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**National Institutions and High Tech Industries:  
A Varieties of Capitalism Perspective on the Failure  
of Germany's "Neuer Markt"**

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## ABSTRACT

### **National Institutions and High Tech Industries: A Varieties of Capitalism Perspective on the Failure of Germany's "Neuer Markt"**

by Sigurt Vitols and Lutz Engelhardt

One of the more prominent recent failures in institutional innovation in Germany was the Neuer Markt (1997-2003), a special segment of the Frankfurt stock exchange designed for high-growth companies. Based in part on insights from the law and economics approach to agency theory, which emphasizes transparency in financial reporting and shareholder rights, the Neuer Markt was an attempt to promote high-tech sectors through increasing the supply of risk capital in Germany. Proponents of the agency approach have suggested that the Neuer Markt failed because reporting requirements and shareholder protection were still inadequate, and have argued for even stricter financial regulation.

This paper offers an alternative explanation for the failure of the Neuer Markt based on the Varieties of Capitalism (VOC) approach. This explanation focuses on the complementarities between financial markets and labor markets.

Successful entrepreneurial companies require both capital and experienced managers and scientists willing to take higher risks in search of higher returns. Although the supply of risk-friendly capital increased briefly in the late 1990s in Germany, labor markets did not fundamentally change. In particular, mobility in the market for mid-career scientists and managers remains quite low, making it difficult for startups to attract the experienced knowledge workers they need to succeed.

*Keywords: Startups, Venture Capital, IPO, Stock Market, High Tech, Software*

*JEL Classification: L86, G30*

## ZUSAMMENFASSUNG

### **Nationale Institutionen und High-Tech-Industrien: Eine „Varieties of Capitalism“-Perspektive auf den Misserfolg des deutschen Neuen Marktes**

Einer der letzten bedeutenden Fehlschläge bezüglich institutioneller Innovation in Deutschland war der Neue Markt (1997-2003), ein spezielles Segment der Frankfurter Börse, das für Wachstumsunternehmen konzipiert worden war. Auf Beiträgen des Recht- und Ökonomie-Ansatzes der Agency-Theory basierend, welcher transparente Unternehmensberichterstattung und Kleinanlegerschutz betont, war der Neue Markt ein Versuch, High-Tech-Sektoren in Deutschland durch höheren Risikokapitalzufluss voran zu bringen. Befürworter des Agency-Ansatzes vertreten auch nach dem Scheitern des Neuen Marktes die Ansicht, der Neue Markt sei ein Misserfolg gewesen, da Offenlegungspflicht und Aktionärsschutz noch nicht ausreichend ausgeprägt waren. Eine ihrer Forderungen für zukünftige Politikentwürfe sind folgerichtig noch strengere Regulationen an den Aktienmärkten.

Dieser Text bietet eine alternative Erklärung für den Misserfolg des Neuen Marktes, die sich auf den „Varieties of Capitalism“-Ansatz (VOC) beruft. Sie richtet sich auf Komplementaritäten zwischen Finanz- und Arbeitsmärkten. Erfolgreiche Unternehmen benötigen nicht nur Kapital, sondern auch erfahrene Manager und Wissenschaftler, die bereit sind, auf der Suche nach höheren Erträgen das Risiko einer Anstellung bei einem Wachstumsunternehmen einzugehen. Obwohl das Angebot von risikofreundlichem Kapital in Deutschland in den späten 90er Jahren kurz anstieg, änderten sich die Arbeitsmärkte nicht grundlegend. Insbesondere blieb die Mobilität von Wissenschaftlern und Managern zur Mitte ihrer Laufbahn recht niedrig, was es für Wachstumsunternehmen schwierig machte, erfahrene Wissensarbeiter zu rekrutieren. Dies entzog jungen Unternehmen das für schnelles Wachstum und den wirtschaftlichen Erfolg benötigte Talent.

## 1. Introduction

One of the key challenges for economic policy in Germany since the 1980s has been to try to reduce the gap relative to the US with regard to the development of high technology industry ("high tech").<sup>1</sup> In the debate on the causes of this perceived backwardness, differences between the financial systems of the two countries have received special attention. In particular, the shortage of equity capital available for high risk, but potentially high return investments in startup companies (i.e. "risk capital") has been identified as a serious barrier to the development of high-tech in Germany (Albach 1983; Pfirrmann, Wupperfeld, and Lerner 1997). Although Germany has a well-developed banking system, bank lending is inappropriate for financing high tech startups due to the high risk of failure and the lack of fixed assets that could serve as security for the loans.

In addressing this issue over the past decade, the policymaking community has been strongly influenced by the law and economics approach to agency theory (Hart 1995; La Porta et al. 1997; La Porta et al. 1998; Posner 1973). In contrast with earlier work in financial economics, which focused on the cost of capital, the law and economics perspective emphasizes problems in the governance and monitoring of companies by shareholders, as well as conflicts of interest between large and small shareholders. According to this perspective, key regulatory problems in Germany have been the lack of transparency in company reporting and the weakness of shareholder rights (Hopt 1995; Hopt, Rudolph, and Baum 1997). As a result, potential investors have been discouraged from providing risk capital to high-tech startups.

Based in part on the agency perspective, a major institutional innovation was introduced in Germany in 1997: the creation of a special segment of the Frankfurt stock exchange called the "Neuer Markt" (Beike, Köttner, and Schlütz 2000; Knips 2000). In contrast with the main stock exchange, the listing rules of the Neuer Markt required more detailed and frequent reporting by companies, and also provided for stronger protection of small shareholders. Initially the Neuer Markt appeared to be a great success. The number of new companies raising capital through listing on the stock market and offering shares to the investing public (in financial jargon an "initial public offering", or IPO) increased from an average of roughly 20 per year in the first half of the 1990s to about 130 in both 1999 and 2000. Much of this activity was in "new economy" companies. The Neuer Markt became the clear leader of the set of stock markets or market segments created for small high-tech companies in Europe in the late 1990s.

However, following a sharp decline in stock prices after March 2000 (the so-called "bursting of the stock market bubble"), the level of IPO activity declined

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rapidly. Due in part to a total standstill in IPOs activity, the Neuer Markt was declared a failure by its owners and closed in 2003. Proponents of the agency approach argue that a number of scandals and cases of conflicts of interest show that regulation in fact was not strong enough to satisfy the concerns of small investors. According to this view, the policy solution to this problem is to increase the degree of regulation even further.

This paper offers an alternative point of view based on the varieties of capitalism (VOC) approach developed by Peter Hall, David Soskice, and a number of other scholars (Hall and Soskice 2001). According to this view, the main cause of failure of the Neuer Markt was not the weakness of the financial regulatory system, but rather the difficulty of transplanting individual institutional features of liberal market economies (LMEs, or countries characterized by the dominance of markets as coordinating mechanisms) such as the US to coordinated market economies (CMEs, or countries in which non-market mechanisms play a much greater role in economic coordination) such as Germany. Specifically, the broader financial system and labor markets in Germany represent a hostile environment into which it is very difficult to successfully import institutions that work well in places like Silicon Valley. On the capital market side, Germany lacks a significant capitalized pension system (the main source of equity capital in LME countries like the US) and the household sector has invested for the most part in less risky types of assets. Household investment in Neuer Markt companies in the late 1990s represented a "brief summer" of flirtation with equity culture influenced by the world wide internet euphoria. On the labor market side, the lack of an open market for mid-career scientists and entrepreneurs makes it very difficult to attract the type of labor needed to create successful high-growth entrepreneurial companies, i.e. the Microsofts and Intels of the future. As a result, no companies based on the Silicon Valley entrepreneurial model of organization have developed successful "blockbuster" products needed to achieve a high level of sales. A critical mass of such companies, it is argued here, would have been needed to sustain the Neuer Markt in the long run.

