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Hartmut Hirsch-Kreinsen

Technological Innovation and Finance[1]

Abstract

This paper addresses the relationship between technological innovation and finance. The financial market must be regarded as one of the fundamental prerequisite of innovation, inasmuch as it is here that decisions are made on capital allocation to enterprises. However, less has been written on the interdependencies between the patterns of corporate finance and governance on the one hand and company innovation strategies on the other hand. The paper takes up these open questions. It analyses the transformation process of the German innovation system due to the dynamics of the financial market in the last decades. In conclusion, some general insight into the relationship between finance and innovation beyond the German context will be provided. The paper is based on an extensive literature research in the fields of economic sociology and innovation studies and the analysis of the public debate on the prospects of the current economic development.

Zusammenfassung

Gegenstand des Papiers ist der Zusammenhang zwischen dem Verlauf technologischer Innovationen und den Bedingungen ihrer Finanzierung. Ausgangspunkt der Argumentation ist, dass die Bedingungen des Finanzmarktes als eine der zentralen Voraussetzungen für Innovationen anzusehen ist, da auf dieser Ebene über die Modi der Finanzierung von Investitionen und von Unternehmen entschieden wird. Im Feld der sozialwissenschaftlichen Innovationsforschung wurde bislang dieses Thema jedoch sehr stiefmütterlich behandelt. Der Zusammenhang zwischen den Modi der Unternehmensfinanzierung und Unternehmenskontrolle einerseits und Innovationsstrategien von Unternehmen andererseits wurde bislang kaum untersucht. Das vorliegende Papier greift diesen Zusammenhang auf. Analysiert wird der Entwicklungsprozess des deutschen Innovationssystems im Kontext des Prozesses der Globalisierung des Finanzmarktes. Darüber hinaus zielt die Argumentation auf einige weitergehende konzeptionelle Überlegungen zu den Interdependenzen zwischen Finanzmarkt und Innovation. Die Argumentation basiert auf einer intensiven Literaturrecherche in den Feldern der ökonomischen und sozialwissenschaftlichen Innovationsforschung und einer Analyse der öffentlichen Debatte über die ökonomischen und technologischen Entwicklungsperspektiven.

[1] A revised version of this paper will be published in *Industry and Innovation*, April 2011

1. Introduction

This paper addresses the relationship between the structures and development of financial market and the course of technological innovations. Therewith it delves into the interaction between central structural characteristics and development moments of capitalist societies, an aspect which has so far been analysed only marginally in the social theory debate on the dynamics and transformation of capitalism as well as in socioscientific innovation research (cf. O'Sullivan, 2005; Tylecote and Visintin, 2008).

The socioscientific debate emphasises that the course and the scope of technological innovations correlate with the given social-institutional conditions. This is instructively shown by innovation studies that examine different kinds of innovation systems from the perspective of institution theory. The key idea here is that the different social-institutional arrangements, which vary not only in the different countries but also in sectors and regions, shape the process of technological innovations. In this context, the concept of "national innovation systems" with its many variations has gained particular scientific and political prominence (cf. Lundvall, 1992, 2007; Nelson, 1993; Edquist, 2005). This research points to the significance of institutional factors such as the scientific system, the educational system and the labour market, industrial relations and the financial sector, which in the interplay with the structures and strategies of relevant organisations (in particular of enterprises) shape the focus areas and process of innovation.

These studies reveal the interplay of all of the institutional factors that shapes an innovation system and the therein embedded corporate strategies. Furthermore, the literature points to the fact that the financial market must be regarded as a fundamental structural condition of the capitalist method of production and innovation, inasmuch as it is here that decisions are made on capital allocation to enterprises.[2] As is shown not only by international comparative studies on systems of innovation but also by economic history studies (e.g. Gerschenkron, 1962; Zysman, 1983; Deeg and Jackson, 2007), the different conditions of the financial market decisively shape "the logic of the whole political economy" (Lane, 2003: 80). More specifically, the different financial market conditions entail different forms of corporate financing, specific patterns of the system of corporate governance as well as divergent latitudes for enterprise strategies.[3]

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2 The term "financial market" is used to subsume the different subsectors of debt and equity financing of private and public investments. The stock markets with their influential actors, such as investment funds, analysts and rating agents, are considered to be the steering centres (cf. Huffschmid, 1999; Windolf, 2005).

3 The term "system of corporate governance" is here taken to mean the complex of structures, interests and practices which governs and controls the enterprises and their strategies; basically this refers to the prevailing ownership structures and the associated entrepreneurial objectives as well as the rules of decision-making in corporate management (cf. Lorsch and Graff, 2001).

However, less has been written on the interdependencies between the patterns of corporate finance and governance on the one hand and company innovation strategies on the other hand: A few studies were conducted with an international and historical comparative perspective. Particular mention must be made of the extensive international comparative studies of Andrew Tylecote, Paulina Ramirez et al., in which the consequences of the differences between the innovation systems of various countries were systematically analysed (cf. Tylecote and Conesa, 1999; Tylecote and Ramirez 2006). In a broadly based study, Tylecote and Visintin (2008) examine how systems of corporate governance and finance vary in different nations and how these variations affect the technological performances of these nations. However, this international comparative analysis provides few insights into current trends and future prospects of the divergent systems. William Lazonick (Lazonick and O'Sullivan, 1996; Lazonick, 2003, 2007) delves into the connection between the (likewise) Anglo-Saxon financial market conditions and the structural characteristics of innovative enterprises particularly with regard to innovations in high-tech sectors. This author explicitly formulated the hypothesis that the internationally more and more dominating American shareholder-oriented financial market conditions retard rather than promote innovations.

The developmental perspectives of the financial markets have been more explicitly discussed in several papers by economists. Carpenter and Petersen (2002) as well as Brown and Petersen (2009) in particular focus on the role of equity markets as one major pillar of the financial system which has emerged during the last decades. From this perspective, the authors point to the changing environment for innovation financing and explain country-specific differences. However, they mainly focus on the consequences for high-tech innovations in the American innovation system. Only the paper by Rajan and Zingales (2003) pursues a broader comparative perspective and does not only analyse the development in the U.S. but also in several European countries. Its findings indicate that since the 1980s the European financial markets show more and more similarities to the capital markets in the USA. And, it is shown that the American capital market-oriented system gives new firms attempting new technologies a better chance of obtaining financing than European bank-dominated systems.

The following argumentation takes up these debates and open questions. It starts with a brief summary of the various country-specific patterns of interdependencies between finance and innovation outlined in the aforementioned studies. These country-specific patterns are taken as reference point for the next steps of the argumentation: On the basis of these traditional patterns, the developmental dynamics of the relationship between finance and innovation in the course of the internationalisation of the financial markets will be analysed in three steps. Firstly, the underlying mechanisms of the dynamics of the financial markets will be outlined by referring to the ongoing debate on the emerging "financial market

capitalism" in economic sociology (cf. Windolf, 2005). Secondly, the consequences of this change process will be analysed with regard to the development of the German innovation system. Germany is of great importance in this respect as its system of corporate finance has been subject to substantial transformation processes in the last two decades. The paper will conclude with some general insights into the relationship between finance and innovation beyond the German context.

