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# **From Tools to Theories: The Emergence of Modern Financial Economics**

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## **Abstract:**

*It is shown that early research in modern financial economics had substantially been driven by the application of the research strategy of economics and the use of newly developed mathematical methods. For this purpose the professionalization of business education as a consequence of changes in the U.S. economy after World War II is presented. The emergence of professional Journals in financial economics, similar to the academic culture including the trend of applying abstract mathematical reasoning and during the war developed methods like linear programming are highlighted. Also the meaning of Milton Friedman's 1953 essay "The Methodology of Positive Economics" for the dominance of abstract and prediction driven research in modern financial economics gets discussed. Finally, the emergence of Harry Markowitz's paper "Portfolio Selection" (1952) is used to substantiate the hypothesis.*

## **Keywords:**

*History of Finance, Portfolio Theory, Business Schools, Modern Financial Economics, Modelling, Theories of Modern Financial Economics, Risk Management, Positivism, Professionalization, Methodology of Finance*

## **1 Introduction**

Claims like that of Stephen A. Ross in The New Palgrave Dictionary of Economics (2008), that options pricing theory "[...] is the most successful theory not only in finance, but in all of economics", have strengthened the confidence in the theories of finance and the belief in its significance for practical purposes, like financial risk management. This confidence in the theories of finance and also in the risk management models, which are based on the findings of the theories of finance, have led to the phenomenon that neither the theories of finance nor the risk management models and strategies which were applied on the large scope have been discussed critically before the Great Recession of 2008 and the following years. Only this economic meltdown has brought critical discussions of the theories of finance and its theoretical foundations on the agenda. Since the crisis had hit, the theories of finance have been criticised on many grounds and most of the criticisms are from my point of view illegitimate as they go beyond what the theories of finance are able to do and what they actually aim at. Before the theories of finance can be wiped away for being based on unrealistic assumptions or for applying a deductive research methodology it is necessary to

clarify what they aim at. Based on such an analysis the scope and the limitations of the theories of finance can be clarified and the role they should play in future financial regulation could be debated. In the first instance the ambiguity about what can be expected from the theories of finance have to be clarified. It is unclear what can be expected from the theories of modern financial economics. There is no consensus about what the theories of finance aim at. It is also unclear, which research strategy modern financial economics is following. It is the aim of this essay to identify the motivation that drives research in modern financial economics. For this purpose the emergence and development of the scientific discipline of financial economics is looked at from different perspectives. The historical background provided in this essay shows that the use of abstract and deductive economic reasoning similar to the application of newly developed statistical and mathematical tools (e. g. linear programming) to problems of business finance may explain the increasing importance of modern financial economics as well as its scientific success.

It will be argued that financial economics developed from tools to theories. Research was not driven by the interest in problems or the aim to develop a body of positive theories of finance, but rather by the application of newly developed methods and mainstream economic methodology. The fundamental aim of the theories of modern financial economics is prediction. Research in finance was driven by practical problems and the application of new scientific methods. The use of scientific methods as well as the scientific appearance of theories of modern financial economics might have fostered the misbelief that financial economics is positive science. Actually it is a field of research in which scientific methods are applied to practical problems. The theories of modern financial economics are analytical tools<sup>1</sup>, which might be used to develop practical models with limited scope in financial investment and financial engineering.

The essay begins by describing the transformation of the U.S. economy after World War II (2). The reorganization of the economy had caused companies to become larger and more diverse, which again changed the demands for business education (3). The new organizational structure of the economy evoked the study of finance to become more important.

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<sup>1</sup> In the course of this essay the concepts *models*, *theories* and *analytical tools* is used in the way Hausman (1992) had defined them. When I write about *models* I refer to instrumental theories. Different to the *theories*, which aim at universally and empirically true law like relationships, they aim at theoretical coherence only. *Models* are empirically not testable and based on highly idealistic assumptions or analytical hypothesis. Their main objective is prediction. Models may state empirically stable law-like relationships. This, however, does not imply that the hypotheses on which the models are based are correct, even if their predictions are correct. The truth of the conclusions of the models does not imply that the assumptions of the models are correct. *Models* are used as instruments. Different to theories they do not aim to describe some complex phenomenon in a simplifying way with the aim to identify some fundamental logic. Instead they are *analytical tools* constructed to picture some regularity, of which the underlying causes are unknown. As such *models* are instruments or tools, which help their user to handle problems or phenomena of which he or she does not or cannot know the underlying causal structure. Hence *models* are based on analytical hypotheses, are concepts which are logically valid, yet empirically not necessarily true. They are used as *analytical tools* to make the problem at hand operable. The concept of *analytical tools* refers to concepts, which are used to describe some fundamental relationship. They are constructions of the human mind used to reach analytical clarity.

Consequently, fundamental changes took place in U.S. higher education. The section focuses on the emergence and development of three leading business schools, which later became the hosts of the new theories of finance. The emergence of professional Journals in modern financial economics (4), similar to a change in the academic culture of that time will be outlined. Abstract reasoning and the application of newly developed mathematical methods gained importance (5). In this context the meaning of Friedman's essay "The Methodology of Positive Economics" (1953) will be discussed. Afterward (6), the significance of the findings will be substantiated on the example of Harry Markowitz's groundbreaking paper (1952) "Portfolio Selection". The last section concludes (7).

