functions were applied to provide within a financial year the resource volume (= production or sales volume dependent on the GAAP format on hand), Calculative Cash Outflow consistently accounts for these costs. Other proponents of all-in costs accounting leave them out though. But particularly in a "normal" financial year without closed M&A transactions deviations are of minor nature. In view of such all-in costs' *practicability and explanatory power* the professional journal Mining Weekly follows: "With cash costs dethroned, ounces of production uncrowned, and reserves defrocked, it seems that free cashflow is the newly crowned king" (Creamer (2008)). And to measure the resource production's influence on free cashflow, the companies use simply all-in cost figures having idiosyncratic names. Up to the author's knowledge the most widespread one was developed by Gold Fields, the 4th largest gold mining company in the world. They introduced a ratio called "notional cash expenditure" ("NCE") to compute the all-in costs per ounce or kilogram of gold and copper for the Group and for each operation in order to offer investors greater cost transparency of the mining sector. This objective conforms to Calculative Cash Outflow as developed in this dissertation. Notional cash expenditure expresses (nearly) the same as Calculative Cash Outflow as a matter of principle. So not only the figures' purposes but also their calculations can be reconciled easily (notional cash expenditure = Calculative Cash Outflow – greenfield exploration costs – closed M&A transactions' purchase price allocations). Such financial figures' superior explanatory power compared to other financial figures is advertised also by Nicholas Holland, Gold Fields' CEO: "The accounting profession, I think, has been responsible for capitalizing more and more expenses that ordinarily would have been working costs, like ore-reserve development costs. Over the years, people have tended to capitalize all of that. It makes their cash costs look good, but people see that the capital's gone up, and find that, although their cash costs look good, they don't make any cash, and you say, 'But why?' and it's because too much has been capitalized. We are saying: forget about that. What you are to look at is the NCE per ounce, which is capital and operating costs expressed together on a per-ounce basis because it doesn't matter where the dollar is spent, in the capital budget or in the operating cost budget, it is still spent, and we need to know what the total cost per ounce is after all of that, and that's going to be the driver for us" (Holland cited by Creamer (2008)). The executives of Gold Fields achieved notional cash expenditure's group-wide implementation because they opine that – at the end of the day – all-in costs determine whether or not money is made. Furthermore the company claims it is the *only true measure of free cashflow generation* to pay greenfield explorations interest and dividends as well as taxation. Hence in the long run – e.g. 10 years – it reflects the cash that actually had to be spent to get one unit of a specific resource. (Therefore it also seems to be an appropriate *starting point* to measure both *Conserved Cash inflow* generable by a company that produces and sells a resource as well as to measure the related *conserved* all-in current costs, expenses and investments by Calculative Cash Outflow. The adjustments explained herein to come to *conserved* all-in costs must be performed in any case though). Presumably due to these reasons some of Gold Fields' peers started adopting financial figures to measure all-in costs, too (cf. Creamer (2008), Gold Fields (2006-10), J.P. Morgan (2010)). And taking together the facts that firstly accounting of all-in costs became increasingly popular and that secondly deviations between particular financial figures like notional cash expenditure and Calculative Cash Outflow are of minor nature – particularly in "normal" financial years – there seem to be good reasons to give a chance to Calculative Cash Outflow, too!

3.5 Addendum: Calculative Cash Outflow benchmarking in context of regulating markets for agricultural resources

After finishing this Chapter IV, 3 the Spiegel, one of Germany's leading news magazines, issued a publication entitled (translated to English) "Speculation with misery". Therein the authors argue: Food products become more expensive so that millions of people cannot afford their staff of life anymore. There is climate change, the growing world population and the cultivation of crops applied for green fuels (= here: selected Significant Influencing Factors) – all these obvious factors seem to be logically understandable reasons but the misery's principle blame bears none of them. Instead the speculators' gilt is at fault: After the financial industry entered the *agricultural resource business* the market values exploded – and with them the third world's misery. It becomes obvious that today – instead of market participants having anything to do with food – institutional "investors" having large funds at their disposals dominate agricultural resource markets. And thereby – according to the Spiegel – the misbalances between (large) traded volumes and (relatively lower) actually required ones originated so that – as final consequence – market values must overshoot because they lack any kind of fundamental fixture (cf. Spiegel (2011a)).

Please note that the Spiegel's status report resembles perfectly the examples dealt within this dissertation: There is (non-conserved) demand that is unequal to (conserved) Functional Requirements. And therefore (non-conserved) market values must be unequal to – respectively in all likelihood must be higher than – (conserved) Functional Values. And given institutional financial "investors" do not decide based on Significant Influencing Factors on Functional Requirements for resources but on short-term trends and guided by speculations – simply because they never intended to actually absorb a product to bring any of its functions to application – these people in actually are to be called "speculators". As such – like described in the reportage – they are even "economically harmful" because they contribute to market distortions instead of contributing to robust (= non-chaotic) market equilibria based on fundamental facts (= one of markets' elementary purposes). Or put alternatively: The speculators rather contribute to market value bubbles and volatility than to market equilibria, whose values are (in large parts) somewhat related to – or at least positively correlated with – Functional Values so that they could provide predictability and planning reliability. Taking these considerations together the author decided to discuss briefly Functional Valuation – respectively potential market reforms by applying it to the agricultural resource sector – in order to provide an alternative suggestion to better the situation. Ultimately the Calculative Cash Outflow approach must be universally applicable for any kind of resource, i.e. also for agricultural ones. (Though the author claims this requirement is fulfilled, for applying Calculative Cash Outflow beyond the scope of Conserved Quantity Accounting and Functional Valuation of *single* transactions – like here for market regulation – additional considerations must be taken (cf. below)).

Before suggesting an alternative method for resolution – and align with it a potential area for future research – it seems necessary to present some background information on the development of agricultural resource markets' structures. Inevitably the step-wise turning away from Conserved Quantity orientation becomes obvious thereby; it is interesting to discover that – as markets were working satisfactory in former periods – market participants' decision making *implicitly* must have been guided (to a large extend) by Conserved Quantities:

1. *Market access deregulation in 1999:* Before 1999 pricing of agricultural resources was somewhat "objective" because market participants predominantly were required to have something to do with the agricultural sector – like farmers, millers, warehousemen, multinational food companies, etc. In consequence agricultural resources were absorbed and taken off the market in most instances because the buyers wanted to make profit by satisfying Functional Requirements (back then: "satisfy hunger"; today to a minor extend accompanied by usages like: "produce green fuel"). For that agricultural resources had to be *applied*, e.g. milled, baked and finally eaten. And thereby each and every resource volume could have been used just once (= Strict Conservation Law in Business was fulfilled (cf. Chapter V, 2.2)). So by limiting the market access to a group of people that in actuality was concerned with the products – respectively their inherent Required Functions – regulatory authorities automatically limited market demand to round about (conserved) Func-

tional Requirements. Finally that resulted in *robust market values* being much less unpredictable, much less volatile and finally much less prone to chaos than today.

At this occasion please note that the term “robust market values” does not mean “stable market values” or “fixed market values”: Robust market values are allowed to change – and shall change in actuality – given at least one Significant Influencing Factor (on Functional Requirements for a resource) changed before. But robust market values should remain about equal, too, as long as there was no change in Significant Influencing Factor(s) before. In this sense “robust” may be understood at best as “non-chaotic” (in the mathematical sense). In consequence robust market values are nothing else than market prices, which *resemble* Functional Values at best. For a graphical example please remember Figure 25 in the SAP case: (Robust) Functional Firm Value changes indeed. It follows an upward trend without significant shifts or breaks. Thereby it reflects operative Functional Value Creation, which develops gradually and foreseeable. Hence (conserved) Functional Firm Value can be declared “robust” (= non-chaotic) indeed. Instead the (non-conserved) stock market price varied wildly within the same time period – irrespective of the robustness of SAP’s underlying businesses. In consequence here the market price respectively the market value must be declared “volatile”. Over and above it showed repeatedly to be “chaotic” – due to its often significant rises, spontaneous turning points and massive drops. Please also note that (conserved) Functional Values are always robust (= non-chaotic), i.e. not only in this example. The reasons are that changes in Significant Influencing Factors materialize relatively slowly so that Conserved Quantities cannot change without notice and without further ado. In addition market prices respectively values market do not always resemble Functional Values. In actuality market values not necessarily account for (conserved) Functional Requirements of customers so that they are at large variance to (conserved) Functional Values more often than not. Therefore market values tend to be volatile and maybe develop chaotically (= not robust) – this issue prevails not only in the example of SAP but also in nowadays’ markets for agricultural resources (cf. Figures 34 and 35 below).

However let us come back and examine the special case of agricultural resources in more detail. The reasons why limiting the access to the agricultural resource markets had worked out particularly well before 1999 are: The market values were more robust (= less prone to chaos). And to make money in such robust markets the agricultural resources on the one hand had to be accepted, maybe further processed and finally resold to end-customers (whose buying behavior was foreseeable long-term). And on the other hand agricultural resources could not be stored very well. So buying them as an "investment" was rather imprudent – back then the market was so robust that the goods presumably were ruined before (slowly developing) Significant Influencing Factors led to big changes in market values. *In consequence the traded goods resembled Conserved Quantities perfectly!* So here we face the special case of market values that developed robust because they were tied closely to traded products' (conserved) Functional Values. And that was the reason, too, why the future markets for agricultural resources were helpful back then: For speculators they were comparable to rather "boring" credit transactions. But since financial institutions – who are not at all concerned with Functional Requirements for agricultural resources and further-processed products – were allowed to hold and trade large positions of contracts that have any agricultural resource as underlying, things are not that "boring" anymore: Market values became *chaotic* as trading frequencies increased and as trade volumes were inflated by speculators' non-conserved orders. That made trading of hardly storable agricultural resources and related future contracts "interesting" for speculators: Now markets allowed for relatively larger profits as well as larger losses (measured as monetary unit per traded volume) within short-time. All that followed the CFTC's large-scale deregulation of future contract markets in 1999.

2. *Harming robust market values further by increasing financial leverage in 2004*: In 2004 the Securities and Exchange Commission ("SEC") of the U.S. allowed to increase financial leverage by up to 40x (equity). So since 1999 there were players, who have not even in the broadest sense Functional Requirements for the resources that they traded. And since 2004 their significance on influencing market values by placing (non-conserved) orders to buy and sell was multiplied by up to 40x! Over

and above any leverage increases a traders' (potential) return on equity by limiting its equity stake in parallel – that may have influenced readiness to assume risk, too (cf. "decision theory" respectively "risk aversion"). Not surprisingly the Food and Agriculture Organization of the United Nations ("FAO") reported between 2003 and 2008 a drastic increase of the speculative trade volume by 2,300%! In 2008 only 2% of the agricultural commodities underlying the future contracts were shipped in actuality. The remaining 98% were resold by speculators before – in the end they not surprisingly were interested only in making money and not in getting delivered e.g. 1,000 lean hogs (cf. FAO cited in Spiegel (2011a)). Another example on speculative outgrows is provided by Figure 32; it shows the trade volumes in the corn market that inflated from mid 2001 at the latest. (In view of it please note three things: On the one hand the global corn production (= supply) changes slowly. It develops robust and easily foreseeable – one could even say "boringly". On the other hand within the same short period of time there are changes in demand, which – compared to Significant Influencing Factors on the Functional Requirement for food – seem disproportionately strong. And such overshooting in purely speculative trading bears comparison with gold trading (cf. Figure 28)).

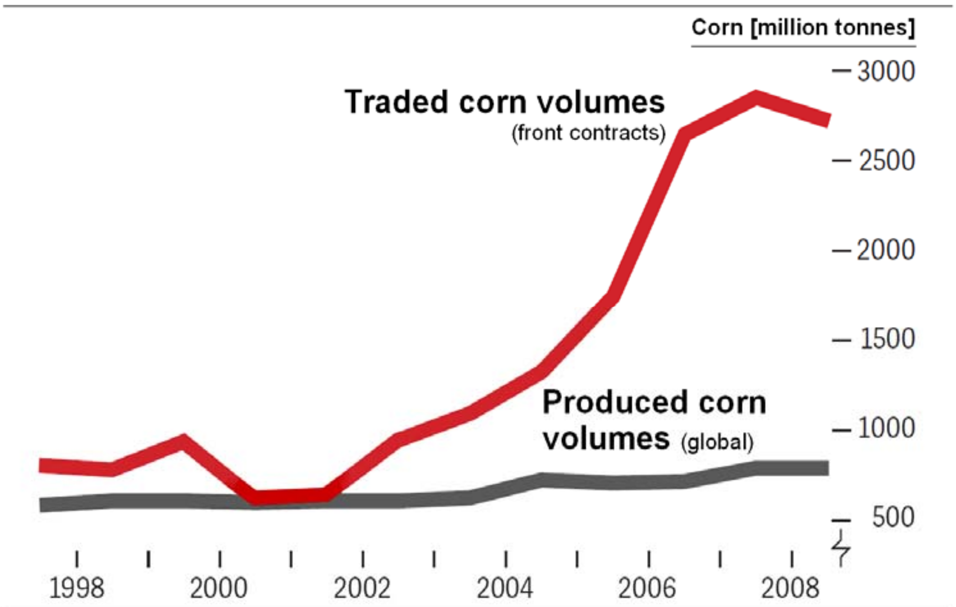


Figure 32: Traded corn volumes overshooting produced ones (cf. LBBW Commodity Research Thomson Reuters Datastream, Spiegel (2011a))

Therefore given financial institutions are allowed to apply financial leverages of up to 40x to trade resources they want to get rid of – to make profit thereby – *before* they are delivered to get used, the situation is neither “boring” nor robust (= non-chaotic) anymore. Instead it turns out to become volatile and finally chaotic – what is good for speculators because they can earn more money more quickly the higher the magnitude of shifts in market values become. And it becomes critical in particular for less wealthy people, who actually have interests in the agricultural resources and products made thereof: Farmers must pay more for seeds; end-customers must pay more for food. Over and above farmers have lost foreseeability and planning reliability: Back then when market values were close to Functional Values, i.e. more robust, deciding on crop growing was much easier. Farmers had to sell their products betimes after they were harvested. And since market values resembled Functional Values much better they consequently were foreseeable much better – therefore well-founded decisions in view of how much wheat, corn, etc. should be cultivated could have been taken. But with the strong mark-ups and mark-downs that prevail in the current volatile and potentially chaotic markets, what should farmers do given market values may drop drastically and hit rock-bottom until harvesting time? Then farmers may not even amortize their all-in costs (= Calculative Cash Outflow).

3. *Real prices follow (overwhelmingly) future contract prices:* In view of the above the futures markets for agricultural resources (lost some of) their right to exist, too: Originally one could say they worked like exchanges to trade market value risk (particularly of farmers) against cash (of recipients for the agricultural resources) before the point of harvest. But due to the described developments the future contracts became somewhat harmful; now they heat speculations with real resources even further. This was proven by the International Food Policy Research Institute (“IFPRI”): Anyone having real resources at hand is animated to stock-pile them given market values of future contracts rise – that sort of speculation fosters market values to climb even more. And the higher the market values climb the more money from the outside floods the markets for agricultural resources. In consequence – due to the simple mechanism of supply and demand – market values

rise progressively once more. That is the vicious circle prevailing in markets for agricultural resources as of today. (If not otherwise stated, for the points 1 to 3, cf. Spiegel (2011a), Spiegel (2011b), Spiegel (2011c) and Sueddeutsche (2010)).

So there are several symptoms and causes how financial industry completely misbalanced the former robust agricultural resource markets. Against the background of the above it seems appropriate to follow: *Financial industry put agricultural resources on the same level with gold!* This is because in either case:

1. In order to make profit ordered volumes need *not* be Conserved Quantities anymore. This means: Orders need *not* be performed to accept a resource – and maybe further process it – in order to finally satisfy end-customers' Functional Requirements in exchange for Conserved Cash inflow.

2. In order to make profit either resource can be bought and resold simply like an "investment" – definitively *without* any (Functional) Value creation in-between – just dependent on rising or falling *market trends* (and on the financial instrument the speculators hold respectively).

3. Well-established exchanges exist that allow *high frequency trading*, which drives market values' volatility and – to make things even worse – fosters chaos because here decisions to buy and sell are based only on non-conserved market values (cf. "algo trading" e.g. in Chapter III, 3.2.2.2). This is bad for people, who really have Functional Requirements for the resources respectively. But that is not disastrous for speculators – their short-term profit potential increases thereby. (And luckily for them their risk of losses is lower than their equity commitment due to the leverage). The bottom-line result therefore is: *Agricultural resources became nothing more than any other "liquid asset"!*

But is not more responsibility required when dealing with things like food than when dealing with anything else like some sort of precious metal? This view is advanced for example by Nicolas Sarkozy, the president of France and in 2011 the holder of the chairs of the group of 8 respectively of 20 major economies ("G8" respectively "G20"). At the G20-Agricultural Ministers' Meeting at the end of June 2011 he therefore stood up for assuming more control to manage better the short-term changes in market values of food: "A market that is not regulated is not a market but a lottery where fortune favors the most cynical instead of rewarding work, investment and value creation" (the guardian (2011)).

The situation analysis above summarizes a series of media coverage, in particular the Spiegel's reportages, which treats the effects of agricultural resource markets' disequilibria that were caused by the financial industry. Almost all articles came to the conclusions that:

1. Common sense suggests that for agricultural resources and products, the magnitude of short-term changes in market values *seem* to be irrational.

2. Common sense suggests also that market values (often) *seem* to be too high. Finally within one year the market value for food rose by 39% according to the FAO; Figure 33 shows three other extreme symptoms for short-term price spikes:

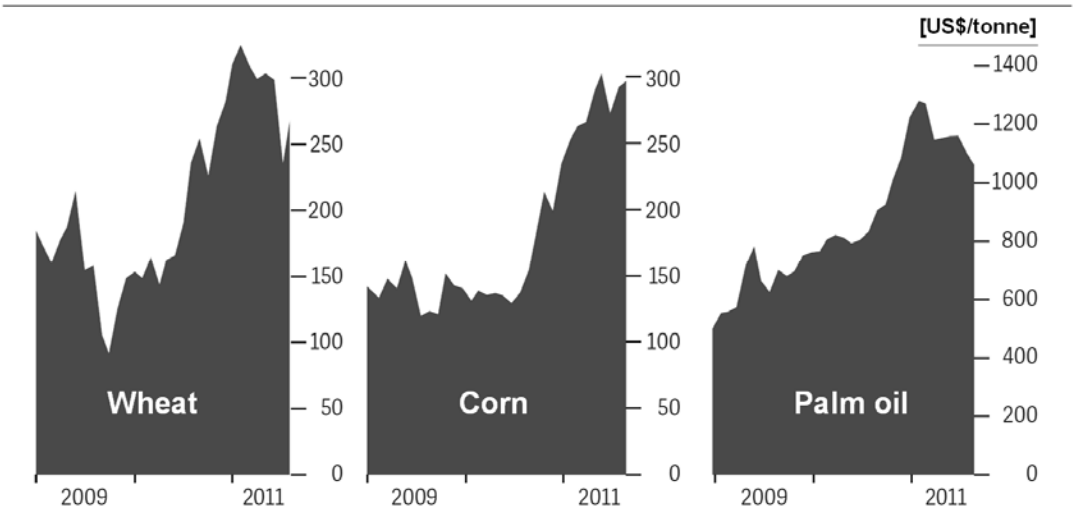


Figure 33: Exemplary jumps in market values in markets for agricultural resources and products (cf. Spiegel (2011a), Thomson Reuters Datastream)

Suggestions to better the situation call for strict rules for market participants' behavior, more market transparency, less leverage, limits in traders' positions, transaction tax, reserves of raw agricultural materials to smooth out market value swings as well as removing of export limits that e.g. Russia imposed interim in response to drought damages – what contributed to a jump in non-domestic market values of grain, of course (cf. Bloomberg (2011), Spiegel (2011a), Spiegel (2011b), Spiegel (2011c) and Sueddeutsche (2010)). But policy makers are still reluctant when it comes to execution. So relevant questions in view of new rules and regulations are: When is it actually inevitable to take counteractions actively? When e.g. should raw material reserves be released? *At which market values, etc.?* The authors of the reportages as well as their interview partners were aware that the current markets for agricultural resources lacked "realistic" benchmark prices – or at least a "realistic" market value ranges. But – up to the author's knowledge – no solution to quantify the magnitude of (speculative) overpricing exists to date.

However – as explained yet – the situation analysis is accordable with this dissertation's line of reasoning: Market values are not reliable per se because market equilibria – that finally determine them – can be distorted easily as soon as market structures allow deviating (strongly) from well-founded taking of (dis-)investment decisions based on Conserved Quantities. Therefore the author would like to bring forward an alternative suggestion: *Adapt resources' Functional Valuation by Calculative Cash Outflow to the markets for food products!* Then there would be average Functional Value per agricultural resource, which was determined before by Calculative Cash Outflow benchmarking. This value can be quantified clearly; therefore the border between "realistic" and "overshooting" (speculative) market values became considerably more transparent. In addition – and that is most important – there should be an upper limit to define *commonly accepted Value Gap* respectively (= market value – Functional Value). In between market values can fluctuate to allow them to adjust to changes in Significant Influencing Factors. And if market values became too high counteracting measures could be enforced on time to stop the then overshooting prices from rising furthermore. (In this sense the suggestion is comparable to setting a cap to foreign exchange rates by applying the "Swiss approach": Since September 2011 the market value for 1 CHF is allowed to vary as long as it remains below the threshold of CHF1.20 per €1.00 (= upper limit: 0.8333€/CHF). And given the market value for

CHF increases even more the Swiss Central Reserve Bank starts counter measures to push it back below this upper limit (cf. tagesschau (2011)). So describing this suggestion alternatively: An agricultural resource's Functional Value is the "realistic" benchmark for setting the *lower* market value limit, (in the end) politicians must decide on commonly accepted Value Gap that defines the *upper* market value limit and – as soon as the market value increased beyond it – regulators must become active to stop and turn back the market value's development. The advantages of this suggestions are: Farmers re-gained planning reliability in view of potential sales prices, end-customers could afford the food products they have Functional Requirements for at appropriate market values and – since market values still had some room to maneuver – investors like those of the pre-1999 period still had an incentive to provide their funds with the chances of profit. (But the profits would be just reasonable instead of excessive – finally without chaos effects the investments became as foreseeable and "boring" as credit transactions again).

Please note that determining Functional Value of a resource by Calculative Cash Outflow most accurately – e.g. for deciding on a *single* transaction or for Conserved Quantity Accounting – is different to taking such Functional Value as "guideline" for market values of particular important "liquid assets" – like agricultural resources. In the end markets are *not useless unavoidably* – they allow division of labor (to gain economic efficiency), act as sources of finance (to become able to invest betimes) or facilitate "risk trading" respectively "gaining cashflow security" (e.g. by future contract trading), to name just a few. Therefore trading as well as allowing for differences in product quality – maybe enabled by innovations – must not be stopped by market values that are equal for all quality levels hence are not allowed to change or increase anymore. Therefore fixing market values is counterproductive. Instead a reasonable market value *range* defined by commonly accepted Value Gap *must* be permitted. Its purpose is to allow markets to re-gain some of the positive properties, which were named above. In this sense Value Gap can be interpreted as the *economic most effective market value span*, which helps the *real* economy to innovate, produce and sell *real* products by providing the funds needed for Functional Value generation: On the other hand it limits market values of staple foods and preliminary products – thereby producers re-gained lower prices for seeds and planning reliability, further-processing companies could invest more (easily) because cost prices would be lower and end-customers could consume with their Conserved Cash more other things in addition. So that also would strengthen growth in other economic sectors in all likelihood. Admittedly to analyze in detail the effectiveness as well as concomitant phenomenon of this procedure is a big subject for *continuative research* but from the author's point of view it seems worthwhile trying. For example in view of *commonly accepted Value Gap* the price elasticity of the traders is suggested to be analyzed. Thereby it could be determined how much the market value volatility may be narrowed down (ceteris paribus) until too much traders reallocate their funds to other markets (cf. "price elasticity of demand").

4 Reasoning Functional Value of trading by applying the example of resources

On the highest level each economy has three sectors: Agriculture, industry and services – Table 6 exemplifies their relative importance throughout the world:

Table 6: Sector break down by selected countries, the European Union and the world (cf. Central Intelligence Agency ("CIA"; 2011))

Gross domestic product ("GDP") by sector [%]

	Selected European countries (in alphabetical order) and total sum							United States	World
	France	Germany	Italy	Portugal	Spain	United Kingdom	European Union		
Agriculture:	2.0%	0.9%	1.9%	2.4%	3.3%	0.7%	1.8%	1.1%	6.0%
Industry:	18.5%	27.8%	25.3%	22.9%	26.0%	21.8%	25.0%	22.1%	30.9%
Services:	79.5%	71.3%	72.8%	74.7%	70.7%	77.5%	73.1%	76.8%	63.2%
Base year:	2010e	2010e	2010e	2010e	2010e	2010e	2010e	2010e	2010e

Labor force by sector [%]

	Selected European countries (in alphabetical order) and total sum							United States	World
	France	Germany	Italy	Portugal	Spain	United Kingdom	European Union		
Agriculture:	3.8%	2.4%	4.2%	11.7%	4.2%	1.4%	5.6%	cf. below	36.7%
Industry:	24.3%	29.7%	30.7%	28.5%	24.0%	18.2%	27.7%	cf. below	21.5%
Services:	71.8%	67.8%	65.1%	59.8%	71.7%	80.4%	66.7%	cf. below	41.7%
Base year:	2005	2005	2005	2009e	2009e	2006e	2007e	cf. below	2006e

	United States
Farming, forestry, and fishing:	0.7%
Manufacturing, extraction, transportation and crafts:	20.3%
Managerial, professional, and technical:	37.3%
Sales and office:	24.2%
Other services:	17.6%
Note:	Excluding unemployed
Base year:	2009

Note:
Agriculture: **Farming**, fishing, forestry
Industry: **Mining**, manufacturing, energy production, and construction
Services: Government activities, communications, transportation, finance and all other private economic activities that **do *not* produce material goods (= including software development and trading)**

Sector-wise this dissertation discloses what Conserved Quantities are. Additionally it explains how to come to Functional Values respectively:

1. *Agriculture sector*-specific Functional Valuation was discussed particularly in order to widen the focus from applying Calculative Cash Outflow only to gold mining (= industry sector) to any other resource-related sector like agriculture. In course of that it also was explained how agricultural markets may be amended by defining market value ranges by Functional Values plus commonly acceptable Value Gaps: Then market values still are allowed to float but their development over time is more "controlled" and more predictably within the pre-defined limits. Such kind of regulation makes purely speculative strategies to buy and sell at short notice by members of other sectors – like the financial industry (= service sector) – less likely. So finally price points could be foreseen more accurately again because they essentially reflected adjustments to changes in agricultural sector-specific Significant Influencing Factors like in the pre 1999-era (cf. Chapter IV, 3.5). That means: Market values would adjust to really existing supply of goods and really existing conserved demand (= Functional Requirements) for them – and they would not be diluted by inflated (non-conserved) trade volumes that lead to inflated (non-conserved) market values (cf. Chapters IV, 3.4 and IV, 3.5 – in particular Figures 29, 34 and 35).

2. *Industry sector*-specific Functional Valuation is discussed throughout the whole dissertation: As mentioned above the (conserved) non-GAAP figure "Calculative Cash Outflow" was developed and tested by examples in the industry's sub-sector "mining". Important are also the Sub-Chapters of "Valuation and accounting of Conserved Quantities": Strict Conservation Law in Business is formalized therein. It is explained in detail how – in course of (physical) products' manufacturing – Functional Value is transferred to products and how any related asset's Functional Value changes thereby. Needless to say that Strict Conservation Law in Business postulates that also Conserved (Tax) Balance Sheets must reflect this Functional Value transfer in the end. Please note that the industry sector provides particularly good showcases to exemplify how that works. Nonetheless the frameworks and

rules for Conserved Quantity Accounting are generally applicable and therefore to be used for the agricultural and service sector, too (cf. Chapter V – in particular Chapter V, 2.2).

3. *Service sector* typically is the biggest and most important one of each economy, measured by both gross domestic product and labor force (cf. Table 6). *On the one hand* service sector-specific Functional Valuation was discussed by applying the example of the software company SAP: Calculation of (conserved) Functional Firm Value was introduced thereby. And obviously – though SAP does not create physical products – the company generates Functional Value (cf. Chapter IV, 2).

On the other hand service sector's huge labor force is not only employed in software development but also in all other economic activities that do *not* produce material goods. Finally that includes *trading*, too: The view angle on markets and trading in general was widened yet. It began with non-conserved speculation (cf. "tulipmania" e.g. in Chapter III, 3.2.1), means and ways to discriminate non-conserved from conserved trade volumes (cf. interpretation of CFTC's data e.g. in Chapter IV, 3.1) and finally included market regulation geared to Functional Values, which may strengthen growth across single economic sectors (cf. Chapter IV, 3.5). Nonetheless – though the dissertation tries to provide a balanced view on market participants' behaviors and their effects – it cannot neglect that examples on resource *trading* showed clearly, too, that traders (often) place orders to buy and sell *without* any interim activity like further processing or overhauling. (Please note that commodities respectively resources, whose characteristics are quite homogeneous across resource volumes, are particularly qualified to judge whether or not (potentially) Functional Value adding activities were performed during a trader's holding period. Therefore in particular the examples of gold and corn were used here). In addition – given traders do not place orders because they want to get more (or less) goods delivered neither to their own warehouse nor directly to their principals (= customers) – it seems valid to claim that the orders were *not* placed to meet any changes in Significant Influencing Factors on Functional Requirements (= conserved part of total demand). Hence such orders must be declared "non-conserved": They are a means to the end of making (nothing else than) money by betting on changes in non-conserved market values; the traders (= here: speculators) are not at all concerned with the traded products or their Functional Values. How could they? By performing "investment strategies" like spread or day trading such traders not even try to fulfill a (Functional) Valuable role like being a mediator between a producer and an end-customer or being a *real* investor, i.e. someone who provides funds sufficiently long-term so that companies can invest in initiatives for future growth (cf. Figure 28 respectively its reinterpretation in form of Figure 34 below). The whole issue is that their orders to buy and sell are performed just to bet on *non-conserved* market value changes – i.e. *not* on changes in view of (conserved) Significant Influencing Factors on the underlying goods' supply and demand. So the money these traders reallocate by their orders is non-conserved. Not to mention the non-conserved resource trade volumes: Often they *not* even exist in reality hence they cannot even be reallocated anywhere – that contradicts severely Strict Conservation Law in Business (cf. Figures 34)! Naturally the related orders must be deemed "purely speculative". Of course such orders do *not* contribute to market equilibria having explanatory power; they do *not* manifest a common consensus of all market participants' perception of the traded goods' current real values respectively future (value) performance (cf. "efficient market hypothesis" e.g. in Chapter III, 3.2.2 as well as Chapter IV, 3.5 that criticizes changes in agricultural resource markets since 1999). Instead – due to their origin and since they do not lead to a change in another Conserved Quantity – these purely speculative orders manifest only bets on changes in (non-conserved) market values, which can be to such an extent short-term that the bets have *no* meaning beyond one single day! Therefore efficient market hypothesis should be amended by excluding speculative orders to buy and/ or sell in order to lock out their dilution on market values. Please note: In principle this is implemented in this dissertation by focusing on Conserved Quantities in form of Functional Requirements of customers, Required Functions provided by products – no matter whether or not they are material ones or immaterial services – as well as Significant Influencing Factors affecting them.

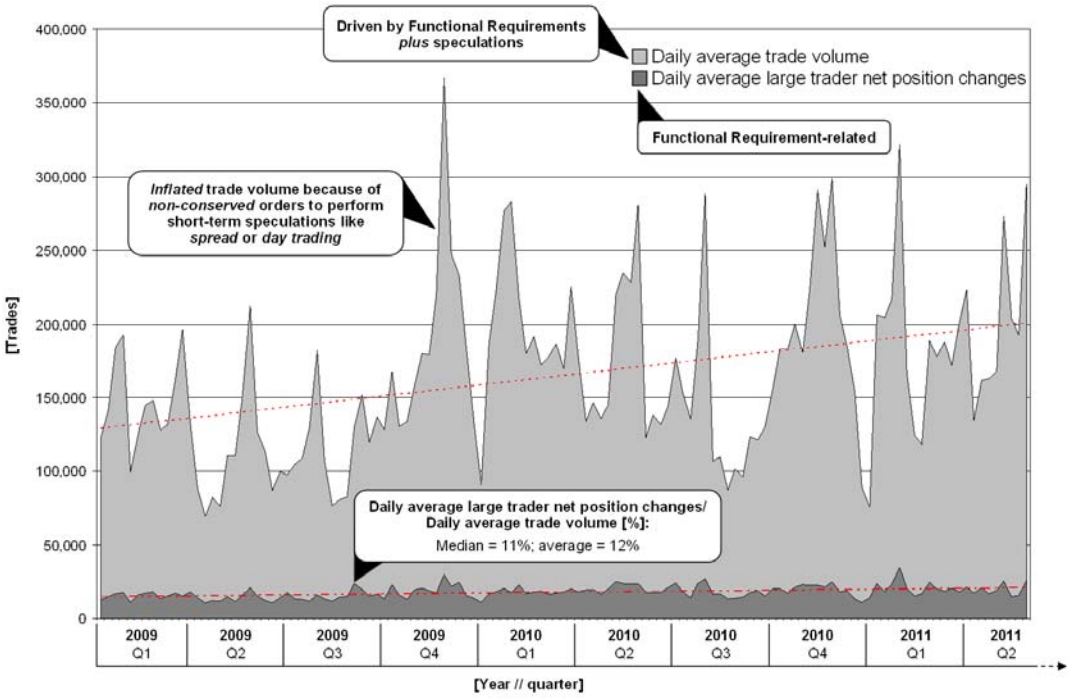


Figure 34: Average trade volume vs. average large traders' net position changes per day applying the example of gold (renewal of Figure 28)

However Figure 34 also suggests that some of the traders' orders last more than one day (= "daily average large trader net position changes"); they may have been placed indeed in order to match changes in Significant Influencing Factors on Functional Requirements (= conserved part of total demand). In this sense traders may take their chance of becoming (Functional) Value adding here by taking the role of *moderators* between the market's supply- and demand-side. And the underlying goods may be taken off the market either to be resold directly to the end-customers (e.g. gold taken as safe haven) and/ or to be applied in further processing (e.g. corn that is milled) – these examples show conserved transfers of resources in exchange for Conserved Cash. But the traders, who work as middle-men here, for sure will ask for a *margin*, too. So in view of *non-chaotic long-term financial forecasts* of the service sector – respectively its sub-segment "trading" – as well as *Conserved Quantity Accounting* of its performance, the question is: Are margins that traders ask for conserved ones (= Value Tags (cf. Chapter V, 5.1.3))? Or to phrase it more general: Can traders offer services that add Functional Value to the merchandise – which justifies an increase in the conserved part of customers' willingness to pay – though the merchandise remains physically *un*changed? If so these services bear Value Tags that *must* be accounted for in traders' Conserved (Tax) Balance Sheet in either case.

Please note that answering the above questions may have far-reaching consequences – not only for the sake of "completeness" (as far as it can be reached at all in one single publication) but also in view of accounting and taxation: After all the introductory Table 6 suggests that trading – being a part of the service sector – may account for a big part of an economy's national product. Its lion's share therefore better should *not* be non-conserved! Chaos Exposure on the national economic level would be alarming otherwise (cf. Chapter V, 6). To provide the answer right away: Traders' work including the orders they place *not necessarily* is non-conserved or (Functional) Valueless. Dependent on traders' (additional) services they can increase efficiency on the national economic level: Such services typically allow for the division of labor, for increasing customers' time value of money, for reducing customers' search costs and/ or the traders' services help to solve customers' (idiosyncratic) issues better – i.e. traders' services may lead to higher economic efficiency. Naturally such services add Functional Value also from customers' point of view. That feeds back on the conserved part of their willingness to pay. In addition in order to become able to offer such services traders must invest money, (spare) parts and/ or time, etc. So the (Functional) Value perceived by the customers does not "appear from nowhere"; there was a conserved change in something else before (cf. below)! Consequently the margins – respectively Value Tags – traders can ask for these services are definitively conserved, too. When looking at the setting more closely the specific levers to *raise traders' Functional Value by "services"* become more obvious:

1. *Secure product availability* in terms of both regional and timely availability.

2. *Provide convenience services* like delivery services, product installation or access to a network of solution providers (cf. "one face to the customer" approaches).

3. *Offer advisory services* like assistance for customers to identify their actual Functional Requirements.

4. *Extend customization services* like configuration or customization of standardized products to fit them better to customers' Functional Requirements, which were identified in close corporation with the customers before. (Please recall that herein the term "product" is used always collectively for material "goods" and immaterial "services". Thereby it also includes "equipment", which customers may select to better fit a standardized core product to individual Functional Requirements).

5. *Provide additional rights* to customers like warranties in case of damages and/ or customer satisfaction guarantees (including sale or return for used products).

6. *Keep customers up to date* e.g. by information on technical product innovation (e.g. by newsletters), securing the exchange of experiences how to apply the sold products more effectively and/ or more efficiently (e.g. by customer workshops), allowing for (thorough) tests of new products or accomplishing product maintenance and "automatic" product updates (e.g. within pre-defined limits, before a warranty case materializes, preventive maintenance at the expenses of the seller).

7. *Other: Implement services lowering customers' transaction costs* disproportionate to the additional margin asked for them (cf. "transaction cost theory").