The following argumentation is based on extensive literature research in the fields of economic sociology and innovation studies and on the analysis of the public debate on the prospects of the current economic development. Therefore, the paper does not present final research findings but rather puts reflections from research in progress up for discussion.

2. Relations between finance and innovation

The term 'innovation' is taken to denote technological innovations, i.e the genesis, development and diffusion of new marketable products, services and techno-organisational processes. Well known characteristics of technological innovations are the uncertainty with regard to the attainable technical and economic success, the risks of the usually fairly unpredictable course of the innovation process with its ex ante almost incalculable intermediate steps and unexpectedly arising decision-making situations and, finally, the difficulty to predict innovation costs. These features entail specific requirements regarding their financing: In a nutshell: "Innovation is an expensive process; significant resources must be expended to initiate, direct and sustain it. It is a process that takes time, which means that the resources that support it must be committed until the process is complete. Finally, its outcomes are uncertain so the returns to innovative investments are not assured." (O'Sullivan, 2005: 240) Furthermore, as economic theory stresses, there is often a high degree of information asymmetry between the financier and the innovator which may lead to opportunistic action on the side if the innovator and adverse risk selection on the side of the financiers. Because normally the innovator has a better understanding of the opportunities, risks and uncertainties of an innovation process than the external financier (cf. Rammer, 2009). Therefore, according to Giovanni Dosi, the financier of innovation always needs "…some sort of heroic trust in unexplored opportunities." In other words, a financial system must allow for the possibility of numerous gambles on unexplored opportunities, about which little is known ex ante, but which can reasonably be expected to be, on average, failures (Dosi, 1990: 307).

Due to the different social-institutional conditions the financing problem of innovation is solved in different country and time-specific ways. To analyse this in an international comparative perspective one can refer to the well -known differentiation between "insider-dominated" and "outsider-dominated" financial

systems (cf. Franks and Mayer, 1997). Based on this approach (cf. in particular Rajan and Zingales, 2003; Tylecote and Visintin, 2008) the following country-specific conditions become apparent:[4]

a) Insider-dominated system

The German innovation pattern with its sophisticated incremental innovations is seen to be linked to an institutional context of a system of networked corporate governance dominated by universal banks and industrial cross ownership (cf. Streeck, 1991). In the literature on finance and innovation, this system is generally referred to as "insider-dominated" (Mayer, 2002; Tylecote and Visintin, 2008) or "relationship-based" (Rajan and Zingales, 2003). According to Tylecote and Visintin, this type comprised all non-English speaking countries until at least the 1990s most notably due to the concentrated ownership of debt and equity and a dominating consensus-seeking culture between the different groups involved in the governance of a company. Taking into account the role of employees and the strong influences of co-determination on corporate governance in Germany, they regard the German situation as a specific subtype of the insider-dominated system, viz as "stakeholder-system" (Tylecote and Visintin, 2008: 64). A dominating consensus-seeking culture between the different groups involved in the governance of a company is being regarded as a general feature of this German system. Concerning the typical mode of financing, the authors speak of "relational banking": Typical of this type is a high degree of enterprise-oriented commitment of the banks and external capital providers and their relatively detailed knowledge of the situation and the activities of the enterprises they finance; in other words, they show a "firm-specific understanding" (ibid.: 83). Concerning innovation activities, lasting learning processes between the involved actors from inside and outside a company are characteristic for this system and also the fact that the role of external investors is based on "participation" and "voice" (Dosi, 1990). The funding of innovation is characterised by a broad spectrum of features: On the one hand, a main feature of the German system is that external financing of innovation is less acceptable for the companies and it is less available than in other countries (cf. Ramer, 2009). Particularly the owners of family-controlled firms very often refuse a real stock exchange listing of their companies for fear of loosing control. This holds for the huge amount of unlisted firms in Germany which can be assumed to be mostly family controlled; as is known unlisted firms are much more important in Germany than in other countries.[5] But this may also hold for a certain percentage of publicly-traded German firms because many of them are family-controlled. Referring to data summarized by Tylecote and Visintin (2008: 78) for the late 1990ies 64,6%

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4 The fact that in a historical perspective various forms of solutions for the financing problems of innovations were found within the different national contexts is for the moment neglected here. On the long-term development in the US, see, for example, the research study of Perez (2002) and the bibliography in O'Sullivan (2005); for a differentiated analysis see Block (2002).

5 Cf. Tylecote and Visintin (2008: 77) who present figures for the low stock market capitalisation in Germany compared to the U.S.A. and Japan for the second half of the 1990ies.

of publicly-traded firms in Germany are family-controlled, in contrast to e.g. UK with a resp. percentage of 23,7%.

On the other hand, the dominant means of financing of firms and thus of innovations are external resources, namely the loan from the firm's bank. This holds true in particular for medium-sized and family-owned companies ("Mittelstand") because of their limited equity (Vieweg, 2001). Hence a specific form of economic rationality results: It is not in the interest of the lending banks that their debtors, i.e. the enterprises, pursue short-term strategies of profit maximisation and thus take risks regarding their long-term existence; if these are avoided, the repayment of the loans and the profits of the creditor banks are assured. Paul Windolf (2005: 22) describes this as follows: "The loans of the banks were patient, controlling and risk-averse capital".

With regard to innovation processes, this implicates a strong and long-term commitment of external capital providers to an innovating company on the basis of a relatively exact knowledge of the processes that have to be financed. This also implicates that the investors' access to the free cash flow of the companies is limited. In other words, the management can dispose of internal funds for innovation decisions. Consequently, innovation with a long-term perspective proceed incrementally along fairly established technological trajectories, as the accumulated skills of the involved actors and the well-oiled organisational routines in the context of the long-term oriented relations are prejudicial to radical innovations and their risks and uncertainties. In this regard, firms that work on radical innovation are at a disadvantage because, given these financing modalities, the availability of risk-oriented venture capital for such innovation strategies is limited (e.g. Caspar et al., 1999).

b) Outsider-dominated system

In contrast, the prominence of high-tech-oriented radical innovations, typical for instance for the US, is seen in close conjunction with market-regulated financing conditions. The basis here is capital market financing, the central instrument is the share which goes hand in hand with a high degree of flexibility and willingness to take risks. With respect to concrete innovation patterns, however, one must differentiate between two segments of the financing system: The one segment is based on a financing system, in which the economic objectives of the firms and their investors centre on a short-term profit maximisation and on an as high as possible share price. The main players of the financial market in this respect are pension funds, insurance companies, mutual funds and the "asset management houses", which manage investment portfolios. These organisations are likely to own shares in several firms of a sector, and thus to have a general understanding of the sector as a whole as a precondition for their investment decisions. An important role is also played by private equity firms which invest in large control-oriented

equity stakes on behalf of other financial institutions such as pension funds (Tylecote and Ramirez, 2005: 12).