The second section of the paper reviews the debate on the "high tech problem" in Germany and the focus on financial factors as the key bottleneck here in light of agency theory. The third section describes the rise and fall of the Neuer Markt and policy prescriptions offered by the agency perspective. The fourth section offers an alternative explanation for the failure of the Neuer Markt in terms of the VOC framework. The fifth section summarizes and concludes by discussing policy alternatives for Germany in view of this analysis.

## **2. The Debate on the Weakness of High Tech in Germany**

In the 1980s a sustained debate started in Germany on the causes of a perceived backwardness in the development of newer, high-tech (i.e. research and development intensive) industries (Albach 1983; Pfirrmann, Wupperfeld, and

Lerner 1997). Although Germany was a clear world leader in so-called medium-tech industries, such as motor vehicles, machinery, and chemicals, it was less successful in the development of newer industries, such as semiconductors, computer hardware, software, and biotechnology. Indicators of backwardness here included the level of start-up activity (i.e. foundation of new firms in these sectors), world market share of high tech products, and number of high tech firms offering "blockbuster" products (i.e. research-intensive mass standardized goods, such as microprocessors or operating system software).

One possible explanation for this weakness in high tech is offered by the new institutional economics (NIE). This approach analyzes microeconomic behavior in terms of the economics of information and contracting (the "principal-agent" approach) (Berglöf 1991; Williamson 1985; Williamson 1988). Information is assumed to be both imperfect and costly. Furthermore, relationships between parties are subject to "moral hazard"; that is, agents will engage in self-interested opportunistic behavior in the absence of monitoring mechanisms and incentives to behave in the contracting principal's interests. Cross-national differences in financial contracting can in part be explained by the varying levels of success different legal and regulatory regimes have in increasing transparency and controlling opportunistic behavior (Berglöf 1991; La Porta et al. 1997).

A leading example of this type of analysis is provided by the influential article "Legal Determinants of External Finance" (La Porta et al. 1997). In this article La Porta et al. examine the relationship between types of legal regimes and financial regulations on the one hand and a number of indicators of national financial development on the other hand. Regression analysis of these variables for 49 countries explains about half of the cross-national variation in IPO activity (the rate of IPOs per million population) in 1995-96. This analysis, it is argued, shows that the nature of the legal system is the most significant determinant of the IPO rate. Common law systems predominant in English-origin countries are particularly supportive of IPOs. Specific financial regulations also have a significant positive impact, including the "one share-one vote" principle and rights enabling shareholders to overcome management opposition. The GDP growth rate variable was also significant, but the size of the coefficient was small; the absolute level of GDP was not a significant variable. The implications of this analysis is that countries can improve their level of financial development, including the rate of IPO activity, by adopting elements of the common law system and/or financial regulations strengthening shareholder rights.

Policy analyses based on this approach have put major emphasis on the need for strict regulation to promote the supply of "risk capital" to finance the growth of the firm. High tech firms generally loose substantial amounts of money in the first years after foundation. In the earliest stage of growth (start-up phase), the firm incurs costs for research and development (R&D) for new products, but generally earns little or no income (see Table 1). In the expansion stage the firm's revenue increases with growing sales of new products. However, the firm frequently is not

yet profitable due to the costs of expanding production facilities and/or sales and marketing operations. Only in the later stages of development will the firm have a stable profits base due to an established market and economies of scale.

**TABLE 1: Profitability and Potential Sources of Finance at Different Stages of the Firm's Development**

<b>Stage of High-Tech Business Development</b>	<b>Profitability of company</b>	<b>Sources of Finance</b>
Seed and Start-up	Little or no revenue, i.e. ca. 100 % losses	Founder Early-stage venture capital Business angel
Expansion	Decreasing losses	Later stage venture capital Growth stock market IPO
Later stage	Profitable	Traditional stock market IPO

Source: Own compilation.

In this context, the institutional structure of the German financial system has been criticized for not satisfying the needs of startup firms and risk-friendly investors (Beike, Köttner, and Schlütz 2000; Knips 2000). Until the mid 1990s a key feature of the German financial system was that the universal banks controlling the Frankfurt stock exchange only allowed IPOs of companies with a solid history of profitability. Loss-making high tech companies in the early stages of development were therefore excluded from the market.

A second problem was lack of transparency, which made it difficult for investors to judge the risks involved in investing in high tech companies. Whereas the practice for companies listed in the US is to report their financial status on a quarterly basis (i.e. every three months), German listed companies for the most part would report on an annual basis, or only provide limited quarterly information. Furthermore, German companies used German HGB

(Handelsgesetzbuch, i.e. Commercial Code) accounting standards, which were considered to give companies too much leeway in deciding how to report their financial situation and hide income. Furthermore, companies were not required to provide a cash-flow statement to supplement the balance sheet and income statements.

Finally, minority shareholder protection was considered inadequate. Insider investors (e.g. founders and family) and large institutional investors typically have greater influence and better access to information than small shareholders. This advantageous position can be used to make money by purchasing shares before positive information becomes public (or losses avoided by selling before negative information becomes public).

These weaknesses were held to prevent or to discourage not only potential investors in the IPOs of growing high-tech companies, but also to stunt investment in much younger companies many years away from an IPO. The early-stage portion of the venture capital market is dependent upon an active stock market, since venture capitalists typically would not invest in early-stage companies without the possibility of exiting their investments a few years later through an IPO. In the first half of the 1990s there was much less German venture capital activity than in the US, and this activity was concentrated much more in later stage companies than was the case in the US (Pfirrmann, Wupperfeld, and Lerner 1997).

### **3. The Rise and Fall of the Neuer Markt**

The agency perspective had a great influence on the institutional design of the Neuer Markt, which was founded in March 1997, as well as on other growth markets in Europe founded around the same time (Garz, Gilles, and Volk 1999; Posner 2000a; Posner 2000b). In the 1970s and early 1980s, financial economics literature stressed the cost of capital and the hierarchy of finance (i.e. differential preferences for different types of financing). In 1987 a special segment of the Frankfurt stock exchange (the "geregelter Markt") was created under the influence of the "cost of capital" approach. This approach emphasized the higher cost of capital for smaller firms, due in part to the high fixed costs involved in an IPO. Less strict regulation for smaller firms was recommended to compensate for these higher costs. However, the "geregelter Markt" failed to significantly increase the number of IPOs in Germany.

The Neuer Markt was designed to address a number of deficiencies in the main stock market in Frankfurt vis-à-vis smaller growth companies (Vitols 2001). Specific features of the Neuer Markt included:

- Greater *transparency* for investors, particularly for smaller "outsider" investors who did not have intimate access to company management.