Given services such as the once noted above from 1. to 7. are decisive for customers' buying decisions they can be used by trading companies in order to increase their *(conserved) strategic fit*. Then it makes sense – from an economic point of view – that traders allocate sufficient of their (scarce) resources to one or more of theses business areas to fit them well to customers' (conserved) Functional Requirements. Thereby traders can increase the (conserved) Functional Firm Value of their own companies (cf. in particular Chapters V, 5.1.1 and V, 5.1.2). Please note this is perfectly in line with Strict Conservation Law in Business, which claims that Functional Values are foreseeable in the long run – hence implicitly robust (= non-chaotic) – because they cannot just appear or disappear at short notice without a previous change in "something else" (cf. Chapters III, 2.1.2 and V, 2.2). Please note also that in conformity with so-called "one face to the customer" approaches either directly a trader or an adjacent service provider may perform the services being Functional Value adding.

If it should not be clear by now how *Strict Conservation Law in Business* comes into play here please follow another every day example. Naturally it deals also with the service sector respectively its sub-segment "trading", more precisely the market for second hand articles: Professional traders here (generally) are able to ask for higher prices than private ones – though they may be on the same trade level. The reason is particularly related to the fact that professional traders (almost always) have to provide more comprehensive warranties than private ones. In addition the conditions of the already used products offered by diverse professional and/ or private traders may or may not be comparable. But "ordinary" customers may not be able to evaluate them – particularly not in cases of sophisticated (technical) products' conditions. Then additional warranties can actually lead to higher Functional Value from customers' point of view so that they will be willing to spend more Conserved Cash for buying at a professional trader in order to reduce their risk going along with the purchase. And the cash spent in addition is conserved indeed because: The professional trader is coevally the warrantor so that – in the first step – he/ she must proof and maybe repair the merchandise more thoroughly than a private one before closing a sale and purchase contract. That is the only way to (legally) reduce his/ her risk from the (more comprehensive) warranty. That means the professional trader must "invest something" – at least time and maybe also money, spare parts, etc. – in order to become able to offer the merchandise with calculable risk. These "things" that were invested cannot be used otherwise anymore for any other form of Functional Value creation. Yet they lead to higher (net) Conserved Cash inflow for the trader. If the risk of a warranty case materialized nonetheless – in the second step – the trader (= warrantor) again has to spend something (time, money, spare parts, etc.) to fix the issue. Again these "things" cannot be used anymore for other purposes. This means: In any case Conserved Quantities can be found throughout the trader's value chain due to his/ her offering of the Functional Value adding service "additional rights/ warranties".

Though the adaption of Strict Conservation Law in Business seems straight forward please note that things are not always that clear cut. In view of long-term planning and financial forecasting of companies' Functional Firm Values, which are (partly) dependent on transaction-related services, please note the following: Providing more (services) not necessarily leads to more *net* Conserved Cashflow! Companies can increase their Functional Firm Value only given they sell more (material) products and/ or (material) products having more Required Functions from customers' point of view. But of course this rationale applies for their (immaterial) *services*, too. Hence providing just more services – irrespective of the customers' appreciation – (often) does *not* increase Functional Firm Value. In contrast Functional Firm Value even may be reduced due to service processes being costly for the company yet in actuality at best "nice to have" from the customers' point of view. The reason is: Given customers have no Functional Requirement for services, which are offered nonetheless, it seems valid to assume that margins realizable for such non-required services are too low to justify the additional complexity and costs they entail (= "nice-to-have" services). But given any transaction-related service fits one or more of customers' Functional Requirements – like those exemplified by the points 1. to 7. (cf. above) – it may be decisive for customers' buying decision. Then Value Tag can be assumed being high enough to economically justify additional efforts. Though "investment decisions" in view of allocating time, money, capital lockup, workforce, etc. to transaction-related services must be taken case-based they definitively bear Functional Value *potential*. So the initiating questions on service sector's Functional Value creation can be answered now:

1. Traders can be economically helpful – also from Conserved Quantity point of view – because adding Functional Value not necessarily means amending a product physically.

2. By (selected) transaction-related services traders can offer Functional Value added that is perceivable and appreciated by customers.

3. Given there is a (strategic) fit between (immaterial) services and customers' (immaterial) Functional Requirements the conserved part of customers' willingness to pay increases.
4. Since Conserved Quantities neither appear nor disappear just like that – i.e. since they require at least one consistent change – Functional Firm Value of the traders' companies rise, too: In the end more Conserved Cashflow changes hands due to more "things" the traders offered before closing the deal.

5. Needless to say that long-term financial forecasts – e.g. of the trading firms' management or (Functional) Value investors – as well as Conserved (Tax) Balance Sheets must represent the results of the "conserved services" offered by traders!

5 Consequences for accounting and taxation

This dissertation essentially opines that speculation is the same as gambling. Admittedly that is rigorous – the examples provided herein as wells as by Appel and Grabinski (2011), (2010) and Appel et al. (2012) support this claim though. Yet there is a difference in their *typical* operations:

1. In *speculation* many people earn some small amounts of money for a while. This attracts more and more people so that the market mechanism, which relies on a mixture of conserved and non-conserved volumes of supply and demand, results in both inflated trade volumes and finally inflated market values. When the bubble bursts suddenly at least some people will suffer big losses (cf. Chapter III, 3.2).

2. In *gambling* it is normally the other way round: Players will lose some money for a long period of time – e.g. the weekly fee for the lottery. After a long time very few people will get a lot of money – e.g. by hitting the jackpot.

However there is also a form of gambling that operates *like a typical speculation*: One way of gambling at the roulette table is to bet say €1 on red. If the outcome is red the player gains €1. Then the game starts again. If the outcome is not red (black or zero) the player looses €1. Then – in the next round – he/she bets €2 on red. Let us suppose there is "not red" again. The player already will have lost €3. Then he/ she must bet €4 on red. Let us suppose red comes so that the round's win is €4. Having lost €3 before the net gain will be €1. In doing so the player will always win €1 each time the roulette shows red, which may occur over a hundred times within one night. Though it seems to be a foolproof money machine it is not in reality. There are reasons to stop the game before winning: There are *resource constraints* that compel the player to plan, forecast and act with respect to his/ her Conserved Quantities at hand. Here the most severe limit is time – nobody will live forever. And the player will always end up with a (net) loss when taking into account the possibility of an end before winning plus taking into account the probabilities for each event. Being forced to stop after n rounds will lead to an average loss of: 1 – 38n / 37n. Even taking n to infinity (= gambling forever) will lead to a (net) loss. *Despite this fact such kind of gambling is very analogous to speculating in a booming market*: Most people have some continuous income over a long period. Then suddenly a catastrophe happens and a huge amount of money – not real (Functional) Value – disappears. That properly leads to the (false) perception that speculations lead to income before, which is now missing. There are also gamblers at the roulette table performing the game stated above. Quite a few never lost over many years leading to a (false) "proof" that at the roulette table "money can be made". (Please note that this common formulation contradicts any Conservation Law because players' return service for the money is next to nothing)! Hence the existence of "lucky beggars" cannot proof anything – therefore nobody should be dependent on money from gamblers (cf. Appel and Grabinski (2011), Appel et al. (2012)).

As a consequence *the* aim of valuing assets based on Conserved Quantities is to consciously exclude any "gambling" in form of following "fads and fashion" by speculation with economic exploitable but unforeseeable, potentially chaotic short-term market trends. Therefore Functional Valuation addresses the importance of understanding the fundamentals of future (net) Conserved Cashflows on an economic level – here services *and* return services can be found that are in line with Strict Conservation Law in Business (cf.

Chapter V, 2.2): There are companies that employ people and acquire material assets to research, develop, manufacture and sell products – which by definition also include (non-material) services. So both companies and workers receive Conserved Cashflows for their contribution to realizing products with (conserved) Required Functions. In addition they also invest and consume namely in research, development, capital assets respectively end-products as well as training and education in either case – all these “things” serve more or less (conserved) Functional Requirements. To understand long-term distribution of Functional Values between the economies’ participants – which will be realized *irrespective* of speculators’ luck or chaos – analysis therefore must ask: What are the fundamental (conserved) Functional Requirements, which companies and customers throughout the whole economic value chain aim to satisfy by products having Required Functions? These are the “things” that prevail in the long run. So by answering the question the following becomes clear and calculable:

1. Functional Values of the products after each step in the economic value chain (i.e. resources, semi-finished and finished goods).

2. Functional Values of the “assets” used to realize the products’ Required Functions, which are asked for by the customers respectively (i.e. capital assets, financial assets and liabilities, human resources and intangibles like goodwill).

3. The manufacturers’ Functional Firm Value as of a certain due date, which has to equate to the sum-of-the-parts Functional Value of all the above.

For accounting and taxation the advice derived therefrom is: Capitalize on the advantages of Conserved Quantities respectively Functional Values, too! They are the alternative draft to “money made at the roulette” and potentially speculative market values. They are not determined by luck – respectively not threatened by chaos –, they cannot be generated out of nothing and luckily they also cannot disappear without notice and without further ado. That is why they develop robust (= non-chaotic) hence foreseeable long-term. To obtain these advantages compared to GAAP accounting, which is based on non-conserved quantities in form of market values and fair values (cf. “fair value accounting”) auditors always must take an economic perspective. The reason is: (Conserved) Functional Values are rather redistributed between all participants within an economy and between the world's economies than "made" (= Strict Conservation Law in Business). And the redistributions follow clear cause-effect relationships. Their outcomes are determined by Significant Influencing Factors; they may be either company-internal – like innovations or improvement in efficiency initiatives – or macroenvironmental – like political, economic, social, technological, legal and/ or environmental ("PESTLE") influences (cf. Chapters III, 2.1.2 and V, 5.1 – in particular Figure 40). Considering these internal and/ or external Significant Influencing Factors the outcomes in redistributions of Functional Values between all economic participants can be foreseen long-term. And since the general government can raise taxes and/ or dues potentially for each and every transaction the Conserved Cashflow cycle must be widened to consider not only companies, employees and end-customers but also *general governments!* In this context please note that also public institution cannot "make money": Given central banks print and issue more money inflation will increase the prices to counterbalance the increased volume of money – so after a while there will be just a change in the relationship between the volume of money and the volume of products one gets for it. (This is a ceteris paribus-argument whose additional assumptions are: Velocity of money as well as real production (= trade volume) remain unchanged (cf. "monetarism" for Significant Influencing Factors on inflation)). Obviously this procedure is not useful to increase a country's (conserved) economic power in the long run. In consequence the only option is to increase the conserved part of the gross domestic product (= national Functional Value of Work). The public institutions required here are the general governments – they must reduce the countries' Chaos Exposures by limiting speculative businesses' activities (= perform market regulation) and in parallel foster industrial location and growth of companies, whose products serve (conserved) Functional Requirements. Unfortunately such state initiatives are not free of charge. At least in the short run taxpayers' speculative income will be missed. So wouldn't it be a great advantage for national budgeting to know the amount of *conserved* state revenues, which can be collected most probable by taxes and/ or dues? Finally they form the Conserved Cash inflows that general governments are able to spent regularly – also when considering a long-term time frame – in order to perform public tasks like *conserved* investments in schools, universities, new energies, transportation infrastructure, social services, etc. or discharge of debt! Therefore the author argues: Economic respectively financial crisis and their "collateral damages" particularly in view of bail-out costs are avoidable. For it national general governments – respectively governments within the same currency area – have to advocate only the growth of those businesses, which actually increase their national products' Functional Value!

In summary this means: Not only from investors' and companies' point of view there is just one best possible strategy – namely the one that optimizes *net* Conserved Cashflow *long-term!* Finally no wise businessman would accept any business case whose net cashflow – due to chaos – may or may not allow him to continue his/ her venture(s) long-term. Decision makers working for the state should learn a lesson therefrom – in particular those in the ministries of finance and economics! Needless to say that accounting rules and taxation laws should be changed to account for Functional Value in Conserved (Tax) Balance Sheets going forward. This is the reason why this dissertation provides suggestions for identification of Conserved Quantities and Functional Valuation that are specific to diverse classes of assets (and liabilities). For your convenience Figure 35 summarizes the Chapters dealing with Conserved Quantity Accounting-rules derived therefrom:

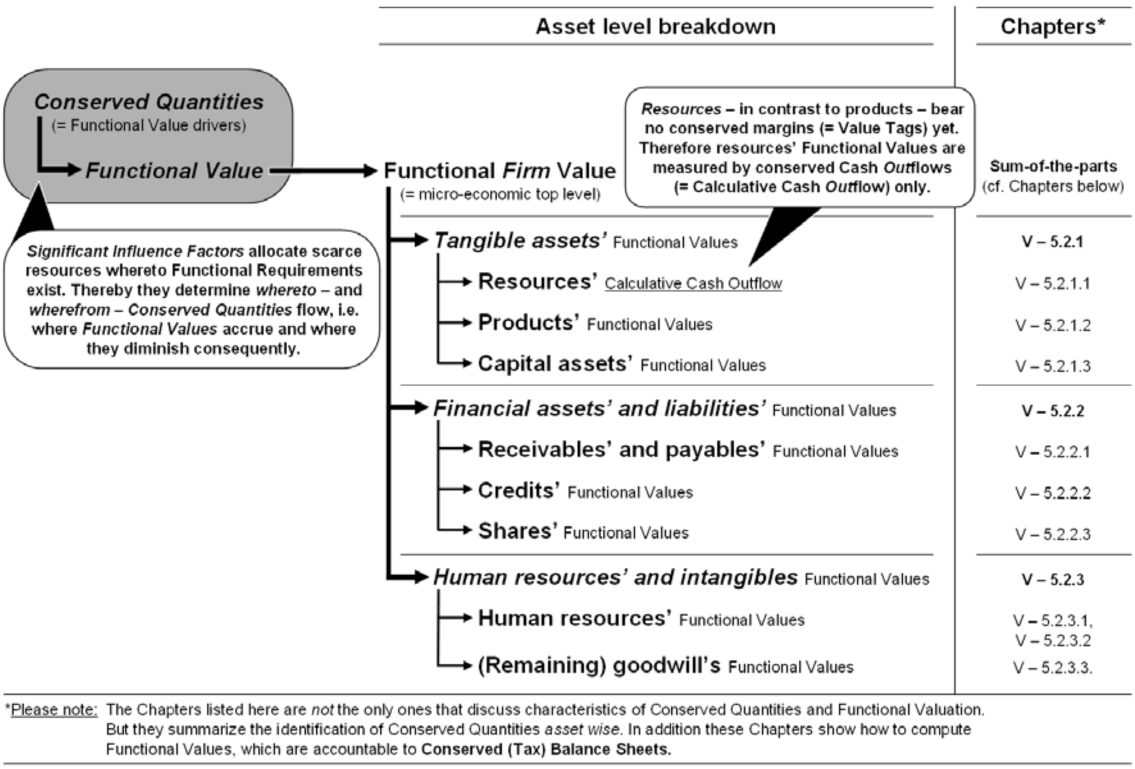


Figure 35: Directory for Functional Valuation adapted to accounting and taxation

CHAPTER V

ASSEMBLING OF GENERALLY APPLICABLE CONSERVED (TAX) BALANCE SHEETS

1 Conserved (Tax) Balance Sheet's goals and advantages

There is a primary issue with numbers: They suggest being objective and therefore people trust them in decision making by e.g. extrapolating them into the future. In particular wrongly defined (non-conserved) key figures are sunshine friends though. This holds in particular for market prices respectively market values: In the long run they regularly fool speculators, who decided only based on market values and related trends. In addition politicians may imagine their economies being safe though they are endangered in actuality by growth that is unjustified in view of real value creation (= Functional Value added) and therefore frequently leads to bubbles and sharp reversals (cf. Chapter III, 3.2 and Chapters IV, 2 and IV, 3 as well as Chapter IV, 5).

Companies' Functional Firm Values – which are measured by their net Conserved Cashflow forecasts including terminal values – were shown instead to be reliable guides for investors, who strive to allocate cash to companies with robust (= non-chaotic) long-term growth (cf. Appel and Grabinski (2010) and (2011), Appel et al. (2012) as well as Chapter IV, 2). Functional Firm Value can be taken as the sum-of-the-parts value of a company's total material and immaterial "assets" (including goodwill and employees). Now this Chapter V shows ways and means to break down (total) Functional Firm Value to the level of underlying assets. The suggested approaches utilize data from business planning and economic forecasting to set-up a valuation and accounting system, which applies Conserved Quantities only. The results are intended to be helpful for single companies, investors as well as public authorities by providing the following insights and advantages:

1. Diverse corporate and/ or competitive strategies have different effects on companies' future financials: Given Functional Firm Value can be broken down to the asset level both company managers and investors can select easily the *"optimal" strategy*, i.e. the one which offers the most robust long-term growth. Over and above by comparing Functional Value per asset they can see clearly the *reason(s)* why one strategic option is more robust than the other one(s).

2. Balance sheets showing Conserved Quantities only can be calculated: General governments – respectively their Ministries of Economics and their Departments of Commerce – could use them to forecast robust long-term economic growth (e.g. on the national economic level and/ or within the same currency area). This implies that companies could be taxed and that duties could be demanded based on companies' regularly expectable long-term contribution to conserved economic growth. Given national budgeting is based on the income by such conserved taxes and duties also the economies' *national budget would become robust (= non-chaotic)* and thereby foreseeable long-term. In consequence forecasted national income by taxes and duties would resemble the actual future one as far as possible. *Fiscal crisis* due to chaos could be scotched. Over and above there would be a way to identify *economic bubbles* in order to counter them at an early stage.

At this occasion please note the reason why the generally applicable principles defined in this Chapter V are not termed e.g. "Functional Value Accounting"-rules but *"Conserved Quantity Accounting"-rules*: Conserved (Tax) Balance Sheets must not only reflect real values (= Functional Values) but also the conserved part of current and future demand (= current and forecasted Functional Requirements). This means in addition to the conserved part of any asset's value also the conserved part of any asset's volume must be gauged; the product of both is the amount that is accountable to the respective asset's line item in Conserved (Tax) Balance Sheet (cf. Figure 29 respectively Figure 36 below).

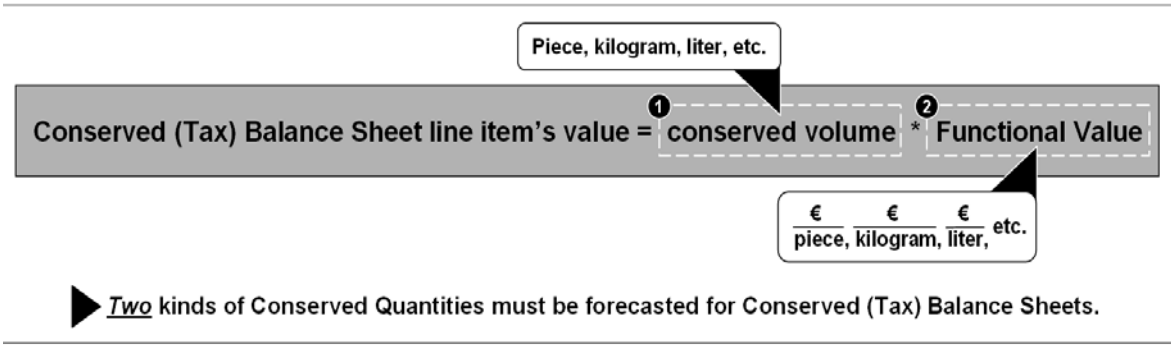


Figure 36: Generic formula for valuing line items in Conserved (Tax) Balance Sheet (renewal of Figure 29)

2 Premises of generally applicable Functional Valuation

Valuation and accounting of Conserved Quantities is based on the notion that customers' needs for products (including services), which have *specific* functions, cannot change without previous changes in the real world and without notice. Therefore customers' Functional Requirements for products' Required Functions remain unchanged as long as Significant Influencing Factors remain unchanged – by this conserved cause-and-effect chain Functional Values are determined of the related products, of the companies that provide them as well as of the assets that these companies apply. (Please note that often there is no such thing as a non-conserved cause-and-effect chain for market values e.g. in markets for resources or equity markets (cf. Chapter III, 3.2 as well as Chapters IV, 2 and IV, 3)). In this sense getting access to products' Required Functions is like requiring staple food: Required Functions are so necessary that customers cannot forego them *long-term*. Being that significant they guide (in large parts) the flow of values and items within the global *economy* – no matter whether they appear in form of cash, resources, assets and products or human labor. Therefore – given a product that serves a specific Required Function is sold in more (less) volumes – at least one previous, consistent change in something else is required, e.g. a change in demographics and/ or the stop (launch) of production of a substitute. This makes Required Functions equivalent to Conserved Quantities. (At that occasion please note: "Getting access to products' Required Functions" is beyond the acquisition of products; it also includes paying fees or royalties for their application). In consequence flows of values and items must be analyzed *holistically*. Furthermore it has to be questioned in particular whether or not resources ended up in products (or services), which bear nothing but Required Functions. If not the value of their (conserved) Required Functions (= Functional Value) may not fully amount to their (non-conserved) market value. The difference – called (non-conserved) Value Gap – is a grain for an economic bubble, which may grow and collapse chaotically.

As implied above any product's Functional Value must be analyzed from the point of view of its *average* user – no matter if it is a customer spending money for private consumption or a company performing investments and employing people. (Therefore just Significant Influencing Factors are taken into account. They influence the conserved part of demand *beyond* those parts of an individual customer's buying behavior that can be explained by psychological concepts like mood, emotions and/ or fads and fashion, whose manifestations spoken in economic terms are short-term market trends and speculations (cf. Chapter III, 2.1.4.2)). In any case it has to be considered, which Required Functions justified acquisition of a product (or closing of a labor contract). These are the conserved functions that force a consistent change in something else because: Given Required Function is fulfilled, why spending money once more? Right, there is no actual (Functional) Requirement anymore! Therefore the remaining functions of a product (or service) do not apply resources efficiently. They may not be economically harmful but nonetheless they are at best just "nice-to-have". In consequence customers do not require them in actuality; the related (non-conserved) demand can vanish quickly.

So Functional Valuation unmasks mispricing, related potentially chaotic developing speculations as well as economic bubbles at their source – i.e. on the level of particular company's balance sheets – by adjusting them to reflect only conserved volumes and values per line item. Thereby it accounts only for those functions of products, assets and/ or employees and so forth, for which there is demand that cannot change without notice, because they satisfy (long-term lasting) Functional Requirements. This conserved demand for conserved functions is determined by general economic facts – herein called "Significant

Influencing Factors" – that affect average customers' real lifes. Therefore Functional Valuation can be assumed being qualified for application beyond determining conserved values for single market transactions; it can be assumed to be *generally applicable* to fill Conserved (Tax) Balance Sheets.

2.1 Reasons for performing Functional Value analysis holistically

For Functional Valuation it is crucial to observe changes in macroenvironmental basic conditions. Here the task is to identify Significant Influencing Factors. They must be opposed to business plans in order to set-up and verify financial forecasts. Though established forecasting schemes may start the same way there is one essential difference: Conserved Quantities require that there is a *consistent change in something else*. If such consistent change is missing there is no conserved change at all! In principle this is like in physics: The conserved energy within a system cannot change without a corresponding change in something else. Otherwise there would be an infinite source or drain of energy, which is impossible. "Something else changing" could be any kind of energy consumer, which is part of the system like a lamp, an engine, a refrigerator or a TV set sharing one closed electric circuit. So there is another parallel to physics: At least at first glance the electrical devices are very dissimilar. Nonetheless they share one common ground – they compete for the (scarce) energy within the electric circuit. And the same is true for the global economy – customers can spent each Euro (and each and every second of their lives) just once. This means every kind of product competes with every kind of consumption, saving or investment. Consequently – in financial forecasts that focus on Conserved Quantities – the general macroeconomic data and the individual companies' business plans must agree regarding three things:

1. Whereto Conserved Quantities flow – and what is the reason respectively.

2. Wherefrom Conserved Quantities flow away – and what is the reason respectively.

3. The amounts of opposed flows of Conserved Quantities – which have the same reason (= Significant Influencing Factor) – must even out each other. Otherwise some volumes of Conserved Quantities are either missing or one accounted for volumes that are not conserved in actuality.

Conserved Cashflow by selling products and/ or services that have Required Functions parallels the change in customers' Functional Requirements. Thereby it is indirectly determined by *external* Significant Influencing Factors. This is easily understood (and had been discussed previously). But what about other non-monetary quantities that are inherent to any company's business activities, which may or may not be conserved? Here particularly relevant questions and tasks to ascertain Conserved Quantities are:

1. Do all resources and purchased parts offer (conserved) Required Functions? For that the total volumes of items on stock are (still) required to contribute to any product's Functional Value. Volumes are to be *written-off* if they are *not applicable (anymore)* in further processing to add Functional Value to a product. This may be the case if a company simply ordered too much or if there were changes in product architecture and material. The reasoning for write-offs is easy, too: Given there is no product (anymore), which has Functional Value, then the items once intended to be used for this "valueless product" also cannot bear Functional Values (anymore)[3].

2. Which Required Functions determine asset utilization? *Asset utilization* must be verified based on *manufacturing of products' Required Functions* as well as *investments in (rival) assets* – finally utilization and the kind of product functions generated thereby are the two drivers of capital assets' Functional Values. Hence *outsourced production volumes* must be considered, too! After all internal and ex-

[3] Having resources not being useful anymore is in some sense learning. One has to learn which resources are necessary by trial and error. The created knowledge is nothing but an asset. However this situation is (from the outside) undistinguishable from ordering worthless material on purpose, which is either fraudulent or a sign of mental illness (cf. Chapter V, 2.2).

ternal production factors can compete for utilization the same way as products from different markets can compete for getting a share of the total Conserved Cashflow within the global economy!

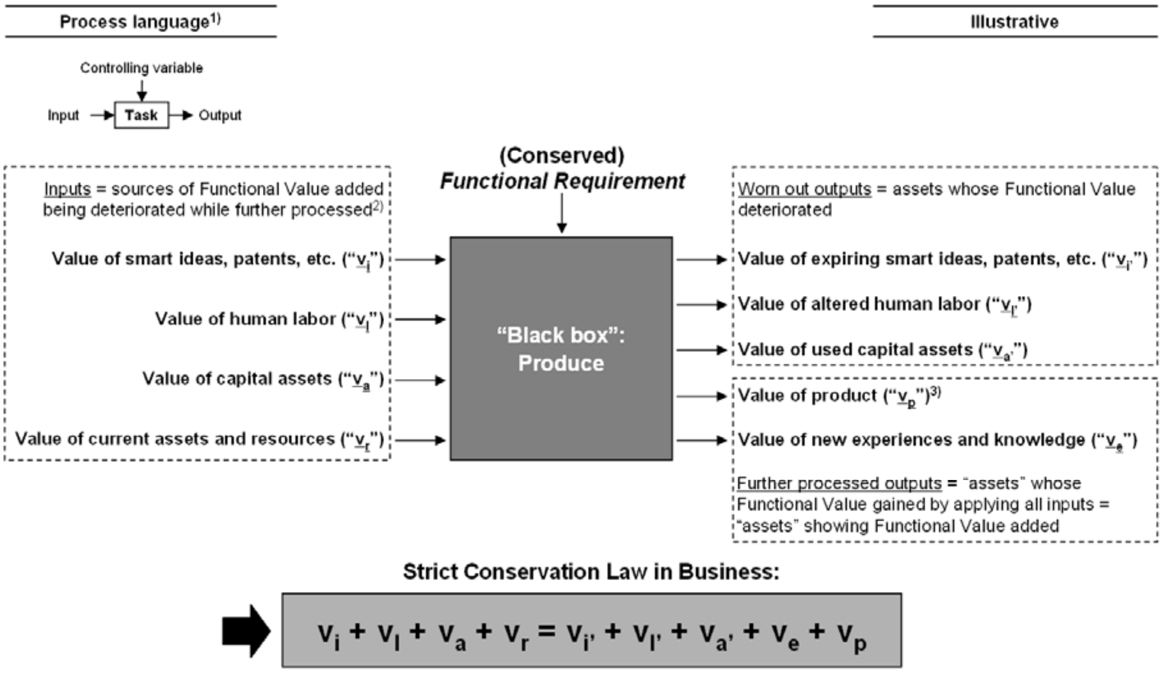
3. Which task performed by any employee contributes to the supply of Required Functions and which one does not? Related questions that should be answered in this context are: What about tasks once performed by employees in-house, which will be performed by an outsourcing partner going forward? What if manual work by employees gets increasingly substituted by capital assets? Do Functional Values of direct and indirect workers differ – if so in which way and how can they be calculated nonetheless (cf. Chapter V, 5.2.3 – including its Sub-Chapters)?

Though the list of questions and related tasks must be finalized later, it nonetheless served its purpose for now (cf. Chapters V, 2 to V, 5.2.3.3): To clarify by some selected questions how complex Functional Value generation can be in actuality. Though a valuation system – like any other model – is allowed to abstract from certain details, its user has to gain a well-founded understanding of its Significant Influencing Factors. Otherwise he may get mislead by a too big margin of error (cf. Chapter II, 3). To avoid that *holistic* analysis is inevitable that considers not only conserved streams of cash but also conserved streams of volumes of resources, products and services, of asset utilization and human labor, etc. within both the general economy and the specific company under consideration: On the one hand analysis has to pay respect to Significant Influencing Factors preconditioned by the macroenvironment and on the other hand it has to recognize Significant Influencing Factors that can be influenced by the company itself – herein this methodology is termed "Holistic Functional Value Analysis". (For its introduction in context of Conserved Quantities cf. Chapter III, 2.1.2).

Academia as well as practitioners created frameworks, which can support Holistic Functional Value Analysis – yet they must be adjusted more or less before. Over and above no framework is able to separate between short-term (non-conserved) and long-term (conserved) economic developments on its own – the reasons are the plenty questions to be answered and the comprehensive tasks of related analysis to be performed. Therefore the following Chapters III, 3 to III, 5 show step-by-step how to interlink and refine the relevant frameworks in order to come to well-founded Functional Values for specific classes of assets and liabilities, which rightly can be regarded qualified for being accounted to Conserved Balance Sheets that also may be used for taxation.

2.2 Requirement for following Strict Conservation Law in Business

Holistic Functional Value Analysis identifies Significant Influencing Factors and their impact in particular on Conserved Cashflow allocation within the global economy as well as between (rival) companies. In a closed system like the economy (or an electric circuit) the total amount of Conserved Quantities cannot change without adding a source or drain. Therefore a strict conservation law can be formed mathematically also in the economic context ("Strict Conservation Law in Business"). It has to be valid for any financial forecast and valuation methodology based thereon. Or to put it the other way round: Forecasts have to be reconsidered given the formula stated on the following page by Figure 37 is *obviously* not balanced. The word "obviously" is used in order to relax the formula for a reasonable margin of error (cf. Chapter II, 3). It should be allowed because in- and outputs are interlinked non-trivially and the assessment of changes requires not only thorough analysis but also some (well-grounded) assumptions. This is in particular true for "soft" Functional Values like the ones of smart ideas, patents or new experiences being generated by human labor. But in any case bringing new "soft" Functional Values to market for sure helps to narrow down the margin of errors. (That is the reason why royalty-generating patents – which are marketed – are easier to be valued than self-employed ones). In this context please note the importance to analyze the *market's feedback* not only regarding *sales prices* (= market values) and *sales volumes* but also regarding *customers' application of the products' Required Functions* (cf. "lead user approach")! Then it can be verified what product features customers consider worth to spend money for and to forego other things instead (= conserved Required Functions) and which one are not (= non-conserved "nice-to-have" functions). This information should be interpreted in view of Significant Influencing Factors, which may have changed interim, in order to gain new knowledge for amending forecasts and Functional Valuation that must be performed in the future.



1) Illustration only at first glance follows the style of Strategic Analysis and Design Technique (“SADT”). In SADT’s generic version *input is transformed into output by a task*. Each task is triggered by a *controlling variable*. The task may be performed by a machine (or system) remaining unchanged (Grabinski (2007)). In case of Strict Conservation Law in Business there is one new thing: Not only the input but also the *machine (or system or employee)* is transformed – and thereby any (conserved) Functional Value changes. This means machines (or systems or employees) must be treated like inputs, too. The reason is that Functional Value of any capital asset, current asset (or resource) or human resource changes by application e.g. due to wear and tear, further processing, exhaustion or cumulating experiences. And since all relevant process knowledge has to be treated like inputs the only controlling variable affecting production is the forecast of the requirement for the product’s (conserved) Required Functions.

2) Even immaterial things like ideas and patents require a change in value: The time necessary for their development cannot be applied for other things anymore e.g. not for more operational labor. In addition competitors often copy or imitate smart ideas and also patents hold only for a limited time period – i.e. their values deteriorate over time. (In this context please note that only one production step is shown. In reality there is a link between new experiences and knowledge on the one hand and smart ideas, patents, etc. on the other hand. So if there is more than one production step new experiences and knowledge (= outcome of step 1) may become smart ideas, patents, etc. (= inputs for following steps).

3) “Product” is used in the broadest sense: Besides physical products it involves services provided to internal and external customers, too.

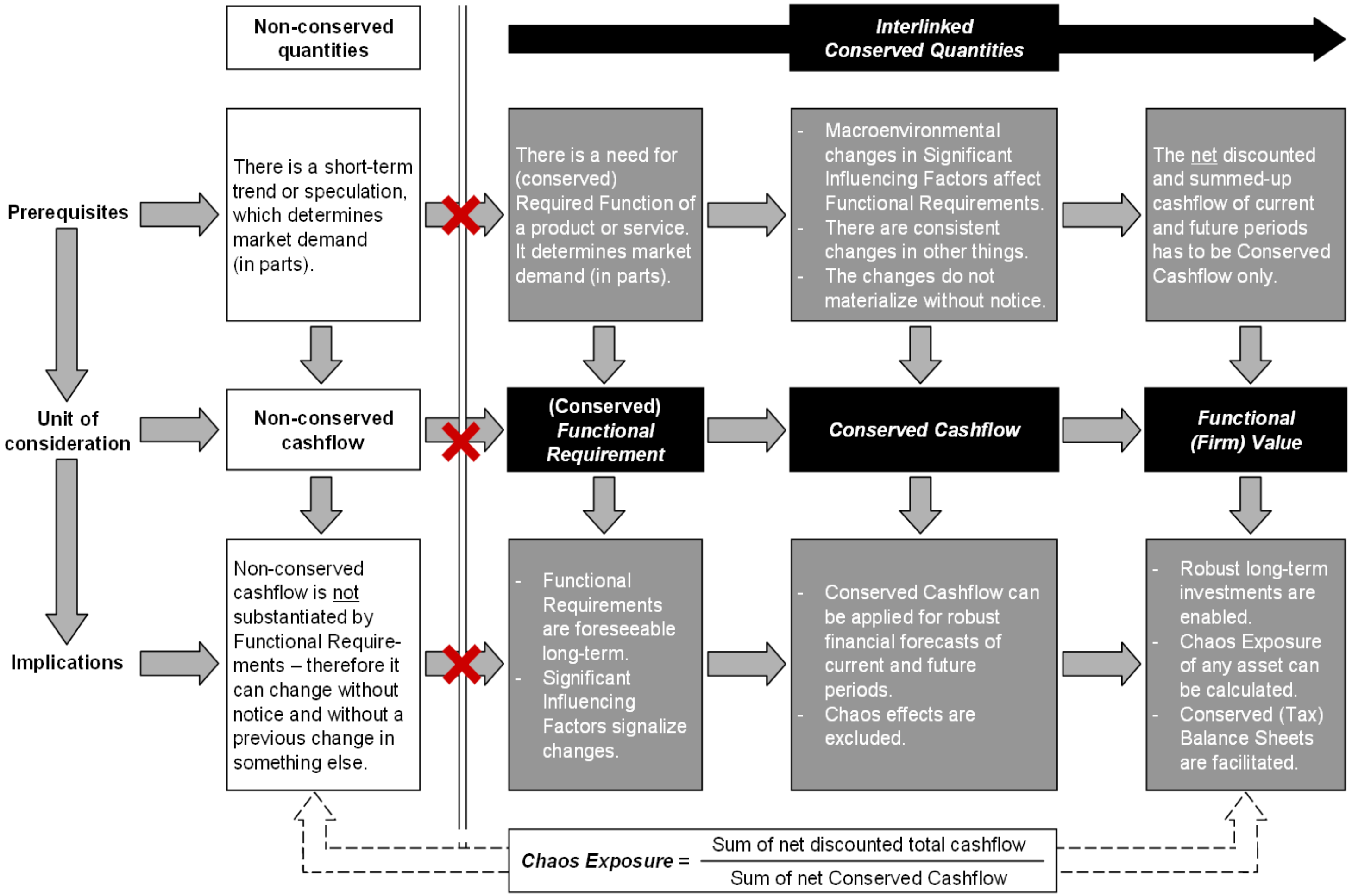
Figure 37: Strict Conservation Law in Business (illustration)

Strict Conservation Law in Business prevails not only for Functional Value creation but also for Functional Value *destruction*: Consider the case of a worker impairing something accidentally e.g. by drilling a hole into a piece of metal at the wrong place. Then some parts of Functional Value of the human labor (“$\underline{v_l}$”) and the capital asset (“$\underline{v_a}$”) were applied to destroy some parts of Functional Value of the resource (“$\underline{v_r}$”) without raising any part of the Functional Value of the product (“$\underline{v_p}$”)! The further processed piece of metal may be suitable for serving another (conserved) Functional Requirement – therefore the metal’s destroyed v_r can be determined case-based only. But without further analysis it can be claimed that the loss of v_l, v_a and particularly v_r can be ascribed to Functional Value of new experiences and knowledge ("$\underline{v_e}$"). Thus Strict Conservation Law in Business remains true anyway! In this context also heuristics seem to make a good case for Strict Conservation Law in Business: No company actually employs people, who – at the same production step – continuously destroy things accidentally (cf. Chapter V, 2.1 – in particular footnote 3)! (The only counterexample may be a company without a caring management, which consequently lacks going-concern potential. But such a company does not require long-term forecasts and Functional Valuation anyway). In actuality workers once having destroyed something will better understand the underlying processes. This makes them more efficient going forward – so there is a gain in v_e that they can apply for their own account but also for the one of their employer. (Looking back at my experience in production companies workers from time to time showed me their self-created devices, which helped to reduce their scrap rate. These devices, which were born out of experiences, increased not only their efficiency but also the one of their co-workers). This means in summary: Functional Value destruction leads (demonstrable) to Functional Value creation in the next step – thereby Conserved Quantity cycle is closed in any case (= Functional Value creation *and* destruction).