Generally, this mode of financing is characterised by a loose relationship between investors and individual enterprises; a few specialised long-term oriented private equity funds are the exception. Normally, successful corporate financing hinges upon the public proof of the profitability of the company activities. The basis for this are – frequently standardised – cost accounting methods which abstract from the concrete context of a company and its activities. Therefore this form of corporate financing and of corporate governance is labelled "outsider-dominated" system. Its "arms-length relationships" are also characterised by a high pressure for shareholder value (Tylecote and Visintin, 2008: 92). With regard to innovation processes, this implicates a loose commitment of external capital providers to an innovating company on the basis of a low company-specific expertise. The strategies of the investors are seen as selection processes based on "entry" and "exit-mechanisms" (Dosi, 1990). Tylecote and Ramirez summarise the consequences for innovation strategies as follows: "…R&D intensity will not be a positive function of pressure for shareholder value, but rather a negative one,…shareholders who do not understand the value of spending on innovation…will impose short-term pressure which discourage it." And they go on to say: "Moreover, innovation which promises a return somewhat less than the cost of capital will certainly be discouraged by pressure for shareholder value – whereas a management free of such pressure will favour it…" (Tylecote and Ramirez, 2005: 27). Innovations in established firms therefore usually proceed with a short-term orientation, aim at rapid economic successes and develop the available technologies at a very slow pace. Evidence for this is the decades-long dominance of traditional manufacturing technologies in the U.S. (cf. Hirsch-Kreinsen, 1992) and the non- advanced automotive technology of American automotive manufacturers.

The prominence of high-tech oriented radical innovations in this innovation system can primarily be put down to the existence of a second, institutionalised segment of the financial market for risk and innovation-oriented venture capital. The driving power is the high availability of risk-oriented capital. Venture capital can be regarded as a subset of private equity that is invested in new or young firms in high growth mode, usually high-technology sectors pursuing risky innovation strategies. In the U.S., venture capital is basically responsible for the remarkable rise in the proportion of R&D performed by firms with less than 500 employees, with an increase from 5.9% in 1984 to 20.7% in 2003 (Tylecote and Ramirez, 2005: 14). This segment of the financial market plays an important role in financing high-risk innovation strategies fraught with uncertainties (Dosi, 1990). The providers of venture capital are characterised by their high willingness to take risks in conjunction with a detailed knowledge of the innovation project. Hence, venture capitalists expect to participate in company management as well as in finance and there

is a close relationship between investor and the innovating company. In other words, the strategies of the capital providers are based on "voice-mechanisms" and less on "entry/exit-mechanisms" of pure selection. Of course this segment is linked to the "outsider-dominated"-segment of corporate financing in specific ways: For one thing, venture capital normally finances the particularly risky early phases of an innovation which the majority of investors shun. For another thing, venture capitalists ultimately aim at selling their interest in firms with successful radical innovations at a high profit. A precondition for this are the market processes of an "outsider-dominated" financial market as well as the possibilities to sell the shares to large established firms (cf. Rajan and Zingales, 2003).

To clarify these comparative perspective, central features of the two types of innovation systems are summarised in the following table 1.

Table 1: Types of relations between innovation and finance

	Outsider-dominated	Insider-dominated
Basic finance tool	Stocks and cash-flow	Loans and cash-flow
Investor orientation	Short-terminism	Long-terminism
Investor expertise	Finance-oriented and industry-specific	company-specific
Basic agency conflict	Shareholder vs. management	Insider vs. management
Relations between investor and innovating company	Loosely coupled; low company-specific expertise	Tightly coupled; normally distinct company-specific expertise
Investor strategy	Dominance of selection proc-esses – "exit"	Dominance of learning processes – "voice"
Venture capital market	Key role for high tech innovation	Limited influence
Dominant pattern of innova-tion	High-tech/radical	Traditional/incremental
Typical countries	U.S.A.: shareholder-dominated system	Germany: stakeholder-dominated system

3. Dynamics of the financial market

Recent research – in particular in the field of economic sociology – emphasises the fact that the boundaries between the different country-specific innovation systems have begun to blur since the 1990s due to the internationalisation of the financial markets.[6] It furthermore points out that the Anglo-

6 A discussion of the factors causing this process of internationalisation and the financial markets changes goes beyond the scope of this paper (see e.g. Deeg, 2009).

Saxon forms of corporate financing are asserting themselves while the "insider-dominated" forms of corporate financing and of corporate governance are eroding. According to the research findings, this is especially true for Germany, where the dissolution of the traditional networked system of the "Deutschland AG" is very conspicuous. The researchers speak of a new production regime, which is referred to as "financial market capitalism" (e.g. Kädtler and Sperling, 2002; Beyer and Höpner, 2003; Windolf, 2005). The networked system of long-term lending by relatively autonomous universal banks tends to be replaced by an internationally oriented system based on Anglo-Saxon capital market and corporate financing norms, which leads to lasting changes in the system of corporate governance.

To sum up this discussion (cf. Hirsch-Kreinsen, 1998; Windolf, 2005; Deeg, 2009), the transformation processes in several interlinked levels of the system of corporate finance and control can be regarded as central features of this new production regime. On the supply side of investors, a changing constellation of actors is discernible: First, mention must be made of the growing influence of new economic institutions and actors such as various forms of investment funds as well as analysts and rating agencies. Second, research findings point to the worldwide greatly increased importance of not publicly regulated international forms of capital allocation within the scope of various kinds of private equity funds. Third, changes in the structures and strategies of banks are emphasised by research. These result in the increasing importance of profit-oriented and short-term oriented investment banking at the expense of long-term oriented lending to firms. In this context, analysts and rating agencies play a key role for the investment decisions of the capital providers, as the investors expect an assessment of the risks and the future profitability of an investment from them (Windolf, 2005). This change is accompanied by changed regulations of credit rating and financing modalities (so-called Basel II-Regulations) which are primarily driven by the evaluation of default risk on various forms of debt. This primarily concerns the firm's cost of capital, structure of the balance sheet and variance of cash flow and therefore these regulations strongly influence the financial scope of companies.