## **2 The U.S. Post-War Economy and the Emergence of Financial Economics**

The war economy (World War II) transformed large horizontally and vertically integrated corporations with few closely linked products to multidivisional and highly diversified conglomerates. By 1960 more than half of the Fortune 500 firms operated in multiple industries, while a majority of firms worked only in one or two industries before the war (Nohria 2002). Growing scales and spreading risk across industries and product lines became the dominant corporate strategy (Fligstein 1993; 2002). Production became more and more automated; so that personal planning and management became less dominant, while efficient logistic management became a key to success. The newly developed methods of operations research were used in practice and contributed to a highly efficient corporate organization. The change in management style, which took place during that time, resembles the ideas of Winslow F. Taylor, which he had already laid down in his pioneering *The Principles of Scientific Management* three decades earlier (1911).

Simultaneously, changes in U.S. capital markets were taking place. Financial intermediaries like insurance companies, investment companies, pension funds gained importance quickly. Their ownership of corporate stock increased and institutional investors gained power in private companies. Especially the newly developed state and company pension funds and mutual investment funds changed the structure of investment, which had been mainly driven by company and individual private interest and bank trust departments before the war. The latter still played the mayor role in investment after the war. Additionally, diversification and internationalization of the large U. S. companies lead to a separation of the corporate treasury department from divisional financial management (Whitley 1986a: 181). While the corporate treasury department were occupied with cash management, banking relationships, credit management, dividends, currency movements, insurance and pensions, corporate financial management had a special interest in the optimal use of corporate funds, which included lending as well as short term capital management. Institutional investment became dominant. Consequently, ownership and governance structures of large companies changed, which again

entailed that new types of jobs were developing and some fields of work were expanding, while others were declining. The number of people who were engaged in brokerage, analysis and fund management was growing rapidly. Also the organization of work changed. More hierarchical structures were applied and auditing and performance analysis via standardized management tools became fashionable (Whitley 1986b).

All in all this contributed to the trend that the entrepreneurial ethos combined with individualistic skills of early brokers and business managers gave way to more “[...] bureaucratic notions of publicly certified knowledge and specialised expertise being organised and managed in competing institutions. Investment analysis and management has become an activity undertaken by quasi-professionals in hierarchically planned and administered ways.”<sup>2</sup>

The newly developed multi national firms, as well as the specialisation of managers and the emergence of institutional investment created the need for more professional business education. Without changes in higher education system the reorganization of the U.S. economy in the way it happened would not have been possible. However, only the changes within the economy during the war and the experiences of the war allowed for the development of more scientific and method driven business education. In this way the renovation of the U.S. economy and the U.S. higher education system in business education has to be understood as a symbiotic process, which conjointly formed the breeding ground for financial economics.

### **3 Towards a more scientific approach: GISA, Chicago GBS and Rochester Business School**

The war changed the way management problems were tackled. This had an impact on management education and caused the development of management science. While management was highly dependent on the personal skills and attitudes of the manager in the years before the war, it became professionalized after the war. System and decision analysis started to dominate the educational landscape.<sup>3</sup>

Similarly, business schools existed well before the war. However, after the war their image and importance changed fundamentally. Before the war business school education was of low reputation, it was mainly aimed at the education of post-graduates from engineering or the liberal arts with a clearly practical focus, the methods were descriptive or aimed at hands on practical problems. Most courses in business education were concerned with technical procedures and practises in banks and companies, including long term finance, particular investment techniques or legal problems. Only little attention was paid on working capital

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<sup>2</sup> Whitley (1986a: 182).

<sup>3</sup> Cf. Whitley (1984); Beldstein (1978); Khurana (2007).

management, capital market theory or risk management (Whitley 1984; 1986a; b). More generally speaking theoretical models played no role in business education. Simultaneously, positions in companies, banks, universities and financial associations were to a large extent staffed in personal union. Thus there was no separation between academia and economic practice. Furthermore, business schools had no scientific impact (Beldstein 1978). The disciplines taught at business school were rather broad, beside economics classes, the disciplines that were thought to embody the highest social and moral progress were held. Special importance was attached to the social sciences and a broad cultural foundation in the liberal arts. The applied focus of business education persisted initially after the war, while business education became more professionalized and oriented towards methods (Whitley 1986a).

Many undergraduate programs developed. Mathematics, statistics and economics began to dominate the curriculum of business education and management became an independent profession. Simultaneously, research in business associated domains started to gain importance (Khurana 2007).