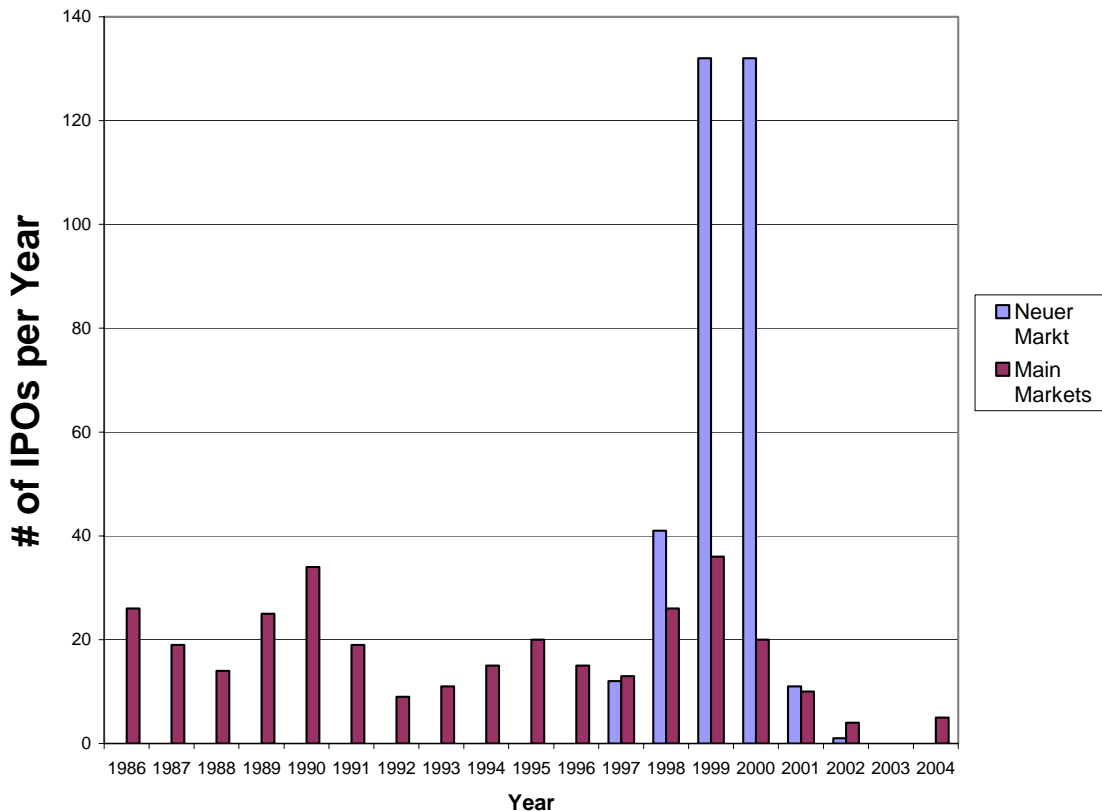
Companies listing on the Neuer Markt were required to report on a quarterly basis (i.e. more frequently than companies on the main market). Furthermore, international accounting standards (US-GAAP or IAS), which were considered more reliable than the German HGB standards, were to be used;

- *Liberal listing requirements*, which allowed relatively new companies as well as loss-making companies to get a listing;
- *Increased protection for small shareholders*, for example in defining a minimum period of time after the IPO during which inside investors could not sell their shares ("lock-up period").
- *Greater liquidity*, that is, the ability to buy or sell shares near the current market price, provided through a system of designated sponsors obligated to provide bid-ask market quotes (prices at which the designated sponsor would buy or sell shares).

Thus the Neuer Markt was designed to mimic a number of aspects of the US NASDAQ (National Association of Securities Dealers electronic exchange), home of high-tech successes such as Microsoft, Intel, Cisco Systems, JDS Uniphase, Dell Computer, Biogen and Amgen.

Initially the Neuer Markt got off to a slow start, with only twelve IPOs in 1997 (see Chart 1). In addition, a number of companies transferred from other segments of the Frankfurt stock exchange. Nevertheless, some of these turned out to be rapid successes, such as the new mobile phone company Mobilcom, one of the main winners in the newly deregulated telecommunications market. Word of these successes spread, and the developing mythology of the "new economy" attracted many first-time investors to the stock market. In 1998, despite the serious (but temporary) stock market decline caused by the Asian crisis, the number of IPOs climbed to 41. During the peak of the bubble in 1999 and 2000 there were more than 130 IPOs annually. At the same time, the number of IPOs on the main market increased only slightly.

**Chart 1: IPOs in Germany: Neuer Markt and Main Markets (1986-2004)**



Source: Frankfurt Stock Exchange

The success of the Neuer Markt was based in part on widespread media coverage, which reached people previously not invested in the stock market. For example, the business television station "ntv" reported every half hour from the floor of the Frankfurt stock exchange. Popular publications including not only staid weeklies such as Spiegel but also television guides and fashion magazines expanded their coverage to include recommendations for purchasing stocks from the Neuer Markt.

By 2000 the Neuer Markt had become by far the most significant growth stock market in Europe, accounting for over 50% of market capitalization, and overtaking markets in countries with more developed equity markets, such as the UK's AIM and France's Nouveau Marché (WestLB/Panmure Research 2000). Significantly, the Neuer Markt also had become a platform for IPOs for companies from other countries, including the US. The composition of the Neuer Markt appeared to be solidly high-tech, with 22 percent of the listed companies classified as Internet companies, 19 percent as technology companies, and 17 percent as software companies. As time went on, an increasing proportion of

these companies were venture-capital backed, as a parallel rapid expansion was also taking place in the venture capital industry in Germany. In 2000, the German Venture Capital Association reported that half of all Neuer Markt IPOs had some form of venture capital participation. In a relatively short period of time, it therefore appeared as if Germany had successfully reformed its financial system so it was capable of supporting both “old” and “new” economy companies. However, this hubris rapidly turned out to be short lived.

At the end of March 2000, after reaching an all-time high of over 9000, the Nemax all-shares index (composite index for companies on the the Neuer Markt) began a rapid descent that would bring it down to 300 by 2002. Perhaps even more devastating for the reputation of the Neuer Markt than this decline of over 96% in stock market value, however, was the growing number of scandals that were emerging. Most of these involved managerial misrepresentation of the financial situation of the company. The most audacious of these was at Comroad, an internet company, where an investigative journalist found that 98 % of the sales for the first half of 1999 were accounted for by one contract with a nonexistent Hong Kong firm.

However, the scandals uncovered spread beyond company managers, including price manipulation by the investment manager of one of the major funds specializing in small firm investment (Kurt Ochner, known at the time as “Mr. Neuer Markt”). Conflicts of interest were also uncovered for stock analysts and for the issuing departments of investment banks.

This tarnished reputation, as much as the loss in share prices, led the Deutsche Börse in late 2002 to announce that it would be closing down the Neuer Markt by the end of 2003. As an alternative, it would restructure the stock indexes on the main market in order to try to accommodate the needs of high tech companies and their investors. Neuer Markt survivors meeting minimum standards for transparency and corporate governance would be pooled together with old economy companies in the new Prime Standard segment. The largest surviving technology companies would be included in the new technology index (TecDax 50); Neuer Markt companies not meeting the minimum standards would be relegated to the segment named the General Standard. In all, the Neuer Markt experiment lasted six years.