On the demand side of the companies, complementary changes can be observed: To begin with, studies generally point to a stronger financial market orientation of the top management of many companies, which takes effect regardless of the actual influence of the financial market and its actors. The prevalence of a general principle that can be described as shareholder value conception of the firm is often emphasised (Fligstein, 2001). An important driving force for this phenomenon are the much discussed stock options and bonus systems that generate massive additional income for managers in the case of a successful financial market-oriented reorganisation of the enterprise (cf. Kädtler, 2005). A further reason for the prevalence of the shareholder value conception is that a new manager type has begun to predominate in many German industrial enterprises since the 1990s. This new manager type,

that is to a great extent recruited from across-the board qualified generalists and from managers from the areas of finance and controlling, is increasingly replacing the former type of the technical/scientific specialist with a long-standing commitment to the company. In addition, the fluctuation and the mobility of the top managers are markedly higher (cf. Freye, 2009). Furthermore, the dissemination of and implementation of new international accounting and financial reporting standards in the companies plays an important role for the growing financial market orientation. These standards aim at making an as profitable as possible use of the financial reserves of a company. Available research findings show that cost structures are thus made more transparent, previous scopes for financing are constricted and profit potentials are easier to identify than in the past (cf. Botzem and Quack, 2009).

Both the supply side of the financial market and the demand side of the companies are linked by the system of corporate governance. The complex of structures, interests and practices characterising this system has changed considerably. In particular, the emergence of a market for corporate control is emphasised, on which businesses are bought or sold. It is generally assumed that this market has "disciplining effects" on businesses because of changed power constellations and potentially possible as well as actually impending "hostile takeovers" (Windolf, 2005: 49). Furthermore, new ownership structures are highlighted as central factor for this change. The funds and other institutional investors have a "control advantage" over other owners such as minor but also major stockholders, as they often only hold limited shares that do not constrain them strategically. Most notably, to assert their interests, they can at all times threaten the other shareholders with their exit and the accompanying stock market losses (cf. Beyer, 2009).

The question arises in which way these changes in the financing conditions of a hitherto "insider-dominated" system like the German "stakeholder economy" influence the innovation strategies of the enterprises. The answer to this question cannot be deduced a priori. On the one hand the changes in financial market conditions may lead to constraints on innovation strategies. On the other hand the influence of new shareholder groups may open new innovation opportunities. To come to a preliminary answer the findings of available studies as well as empirical data will be interpreted and summarised in the following.

a) Constraints on the innovative capability of firms

It is argued that the changes in the financial market conditions are leading to constraints on the innovation capabilities and strategies of enterprises (Deutschmann, 2005, 2008; Lazonick, 2007): For neither is the sufficient stability of the financial means guaranteed nor is there sufficient strategic room for manoeuvre. Moreover, because of their lacking contextual knowledge, neither the dominant financial market players nor the new financing regulations and instruments are able to adequately assess the risks

and uncertainties of technical innovations and their preconditions with regard to the corporate structure. Accordingly, collective learning processes and knowledge accumulation are seen to be curtailed and innovation projects to be reduced to calculable activities. Consequently, technological innovations are solely conducted with short-term considerations and the criterion of risk avoidance.

Empirically this situation is most likely to be encountered in the case of large listed firms with a pronounced financial market orientation. As aggregated data show, there has been a clear trend in large German corporations away from bank financing towards more market financing since the beginning of the 1990s (cf. Deeg, 2009). Therefore one can assume that massively increased, short-term oriented profitability criteria and expectations of external investors lead to an abandonment of innovation activities or at least to the curtailment of innovation perspectives and of the associated expenses. An empirical example for this trend are large pharmaceutical companies that have in the past few years extensively reorganised their value added chains, in particular their research departments. The innovation activities of this industry are influenced by a lot of specific factors, in particular the governmental health policy. However, there are research findings pointing to the specific influences of financial market conditions (Briken and Kurz, 2006; Kädtler, 2009): For one thing, the innovation processes are streamlined and strictly controlled according to financial performance figures or other indicators in order to detect undesirable developments at an early stage and to reduce development times. For another thing, the linking of innovation processes in the field of pharmaceuticals to criteria of the financial market leads to a focus of their innovation strategies on products with particularly good prospects, blockbuster, i.e. patented key products with a high turnover and profit margin. This innovation focus is based on an ultimately risk-averse preference for limited modifications in the principles of known chemical entities. Parallels can be drawn to the automotive industry, where– under the conditions of a pronounced innovation competition – companies are attempting to generate profitability by means of growing but calculable innovations (Tylecote and Visintin, 2008: 40ff.). Characteristics of these innovation dynamics are a marked rise in the overall R&D since the 1990s, the marked reduction of the development times and the massive broadening of the range of products (EFI, 2009). However, these dynamics go along with a continuous reduction of the *in-house* R&D expenditure and a marked rise in *external* R&D since the mid-1990s, whereby the innovation risk in particular regarding the use of new technologies is shifted to external suppliers (Jürgens and Sablowski, 2008).

The takeover of companies by private investment corporations such as private equity funds has similar consequences. The strategy of the corporations is directed at a loan-funded investment in companies, the utilization of the financial potentials of the taken-over company and a rapid exit at as high a sale value as possible – in a nutshell: “invest to sell“ (Klier et al., 2009). According to the available literature

(cf. Kamp, 2007), short-term improvements in the efficiency and competitiveness of the enterprises can by all means be achieved by these company takeovers but long-term oriented strategies and investments in research and development are hardly possible anymore. This is shown by a whole range of examined taken-over companies, for instance by medium-sized companies from the capital goods industry: the investors shy away from the financial risk of innovations and are little appreciative of them. Moreover, due to the often drastic restructuring measures resulting in the dismantlement of supposedly surplus resources and a reduction of business functions to core competences, the organisational room for manoeuvre and the personal competencies that are often indispensable for innovations are lost (cf. Lembke, 2008).

This restrictive situation for innovation projects also affects non-listed companies such as smaller and family-owned enterprises. This is due to the generally changed structures of the system of corporate financing and of granting of loans (Basel II-Regulations) with its risk-averse and intricate rating and evaluation procedures, which subject innovation projects to a more pronounced and systematic economic control than in the past (e.g. Belz and Warschat, 2005; Springler, 2007). According to available data, this applies in particular to enterprises from traditional sectors, which , due to limited own resources, to a large extent finance innovation activities with tied bank loans; thus in the years 2004-2006 around 30% of the companies from the food and furniture industries as well as from metal production and metalworking financed their innovation plans with loans (in addition to other sources of funding); around 21% of the mechanical engineering companies also availed themselves of bank loans (Rammer, 2009: 41). Furthermore, small and medium-sized enterprises in general are probably subject to these restrictions, as their financing is generally largely based on bank loans; as available data show, bank debt as a percentage of balance sheet totals has remained constant for German small and medium enterprises since the mid-1990s (Hommel and Schneider, 2003; Heimer et al, 2008; Deeg, 2009).