After the war the education of practitioners became professionalized and academic methodology started to dominate management and business administration. Also the transformation of business finance into a field of economics has to be understood as a product of the change in U.S. higher education structure after the war (Fourcade and Khurana 2011). The reasons for this change in business education are diverse and complex. It seems that the development of large multinational company conglomerates, which were developing after World War II, changed the requirements for business education. Similarly, Fourcade and Khurana (2011) have argued that funding authorities like the philanthropic Carnegie, Rockefeller and Ford Foundations contributed to the changes in the higher education system.<sup>4</sup>

Additionally, the success of the hard sciences during the war triggered the desire of the low sciences, to which business education belonged, to become more scientific (Whitley 1986a). Consequently, many post-graduate business schools were desired to become more “scientific” after the war. For this purpose researches from more established fields of science were recruited to teach and research at the newly established business schools (Whitley 1986b). Especially economics, mathematics, law and physics were the original fields of study of the new business professors. Consequently, the style of business education changed fundamentally. Mathematical tools and abstract models, which were common in the hard sciences, like physics, were introduced to business education.

In a recent study Fourcade and Khurana (2011) show the special importance of the development of the Graduate School of Industrial Administration at Carnegie University (subsequently also GSIA), Chicago Graduate Business School (subsequently also Chicago GBS or GBS) and Rochester Business School for the emergence of financial economics. In

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<sup>4</sup> Cf. Laungemann (1987).

particular the Chicago GBS is of special importance for the emergence of finance, as most of the leading and most innovative scholars in finance were professors at the Chicago Business School or have been educated at Chicago or by originally Chicago trained researchers.

Harry Markowitz, whose 1952 paper is thought to be the birth of modern financial economics, was a Chicago trained economist and gained his PhD from the University of Chicago. His PhD dissertation earned him the Nobel Memorial Prize in Economic Sciences in 1990. Also Myron S. Scholes, who received the Prize in 1997 together with Robert C. Merton for the method to determine the value of derivatives, was educated in Chicago. Further important contributors to the development of financial economics like Eugene F. Fama have been trained in Chicago or held a professorship.

The GISA went off to offer a new model of studying and teaching directly after the end of World War II. It was designed to meet the demand for executives trained both in engineering and in economics, created by the newly developed conglomerates (Fourcade and Khurana 2011: 18).

Lee Bach a Chicago trained economist who had been working for the U.S. Navy during the war on post-war reconstruction planning was the dean of GISA. He wanted business education to become an extension of the social sciences, rooted in quantitative analysis and the behavioural disciplines. This new approach to business education released a trend towards more professional and scientific training of business executives (Fourcade and Khurana 2011).

While the Chicago GBS president Robert Maynard Hutchins has prevented early efforts to put business education on a more professional basis in Chicago between 1945 and 1951, arguing that business education has no place at the university, by cutting the schools recourse, his successor Lawrence Klimpton together with dean Allen Wallis restored business school education and started transforming business education immediately (Van Overtveldt 2009). Similar, to GISA financed by the Ford Foundation, Wallis together with his associated dean James Lorie, which both have been Chicago trained economists with special interests in statistics, implemented the idea that a business school should not be much different from a university. According to Wallis idea business education should be oriented towards further learning as opposed to vocational training. Descriptive studies of institutions have to be replaced by first-rate research. Statistics, mathematics, accounting, law and economics became the new core fields of study in business education at Chicago (Fourcade and Khurana 2011).

Fourcade and Khurana (2011) describe that this transition took place quickly and regardless of the consequences, by referring to a memo between the Ford foundation officials Gordon and Chamberlain. This memo also shows that Walli's friends Milton Friedman, who already had been at Chicago since 1946 and George Stigler, who became professor at GBS and helped



to transform what had been Chicago law school before in a highly scientific economic research centre.

The changes at Chicago GBS also contributed to the emergence of financial economics (Whitley 1986a; b). Business finance has been an old topic at traditional American business schools, which was mainly descriptive and oriented towards institutional analysis. Originally, practitioners played a mayor role in teaching, which was directed at leading executives like managing directors and leading managers. By the 1980s this has changed fundamentally (Whitley 1986a; Jovanovic 2008). Finance was no longer oriented to the problems of firms and executives but to the financial market. Finance became dominated by academics. High levels of mathematics and statistics in a general deductive equilibrium framework became dominant (Gordon and Howell 1959).

In the years after the war the University of Chicago became a host for innovative financial research. A unique financial database, the Centre for Research in Security Prices (CRSP), of the University of Chicago gave scientist at the university access to massive volumes of data, which made them superior to their colleagues at other finance departments in the country (Fourcade and Khurana 2011). This contributed to the importance of the intellectual development of financial economist at the university of Chicago (MacKenzie 2006). Quickly, research results were presented at economic conferences and published in leading economic journals. Mainly the applied statistical methods and advanced mathematic techniques qualified the articles for being published in one of the leading economics journals (Fourcade and Khurana 2011:33). Fourcade and Khurana (2011) and similarly Whitley (1986b) argue that if the same problems had been discussed less mathematical, a publication in one of the leading journals of that time would have been out of reach. At least in the beginning the methods triumphed not the theories. New and mainly mathematic and statistic research methods came to dominate the relevant literature and the language applied became more technical.<sup>5</sup> In the beginning this change only affected academia, later the newly developed techniques and terms gained importance in practice as well.

Meanwhile, the focus point of business schools shifted from training mainly executives on the graduate level, with backgrounds in other disciplines and particularly engineering, to training professional investors on both the graduate and undergraduate level. The newly developed financial intermediates employed the new professionals in investment.