3 Functional Firm Valuation: Verified principle approach

Planning and forecasting are key tasks of any manager and investor. They are not only performed in course of the regular budgeting process but also in order to decide on the acquisition of assets and shares (if applicable until the whole company is owned) or the terms and conditions of an alliance. Forecasting at large is performed by taking a historic set of data, which is extrapolated into the future. For that forward-looking assumptions regarding changes in external determinants and the corresponding system-immanent reactions – as well as their interrelationships – are applied. In this sense management forecasts work like those in natural sciences (cf. "butterfly wing effect" e.g. in Chapter II, 3). The latter often are severely affected by chaos. Therefore it is advisable to expect chaos effects in business forecasts, too (cf. Grabinski (2004) and (2007)).

On the company level chaos evidentially can be excluded from financial forecasts yet: For that Appel and Grabinski (2011) and (2010) as well as Appel at al. (2011) analyze the actual need for the (conserved) Required Functions of a company's products, which can considerably deviate from total market demand. Based on their findings they compute Conserved Cashflow forecast. It amounts to *net* Conserved Cashflow of production (and distribution, etc.) and sale of product's Required Functions. The authors show that Functional Requirements – and thereby the company's net Conserved Cashflow – may (slightly) swing as well. However it shows no major jumps like market demand does. And changes in net Conserved Cashflow do not occur without notice but require consistent changes in something else. So Conserved Cashflow was proven by the authors' research to be the *primary unit of consideration* in order to exclude chaos from financial forecasts: To get a robust (= non-chaotic) value on the company level future net Conserved Cashflow has to be forecasted, discounted and summed-up – the result is Functional Firm Value (cf. Chapter IV, 2). To validate the effects of conserved and non-conserved quantities on Functional Firm Value setting-up scenarios is sensible. Thereby the margin of error, which is immanent to any (valuation) model, can be gauged. (In practice scenario assumptions are summarized frequently in the company's business plan. They stem from the analysis of the economic macroenvironment – including the industry structure – and the analysis of the strengths and weaknesses of the company under consideration relative to its rivals).



Please note that the total cashflow is applied in order to forecast in the "traditional" way.
In these cases the topline (= revenue) is determined by market values (= non-conserved cashflow + Conserved Cashflow).

Figure 38: Functional Requirements result in Conserved Cashflow and Functional Value

So taking everything together this implies that Functional Firm Value – which obviously is calculable with acceptable accuracy yet – reflects the sum-of-the-parts Functional Value of all material and immaterial assets of the company. They can bear conserved Functional Values (in parts) given they contribute to the fulfillment of Functional Requirements of customers and/ or the company – thereby Conserved Cash in- and/ or outflows are affected. That qualifies Functional Firm Value to verify the bottom-up calculation of Functional Values (= net Conserved Cashflows) of the company's individual assets – if there is a gap not all immaterial assets were accounted for yet. This artifice facilitates to fully account for all assets and liabilities (cf. Chapter V, 5).

4 Functional Valuation of equity by assets and liabilities

Conserved (Tax) Balance Sheet is to show a "one-pager-overview" of all Functional Values of immaterial and material assets and liabilities, which affect net Conserved Cashflow of any company. In order to balance sources and applications of funds – just like established balance sheet schemes do – the following assumptions must be taken for Conserved (Tax) Balance Sheets:

1. *Conserved (Tax) Balance Sheets contain all assets' and liabilities' Functional Values:* For Functional Valuation the term "asset" collectively contains immaterial "assets" like (self-provided) goodwill and employees' (current and future) labor besides the more obvious capital assets and current assets. (Herein "goodwill" is defined broader than in most established accounting schemes (cf. Chapter V, 5.2.3.3 – in particular Figure 56)).

   Immaterial "assets" are accounted to Conserved Balance Sheet (in parts) because they have the potential to change Conserved Cashflows – either by the fulfillment of customers' need for (conserved) Required Functions or by the fulfillment of the company's need for (conserved) Required Functions. The latter includes not only labor utilized in production but also labor in assistant services that keep the relevant infrastructure up and running (cf. Chapters V, 5.2.3 to V, 5.2.3.3.)! Though no company could exist without their employees' knowledge, experiences and labor these items are not shown (fully) in GAAP balance sheets (cf. Chapter V, 7.5).

2. *Conserved Balance Sheet shows long-term Functional Value added (or lost) per asset and liability.* Hence any Functional Value is measured as the sum of discounted Conserved Cash inflow and discounted Conserved Cash outflow per asset – not by e.g. the lower of cost or market value as established GAAP balance sheet schemes advice in case of inventories (cf. for example US-GAAP ARB No. 43 (1953) as well as the related comment in Chapter IV, 3)!

3. *Net discounted Conserved Cashflow to equity (= long-term Functional Value added (or lost) per investment in a total company)* therefore can be calculated as:

Functional Value added (or lost) for investor = Net discounted Conserved Cashflow to equity =

$$\sum_{1}^{a} \text{Asset's Functional Values} \ ./.\ \sum_{0}^{l} \text{Liabilities' Functional Values}$$

a = Total number of assets (Must not be 0 due to capital brought in at corporation of an enterprise).
l = Total number of liabilities (May be 0 if 100% of financing comes from equity).

Figure 39: Equity calculation

Equity is the *connecting piece* between assets and liabilities – not only in GAAP but also in Conserved Balance Sheets (cf. International Financial Reporting Standards ("IFRS") F49 (c) (2001)). The next logical step in Conserved Quantity Accounting is therefore to calculate assets' and liabilities' Functional Values. For that the proven approach of Functional Firm Value calculation is adapted; details for the diverse classes of assets and liabilities are discussed throughout the twenty Sub-Chapters of the upcoming Chapter V, 5.

5 Functional Valuation of assets and liabilities

Due to complexity this Chapter V, 5 is separated in two parts: At first it explains the core concept of Functional Valuation by applying the example of Functional Value analysis of a product. Thereafter this general approach is refined to address the specifics of diverse classes of assets and liabilities. (Please note that a particular company's liabilities are the assets of another one. Therefore their Functional Valuation approaches look alike).

5.1 Process of Holistic Functional Value Analysis

In order to retain the thrill it is rather uncommon to provide solutions right at the beginning of a Chapter (or a book). Nonetheless the "answer-first-principle" was consciously chosen here because: As soon as more than one task must be performed a well-founded understanding of the interrelationships between the diverse process steps becomes as crucial as the functional knowledge to perform any of the single tasks in isolation. Therefore Figure 49 is provided already here – it shows the process overview of Holistic Functional Value Analysis for assets and liabilities. Regarding the assistant frameworks the dissertation focuses on explaining the relevance and correct application of their (more or less adjusted) versions in the context of Functional Valuation. So the reasons why to apply a specific (adjusted) framework in order to perform a certain task are described without introducing its most general form before. Thereby readers should be able to focus as much as possible on the new in Functional Valuation without getting distracted unnecessarily by general and yet known issues. Over and above the general frameworks consider also non-conserved quantities – therefore they may not be completely appropriate anymore. Against this background the three key topics of Chapter V, 5 – and thereby of the following Sub-Chapters – are.

1. How to apply yet known analytical tools to differentiate between Conserved Quantities and non-conserved ones on the diverse levels of the economic system –

from the macroenvironment that affects the average customer to operational value creation that applies specific “assets” like capital assets or employees’ knowledge?

2. How must these analytical tools be amended before to identify Conserved Quantities – and if applicable what additional assumptions must be taken thereby?

3. Since Functional Value is measured from the point of view of the average (company-external) customer: How to come to an end result that mirrors this customers current and future appreciation of the (company-internal) assets and liabilities, which allow for generating products that have more or less required functions?

Analysis (and core consideration)	Analytical steps	Reason for global cash (re-)allocation	Assistant frameworks, studies, data sources
1 Strategic fit	1.1 Industry attractiveness 1.2 Macroenvironment	*External* Significant Influencing Factors	- Five forces - PESTLE[1] - Economic statistics
Strategic fit increases company's potential to wrest parts of global net cashflow from any kind of consumption, investment or saving. Strategic fit from customers' point of view is describable as: $\text{Fit} = \frac{\text{Functional Value}}{\text{Market value}}$	1.3 Company's selected strategy and implementation 1.4 Company's enablers of competitive advantage (material and immaterial assets)	*Internal* Significant Influencing Factors	- Market-based view - PIMS[2] (and follow-ups) - Value chain - Resource-based view
	1.5 Synthesis: Company's relative position in industry (determined by Functional Value generation from customers' point of view, enabled by company's material and immaterial assets)	*Fit* between ex- and internal Significant Influencing Factors	SWOT[3]
2 Functional Value per *single* asset and liability	2.1 Split of assets – and liabilities[4] – in functions and related cost drivers (material, machine utilization, human labor, capital costs)	*Internal* Significant Influence Factors	- "Common" value analysis - ERP[6]-system
Functions are either conserved or not! This means they bear either value or not!	2.2 Margins or IRRs[5] ("Value Tags") additionally accountable to all functions 2.3 Synthesis: (Conserved) Required Functions and related Functional Values per asset and liability[4]	*Fit* between ex- and internal Significant Influencing Factors	- "Common" value analysis - ERP[6]-system - Functional Value analysis
3 Functional Value per *total volume* of assets Surpluses of current assets, capital assets and human "assets" bear no Functional Value!	3.1 Total volume of once acquired current assets compared to sales forecasts and against background of current and future plans on products' materials to be used 3.2 Total capacity of operational (capital and human) "assets" compared to sales forecasts and against background of current and future (in-house) production 3.3 Synthesis: Total Functional Value by asset category accountable to Conserved Balance Sheet, adjusted for obsolete volumes respectively idle capacities having no Functional Value	*Fit* between ex- and internal Significant Influencing Factors	- Business plans - Product (construction) plans - Production schemes - Sales forecasts - ERP[6]-system

[1] Political, economic, sociological, technological, legal, or environmental
[2] Profit impact of market strategies
[3] Strength, weaknesses, opportunities, threats
[4] Liabilities are valued analogously to assets because liabilities of the company under consideration are assets of another one. Hence liabilities' functions are determined by its most likely application, too: If a liability is spent for speculation respectively for items having no Functional Value at all its Functional Value is zero, too. But if it is invested in capital assets generating Functional Value in course of being applied in production the liability's Functional Value has to be accounted to Conserved Balance Sheet. It is valued from the point of view of the (debt) investor, too. Hence Functional Value of a liability amounts to the related net cashflow, which is the sum of the principal yet outstanding plus the expected capital costs until repayment.
[5] Internal rate of return
[6] Enterprise resource planning

Figure 40: Process of Holistic Functional Value Analysis for assets and liabilities

5.1.1 Analyze changes in external Significant Influencing Factors plus strategic fit

Looking at the conserved part of the economy it becomes obvious that people spend their money for goods and services, which from their point of view at the time of acquisition have more Functional Value than *any* other opportunity for resource allocation – i.e. not only the opportunities offered in the same product market segment (cf. Chapter III, 2.1.3.3). Hence customers prefer things having a better *fit* with their (conserved) Functional Requirements in comparison to any other alternative (= acquisition of another product, investment or saving). Over and above – and that is most important in view of Strict Conservation Law in Business (cf. Chapters III, 2.1.2 and V, 2.2) – people in parallel *forego* acquisition of something else, investment and/ or saving so that there is a *consistent change* in another Conserved Quantity. Because each Euro – and every second of life – can be spend only once the identification of Conserved Quantities – as well as of Value Gaps and economic bubbles – is facilitated. Holistic Functional Value Analysis becomes inevitable though in order to trace Conserved Quantities' flow: For this purpose total *conserved* purchasing power of people (= Functional Value of Work) as well as of economies must be separated into parts and allocated to the respectively most likely use of consumption, investment and saving (cf. below and Chapter III, 2.1.3.1).

When looking at this global economic system from the point of view of a particular industry or company the total of all people (= all potential customers) of course must be further analyzed to find the group of people, which currently and in the future may purchase the industry's or company's products (= target customers) – here Significant Influencing Factors on customers' Functional Requirements facilitate forecasts. Hence for Functional Valuation – which is also applied in Conserved Quantity Accounting – (net) Conserved Cashflow must be allocated from the point of view of the average customer of the industry under consideration. The principal assumption hereby is that the average customer is the one who performs Functional Valuation of the fit between the function(s) of the product(s), which the respective industry offers, and his/ her Functional Requirement(s). This Functional Value can be allocated in the next step to the involved companies, their material and immaterial assets as well as their employees. Yet it is most important to check before whether or not the forecasted marketing potential is conserved in actuality.

5.1.1.1 Reconsidering marketing potential in view of Conserved Quantities

At this point please allow for an excursus, which relates Strict Conservation Law in Business to the (missing) fit between customers of a particular industry and its offerings. For it let us assume that Holistic Functional Value Analysis shows money, which is increasingly spent for certain products – respectively their more or less required functions – though other things are *not* changing consistently. Then the buyers did not reallocate their scarce funds away from other thing (= acquisition of another product, investment or saving). In consequence there is a high threat that (some parts of) the cashflow, which was spent yet, was not conserved! This may lead to an economic bubble in particular given such non-conserved buying behavior continues. The only counterargument here is that something is missing in the line of reasoning stated so far. More clearly this means that the high-spending buyers may have found *new ways to balance their cash outflow*. Finally if every member of the economic system could increase his/ her Functional Value of Work (= total conserved purchasing power) they not necessarily needed to forego other consumption, investment and/ or liquidate savings in order to consume more than before. (Nonetheless a change in Significant Influencing Factors would be cognizable still, which guides the buying behavior). But is it actually possible in view of Strict Conservation Law in Business to increase Functional Value of Work? For *individuals* it is feasible in any case – Functional Value of Work of one particular employee, who e.g. programs the ERP system offered by SAP, increases while the one of an accountant, whose employer implements this system, decreases (cf. Chapter IV, 2.2). However arguments in favor of conserved growth in purchasing power (= Functional Value of Work) can be disproved for the *global economy*. The total number of potential customers – which equates to increases in Functional Requirements – *and* Functional Value of Work (= conserved part of purchasing power) – which changes correspondingly to serving these Functional Requirements – would have to increase. The falsifiable arguments are as follows:

1. The cash flowing to “new markets” respectively “new products” may be balanced given *Functional Value of Work* was raised before due to *efficiency increases*. The issue is here: The argument is not yet sufficient to grow Functional Value of Work within the economy under consideration. In parallel to efficiency increases

there must not be higher unemployment rates – this is typical however in course of improving industrial production. In addition employed people must perform *Functional Value adding tasks*! In this sense producing something for which there is *no* Functional Requirement is as *insufficient* for operational Functional Value creation – and thereby increasing Functional Value of Work – as employees who are physically present at their workplaces but "have just fun" at the expense of the respectively employing company (cf. Chapter V, 5.2.3.2).

Over and above efficiency does not increase to the same magnitude in each and every country, industry or company. And disparity in efficiency means disparity in processing times and costs – these things result in competitive advantages for some and competitive disadvantages for others. In reality that would lead to a *conserved shift* in market shares – i.e. more conserved required work for some and more unemployment for the rest. Therefore the conserved part of total purchasing power would be *reallocated* but would *not* grow. The first argument is wrong!

2. The cash flowing to "new markets" or "new products" may be balanced given the *number of potential customers increases* and their *average conserved purchasing power (= Functional Value of Work) retains at least stable*. The issue is: The line of reasoning follows to some extend the one above. But again such changes do not yet support the argument that total conserved purchasing power may grow! First and foremost people must perform not just any work but Functional Value adding work! Whether or not it is possible to bring more people in Functional Value adding work – while eventually becoming even more efficient – is meanwhile questionable, in particular in highly developed affluent industrial societies.

In this context the *reallocation* of total conserved purchasing power (= Functional Value of Work on the level of economies) is far more realistic than its growths. The second argument is wrong, too! (As discussed yet total gross domestic product bears no explanatory power in view of Functional Value of Work. Hence for further confirmation economic research is suggested, which links societies' Functional Requirements to citizens' work contents. The CLPK research program will attend to this topic under the direction of Prof. Dr. Michael Grabinski).

Though this excursus focuses implicitly on equity financing until here please note there is nonetheless *no further way* to increase total Functional Value of Work respectively *conserved* purchasing power of all economies, companies or people in parallel – yet this would be the *only* way to avoid consistent, conserved changes. But already the established economic theory points out that customers' purchasing power is *net* of any debt service. Furthermore it must be tested case-based still whether or not debt financing bears Functional Value from the point of view of Strict Conservation Law in Business. The following generic examples depict how such testing works:

1. *Debt financing is conserved*: The funds were used for acquiring products or assets (e.g. for production), which have Required Functions *and* the funds can be repaid by Functional Value of Work.

2. *Debt financing is non-conserved*:

   2.1 The funds were used for acquiring products or assets (e.g. for production), which have Required Functions but the funds *cannot* be repaid by Functional Value of Work.

   2.2 The funds can be repaid by Functional Value of Work but they were used for acquiring products that do *not* bear Required Functions, assets that are *not* applied in operational value chains for products bearing Required Functions *or* the funds were spend for speculation.

The key insight therefrom for Holistic Functional Value Analysis – and its application in Functional Valuation as well as Conserved Quantity Accounting – is: Conserved Cash for "new markets" and/ or "new products" cannot be generated so that also conserved "new markets" for "new products" cannot be generated – therefore there must be always at least one consistent change (though some marketing managers may claim something else):

In actuality Conserved Cash flowing to this "new market" to acquire "new products" will be missed in "established markets" for "established products" in the future – this manifests a consistent, conserved change! Or some accounts will not be cleared – which manifests a special form of non-conserved trading though (cf. below).

Internalizing the fact that Conserved Quantities can be transferred but cannot be generated out of nothing is core for long-term robust (= non-chaotic) business planning, forecasting, Functional Valuation and Conserved Quantity Accounting. Non-conserved changes like in the case of "new markets" and/ or "new products" that have no effects on the cash allocated to "established ones" parallel the example of an electric circuit, which is able to compensate any energy consumption no matter how large the demand becomes. In physics it is understood that such energy seemingly appearing out of nowhere is neither realistic nor conserved. Consequently the electric circuit – and all cable-connected devices – at some point in time in the future *must stop* (cf. "perpetual motion machine" as well as Chapter III, 2.1.2). The same holds for any non-conserved trend in business and economics, which is manifested by cashflow that bears no equivalent countervalue. In the conserved case such *countervalue* stems from Functional Value of Work *and* there is at least one consistent change in another Conserved Quantity in form of a change in Functional Requirements that guide consumption, investment and/ or saving behavior. If not both of these requirements are fulfilled the forecasts of the marketing potential of any product will not be conserved and therefore *overestimate* the positive effect any trend may have long-term on the producing company's Functional Firm Value as well as on its assets' Functional Values. The reason is obvious: There is no Functional Value allocated to a company who sells products, which may bear Functional Value but cannot be paid by the customers (= no conserved transfer of a countervalue). But this insight was – and most likely still is – ignored often! The latest financial crisis, which started as the burst of a bubble in the real economic market for real estate, may be one of the best examples for it (cf. also Chapter III, 3.2.1.3):

1. The seed for the crisis was planted by people who spent funds largely obtained by borrowing in order to own private real estate *though* the buyers were *not performing changes in at least one other Conserved Quantity* (= here: changes in *con-*

sumption, *investment* and/ or *saving* given (changes in) their *Functional Value of Work* were too low for debt services). Of course lenders – in particular banks – and public institutions that eased debt access to people with too low Functional Value of Work are responsible, too. In any case buyers of houses on the short run were not pressured to forego any consumption, liquidate some of their investments and/ or use up saved money (if they had any) in order to pay down their houses. Instead they could lend easily on their houses if new money was needed. Total consumption therefore was kept high by rising market values of the real estate, which backed the credits. To be more precise: *On the total economic level consumption was kept high due to people speculating that the market trend in form of rising real estate market values will continue.* However market values are non-conserved quantities and non-conserved changes or trends are irrelevant in context of robust business planning, forecasts that are free of chaos – but are traceable back to economic facts instead – as well as in context of Functional Valuation and Conserved Quantity Accounting!

2. After a while lots of people *wrongly* viewed upon *houses as investments* such as annuity insurances, whose *values rise continuously* and can be loaned on or liquidated in order to get money for consumption. Furthermore debt conversion is relatively easy in flourishing markets. However the positive market forecasts were illusory because something essentially was missing, which separates conserved trends from non-conserved ones and investments from speculations: Again there was *no change in another Conserved Quantity* (= here: change in Functional Requirements – triggered by changes in Significant Influencing Factors – which could justify positive changes in market values). Since people did not acquire houses anymore due to intrinsic Functional Value only (= here: to have “a roof above ones head”) the non-conserved market demand outpaced Functional Requirements. In consequence (non-conserved) market values of houses overshot considerably their (conserved) Functional Values, which could be justified by real economic facts in form of Functional Requirements. This means a large group of involved people expected values, which actually did not exist.

3. Neither lenders nor debtors questioned whether or not the overvalued houses, which nonetheless found a ready market, were *(strategically) fitting* their new owners' Functional Requirements. First and foremost the lion's share of the buyers had Functional Requirements for a *place to live* and *not* for a speculative asset, which they *cannot* pay down given their positive market forecasts – that applied non-conserved quantities – do not materialize. But in particular buyers expected being not required paying down the houses, which they purchased on credit, by their often comparatively low Functional Value of Work they generated by their main profession: For years they learned that they as well could resell their houses profitably within the (temporarily) rising market to discharge their liabilities. Over and above buyers' risk aversion was disoriented by ludicrous low or variable interest rates, whose future developments were neither fully understood nor foreseeable by them. Therefore they did *not* prefer things having a better *fit* with their (conserved) Functional Requirements in comparison to any other alternative (= acquisition of another product, investment or saving). Looking back – in view of Strict Conservation Law in Business – a better fit (often) may have been to buy cheaper houses or none at all, i.e. to remain renters for the time being. (At this occasion please recall the following: Functional Value of Work includes collectively people's earnings from their main profession *plus* returns on investments that accrue Functional Value. The latter must be added because it requires thorough analysis to find such investments. So the related time cannot be spend e.g. for other work anymore and of course also the funds cannot be invested more than once at one time – hence they are Conserved Quantities (cf. Chapters III, 2.1.3.1 and III, 2.1.3.2 as well as Chapter III, 3.2.1.3). Nonetheless it is unlikely that a person, who is no full-time investor, will be able to remain the owner of a house and pay down its acquisition price by returns from investments that he/ she performed in his/ her scarce free time. Therefore the buyers' spending capacity – and thereby their ability to own a certain class of real estate – is set here by (changes in) Functional Value of Work, which buyers generate in their respective main profession).

4. Irrespective of the missing fit the *overvalued houses* were *acquired continuously at large scale*! The reason was that house owners *speculated* they could always

make a profit by reselling their home someday. And also banks, which *speculated* on rising market values as well, were happy to provide fresh new funds. Thereby all related parties made the same culpable mistake: Their private consumption plans – respectively their business plans – relied on forecasts, which *ignored Strict Conservation Law in Business*! The acquisition of a house for sure is Significant Influencing Factors on the buyer's Conserved Cash allocation so that there must be a consistent change in view of his behavior of buying, investing and saving. Furthermore given variable interest rates were agreed – and higher interest rates fall due – there eventually must be another consistent change namely in form of the buyer's Functional Value of Work. Otherwise repayment of the loan becomes even less likely. Over and above given there is no change in Significant Influencing Factors on Functional Requirements – e.g. migration movements to certain residential areas and consistent countermovements to other ones – the house may be overvalued (everywhere). Then chances of repayment of the loan – e.g. by a forced sale – is most unlikely.

At this occasion please note that hedge fund managers like John Paulson and Andrew Lahde made a fortune with *misvalued securities*: In fact Paulson said he found the most misvalued ones in subprime mortgage-backed securities in the USA, which were based on lending standards that required no job, no assets, no credit history and no down payment. So there was a harmonization of interest levels of actually risky house buyers with the ones of buyers which actually deserved good credit ratings. This means: *The ignorance of Functional Value of the total countervalue,* which equates to *total Functional Value of all funds* that the buyer could raise by his work and the liquidation of his properties that backed the loan for his house. Therefore everybody got the chance to become a house owner, which finally led to the (non-conserved) real estate bubble. Both buyers and lenders ignorance of Strict Conservation Law in Business can be assumed to be implicitly taken into account by Paulson, Lahde and the likes. Or to phrase it alternatively: When following Strict Conservation Law in Business investors could have known that the market for real estate in the USA – and thereby also the markets for related credits, securities and insurances – were threatened to collapse chaotically someday. For it the reason is simple: Strict Conservation Laws – no matter whether or not they appear in natural scientific or economic systems – always require the consistent change respectively the *transfer of a (conserved) countervalue*. And since the buyers of the houses were unable to provide it at large scale – often right from the beginning – and since the inevitable consistent change in form of buying, investing, saving and/ or Functional Value of Work were missing for years it became clear for Paulson, Lahde, etc. that *somebody else* must settle the house buyers' accounts someday! Finally at the latest on the total economic level Strict Conservation Law in Business equates always to a *zero sum game* (cf. Chapters III, 2.1.3.2 and V, 2.2).

So *signals for non-conserved market trends* are in summary: The missing of consistent, conserved changes in buyers' Conserved Cash allocation in connection with the missing fit between – on the one side – buyers' Functional Requirements as compared to Required Functions of products or assets that they acquired and – on the other side – buyers' Functional Value of Work. The example of the real estate market in the USA was intended to depict the manifestation thereof namely: Steady growth of (non-conserved) *Value Gap* between the houses' rising (non-conserved) market values – which in addition were often too high in comparison to the owners' (conserved) Functional Value of Work – and the houses' (conserved) Functional Values that remained relatively stable over time though. In consequence large parts of the money spent in this market simply could not be conserved so that the market could not continue growing robust (= non-chaotic) long-term! Therefore *Value Gap* of yet traded products or assets can be interpreted also as the *non-conserved countervalue* of the *non-conserved part of the total funds*, which circulates within the economic system. In this sense Value Gap is *"the amount of money coming out of nowhere"* or *"the amount of money that is too much to be real"*. Needless to say that these amounts must *not* be used for marketing forecasts, which shall serve as input for Functional Valuation and Conserved Quantity Accounting. (For this Chapter V, 5.1.1.2 cf. CNBC (2010), Pitzke (2007), Pitzke (2008), Spiegel (2011d), Mallaby (2011) and WeltOnline (2008)).

5.1.1.2 Foreseeing conserved changes in marketing potential by strategic fit

The real estate example in the previous Chapter V, 5.1.1.1 was chosen consciously in order to stress over and over the starting point of Holistic Functional Value Analysis. As noted it is *the* key insight to perform robust businesses planning and forecasting correctly: Look for the *consistent changes*! There must be a *change* in Significant Influencing Factor(s) that determines the system's future state and – in order to be conserved indeed – this *change* must result in *changes* of more than one Conserved Quantity (cf. Chapter III, 2.1.2). Then one has found Conserved Quantities that are valid inputs to calculate Functional Values, which are accountable to Conserved (Tax) Balance Sheets. At this occasion please note that Holistic Functional Value Analysis can be handled *effectively* and *efficiently* just when looking for changes in the allocation of the target customers' Functional Value of Work – i.e. changes in the allocation of their regularly distributable Conserved Cashflow – as compared to the current state. Instead aiming to calculate in one single step the *absolute numbers* of cash allowed for the conserved part of any kind of consumption, investment or saving – e.g. in real estate – would be too cumbersome. In addition one would miss a starting point, which is required for comparison in order to estimate the financial forecast's margin of error. Hence the suggested process to come to the conserved marketing potential a particular industry and company can capture going forward is:

1. *Analyze changes in external Significant Influencing Factors:* Look at the current situation of the company under consideration, its competitors and their macro-environment. Find out how external Significant Influencing Factors affected their customers' Functional Requirements. In addition analyze future scenarios to forecast the magnitude how strong customers' Functional Requirements will react on most likely future changes in external Significant Influencing Factors. Thereby the *total conserved volume for specific industries* can be forecasted.

   For verification: Given the financial forecast shows that a certain industry grows stronger than total Functional Value of Work of the total number of potential customers, there must be a transfer of Conserved Cashflow from some other industry (applied for consumption or investments) or from savings. This transfer of Conserved Cashflow must be traceable back to changes in external Significant Influencing Factors and – on the levels of the related industries – Conserved Cash inflows and outflows must be round about equal. Otherwise the calculation of the total future marketing volume is dubious. It has to be reviewed because the forecasted marketing potential of the total industry seemingly does not reflect Conserved Quantities only.

2. *Analyze changes in internal Significant Influencing Factors:* Find out the internal Significant Influencing Factors, which determined the current market position of the company under consideration relative to its direct competitors as well as to substitute providers. These are the company's strategy and the "enablers" of competitive advantage, which lead to successful strategy implementation. So "enablers" comprise the company's material and immaterial assets – the latter include goodwill as well as employees, their labor, ideas, experiences, knowledge, etc.

In particular the immaterial assets are hard to imitate (cf. Collis and Montgomery (1997)). Therefore their potential to provide long-term competitive advantages is relatively larger than the one of material assets. Therefore immaterial assets are relatively better in long-term Functional Value generation. But only Conserved Balance Sheet shows Functional Value of all immaterial assets – GAAP balance sheets in contrast do not (cf. Chapters V, 5.2.3 and V, 7.5).

3. *Plan the company's future (strategic) fit and forecast its magnitude on net Conserved Cashflow:* Find out how the company's strategy could be optimized in order to provide a better fit between the most likely changes in external Significant Influencing Factors, their effects on both targeted customers' Functional Value of Work and targeted customers' Functional Requirements. Thereby it becomes clear what Required Functions the companies' products should have going forward taking an average customer's point of view. Furthermore the conserved market share – and thereby Conserved Cash inflow – could be gauged, which the company under consideration could wrench from its rivals given it changes its strategy and product portfolio like the analysis suggests. To finalize this step forecast not only the mag-

nitude of strategic amendments on Conserved Cash inflow but also on the Conserved Cash outflow due to upfront investments and potential changes of the cost structure. Please note these are also Conserved Quantities since Strict Conservation Law in Business requires that Functional Value, which is transferred to any product, is reduced at some other place in the operational value chain (cf. Chapters V, 2.2 and V, 5.2.1.1). So the levers for operational value creation – increase (conserved) revenues and/ or reduce (conserved) costs – are valid for Functional Value creation, too.

For verification: Again there need to be Conserved Quantities only – given one company's share of the total conserved market volume is expected to *grow* the market share of another company has to *decrease* accordingly. And there must be a well-founded analysis, which is able to link this transfer of conserved market share to a better (or worse) *fit* between changes in customers' future (conserved) Functional Requirements that are determined by both *external* Significant Influencing Factors and Functional Value propositions of companies' rivaling products (= *internal* Significant Influencing Factors). If there is no such link a transfer of conserved market shares *cannot* be assumed. Therefore the difference in market shares, which – on the level of the related companies – equates to the overestimate of cash inflows, cannot be conserved. In consequence it cannot be taken for granted and it should not be applied in Functional Valuation and Conserved Quantity Accounting of any company respectively of its assets!

5.1.1.3 Strategic fit's effects on Functional Values

The notion of *"(strategic) fit"* implies diverse ways how companies can match customers' Functional Requirements by products' Required Functions. Naturally the implementation of related strategic changes affects operational Functional Value creation of the company under consideration and the portfolio of assets the company applies for it. In the context of forecasting changes in conserved market volumes and conserved market shares the process, which the average target customer performs to evaluate the fit before allocating (parts of) his/ her Functional Value of Work, is assumed to work as follows:

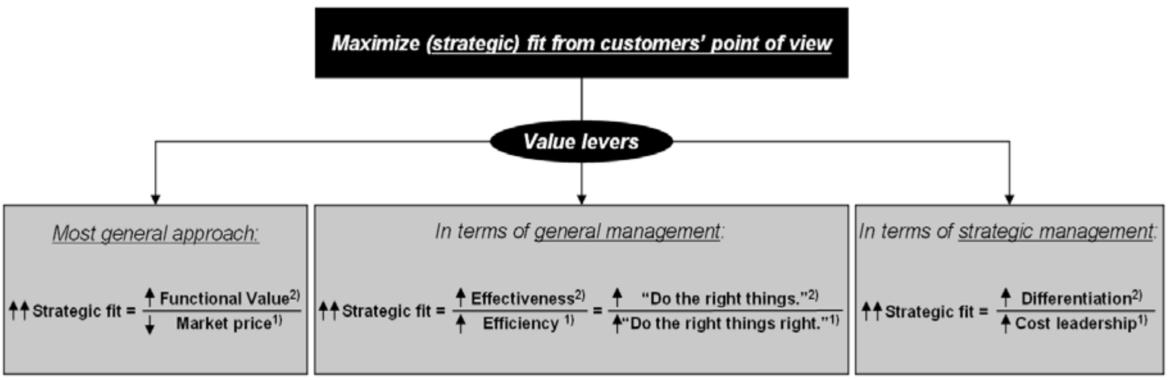
1. The customer explores *all* opportunities for cash allocation, i.e. consumption, investment, saving. How much of the cash that he/ she will spend can be declared "conserved" is determined by the decision the customer takes in the end – for it the item's functions must be discriminated into conserved and non-conserved ones (cf. Chapters III, 2.1.2 and V, 5.1.3).

2. Customers assort a *bundle* of products or investment/ saving opportunities. All items within the bundle – in principle – are able to provide customers' *currently most Required Function(s)* being determined by Significant Influencing Factors.

3. Among all these items the customer selects the one with the highest competitive advantages relative to the others (= *highest Functional Value* from average customer's point of view = best fit).

Here one crucial detail must be considered in the context of Functional Valuation: It is a fact that functions *either* bear Functional Value *or* not. Nonetheless Functional Valuation does *not* assume homogeneous products that bear *either* Functional Value *or* not! Instead it assumes that companies are able to excel by offering products, which have a closer (strategic) fit with customer's Functional Requirements, by selecting among a portfolio of functions that they can – but not necessarily must – add to their products respectively (cf. Chapter V, 5.1.3). Against this background one of managers' primary tasks becomes to plan strategies and execute their operative implementation, so that the offered products' (conserved) Required Functions – firstly – *fit at all and* – secondly – provide this fit in a *better way than their rivals* do (cf. below).

An advanced *value-for-money-concept* describes mathematically how to maximize the fit of companies' offerings from *customers' point of view*: A strategic fit that bears a higher amount is not only the way to capture more of the total conserved market volume. It also leads to a more robust (= non-chaotic) business with less Chaos Exposure. (Due to logical reasons Chaos Exposure must be defined as the reciprocal value of strategic fit (cf. Chapter V, 6)). Please note that there is an inevitable link between the advices to "look at consistent changes" and to optimize (strategic) fit – the latter must be adjusted as soon as Significant Influencing Factors shifted. This link shows once more that Conserved Quantity Approach does not lead to the definition of fixed Required Functions having fixed Functional Values but to *dynamic* ones – however only if a justification in terms of both *direction* and *magnitude* of the change!



↑↓ Directions of changes, which are required respectively.

1) Formula assumes that companies *in principle* can pass on higher/ lower costs to customers by asking for higher/ lower market prices (= market values). But whether or not price adjustments are sensible must be analyzed in the context of the selected *strategy* because:
- Whether or not the formula's numerator and/ or denominator should be optimized depends on the company's plan to implement a differentiation, cost leadership or hybrid strategy (= mixture of both).
- For example in markets for luxury respectively superior products a reversed demand function may prevail – then lowering market prices may even scare off customers instead of enthusing them.
- However in markets that have regular demand functions – like in most segments of the consumer electronics, automotive and capital goods markets – lowering market prices in all likelihood will increase the share of the total conserved market volume that this particular provider is able to capture.

Therefore strategy selection as well must consider from customers' point of view "soft" Functional Requirements, which are determined by external Significant Influencing Factors, too (cf. Chapter III, 2.2.3 as well as Chapters V, 5.1.4.1 and V, 5.1.4.2).

2) Increasing Functional Value is particularly an issue of *accuracy* because: A company may succeed by providing more (conserved) Required Functions per product than rivals. But if (some of) the functions are not required customers nevertheless may not be willing to prefer the product and spend additional money. Furthermore "over-engineering" by (conserved) Required Functions is no path to success either. Whether customers view upon the product being an "all-purpose" masterpiece or whether the essence of the whole is fraught with distracting details depends heavily on the specific product and the targeted market segment, i.e. the (average) target customer's love for technique.