A second reason for the restrictive situation is the increasing application of international accounting and financial reporting standards which follow the principles of a stronger accountability towards external investors and are oriented towards the (listed) company value. Generally speaking, with their emphasis on “fair value” accounting principles, these standards reveal the firm’s financial reserves and press for the most profitable use of the corporate assets as measured by financial benchmarks. As a result, the return expectations of investors are becoming a dominant target figure of the corporate management too (Botzem et al., 2007; Deeg, 2009). This can have twofold consequences: For one thing, managers often strictly avoid investments in uncertain and risky innovation projects so as not to unnecessarily weigh down the balance sheets. For another thing, the growing cost pressure, the introduction of rationalisation-based forms of work organisation and of shorter work cycles in the course of ongoing innova-

tion processes often lead to the already mentioned “good enough-solutions“ and “pseudo solutions“ (Grewer et al., 2007: 78).

A third reason for the growing economic pressure on technological innovation processes are changed conceptions of the relevant actors on appropriate profit objectives and changed management principles with regard to strategies, methods and organisation concepts. This applies particularly to the organisation and management concepts often favoured by financial market players, management representatives and analysts, viz. concepts which focus on the so-called core business. As a consequence, the previous breadth and diversity of R&D areas and of engineering departments are reduced and centralised. Furthermore, the grown and (horizontally and vertically) integrated company structures and their adherent resources and knowledge base of many years are often only regarded as cost drivers and are dismantled. Hence company structures that were previously characterised by a high degree of integration of different functions, synergies, knowledge transfer and learning processes between various competence and knowledge areas as well as by organisational “slack“ and redundancies, are streamlined, thus abandoning important preconditions for the innovation capability of companies.[7]

b) Stabilisation of existing innovation patterns

The question arises whether one can generally assume this described tight coupling between the financial market and innovations and hence resulting constraints on the innovation strategies of enterprises. There is no clear-cut answer to this question. The available data on the funding methods of companies reveals that the enterprises make use of various financing sources for innovation. Thus the influence of the financial market and its actors on the corporate strategies is at least put into perspective. Data of the years 2004 - 2006 show that the enterprises in Germany use various financing sources for innovations: According to the data, many innovating enterprises make exclusive use of internal financial resources from ongoing business activities. Just as many enterprises combine internal with external financial sources; the exact figures are: 82% of all enterprises use internal financial sources, 41% of the enterprises make exclusive use of these while 41% of the enterprises combine them with external financial resources (Rammer, 2009: 41). On the one hand, this large share of self-financed investment is not a new phenomenon but was already of great importance in the past. On the other hand, there has been a marked rise in the share of internal financing since the 1990s (Deeg, 2009: 558). In general, this means that enterprises are not often directly dependent on the increasingly restrictive financial market conditions to finance innovations but are at the most loosely coupled with them. This becomes even more

[7] The trend towards innovation processes characterised as “open innovations“ may also be influenced by this pressure to change corporate structures; i.e. companies are harnessing external ideas in order to reduce the costs and to leverage their in-house R&D activities (cf. Chesbrough, 2003).

apparent from the finding that research-intensive companies ("medium- and high-tech") in particular use internal financing sources, this strategy is pursued by about 95% of these enterprises (ibid.). It can be assumed that the enterprises thus wish to secure room for manoeuvre for risky and far-reaching innovations.

It can also be assumed that under otherwise equal conditions, non-listed companies can secure room for manoeuvre vis-à-vis the changed financial market conditions because of their financing and ownership structures which are decoupled from the financial market. Quite large family-run companies are often cited as examples for this. These companies have sufficient own capital resources and their productivity is generally considered to be very high (e.g. Kamp, 2007). Shareholder loans are a typical form of financing in this case. According to the above-mentioned data, approx. 18% of all innovating enterprises draw on these to finance their innovations. But listed companies with a distinct financial market orientation can also try to maintain their autonomy and pursue innovation strategies independently, provided that their overall economic situation and their profitability are good.

Finally, at the level of working processes, the structural conditions of research, development and design processes have to be taken into account. Their far-reaching and financial market-driven rationalisation would block essential innovation opportunities. As has been convincingly shown by work process studies (cf. Wolf et al., 1992), it is hardly possible to standardise and formalise innovation work due the ever present risks and uncertainties, i.e. the functional logic of these work processes in many cases counteracts such attempts. This is also true for the cases in which the innovations processes were effectively reorganised as a result of new organisation and management concepts and the introduction of new computer-aided systems. These systems have to be well adapted to the respective requirements, a task that only the experts on the operative level can accomplish, given the always occurring risks and uncertainties. A precondition for this is the "appropriation" of the respective systems, i.e. the competent adaptation of these systems to the given conditions by their users. Hence, structural barriers to the rationalisation of innovation processes and a substantial amount of power on the part of the involved scientists and development engineers are the result.

c) New scope for innovation

However, the changed financial market conditions also lead to the emergence of new and extended scopes for innovation strategies.[8] Firstly, mention must be made of investors such as some industrially oriented private equity funds that pursue a long-term investment strategy and open up new scopes of action for increases in productivity and innovations (Achleitner et al., 2008). Secondly, venture capital

[8] See also recent findings by Brown and Petersen (2009) that provide evidence for string stock market effects on the increase in R&D intensity especially of young firms in the U.S.

that is geared to financing risky product innovations in high-tech sectors plays an important role in this context. Apart from the new economy boom of the second half of the 1990s, venture capital in its various forms plays a relatively subordinate role for the funding of innovations in Germany in comparison especially to the US (BMBF, 2007). Moreover, the volume of venture capital dropped significantly after the new economy bubble burst at the beginning of the 2000s. While approx. 2.5 billion Euros of venture capital were invested in 2000, this sum only amounted to around 0.75 billion in 2003. For the then following years, however, researchs speak of a "modest revival" of this capital market segment (Deeg, 2009: 571). Thus the investments in 2005 already amounted to approx. 1.3 bn again and in 2007 to about 1 bn Euro (BVK, 2005, 2010).

In some high-tech sectors, however, venture capital plays a vital role in Germany too. This applies in particular to the IT and biotechnology sectors as well as to medical engineering, communication technology, automation and control as well as feedback control systems. It is estimated that around a fifth to a quarter of the R&D expenditure in the biotechnology sector is financed by means of venture capital (KfW-Research, 2006: 121; Champenois et al., 2006).[9] "*Business angels*" represent an often underestimated subsegment of the market for venture capital. These are wealthy and highly specialised private persons who are able sufficiently to assess the risks and uncertainties of specific innovations and to offer the innovating companies not only corresponding financing options but also their advisory skills (Carpenter et al., 2003; Tylecote and Ramirez, 2006). Although the available data so far is based on estimates, this segment of the capital market too is very small in Germany in an international comparison but is extremely significant for certain high-tech companies, especially for research-intensive spin-offs from the field of science (Fryges et al., 2007). One also has to point to a further subsector of the market for venture capital: corporate venture capital. Therewith large-scale enterprises fund innovation projects of other smaller companies of interest to them by means of specifically founded companies. The financing strategy has a long-term orientation and is normally coupled with consulting services for the innovating company. This form of financing can mainly be found in the pharmaceutical sector. Despite the current crisis, this small segment of the financial market is evidently growing due to the high pressure to innovate in the pharmaceutical industry (FAZ, 2009).