The combination of business finance and economic methods was also reflected in the conjoint establishment of the Centre for Mathematical Studies in Business and Management of Chicago GBS and the leading economics department. Also the famous Chicago Workshop System was taken over by GBS from the economics department. This teaching method mainly contributed to Chicago GBS's success (Emmett 2007; Van Overtveldt 2007).

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<sup>5</sup> Operations Research, which had been invented during the war, will be discussed below. The method of linear programming was the key to the development of PT in 1952.

Similarly important to the emergence of financial economics at the Chicago GBS was the development of the Business School at the University of Rochester. After Allen Wallis has introduced the major change in the curriculum at the Chicago GBS in 1963 he moved to the University of Rochester. There he became president of the university and introduced the same changes as he had done earlier at Chicago. The University of Rochester became the eastern outpost of Chicago school in the U.S.. Beside the methods Wallis also assembled a “critical mass” of former Chicago professors at Rochester (Fourcade and Khurana 2011: 34). Rochester Business School especially played a mayor role in publishing the newly developed theories, as the next section will show. Beside that Rochester similar to Chicago supported abstract reasoning and required a clear focus on scientific output in the form of journal publications.

The scientific approach to business education and management was new by that time and exemplary for changes, which took place in higher education system. For the emergence of financial economics these changes were crucial. Business finance has always been an important topic in business education, however, it was oriented to practical problems and lacked a theoretical basis. The applied methodology of the old type business finance study did not satisfy the standards of research in economics. Only the implementation of rigorous mathematical models to problems of finance, which had newly developed due to the emergence of professional investment, allowed finance to become a subfield of academic economics. Especially, the discussion in the next section shows that the applied methodology was more important than the problem under study for the publication in leading economics journals.

#### **4 Scientific Relevance: Journals of Financial Economics**

Before World War II publications in business and management by academics and practitioners were similar in style and thematic focus. Research practices and skills were not standardised and also not very formal. Even by the educational standards of the time the level of abstraction and mathematical advance was rather low (Whitley 1986a). The assessment of new research was subject to the particular universities or research facilities. Peer reviews or other forms of standardized evaluation have been very rare (Whitley 1984). By the release of professional journals after World War II the structure of publication changed fundamentally. In 1946 the American Finance Association published the first issue of the still today highly prestigious *Journal of Finance*. Already before the American entry to the war the publication has been prepared. *The Journal of Finance* was the first professional journal in Finance. Other professional journals followed in the coming years. *The Journal of Financial and Quantitative Analysis* has first been published in 1966 by the School of Business Administration at the University of Washington. In 1974 *The Journal of Financial Economics*

had been established. The publisher of this journal as well as *The Journal of Accounting and Economics* and *The Journal of Monetary Economics* is the School of Business at the University of Rochester. These publications are among the leading journals in financial economics today as well as among the top journals in economics in general. They are all belonging to the most cited journals in economics. The list of affiliations of all the authors clearly shows the connection between Chicago and Rochester.

Most papers published between the origin of the Journal of Financial Economics in 1974 and 2004 have been written by Chicago economists (123), closely followed by papers of members of the University of Rochester (114) (Whitley 1986a). In 2004 4/5 of the most cited authors of this Journal were Chicago Economists (Fourcade and Khurana 2011: 35). Even today the list of authors with most publications is still lead by G. William Schwert from University of Rochester's William E. Simon Graduate School of Business Administration, who got his PhD in 1975 from the University of Chicago.<sup>6</sup> The evidence provided by Fourcade and Khurana clearly shows the linkage between the two universities and financial economics.

The nature of the majority of the articles is theoretical and applies deductive mathematical reasoning. This is typical for publications in leading economics journals as Debreu (1991) points out. The application of mathematical reasoning had become the prerequisite for the publication in a leading journal of economics. While academic promotions before 1960 were not based on standardized formal criteria, meanwhile publications in one of the leading Journals became crucial for promotion in the sequel. "Publish or perish" became the slogan of the following years. This is not only true for financial economics, but for economics in general. If one had the wish to publish articles in the leading journals, one had to follow the dominant methodological agenda. In this way the new emphasis on journal publications for making a career in economics or finance supported the dominance of economic methodology and econometrics in financial economics. Consequently, the "publish or parish-syndrome" contributed to a massive raise in paper output, applying more quantitative methods (Whitley 1986a; b). In addition, this shows that not only research methods took a more scientific direction. Academia in general became more standardised, this is especially true for the social sciences.