Figure 41: (Strategic) fit as evaluated from customers' point of view

The example of the Swiss watch industry may help to interpret correctly the formula shown by Figure 41: The industry underwent drastic changes in particular in the 1970's as quartz watches could be produced increasingly cheaper and on large scale. Back then customers were no collectors and technical gadgets like laptops or mobile phones did not exist yet. Therefore customers largely had one Functional Requirement: *To know the exact* *time*. This Functional Requirement was understood by managers in watch companies worldwide. Also managers in Switzerland accepted it. But they did not want to abandon their roots in mechanical watches. In consequence they invested lots of effort in developing, manufacturing and certification of accuracy of their mechanical watches. Actually their products became increasingly better in primary Required Function of showing the time exactly. *Hence a strategic fit existed for Swiss watches*. However they in parallel became even more expensive relative to the rival offerings – and customers of those days at large did not want to pay an additional margin for any heritage in watch making. In consequence *strategic fit was even better for rival offerings* with cheaper quartz movements. The rivals understood the Functional Valuelessness (in the term's most narrow sense) of wasting resources for "soft" functions – like heritage – that were non-conserved, not required and therefore unable to positively affect the products' fit from the average customer's point of view. So – to put it more general – the rivals understood that the average customer's product selection and willingness to pay is not affected positively by anything he does not have Functional Requirements for. In the end the conserved transfer of market shares from Swiss manufacturers to largely Asian-based highly automated producers was facilitated because the Asians applied the scarce resources of their companies more efficiently – therefore they could pass on their lower costs in giving Functional Value to their products to customers that appreciated the comparatively lower prices. In addition the strategy of Asian watch manufacturers was also more effective because most quartz movements were not only cheaper but also became more precise. Please note that the transfer of market shares was conserved indeed because: The changes in the same external and internal Significant Influencing Factors – which from customers' point of view determine collectively a more or less good fit of the products – resulted in a loss of Swiss companies' marketing potential, which was consequently absorbed by Asian companies (cf. Trueb (2003)). Please also note that Significant Influencing Factors have changed the watch market as of today once more: Due to portable electronic devices, which not only but also show the time, it is not required anymore to wear a watch in order to know the time exactly. Though these electronic items have completely different core Required Functions such as mobile telephony or mobile data processing they took away conserved market volume from the market segment of non-collector's watches. Nonetheless – respectively therefore – Holistic Functional Value Analysis would have been able to foresee today's conserved market volume by looking at the related changes.

The Asian companies in the example above finally understood at best what *optimizing (strategic) fit* really means: Focus on the most accurate serving of customers' (conserved) Required Functions – better than any other rival – and leave out valueless things. Furthermore – in order to find better ways to generate these Required Functions – continuously challenge proven things by looking for changes in Significant Influencing Factors (e.g. in view of new technologies)! Needless to say that Conserved Balance Sheets must be able to account for such kind of developments in companies' macroenvironment. Finally they shall provide on one page an overview of all assets' Functional Values, which reflect real values that measure economic facts and add up to Functional Firm Value. (For details on general frameworks on strategic fit, whose insides were used in particular in this Chapter V, 5.1.1.3, cf. Andrews (1971), Henderson (1989), Peteraf (1993) and Seifert (2001)).

5.1.2 Link planning of strategic fit and its implementation to financial forecasts

Markets cannot be generated (cf. Chapters III, 2.1.2 and III, 2.1.3.2 as well as Chapter V, 5.1.1.1). Hence – given there is a superior fit in view of customers' (conserved) Functional Requirements – the respective company's strategy creates Functional Value for one (group of) investor(s) but in parallel takes away Functional Value from others. In consequence to succeed long-term companies have to establish a better (strategic) fit between external Significant Influencing Factors changing the need for their products' Required Functions and their internal capabilities to adapt to this changes. This stretches the concept of competitive advantage:

1. *Serve better customers' yet existing (conserved) Required Functions*, which were defined by yet existing external Significant Influencing Factors, than any direct rival or substitute product.

2. *Adapt faster to changes in external Significant Influencing Factors*, which changed customers' yet existing (conserved) Required Functions, than any rival or substitute provider (cf. "first-mover advantage").

3. *Combine 1 and 2* in order to excel on externally determined Functional Requirements compared to direct rivals and substitute providers.

4. *Apply internal Significant Influencing Factors not reactively but proactively:* They enable companies to produce changes by themselves, which are so significant that they feed back on the target market by becoming external Significant Influencing Factors. Then they must be considered by both customers in the buying decisions and direct rivals as well as substitute providers in their product designs – like industry standards (cf. Chapters III, 2.1.3.3 and V, 5.1.1.2). Thereby not only current but also potential future rivals or substitutes can be outpaced.

Please note the difference compared to 3: In case of 4 the company is challenged even more. It needs not just to react but to invent something, whose new solution to serve customers' Functional Requirements is significant for their buying behavior in the sense of 1. So the all-embracing example is an idiosyncratic technique, which is better in providing Required Functions, new – and in consequence marketable faster – and considered so significant by all market participants that even direct rivals, providers of substitutes as well as providers of related equipment switch to this technique. (For Significant Influencing Factors beyond the technological scope please cf. the PESTLE framework and its application as outlined e.g. in Chapters III, 2.1.2 and III, 2.2.3 as well as in Chapter IV, 5).

By all means generating competitive advantage has two consequences in terms of required changes:

1. Companies must amend Functional Value generation in view of strategic fit. For that changes are indispensable on the level of *current, capital and human "assets"*.

2. Customers must be able to *recognize* – and *appreciate* – these changes.

Please note that all these changes will take time to materialize: Therefore forecasting should pay respect to *ramp-up* and *(consistent) ramp-down phases* as well as *related costs* e.g. if the company intends to implement changes of its of product range or product design. The same holds if the company performed an M&A transaction in order to get (in time) the assets having the Required Functions needed for competitive advantage. Also here ramp-up phases and related costs must be forecasted because the restructuring, which is (often) inevitable before synergies can be developed, does not come for free – hence here are Conserved Quantities, too. So it seems appropriate to take a closer look at the operational levers of Functional Value, which a company can adjust to become better and/ or faster in implementing strategies that provide a better fit respectively that allow to become better and/ or faster in providing products that are appreciated by customers for their high(er) Functional Value. In the end not only strategies but also operations and related processes form the things, which affect investments and operating expenditures at large (cf. Tables 1 and 5). Consequently *operations and related staff* must be planned and forecasted in course of Holistic Functional Value Analysis, too. Thereby one gets also Conserved Cash outflow, which flows from the company to its suppliers and employees.

5.1.2.1 Strategic changes' influences on conserved financial forecasts

Like explained yet the planning and forecasting of changes in a company's internal Significant Influencing Factors on fit addresses both operational changes and strategic amendments, which caused them: Strategy changes the company's structure either by setting the course for internally performed (= generic) growth (cf. "competitive strategy") or by M&A (cf. "corporate strategy"). In any case – given *strategy is effective* – i.e. (strategically) fits products' Required Functions to customers' Functional Requirements it increases customers' conserved willingness to pay and thereby Functional Value they ascribe to the company's products. This increases *Conserved Cash inflow*, which flows from the customers to the company under consideration. In financial forecasts the successful implementation of such effective strategic plans is manifested by:

1. *Increased sales*: Functional Value lever here is *competitive advantage*, i.e. being better and/ or faster than rivals and substitute providers. This is competitive strategists' line of action. They have to understand how external Significant Influencing Factors affect customers in order to forecast whereto conserved market volumes will change in the future and how high the magnitude of changes in external Significant Influencing Factors are respectively. In response competitive strategists must initiate a (corresponding) change of their company's assets into this direction. Hence they have to guide the production and accumulation of new assets (including "soft" ones like new ideas, experiences and knowledge), which are able to address *effectively* Functional Requirements that go beyond the current ones.

To make this point clear please allow for reconsidering the watch market example (cf. Chapter V, 5.1.1.3): The effective part of the Asian watch manufacturers (Functional Value) strategy, which lead to a competitive advantage and higher Functional Value as compared to Swiss ones, was their application and enhancement of the new, accurate quartz technology. (The efficient part was their ability to provide quartz-equipped watches cheaply (cf. below)).

2. *Reduced costs due to growth (= increased sales)*: Value levers are economies of scale and scope (cf. Chapter IV, 3.2). They can be gained generically by competitive advantage, which materializes successively over time, or by taking a "short-cut" by so-called "order book-acquisition" in course of M&A transactions (cf. Jansen (2000), Vogel (2002)). This leads to point 3.

3. *Increased sales due to synergies*: Value levers are in principle the same as for 1. But here the company does not own the required assets yet and analysis shows it would take too long to generate them internally. This is corporate strategists' line of action. Functional Value is added e.g. by being able to offer products with more Required Functions or by being able to operate as a system provider in the future. Anyway additional functions for amended products have to be selected accurately to avoid (valueless) non-required ones or "over-engineering" by packing too much actually Required Functions into one product (cf. Figure 41).

An example of *effective* corporate (Functional Value) strategy is the alliance between Sony, the Japanese consumer electronics corporation, and Ericsson, a Swedish leading provider of telecommunications equipment and related services: The companies identified the (conserved) convergence between their core markets. But neither had all required assets right in place to provide mobile devices, which are not only useable for telephony but also for entertainment, in particular for music and gaming. In addition they realized that rivals already had built up competitive advantages regarding the combination of those Required Functions. Therefore following as lone fighters the paths of such rivals for both companies would have been too time-consuming and costly. In consequence they teamed-up as “Sony Ericsson” to leverage their competitive advantages in their respective core markets. And the synergies of this newly formed alliance were so significant that they led to a (conserved) transfer of market share in mobile telephony *and* in mobile music from rivals that offered either and/ or both of these Required Functions to Sony Ericsson. But for Sony and Ericsson this alliance also was *efficient* in the sense of point 2 because they could amortize their investments and operational expenses particularly in R&D and marketing across over a larger volume. Especially Sony should be named here because the alliance had to enter a licence agreement in order to get not only access to Sony’s technology and sales network but also access to Sony’s famous “walkman” brand name. However other mobile phone providers once more *“applied their internal Significant Influencing Factors not reactively but proactively”* (cf. above) so that they created Significant Influencing Factor by launching so-called “smartphones”. Sony Ericsson thereby lost its competitive advantage – mobile phoning and mobile music finally were no rare combinations of Required Functions anymore. Over and above smartphones had additional Required Functions – not surprisingly there was once more a consistent transfer of conserved market shares. Also this one could have been foreseen by Holistic Functional Value Analysis, which looks for consistent changes that damask the transfers of Conserved Quantities.

5.1.2.2 Operational changes' influences on conserved financial forecasts

Amending the strategy changes a company's existing structures and leads to larger *Conserved Cash inflow* (maybe followed by cost reduction via economies of scale and scope) whereas operational changes effect within a company's existing structure (just) *Conserved Cash outflow* by reducing total investments and/ or operational expenses going forward. In financial forecasts consistent changes due to more efficient operations are manifested by:

1. *Reduced machine hour rate*: They are recognizable by changes on capital asset level (and by looking at depreciation and amortization in GAAP financial statements). Functional Value lever is in particular raising the asset utilization. Given strategies are effective they lead to more sales and higher asset utilization comes for free when assuming round about stable outfits of machinery and equipment (in terms of capacity). Operational restructuring is another way to reduce idle capacity and in turn transfer of the corresponding (conserved) capacity to the remaining outfits of machinery and equipment, which consequently can be used up to their full capacity. If there is no idle capacity (yet) process improvement to reduce lead times – and thereby required capacity – as well as investments in operations having less total operational expenditures (or better: higher Functional Value) may increase efficiency (cf. Chapter V, 5.2.1.3).

   In any case to actually operate more efficiently there must be the (conserved) transfer of machine utilization from one facility to another. This means process improvements and investments must not result in higher idle capacity. Over and above total restructuring costs to close down old facilities, lay of employees, etc. must be lower than expected savings. (At least in Germany restructuring costs often are booked as "extraordinary expenses" in GAAP profit-and-loss statements. So please beware when comparing financial forecasts with actual financial figures to gauge the margin of error: Restructuring is (temporary) internal Significant Influencing Factor on Conserved Cashflow. Its magnitude does not accrue without notice so that financial effects of ramp-up and ramp-down phases must be considered in terms of both one-off investments and one-off costs and consistent changes in view of successively decreasing running operational expenses. Accounting for these Conserved Cash Outflows that over time run consistently in opposing directions is inevitable in order to adhere to Strict Conservation Law in Business in cases where forecasts of the company's conserved marketing potential stagnate but machine hour rates shall be cut nonetheless).

2. *Reduced material costs per product*: They are recognizable by comparing changes in revenues with the ones on the level of current assets (and with material costs in GAAP financial statements). Functional Value levers are in particular process improvements to lower scrap and thereby required volumes of resources, changes towards less costly material or fundamental changes regarding the construction of the product, which make particular (material) components or (immaterial) process steps unnecessary.

As in case 1 please look for consistent changes over time between items that will be accounted to the balance sheet, the profit and loss statement as well as the cashflow statement in the forecasting model. Given these three elements of the financial forecast do not show consistent changes they are still "unbalanced" with regard to transfer of Conserved Quantities.

3. *Reduced net of total costs for operations and purchased parts*: This is recognizable by comparing changes in capital assets, current assets, employees – and related costs – with the ones of purchased parts. Functional Value lever is outsourcing to (specialized) companies being able to produce (strategically insignificant parts) more efficiently than the company under consideration (cf. "resource-based view").

In parallel to investing in new facilities owned by the company – like in case 1 – outsourcing does not necessarily led to more idle capacity. To be efficient, i.e. to raise Functional Firm Value by lowering Conserved Cash outflow, there must be consistent (conserved) changes in all things utilized for in-house production before.

And the total costs for implementing these changes – meaning restructuring costs – again must be lower than the forecast of the savings, which are determined by the cost difference between in house outside production!

4. *Reduced capital costs*: They are recognizable by changes in interest accrued and paid, trade payables and trade receivables. Functional Value lever is optimizing the time value of money. A straight forward form of implementation is negotiating better conditions with debt providers, i.e. lower margins and/ or (re-)payment schedules of principal and interest in favor of the debtor. Having to accept longer payment schedules from customers increases capital demand and costs; getting allowed to pay suppliers later reduces it.

At this occasion please note that waiting for cash is never cost-neutral due to either the need to refinance the receivable or at least the opportunity cost of foregone investment opportunities. The opposite is manifested by outstanding payables. Again there are Conserved Quantities at work – the gain of one party transfers to the loss of another one (cf. Chapters V, 5.2.2.1 and V, 5.2.2.2).

5. *Reduced costs of immaterial "assets"*: They are recognizable on the level of employee costs and purchased parts. (At least in German GAAP temporary staff and training costs are often allocated to the latter). Functional Value levers are process improvements to lower the number of required employees, employee training as well as learning curve effects (cf. "learning curve").

Regarding the two latter levers – namely effects of training and learning curves – please note: They may not only raise efficiency (i.e. reduce costs) but also upgrade effectiveness (i.e. increase revenues). Given customers approve by their buying decisions that one particular company has a competitive advantage directly related to its more efficient employees – e.g. by service quality (= here: less rework) and response time – the costs by employee and carried out order will be comparatively low. But these more efficient employees in addition may lead to a conserved transfer of market shares, too, namely away from less efficient rivals. This exemplifies once more the interplay between increased sales (strategic level) captured from the conserved market volume by more efficient employees (operational level).

5.1.2.3 Identify (non-conserved) misalignments between strategic and operational plans, and resultant financials forecasts

As reasoned above the changes in operations, which lead to gains in efficiency, affect a company and its financials in manifold manner. Again the Asian watch producers (cf. Chapter V, 5.1.1.3) provide a nice showcase of goals that must be set on the highest level of operational planning:

1. *Fit operating costs* to willingness to pay.

2. *Fit operational capacity* to required volumes (= the particular company's share of total conserved market volume).

3. *Do not loose sight of strategic fit*: Product quality (still) has to meet customers' Functional Requirements after changes for efficiency increases were implemented. In the end – no matter how cheap products are – nobody pays for any item if it does not work appropriately!

On lower levels of operational planning and forecasting *all* conserved changes may not be found that easily anymore. In order to become more sensitive regarding the issue of considering *all* Conserved Quantities *correctly* please follow another example, which is all-embracing regarding potential misalignments between strategic and operational plans and resultant financials forecasts. So it describes a financial forecast, which shows quantities that must be analyzed carefully before one can declare whether or not they are conserved indeed: Assume a long-term financial forecast, which shows steadily increasing cash inflow. But in parallel there is a steady decrease in total production costs, in current assets as well as in capital assets and in depreciation and amortization. (Here it is assumed that the forecast was performed by using a regular GAAP accounting scheme, i.e. there is depreciation and amortization that reduces asset values continuously over time). This means in relation to the increase in forecasted marketing potential operating expenses for production are expected to decrease and asset efficiency to rise continuously and long-term. But is such a combination of increasing and maybe conserved demand for certain products' functions and decreasing inputs to manufacture these products' functions realistic and conserved indeed? Or does the financial forecast show nothing but the manifestation of a non-conserved *perpetual motion machine in business*, which of course cannot be realistic? To become able to declare whether or not the forecast expresses all changes in Conserved Quantities correctly, which may occur in course of a amending a company's operational value creation towards a new strategic fit, in particular the following issues must be checked:

1. Are the *magnitudes in savings* of operational improvement programs – which may be performed continuous and/ or by one-off restructuring programs – *calculated correctly*? And do calculations consider that costs and investments cannot be undercut anymore at a certain point in order to maintaining an appropriate fit and quality regarding customers' Functional Requirements? In this context the financial forecast must be challenged further by the following questions – and in course of that also compared with time series of the company's historic financials – to gauge the *margin of error*: Is it possible indeed for a company to work to such an extent inefficiently to date so that it will be able in the future to uninterruptedly decrease operating expenses and asset levels long-term without ultimately being unable to manufacture the products accounted for in the steadily increasing forecast of (conserved) sales volume? (And why did the company not amend its processes before given it seemingly is possible that easily going forward)? Or will the company rather end with having too few/ broken down machines, too few materials, too few employees, etc. to meet customers requirements? Or will the forecasted sales volume not be realizable because product quality will not meet Functional Requirements anymore, i.e. will there be too much cost-cutting that brings customers to shift to rivals? Please remember: *Conserved Cashflow* – which is the primary unit of consideration when it comes to *non-chaotic forecasts, Functional Valuation and Conserved Quantity Accounting* – in the end must measure all changes in external

and internal Significant Influencing Factors in monetary terms. For changes to be conserved they must be consistent, i.e. there must be at least one related counter-movement that is fully justifiable by the same (economic) fact. In brief this means here: Can the actually justify the amount of expected conserved long-term savings and asset efficiency enhancements while retaining an adequate product quality (and in view of increased sales forecasts) or is the magnitude of the planned operational improvement program(s) overestimated, i.e. non-conserved? So for verification it is essential to recompute: How much costs, investments and stock turnover were needed in previous years to provide one volume of the product(s) under considerations? How large was the magnitude of yet performed operational improvement programs on costs, investments and asset levels *and* what are the similarities (and dissimilarities) between past and future operational improvement programs?

2. Were the *costs and investments*, which may occur because of continuous operational process improvements and restructuring programs, *accounted for indeed*? Or are the forecasts of the bottom-lines of the profit and loss and the cashflow statements as well as the forecasts of the asset levels shown in the balance sheet that astonishingly good just because they are *missing* cash outflows and asset volumes at some upper levels? Of course accounting just for the positive effects of an economic change and leaving out its negative ones contradicts *Strict Conservation Law in Business*, too!

3. Is the *planned timeline* too ambitious? For verification discuss it in particular with practitioners e.g. from the R&D and operations department given new and potentially cost-saving products are to substitute older and potentially more expensive ones and given also (investment levels for) machinery and equipment must be changed in course of it. Hence in brief is should be questioned: Are times for the ramp-up and/ or ramp-down phase compatible with forecasted changes in sales volumes, costs and required assets? Only then there are consistent, conserved changes between (Conserved) Cash in- and outflows. Otherwise the *time* – which is *Conserved Quantity*, too – is not accounted for correctly (cf. Chapter III, 2.1.3.2)!

4. Is there a *(non-conserved) breach in planning and forecasting*? In forecasting trends are sometimes extrapolated though there are no related plans anymore that could justify the (financial) figures. This means up to a certain point in time plans (= internal Significant Influencing Factors), which affect the company's net Conserved Cashflow, may be readily available and their implementation may be realistic, too. Therefore chances are high that also the related forecasts of Conserved Cash in- and outflows are correct. But afterwards there are no plans anymore. So there is no justification anymore for the (long-term) continuation of the trend(s) in financial forecasting systems because in such cases the trends will be short-term in reality. Here it has to be reminded: If there is no (planned) change in Significant Influencing Factors determining Conserved Cash in- and/ or outflow in the future the forecast of the Conserved Cash in- and/ or outflow must not change, too! Hence trends must not be extrapolated but the quantity structure – which can be measured ideally by Calculative Cashflow per volume – must remain round about equal. Or to phrase the more general requirements for verification: The same Significant Influencing Factor (or a similar one that operates in the same direction and bears round about the same magnitude) must prevail in the future. Otherwise there is no (continuous) change in any Significant Influencing Factor anymore, which could justify the (historic) continuation of a trend in the future.

At this occasion please note that the real estate market in the USA is once more a good showcase – here for problems that occur given there is no consistent change (anymore) in Significant Influencing Factors but financial forecasts (wrongly) show the actually just short-term trend on the long-run, too: Hedge fund manager John Paulson reports that the key signal for misvalued securities was the "investment bubble" (= economic bubble) in the underlying real estate market. He met with rating agencies to discuss their modeling techniques, which he said "bewildered" him. According to Paulson their problem "is that they are *backward-looking*. There's never been a period in the history of their statistical data when housing prices decreased. The agencies' models didn't take account of the possibility that housing assets could fall." When Paulson exposed this logistical hole to the rating agencies their response was that they couldn't make up any data points or "hypothetical" scenarios where houses' market values fall because to make up this scenario would be to "speculate". And Moody's said it "doesn't speculate" (cf. CNBC (2010), Focus (2011) as well as Chapter V, 5.1.1.1). When associating Paulson's experiences and decision process with Conserved Quantity Approach the following three things become apparent:

1. From the point of view of Conserved Quantity Approach the rating agencies speculated – Paulson questioned "where the money should come from" in the future like Functional Value investors do (cf. Chapters III, 2.1.2 and III, 3.2.3).

2. Relying on past trends is no guide to the future but looking at changes in Significant Influencing Factors and questioning whether or not they can prevail going forward is – again this describes what Paulson did successfully and what Conserved Quantity Approach postulates.

3. Accounting agencies and standard boards like the FASB in principle argue like rating agencies in that they are reluctant to apply forecast. They argue there is a fundamental difference in the work of an analyst, who should be allowed to perform forecasts for his/ her valuations, and an accountant, who must not do so. However history showed more often than not that accounting for market values of past transactions does not reflect real values either. And adjustment of purely calculative depreciation and amortization does not better the valuation (cf. Chapters II, 4.4.3 and V, 3.2). Therefore Conserved Quantity Accounting was developed herein – it consequently ties the tasks of analysts and accountants more closely (cf. particularly Chapter V, 7 and its Sub-Chapters).

To get to the point the main insights from the cases 1 to 4 – as well as from the real estate example that was reconsidered to highlight the importance of case 4 – are: There needs to be more than just a *(strategic) fit* between external Significant Influencing Factors determining customers' Functional Requirements and (company-internal) selected strategies. In addition there must be an *(operational) fit* between strategies and all other internal Significant Influencing Factors, too. (The later reflect the operational value levers whose effects are measured in monetary terms by operational expenditures – and all costs summarized thereby – and investments, i.e. OPEX and CAPEX). All these fits must consider consistently *all* changes in external respectively internal Significant Influencing Factors within the *complete* planning period. So (changes in) financial forecasts *always* must be *traceable* back *completely* in *direction* and *magnitude* to *another directly related consistent change* – only then all figures can be declared "conserved". Consequently it is not yet sufficient that general macroenvironmental, industrial and company-internal changes shift in the right direction (= fit). To conform to Strict Conservation Law in Business all changes must also be reasonable regarding their quantifiable magnitude – both for themselves and for their counter movements. Otherwise there is the threat of creating forecasting models showing unrealistic changes like *"newly generated markets"* respectively *"newly generated market volumes for which nobody will be able to meet the bills"* or *"perpetual motion machines in form of (inexhaustible) companies' assets"*. This was shown unrealistic by reasoning that:

1. Product markets (= market segments) cannot grow without cannibalization of other product markets (= market segments) or reduction of customers' savings.

2. Customers' Functional Requirements cannot occur or disappear without reason.

3. Products having fitting Required Functions cannot be generated out of nothing.

The following Figure 42 depicts graphically the main insights from above as well as their interrelationships. Needless to say that they underlie not only Conserved Quantity Approach but also Holistic Functional Value Analysis. (For this Chapter V, 5.1.2.3 please cf. Appel and Grabinski (2011), Porter (1980), Hax and Majluf (1984) as well as Seifert (2001)).

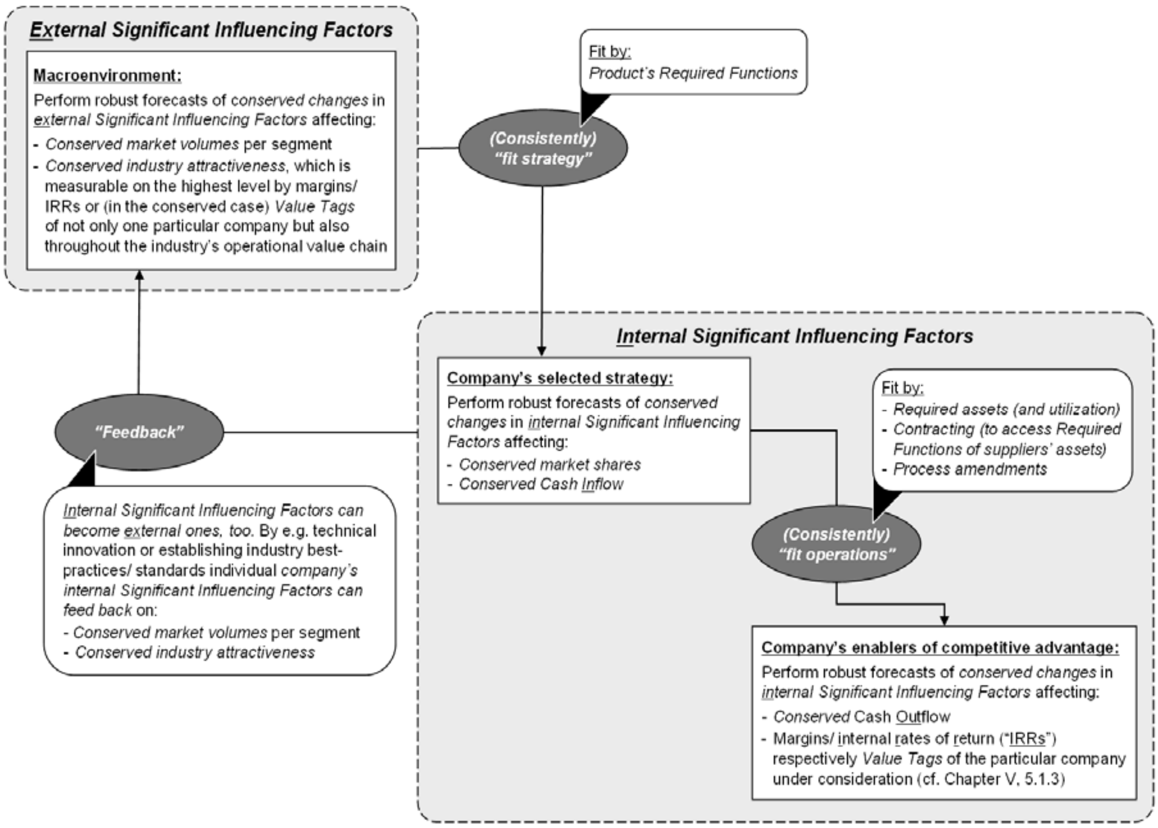


Figure 42: Conserved Quantity Approach requires fits starting from external Significant Influencing Factors down to the company's shop-floor

5.1.3 Synthesis: Discriminate non-conserved and (conserved) Required Functions

How to spot Significant Influencing Factors on products' Required Functions was shown already. Furthermore it was explained increasingly detailed that a company has Significant Influencing Factors on both costs and Required Functions, which may feed back on the macroenvironment (cf. Chapters III, 2.1.1 and III, 2.1.3.3). Conserved market volumes, conserved market share of the company under consideration respectively its conserved revenues (= Conserved Cash inflow) as well as its expenses and investments to manufacture the products can be forecasted thereby (= Conserved Cash outflow). Based on these financial figures *net* Conserved Cashflow can be computed; discounting it leads to the total company's (conserved) Functional Value, i.e. Functional Firm Value (cf. particularly Chapters III, 2.1.2 and III, 2.1.3.5 as well as Chapters III, 3.2.2.1 and IV, 2). It should be understood by now that this process of Functional (Firm) Value generation determines the conserved cause-and-effect chain, which Holistic Functional Value Analysis follows. But in order to forecast Conserved Cash inflow something like the *"conserved part of market value"* must be found first. Applying the example of a product this Chapter V, 5.1.3 demonstrates how to get such Functional Value.

Holistic Functional Value Analysis must be finalized on the level of single "assets" – which also comprise intangibles like goodwill and employees – and liabilities as well as products. Key tasks are *decomposition into all functions* of the item under consideration, *attaching costs and margins* to the functions and in the end *discriminating functions* dependent on whether or not they are conserved. Summing up all costs and margins yields the *total market value*; summing up costs and margins of (conserved) Required Functions only yields the *conserved part of the market value.* Further instructions and rationales are provided in the interrelated Sub-Chapters V, 5.1.3.1 and V, 5.1.3.2.

5.1.3.1 Performing "common" value analysis

"Common" value analysis was developed to better understand how products' and processes' expenses are composed, i.e. what cost drivers they have. Thereby optimization potentials become identifiable is the sense of: "What expenses are relevant to satisfy customers' demand (adequately) and what expenses can be cut because the related functions are over-engineered or non-required". Such kind of value analysis, which differentiates not yet between conserved and non-conserved functions, works as follows (cf. Hoffmann (2002), Sigel (2003)):

1. Breakdown the item – e.g. the product – under consideration into *all* underlying functions. They are the reasons why customers have Functional Requirements for it – or at least demand it (cf. Chapter III, 2.1.3.3).

At this occasion please note that in Holistic Functional Value Analysis employees are comparable to internal service providers that supply their work (= here: the *product functions*) to an internal customer (= here: employer) for a certain counter-value (= Functional Value of Work).

2. Allocate to *all* product functions the direct and indirect costs of the required materials, the employees as well as the application of capital assets. Please note to consider total production costs allocable to the product functions. These are not only costs for physical inputs, further processing and assembly of the components but also for associated up- and downstream activities within the company's value chain that *secure supply and proper functionality* like procurement and quality testing as well as activities that *secure the knowledge to manufacture a product* like research and development. Over and above *"soft functions"* may be fulfilled not only but also by the marketing department, which is able to affect the (average) customers' point of view and thereby his/ her Functional Valuation of an item (cf. Appel and Grabinski (2011) as well as Chapters III, 2.2.3 and V, 5.1.4.2). Taken together these are all cost drivers of a product. This means the typically differentiation between direct and indirect employees is not appropriate here: Also indirect employees can add Functional Value to the product and consequently bear also costs allocable to at least one product function (cf. Chapters V, 5.2.3 to V, 5.2.3.3).

Please note that "common" value analysis cannot be related to tasks and concepts such as (financial) forecasting, valuation and/ or Conserved Quantity Approach. Therefore it must be expanded like shown below.

5.1.3.2 Advancements to perform Holistic Functional Value analysis

The following has *nothing* to do anymore with "common" value analysis. But the additional steps 1 to 5 are inevitable for Holistic Functional Value Analysis in order to size the gaps between the company's costs respectively expenses, the total market value and the conserved part of the market value (= Functional Value):

1. Determine the total margins of *all* functions: Contribution margins may be available on a very detailed level in cases where there is a huge amount of configurable equipment. (For example in the automotive industry original equipment manufacturers ("OEM") use such data for deciding on their special equipment strategy). Since equipment closely mirrors functions, which customers select to configure a core product to their needs and taste, in such cases some kind of margin may be available even on the functional level. But for our purpose not only direct costs but also all indirect labor costs allocable to the product should be considered – and that cannot be taken for granted (cf. Chapters V, 5.2.3 to V, 5.2.3.3). So to provide a practical solution, which works in any case, the application of the *total* internal rate of return ("IRR") is suggested. It may be available on diverse levels of aggregation – on product level, on business unit level, on whole company level.

Of course having products' IRRs at hand is best. Investors and managers can apply less detailed IRRs, too. But for tax balance sheets public authorities would have to agree on rules for such simplification). In any case to avoid inflated values the IRRs must not be taken from the bid estimate but have to be taken from the *post calculation*. This is in particular important to eliminate wrong assumptions regarding realizable expenses and market values (= customers' willingness to pay for bundle of potentially conserved functions in form of a product). Hence the quintessence here is that – given more detailed data is *un*available – the best guess for a function's margin may be indeed a more aggregated IRR. In this sense the IRR becomes a price tag or – given it can be asked for Required Function – Value Tag. Please note that this suggestion implies that IRRs can be spread linearly across functions, products, business units and companies. (In view of groups of companies it is however not advisable to spread IRRs linearly if they are strongly diversified. Then subsidiary companies participate in totally different industrial sectors, which most likely have strong varying IRRs. Taking an average thereof would result in a too big margin of error. But for such companies IRRs should be available on company level at least – otherwise framing a well-founded corporate strategy would be impossible). Either way the underlying assumption for allowing more aggregated IRRs is: The *risk-return-profile* – dependent on which IRR was taken –needs to be equal for all capital, current, human and immaterial assets applied for Functional Value creation in terms of the function and the product under consideration, the business unit or the company (cf. Chapter III, 3.2.2.2). In theory there are valid reasons to disagree. But in practice taking the IRR of the total product, the business unit or even the company as a starting point to calculate a product function's (conserved) Functional Value is by far better than relying on potentially chaotic (non-conserved) total market values.

At this occasion please also note that the *indirect link* between a company's *operational efficiency*, *Value Tag* and *Functional Value*: Increasing costs (or better: too high costs) in general cannot be passed on to the customers in total. If there is a more efficient rival offering the customers (at large) would prefer it – in turn this would lead to a (conserved) transfer of sales. In order to avoid such customer migration the less efficient company has to *optimize its operational processes* and/ or *reduce Value Tag*. The first alternative adds Functional Value particularly to the company; the second one reduces it since it does not counter the unnecessarily value transferred e.g. to suppliers, overhead or "over-engineered" functions. At all events it cannot be claimed that Functional Value added might be gained by inefficiencies or high costs. This holds for Functional Value calculation in view of foreseeable customer behavior, which assumes customers strive to access efficiently functions (= by paying least) that effectively serve their conserved needs (= Functional Requirements), i.e. better serve them than rivals (cf. Chapter V, 5.1.1.3 – in particular Figure 41).

2. Value *all* functions – no matter whether or not they are conserved: For this purpose sum-up the total costs per function. Then charge for the margin respectively Value Tag. For *verification* of the calculation the values of all (conserved) Required Functions and non-conserved functions have to equal the total actual market value. If no IRR was available on the functional or product level, which could be used as margin (for non-conserved functions) respectively Value Tag (for Required Functions), there may be some margin of error regarding total actual market value. Its magnitude depends on whether or not there is a strong deviation between the

(average) IRR on the level of the business unit or the whole company, which was applied also on the functional or product level to counter lacks in data availability, and the actual IRR of the function or product under consideration.

Given the deviation between actual product IRR and some other average IRR is too high the author suggests applying *"calculative Value Tag"*, i.e. to adjust the IRR applied for Functional Valuation of the product's functions. Thereby calculative Value Tag should be selected, which "justifiably" narrows down the gap towards the respective product's sales price (= market value). Here "justifiably" means that *feedback by customers* must be incorporated, too: The product may not be sold without heavy discounts in cases where company-internal planning and post-calculation was wrong. This means customers do not approve a close *strategic fit* between their (conserved) needs and tastes and the product's (conserved) functions. (How to check whether or not functions are conserved becomes relevant below in point 3). In consequence – to reflect justifiable values per function – calculative Value Tag must take into account such *inevitable discounts*. Or to describe the opposite situation, which leads to *potentially conserved premiums*: Given customers are willing to pay higher market values also this change must be justifiable if it should be accounted to calculative Value Tag – then there must be a close *strategic fit* between the product's yet existing functions and changes in macroenvironmental Significant Influencing Factor, which was the reason for that increase in customers' willingness to pay over time.

In view of the recapitulatory formula shown by Figure 43 please note once more that products – in the sense of *further processed products* – must account for margins respectively *Value Tags* whereas resources must be accounted for at Conserved Cash Outflow only. When reconsidering the previous Chapter V, 5.1.3.1 – in particular its reasoning on the potential input of total allocable production costs in point 2 – it should have become obvious that total allocable production costs parallel *Calculative Cash Outflow* (cf. Chapters IV, 3 and V, 5.2.1.1)!

Value of single product function **= total allocable production costs**$_h$ * **margin**$_h$

= (machine costs$_h$ **+ labor costs**$_h$ **+ material costs**$_h$**)** * **margin**$_h$

For verification:

$\sum_{1}^{f}$ ***Value of single product function*** **≈ Total market value of product (= here: sales price)**

h = Historic
f = Total number of product's single functions (no matter whether or not they are conserved).

Figure 43: Product function's value (no matter whether or not it is conserved)

3. *Differentiate* between non-conserved functions and Required Functions: Changes in macroenvironmental Significant Influencing Factors determine customers' (conserved) Functional Requirements. *And a function must be either conserved or not – there is no in-between*.