A basic characteristic of these forms of financing of innovations are the often close personal ties between the innovating firms and the capital providers. On the basis of their detailed knowledge of a certain technology field, the investors often have close connections to the company they fund and take an active part in the business operations by means of various executive functions they hold within the

[9] This figure does not comprise the volume of financing of foreign venture capital companies that play an important role in the biotechnology sector (KfW-Research, 2006: 121).

company. Thus the executive management is more closely controlled by the venture capital givers than is the case for other forms of external innovation financing (Rammer, 2009: 37). It is thus worth noting that a reconfiguration of the insider system is observable in the segment of venture capital. Its central characteristic is the close tie between individual innovating companies and financial market actors and the interest of the latter in short-term and high profits which they hope to realise due the influence they wield and their intimate knowledge of the technology requirements, risks and uncertainties of innovation processes.

d) Development perspectives

If one recapitulates the described developments, a growing diversity can be discerned in the German innovation system. It is noticeable that the formerly relatively homogeneously structured stakeholder-dominated system is increasingly differentiating into various subsystems. One can speak of an emerging "three pillar" system structure: On the one hand, there is a pillar characterised by increasing constraints on the companies' room for innovations. Especially large listed firms but also a fair number of externally financed small and medium-sized enterprises from traditional industrial sectors operate under such conditions. On the other hand, there is a pillar featuring companies, mainly from new technological fields, that have new scope for innovation. In between these two pillars a sub-system can be found that is characterised by the stabilisation of traditional, existing innovation patterns. Here we find a number of non-listed and family-owned firms and in particular companies that use their available internal resources for innovation activities and are thus unaffected by financial market influences. This three pillar German innovation system can be summarised as follows (see table 2 on the next page).

To be sure, the emerging pillars or subsystems of the German innovation system presented here are schematic and are based on preliminary findings. No attempt was made in this article to state more precisely or even quantify the types of firms falling into each category. This requires much more empirical research.

To sum up, the German innovation system is certainly not totally eroding and converging with the type of the Anglo-Saxon outsider-dominated system. One can rather speak of the emergence of a "hybrid" innovation system mixing new and old structures. Although it is becoming more akin to the Anglo-Saxon model, in an international comparison it still features a specific configuration. The institutional change can thus be conceived as "displacement", i.e. "foreign" system elements were integrated into an institutional system without giving up the hitherto existing elements (Streeck and Thelen, 2005). This development results in an opening up of the stakeholder-dominated system to new requirements that ensue from the international integration and the rapid technological change.

Table 2: The emerging "three pillar" German innovation system

	Pillar 1: Constraints	Pillar 2: Stabilisation	Pillar 3: New scope
Prevailing type of firms	large listed firms, SMEs	non-listed firms, family owned, SMEs	newly founded firms, start-ups
Available firm's resources	limited internal, dependent on various forms of external financing	high internal	very limited internal resources, dependent on external financing
Influence of financial market conditions	- market based financial modes and new investors - Basel II-regulations, - International accounting and reporting standards, - changing management concepts and profitability norms	only limited influences, high significance of firm's internal financial resources	- specific and focused financial market pressure on innovation, - significance of new financial market segments: VC and industrial oriented PE funds
Sector/technological field	established, R&D intensive industries, low-tech	established, medium-tech	new, high-tech
Type of innovation	incremental, restricted, more focused	incremental, radical	more or less radical

4. Conclusion

In conclusion, some general insight into the relationship between finance and innovation beyond the German context will be provided. For there are as yet few studies - in particular from an institutional analysis perspective - on this topic (cf. O'Sullivan, 2005). In a first attempt, the research findings on the German system of innovation financing can be generalised in a model of interdependent variables:

As institutional analysis shows institutions, firms and emerging technologies co-evolve (cf. Hollingsworth, 2000; Edquist, 2005). In particular, the institutional conditions of the financial market play a key role for the ability of companies to follow long-term strategies as well as for their innovation activities (cf. Deeg and Jackson, 2007). Therefore, the conditions of the financial market can be considered as independent and determining variables regarding the analysis of the course of technological innovations whereas the innovation strategies of enterprises have to be regarded as dependent variables. However, different patterns of interaction between the conditions of the financial market and the innovation strategies of companies can be identified. These different patterns are primarily determined by in-

tervening variables including several factors: First, one has to point to the system of corporate governance which is characterized by the distinction between de facto publicly-traded companies and family-run companies. This correlates with the extent to which the management is able to pursue autonomously financial market-oriented objectives. Second, one has to refer to the available resources of the enterprises, which determine to which extent innovation strategies can be pursued autonomously. In this context, the latitude for internal financing decoupled from the financial market is of special importance. Third, the company-specific innovative capability (e.g. accumulated experience and management skills) also plays a key role. Fourth, the structure of the innovation processes of the companies has to be taken into account. This refers to the technical-functional, organizational and personnel structure of research, development and design processes in intra-company and cross-company (e.g. innovation co-operations and networks) respect. These interdependencies do not only determine the degree of the calculability of the risks and uncertainties of innovations but also influence the autonomy of action of the companies vis-à-vis the profitability expectations and requirements of the financial market.

Finally, following institutional analysis, the relationship between institutional conditions and firm strategies can by no means be described as unidirectional deterministic. For one thing, the institutional conditions do not force the companies into a predetermined direction, in fact the situation is characterised by discrepancies; thus, as has been shown, the strategies of external investors can range from short-term takeover ambitions to long-term portfolio-oriented investment strategies. For another thing, the interaction among actors and their institutional environment has to be conceptualised as a multi-faceted process and it must be taken into account that actors are able to influence and modify institutional regulations (Hollingsworth, 2000: 597). Of decisive importance in this model are therefore the mechanisms that act as intermediaries between the structural conditions and the decision-making and action patterns of the actors. In the scope of this paper these mechanism haven been preliminary characterised as different patterns of coupling between financial market conditions and company innovation strategies. However, which concrete mechanisms take effect still remains an open question. They involve interaction, communication and negotiation processes on the different levels of the whole system and among the various involved companies, organisations and other actors. To analyse these much more in-depth research is required.

References

Achleitner, A.-K., Andres, C., Betzer, A. and Weir, C. (2008) Economic Consequences of Private Equity Investments on the German Stock Market, *mimeo*, University of Bonn.

Belz, J. and Warschat, J. (Eds.) (2005) Innovationskraft in KMU – Das Rückgrat der deutschen Wirtschaft*, Impulskreis KMU in der Initiative „Partner für Innovation"*, Stuttgart.