In the early years of financial journals the emphasis was clearly on business finance. Also investment, money and banking as well as financial institutions played a major role in early publications. These contributions had applied an empirical method. By the 1980s the structure of publications in the Journal of Finance had changed drastically. The majority of publications were theoretical in nature (Whitley 1986a; b). Furthermore there were empirical studies, which were mainly based on statistics and advanced statistical analysis. Though, these contributions were empirical in nature the differed fundamentally from the empirical studies of the 1960s, which had a more descriptive character (Whitley 1986a). Research on share

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<sup>6</sup> Cf. [[http://apps.isiknowledge.com/RAMore.do?product=UA&search\\_mode=&SID=V298Pc7doDMk7NMFFgI&qid=1&ra\\_mode=more&ra\\_name=Author&db\\_id=UGB&viewType=raMore](http://apps.isiknowledge.com/RAMore.do?product=UA&search_mode=&SID=V298Pc7doDMk7NMFFgI&qid=1&ra_mode=more&ra_name=Author&db_id=UGB&viewType=raMore) (2011-06-05)].

price models, stock price movements and financial market models became dominant by that time. Whitley (1986a: 174) suggests, that “[e]ssentially, business finance became transformed into a branch of economics.” In the following he shows that the applied theoretical tools and models are taken from neoclassical microeconomic theory, and continues: “Analytical models of asset valuation in perfect markets dominate the literature and the reputational system is similar to that in economics in giving high intellectual priority to theoretical analyses. Indeed, the dominant intellectual standards and goals are remarkably similar to those in Anglo-Saxon economics and research appears to be similarly organised and controlled as a ‘partitioned bureaucracy’”.<sup>7</sup>

The publication of articles in financial economics was driven by the application of an abstract mathematical methodology. This publication strategy helped financial economic papers into the leading journals and supported the emergence of financial economics. The editors of the newly developed Financial Economics Journals have also applied this strategy. The scientific relevance of these journals and the high reputation still today, is owed to the dominance of theoretical publications and statistical work.

## **5 Scientific Rigor, advanced Mathematical Models and Prediction**

The enthusiasm for new scientific tools was huge in academia, business and politics (Whitley 1986 a; b) after World War II. Particularly management science was affected by the application of new mathematical and statistical tools, which have been developed during the war (Simon 1996; Mirowski 2002).

Between 1930 and 1970 economics became a mathematically dominated science (Weintraub 2002). In contrary to the arguments put forward by the economists prior to the war, the economists of that time and especially after World War II presented their arguments by using more and more advanced mathematics, instead of presenting them in prose. While only a small number of articles used geometry or algebra in the 1930s, the majority of articles published in the 1970s contained mathematical calculus, as the earlier section on the emergence of journals of financial economics has already indicated.

Backhouse (2002: 237f.) argues that mathematics was used in two different ways. Firstly, he argues, “[a]lgebra, geometry and even numerical examples enable economists to deduce conclusions that they might otherwise not see, and to do so with greater rigour than if they had used only verbal reasoning.” Secondly, mathematical tools and especially those of statistics are used for empirical and inductive research. Both forms of use of mathematics ever

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<sup>7</sup> Whitley bases his argument on research done by Deane (1983), Leijonhufvud (1973) and himself (1984) and “partitioned bureaucracy” is used as a metaphor for the uniformity of problems and the applied concepts and techniques.

since accompanied economic reasoning. However, especially the former came to dominate economic articles in Post-War America (Cf. Debreu 1991) and different to earlier uses of the techniques as methods to discover or represent some facts, the use of a particular set of methods became constitutive for economics (Backhouse 2002: 238). The new dominance of mathematical reasoning in economics (Mirowski 2002; Weintraub 2002) was the breeding ground for abstract reasoning. The application of new econometric methods like linear programming supported this general trend.<sup>8</sup> And though Milton Friedman was no supporter of abstract mathematical models, his essay *The Methodology of Positive Economics* is used as a legitimization for abstract deductive theories, like they are common in modern financial economics.<sup>9</sup> Friedman's plea for predictive power is used as a shield against criticising the theories of finance as too idealistic.

#### a) *Linear Programming and Operations Research*

The emergence operations research and the method of linear programming was crucial to the development of financial economics. Markowitz's 1952 paper "Portfolio Selection" is fundamentally based on the application of this new methodology. However, using linear programming methods in management and for financial market operations, as already indicated above, was accompanied by a general trend in economics to use mathematical reasoning and arguments, more extensively (Amadae 2003).

During the war linear programming developed as a mathematical model to plan the use of resources efficiently. It was the aim to reduce cost at the army and similarly increase losses at the enemy. Linear programming is a method to optimize two or more variables at one time. Especially, the U.S.-Air Force used the tool to plan their air raids efficiently. After the war linear programming was used for civil aims and specially in companies, for example to plan logistic or storage (Whitley 1986a).

The Russian mathematician Leonid Vitaliyevich Kantorovich (1960) developed the concept of linear programming in 1939. His paper "Mathematical Methods of organizing and planning Production" is the birth of linear planning, which owed him the Nobel Price in economics sciences in 1975<sup>10</sup>. The U.S. mathematician George Bernard Dantzig detected the significance of this mathematical innovation in the 1940s. As head of the *Combat Analysis Branch, U.S.A.F. Headquarters Statistical Control* of the U.S.-Air Force between 1941 and 1946 he used the method for flight planning during the war. After the war Dantzig developed

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<sup>8</sup> Similarly important for the emergence and development of modern financial economics was according to Weston (1966) the development of game theory (Von Neumann and Morgenstern 1944) and decision theory (Friedman and Savage 1948; Lehmann 1950).