The only possibility to make something wrong in this step is to declare a function is conserved, which in actuality is not (and vice versa). The logical argument is quite simple: In reality customers can neither acquire just parts of a product nor just parts of its functions. They either acquire none, one or several products. And – given the acquisition was not based on speculation or short-term trends – there is a conserved change in something else. In the conserved case this means the customer will likely omit the acquisition of a competitive product just because he/ she already owns something applicable to satisfy his/ her Functional Requirements. In this conserved case buying another product would lead to the assumption that the person does not acquire things just in order to use them but rather because he or she is a collector. The group of people for whom common objects of utility are collector's items however can be assumed being insignificant. For all the rest, i.e. the growth of the customers, analysis of the strategic fit from the point of view of an average customer should minimize the margin of error related to an incorrect declaration of Required Functions (cf. Chapter V, 5.1.1 and its Sub-Chapters).

4. *Add* the values of (conserved) Required Functions to get (conserved) Functional Value of the product under consideration: Holistic Functional Value Analysis is done herewith for a single product.

5. In view of *Conserved Balance Sheet* consider furthermore how much semi-finished and yet finished products are in storage. This includes *two additional, interrelated determinants* for Functional Value of each line item accountable to Conserved Balance Sheets:

4.1 conserved volume in storage *per*

4.2 stage of further processing within the respective company's (Functional) Value chain as of the due date.

So when multiplying Functional Value of a single product with the *conserved volume in storage* – and when one performs this multiplication not only for yet finished products but also for semi-finished ones – one gets Functional Values accountable to Conserved Balance Sheets; they comprise all steps of operational creation of real values in the real economy measured by the progress of generating an item that is required in reality. Please remember that only conserved volumes – i.e. volumes net of non-conserved trading volumes – must be accounted for. The reasons for it were both exemplified and discussed in detail yet (cf. particularly Chapters III, 2.2.3 and III, 3.1 to III, 3.2 as well as Chapter III, 3.2.1.2). In brief the reasons are that non-conserved volumes lead to overvalued market prices and potentially economic bubbles and/ or have no Functional Value given no downstream-customer acquires them. These reasons are of general nature. Therefore the rule of accounting just for conserved volumes must be applied consistently for *all* assets and liabilities – including products that result out of their application.

By reassessing the steps of Holistic Functional Value Analysis four things become clear regarding the interpretation of the financial figures that form its inputs as well as its final results; thereby also the allocation of Functional Value to particular line items is getting clearer:

1. Value Tags implicitly consider not only *margins* but also all *costs* of manufacturing products' Required Functions by applying assets' Required Functions. This is simply because Value Tag is suggested to amounts to IRR until further notice (for the sake of simplification given no more detailed data is available). IRR in turn is defined as the interest rate at which the net present value of any investment's total cash outflow equals the net present value of the investment's total cash inflow. Therefore *IRR* can be taken as the *investment's calculative average annual return* – even if returns were irregular and volatile (cf. Matchett (2003)). This property supports the goal of making financial forecasts, related values as well as amounts accountable to a balance sheet more robust (though it is not equivalent to means and ways of Conserved Quantity Approach). This leads to point 2.

2. In view of the above – and against the background of Conserved Balance Sheet's goal of showing the *real* values of *all* assets – one must be careful to avoid double accounting of costs, margins and resultant Value Tags: To avoid double accounting keep the simple rule to always account *all allocable production costs* like described in Chapter V, 5.1.3.1 to finished and semi-finished products in storage just like explained above. Thereby one gets a *product's Functional Value*: From an operations point of view it reflects an *ex post* Functional Value because it was transferred to the product already by performing processes that added Required Function(s) to it; consequently products bear *ex post* Functional Value that must be accounted on the product level to Conserved Balance Sheets.

However not all assets are completely used up after manufacturing one product so that they still bear *ex ante* Functional Value going forward; naturally *ex ante* Functional Value must be accounted for in Conserved Balance Sheets on the level of the re-usable asset hence capital asset and/ or human "asset". Their Functional Valuation parallels the one of the products, which they manufactured yet. This means they also must be valued by forecasts of their Functional Value generation, i.e. their discounted net Conserved Cashflow. It is the key prerequisite for upmost consistency in Conserved Balance Sheets (cf. Chapter V, 5.2.1.2 vs. Chapters V, 5.2.1.3 and Chapters V, 5.2.3 to V, 5.2.3.3). This leads to point 3.

3. In view of Conserved Balance Sheet please note there is *no mandatory D&A*: As long as the forecast of a product's *(conserved) Value Tag* remains the same – which is determined by both Conserved Cash in- and outflows – Functional Value of the product under consideration remains unchanged, too. Hence for accounting purposes regular *"impairment tests"* have to be performed in order to check whether or not the underlying assumptions regarding external and internal Significant Influencing Factors hold still. These tests must perform again the steps of Holistic Functional Value Analysis, which are summarized by Figure 40 and detailed throughout Chapter V, 5. At this occasion please note that not only positive but also negative Functional Values can be considered in Conserved Balance Sheets by using positive or negative Value Tags.

4. *All production costs allocable to a particular product* (cf. Figure 43) of course must be reconcilable to *Calculative Cash Outflow* (cf. Table 5). The fact that this need can be fulfilled becomes obvious when assuming all allocable production costs of a long time period – say 10 years – were used to calculate the all-in production costs for one product (like defined in Chapter V, 5.1.3.1); it will amount to Calculative Cash Outflow. This is due to a principal reason because capital expenditures must be allocated across (the forecast of) a machine's (conserved) production volume in order to finally get the machine cost for manufacturing one unit. That operational costs and expenses must be reconcilable seems to be self-explanatory. However there is one difference: Products' Functional Values also bear Value Tags; resources' Functional Values are measured by Calculative Cash Outflow only. So to avoid confusion the *interim* result one has to consider in products' Functional Valuation is circumscribed *"total allocated production costs"* and is used in addition – i.e. not synonymously – to the *final* result of resources' Functional Valuation that is termed "Calculative Cash Outflow" (cf. Chapter IV, 3 including its Sub-Chapters).

In summary "labeling" functions by costs and margins respectively Value Tags and subsequently identifying conserved hence really Required Functions is the straight-forward way for Functional Valuation. By this process something like "calculative conserved market value" is gauged, which is much less affected by chaos than the total one – hence it will lead to financial forecasts being much more robust (= non-chaotic) than established ones based on total market values (cf. Appel and Grabinski (2010) and (2011) as well as Appel et al. (2012)). Over and above such advanced Holistic Functional Value analysis clearly shows what functions and what kind of related work really add Functional Value, make future cash inflow conserved hence robust and thereby reduce the company's Chaos Exposure (cf. Chapter V, 6). The remaining product functions and every step performed to become able to provide them can be challenged because there is no related contribution to (strategic) fit – hence cutting them should not reduce Conserved Cash inflow in the long-run (cf. Chapters V, 5.1.1 to V, 5.1.2.3).

5.1.4 Example of discriminating non-conserved and (conserved) Required Functions

Table 7 exemplifies Functional Valuation by referring to an everyday product, namely a hole puncher for filing paper. The example is based on a *real* consulting project applying *"common"* value analysis. Therefore the raw data had to be fudged slightly. The allocable costs are summaries from the company's ERP system. Showing all single cost-line items would have been rather destructive than instructive because a well-arranged one-pager-overview would have been impossible. Over and above the example was advanced to show *Holistic Functional* Value analysis. By all means the bottom line is: Suggested Functional Valuation process proved to be applicable here. Please note that the example was not only chosen because everybody knows the product and its functions. It also shows that a product may have a function like "give design", which is more or less costly but does not bear Functional Value.

Table 7: Functional Valuation applying the example of a hole puncher for filing paper

Total market price, Functional Value and allocable production costs

Product	Market price	*Functional Value*	Costs
Hole puncher	57.3	51.8	35.8
Value Tag-margin	160%	160%	n/a
Chaos Exposure		1.10	n/a

Relatively high Functional Values, i.e. low Chaos Exposures, are typical for common objects of utility.

Customers' point of view / **Company's point of view**

#	*Product functions*	Conserved?	*Functional Value*	Costs	#	*Company functions*	Costs	Resources/ raw materials Costs	Resources/ raw materials %	Purchased parts Costs	Purchased parts %	Labor: Production Costs	Labor: Production %	Labor: Assembly Costs	Labor: Assembly %	Labor: Quality testing Costs	Labor: Quality testing %	Semi-finished products allocated via ERP*-system
1	Punch holes	Yes	39.7	24.8	1.1	Procure material	13.8	13.0	72%	0.8	30%		0%		0%		0%	- Arrangement of levers - Hinges - Cutter - Bottom plate - etc.
					1.2	Process material	7.1		0%		0%	6.8	76%		0%	0.3	38%	
					1.3	Execute assemply	3.9		0%		0%		0%	3.5	66%	0.4	50%	
2	Fix hole position	Yes	4.6	2.9	2.1	Procure material	1.7	1.3	7%	0.3	11%		0%		0%	0.1	13%	- Backing device - Grab handle - etc.
					2.2	Process material	0.8		0%		0%	0.8	9%		0%		0%	
					2.3	Execute assemply	0.4		0%		0%		0%	0.4	8%		0%	
3	Accumulate drop-offs	Yes	7.2	4.5	3.1	Procure material	3.7	2.1	12%	1.6	59%		0%		0%		0%	- Receiver box - Receiver box door - etc.
					3.2	Process material	0.5		0%		0%	0.5	6%		0%		0%	
					3.3	Execute assemply	0.3		0%		0%		0%	0.3	6%		0%	
4	Empty drop-offs	Yes	0.3	0.2	4.1	Procure material	0.0		0%		0%		0%		0%		0%	- Hinge - Bolt - etc.
					4.2	Process material	0.0		0%		0%		0%		0%		0%	
					4.3	Execute assemply	0.2		0%		0%		0%	0.2	4%		0%	
5	Give design	No	0.0	3.4	5.1	Procure material	1.7	1.7	9%		0%		0%		0%		0%	- Metal cover - Screw - etc.
					5.2	Process material	0.8		0%		0%	0.8	9%		0%		0%	
					5.3	Execute assemply	0.9		0%		0%		0%	0.9	17%		0%	
						Total		18.1	100%	2.7	100%	8.9	100%	5.3	100%	0.8	100%	

In practice, company functions are often shown in more detail. They need not be generic like here.

Functional Value = product of total allocable costs and Value Tag-margin

Just seasonal finish, i.e. no idiosyncratic industrial design that could add Functional Value from customers' point of view.

Except of the trendy design, all product functions meet customers' (conserved) Functional Requirements.

Data source for costs, Value Tag and total market price.

Verification of total production costs is eased by allocating semi-finished products - and their costs - to single functions.

Notes:
- All amounts are in €, if not stated otherwise.
- *Enterprise resource planning
- Yellow cells are for data entry. Based on the entries, all remaining figures can be computed automatically. (In practice, as soon as the relevant semi-finished products per function are known, their costs may be copied from the company's ERP-system and summed-up automatically, too).

5.1.4.1 Irrelevance of design for capital goods and common objects of utility

Relevance of design for long-term Functional Value forecasting depends heavily on the industry and on the customers' motivation to buy something. Considering capital goods design may be irrelevant from customers' point of view: The product must deliver certain technical functions, its handling must me comfortable – i.e. it must be able "to do something" –, lifecycle costs must be low and that is it. Or have you ever seen a chief operating officer ("COO") preferring one machine to another just because it looked "nice"? The same is true (at large) for objects of utility like the hole puncher, whose functions are depicted by Table 7. Maybe even no customer would have noticed the missing of the function "give design": The design elements were selected seasonally and could not communicate anything like "good" taste, technological affinity, consciousness in view of ecologic sustainability, wealth, etc. Or have you ever appreciated someone more or less just because he had plastic covers attached to his hole puncher? These things could not even suggest higher durability. There was simply nothing from the customers' point of view or in the macroenvironment that could ascribe Functional Value to these plastic parts. This makes the function "give design" in this case non-conserved and (functional) valueless. It simply could not guide (conserved) Cashflow in either direction. Since the production bears nonetheless allocable costs of in total €3.4 the company actually may have increased the product's strategic fit by a re-design, which omitted the covers. So in view of capital assets and daily objects of utility the examples mentioned clarify three things:

1. *Ordinary designs are irrelevant* from customers' point of view, given they do not have technical Functional Value, i.e. given *"they cannot do something"*. Then they do neither increase (conserved) demand – respectively satisfy Functional Requirement – nor (conserved) willingness to pay.

2. *Ordinary designs are (nearly) irrelevant* from customers' point of view, given *"they cannot communicate anything"* in view of customers' properties, trendiness, value system, status, etc. Then they do neither increase (conserved) demand – respectively satisfy Functional Requirement – nor (conserved) willingness to pay (strongly).

3. Hence these designs are at best something *"nice-to-have"* that comes in combination with a more or less required product but nobody would spend additional money for them. And – since these common designs are neither functional nor explicitly appreciated by the customers – they may affect strategic fit slightly at best (cf. Chapter V, 5.1.1 and its Sub-Chapters) but they cannot cause short-term trends and/ or speculations. That makes them less critical in view of long-term forecasts of Functional Values (e.g. Table 7 manifests a quite low potential to increase strategic fit – respectively reduce Chaos Exposure – by just about 10%).

There is just one counterexample where ordinary design – no matter whether or not it bears Functional Value – may lead to trends and/ or speculations. That is: The related product in total becomes a *collector's item*. The trend to collect ordinary things is particularly fostered given they were popular and production was nonetheless stopped (e.g. due to a product upgrade or substitute). Such products naturally become more and more scarce. And scarcity – in combination with popularity – often drives trends and/ or speculation. In consequence the market value of the product in total may unhinge its Functional Value due to lowest changes in design: E.g. the Functional Value of a € 50 cent stamp does not change just because the picture on it was substituted by another one – for that the logistics companies would have to adjust its tariffs. But the design update may affect market values from collector's point of view considerably (cf. Figure 2). Over and above there is another counterexample – yet design bears Functional Value right from the beginning here. By acquiring an item having such kind of design the buyer can convey a message to his/ her macroenvironment. This means there are – in contrast to the above (cf. point 2) – idiosyncratic designs that "say something about the owner of the product". And these idiosyncratic designs bear another important property: They can be evaluated in view of their (strategic) fit with changes in the macroenvironment. That eases Functional Valuation and long-term foreseeability of related products as will be explained in the next Chapter V, 5.1.4.2.

5.1.4.2 The special case of idiosyncratic product design and company goodwill

Any product's Value Tag includes already parts of the Functional Value of the company's immaterial goodwill. It is because – given there is "something" that has (conserved) Functional Value from customers' point of view – they will accept to pay for it. Value Tag is increased thereby. "Something" here paraphrases the company image or goodwill, which is reflected particularly in brand labels or more general *idiosyncratic industrial design*. Such design may be costly to develop due to investments in design studies and over and above investments in marketing to make them known and to grow popularity. But as soon as they are established they can raise a product's Value Tag considerably!

Though Functional Value of idiosyncratic design is accounted in Conserved Balance Sheets on the product level via Value Tag it cannot be generated there only. Idiosyncratic design is used for *branded products*, whose design has Functional Value only because people know it: By the idiosyncratic design people can link the product to a specific company and the values the company stands for. If these values are popular against the background of macroenvironmental Significant Influencing Factors chances are high that customers would accept paying a price respectively Value Tag premium. But if the company's values became unpopular it would not help significantly to change nothing but a single product's appearance or the label on it. No-one would pay a premium if a product's design cannot be linked anymore to a (popular) brand and the values it stands for. Hence by just abandoning from idiosyncratic product design a company may generate nothing but no-name-products from customers' point of view. (That is why product's Value Tag can be assumed to be positively correlated with company's *goodwill*).

Here it becomes clear that the company's top management must trigger the development of an idiosyncratic design, which is able to communicate the *strategic fit* of the whole company and all its activities in view of internal and external values, which – non-surprisingly – can be found by analyzing internal and external Significant Influencing Factors. In consequence the advice for managers that aim to realize Value Tag premiums on product design is:

1. Develop a system of values for both (potential) employees and (potential) customers (= vision and mission).

2. Check whether or not there is a strategic fit between vision, mission and the macroenvironment – respectively Significant Influencing factors that determine its value system. If there is no fit (yet) amend the vision and/ or mission!

3. Then develop an idiosyncratic design that can "communicate" the company's system of values, which were formalized by the vision and mission before. Thereby anyone knows whether or not products having such an idiosyncratic – i.e. company-specific – design fit his/ her (conserved) Functional Requirements. If so they fulfill (conserved) *"soft functions"* (or better: soft Functional Requirements) from customers' point of view (cf. Appel and Grabinski (2011) and Chapter III, 2.2.3).

Not all designs but just idiosyncratic industrial designs are able to fulfill these prerequisites. But that gives the latter Functional Value from customers' point of view: Only idiosyncratic designs can be linked to both the company's value system and (changes in) Significant Influencing Factors of the macroenvironment. Thereby they send a message about the owner of the product. They fit peoples' requirement to *express themselves non-verbally*. And that helps to satisfy an even more essential (conserved) Functional Requirement of (maybe) any person: *The (Functional) Requirement for the sense of being appreciated and belonging to a group of like-minded people.* Here idiosyncratic design can help because: Technology-loving persons can show their interest by applying products that are apparently from a company being regularly on the leading edge of technology, people can display their active lifestyle by fitting products combining practicability and sportiness par excellence and wealthy people can show their achievements effortless, etc. Real examples can be found in consumer electronics (e.g. apple's design of mobile music, telephone and computer devices), in the automotive industry (e.g. BMW's shape of the 3, 5 and 7 model range), or the luxury goods industry (e.g. the classical Louis Vuitton pattern, which is not used solely on luggage anymore but also on all kind of cloth and accessories). Hence acquiring such products has a lot in common with becoming a member in a club: The *idio-*

syncratic designs are comparable with club colors, which are worn with a sense of pride; the *Value Tag premium parallels the admission fee*.

After establishing a common ground regarding idiosyncratic designs' properties – and their effectiveness in view of related products' Functional Values – please let's come back to the core issue of discriminating conserved and non-conserved quantities in business: Given the *five prerequisites* below are fulfilled *there is idiosyncratic design*, which bears (conserved) Functional Value that must be accounted to products stated in Conserved Balance Sheets. In addition *idiosyncratic design* influences changes in a company's conserved market share respectively its conserved sales, which can be forecasted long-term and converted to Functional Firm Value (= sum-of-the-parts Functional Value of all material and immaterial assets of a company):

1. *Groups of persons* are characterized by their *shared values*.

2. *Customers strive to belong to such groups* in the industry (segment) under consideration.

3. The *popularity of the groups* – respectively their shared values – is determined by conserved (changes in) macroenvironmental, i.e. *external Significant Influencing Factors*.

4. *Idiosyncratic designs* manifest *belonging to at least one of the groups of persons.*

5. Given there is a (strategic) *fit* between the company's value system and the macroenvironment, which is determined by aligning external and internal Significant Influencing Factors, and given people also *associate this fit when looking at the company's products*, the *product design is idiosyncratic*. Then it can be considered conserved and having Functional Value.

5.2 Refinement for Conserved Quantity Accounting

Though Functional Valuation principles may be understood most easily having the example of a physical product in mind (cf. Chapter V, 5.1 and its Sub-Chapters) it also works for "immaterial products" (= services) as well as all kinds of *assets* and *liabilities*. Regarding the similarities of the latter please note:

1. Given funds were used for joining short-term trends or speculations the related cash outflow was *non-conserved* in any case: Obviously it does not matter whether or not the cash was spent to pay employees, machine and material suppliers to produce non-conserved functions or to pay *capital costs* to any debt provider for financing such activities. The cash – and employees, assets and liabilities (re-) paid by it – did not add Functional Value anyway. In consequence the results of such non-conserved cash outflow *must not* be accounted to Conserved Balance Sheet.

2. The other way round: Given funds were applied for serving (conserved) Functional Requirements of customers by adding to products (conserved) Required Functions the results of related transactions in consequence must be *conserved*, too. Again it is irrelevant whether or not related Conserved Cash outflow was spent for "physical" production of a (conserved) Required Function of any kind of product or in form of *capital costs* paid to a debt provider that finances production (in parts). Hence results of these conserved transactions *must* be accounted to Conserved Balance Sheets of *both* the company under consideration and its debt provider. Only then Strict Conservation Law in Business is fulfilled also in terms of Conserved Quantity Accounting; otherwise parts of the funds that keep the economic system up and running are (wrongly) missing without a previous change in something else.

The following Sub-Chapters V, 5.2.1 to V, 5.2.3.3 address practical issues of Functional Valuation beyond the yet known "product case". In particular they deal with issues of data availability and limiting related margins of error, which cannot be totally avoided in any system's quantitative description (cf. Chapter II, 3). Furthermore the following Sub-

Chapters show how to account for *specifics* of diverse assets and liabilities *without* disregarding Functional Valuation's core principles.

5.2.1 Accounting for Functional Values of tangible assets

Tangible assets (= material assets = physical assets) comprise resources and purchased parts, semi-finished and finished products in storage as well as (re-usable) capital assets, which are applied in course of manufacturing. Naturally not only Conserved Balance Sheets but also GAAP balance sheets account for these assets. But Functional Values in Conserved Balance Sheets measure the conserved part of the assets' values: It may be *higher or lower* than the (calculative) market value, which GAAP accounting uses as primary guideline, because it traces back to Functional Value that is added to any product in course of operational, real economic value creation (cf. Chapters II, 4.4.3 and IV, 3.2 as well as Chapters V, 7 to V, 7.7). The generally valid postulation to concentrate on *"real economic value creation"* in Functional Valuation – and consequently also in Conserved Quantity Accounting – is reasoned in particular in Chapter III, 3.2.2.1 as well as throughout Chapter IV (cf. also Appel and Grabinski (2010) an (2011) as well as Appel et al (2011)). Details on pitfalls and approaches to manage nonetheless tangible asset's Functional Valuation are detailed in the following three Sub-Chapters.

5.2.1.1 Functional Value of resources

Setting up the formula for Functional Valuation of any kind of resource may be easier than for any other tangible asset: Given the company under consideration did not perform any activities yet, which (potentially) added Functional Value to the resource, no Value Tag needs to be considered here. Thereby a problem is circumvented, which may harm explanatory power of values calculated by considering GAAP accounting rules: As was proven before by using the example of gold, when it comes to accounting of resources, even a company having best intends to account for nothing else than conserved Functional Values runs the threat to account for inflated market values instead. So accounting for total market values (and if applicable D&A) – or fair value accounting – is both unrealistic in view of accounting for the required assets, the required volumes of assets and these assets' value by operational utilization (= Functional Value): Companies applying physical resources – particularly if they can be stored for longer periods – may have overstated but potentially also understated the related values in their balance sheets so that they have no meaning at all anymore. Within short spell market values may shift (chaotically) by a huge margin and the probability they will do so during any asset's holding period increases with the time passed by – therefore market values are not an option for accountants that aim to use values behaving non-chaotic hence having explanatory power long-term (cf. Chapter IV, 3).

To remember better what is meant thereby please think a matter over these additional examples: A car manufacturer is dependent on the supply of physical resources like steel, which is somewhat affected by speculation. A more severe case is the one of a circuit producer, which may require gold for coating the contacts, is a more severe case for (involuntarily) getting involved into speculation. In such cases – in contrast to GAAP accounting values – Functional Valuation provides means and ways to exclude speculation as far as possible. A small margin of error however may have to be accepted for tangible resources, which are completely used up in the sense of becoming part of a (tangible) product. This is somewhat different compared to human resources, who of course can be "reused" like capital assets: A service provider (in general) depends predominantly on human resources. Most of them are not hired based on speculations or short-term trends but rather in response to a consistent period of high workforce utilization (and/ or well-founded forecasts signaling high workforce utilization in the future). Hence the margin of error, which may occur when identifying Functional Value adding work that is accountable to a service provider's Conserved Balance Sheet, may be negligible. (At this occasion please allow the author to ask for being allowed to use rather uncommon language in combination with human resources: Of course human resources, people in general as well as their integrity – from an ethical point of view – should not be treated like any other "thing". Functional Valuation and related suggestions provided herein promote this fact, too (cf. Chapter IV, 3.5). However there are core principles in Functional Valuation, which – from an accounting point of view – apply for re-usable "asset" like capital assets *and* human resources. So for highlighting the similarities in accounting of Functional Values it seems alright and beneficial to use a similar language for explanations, which is rather technical/ production-related. One of the reasons why this language seems more familiar – and therefore may be understandable easier here – is that human resources are *not* accounted for in today's established GAAP accounting, which does not at all consider human resources. This seems intolerable – in particular in view of Strict Conservation Law in Business – because human resources' work definitively can contribute to Functional Firm Value! Consequently human resources are appreciated herein in that the conserved countervalue of their work is accounted to Conserved Balance Sheets – that fact makes them not only more robust but also more realistic is view of showing "everything" that adds Functional Value to the company under consideration (cf. Chapter V, 5.2.3))!

(Conserved) Functional Requirements are not equivalent to total (non-conserved) market demand hence cannot justify completely (non-conserved) market values either (cf. Chapters III, 2.1.3.2 and IV, 3.1 as well as Chapter V, 2)! Therefore – particularly in context of Conserved Quantity Accounting – Functional Requirements must be interpreted in two ways in any case (not only but in case of resources):

1. Functional Requirements = description of customers' appreciation of (conserved) Required Functions: Following this consideration Holistic Functional Value Analysis determines the *"conserved part of total market value"* (cf. Chapter V, 5.1 and its Sub-Chapters).

2. Functional Requirements = description of (conserved) required volume: Following this consideration the *"conserved part of total market volumes considered in financial forecasts and accounting"* can be determined (cf. also Chapter V, 5.1 and its Sub-Chapters). For clarification please assume that long-term forecasts predict a conserved marketing potential of 1,000 products per year. The company under consideration however stores resources that could be applied to manufacture 1,100 products per year. So there is a (non-conserved) *surplus* in form of resources for 100 products, which are not required by customers as of the due date. Given

they cannot be brought to any application by any other operational mean Functional Value of the resource surplus is zero.

So Functional Value is not attributed to the total volume of steel, gold (cf. example above) or any other resource in storage but only to conserved volumes that can be used for adding Required Functions to products. In consequence the total volume of any resource stated in a GAAP balance sheet must be adjusted for such amounts, which cannot be used for products' Required Functions but are intended for (occasional) speculative trading instead. Verification of required resource volumes can be performed by comparing the resources required to secure the forecasted conserved sales volume with the volumes accounted for in the balance sheet (and its forecasts). Analysis may show resource surplus, which neither generates Functional Value for any product (e.g. by being further processed or mounted) nor secures that the company can gain or retain Functional Value (e.g. by updating its infrastructure). In consequence Conserved Balance Sheets account Functional Values of these (actually non-required) volumes of *"trading assets"* at amounts of zero (CHF, €, US$, etc.). This adjustment of the resource volumes is indispensable to conform to Strict Conservation Law in Business (cf. Chapters V, 2.2 as well as Figure 46 below): *Only such (volumes of) items must be accounted for, which generate or absorb Functional Value!* In consequence resource balances become more realistic in view of their contribution to Functional Value creation. And speculative elements are reduced as far as possible, which increases robustness (= non-chaotic development over time). In contrast GAAP accounting rules even expand speculative elements! They force not only accounting for non-conserved market values (respectively fair "values"), which can change chaotically under certain circumstances, but also demand for applying highly speculative D&A schemes (cf. Ohlson et al. (2010), Penman (2009) as well as Chapter V, 7). In consequence "values" in GAAP balance sheets may not be functionally justifiable right from the beginning! After a while they even cannot reflect market values respectively fair values anymore due to adjustments for wear and tear in form of calculative D&A, which also may be functionally not justified! The combination of both pushes on the deviation of robust and real values, which are traceable back to (conserved) Functional Requirements, in favor of GAAP accounting "values" that cannot reflecting anything (cf. Appel and Grabinski (2011)).

Performing “demand/ Functional Requirement”-adjustments in order to account for conserved volumes only can reduce the volume *and* the value of any resource accountable to Conserved Balance Sheets compared to the volume *and* the value stated in GAAP balance sheets (cf. Figure 44). Please note that such adjustment may be relevant for *any asset in storage* given the company produced – or planned to produce – more than it could actually sell in view of its conserved marketing forecast. Please think about the most extreme case to gauge the potential magnitude of total market demand’s non-conserved part: In core collector’s items are not really required – at least their market demand is at large variance to Functional Requirement. One could also say they are (at large) just “nice-to-have”. Consequently owning one may not lead a collector to stop buying additional items – a passionate collector may even want to buy more and more things the bigger his collection got! This means, due to their nature, collector’s items cannot force a consistent (conserved) change in something else! In contrast products someone “must have” to satisfy Functional Requirement(s) will lead to a consistent, conserved change as soon as the buyer can access the Required Function. (Otherwise the buyer would become a collector not interested in utilization of something but in having something – no matter whether or not it is needed).

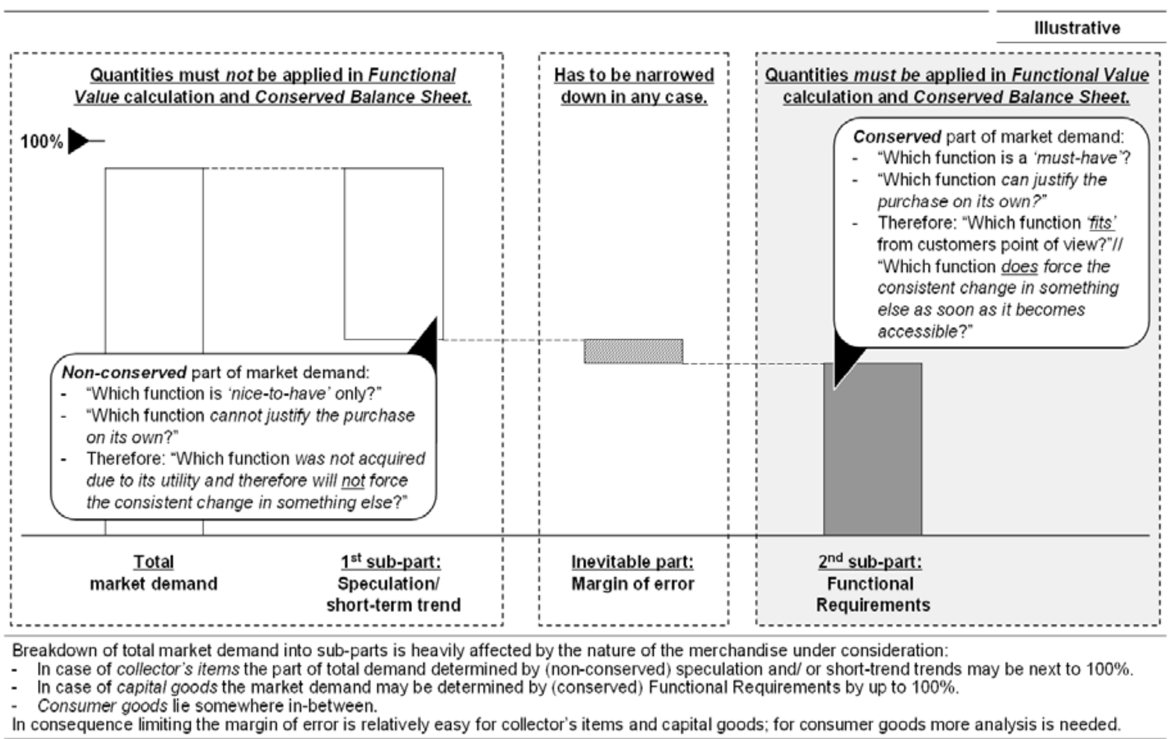


Figure 44: Part of total market demand accountable in Conserved Balance Sheets

No later than at this stage economists may argue that cashflow is a function of both *market value* and *market demand*: For certain resources – namely commodities – one therefore could estimate the speculative demand and deduct it from the total trade volume in order to get the amount of a commodity, which is actually applied in Functional Value generation (≈ "some kind of conserved demand"). Applying a supply-demand-function for the commodity – and assuming a constant supply in order to perform a ceteris paribus-analysis – one might gauge "some kind of conserved value". In principle the author agrees. But in practice there is a problem making that approach for Functional Valuation impossible: For the bigger part of all products – let alone their non-conserved functions and (conserved) Required Functions – there is *no* supply-demand-function! It seems impossible to develop such a function even for the simplest product – i.e. a commodity – given the fact that any product's Functional Value comes from its utilization. In general the application of a commodity is manifold however so that Functional Value of a commodity like gold depends strongly on its diverse application areas in medical sciences, luxury goods, printed circuits, etc. (cf. Chapter IV, 3.1). Therefore also the reservation price, which diverse potential customers throughout the value chain would be willing to pay, deviates considerably (cf. "reservation price"). That is why there will be no such thing as a practical solution for working with supply-demand-functions in the context of Functional Value calculation!

But balance sheets must account for the product of volume and any kind of (meaningful) value – of course that holds also for Conserved Balance Sheets. However neither market values taken from actual transactions are guidelines to real values nor are calculative market values derived from of any *adjusted* supply-demand-function that considers Functional Requirements for resources instead of total market demand (because in either case supply-demand-functions simply do not exist). To overcome these shortcomings in data availability another solution is recommended to get (conserved) values here: Do *not* attach Value Tag to any resource as long as the upstream company under consideration, which may be allocated anywhere within the total value chain, performed any further processing activity that adds Functional Value to the resource! To state it more clearly: Not yet further processed resources must be accounted to Conserved Balance Sheets without any margin just at the amount of the (average) resource producers' Calculative Cash Outflow (cf. Chapters IV, 3.2 to IV, 3.4.3). By this suggestion an issue is circumvented effectively, which is specific for resources: Foreseeing for any resource volume its future application would be pure speculation respectively impossible due to its *manifold* potential applications and thereby broad ranges of potential Functional Values. Therefore one has to wait until further processing took place. Only thereafter one can perform Holistic Functional Value Analysis in order to see whether or not the function is conserved that was added to the resource by further processing (cf. Chapter V, 5.1). But before *no* margin respectively *no* Value Tag is considered at all in order to avoid speculation (cf. above as well as Chapter IV, 3.1). In course of further processing the resource becomes a semi-finished product, whose Functional Value must consider Value Tag though. This is inevitable in order to reflect the countervalue – measured by Conserved Cashflow –, which the (average) customer is willing to spend in order to access *specific* Required Functions that semi-finished and finished products – in contrast to resources – have obviously (cf. Chapter V, 5.2.1.2).

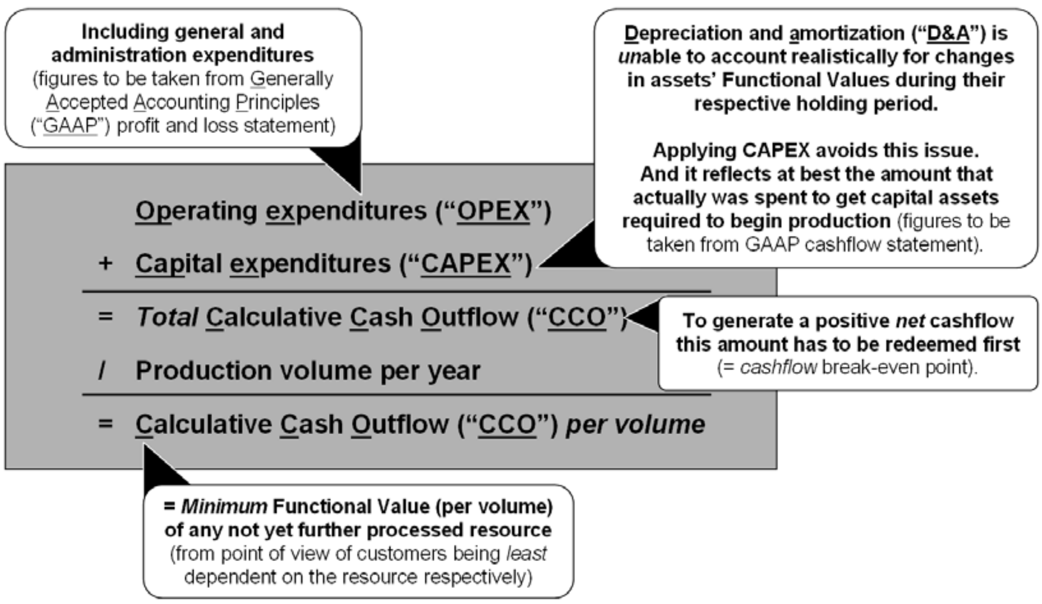


Figure 45: Resources' Functional Value measured by Calculative Cash Outflow (reprise of Figure 30)

Figure 49 summarizes Calculative Cash Outflow calculation (for a more detailed description cf. Chapters IV, 3.2 to IV, 3.4.3 – in particular Table 5). The underlying assumption that Calculative Cash Outflow is able to reflect real value, i.e. (conserved) Functional Value, of a resource seems valid indeed: After all no resource manufacturer would start production given there is no customer willing to pay an amount at least large enough to amortize the manufacturer's current costs respectively operating expenditures and upfront investments (that the company must pay to access Required Functions of their workers, machinery equipment, IT-systems, etc.)! In particular this holds in view of longsome site developments needed before the first volumes can be manufactured. Finally no resource manufacturer could justify such enormous efforts economically given there is just a short-term market trend and/ speculation, without indication (= change in external Significant Influencing Factor) that rising market values can be sustained long-term. In this sense Calculative Cash Outflow can be interpreted as any not yet further processed resource's minimum Functional Value, assessed from the point of view of the customer being least dependent on it. Please note that irrespective the fact that one cannot rely on supply-demand-functions in cases of Functional Valuation – when compared to traditional micro-economics – the "minimum Functional Value" argument parallels the customer's point of view, whose reservation price is the lowest one.