#### **4. The Failure of the Neuer Markt: A Varieties of Capitalism Approach**

The conventional wisdom for the failure of the Neuer Markt in Germany focuses on the inability of regulators to adequately control “moral hazard” on the part of company managers and finance professionals vis-a-vis the investing public. In part influenced by this view, the government has responded by trying to tighten up company and securities law and by beefing up the enforcement capacities of the financial services regulator, BaFin (Bundesanstalt für Finanzdienstleistungs-

aufsicht). In March 2003 the federal finance ministry announced a 10 Point Plan defining a roadmap for passing legislation designed to improve transparency, to create new mechanisms for minority shareholder complaints, and to increase penalties for violators of securities law.

Although the agency approach offers a simple, attractive explanation for the failure of the Neuer Markt which appears to have been accepted by policy-makers, a number of facts cast doubt on the plausibility of this approach. One concern is that IPO activity stopped not only on the Neuer Markt, but also on the main Frankfurt market. Despite the increase in the level of the regulation overall, there were no IPOs on the main market at all in 2003, and only five in 2004. In other words, the decrease in activity below levels typical of the early 1990s would seem to indicate some type of shock to the investment community and financial system that spread beyond the Neuer Markt, i.e. of deeper problems within Germany.<sup>2</sup>

A second, related concern is that IPO activity since the bursting of the bubble has recovered significantly in many other countries. In the US, there were 85 IPOs with a value of \$15.8 billion in 2003 and 219 IPOs worth \$42.3 billion in 2004 (as of early December). Even more interesting is the contrast with the UK. In this country there were 94 IPOs in 2003 and 305 in 2004. It is particularly significant that the bulk of these (84% in 2003 and 86% in 2004) occurred on AIM (Alternative Investment Market) rather than the London Stock Exchange's main market. AIM is in fact much less regulated than either the main market or the German stock exchanges (PriceWaterhouseCoopers 2002). This would indicate that investors are less concerned with the level of regulation than suggested by the principle-agent approach, and that something else is driving cross-national differences.

A third concern is that, although scandals admittedly occurred on the Neuer Markt, in fact the extent of "moral hazard" activity arguably was much less in Germany than in the US, the "model" for tight securities regulation. For example, the percentage of IPOs accounted for by loss-making companies during the peak of the bubble was much lower in Germany than in the US. Furthermore, the finance scandals in Germany clearly paled in significance in comparison with the Enron scandal in the US. These facts cast doubt on the efficacy of the principal-agent approach in explaining the failure of the Neuer Markt.

An alternative explanation is provided by the varieties of capitalism (VOC) approach (Hall and Soskice 2001). In a nutshell, this approach makes a number of strong claims about the way advanced industrial economies function. The first claim is that the national institutional framework is a key determinant of how firms

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<sup>2</sup> Although there also appears to be some cyclical variation in IPO activity related to the business cycle, low economic growth since 2000 in Germany would not appear to explain all of the slowdown in IPO activity. During the 1992/93 post-unification economic crisis, which was arguably more severe than the 2000/01 recession, there were at least ten IPOs per year.

operating within this framework are organized and behave. The second claim is that economies can be analytically broken down into a number of discrete subsystems, such as financial systems, training and education systems, industrial relations systems, and R&D/technology transfer systems. The third claim is that there are strong complementarities between these subsystems. Economies with well-matched institutional subsystems will enjoy comparative advantages, whereas an institutional mismatch can adversely affect the operation of the economy. Finally, from a VOC perspective, advanced capitalist economies fall into two broad groups: liberal market economies (LMEs), such as the U.S.A. and the U.K., in which markets play a dominant role in economic governance; and coordinated market economies (CMEs), such as Germany, Japan, and Austria, in which non-market mechanisms play a particularly strong role in economic governance. LMEs are considered to offer a particularly supportive institutional environment for radical product and process innovation, e.g. in the high-tech industry, whereas CMEs are better at incremental innovation in medium-tech industries such as automobiles or machine building.

**TABLE 2: STYLIZED CHARACTERISTICS OF ENTREPRENEURIAL AND CONVENTIONAL FIRMS**

<i>Characteristic</i>	Entrepreneurial	Conventional
<i>Innovation Pattern</i>	Radical innovation	Incremental innovation
<i>Standardization</i>	High. Operations and production are easy to scale.	Low. A high proportion of costs are variable (labor, etc.).
<i>Profitability</i>	Loss making in the R&D stage. Highly profitable once consolidated.	Moderate profitability throughout the entire business history.
<i>Growth</i>	Offensive growth orientation.	Defensive growth orientation.
<i>Finance</i>	Risk-tolerant equity (venture capital, IPO)	Risk-averse debt.

Source: Own compilation.

Of particular interest for a VOC approach to high tech IPOs are the complementarities between financial systems and labor markets and the resulting implications for stock markets. A key distinction to be made here is between *entrepreneurial* and *conventional* firms (Engelhardt 2004; Engelhardt 2005) (see Table 2):

- Entrepreneurial firms attempt to develop radically new, standardized products, the production of which can be multiplied at decreasing costs

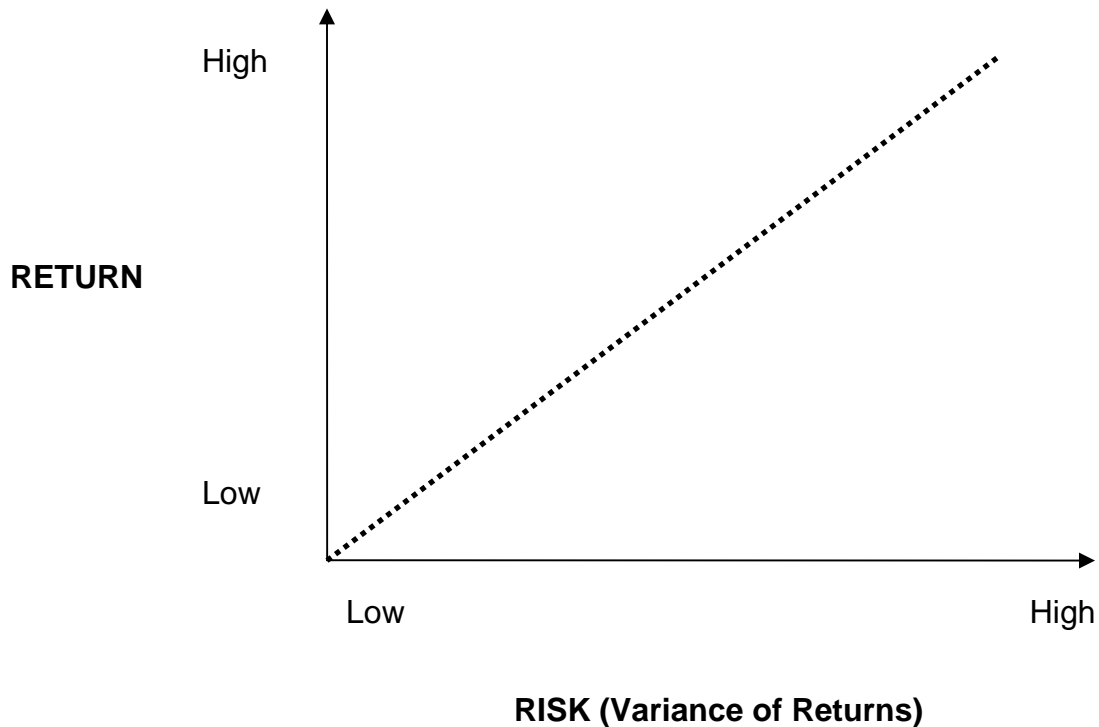
(economies of scale). Companies attempt to rapidly achieve a dominant position in the new market. Potential rewards are very high, particularly if a mass market develops for the product ("blockbuster"); economies of scale mean that profits increase more rapidly than the increase in production. Investors may therefore reap very high rewards as the value of the firm grows, and employees may also benefit financially, particularly if they are granted stock options in the company. However, the entrepreneurial company also involves high risks for both investors and employees. Companies developing radically new products have a high risk of failure, thus employees may lose their jobs and investors may lose the initial capital they invested in the company.