Beyer, J. (2009) Varietät verspielt? Zur Nivellierung der nationalen Differenzen des Kapitalismus durch globale Finanzmärkte, in: J. Beckert and C. Deutschmann (Hg.) Wirtschaftssoziologie, Kölner Zeitschrift für Soziologie und Sozialpsychologie, Sonderheft 49, Wiesbaden, pp. 305-325.

Beyer, J. and Höpner, M. (2003) The Disintegration of Organised Capitalism: German Corporate Governance in the 1990s, *West European Politics*, 26(4), pp. 179-198.

Block, T. (2002) Financial Systems, Innovation and Economic Performance, *MERIT-Infonomics Research Memorandum Series*, 011.

Bundesministerium für Bildung und Forschung (BMBF) (Ed.) (2007) *Bericht zur technologischen Leistungsfähigkeit Deutschlands 2007* (Bonn/Berlin: BMBF).

Botzem, S., Quack, S. and Konrad, M. (2007) Unternehmensbilanzierung und Corporate Governance – die Bedeutung internationaler Rechnungslegungsstandards für die Unternehmenssteuerung, in: U. Jürgens, D. Sadowski, G. F. Schuppert & M. Weiss (Hrsg.) *Perspektiven der Corporate Governance*, pp. 358-384 (Baden-Baden: Nomos).

Botzem, S. and Quack, S. (2009) (No) Limits to Anglo-American accounting? Reconstructing the history of the International Accounting Standards Committee: A review article, *Accounting, Organizations and Society*, 34(8), pp. 988-998.

Briken, K. and Kurz, C. (2006) Innovationen in der deutschen Pharma- und Biotechindustrie, in: H. Heine, M. Schumann & V. Wittke (Eds.) *Wer den Ast absägt, auf dem er sitzt, kann deshalb noch längst nicht fliegen*, Berlin, S. 39-64.

Brown, J. R. and Petersen, B.C. (2009) Why has the investment-cash flow sensitivity declined so sharply? Rising R&D and equity market, *Journal of Banking and Finance,* 33(5), pp. 971-984.

BVK (Bundesverband Deutscher Versicherungskaufleute e.V.) (2005) Zur Rolle von Private Equity und Venture Capital in der Wirtschaft Aktualisierte Fassung der im Dezember 2003 erschienenen BVK-Untersuchung „Zur volkswirtschaftlichen Bedeutung von Private Equity und Venture Capital, http://www.bvkap.de/media/file/55.pe_wirtschaft.pdf (download, March 10, 2010).

BVK (Bundesverband Deutscher Versicherungskaufleute e.V.) (2010) BVK Statistik. Das Jahr 2009 in Zahlen, http://www.bvkap.de/media/file/300.20090308_BVK_Jahresstatistik_2009_final.pdf (download, March 10, 2010).

Carpenter, R. E. and Petersen, B. C. (2002) Capital Market Imperfections, High-Tech Investment, and New Equity Financing, *Economic Journal, Royal Economic Society*, 112 (477), pp F54-F72.

Carpenter, M., Lazonick, W. and O'Sullivan, M. (2003) The Stock Market and Innovative Capability in the New Economy: The Optical Networking Industry, *Industrial and Corporate Change*, 12(5), pp. 963-1034.

Caspar, S., Lehrer, M. and Soskice, D. (1999) Can High-technology Industries Prosper in Germany? Institutional Frameworks and the Evolution of the German Software and Biotechnology Industries, *Industry and Innovation,* 6 (1), pp. 5-24.

Champenois, C., Engel, D. and Heneric, O. (2006) What Kind of Biotechnology Companies do Venture Capitalists and Corporate Investors Prefer? *Applied Economics*, 38(5), pp. 505-518.

Chesbrough, H. W. (2003) The Era of Open Innovation, *Sloan Management Review*, 44(3), pp.35-41.

Deeg, R. (2009) The rise of internal capitalist diversity? Changing patterns of finance and corporate governance in Europe, *Economy and Society*, 38(4), pp. 552-579.

Deeg, R. and Jackson, G. (2007) The State of the Art. Toward a more dynamic theory of capitalist variety, *Socio-Economic Review*, 5 (1), pp. 149-179.

Deutschmann, C. (2005) Finanzmarkt-Kapitalismus und Wachstumskrise, in: P. Windolf (Hg.) *Finanzmarkt-Kapitalismus – Analysen zum Wandel von Produktionsregimen*, Kölner Zeitschrift für Soziologie und Sozialpsychologie, Sonderheft 45, pp. 58-84.

Deutschmann, C. (2008) *Kapitalistische Dynamik. Eine gesellschaftstheoretische Perspektive* (Wiesbaden: VS Verlag).

Dosi, G. (1990) Finance, Innovation and Industrial Change, *Journal of Economic Behavior and Organization,* 13(3), pp. 299-319.

Edquist, C. (2005) Systems of Innovation, in: J. Fagerberg, D. Mowery & R. R. Nelson (Eds) *The Oxford Handbook of Innovation*, pp. 181-208 (Oxford: Oxford University Press).

Expertenkommission Forschung und Innovation (EFI) (Hrsg.) (2009) *Gutachten zu Forschung, Innovation und technologischer Leistungsfähigkeit 2009* (Berlin: EFI).

Frankfurter Allgemeine Zeitung (FAZ) (2009) *Wagniskapital aus der Konzernkasse*, Nr. 85, 11. April, S. 17

Fligstein, N. (2001) The Rise of the Shareholder Value Conception of the Firm and the Merger Movement in the 1980's, in: N. Fligstein, *The architecture of Markets*, pp. 147169 (Princeton: PUP).

Freye, S. (2009) German Business Elite in Flux, *MPIfG Discussion Paper*, Max-Planck-Institut für Gesellschaftsforschung, Köln, pp. 59-64.

Fryges, H., Gottschalk, S., Licht, G. and Müller, K. (2007) Hightech-Gründungen und Business Angels, Endbericht für das Bundesministerium für Wirtschaft und Technologie, ZEW Mannheim.

Gerschenkron, A. (1962) *Economic Backwardness in Historical Perspective* (Cambridge/MA.: Belknap Press of Harvard University Press).

Grewer, H. G., Matthäi, I. and Reindl, J. (2007) *Der innovative Ältere* (München und Mering: Rainer Hampp Verlag).

Heimer, T., Hölscher, L. and Mathias, W. (2008) Access to Finance and Venture Capital for Industrial SMEs, *Frankfurt School of Finance & Management Working Paper No. 97.*

Hirsch-Kreinsen, H. (1992) On the History of NC-Technology – Different Paths of Development, in: N. Altmann, C. Köhler and P. Meil (Eds.) *Technology and Work in German Industry*, pp. 63-76 (London: Routledge).