For a talented analyst, who regularly values assets e.g. for M&A purposes, getting access to relevant data on Calculative Cash Outflow may be relatively easy. This seems particularly true for analysts having industry experience: E.g. J.P. Morgan (2010) performs comparable analysis on all-in costs. Also my former colleagues and I had to start any valuation with publicly accessible information in almost all M&A cases for which we were mandated as consultants, in order to calculate and break down total costs, investment levels, margin potentials as well as IRRs. Given the projects continued and increasingly more internal data became available initial calculations proved being realistic – not just once but repeatedly. Irrespective thereof – for accounting (and taxation) purposes – there is still an issue related to the comparability of costs and investment assumptions applied by diverse companies. Realizing comparability is required to finally calculate something like an "industry-average Calculative Cash Outflow per volume", which is at best generally accepted. And general acceptance finally is required for accounting such Calculative Cash Outflow to Conserved Balance Sheets of manifold companies in diverse industries. Though some tasks to match requirements linked to accounting resources' Functional Values are named yet by the author the door for additional research is open still (cf. Chapters IV, 3.3 to IV, 3.4.3 as well as Chapter V, 9). One issue for sure is that initial manufacturers of initial resources after all face competition like any upstream company does, too. Therefore like (most) other companies they will strive to retain information asymmetries in their favor – in particular regarding costs, margins, investments and IRRs. This is an additional reason why upstream companies have next to none mean to attach Value Tags to resources they purchased. (In contrast margins exist at upstream companies for further processed resources and self-provided goods; they consequently are accountable to Conserved Balance Sheets). Up to the author's knowledge the only counterexamples where supplier's financials are transparent for buyers exist in selected parts of the value chains in the machine building industry, the automotive industry and the utilities sector: Here "open book calculation" and/ or "on-site engineers" were put through either by huge downstream market power of original equipment manufacturers ("OEM") or by public authorities (cf. Bundesnetzagentur (2007)). But generally speaking the sharing of cost and margin data across companies is uncommon!

All-in costs' superior explanatory power is thereby not at all confuted though! Instead they are proven key figures in the resource sector yet – for mangers as well as investors (and investment analysts). Over and above it was shown herein how to come to *conserved* all-in costs, i.e. Calculative Cash Outflow, which rightly can be assumed to measure Functional Value in the special case of (not yet further processed) resources (cf. above as well as Chapter IV, 3 and its Sub-Chapters). So the task seems to be rather making relevant data accessible instead of neglecting any all-in cost considerations in accounting. Therefore this Chapter closes by Figure 46, which reconsiders the initial example of the highly speculative resource "gold": This resource – amongst other "things" – must be accounted for while Strict Conservation Law in Business must hold in every case. Therefore the right hand side shows how further processing (= here: production of one gold-coated circuit) affected the inputs so that the conservation law actually holds here. (For the sake of "completeness" – irrespective whether or not completeness could be reached at all – Functional Valuation of the "things" beyond the scope of resources is exemplified, too. (For details cf. Chapters V, 5.2.1.2 and V, 5.2.1.3 as well as Chapter V, 5.2.3 and its Sub-Chapters)).

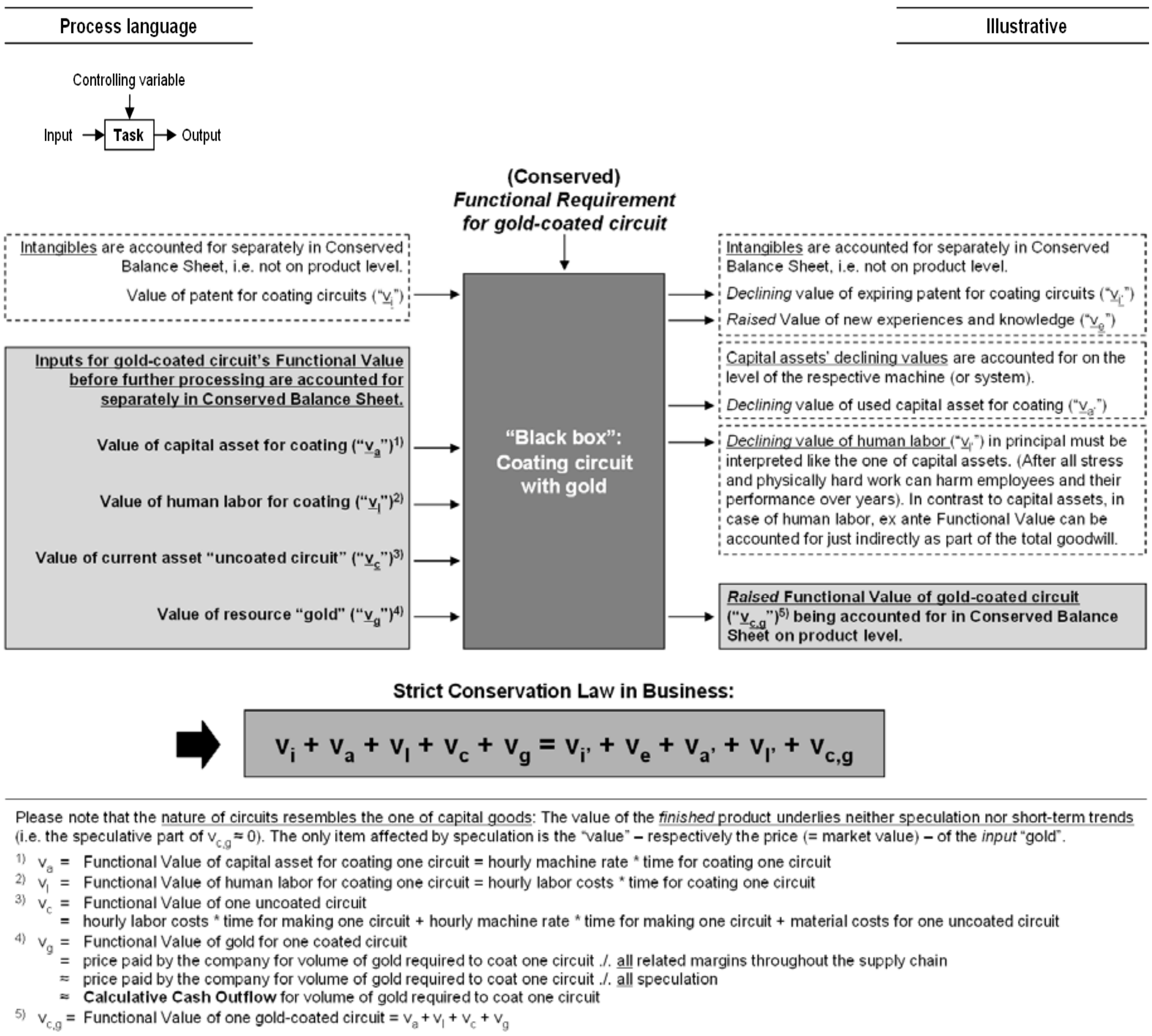


Figure 46: Example on Strict Conservation Law in Business applied for Conserved Quantity Accounting (cf. Figure 37)

5.2.1.2 Functional Value of products in storage

Any financial statement has to avoid double-accounting – in this context please think about the following: On the one hand Conserved Balance Sheets include current assets, which comprise not only but also semi-finished and finished goods. On the other hand the calculation of the latter current assets' Functional Values (called collectively product value = "v_p" in Figure 37and "v_c" and "$v_{c,g}$" in Figure 46 that is more detailed) may include machine hour rates – and thereby already some part of the capital asset's value.

Nonetheless Functional Values of the capital assets on and of themselves also must be calculated based on their own Conserved Cashflow forecast because: Both values are not at all identical!

Functional Value of a product in storage is an *ex post* value from a production point of view. It is determined by Value Tag plus the costs in course of giving the product its Required Functions including "soft functions" (cf. Appel and Grabinski (2011), Chapter III, 2.2.2 as well as Chapters V, 5.1.3.2 and V, 5.1.4.2). These are costs for acquiring resources (= here: measured by Calculative Cash Outflow), which must be further processed for this purpose, as well as costs for utilizing operational "assets". The latter are the ones performing Functional Value adding work *and* are re-usable. They comprise capital assets as well as employees. In order to be able to access and maintain their potential for Functional Value creation the company under consideration has to invest in them. Furthermore it must pay (continuously) operational expenses. Both elements are condensed by the terms "machine costs" and "labor costs".

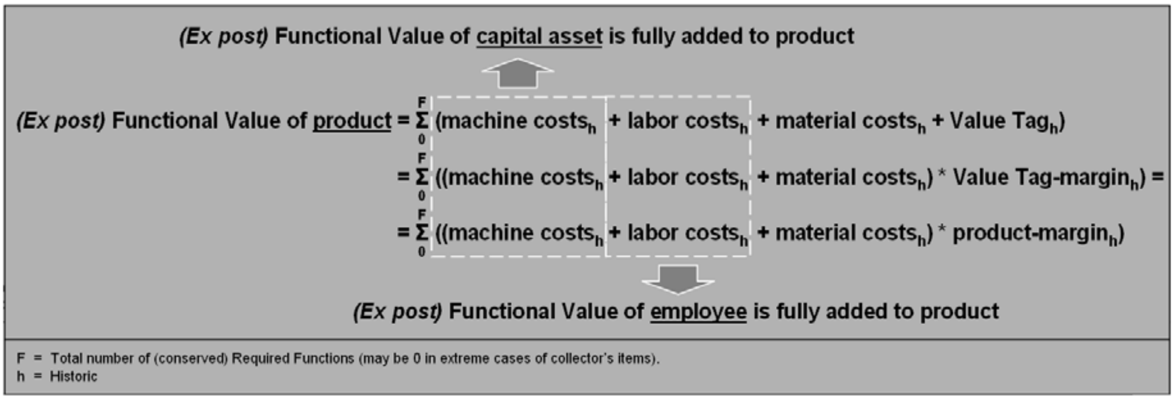


Figure 47: *Ex post* Functional Values of capital assets, human "assets" and further processed resources fully allocated to product in storage

Products must have been generated in a previous period in order to be in storage as of a certain due date (e.g. end of a financial year). In consequence, for them, no capital asset is required anymore for any production purpose as of today. This means: In course of further processing some parts of the capital asset's Functional Value were already added (respectively transferred) to the products in storage. This "value transfer" happened each time a capital asset was used to contribute to any product's fulfillment of Required Functions. (On principle it is the same for human resources). In consequence the related costs of further processing calculable by historic hourly machine rates (or historic hourly labor costs) must be accounted completely to the product because it is the unit of consideration, which bears related Required Functions. Please remember this Conserved Quantity Accounting rule perfectly implements Strict Conservation Law in Business, which postulates the (partly) transfers of Functional Value of operating "assets" to the product by every further processing activity (cf. Chapter V, 2.2).

5.2.1.3 Functional Value of capital assets

Ex ante Functional Value of capital assets is determined by a forward-looking calculation from a production point of view. It is the *remainder* of operating assets' Functional Value, which was not yet transferred to any product (in course of further processing). Such kind of remaining value is available to be transferred to any products' Required Function in the future. (The same holds for human resources that form the rest of operating "assets", which are re-usable (cf. Chapter V, 5.2.3 – particularly Sub-Chapter V, 5.2.3.2)).

Significant Influencing Factors on future hourly machine rates have to be planned and their magnitudes have to be forecasted in order to calculate a capital asset's *ex ante* Functional Value. Please note that he hourly machine rates include not only capital investments in the asset under consideration but also the capital asset's calculative utilization (determined by sales forecasts, production plans, service intervals, availability of rival capital assets and outsourcing, etc.). But this it is not yet sufficient in order to plan which products will be manufactured by which machine, i.e. the machine schedule must be forecasted, too. In addition the respective processing time to manufacture only things adding to products' Functional Value must be predicted. The same holds for Value Tags of current and future products, for which input data should be available in form of business plans respectively business case calculation (cf. "zero-based-budgeting"). Over and above – since a long-term perspective is taken – timing of Significant Influencing Factors must be planned and their materialization in the capital asset's net Conserved Cashflow must be forecasted. (This is relevant to consider the time value of money correctly). For the time being please accept this comprehensive methodology as the *"pure tenet"* of capital assets' *ex ante* Functional Valuation (cf. below).

$$\text{(Ex ante) Functional Value of capital asset}_t = \sum_{0}^{F} (\text{machine costs}_f + \text{Value Tag}_f)$$

$$= \sum_{0}^{F} (\text{machine-hour rate}_f * \text{processing time}_f * \text{weighted Value Tag-margin}_f) =$$

$$= \sum_{0}^{F} (\text{machine-hour rate}_f * \text{processing time}_f * \text{weighted product-margin}_f) =$$

$$\text{(Ex ante) Functional Value of capital asset} = \sum_{t=0}^{n} \frac{\text{(Ex ante) Functional Value of capital asset}_t}{(1+i)^t}$$

F = Total number of Required Functions (may be 0 in extreme cases of collector's items).
h = Historic
t = Time period
n = Total number of time periods
i = Interest rate (= here: internal rate of return ("IRR"))

Figure 48: *Ex ante* Functional Value of capital asset

Against the background of GAAP accounting – to avoid confusion – please note that *no* balance sheet value was *"ex ante"* as long as it was not accepted in a transaction. Then however it was not part of the balance sheet anymore but booked into the income statement as "sales". Established accounting hence does not allow forecasts in order to avoid inflated balance sheet values. But as soon as it comes to fair value accounting the resolution to account "conservatively" (to be read as: "based on historic transactions respectively historic costs, not forecasts") can be undercut (cf. Ohlson et al. (2010), Chapter V, 7.6). In contrast Conserved Balance Sheets intentionally contain forecasts on the assets' (ex ante) Conserved Cashflows. This is inevitable in order to fulfill the goal of offering a *"one-pager-overview"* that makes transparent the long-term lasting Functional Firm Value of a company, which has the "going-concern"-qualification, as well as of its assets and liabilities that justify an approval of the "going-concern"-qualification. Moreover – since only Conserved Quantities instead of (non-conserved) market values are accounted to Conserved Balance Sheets – the potential shortcoming of GAAP accounting in the sense of value inflation is countered at its source.

It should become clear by now that (ex post) Functional Value of any products in principal is calculated simultaneously to (ex ante) Functional Value of any capital asset. The differences in respective Functional Values come only from:

1. The *time span* under consideration: It affects not only the (historic and forecasted) processing time of products but also the (historic and forecasted) hourly machine rates and thereby indirectly Value Tags (i.e. margins or IRRs).

2. Capital assets' *ex ante* Functional Value calculation does *not* include costs for material and employees: *Ex post* effects of further processed material and employees' labor on Conserved Cashflows are accounted to products in storage (cf. Chapters V, 5.2.1.2 and V, 5.2.3.1) whereas *ex ante* effects of material and in particular employees on Conserved Cashflows must be forecasted and accounted for separately (cf. Chapters V, 5.2.3.2 and V, 5.2.3.3).

Irrespective thereof there are other tasks related to machine schedules and Value Tags, which makes the *"pure tenet"* of capital assets' *ex ante* Functional Valuation difficult (cf. above). Capital assets namely are often used for the production of diverse products – therefore *relaxing conditions* are suggested: Given capital assets manufacture several products their *Value Tags* could be *weighted* by their processing time in order to approach to applied capital asset's most accurate Functional Value. But due to practical reasons it may be appropriate to allow still for further relaxing conditions like applying the *total company's IRR* as Value Tag for *all* products. Such ease may not be necessary for ex post Functional Valuation due to better data availability. But it seems to be acceptable for ex ante Functional Valuation because companies often take IRRs as minimum acceptable rate of return (cf. "hurdle rate" in the context of business and/ or investment cases): In general any planned product must pass a hurdle rate before its realization is approved. This background information allows for a widened interpretation of IRR in the context of Functional Valuation for Conserved Quantity Accounting. Then IRR becomes a ratio to gauge:

1. Functional Value the average customer would ascribe to the product that bears Required Functions according to Holistic Functional Value Analysis (cf. Chapters V, 5.1 to V, 5.1.4.2).

2. Conserved Cash out-/inflow from to point of view of the average customer/the company given the product is marketed.

3. The conserved countervalue for product's Required Functions that is high enough to cover (at least) all costs and expenses allocable to it (including capital expenses).

In conclusion a company's IRR is not only a welcome simplification but also seems to be a conservative yet realistic approximation for Value Tags, which allow measuring *ex ante* Functional Values of capital assets within an acceptable margin of error. (Please note that a follow-up dissertation deals not only but also with effects of relaxing the "pure tenet" of Conserved Quantity Accounting. It will be based on this work at hand and published in course of the CLPK research program, in which the author participated, too. Although the author was not obliged to do so he likes to comment on related issues for continuous research, too, in order to round of the picture he provides herein (cf. Chapter V, 9).

5.2.2 Accounting for Functional Values of financial assets and liabilities

One key insight so far is: Functional Valuation does not strive to account for assets' total (market) values. This principle is valid not only for current assets like resources and (semi-) finished products in storage and re-usable operational "assets" meaning capital assets and human resources (cf. Chapters V, 5.2.1 and V, 5.2.3 including their Sub-Chapters). This principle holds for financial assets and liabilities, too:

1. In any case the key to come to Functional Values is to determine the conserved part of market demand (= Functional Requirements) and market value (= calculated by total allocable production costs and Value Tags for Required Functions only).

2. Financial assets and liabilities will be treated like any other (operational) input that contributes to fit up a product with Required Function, so that it successively gains Functional Value. That equation is to the point because:

2.1. Financial assets and liabilities can be used for Functional Value generation or speculation: E.g. providing a credit to a company that pays therewith its production costs or investments in machinery and equipment most likely reflects conserved funds that must be accounted to Conserved Balance Sheets (Whether or not they are conserved indeed must be checked by Holistic Functional Value Analysis though (cf. Chapter V, 5.1)). But the funds could have been used also to e.g. buy stocks of any company – which has nothing to do with one's own operations respectively core business – just because lots of other people do so, too. These funds are allocated due to short-term trends respectively speculation and consequently non-conserved hence non-accountable to Conserved Balance Sheets.

2.2 "Application" of financial assets and liabilities leads to (interest) income respectively (capital) costs dependent on the point of view. That also parallels the application of any "other (operational) input that contributes to fit up a product with Required Function". This leads to point 2.3.

2.3 Given the "application" of financial assets – or better the funding of something by applying them – results in Functional Value added such financial assets bear Value Tags, too.

In view of the above please note that the *financial assets of one company* are the *liabilities of another one*. The consistent use of Strict Conservation Law in Business postulates that both assets' and liabilities' Functional Values bear the same amount (cf. Chapter V, 2.2). Therefore Functional Valuation works the same way in either case.

5.2.2.1 Accounting for Functional Values of receivables and payables

The general Functional Valuation approach for financial assets is reflected at best in Functional Value calculation of *accounts receivables*: Though being financial assets – due to logical reasons and for the sake of consistency – accounts receivables must be valued like products in storage. Only then the conserved part of the revenues of current and previous periods is treated alike.

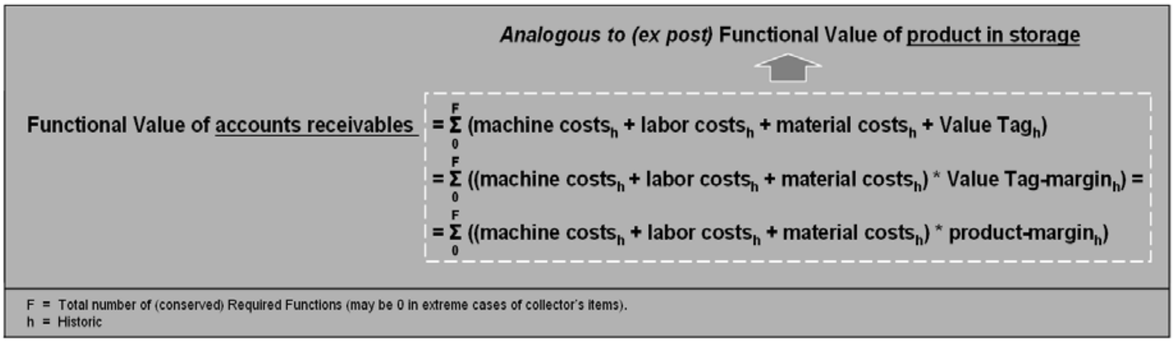


Figure 49: Functional Value of accounts receivables

For the sake of consistency the formula provided by Figure 49 holds for accounts payables, too. Otherwise the accounts receivables of suppliers could be inflated by non-conserved “values” (cf. Chapter V, 5.2.2).

5.2.2.2 Accounting for Functional Values of liabilities

Liabilities used for *conserved items* are to be accounted simply by their *discounted net Conserved Cashflow*; amounts for acquiring *non-conserved items* are to be *deducted*. Otherwise the value of the liability may be inconsistent as compared to the conserved part of the value of the item(s) that was (were) bought therewith when looking at the debtor’s balance sheet. Furthermore the value of the liability stated in the balance sheet of the debtor may be inconsistent as compared to the conserved part of the value that its accounted for in the balance sheet of the creditor. In either case Strict Conservation Law in Business would have been breached (cf. Chapters V, 2.2 and V, 5.2.2).

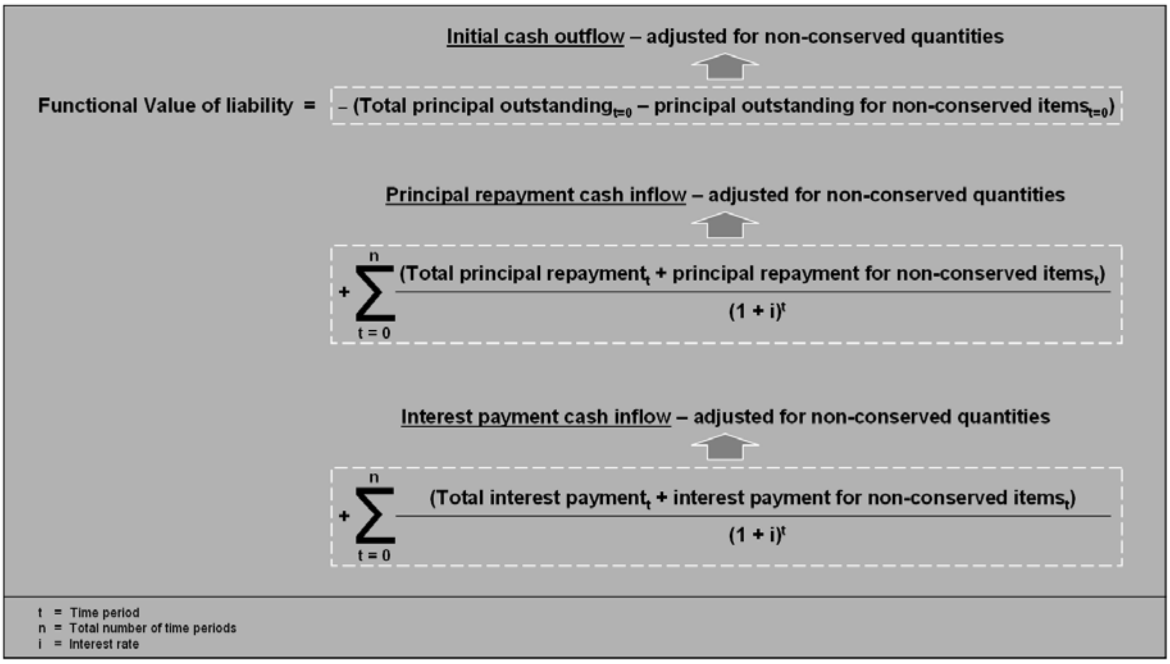


Figure 50: Functional Value of credits

5.2.2.3 Accounting for Functional Values of shares

Stocks outstanding must be valued in particular by changes in Functional Firm Value (cf. Appel and Grabinski (2011) as well as Chapter IV, 2 and its Sub-Chapters): The Functional Value for the holder (at large) is determined by the difference between the conserved part of the entry price (= Functional Firm Value as of the acquisition) and a conserved part of the exit price (= Functional Firm Value as of the planned time of re-sale). The “operating” Conserved Cashflow to the stockholder (= total dividend forecast) also must be included. All these values have to be adjusted for the number of owned shares. Net Conserved Cashflow from an investment in shares then can be calculated dependent on the holding strategy, i.e. resale or hold to infinity – the two cases are depicted below by Figures 55 and 56.

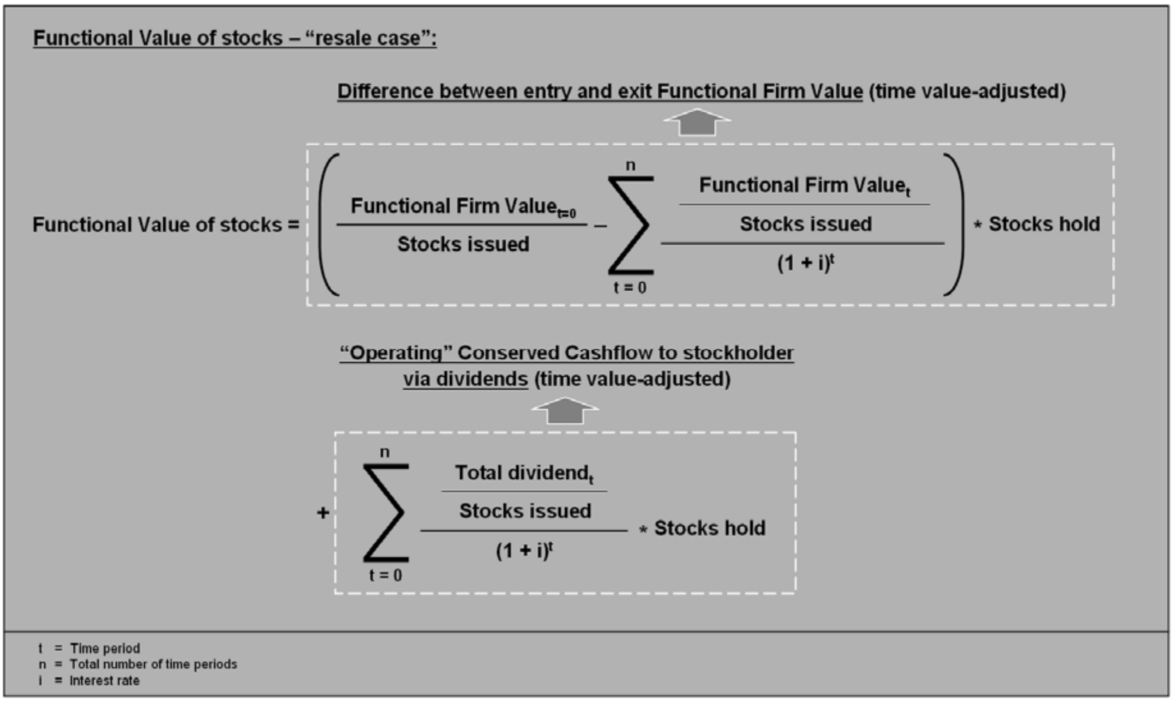


Figure 51: Functional Value of shares – "resale case"

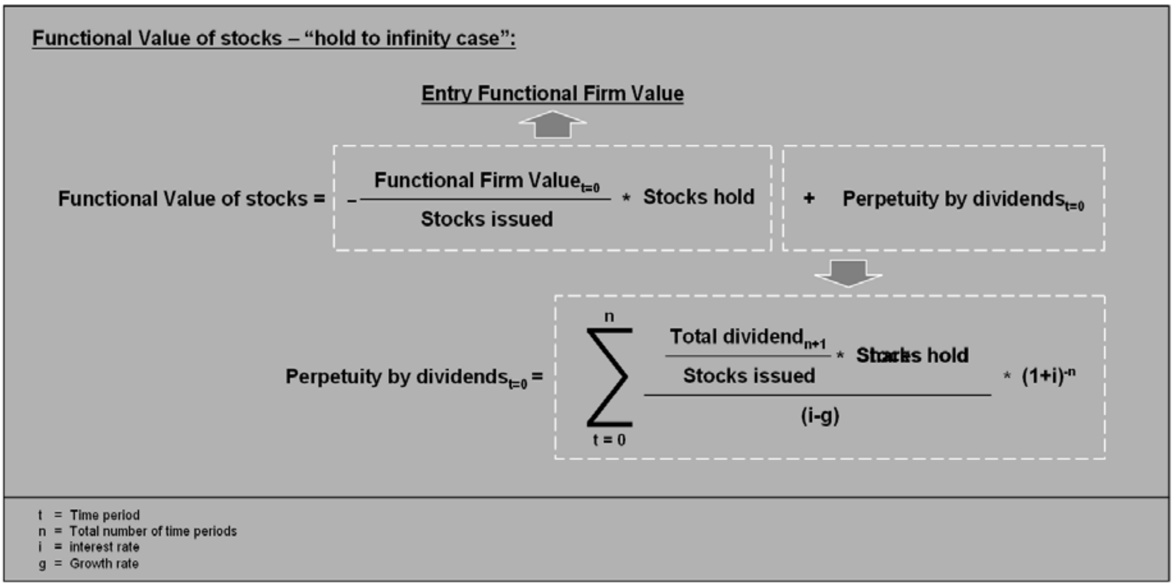


Figure 52: Functional Value of shares – "hold to infinity case"

Regarding the dividends please note that nobody at first glance can declare which part was payable due to the company's successful (conserved) operation, i.e. the sale of products due to satisfying (conserved) Functional Requirements. Therefore one has to assume that *all* dividends are *conserved*. (The Conserved Cashflow of the company that issued the stock – as well as its non-conserved cashflow – however can be calculated accurately (cf. Chapter IV, 2 as well as Chapters V, 3 to V, 5.2.3.3). In view of the dividend payments the following cases clarify the issue:

1. The only example in which it might be possible to see whether or not dividend streams are actually conserved might be a company selling *collector's items* only. But since most collector's items also have Functional Values – though they are often negligibly small compared to market values – one would have to decide case-based. If the (functionally justifiable) Conserved Cash inflow is actually too low for the total of all dividends they actually can be deemed being non-conserved. If not further analysis would be required to break-down the dividend stream. (In principle the same analysis process is applicable for dividends paid by a management holding, which may be payable due to speculation or as well due to investments).

2. Looking at the other side of the spectrum even dividends of *capital goods* companies may be non-conserved – though their operational cashflow may be generated by selling 100% of the products just due to 100% Functional Requirements. And there may also be a counterexample, too:

   2.1 A *"healthy"* company pays 100% of the dividends from (operational) Conserved Cashflow generated by developing, producing and selling capital goods. Here also dividends are conserved.

   2.2 A *"not-so-healthy"* capital goods company is able to pay dividends from borrowed capital only. This capital does neither stem from any Functional Value adding activity nor was it applied for any Functional Value adding activity in e.g. research or manufacturing. In consequence the dividend cashflow from the company to the stockholders is not-conserved here. Though such payments may not be wise from a going-concern point of view there are just certain limitations, i.e. such payments are not always forbidden (at least as long as the company had not failed for bankruptcy before). And an opportunistic management team may try to pay "borrowed" dividends to calm stockholders.

Though it might be possible to differentiate between all of these cases it should have become obvious that accounting for conserved dividends only may become tedious – in particular when the one-period case is broadened to incorporate dividend forecasts. Therefore the relaxing condition *"all dividends are allowed to be account for like being conserved"* seems appropriate.

5.2.3 Accounting for Functional Values of human resources and intangibles

Human resources' Functional Value must be considered in valuation of intangibles in order to comply with Strict Conservation Law in Business on a micro- *and* macroeconomic level (cf. Chapter V, 2.2): First of all workers "give something" to the product and/ or their employing company by performing their job. More precise they add respectively transfer Functional Value to products and/ or the company (dependent on the respective employee's task). For it they receive payments or earnings that they can spend. Secondly – as soon as they spend their money – they express both their Functional Requirements as well as their Functional Valuation of other people's and companies' work. But human resources are just one prominent case of intangibles, which may or may not be accounted to a company's goodwill dependent on the selected accounting scheme. Conserved Balance Sheets consciously incorporate not only but also human resources' Functional Value in addition to the remaining part(s) of the total goodwill. Therefore the next Sub-Chapters V, 5.2.3.1 to V, 5.2.3.3 show how to separate as good as possible goodwill into its diverse parts and how to compute their Functional Values respectively.

5.2.3.1 Ex post Functional Value of human resources

To retain closely to Strict Conservation Law in Business all conserved work performed by any "asset" must be accounted for in Conserved Balance Sheets. This requirement includes the performance of human “assets”, too. For the sake of consistency the author suggests to calculate Functional Values of direct and indirect employees (= here: collectively measured by v_l) similar to the ones of other operating assets (= capital assets).

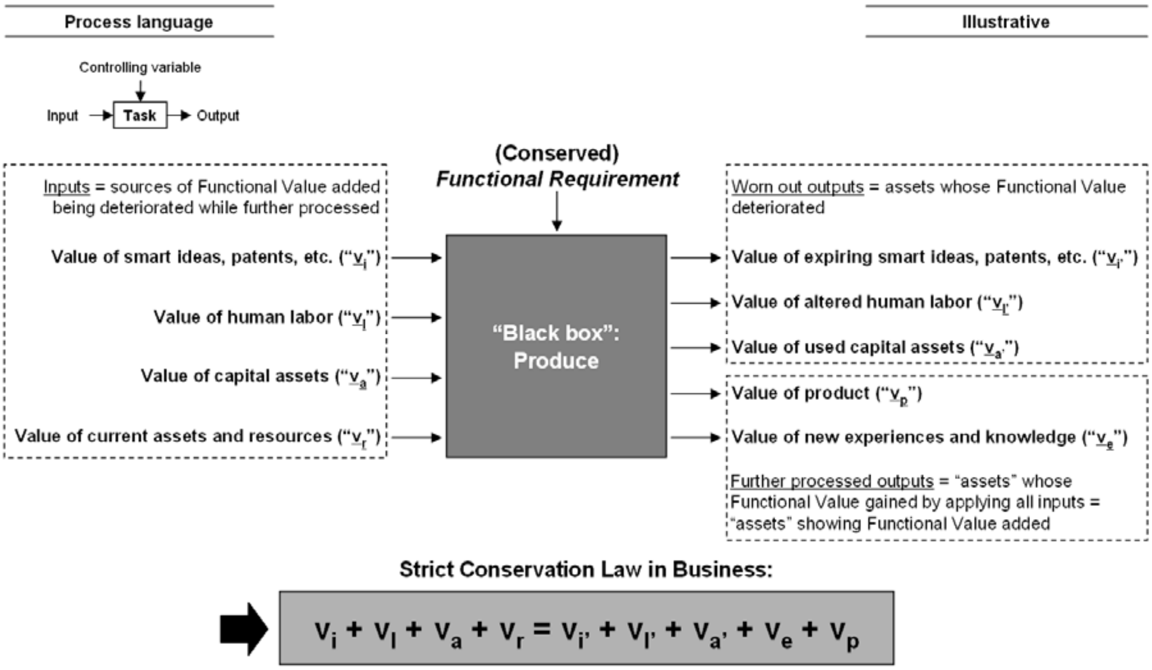


Figure 53: Strict Conservation Law in Business (simplified reprise of Figure 37)

For recapitulation: Both employees and capital assets always “loose” Functional Value through work (cf. Figure 53 or 37). In particular this is due to wear and tear and diverse signs of fatigue, which people cannot escape during their work life. But in parallel both the capital assets’ and employees’ loss in Functional Value (at large) are transferred to the product and captured by its (conserved) Required Functions. Thereby v_p, the product’s Functional Value is increased. In addition human labor often creates value by generating v_e, i.e. Functional Value by new experiences and knowledge. This exemplifies essential propositions of Strict Conservation Law in Business:

1. There is *no* net loss in Functional Value.

2. *Production = transfer of Functional Value* from employees and/ or capital assets to Required Functions of products and/ or new experiences and knowledge.

Attaching Functional Values to employees' labor must not be confused with the philosophical idea, which ascribes a value to the existence of a human being in itself. Due to ethical reasons the latter value cannot and should not be measured in monetary terms at all. However Functional Value can and should be accounted for in Conserved Balance Sheets! The reasons were discussed yet (cf. above, Chapters V, 2.2 and V, 5.2.1.1); the means and ways to do so are: Employee's *ex post* Functional Value added is fully accounted to the *products in storage* – analogously to the case of capital assets. Due to a practical reason v_l comprises *not only* Functional Value added by direct workers' labor-input *but also* the one added by indirect workers' labor-input (= collectively total allocable labor costs in course of production plus Value Tag). At this occasion please note that – in practice – some companies account people working at a production machine as "indirect workers" though they perform *quickly* one *short* value adding task required to manufacture several products. And given the task itself is performed faster than noting for which product it was done the employing company accounts declares such task(s) and worker(s) being "indirect" – though they obviously have nothing to do with managerial or administrative issues and instead add somewhat *directly* to the product's Functional Value, i.e. v_p. Therefore the perception "direct labor costs = labor costs allocable to the product" and "indirect labor costs = labor costs not allocable to the product" is inappropriate here.

***(Ex post)* Functional Value of product**

$$= \sum_{0}^{F} (\text{machine costs}_h + \text{labor costs}_h + \text{material costs}_h + \text{Value Tag}_h)$$

$$= \sum_{0}^{F} ((\text{machine costs}_h + \text{labor costs}_h + \text{material costs}_h) * \text{Value Tag-margin}_h) =$$

$$= \sum_{0}^{F} ((\text{machine costs}_h + \text{labor costs}_h + \text{material costs}_h) * \text{product-margin}_h)$$

***(Ex post)* Functional Value of employee is fully added to product**

F = Total number of (conserved) Required Functions (may be 0 in extreme cases of collector's items).
h = Historic

Figure 54: *Ex post* Functional Values of human "assets"
fully allocated to product in storage (reprise of Figure 47)

5.2.3.2 Ex ante Functional Value of human resources: Reasoning for indirect calculation

Employees' *ex ante* Functional Value has to be forecasted and accounted to the respective person in Conserved Balance Sheets. Again this is just like in the case of capital assets. Thereby the employees' future potential to create Functional Value by fulfilling tasks would be reflected. For the time being please accept this method as the *"pure tenet"* of human resources' *ex ante* Functional Valuation (cf. below and Chapter V, 5.2.3.3).