- Conventional firms in contrast concentrate on competing in established markets through offering products with incremental improvements. The potential growth rate in sales and products is thus limited. The risks of job loss and capital loss are lower for employees and investors, but potential rewards are also lower.

The successful high tech firms listed on US Nasdaq correspond to the entrepreneurial type of firm. Firms such as Microsoft (operating systems software), Intel (microchips), and Cisco Systems (network hardware) all started out by offering a standardized, but radically new type of product that enjoyed economies of scale and created a new market. Although conventional high-tech firms do exist, they tend to focus on providing customized software for one or a limited number of customers, or IT services.

An important empirical regularity in financial economics is the positive relationship between the *return* and *risk* of different asset classes (Bernstein 2001; Dimson, Marsh, and Staunton 2002). Return is the increase in the value of the initial investment in the asset. Risk is the variance in the returns of an asset class. Concretely, although expected returns may be positive, the investor faces the risk that annual returns for a number of years after the investment is made may be negative. The intuition behind this relationship is that investors will demand a risk premium (i.e. higher expected returns) for riskier assets (i.e. those with more volatile returns). This general relationship is summarized in Figure 1, which shows the positive relationship between return and risk (defined as the variance of returns).

**FIGURE 1: RISK-RETURN RELATIONSHIP IN INVESTMENTS**



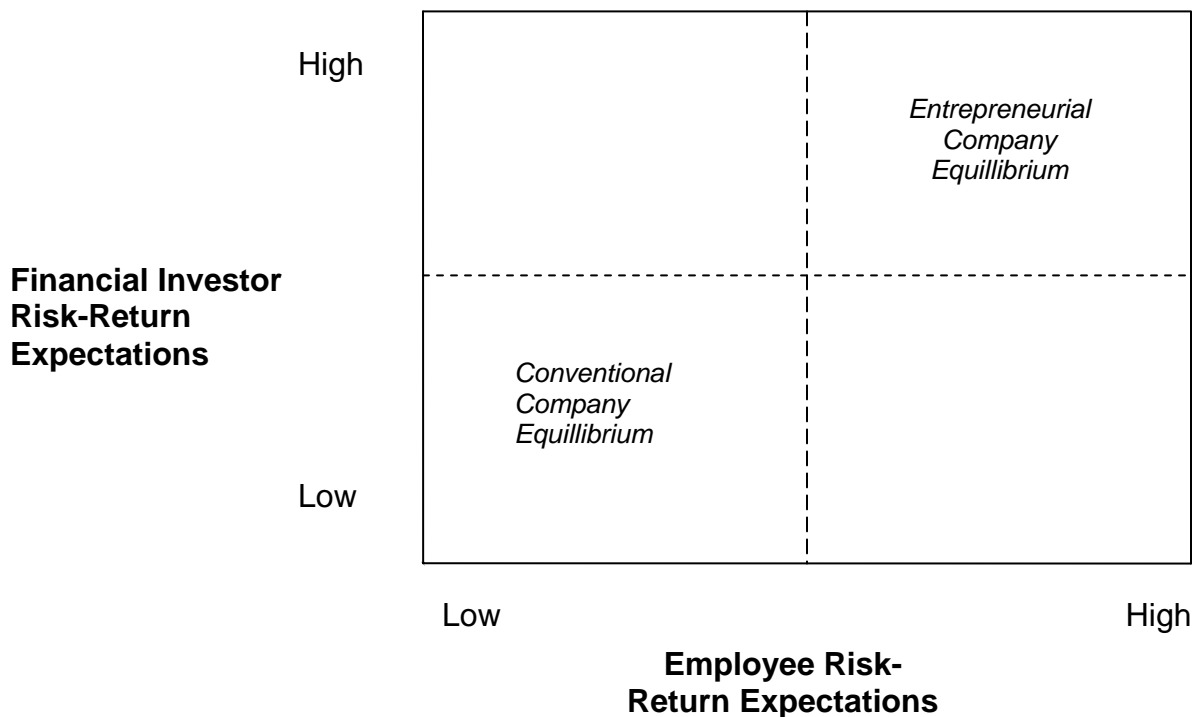
The concept of investors with different preferences for reward and risk is well known from financial economics (see section 4.1 below), but can also be applied to human capital. Due to the greater probability of bankruptcy, entrepreneurial firms involve higher risks for employees than conventional firms. Employees will thus demand strong financial incentives from the company in the form of stock options or incentive pay, so that they will enjoy high financial rewards in case the company is successful. Risk-averse managers, however, will be reluctant to work for a startup company, even if the expected returns may be high.

The primary thesis presented here is that successful entrepreneurial firms require an adequate supply of both risk-tolerant capital and experienced, risk-tolerant entrepreneurial managers and scientists. This situation can be displayed graphically (see Figure 2). The vertical dimension represents the risk-reward profile of investors; investors at the bottom will be willing to invest in low risk, low reward products, whereas investors at the top will be willing to incur higher risks in the expectation of higher rewards. A parallel can be made for labor markets, displayed on the horizontal axis. Risk-averse managers and scientists will be willing to take jobs in which the potential financial rewards may not be large, but the risk of job loss is low (left side of Figure 2). Conversely, risk-loving managers

and scientists will be willing to accept a high risk of job loss if potential rewards are quite high (right side of Figure 2).

The lower left hand quadrant of Figure 2 can thus be understood as an equilibrium for conventional firms, in which both the financing and labor available seek low risk, low reward possibilities. The upper right quadrant, in contrast, represents an equilibrium for entrepreneurial firms, in which both investors, managers and scientists are willing to incur higher risks in search of higher rewards. The upper left hand and lower right hand quadrants, on the other hand, represent disequilibria, in which the risk profiles of investors and employees do not match.

**FIGURE 2: RISK-RETURN EXPECTATIONS AND EQUILLIBRIA FOR ENTREPRENURIAL AND CONVENTIONAL COMPANIES**



The following sections detail shifts in the financial market and labor market position of Germany within the context of a discussion of the Varieties of Capitalism approach. It will be argued that Germany experienced a temporary shift from the low to high financial market risk-return expectations in the late

1990s, but that labor market expectations did not fundamentally change. Graphically, Germany shifted from the lower left hand quadrant (conventional company equilibrium) to the upper left hand equilibrium (position of disequilibrium) in the late 1990s, but reverted to the lower left hand quadrant in 2000/2001.