Hirsch-Kreinsen, H. (1998) Shareholder-Value: Unternehmensstrategien und neue Strukturen des Kapitalmarktes, in: H. Hirsch-Kreinsen and H. Wolf (Eds.) *Arbeit, Gesellschaft, Kritik. Orientierungen wider den Zeitgeist*, pp. 195-224 (Berlin: edition sigma).

Hollingsworth, J. R. (2000) Doing Institutional Analysis: Implications for the Study of Innovations, *Review of International Political Economy,* 7(4), pp. 595-644.

Hommel, U. and Schneider, H. (2003) Financing the German Mittelstand, EIB Papers, 8(2), pp. 52-90.

Huffschmid, J. (1999) Politische Ökonomie der Finanzmärkte (Hamburg: VSA Verlag).

Jürgens, U. and Sablowski, T. (2008) *Sektorale Innovationsprozesse und die Diskussion über deutsche Innovationsschwächen* (Düsseldorf: Hans-Böckler-Stiftung).

Kädtler, J. (2005) Finanzmärkte: Zur Soziologie einer organisierten Öffentlichkeit, *SOFI-Mitteilungen,* 33, S. 31-37.

Kädtler, J. (2009) Finanzialisierung und Finanzmarktrationalität. Zur Bedeutung konventioneller Handlungsorientierungen im gegenwärtigen Kapitalismus, *SOFI Working Paper*, Nr. 5.

Kädtler, J. and Sperling, H.-J. (2001) Worauf beruht und wie wirkt die Herrschaft der Finanzmärkte auf der Ebene von Unternehmen? *SOFI-Mitteilungen*, 29, S. 23-43.

Kamp, L. (2007) Zum Einfluss von Private Equity- und Hedge-Fonds auf die Wirtschaft, *WSI Mitteilungen*, 11, S. 596-602.

KfW-Research (2006) *Mittelstands- und Strukturpolitik Nr. 37*, Sonderband „Innovationen im Mittelstand" (Frankfurt/M:KfW).

Klier, D. O., Harrigan, K. R. and Welge, M. K. (2009) Managing Diversified Portfolios, *Dortmunder Beiträge zur Unternehmensführung*, TU Dortmund.

Lane, C. (2003) Changes in Corporate Governance of German Corporations: Convergence to the Anglo-American Model? *Competition & Change,* 7(2-3), pp. 79-100.

Lazonick, W. (2003) The Theory of the Market Economy and the Social Foundations of Innovative Enterprise, *Economic and Industrial Democracy*, 24(1), pp. 9-44.

Lazonick, W. (2007) Shareholder value and the governance of innovative enterprise, in: U. Jürgens, D. Sadowski, G. F. Schuppert & M. Weiss (Hrsg.) *Perspektiven der Corporate Governance*, pp. 472-500 (Baden-Baden: Nomos).

Lazonick, W. and O'Sullivan, M. (1996) Organisation, finance and international competition, *Industrial and Corporate Change*, 1(1), pp. 1-36.

Lembke, J. (2008) Interesse an Geld, nicht an Farbe und Design, *FAZ Nr. 110*, 13. Mai, S. 27.

Lorsch, J. and Graff, S. K. (2001) Corporate Governance, in: A. Sorge & M. Warnerm (Eds.) *Organizational Behaviour*, pp. 252-260 (London: Thomson Learning).

Lundvall, B.-A. (ed.) (1992) National Systems of Innovation. Towards a Theory of Innovation and Interactive Learning, (London/New York: Pinter).

Lundvall, B.-A. (2007) National Innovation Systems – Analytical Concept and Development Tool, *Industry and Innovation*, 14(1), pp. 95-119.

Mayer, C. (2002) Financing the New Economy: financial institutions and corporate governance, *Information Economics and Policy*, 14(2), pp. 311-326.

Nelson, R. R. (Ed.) (1993) *National Innovation Systems: A Comparative Analysis* (New York/Oxford: Oxford University Press).

O'Sullivan, M. (2005) Finance and Innovation, in: J. Fagerberg, D. Mowery and R. R. Nelson (Eds.) *The Oxford Handbook of Innovation,* pp. 240-265 (Oxford: Oxford University Press).

Perez, C. (2002) *Technological Revolutions and Financial Capital: The dynamics of Bubbles and Golden Ages,* (Cheltenham: Edward Elgar).

Rajan, R. and Zingales, L. (2003) Banks and Markets: The Changing Character of European Finance, *Working Paper No. 9595* (National Bureau of Economic Research, NBER).

Rammer, C. (2009) Innovationsverhalten der Unternehmen in Deutschland 2007, *Studien zum deutschen Innovationssystem Nr. 04-2009*, Mannheim et al..

Springler, E. (2007) Basel II – Finanzierung und wirtschaftliche Entwicklung, *WSI Mitteilungen,* 12, pp. 664-669.

Streeck, W. (1991) On the Institutional Conditions of Diversified Quality Production, in: E. Matzner & W. Streeck (Eds) *Beyond Keynesianism*, pp. 21-61 (Aldershot: Edward Elgar).

Streeck, W. and Thelen, K. (Eds.) (2005) *Beyond continuity: Institutional Change in Advanced Political Economies* (Oxford: Oxford University Press).

The Economist (2009) *Flight of the locusts*, April 11th, pp. 57-58.

Tylecote, A. and Conesa, E. (1999), Corporate Governance, innovation system and industrial performance, *Industry and Innovation,* 6(1), pp. 25-50.

Tylecote, A. and Ramirez, P. (2005) UK Corporate Governance and Innovation, *Sheffield University Management School Discussion Paper No. 2005.*

Tylecote, A. and Ramirez, P. (2006) Corporate Governance and Innovation: The UK compared with the US and „insider" economies', *Research Policy,* 35(1), pp. 160-180.

Tylecote, A. and Visintin, F. (2008) *Corporate governance, finance and the technological advantage of nations* (London: Routledge).

Tylecote, A. and Visintin, F. (2009) Corporate *Governance, Finance and the Technological Advantage of Nations* (London/New York: Routtledge).

Vieweg, H.-G. (2001) Der mittelständische Maschinenbau am Standort Deutschland – Chancen und Risiken im Zeitalter der Globalisierung und "New Economy"', *mimeo*, IFO Institut, München.

Windolf, P. (Ed.) (2005) Finanzmarkt-Kapitalismus - Analysen zum Wandel von Produktionsregimen, *Kölner Zeitschrift für Soziologie und Sozialpsychologie*, Sonderheft 45.

Wolf, H., Mickler, O. and Manske, F. (1992) *Eingriffe in Kopfarbeit* (Berlin: edition sigma).

Zysman, J. (1983) *Governments, Markets, and Growth: Financial Systems and the Politics of Industrial Change* (Ithaca: Cornell University Press).

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