Functional Valuation rules for any kind of "asset" – no matter if it is material, immaterial or human – are consistent and straight forward. Accounting for Conserved Quantities only is facilitated thereby. But there are some basic conditions that make it considerably more difficult to attach an (ex ante) value to an employee than to a capital asset:

1. There is *no* such thing as a *homogeneous* workforce: People have idiosyncratic operational and intellectual strengths and weaknesses. In addition not all employees are allowed to participate in the same trainings and make the same experiences. (Furthermore the effects regarding the progress on the learning curve are individual, too). Over and above employees are more or less prone to illnesses. Therefore their performance in certain functions (and over time) will differ. People also tend to change their employing company more or less frequently, etc. Summarizing it in production terms leads to the conclusion: Employees' actual *capacity* that the company can utilize as well as their *efficiency* deviate – both determine VL (cf. Figure 53 or 37).

2. *Not* all tasks lead to *linear* results of Functional Value materialization: E.g. project plans may show chaotic patterns (cf. Chapter II, 4.1.4). In particular this is true for *more strategic tasks* like research. New things sometimes look valueless at first glance but they for sure are not. Often they help to serve Required Functions in a better way. And if not one knows at least what has to be avoided going forward. Or expressed in managerial terms: In any case new things help to become more *effective* and/ or more *efficient* (at least in the long run). Therefore Strict Conservation

Law in Business measures Functional Value of smart ideas, patents, etc. – they determine VI respectively v_e (cf. Figure 53 or 37). However an important question must be answered still: When is Functional Value recognized so that it can be realized and accounted for? E.g. the American corporation "3M" developed not only but also the glue for the famous removable adhesive notepad called "Post-it". But in actuality its researchers were trying hard to develop something that serves completely different Required Functions namely super durable glue. One could say the Post-it was the result of an *accident* or *luck* or *chaos* (dependent one the point of view). 3M at first regarded the "super durable glue"-project being a failure; the Post-it's Functional Value was not appreciated for years (cf. Picot et al. (2002), Wikipedia (2011b)). As a result 3M could not materialize Functional Value of the removable adhesive glue until the Post-it was finally marketed, which was years after its development though. Nonetheless Functional Value had been there *right from the beginning*.

At this occasion please allow for a little excursus on the "good kind of chaos", which was not treated herein before, versus the "bad kind of chaos" that must get under control by all means: In contrast to the chaotic outcome of the research project 3M could have avoided chaos in the sales forecast for the Post-it by following Holistic Functional Value Analysis (cf. Chapter V, 5.1 and its Sub-Chapters). For sure non-chaotic forecasts are better than potentially chaotic ones. But without chaos 3M would not have found the glue for one of its most popular products. So this example suggests that there must be more than one kind of chaos: There may be *helpful chaos* in *strategic tasks* – like research in order to find new ways to serve Required Functions – and there may be *harmful chaos* in *operational tasks* – like manufacturing things that serve the product's Required Functions or performing forecasts in the product's marketing potential. In the strategic context chaos may be explained best by equating it with concepts like "luck" or "fortune". (Though things may not always look that positive for the short run (cf. above)). Of course the materialization of luck/ fortune is good for the lucky beggar. And generally speaking in an otherwise desperate situation let alone the chance that "one might have luck" or the strong believe that "everything will become well" sometimes may be the only remaining straw, which motivates people to continue and possibly gain outstanding results in the end. But there is no reason why such a person (or company) could rightly claim to have regularly (the same kind of) luck or fortune. Therefore (strategic) chaos in the sense of "luck" or "fortune" must *not* be consciously taken into account when setting up *operational* project plans and/ or forecasting the magnitudes of the included tasks. Instead one core task of meaningful, realistic forecasts is to avoid extreme situations right at their beginning – for this purpose Grabinski's (2007) Conserved Quantity Approach was widened to be applied for Functional Valuation. Needless to point out once more that forecasting and valuation are *operational tasks* – therefore chaos must *always* be avoided here!

3. No easy way exists to declare whether or not an employee adds to a *product's Functional Value*: *Direct workers* e.g. can perform tasks for both conserved and non-conserved "value" creation. (Therefore Functional Value of Work is not equivalent to salary or wages (cf. Chapter IV, 2.3 as well as Chapter V, 5.1.1 and its Sub-Chapters)). But *indirect workers* can contribute to Functional Value from the point of view of a customer, too: Quality management e.g. adds to a product's Functional Value – if it does not work there is no Functional Value at all. Also customer service can add to Functional Value – it helps customers to find the most appropriate product or equipment (cf. Chapter IV, 4). Over and above in many cases there would not be any product at all if the company had no researchers and developers. In contrast – from the customers' point of view – the accounting department (at large) does not affect Functional Value.

4. No easy way exists to declare whether or not an employee adds to a *company's Functional Value*: Though the accountants at best in an exceptional case may add to a product's Functional Value they for sure bear a Functional Value from their employing company's point of view! Or have you ever seen a company functioning without any kind of accounting? Of course not. But there is another practical issue: What if some of the accountants regularly assist the quality management team in tasks like data processing and administering? In a practical way – without running the risk of double-accounting – how to calculate the future part of such account-

ants' work, which adds Functional Value to the company and/ or to one (or more) of the company's products?

5. Employees may (temporarily) cumulate Functional Value for themselves *without* transferring Functional Values to any product or their employing company: A willing employee (= then: $v_l > 0$) at least has the *potential* to add Functional Value to a product and/ or the company. So given the task had something to do with a Required Function of a product – or a service like accounting – *and* given the task was performed correctly v_p increases. In addition the employee gains new experiences and knowledge, which make him/ her work more effective and/ or more efficient going forward. Such experience also adds to the company's Functional Firm Value. Consequently v_e increases (cf. Figures 37 or 53). But what is about employees that "have just fun"? Consider e.g. someone who is reading insignificant things in the internet all the time or who is chatting with colleagues all the time. Thereby v_e increases, too. This time chances are however high that there is an increase in value for the employee only! And the company is betrayed of some value because the employee under consideration goes home without having fulfilled his/ her Required Function. *Conserved Balance Sheet of course only contains the company's accessible v_e.* The part a fun-loving or unmotivated employee may betray his employing company of is neglected. Please note that – apart from practical reasons – the potential betrayal is ignored in Conserved Quantity Accounting because it is the task of any manager to limit misbehavior. (And if this task is not performed effectively the employing company's going-concern perspective is threatened, i.e. a long-term financial forecast by Conserved Quantities may not be required anyway).

In the end – similar to capital assets – it is relatively easier to account for the *ex post* part of employee's Functional Value creation, which is accounted to the finished and semi-finished products in storage. This part is captured by the hourly rates used to contribute to Required Functions. But *direct* calculation and accounting for the *ex ante* part of employees' Functional Value seems impossible in contrast to the one of capital assets – at first glance. This is particularly because an employee's scope of application can be much broader than the one of any machine! But there is an indirect way of considering the remaining *(ex ante)* part of employees' Functional Value – the following Chapter V, 5.2.3.3 discloses the solution.

5.2.3.3 Functional Firm Value: Indirect calculation of goodwill including human resources

Conserved Balance Sheets aim to overcome shortcomings of GAAP accounting. Besides other things the latter cannot provide a *"one-pager-overview"* of all assets and their real values, which are valid long-term. In particular *intangible assets' values* are not fully incorporated in GAAP balance sheets (cf. Ohlson et al. (2010), Penman (2009)). Until here it was shown yet that Conserved Balance Sheets can account for the *ex post* Functional Value of human labor's, which was used to generate products' Required Functions, and labor capacity is an intangible that for sure has the potential to add Functional Value e.g. to a product. At this point please note that GAAP accounting uses somewhat similar approaches to account for *ex post* human labor but without questioning whether or not the work performed by employees was conserved (cf. approaches related to "historic costs" or "production costs"). A margin respectively Value Tag is considered in GAAP accounting *not* before a product is sold – then however it is *not* accounted anymore to the balance sheet on the level of the line item "product" (cf. Chapter V, 5.2.1.3). Therefore the explanatory power of values stated in GAAP balance sheets is rather limited – in view of the products real values (from customers' point of view) and in view of (long-term) future-orientation. This means two things: Conserved Quantity Accounting must be able to provide a new approach to forecast, value and account for intangibles *and* one must not get puzzled with existing GAAP approaches that are inconsequent in this context.

Functional Valuation of the rest of the intangibles requires a closer look at the *elements* of Functional Firm Value: In principle the definition of "firm value" is kept here, i.e. the value amounts to the one of the total company and is not yet adjusted for the total of liabilities to be repaid (cf. "enterprise value", "entity value" or "aggregate value"). More precise this means: Functional Firm Value equates to the *sum of the company's total discounted net Conserved Cashflow forecast* (including a terminal value). Thus Functional

Firm Value includes the *marketing forecasts* not only of current products – respectively their (conserved) Required Functions – but also the ones of products yet to be developed. In addition it contains the *forecasts of total costs* along the company's value chain. Total costs include all costs allocable to the products' production and the remaining ones associated to enabling and supportive functions provided by the company's organization and infrastructure. (Thereby companies are *not* calculated being more profitable than they actually are, i.e. costs are not adjusted. In contrast this would be the case if not only the non-conserved cash inflow but also the non-conserved cash outflow was cut to adjust financials for non-conserved quantities (cf. Tables 1 and 5)). Furthermore total costs include *capital costs* but as already noted repayments of liabilities' principal amounts outstanding as of the due date are *not* considered. (So Functional Firm Valuation does *not* assume that an investor, who acquires 100% of the company, must also redeem the liabilities and accrued interests due to this transaction. Finally no one knows how the redemption would be performed given the company was sold – purely by equity, purely by debt or maybe a mixture thereof? And given debt is involved the exact future leverage rate also must be assumed. Therefore the assumption to redeem the liabilities and accrued interests would bring about just additional assumptions (source of funds/ exact leverage), which cannot lead to better forecasts and values that have more explanatory power. Or to phrase it differently: Given there is no indication that most of the liabilities and accrued interests must be redeemed due to a transaction – which was nonetheless just assumed in order to reason the methodology of firm valuation – it is better to assume no redemption at all).

The derivation of line items for Conserved Balance Sheets parallels the *equity valuation* performed e.g. in course of M&A projects. This is because Functional Values are calculated by the same approach, i.e. by discounting net Conserved Cashflows forecasts. Hence the formula to calculate conserved equity can be *extended* (cf. Chapter V – in particular Figure 39) to Functional Firm Value breakdown of Figure 55; this breakdown is detailed further by Figure 56:

<u>Accounting view:</u>

Equity's Functional Value = Net discounted Conserved Cashflow to equity =

$$= \sum_{1}^{a} \text{Asset's Functional Values} \;./.\; \sum_{0}^{l} \text{Liabilities' Functional Values;}$$

$$\sum_{1}^{a} \textit{Asset's Functional Values} = \text{Equity's Functional Value} + \sum_{0}^{l} \text{Liabilities' Functional Values}$$

<u>Valuation view:</u>

$$\text{Equity's Functional Value} = \text{Functional Firm Value} \;./.\; \sum_{0}^{l} \text{Liabilities' Functional Values;}$$

$$\textit{Functional Firm Value} = \text{Equity's Functional Value} + \sum_{0}^{l} \text{Liabilities' Functional Values}$$

<u>Conclusion:</u>

Total <u>assets</u> of Conserved Balance Sheet <u>(including goodwill)</u>

$$\textit{Functional Firm Value} = \sum_{1}^{a} \textit{Asset's Functional Values}$$

$$= \text{Equity's Functional Value} + \sum_{0}^{l} \text{Liabilities' Functional Values}$$

Total <u>liabilities and shareholder's equity</u> of Conserved Balance Sheet

a = Total number of assets (must not be 0 due to capital brought in at corporation of an enterprise).
l = Total number of liabilities (may be 0 if 100% of financing comes from equity).

Figure 55: Equity calculation and Functional Firm Value
(cf. IFRS F.49 (c) (2001), Matchett (2003))

The rationale to *break-do*wn Functional Firm Value is: The future products' sales forecasts are up to their *ex ante* Functional Values – respectively the sum of future products' discounted Conserved Cashflow forecasts. They will be realizable only by *applying intangibles* like employees' capabilities in research, development, management, procurement, production, sales, service departments for internal and external customers, etc. Please note that this rationale is borrowed from other researchers. But they use it to neglect that (all) intangible assets like human resources – and particularly synergies – should be accounted for in balance sheets. From their point of view the effort of being able to have a "one-pager-overview" showing all assets may not be justified given that the intangibles' effects are non-trivially reflected in the profit and loss statement respectively the cashflow statement (cf. Ohlson et al. (2010), Penman (2009)). But the author disagrees: Profit and loss as well as cashflow statements are oriented to the *past* (cf. above). In consequence they cannot provide information on the company's (long-term) future value. But that is most important for investors – and should be in the focus of responsible managers and public authorities, too. Therefore Conserved Balance Sheets include additional information on long-term robust (= non-chaotic) Functional Values of both tangible and intangible assets.

Functional Firm Value – i.e. company's discounted net Conserved Cashflow forecast – considers Conserved Cash inflows only but total cash outflow, i.e. total costs and investments including the ones in intangibles (cf. Tables 1 and 5). This means Functional Firm Value accounts for the net result of Conserved Cash inflows and total cash outflows of all material and immaterial assets – particularly employees' labor input – that are applied in Functional Value creation. Remember that this approach was reasoned repeatedly in detail before. In view of the current context – and the issues discussed in view of *ex ante* Functional Valuation of human resources (cf. Chapter V, 5.2.3.2) – please note however one peculiarity: *Ultimately all employees contribute to (conserved) Functional Firm Value by any of the following two ways:*

1. By facilitating (conserved) Required Functions of *products* that can be sold.

2. By keeping the *company's organization and infrastructure* up and running.

The only counterexamples are employees who "have just fun", i.e. employees who are paid, but actually not required (cf. Chapter V, 5.2.3.2). But not only the SWOT and the value chain analysis provide first hints to such kind of an employee surplus (cf. Figure 40).

The bottom line from the above can be summarized by two insights: Intangibles Functional Values – except of human resources' *ex post* Functional Value – must be calculated indirectly; the starting point of gauging the remaining intangibles' Functional Values is Functional Firm Value. Then *total goodwill's Functional Value* can be computed by deducting from Functional Firm Value *all tangible assets' Functional Values* stated in Conserved Balance Sheet – these are in particular the ones of capital assets, semi-finished and finished products in storage, resources as well as the conserved cash balance. In this sense goodwill reflects not only but also the *(intangible) enablers* of Functional Value, which support the sale of future (not yet existing) products: Please note this interpretation expresses of course *not* the same as Functional Value of (semi-)finished products that are currently in storage but sold in a future period – they can be accounted for directly. Enablers namely do not necessarily have to be limited to already *existing intangibles* – like industrial design patterns, brand recognition, access to suppliers, customers and talent pools for future employees, etc. They also can be *forward-oriented* like the employees' cumulating experiences, capabilities and creativity along the whole value chain. Furthermore – in a non-trivial way – some parts of the goodwill also reflect the *conserved synergies* between all of the company's assets: E.g. the most talented engineers often prefer working for those employers, who are already on the leading edge of technology. Against this background – when proofing the compliance with Strict Conservation Law in Business – please note that conserved parts of immaterial assets' values beyond the ones of human resources' *ex ante* labor (= here: v_l) like Functional Values of smart ideas, patents, etc. (= here v_i) and of new experiences and knowledge (= here: v_e) are also accountable by the company's goodwill – given it is calculated indirectly as described below by Figure 56. *In consequence the circuit of Functional Value transformation is closed here.* No Conserved Quantity is lost and none is added without a change in Significant Influencing Factor(s) on net Conserved Cashflow that accrues to Functional Firm Value (cf. Figures 40, 50 or 57 as well as Chapter V, 2.2).

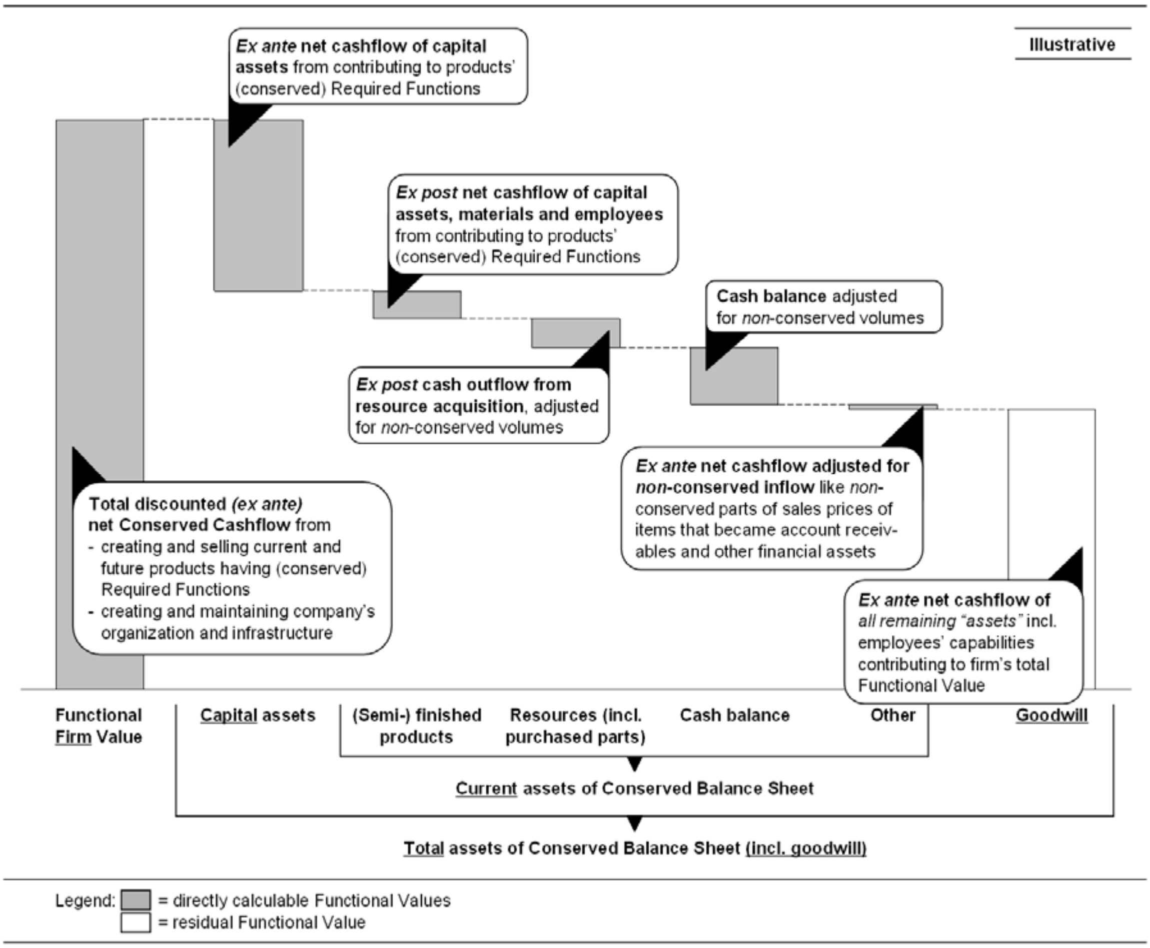


Figure 56: Functional Firm Value split for indirect (conserved) goodwill calculation

In consideration of Figure 56 it becomes obvious that no Conserved Quantity – respectively no (intangible) asset's Functional Value – can be missed by the indirect valuation suggested herein: The reason is that even if there is a *gap* between the sum-of-the parts Functional Value – i.e. Functional Firm Value – and the sum of the directly calculable Functional Values this just indicates the existence of immaterial assets, which were *not yet named*. But irrespective thereof their Functional Value *can be accounted for* in the first step. In the second step – to limit margin of error – the assumptions taken to come to Functional Firm Value should be checked. Thereby it becomes clear what particular magnitude one particular enabler had on the end result, i.e. on Functional Firm Value. By using this information Conserved Balance Sheet's line item "goodwill" – which accounts for the *ex ante* Functional Value of *all* remaining assets – can be broken down even further.

6 Chaos Exposure to measure robustness of market values

Chaos Exposure, a new financial figure, measures how much of an asset's "value" – or to be more precise of an asset's *total* market value – is threatened to collapse due to chaos effects. This is achieved by relating (non-conserved) market values to (conserved) Functional Values. Please note that instead of the market value on principle an asset's "value" stated in a GAAP balance sheet can be taken, too. (This is because established accounting considers the lower of cost or market price, which is often adjusted by the calculative depreciation and amortization (cf. Chapter II, 4.4.3 as well as Chapters IV, 3.2 and IV, 3.4.1)).

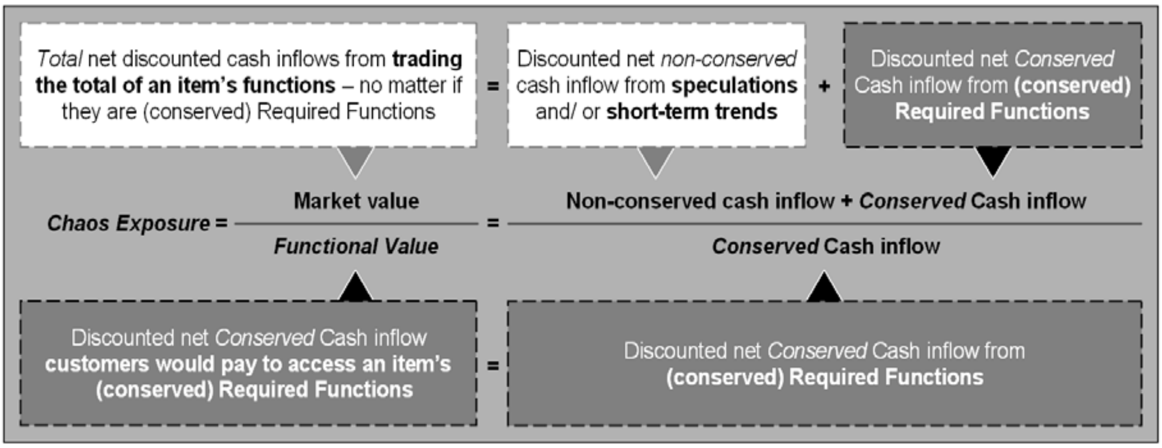


Figure 57: Chaos Exposure calculation

Chaos Exposure, being a *relative* business ratio, makes sense only as long as it is *compared* for several items (= products, assets, investments): Market values in general are much bigger than Functional Values – therefore the ratio will be bigger than 1 in almost all cases. Ratios bigger than 1 imply that someone holding the item under consideration owns something whose price or market value – respectively whose "value" (when using GAAP accounting terms) – in parts can vanish at short notice. The SAP-example again is a good showcase: It shows average Chaos Exposure ratio of about 5.0x. This means on average only 1/5 of the company's (share) market value was justified by discounted net Conserved Cashflow (= Functional Firm Value) generated by SAP's operations. At this occasion please note once more that chaos indeed captures (often) equity markets – this can be recognized via Chaos Exposure ratio, too. Finally chaos is the reason for the strong spreads between average Chaos Exposure (= 5.0x), minimal Chaos Exposure (= 1.5x) and maximal Chaos Exposure (=14.0x)! That means Chaos Exposure does not only provide support to decide whether or not an *item should be bought or resold at all* but also supports the decider in determining the *best timing for both the item's acquisition and its resale* (cf. Appel and Grabinski (2011) as well as Chapter IV, 2).

If people wanted to forego all chaos they would have to stop paying market values. Obviously this would lead to almost no transactions going forward; collapsing businesses and economies would be the results. In reality the core question therefore cannot be: "How to avoid any chaos?" but instead: "How to limit chaos effects as far as possible?" There are two solutions – the second one however is valid in special cases only:

1. Comparing Chaos Exposure of concurrent consumption and investment alternatives provides the *first* solution: The item with lowest Chaos Exposure ratio is the one that can be assumed having the most robust (= non-chaotic) value – respectively net discounted cashflow – in the long run.

2. But there is also a *second* solution because in certain cases Chaos Exposure can be optimized, too: Due to logical reasons Chaos Exposure must be defined as the *direct opposite of strategic fit*. (Mathematically spoken Chaos Exposure must be the reciprocal of strategic fit (cf. Figure 41)). So the best – and in reality only – way to reduce Chaos Exposure of a specific item is to optimize its strategic fit.

Against the background of the second solution it becomes clear why this dissertation contains not only but also suggestions on strategic fit optimization, which are applicable given the decider can amend and/ or actively manage the item under consideration – like in cases where a manager, entrepreneur or investor can influences a company's future development (cf. Chapter V, 5.1 – including its Sub-Chapters).

7 New in Conserved Quantity Accounting

In order to set-up Conserved Balance Sheets accountants need to analyze the long-term sustainability of a business model in order to gauge the robustness (= non-chaotic development over time) of balance sheet values in a way that resembles the work of (M&A) analysts. For that accountants have to leave historic financials behind and rather forecast the (conserved) quantity structure of the company's operations. But in established GAAP accounting this borderline must not be crossed (cf. Ohlson et al. (2010)). Then a methodology termed herein "Holistic Functional Value Analysis" is able to generate much deeper insights than any regular audit; its results grade up Conserved Balance Sheets (cf. Chapter V, 5.1 and its Sub-Chapters). Resultant core differences between GAAP and Conserved Quantity Accounting are depicted by Figure 58. Their manifestations by asset category are detailed in the following Sub-Chapters V, 7.1 to V, 7.7.

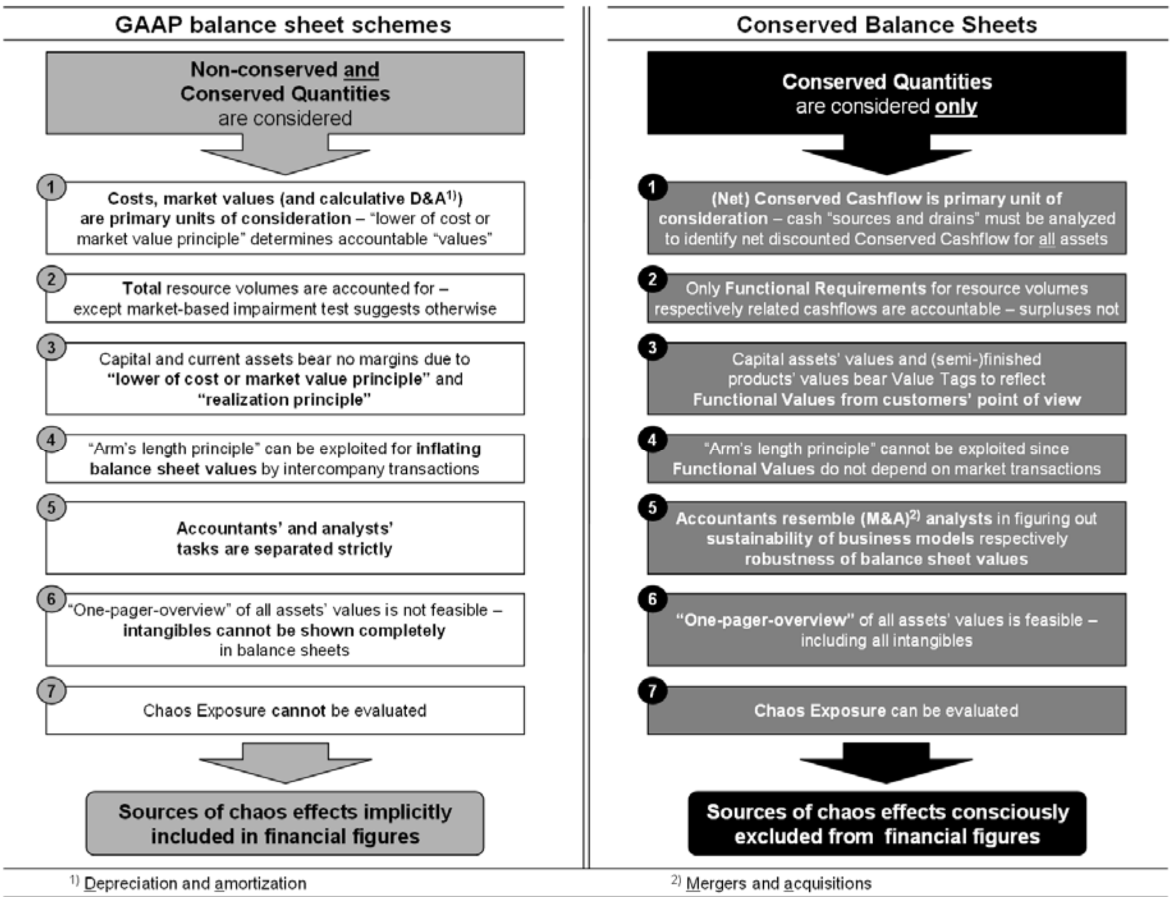


Figure 58: GAAP accounting versus Conserved Quantity Accounting

7.1 New in Functional Valuation of resources

If Conserved Balance Sheet is to show Functional Values of not yet further processed resources the accountant has to research the initial total production costs (cf. Chapters V, 5.1.3.1 and V, 5.1.3.2) respectively Calculative Cash Outflow (cf. Chapter IV, 3 including its Sub-Chapters as well as Chapter V, 5.2.1.1). Please recall that resources are the only items in Conserved Balance Sheets that are accounted at the *value* of all-in costs – i.e. without Value Tags. In order to be considered "conserved" the resource *volumes* stated in Conserved Balance Sheets must be in line with the sales forecast and must not be intended for speculative trading. (The latter prerequisite must be fulfilled for the volumes of all assets accountable to Conserved Balance Sheet). So the accountant also has to forecast – or at least verify yet existing forecasts – regarding Functional Requirements for resource volumes, which are inevitable in order to manufacture the forecasted sales volume of products that bear Required Functions. In GAAP accounting even resource surpluses are fully accounted for – though the company does not require them in actuality. In Conserved Quantity Accounting – given the company had acquired more resources than actually required for serving (conserved) Required Functions – this resource surplus has zero Functional Value. If this adjustment was not taken for all assets – i.e. not only but also for resources – speculations and short-term trends could not be excluded as far as possible from Conserved Balance Sheets.

7.2 New in Functional Valuation of (semi-)finished products in storage

Following the above reasoning – as soon as the company performed Functional Value adding activities – the accountant has to consider Value Tags in order to get Functional Values of semi-finished and finished products. To date this procedure is applied for diverse purposes like determining the fair value of an investment opportunity in order to gauge the economic attractiveness of M&A transactions. Since it contradicts the lower of cost or market principle its application in accounting semi-finished and finished products is illegal to date (at least according to German GAAP). The reason is that public authorities want to have "conservative" balance sheets net of any "bubbles" respectively inflated values. Though the author follows the same goal he suggests another approach: Excluding non-conserved quantities (cf. Grabinski (2007)). By this approach the core of the issue is attacked:

1. Total market values are adjusted in the *first step* by deducting calculative *values* for non-conserved elements. Since the result – which contains the costs and Value Tags of product's conserved Required Functions only – cannot deteriorate ad hoc it can be used for accounting without the threat of inflating the balance sheet.

2. Over and above in the *second step* (non-conserved) surplus *volumes* of any asset are depreciated since they bear no Functional Value.

Both steps in combination guarantee excluding speculative elements and short-term trends from Conserved Balance Sheets as far as possible! Since the *"lower of cost or market principle"* could not hold uncountable GAAP balance sheet values from vanishing into thin air during financial crisis, e.g. the one which started in summer 2007, and against the background of the findings of Appel and Grabinski (2011) and Appel et al. (2012) the author argues his approach is not only reasonable but also leads to more robust and more realistic (conserved) balance sheet values (cf. Chapter III, 3 and Chapter IV including their respective Sub-Chapters).

Conserved Quantity Accounting at the value of net discounted Conserved Cashflows (= Functional Values) of not only finished products but also of semi-finished ones implies a long-term perspective. The same is true for established accounting schemes following the *"going concern principle"*. Therefore chances are high that any semi-finished product in storage today becomes part of a finished product and gets sold within the (infinite) period under consideration. In addition semi-finished products in storage may also be kept in isolation consciously in order to sell them as spare parts – also in this case the suggested approach is rational. Therefore and due to the sake of consistency: Semi-finished products are accounted for their Functional Value, which they add to a finished product. Hence semi-finished products bear the same Value Tag as finished ones.

Theoretically there would be another way to account for Functional Values of semi-finished products. One could argue that there is a reason to account them at their *scrap value*. The reason is that in certain cases further processing may as well reduce Functional Value of semi-finished products for another company because afterwards semi-finished products may be suitable for only one purpose related to the producing company's business. This is however strongly related to the specific product, the production step as of the due date and the business model under consideration – an accountant without deep technological and industry knowledge may struggle to consider all facts accurately. Anyway – given the business cannot go concern – it may be that the further processed semi-finished products' Functional Value shrinks down to scrap value. But for working semi-finished products this is the case only given the acquirer of the bankrupt company cannot use them anymore. However this scenario is *excluded consciously* here because – just like GAAP accounting – Conserved Quantity Accounting confides in the *going-concern* case only. Nonetheless please note that there are also Conserved Quantities if Functional Value of a working (semi-finished) product shrinks down to scrap value:

1. The producing company may have *manufactured too much* – then the surplus' Functional Value added was zero anyway. But correspondent to Strict Conservation Law in Business (cf. Chapter V, 2.2) the *value of new experiences* could have been increased e.g. regarding the company's improvement potential in forecasting.

2. In a *"bankruptcy case"* Functional Value of something else outside of the bankrupt company increased before. One reason why a company has to leave the market and fail for bankruptcy is that competitors' products have relatively higher Functional Value from the customers' point of view. Hence the company having better products absorbs the customer pool of the less competitive (bankrupt) one. By substituting the less competitive products with the more competitive ones the Functional Value of the less competitive products (whose Functional Requirement sunk) decreases and the Functional Value of the more competitive ones (whose Function-

al Requirement rose) increases in parallel. Since (substitute) products do not just appear ad hoc from nowhere but are to be created in a process of diverse Functional Value adding steps (foreseeable) Conserved Quantities exist here, too (cf. Chapter III, 2.1.3 – including its Sub-Chapters).

In the end – also in the going-concern case considered in Conserved Quantity Accounting – semi-finished and finished products' Functional Values depend on the *most likely* use. It must be considered by the accountant in the following way:

1. If semi-finished products are not working, cannot be repaired or used otherwise they become *scrap*. And their declining balance has to amount to scrap's Functional Value. In parallel Functional Value of something else increases – in particular by replacing the defective semi-finished product.

2. If semi-finished products are *working*, and their *volume is in line* with Functional Requirements (or below), their *total* Functional Value can be accounted to Conserved Balance Sheet.

3. If semi-finished products are *working*, but their *volume is above* Functional Requirements the required volume can be accounted to Conserved Balance Sheet at total Functional Value; the non-required *surplus* however must be *depreciated*.

7.3 New in Functional Valuation of capital assets

In GAAP accounting margins respectively Value Tags are not attached to capital assets given the company's business is not related to production – or at least selling – of such machinery and equipment. Furthermore margins respectively Value Tags are attached to these products only after they were sold (cf. "realization principle"). But sold products are not shown in GAAP balance sheets anymore – they became revenues that are accounted at the top line of the income statement. And as long as a product is not sold it must be accounted at costs (cf. "lower of cost or market principle") – yet these are not all-in costs as defined herein (cf. Ohlson et al. (2010), Penman (2009), Chapter III, 3 and its Sub-Chapters as well as Chapters V, 5.2.1.1 and V, 5.2.1.2). These GAAP accounting rules are however not practical for Conserved Quantity Accounting because: Functional Value added from (average) customer's point of view cannot be calculated without a margin or Value Tag.

Though it may seem puzzling at first glance the principle of Functional Valuation to *determine values in view of customers' Functional Requirements* must be applied for *all* assets – hence also for those that are not sold to customers but applied in production. So given a capital asset's *ex ante* Functional Value should be accounted to Conserved Balance Sheet the accountant has to forecast the (net) Conserved Cashflow generable by using the asset's Required Functions in order to add Functional Value to products. (At this occasion please recapitulate that a capital asset's *ex post* Functional Value is accounted not to the asset but to the product, which was manufactured therewith. The reason is that Conserved Quantity Accounting always adheres to Strict Conservation Law in Business, which pays respect to the principle that *value is transferred*. In the production context this means that (re-usable) assets transfer some of their Functional Value while being used in production to the respectively manufactured product. In view of reality this principle seems valid indeed because wear and tear reduce capital asset's Functional Value with each activity they perform to add Functional Value to a product (cf. Chapter V, 5.2.1.2 versus V, 5.2.1.3).

Please note that customers' Functional Requirements are relevant in another context here, too: The part of a capital asset's *ex ante* "value" creation potential, which is intended to serve speculative demand or pure short-term-trends, must not be considered in Conserved Balance Sheets. The reason is again the pursuit of upmost consistency with Strict Conservation Law in Business. Technically its implementation is straight forward and was explained in detail yet: Firstly determine Functional Requirements via Holistic Functional Value Analysis (cf. Chapter V, 5.1 and its Sub-Chapters), secondly gauge how much capacity is required at particular machines to satisfy customers' Functional Requirements, thirdly perform Functional Valuation for which there are Functional Requirements like suggested herein (cf. Chapter V, 5.2.1.3). By this process one gets Functional Values for capital assets, which are accountable to Conserved Balance Sheets.