#### 4.1 Supply of Risk Capital

An important general finding in financial economics is that there is a positive relationship between the *return* and *risk* of different asset classes (Bernstein 2001; Dimson, Marsh, and Staunton 2002). The intuition behind this relationship is that investors will demand a risk premium (i.e. higher expected returns) for riskier assets (i.e. those with more volatile returns). Table 3 displays the risks and rewards typically associated with three different types of financial assets: bank loans/bonds, stock in large, established ("blue chip") companies, and stock in young companies.

**TABLE 3: RISK-RETURN CHARACTERISTICS OF DIFFERENT ASSET CLASSES**

Type of Investment	Risk	Reward
Bank Loan or Bond	Low	Low
Stock in Established Company	Medium	Medium
Venture Capital or Stock in Growing High Tech Company	High	Potentially High

Source: Own compilation.

Table 4 provides an empirical illustration of this relationship based on historical data for different US asset types:

**TABLE 4: Return and Risk on Different US Asset Classes, 1926-98**

<b>Asset Class</b>	<b>Annualized Return 1926-98 (%)</b>	<b>Standard Deviation 1926-98 (%)</b>	<b>Worst single year return 1926-98 (%)</b>
1 Month US Treasury bill	3.77	3.22	0
5 Year US Treasury note	5.31	5.71	-2.65
Large company stocks	11.22	20.26	-43.3
Small company stocks	12.18	38.09	-58.0

Source: (Bernstein 2001: 10).

- Short-term debt issued by the US government (1 month US treasury bills) is considered the safest investment by financial investors. The risk that the US government will default on its debt is seen to be virtually zero. In no single year in the period 1926-98 did investors in this asset experience a loss.<sup>3</sup> However, this asset class also had the lowest returns (3.77 % on an annualized basis);
- Medium-term US government debt is also considered quite safe in terms of default risk. However, the value of this debt fluctuates with medium-run inflation expectations. A purchaser of a 5 year Treasury note, for example, is exposed to the risk that expectations of inflation may increase after the purchase, leading to a decrease in medium-term interest rates and thus a decrease in the nominal value of the securities. The volatility of returns between 1926-98 has thus been about 75 percent higher for 5 year notes than for 1 month bills, with the worst annual return amounting to 2.65 percent. Investors have thus demanded a risk premium relative to 1 month bills of about 2.5 percentage points (5.31 percent versus 3.77 percent) on an annualized basis;

<sup>3</sup> The volatility in returns arises from the fact that short-term interest rates fluctuate with monetary policy and inflation expectations. Reinvesting the capital on a monthly basis thus has some variation in returns due to these shifting interest rates.

- The return on the stocks of large companies is substantially higher than the return on US government debt (11.22 percent on an annualized basis). However, the volatility of returns is almost four times higher than that for 5 year notes and more than six times higher than that for 1 month bills (standard deviation of about 20 %). The maximum loss in a single year came to 43 percent during 1926-98; and
- Small company stock offers the highest return of all asset classes shown (12.18 percent annualized return), but also involve by far the highest risk, with almost twice the volatility of large company stocks and a maximum annual loss of 58 percent.

In practice most investors are not be prepared to invest in all types of assets. Instead, investors are distinguished by different risk-reward preferences. Risk-averse investors will prefer assets with a low expected return and low variability of returns ("low risk"). Risk-loving investors, on the other hand, are willing to accept a higher level of risk in order to achieve a higher expected level of return.

Since different types of assets have varying risk-reward profiles, heterogeneity in risk preferences among investors lead to different levels of demand for different kinds of financial assets. Risk-averse investors will find loans or company bonds most attractive, since these assets offer a low return (generally a fixed interest rate) but also lower risk. In the event of company bankruptcy, loan or bondholders are repaid before holders of other types of financial claims, such as shareholders. Investors with moderate levels of risk aversion, on the other hand, will be attracted to stocks in established companies; historically, stocks have offered a significantly higher return than bonds, but also carry somewhat higher risk, since shareholders are the last claimants in case of company bankruptcy (Siegel 1994). Finally, risk-loving investors will be attracted to investments in venture capital or in the stock of growing high-tech companies, since they are willing to accept a high risk of non-repayment in return for the exceptional returns that may be realized from investments in rapidly-growing companies.

LMEs and CMEs differ substantially in their ability to provide risk capital to stock markets. Table 5 details the rate of IPO activity in different countries. LMEs have a significantly higher rate of IPOs over the past decade and a half, at between roughly 40 to 60 IPOs per million residents. The most important CMEs, Japan and Germany, have a fraction of the IPO activity experienced by LMEs over this period.

**TABLE 5: Rate of IPOs in Different Countries, 1986-2002**

Type of Country	Country	IPO Rate per million residents
LMEs:	Canada	61
	UK	55
	Australia	51
	US	45
CMEs:	Japan	12
	Germany	7

Sources: Own calculations from (Deutsches Aktieninstitut 2003; How and Yeo 2002; PriceWaterhouseCoopers 1998; PWC 2000; PWC 2004).

One factor affecting the potential amount of risk capital supplied to stock markets is the distribution of retirement income provision between the "three pillars" of household savings at pension funds, i.e. state pensions, occupational/company pensions and private retirement savings. Pension funds have become the most important investor in the stock market in countries like the US and UK. Countries in which the large bulk of retirement savings are provided by state "pay as you go" pension systems by definition will have less capacity to provide a pool of risk capital coming from pension funds or private pension savings.

**TABLE 6: Percentage of Retirement Income Provided by State Pensions, late 1990s**

Country	% of Retirement Income from State Pensions
LMEs:	
UK	61
US	46
CMEs:	
Spain	92
Austria	92
Germany	82
Italy	74
France	51
Netherlands	49

Source: Deutsche Bank Research, Deutsches Institut für Altersvorsorge

Retired persons in Germany have one of the highest levels of reliance on state pensions in the OECD (see Table 6). In the late 1990s, an estimated 82 percent of total income of retirees was accounted for by the state pension system. Furthermore, company pensions in Germany are for the most part funded out of book reserves set aside within the company's balance sheet, rather than out of capitalized pension funds (Jackson and Vitols 2001).

A second factor influencing the supply of risk capital to the stock market is the financial risk preferences of the household sector. German households have a particularly high aversion to risk in financial investment in comparative perspective. One indicator for this is the low percentage of households with direct or indirect (i.e. through equity mutual fund) share ownership (see Table 7).<sup>4</sup>

**TABLE 7: Percentage of Households with Share Ownership, by Country (ca. 2000)**

Type of Country	Country	Direct Ownership	Direct and Indirect Ownership
LMEs:	Australia	39	51
	US		51
	Canada		48
	New Zealand	30	44
	UK	27	34
CMEs:	Switzerland	28	30
	Sweden	22	
	France	15	23
	Netherlands	14	24
	Hong Kong		20
	Germany	9	19
	Italy	7	15
	Korea		8

Sources: (Australian Stock Exchange 2004; Deutsches Aktieninstitut 2003; Guiso, Haliassos, and Jappelli 2003: Table 4).

<sup>4</sup> The reasons for these cross-national differences are not well understood. Financial wealth and income are generally positively correlated with the proportion of household assets invested in risky assets such as stocks. However, coefficients on country dummies in regressions on individual level data pooled together from different countries are generally large and significant (Guiso et al. 2003). Historically, government policies towards mass share ownership have varied widely. For much of the twentieth century, German governments have taken a critical view toward mass participation in the stock market.