<sup>9</sup> For a discussion of this argument please see Hands (2009), he bases his thoughts primary on Blaug (1994; 1997b; 1998; 2003); Hutchison (1992; 2000); Lawson (2003) and McCloskey (1994).

<sup>10</sup> Cf. [[http://nobelprize.org/nobel\\_prizes/economics/laureates/1975/](http://nobelprize.org/nobel_prizes/economics/laureates/1975/) (2011-07-01)].

the simplex algorithm, John von Neumann and Oscar Morgenstern (1944) and others developed the theoretical concept further. It was the aim to solve linear problems for planning and decision-making in large-scale enterprises. Simultaneously, scientist of the Royal Navy in Great Britain developed mathematical methods to plan and evaluate resource allocations in the most efficient way. After the war these during the war developed methods constituted operations research, which is the study of efficient resource allocations.

### *b) Positive Economics*

Milton Friedman's famous essay *The Methodology of Positive Economics*, provided a widely accepted defence of abstract reasoning. Even today, Friedman's article is frequently cited as a legitimization for not being realistic in economics. The success of financial economics as a purely abstract and mathematically driven sub-discipline of economics, became possible due to the attitude of leading economists, that abstract and axiomatic physics-like reasoning is more valuable than empirical case by case research, as it is expressed in Friedman's essay.<sup>11</sup>

According to MacKenzie (2006) Friedman's view that economic theory is "[...] an 'engine' to analyze [the world], not a photographic reproduction of it" (1953: 35) was important to the development of financial economics. Furthermore, he argues (especially p. 12; ch. 9) that financial economics in line with Friedman did not aim to analyse financial markets but alter them. Finance theories have been "[...] an active force transforming its environment, not a camera recording it" (p. 12). Though the performativity of financial market theories is not the subject of this essay MacKenzie's argument suggests that if Friedman's "Methodology of Positive Economics" had not been published the actual development of financial economics as an abstract theory would have been different or even not possible.<sup>12</sup>

Friedman argues that the goal of a positive science is "[...] the development of a 'theory' or 'hypothesis' that yields valid and meaningful (i. e., not truistic) predictions about phenomena not yet observed" (p.7). This clearly shows that Friedman's aim was not a descriptive science, but he rather aimed at the predictive power of theories. Furthermore, the predictive power of theories is limited to the class of phenomena the theories seeks to explain. Theories thus do not have a general scope, their predictive power is only judged over the classes of phenomena the theory seeks to explain (Friedman 1953). What matters is "narrow predictive success" (Hausman 2008), not overall predictive adequacy. Theories should be judged according to

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<sup>11</sup> Friedman himself was an opponent of complex mathematical models. He emphasised the value of abstract reasoning and theories, however rejected complex mathematical models. As a practical man his aim was simplicity and predictive power, not mathematical beauty.

<sup>12</sup> Beside Friedman other economist have argued for theories to be unrealistic. They could also have been a legitimization for financial economics to build unrealistic theories (E. g. Machlup 1955, 1960; Koopmans 1957). However, MacKenzie (2006) highlights the importance of Friedman as a Chicago economist, who was due to the connection pointed out in the beginning of the essay at the forefront of the renovation of business education and the development of financial economics.

their relative predictive power; other criteria like accuracy, “fruitfulness” or “simplicity” are secondary.

The second main contribution of Friedman’s essay is the role of theory’s assumptions. According to Friedman (pp. 14-30), the realisticness of assumptions is unimportant for the value of the theory as long as the predictive power of the theory is convincing. Indeed, realisticness is not desirable. Unrealistic assumptions, which are “wildly inaccurate descriptive representations of reality”, are desirable for theory as they allow for the necessary abstraction from reality with all its irrelevant details. He illustrated this point by giving his famous example about gravity: We accept the law of gravity “[...] because it works, not because we live in an approximate vacuum-whatever that means” (p. 18).

His argument against descriptive accuracy becomes clear in the claim that “Economics as a positive science is a body of tentatively accepted generalizations about economic phenomena”. It has been argued that Friedman’s methodology is instrumentalist. Clearly, economists used it to legitimize unrealistic theories in all fields of economic reasoning. William Sharpe chose to defend his Capital Asset Pricing Model (CAPM) against the criticism that it was unrealistic with implicit reference to Friedman’s paper<sup>13</sup>. Sharpe (1964: 434) wrote: “The proper test of a theory is not the realism of its assumptions but the acceptability of its implications”. This formulation is very close to Friedman’s own use of words and definitely close to his ideas (MacKenzie 2006: 55).

Sharpe’s mentor Armen A. Alchian shared Friedman’s convictions and “drilled into” his graduate students, that they should not question the assumptions but rather question the implications and compare them with reality<sup>14</sup>. Like many other economists during that time Sharpe followed the methodological convictions laid down in Friedman’s essay. In an interview with Donald MacKenzie (2006: 55) describes his approach as follows: “[...] take the problem, try to distil out the two or three most important things, build a logically coherent model [...] that has those ingredients in it and then see whether or not this can help you understand some real phenomenon”. In his paper (1964: 434) he wrote:

“Needless to say, these are highly restrictive and undoubtedly unrealistic assumptions. However, since the proper test of a theory is not the realism of its assumptions but the acceptability of its implications, and since these assumptions imply equilibrium conditions which form a major part of classical financial doctrine, it is far from clear that this formulation should be rejected-especially in view of the dearth of alternative models leading to similar results.”