7.4 New in Functional Valuation of financial assets and liabilities

Given Conserved Balance Sheet is to show financial assets' or liabilities *(ex ante)* Functional Values they must be accounted at the conserved part of their discounted net cashflow forecast only. Therefore no matter whether a *receivable*, *payable* respectively *liability* is analyzed the amounts spend to access actually non-required functions – or stated more broadly the *amounts spent for non-conserved business activities* – are to be *deducted* from the total net cashflow forecast. The remaining Conserved Cashflow forecasts can be discounted to get Functional Values respectively, which are accountable to Conserved Balance Sheets (cf. Chapters V, 5.2.2 to V, 5.2.2.2).

Please note that also the *(ex post)* net cashflow has to be analyzed in the same way, i.e. Functional Value of the *cash balance* may not be fully accountable, too. Only cash generated by selling products' Required Functions are allowed to be included in Conserved Balance Sheets. Admittedly this necessitates analyzing the upward cashflow stream beyond the value chain of the company under consideration. The question namely is: "Why did the customers acquire the products of the company under consideration?" Looking at the industry the company operates in – and external Significant Influencing Factors – provides useful hints regarding the principle determinants for an average customer buying decisions. In this sense three general assertions seem to be most likely – nonetheless they should be tested case-based: Cash balances of capital goods companies may be conserved by 100%; the ones of providers of collector's items like art galleries in contrast may be non-conserved by 100%. And the ones of manufacturers of consumer goods for sure require more analysis because their conserved part is somewhere in between – here Holistic Functional Value Analysis provides an effective mean to an end (cf. Chapter V, 5.1 and its Sub-Chapters).

In contrast the *sources and uses of funds* are always irrelevant for GAAP accounting. When performing GAAP accounting financial assets and liabilities therefore must be accounted at the amount of their *total* legal obligation (cf. "face value"). The only counter-example is a financial asset or liability, whose legal obligation cannot be settled anymore. Then an extraordinary markdown becomes due, which reduces the respective face value. But this approach is not sufficient to conform to Strict Conservation Law in Business.

7.5 New in Functional Valuation of human resources and intangibles

Intangible assets like employees' capabilities, economies of scale and scope, learning curve effects or synergies cannot be accounted for as long as the related value respectively was not realized in a market transaction – at least in GAAP accounting (cf. Ohlson et al. (2010), Penman (2009)). But Conserved Balance Sheets are able to show Functional Values of *all* intangibles because they contain the *conserved goodwill*! Thereby all data on total Functional Firm Values – and how this Functional Value spreads across the respective company's diverse underlying material and immaterial assets – can be integrated into *one single financial statement*.

In this context critics may argue that in the end financial figures – namely costs and margins that are comprised in the profit and loss statement – have to reflect intangibles whose values were realized in course of a market transaction. And that such kind of financial figures – just like the underlying intangible enablers – may not be constant over time. That is correct. In actuality it belongs to the nature of intangibles that they change over time – new experiences are gained, patents run out and so forth (cf. Figure 37). But this does not contradict Functional Value calculation by discounting net Conserved Cashflow forecasts. In contrast *modeling net Conserved Cashflows* is the *only* way to *reflect changes over time* in costs and margins respectively Value Tags! Therefore it is possible to incorporate in Conserved Quantity Accounting also immaterial enablers of Functional Firm Value like (future) learning curve-effects etc. (Effects of learning curves or economies of scale and scope can be identified via time series analysis of the company's operational data. Thereby forecasts can be challenged to gauge whether or not they are realistic, i.e. whether or not they will remain within an appropriate margin of error. In any case beware to rely on historic data only – always consider how future Significant Influencing Factors will change the end-result (cf. Chapter V, 5.1.2 – in particular Sub-Chapter V, 5.1.2.3)).

Regarding any potential to elaborate Conserved Cashflow modeling please think about the following: In order to keep forecasting efficient one should always bear in mind that a *long-term perspective* is taken here. This means: Any Conserved Cashflow adjustment has to be discounted. The longer any (adjusted) cashflow lies in the future the longer it has to be discounted. That is the reason why adjustments in later periods may not drastically affect Functional (Firm) Values as of today. Therefore – given that Conserved Quantity Accounting assumes the long-term going-concern case – margins of error in estimating changes in intangibles' Functional Values may be negligible over time.

7.6 Conserved Quantity Accounting versus fair value accounting

On the one hand GAAP accounting insists on the realization principle when it comes to considering margins respectively Value Tags – which partly contradicts accounting of Functional Values to Conserved Balance Sheets (cf. particularly Chapters V, 5.2.1.2 and V, 5.2.1.3). But on the other hand it promotes the use of so-called *"fair value accounting"*. This can lead to a strong *conflict*! Therefore fair value accounting followed by GAAP balance sheets should not be left unconsidered here: Given there is no transaction hence "real" market value at hand fair value accounting allows *assuming a potential future transaction*. Naturally a (calculative) market value must be determined for it. In consequence either market-driven-approaches (transaction or trading multiples) are applied or a discounted cashflow model is set-up. In theory other options being also conformable with the opinion of the FASB respectively with FAS 157 exist, too (cf. FASB (2008)) as well as Figure 59). In practice they are rather uncommon though (at least against the background of the author's experience at a leading corporate finance consultancy). Albeit one thing is for sure: An asset value, which is calculated for a transaction that is assumed only, *should not be deemed "yet realized"*! Yet GAAP accounting, which insists on the realization principle *and* allows the artifice of a calculative fair value, does so implicitly.

For clarification please let us consider the example of an accountant, who follows the "income approach" in order to get an asset's fair value by means of a "present value technique" (cf. Figure 59). He is allowed to apply a discounted cashflow model (= "level 3 input"). So here we have an analogy between GAAP accounting and Conserved Quantity Accounting, which in parts follows a discounted cashflow approach, too. The core difference is: For Conserved Quantity Accounting not the total net cashflow forecast but only net *Conserved* Cashflow forecast per asset is discounted. Thereby future cashflows after *excluding* all speculative and short-lived elements are accounted to Conserved Balance Sheets. But (not yet realized) *cashflows are to be forecasted in either case* – for GAAP accounting and Conserved Quantity Accounting (cf. FAS 157 (2008))! So it seems appropriate to claim that Conserved Quantity Accounting does *not* stretch the applicability of discounted cashflow modeling more than fair value accounting does currently. In line with this argument Conserved Balance Sheet approach must *not* be banned by the realization principle!

Please remember once more that the tasks of conservatism and fighting inflated values (and economic bubbles) was performed *not* well by the realization principle that is incorporated in GAAP accounting principles. It can be served better by *damasking speculations* and *short-term trends* by concentrating on Conserved Quantities rather than by relying on the "voting machine" that determines the outcomes of market transactions in form of market values. Such kind of Conserved Quantity Approach was suggested by Grabinski (2007) and proven to be effective by Appel and Grabinski (2010), (2011) and Appel et al. (2012). Related examples that support this view are also concluded herein, too (cf. particularly Chapter III, 3 and its Sub-Chapters as well as Chapter IV and its Sub-Chapters).

FAS 157-criterion	Description			
Valuation techniques consistent with market approach	Technique	Market approach	Income approach	Cost approach
	Input	- Prices and other relevant information from market transactions of comparable assets or liabilities	- Future amounts, e.g. cash flows or earnings, which are converted to a single (discounted) present amount	- Current replacement cost, i.e. amount that currently would be required to re-place the service capacity of an asset
	Methode(s)	- Multiples valuation (with judgment regarding most probable multiple) - Matrix pricing	- Present value techniques - Option pricing models - Multiperiod excess earnings method for certain intangible assets	- Cost to a buyer to acquire or construct a substitute asset, adjusted for obsolescence, which is broader than depreciation for financial reporting purposes (an allocation of historical cost) or tax purposes (based on specified service lives) and encompasses: - Physical deterioration - Functional (technological) obsolescence - Economic (external) obsolescence

FAS 157-criterion	Priority	Description
Fair value hierarchy of inputs	Level 1	- Quoted (unadjusted) prices in active markets for identical assets or liabilities. - Blockage factors are prohibited, i.e. the fair value is the product of the quoted price and the quantity held - If a quoted price does not reflect fair value because of adjustments due to significant events (e.g. principal-to-principal transactions, broker trades or announcements), the fair value measurement is rendered at a lower level.
	Level 2	- Quoted prices in active markets for similar assets or liabilities. - Quoted prices for similar assets or liabilities in markets that are not active (only few transactions, prices are not current, price quotations vary substantially either over time or over market makers (e.g. some brokerage markets), or markets for which little information is available (e.g. principal-to-principal market)). - Observable inputs other than quoted prices (interest rates, yield curves, volatilities, prepayment speeds, loss severities, credit risks and default rates). - Inputs that are derived principally from or corroborated by market data by correlation or other means (market-corroborated inputs).
	Level 3	- Unobservable inputs for assets or liabilities which shall reflect the reporting entity's own assumptions about the assumptions that the market participants would use in pricing the asset or liability (including assumptions about risk). - Might include the reporting entity's own data

Conclusion	**- Market-based valuation accepts several valuation approaches** **- FAS 157 does not rank the valuation approaches but the inputs**

Figure 59: FAS 157 – permitted valuation techniques and inputs (cf. FAS (2008))

In addition to the contradiction, which is implicit to GAAP respectively fair value accounting (cf. above) there is another potential issue: Some GAAP accounting schemes ease a misbehavior, which practitioners termed *"corporate accounting"*: This means companies with several holdings can more easily inflate their balance sheets by *intercompany transactions*. The only prerequisite is *at least one outside transaction* for a *"comparable"* asset, which was sold at a favorable market value from the point of view of the company that wants to perform corporate accounting. The qualitative element "comparable" must be interpreted case-based and regularly leaves a lot of wiggle room – in particular in case of illiquid assets (cf. Appel and Grabinski (2011) as well as Chapter III, 3.1). Public authorities not only but also in Germany are aware of the criticism raised herein. Therefore they do *not* allow accounting for asset values realized in intercompany transactions given they *deviate considerably* from the ones generable in external transactions (cf. "arm's length principle", in German "Fremdvergleichsgrundsatz"). But this does *not* contradict the cardinal criticism here: As long as there are external parties paying unreasonably high market values – which very well may be the case due to speculations and short-term trends – corporate accounting is applicable to consciously inflate the values in GAAP balance sheets. (Furthermore – according to the author's practical experience as a consultant overwhelmingly working in the corporate finance field – (some) financial auditors put considerably less effort in verifying the comparability of once realized intercompany transactions by data of external transactions than in verifying the assumptions of fair value calculations that were applied to model the financial effects of a transaction that was just presumed). For companies there are strong incentives to stretch the arm's length principle as far as possible for their own favor: The most obvious case may be a private equity or hedge fund, who wants to "prove" investors that it was able to increase the "values" of once acquired assets. For sure such procedure (at the second glance) results in nothing more than an increase in paper value but – for some occasions this is seemingly yet sufficient! Howsoever Conserved Quantity Accounting concentrates on Functional Value, which reflects the real value of an *asset in-use*. Manipulating balance sheet values by intercompany transactions therefore is impossible here. The only way for increasing an asset's Functional Value is to find more opportunities for its application. Only then related (net) Conserved Cashflow can be raised. The most obvious example may be a capital asset whose utilization could be increased by manufacturing more products having (more) conserved Required Functions.

To finalize the discussion about conservatism in accounting please remember: The term *"Conserved Quantity Accounting"* was preferred consciously to "Functional Value Accounting". The reason is that conservatism and sense of reality are reflected at best in Conserved Balance Sheets. They contain conserved parts of assets *values* only and they contain conserved (actually required) parts of asset *volumes* only. So *not only* values *but also* quantity structures must be audited in course of Holistic Functional Value Analysis. This leads to much more robust (= non-chaotic) and realistic balance sheets than any comparable GAAP approach. Finally GAAP accounting relies on adjusting (market) values only namely by (regular) depreciation and amortization or (extraordinary) markups/ -downs.

7.7 Chaos Exposure calculable due to Functional Valuation

Chaos Exposure can be calculated just after Functional Values were calculated and set in relation to market prices and/ or values stated in established balance sheets. Robustness (= non-chaotic changes in value) of both historic and future investment decisions thereby can be evaluated on the level of single assets (cf. Chapter V, 6).

It seems obvious that – given there is no such thing as a long-term foreseeable (conserved) quantity – managers and investors cannot calculate the *magnitude*, which chaos may have on their business activities. This is the core problem when just relying on the inconstant moods of the market that underlie not only but also the lower of cost or market value principle, which GAAP accounting accepted as one of its elementary guidelines.

8 The golden rule of Conserved Tax Balance Sheets

The ultimate step in applying Conserved Quantity Accounting is the implementation of Conserved *Tax* Balance Sheets. Appel and Grabinski (2011) reason its advantageousness as follows: It was shown clearly that considering an asset's market value is no useful guide to Functional Value. The former one is *no* Conserved Quantity and therefore may vary chaotically. No reasonable prediction can be met. Though a change in market value may create (real) profit or loss it is nothing but the proceeds from gambling (cf. Chapter IV, 5). This has an immediate effect on accounting: Slightly simplified *profit* is nothing but a *positive change in value*. In particular modern schemes such as economic value added ("EVA") take this approach. Without going into detail one must define value before being able to calculate any profit. As shown by the authors as well as herein the market value will *not* lead to a reasonable definition of profit (cf. Chapters III, 3 and IV and their Sub-Chapters). A profit defined in such way – i.e. by a change in (non-conserved) market value – may change from profit to loss *without* any change in the *real world*. Therefore one needs instead of GAAP something like Conserved Quantity Accounting Principles ("CQAP") – the first suggestions are provided throughout this dissertation.

Naturally a completely different accounting scheme will have a severe influence on *taxation*. It does not need much imagination to see that CQAP will lead to lower profits (and losses) on the balance sheet. Lower profits will imply less tax revenues. Nevertheless the tax man will be better off: The severe jumps in (non-conserved) market value as compared to Functional Value are of course *averaging out* on the long-run. Therefore the additional (non-conserved) profits and losses will also *averaging out*. Because profits lead to tax income and losses to tax deductions there is *no* net gain in taxes over some period of time. But it is even worse when keeping up to GAAP accounting: Normally an *economic bubble* grows slowly and steadily. This development will lead to a welcome income for the tax man. However the bubble will burst at an *unpredictable* moment. And at this point in time the tax man has essentially to *pay back all his additional (non-conserved) tax* from previous years within a very short period. It will create a national crisis – in particular given the (non-conserved) tax income was spent yet. So the golden rule, which can be learned therefrom, is: *Not taxing in the first place is much smarter than going for every (non-conserved) tax Euro!*

Please note that this golden rule speaks for changing from GAAP to CQAP in form of Conserved Tax Balance Sheets. But that is really just the final (and maybe unlikely) step. Nonetheless picturing it is helpful already as of today. In this sense politicians should bear the golden rule in mind when deciding on issues related to industry policy and support of businesses that "import" more or less Chaos Exposure to their countries, citizens/ employees and national budgets (cf. Grabinski (2011a), (2011b) and (2011c) as well as Chapter IV, 2.3).

9 Potential for future research: Conserved Tax Balance Sheet implementation

Conserved Quantity Accounting respectively CQAP was shown to offer diverse new and advantageous options. In order to utilize them fully public authorities would have to agree on rules and regulations to further narrow down the potential ranges of assumptions for discounted Conserved Cashflow modeling. Since this dissertation should not become a finance textbook it does not focus on issues related to identifying the correct cashflow via direct respectively indirect calculation and the relevant adjustments. (However to provide additional support related suggestions are provided throughout this dissertation (cf. Tables 1 and 5 as well as Chapter V and its Sub-Chapters)). Beyond that there are more "technical" determinants of Functional Value, which simply must be defined in order to secure comparability in applying CQAP by diverse companies. These are in particular:

1. How to come to an (international) consensus on determinants of *Calculative Cash Outflow* of resources on the side of public authorities? There are issues beyond its pure calculation, which should be clear by now. E.g. they relate to consid-

ering one or more sources of supply – e.g. initial production and/ or recycling – as well as the size and number of companies to be considered (cf. Chapter IV, 3.2).

2. What does *"long-term"* mean in the context of Functional Value calculation i.e.: How much financial years are to be planned and forecasted? And when should it be allowed to set in perpetuities? (The examples provided herein assume ten years being enough "long-term" (cf. particularly Chapters IV, 2 to IV, 2.3)).

3. Are *perpetuities* to be static? If not under which conditions may perpetuities grow or shrink? (Conserved Cashflows before perpetuity sets in are most likely not static (cf. particularly Chapters IV, 2 to IV, 2.3 and Chapter V, 5.1.2.3)).

4. How to secure comparability of *Value Tags* (given that data on margins and IRRs does not show the same quality across companies)? In this context please consider also point 5.

5. How to calculate the *capital costs* per company? And how to deal with holdings having businesses that bear unequal capital costs? This is important because the capital costs determine not only Value Tags (given margins are unavailable on product or functional level) but also the discount rate, which is needed to come from net Conserved Cashflow forecasts to Functional Values (cf. Chapter III, 3.2.2.2).

6. Which *inflation rate* must be used to calculate real Value Tags respectively real capital costs? Amounts the "long-term" inflation rate e.g. to the average 10 year inflation rate of the currency are under consideration?

7. What adjustments should be allowed to *elaborate Conserved Cashflow forecasts*? And which adjustments may be left – though they might lead to better results – because they in parallel lead to *disproportional high additional work*?

As yet described the author was asked to leave out issues like those stated above. Instead he was asked to abstract from details in view of (potential) information asymmetries, data availability and established accounting rules respectively established balance sheet schemes. In particular he was asked to leave aside any issue that public authorities may have to clarify before Conserved Balance Sheets can be used for taxation purposes. Instead the author's task was to find ways and means to account for (conserved) Functional Values in Conserved Balance Sheets. His suggested concept is intended as input for upcoming research in the field of accounting. (Another publication based on the findings stated in this dissertation is currently developed under the direction of Prof. Dr. Grabinski). Therefore the author included this Chapter V, 9 only to complete his task by providing starting points for upcoming research by stating what – according to his opinion – may be considered if tax balance sheets should be calculated by applying his interpretation of Conserved Quantity Approach in form of CQAP instead of established GAAP schemes.

But the principal functionality of the author's CQAP is not limited just because they were not yet taken up by any *taxation* law yet: Already today (M&A) analysts, who strive to find among several investment opportunities the one with the highest robustness hence best strategic fit and superior Functional Value, should be able to successfully apply his CQAP as they are currently. In actuality CQAP's (premier) Required Function, which is *"excluding chaos from financial forecasts and valuation as far as possible"*, has been *proven threefold* already (cf. Appel and Grabinski (2011), (2010) and Appel et al. (2012)). Against this background the current situation may be comparable with the one of testing an invention: E.g. automobiles' principal functionality also was *not* affected negatively just because the road traffic regulations did not consider them in the beginning. Instead their Functional Value could be judged *only* against the background of their actual Required Function, which first and foremost is "transportation". In this sense CQAO also should be judged *only* in view of the fulfillment of related Functional Requirements (cf. Chapter I, 3).

CHAPTER VI

SUMMARY OF RESULTS

1 Development of the research task

Being a research associate in Prof. Dr. Grabinski's CLPK-program the author's task was to show how chaos materializes in the macro- and microeconomic world of finance: For this purpose at first he had to explain what characteristics Conserved Quantities have in general. Then he had to argue why and how Conserved Quantities that are defined in such a way have the potential to better financial forecasts as well as valuation as compared to current methods, which may deal with chaos and/ or uncertainty, too. Since no methods and rules were defined yet to counteract – respectively exclude – chaos from financial forecasts by focusing on Conserved Quantities the author had to define frameworks to identify and value them in the (often) interrelated fields of business and economics. During this work it emerged that extensive adjustments must be accomplished to companies' profit and loss statements, balance sheets and finally cashflow statements – they were necessary in order to become able to discriminate the non-conserved from the conserved parts of the line items shown therein. And since the conserved part of all companies' and assets' values – which the author called due to their origination "Functional (Firm) Values" – are comparable to a bank account on which (net) Conserved Cashflows accrue, he had to develop new rules for so-called "Conserved Quantity Accounting" to replace today's GAAP accounting. The outcomes of this work were suggested (in parts) to the research community yet – the paper on "The origin of financial crisis: A wrong definition of value" that Prof. Dr. Grabinski and the author wrote is available on the homepage of the Portuguese Journal of Quantitative Methods, the paper on "Momentum and reversal: An alternative explanation by non-conserved quantities" that Prof. Dr. Grabinski wrote with the author and Katrin Dziergwa, another CLPK-research associate, will be published in the International Journal of Latest Trends in Finance and Economic Sciences.

2 Conclusions on the definition of “real value”

The author would like to summarize the core insights of his work – as well as the conclusions that can be drawn therefrom – as follows: It has been shown clearly that considering a company’s or an asset’s market value is no useful guide to its *real* value, which is linked to *real* economic changes (= Functional Value). The market value is no Conserved Quantity hence may vary chaotically. Therefore no reasonable prediction can be met. Though a change in market value may create (real) profit or loss from the point of view of GAAP accounting it is nothing but the proceeds from gambling. However once having a new definition of value, namely Functional (Firm) Value, one sees easily that it is *robust* (= non-chaotic) over time. Hence it does not show unforeseeable breaks or chaotic step-ups or step-downs at all. Over and above the quantitative example of SAP provided herein shows that Functional Firm Value hardly changed during the latest economic crisis. In other words there was no crisis! For a crisis the Functional Value generation of companies had to be affected (most likely) negatively – again that was not observable.

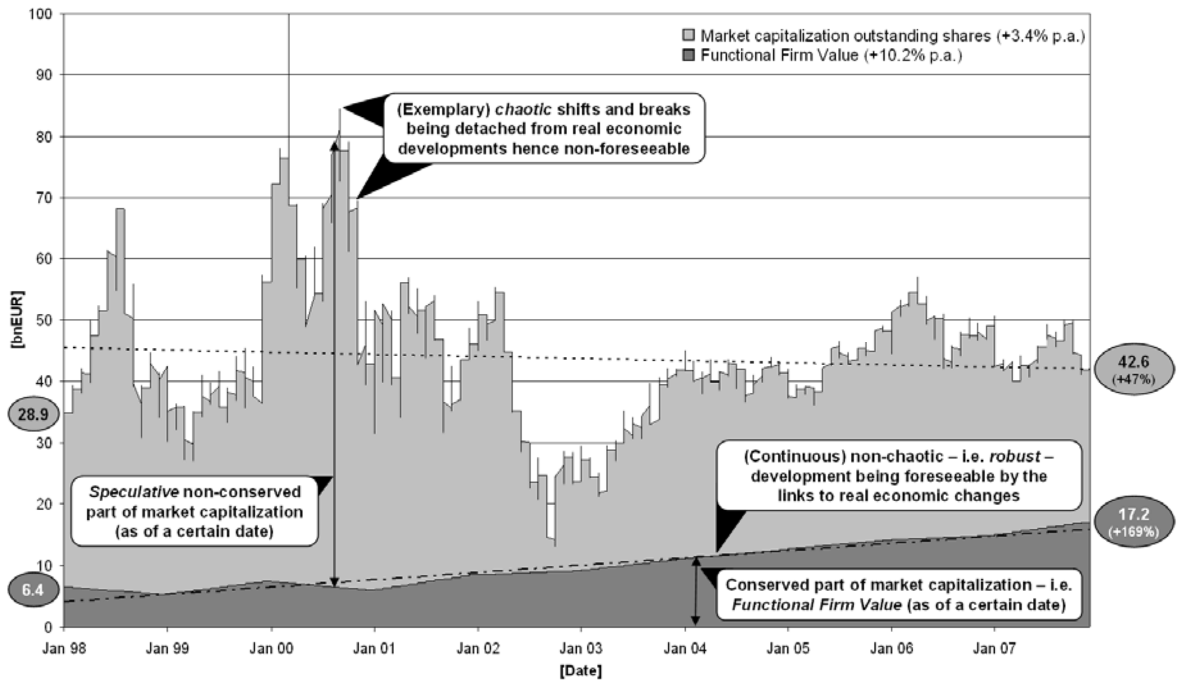


Figure 60: SAP's market capitalization vs. Functional Firm Value from 1998 to 2007 (simplified reprise of Figure 25)

These conclusions are also supported by the example of gold: During economic crises asset values typically diminish. But during the latest crisis gold's Functional Value rose. This is not astonishing though – it was a foreseeable reaction on gold manufacturers' higher economic break-even point. The economic break-even point rose in turn because of Functional Requirement to find save havens for capital during the economic crisis – gold generally is considered an attractive option here. And due to enormous efforts to open and close gold mines – which manifest in considerable ramp-up phases, costs and up-front investments – Calculative Cash Outflow, a new non-GAAP figure introduced herein to calculate resources' Functional Values, develops robust (= non-chaotic) and therefore foreseeable long-term. Consequently gold's Calculative Cash Outflow cannot change without notice and without further ado – hence it is Conserved Quantity indeed. In parallel gold's market value shows chaotic up- and downward spurts as well as drastic turning points being detached not only from real economic operations at gold manufacturers but also from real Functional Requirements of (end-use) customers. Over and above – like in the SAP-example – during economic crises gold manufacturers' (net) Conserved Cashflow should not show significant breaks or step-ups: Gold's Functional Value rises along with Calculative Cash Outflow that rises along with Functional Requirements for gold. Not surprisingly e.g. Gold Fields could not outperform its historic Calculative Cash Outflow margins since beginning of the latest crisis in summer 2007 but rather stabilized it at a low two-digit percentage; its Calculative Cash Outflow had been shown to be well in the range of its peers. So already on the level of Gold Fields' Functional *Firm* Value – in line with Strict Conservation Law in Business – there are Conserved Quantities that (largely) balance economic crisis' chaos effects. This is the reason why the forecast of gold manufacturer's Functional Firm Value is to develop robust like the one of e.g. SAP: There also should be no unforeseeable breaks, no chaotic step-ups and no chaotic step-downs at all!

Figure 61: Gold's market value versus Calculative Cash Outflow for 12 month until October 10, 2011 (cf. gold price (2011), Figures 27 and 31 as well as Table 4)

The newly defined Functional (Firm) Value – that is Conserved Quantity – *cannot* be distorted by *chaos*. If required Functional Value changes by accounting for changes in the *real* economy. In this context the term "Significant Influencing Factors" was coined herein: They are the indicators – and comparable to an early warning system –, which signal there is (are) development(s) in the real economy that will lead to changes in economically meaningful "*real* values" (= Functional Values). Thereby future Functional (Firm) Values become *foreseeable* and their development over time *robust* – instead of the chaotic swings market values (often) perform in parallel. (So in view of long-term financial forecasts and valuation one of the primary goals of the CLPK research program seems to be fulfilled).

3 Conclusions on the amendment of accounting principles

The conclusions drawn above have an immediate effect on accounting: Slightly simplified profit is nothing but a positive change in value. Practically speaking value therefore must be defined before being able calculating any profit. The non-conserved market value will not lead to a reasonable definition of profit. A profit defined in such way may change chaotically from profit to loss *without* any change in the *real* world. Therefore something like Conserved *Quantity* Accounting Principles, i.e. CQAP, is necessary instead of Generally Accepted Accounting Principles, i.e. GAAP and the likes. One could also consider calling such newly defined accounting rules "Conserved *Value* Based Accounting Principles" ("CVBAP") as done in a previous publication. This term does not express that values *and* volumes must be examined in view of their conserved characteristics but it may fit more to the business and finance community (cf. Appel and Grabinski (2011)). But this is of course part of the content of a further CLPK publication under the direction of Prof. Dr. Grabinski.

Needless to say those completely different accounting rules will have severe influences on taxation: It does not need much imagination to see that Conserved Quantity Accounting – howsoever it is termed in the end – will lead to lower profits (and losses) on the balance sheets. Lower profits imply less tax revenues. The tax authority nevertheless will be better off in the long run: The severe jumps in market value as compared to Functional Value are averaging out of course – therefore the additional (non-conserved) profits and losses will average out, too. Because profits lead to tax income and losses to tax deductions there is *no* net gain in taxes over some period of time. But it is even worse than that as argued herein: Normally there is a steady and slow growth of an (economic) bubble. It will lead to a welcome income for the national tax authority. Since the bubble is nothing but the manifestation of accumulated changes in non-conserved quantities (that followed the same tend in the short run) it will burst at an unpredictable moment – and “values” accrued until then will deteriorate progressively. At this point the tax authority has to pay back essentially all its additional tax from previous years within a very short period. Additionally it suffers non-foreseeable from merely low tax income due to massive depreciations and (potentially) lay-offs on the part of companies and private persons. That will create a national crisis, which may infect the real economy, too. Therefore not taxing in the first place is much smarter than going for every (non-conserved) tax Euro! At this point the circle, which started at the introductory statement on this dissertation’s outcomes, is closed: Not taxing gains from speculation bears the same logic as not taxing gains from gambling as accepted by many countries. Taxing proceeds from gambling would also imply to deduct losses from gambling. Speculation or gambling should be considered private pleasure (or maybe addiction). Neither should be considered a business. And neither should be allowed to take over decision making in the macro- and microeconomic world of finance. Given one applied consequently (conserved) Functional Values only so-called financial crisis could not appear at all (cf. Appel and Grabinski (2011), Grabinski (2011a), Grabinski (2011b))!

4 Conclusions on better economic decision taking

In this sense the dissertation on hand provides fact-based arguments and contains suggestions for means and ways to make financial forecasts and valuation more robust as well as to better decision making by focusing on Conserved Quantities. By adhering to these suggestions both private persons as well as (national) general governments can optimize their long-term Functional Value supply fourfold:

1. *Re private sector:* How to better *investment* decisions by focusing on Conserved Quantities is explained herein by multiple cases. Following the suggestions they entail allows companies and (Functional) Value Investors to reduce their Chaos Exposure by finding and evaluating of ventures that (potentially) have long-term robust (net) Conserved Cashflows. Over and above the examples sensibilize planners for indicators of economic developments that may shift to chaos. It is explained herein why – due to principal reasons – the task of "planning outcomes of chaos effects" never can be solved in practice. Consequently these parts of future-oriented planning should be evaded instead of trying harder by using bigger computers, employing more specialists, (wrongly) applying hydrodynamic equations etc. as often done today – all these attempts were damasked as senseless and pure waste of scarce resources.

2. *Re public sector:* This dissertation provides *purely economic rationales* for *market regulation* that is geared towards Conserved Quantity Approach and goes beyond party political viewpoints. Particularly in late 2011 postulations by politicians and non-governmental organizations ("NGO") became louder that demanded: "Markets must be regulated stronger!" and/ or "Speculation must be prohibited!" These postulations were not new but repeated oftentimes since the start of the latest financial crisis in summer 2007. Unfortunately nothing had happened yet. Maybe the reason was a lack of political consensus and/ or political willpower. And maybe the will to actually amend something politically was low, too, because speculation is not always easy to be detected before transactions are closed and/ or bubbles col-

lapsed: Up to the author's knowledge this dissertation for the first time provides a solution to calculate the speculative content in market values of *all* kinds of products respectively assets. (Appel and Grabinski (2011), Appel et al (2011) concentrated on Functional *Firm* Value in their publications). And without having such "tool" it (assumedly) is tedious trying to detect and curtail speculation before a bubble bursts. (Then Value Gaps get corrected so that market values (temporarily) move towards Functional Vales. So afterwards – as decisions (temporarily) became more Functional Requirement oriented – it becomes quite obvious how big the influence of speculation on market values was. But then it is too late of course). The following paragraphs summarize today's' market regulation issues and how the conclusions developed in this dissertation may be helpful respectively:

2.1 *Re regulating the scope of financial institutions' business*: Today, in particular in Germany, the media often cite politicians – who seemingly blindly believe Banking Associations' spokespersons' claim – that "There is no alternative to rescuing financial institutions!" (Irrespective the fact that (most of) the financial institutions got into trouble just because Conserved Cash inflows from their too little conserved transactions could not balance the losses from their predominantly non-conserved transactions anymore in the long run). The justification for it is mostly summarized in the terms "systemic" or "too big to fail" (cf. Schneider (2011)). In this dissertation implicitly an alternative suggestion for the definition of "systemic" is provided namely "conserved" (= relevant for the *real* economy). This definition is derived from comparison of gambling and speculation as opposed to doing business (to satisfy Functional Requirements). And admittedly today there still would be an issue when letting financial institutions going bankrupt given they (overwhelmingly) participated in conserved transactions, too.

So in the first place politicians' task is to open up new alternatives by legally forcing the *separation* of (non-conserved) *gambling* from (conserved) *businesses* throughout the financial institutions' sector. Here the dividing rule is as follows: By providing funds for Functional Value adding investments in the *real* economy financial sponsors like banks, private equity or hedge funds etc. can add Functional Value. Given the funds are actually invested and not just consumed nonsensically right away such kind of businesses are conserved. Only then it is valid to call them *"systemic"*. Please note that these businesses' Chaos Exposure is so low that bail outs by states (with tax money and/ or fresh money driving inflation) are most unlikely here. Finally in the most extreme case – where debtors cannot perform repayments and cannot pay interest anymore – there are still assets having Functional Value that could be liquidated. But there is still the other part of today's financial institutions' business: In particular proprietary trading is (often) highly speculative yet highly profitable – at least in the short run. Not surprisingly analysis of large traders' accounts proved that speculative trading often exceeds by far their conserved trading, which aims to satisfy Functional Requirements. So these business divisions (to the largest extend) gamble by betting on non-conserved market value movements. And the leverage applied here increases considerably the magnitude of these business divisions on the setting of market values, it increases these business divisions' risk (in the finance sense) and over and above it increases their Chaos Exposure (in the mathematical sense). When a market bubble bursts the capital tied-up there is reshuffled increasingly fast and with increasing volumes between the "players" (= traders). That is the materialization of chaos. Indeed, it may be frightened at first glance – in particular for the players participating in this game. But still *shuffling money as end in itself* – without any link to Functional Value creation – *is non-conserved and therefore cannot be systemic*! Some people may suffer from losses and some players may get laid off, too. But given proprietary trading departments were legally stand-alone entities their insolvency would not at all be that bad for the real economy than the (much more unlikely) insolvency of a lender to the *real* economy. Therefore the strong advices to the politics are: Separate legally the (non-conserved) gambling by e.g. proprietary trading departments from those departments that perform (conserved) lending to the *real* economy. And ban capital market products like loan syndication and those kinds of derivatives, which could be exchanged between them. Then not only in theory but also in practice non-conserved and conserved financial services – that are really systemic – remain separated indeed. Thereby the *contagiosity* between the (purely) financial world and the real economy would be embanked effectively. So in the end nobody could (wrongly) claim anymore that it is inevitable to waste tax money for rescuing speculators badly out of luck. And (Functional) Value investors' wise piece of advice could be heeded again: "Do not throw good money after bad!"

2.2 *Re Functional Value geared market regulation*: But still there is the non-conserved trading volume leading to inflated market values and dramatic market values swings that may have severe consequences for the real economy, too. In particular this holds for agricultural products. Herein it is suggested to implement *Functional Value geared trading*, which still allows for market values to adjust to changes in Significant Influencing Factors within a sensible range *(= pre-defined Value Tag)*. Functional Value investors and people who appreciate limited downside risk may like that. In any case such procedure has the potential to take cash from where it is bound in (inflated) speculative market values and allocate it to where it can be applied more sensible – thereby economic growth may be fostered beyond single sectors. And – even more important – markets could be regulated in a mode that ensures for everybody the economic accessibility of staple foods.

2.3 *Re taxation applied like regulation*: As noted yet no private person and no public authority should take (tax) income from speculative business models for granted. Conserved (Tax) Balance sheets help here to see at first glance how much conserved income national tax authorities may generate regularly long-term (dependent on the tax rate). But there is a special case in which consciously taxing non-conserved businesses may be helpful – namely when that leads to less Chaos Exposure on the national economic level. Such kind of taxation does *not* aim to lead to income in the first place – instead it predominantly aims to act as a *deterrent*. Here the modus operandi is to implement a stock exchange turnover tax, i.e. not just speculative income but already the business operation itself is taxed (cf. "Tobin tax"): "An additional tax is always bad for economic

> growth and traders will escape into other countries!" – this statement summarizes the general objections against a Tobin tax. Such arguments are well-known and often right under other circumstances. But looking at it from Conserved Quantity's point of view such arguments are completely misleading here. The Tobin tax will reduce speculative trading which makes about 90% or more of all trading. But such trading has no economic benefit measurable by Functional Value – in particular not in the long run. Therefore concerns of some national general governments against it are (kindly speaking) unreasonable. So if non-conserved trading escapes to other (non-Tobin-tax-countries) this should be more than welcome. Let these countries have the problems with it. From that perspective it is possible and reasonable to create a Tobin tax even for a single country. The only necessity would be to close one tax loop hole: If somebody trades in a non-Tobin-tax-country and tries to include the result in his home country tax declaration the home country should demand their national Tobin tax. That would be analogous to most tax legislations where the world wide income is taxed. Then worldwide trading must be Tobin-taxed accordingly in the next step (cf. Appel and Grabinski (2011), Grabinski (2011b) as well as Grabinski (2011c)).

Large parts of research projects deal with situation description and situation analysis. But in order to amend something these tasks must lead to new insights and finally (suggestions for) new solutions. To bear Functional Value the new solutions must have the potential to somehow better people's living conditions. The economy has manifold points of contact to them. In this sense the author would like to close by thanking the reader for his/ her interest in the work at hand. He hopes having suggested something (Functional) Valuable herein from *his/ her* point of view.

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