There was no significant change in retirement policy in Germany in the second half of the 1990s which would have yielded a significant growth in pension funds investing in the stock market. However, there was a major increase in the amount of funds the household sector invested in the stock market through the vehicle of equity funds. Detailed figures available for US and Germany show that the rate of investment in equity funds in Germany in the first half of the 1990s was about one tenth the level in the US (Table 8). The rate of investment increased in both countries in the late 1990s, but much more dramatically in percentage terms in Germany than in the US (ca. 1000 percent versus ca. 50 percent). In the period 2001-2003 household investment in equity funds in both countries has returned to historical norms.

**TABLE 8: Annual Average Investment per Capita in Equity Funds, in US Dollars, 1991-2003**

Country	1991-96	1997-2000	2001-03
US	420	662	385
Germany	37	417	66

Sources: US Flow of Funds data, BVI Jahrbuch.

Note: German data adjusted for Purchasing Power Parity (PPP)

#### 4.2 Labor Markets for Scientists and Managers

As noted above, a key part of the argument is that the success of entrepreneurial startups is influenced by the characteristics of both labor markets and financial markets. In particular, CMEs have considerably less open labor markets for mid-career scientists, engineers and managers. In systems where employees are oriented towards long-term careers with the same company, and in which training and socialization takes place after entry into this company, it is difficult to get a job at another company in mid-career. This therefore creates a "vicious circle" situation, where it is not easy to recruit experienced engineers and managers for risky start-ups, since many are not willing to take the risk of not being able to reenter the labor market at an established firm after the failure of a startup.

The importance of mid-career labor markets can be seen when examining the career histories of founders of successful US entrepreneurial software companies (see Table 9). These companies have achieved annual sales of at least \$ 200 million in 2003 and fulfill the definition of "entrepreneurial" outlined

above. It is striking that, although the mythology of the "whiz kid" entrepreneur is widely accepted, only Bill Gates fits the profile of a very young person with no extensive work experience. In fact the typical entrepreneur is in his mid-30s to mid-40s and has significant experience with a high technology company.

**TABLE 9: Characteristics of Founders of Successful US Entrepreneurial Software Companies**

Company	Software Sector	Founding Year	Founder Name	Age at Founding	Work Experience Prior to Foundation
Microsoft	Operating Systems	1975	Bill Gates	20	Minimal
Oracle	Database	1977	Larry Ellison	33	Ampex Corp., CIA
BEA Systems	Infrastructure/ Network Management	1995	William Coleman III	47	Sun Microsystems (10 years)
			Ed Scott	56	Pyramid Technology (7 years), Sun Microsystems (3 years)
			Alfred Chuang	33	Sun Microsystems (9 years)
Adobe	Graphical Software	1982	Charles Geschke	43	Xerox (ca. 10 years)
			John Warnock	42	Xerox (4 years)
VeriSign	E-commerce	1995	James Bidzos	40	RSA (9 years)
Citrix Systems	Enterprise Network	1989	Edward Iacobucci	35	IBM (11 years)
Documentum	Document Management	1990	Howard Shao	35	Ingres (database software) (6 years), TTI/Citicorp (3 years), Transtech (startup)
Hyperion Solutions	Management information	1991	James Dorrian	38	Solutions Technology, Thorn EMI Computer Software
i2	Resource Planning	1988	Sanjiv Sidhu	31	Texas Instruments

Sources: SEC Filings, Company Websites

There is substantial evidence, however, that the mobility of founders and personnel involved in R&D is quite low and mid-career labor markets are underdeveloped in Germany. One source of evidence is European Community Labour Force Survey data on the mobility of HRST (Human Resources in Science and Technology). HRST include scientists, engineers, and R&D-related managers. This survey confirms the picture of broad differences between LMEs and CMEs and of particularly low mobility in Germany (Stimpson 2000). The mobility statistic reported in Table 10 represents the percentage of personnel that

have started a new job in the past year. The two LMEs in the study (Ireland and the UK) are among the top three countries in terms of the mobility of HRST personnel in high tech industry. The only exception to the rank ordering is Spain (a CME), which has the highest rate of mobility in high tech industry.<sup>5</sup>

Germany, on the other hand, is second to last in mobility in high tech among the countries under study. The mobility rate in the UK is almost twice as high as the rate in Germany (18.3 percent versus 10.1 percent). This figure likely understates the differences in the degree of mobility for mid-career personnel. The figure is skewed by very high mobility rates (ca. 50 percent) for persons aged 20 to 30 who are starting their first job. A rate calculated for persons aged 35-55 would most likely reveal much stronger differences between countries in mobility.

**TABLE 10: MOBILITY RATES OF SCIENCE AND TECHNOLOGY (HRST) PERSONNEL, 1997**

Country	HRST Mobility Rates		
	High Tech	Information and Communication Technology	Whole Economy
Spain	23.8	24.0	22.9
Ireland	22.6	27.2	16.4
UK	18.3	24.5	16.9
Netherlands	13.7	18.8	8.8
Finland	13.5	21.4	16.9
Sweden	13.4	17.7	10.3
Belgium	12.9	15.6	10.0
Denmark	12.3	15.5	14.6
France	10.9	12.1	13.2
Norway	10.7	18.7	16.9
Germany	10.1	13.1	10.9
Italy	6.9	6.6	6.1

Source: (Stimpson 2000: 11)

In general economic growth rates have been higher in LMEs than in CMEs in the past decade. Economic growth would help explain part of the differences in mobility, since countries with a higher growth rate would be expected to create more new jobs. Nevertheless, important structural features of labor markets in different countries appear to be quite different. One important study (Mason and Wagner 1999), for example, showed that recruitment practices for HRST

<sup>5</sup> We do not have a full explanation of why Spain has the highest level of HRST mobility. Partial factors may include the rapid growth of high tech industry in Spain as well as the flexibility that the extensive use of temporary contracts in that country creates.

personnel in the UK and Germany were quite different, with mid-career labor markets being much more open in the UK:

"The differences in the mix of new and experienced graduate recruits observed in the British and German electronics samples are therefore closely linked to inter-country differences in higher education structures and industry linkages. New First degree graduates in Britain have typically followed shorter, narrower courses of study than their German counterparts and are also less likely to have had any serious exposure to industrial workplaces. Hence, **a key reason for British sample employers recruiting only 30% of new graduate recruits directly from university is simply that such new, young graduates are unlikely to be 'effective from Day One'** and will indeed require considerable training when they first start."

"At the same time, however, British managers also stressed the advantages of bringing in new scientists and engineers with experience of RD&D in other organisations and contexts. **External recruitment of this kind was seen as a powerful way of gaining access to knowledge and ideas which were not available in written form. This process would often be incremental in nature, with new team members regularly drawing on their experience elsewhere to suggest 'new ways of looking at things'**, for example, different ways of tackling problems or applying knowledge already existing within each firm. Without such inter-firm mobility, British managers argued, their RD&D activity was likely to become 'incestuous' and fall victim to the 'not invented here' syndrome (Mason and Wagner 1999: 20)."