Finally, Friedman has legitimized the *as if* methodology in economics. He claims (1953), “[i]t is frequently convenient to present such a hypothesis by stating that the phenomena it is

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<sup>13</sup> Given that also other economists by that time have argued that theories have to be unrealistic, Sharpe could also have referred to their contributions to the discussion about unrealistic assumptions and theories.

<sup>14</sup> Sharpe writes this to MacKenzie in an E-Mail from the year 2004, which is described in (MacKenzie 2006: 55).

desired to predict behavior in the world of observation as *if they* occurred in a hypothetical and highly simplified world containing only the forces that the hypothesis asserts to be important.”<sup>15</sup> The underlying hypothesis is that naturally not all individuals or firms behave according to the axioms of rational choice theory, however, on average it is legitimate to assume this, in order to be able to end up with general theories. These simplifications Friedman argues are common to all abstract reasoning and a necessary condition for not ending up in the middle of every day life. It turns out that these *as if* simplifications or assumptions in some cases are crucial for the validity of the argument, which makes a mechanical application of theories which are based on *as if* assumptions problematic. Paul A. Samuelson (1947), another leading 20<sup>th</sup> century economist, for this reason has argued that unrealistic assumptions are only legitimate to that extent that they are not crucial to the conclusions of a theory. His view did not become dominant in economics, whereas Friedman’s methodological reasoning legitimized abstract economic theories, like they are common, especially, in financial economics.

The evidence provided in this section is not sufficient to argue that only because of Friedman’s essay financial economic theories are abstract analytical tools, which aim at prediction only. It rather is the case that this section provides support for understanding the theories of finance as analytical tools. The spirit of the age in which modern financial economics has been constituted at the University of Chicago and other leading Business Schools, was strongly influenced by positive economics, as Friedman (1953) had promoted it. The theories of financial economics have to be understood as children of the age of positive economics.

## **6 Portfolio Theory and the new Scientific Ethos**

In 1950, 23-year-old Harry Markowitz received his Masters degree in economics from the University of Chicago and became a student member of the Cowles Commission for research in Economics. Only two years later he published his paper “Portfolio Selection” in the Journal of Finance. This article became the cornerstone of modern financial economics. The paper was a preliminary study to his PhD thesis and an extended seminar work of his operations research class.

Stock market research was not very fashionable during that time and especially not for economists. His thesis was innovative on many levels. First of all his topic equity investment was not fashionable back then. Only 3% of graduates from Harvard Business School took jobs at Wall Street. Wall Street’s low prestige also affected academia. Courses in investment were unpopular and usually held during undesirable lunchtime at the Harvard Business

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<sup>15</sup> Italic is in the original.



School (Bernstein 1998: 110). The more surprising it is that Harry Markowitz an academic economist by profession choose stock market investment as topic for his PhD thesis. Focusing on the investor's total wealth, the portfolio was new to the existing investment literature. Beside his exceptional topic the methodology applied was innovative and new to the study of investment. Combined with the practical relevance of his contribution this earned him the Nobel Prize in Economic Science in 1990 for pioneering work in the theory of financial economics.

His operations research Professor and member of the Cowles Commission Professor Koopmans had encouraged his students to apply the method of linear programming to practical problems. Markowitz's term paper had been exceptionally good and his professor encouraged him to take his thought a little further, which became his 1952 article. The topic of his paper as well as the mathematical reasoning applied was exceptional. As MacKenzie (2006: 47) reports it from an interview with Markowitz he had asked himself what would happen if he applies the method of linear programming learned in operations research with Professor Koopmans to the problems of investment.

Markowitz came to think about equity investment at the stock market almost accidentally. As Bernstein (1998: 250 f.) reports Markowitz was waiting to see his professor to discuss a topic for his PhD thesis when he got involved in a conversation with a stock broker sharing the waiting room with him. The broker urged him to apply linear programming to the problems of stock investment. His professor supported the idea, though he was not familiar with the stock market. He advised Markowitz to see the dean of the business school Marshall Ketchup, who, the professor thought might know something about the topic as he taught traditional finance at Chicago GBS and might help to advise Markowitz how and where to begin the project. The dean advised Markowitz to read John Burr Williams' PhD thesis "The Theory of Investment Value" (1938), which was an influential book on finance and business management by that time. Williams himself was a broker during the 1920s and the Great Depression. In 1932 he returned to Harvard as a graduate student. Williams' book pointed Markowitz to the fact that investors are guided by the expected return of a stock, when making investment decisions. Expected return however includes the investor's belief about the value of a stock in the future and its riskiness. Given that investors want to maximize profits, they would invest all their money in the one stock with the highest expected value. Obviously, this was not the case in stock markets. Investors diversified their investments in order to reduce risk. Markowitz concluded that investors not only optimizing for risk and return in one stock, but over their portfolio. Optimal portfolio selection is thus about the efficient combination of both risk and return. Applying linear programming can therefore not solve optimal portfolio selection, as the problem is not linear but rather quadratic. At this point Markowitz entered the only little explored terrain of quadratic programming and applied it to the problem of portfolio optimization.

This historical overview shows that Harry Markowitz almost accidentally ended up doing research about the financial market. His Portfolio Theory (PT) was more of a methodological exercise than an inquiry into the nature of financial markets. Though his work was brilliant in style and analytically well developed, it was not aimed at enhancing economic theory. Milton Friedman even doubted the Markowitz's work was economics, when he said: "What he did was mathematical exercise, not an exercise in economics."<sup>16</sup> Additionally the development of Markowitz shows the interconnection between the emergence of financial economics and advanced mathematical methods, as they became fashionable after the World War. At the heart Markowitz's theory is an application of operations research methods to the practical problem of investment at the stock market. Furthermore it is based on highly idealized assumptions. These assumptions contribute to the mathematical accuracy and beauty of the theory. In addition to that the theory shows how portfolio selection would work in principal, if investment would take place in an idealised world. Markowitz theory thus may be interpreted as a simplified model of real world investment, which used in a metaphorical sense helps to understand real world phenomena. Nevertheless, the model has become a practical tool for investment decision. This practical relevance was neither intended by the author nor foreseeable in the years after the publication of "Portfolio Selection" (1952).

Markowitz paper is commonly cited as the founding stone of new or modern financial economics. It was the first paper on a financial topic, which applied abstract reasoning and established a theory of optimal investment behaviour under certain conditions. In the previous section it has been shown that the applied methodology was more important to Markowitz and initially also to the audience, than the practical implications of the theory. As such the founding stone of modern financial economics is a prime example of the application of the new analytical methodology (Weston 1966, Sauvain 1967; Pye 1968). The new analytical methodology used abstract reasoning and advances mathematical and statistical tools in order to reach clarity about some real world problem. In this way it differs from pure formal reasoning, which only aims at formal correctness and not at practical relevance. However, the practical relevance of the new finance literature is solely analytical. The models are argued to be neither designed for practical use nor able to serve the needs of practical men (Weston 1966). Put more critically David Durand<sup>17</sup> (1968: 848) concluded:

"[T]he new finance men (Modigliani, Miller and Markowitz) lost virtually all contact with terra firma." [...] "On the whole they seem to be more interested in demonstrating their mathematical prowess than in solving genuine problems; often they seem to be playing mathematical games." [...] "Some of these same young men spent so much time studying statistical theory and formal methodology that they learned too little about practical data

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<sup>16</sup> Friedman had reported this in an interview with Donald MacKenzie (2006: 50).

<sup>17</sup> Durand was one of the old-school finance people, who valued practical problem solving more than theoretical reasoning. Modigliani and Miller (1958: 271), who were similar to Markowitz pioneers in modern financial economics, criticised Durand's approach strongly.

handling, sources of data, or the need for critical appraisal of data. When they built models, they often become so infatuated with product that they will plug in any data, no matter how inappropriate, just to obtain numerical results. [...] The idea of adapting their analytical approach to the limitations of available data hardly ever occurs to them.”

Durand doubted the practical value of the new analytical approach to financial economics and anticipates much of the debate about the merits of financial economics of today and closes his paper with an gloomy prophecy (p. 852), the prediction

“[...] that the textbooks five or six years hence will look much like the professional journals of the past few years is pessimistic indeed. It suggests that coming generations of business school graduates will embark on their business careers well indoctrinated in the ineffective use of quantitative methods and abysmally ignorant of finance.”

## **7 Conclusions: A Compass not a Camera**

The history of the emergence of financial economics suggests that, financial economics was mainly constituted by the use of a rigorous and mathematical research methodology. Methods developed during the war as well as the methods of theoretical economics were applied to new fields. Changes in the U.S. economy induced by the wartime economic organization lead to a professionalization of management and business education. This movement towards professionalization was mainly characterised by a change in the applied methodology, from a more narrative and institution oriented approach to standardised mathematical methods. Similarly, also the fields of study changed, as the new economic structure was characterised by new types of problems. Business finance and operations research became dominant in education and research. However, the focal point in education as well as in research was on the application of a rigorous methodology.

Particularly, when it comes to financial economics, the emergence of financial economic journals and early publications in financial economics clearly show that the applied methodology was more important than the correct representation of financial markets and the behaviour within them. This does not imply that the theories of financial economics are no sound basis for the prediction of financial market phenomena a priori. Indeed, it shows that financial economic theories have a focus on the applied methodology and on their theoretical character. Financial economics never was intended to give a realistic picture of financial markets or investment behaviour, like a camera could do. Financial economic theories therefore have to be understood and used as tools of orientation. Like a compass they guide our ways. The way we take, however, depends on the way in which we use the compass. The compass helps us to find the right way. Still, finding the way is on us.

The emergence and development of financial economics has been dominated by methodology and theoretical progress. Consequently, the theories are grounded on idealistic assumptions, which restrict the concepts and simultaneously allow for their generality.

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