Longitudinal data calculated over the late 1990s indicates a general trend towards somewhat higher mobility rates across countries, but no radical changes in the degree of mobility or in the rank ordering of countries (Stimpson 2000). The German labor market for mid-career managers and scientists does not appear to have become significantly more open over the past half a decade.

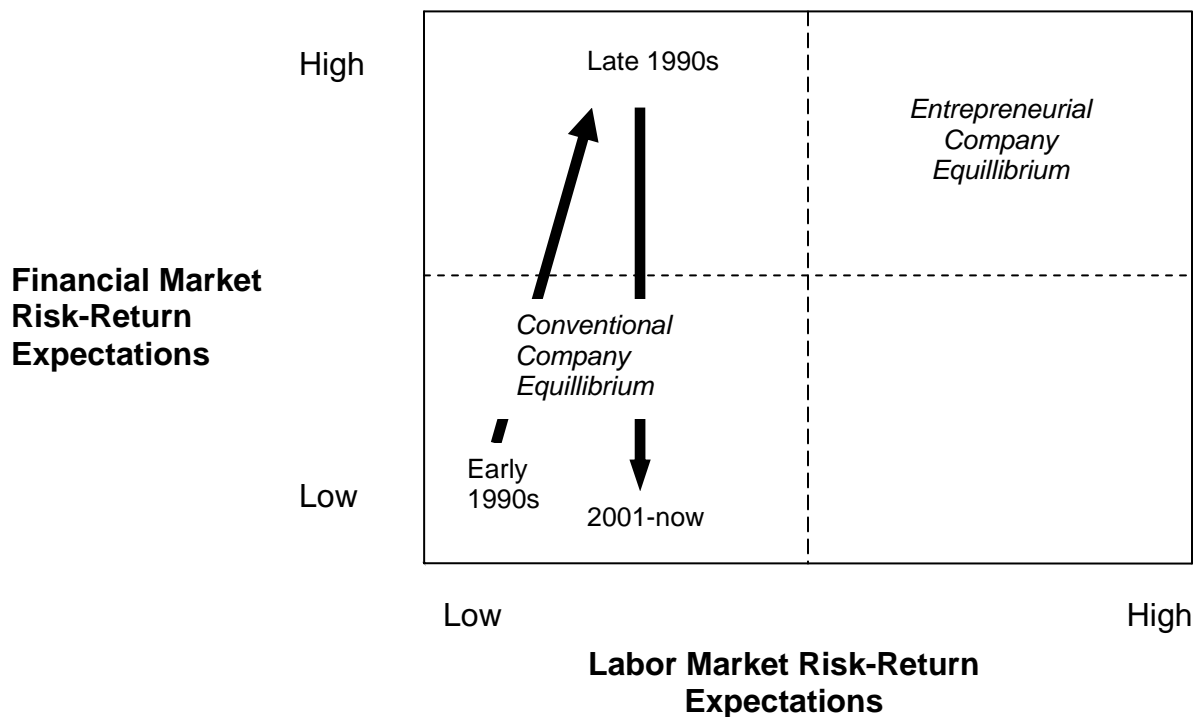
### 4.3 Summing Up

The shifting position of Germany can be displayed on Figure 3 as follows. Prior to 1997, Germany was located in a conventional company equilibrium in which both investors and employees had a low risk-reward profile. In the late 1990s there was a significant increase in the amount of risk capital. The surge in high tech IPOs on the Neuer Markt was attributable to this brief surge in the availability of

risk capital. Since 2001, however, the supply of risk capital has reverted to levels corresponding more to the norms of the 1980s and first part of the 1990s.

German labor markets, however, never fundamentally changed, and a large supply of experienced managers and scientists willing to join startup companies never developed. Although startup companies on the entrepreneurial model were able to attract risk capital, they never had enough experienced managers and scientists needed to succeed. Thus in the late 1990s Germany briefly shifted up to the upper left hand quadrant (a situation of disequilibrium). Since then it has shifted back to the conventional company equilibrium in the lower left hand quadrant.

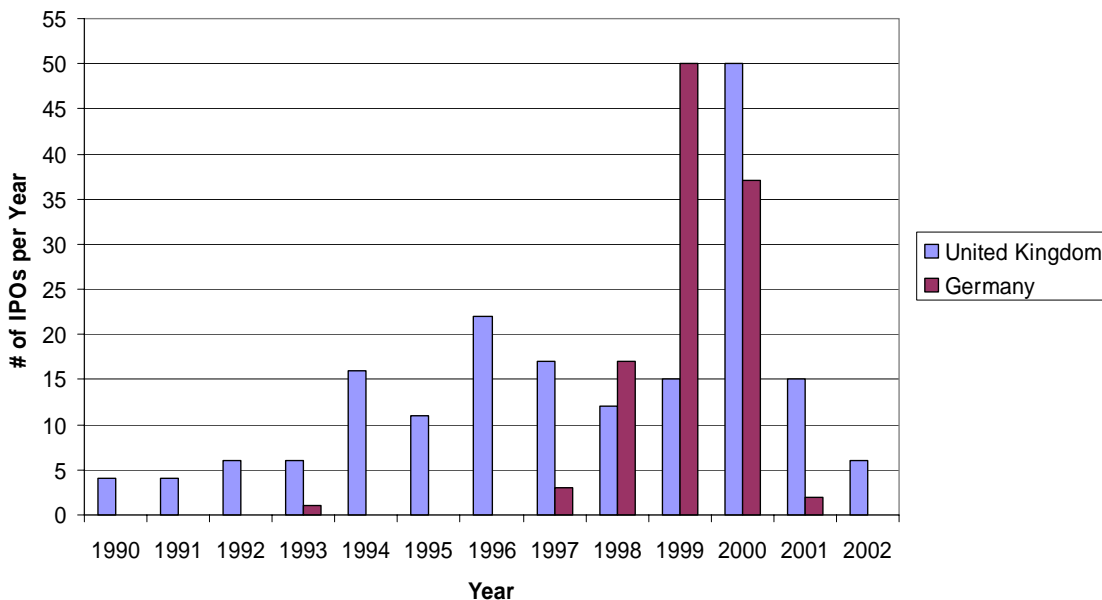
**FIGURE 3: RISK-RETURN EXPECTATIONS IN GERMAN LABOR AND FINANCIAL MARKETS**



#### 4.4 Evidence from the Software Industry

Evidence supporting this view can be gathered from an examination of IPOs in the software and IT services industries in Germany and the UK. Software is arguably the premiere industry for entrepreneurial companies, since the costs of increasing production are negligible (i.e. the cost of a CD for duplicating software code) (Engelhardt 2004). A successful standardized product can sell millions of copies, reaping millions or even billions of dollars in profits. The most prominent example of an entrepreneurial company in software is Microsoft, which has long been the largest company in the US in terms of stock market capitalization (i.e. the financial value of the shares of a company). However, the costs of developing a new software application can be quite high, and startup companies can spend millions of dollars without a guarantee of ever making a cent in sales. Software startup companies are therefore seen as a risky, but potentially quite rewarding investment.

**CHART 2: Number of IPOs in the German and UK Software and IT Services Industry, 1990-2002**



Source: Own calculations from Deutsche Börse and London Stock Exchange data

The software industry is one of the areas of high tech where Germany is seen as particularly weak (Lehrer 2000). Only one of the top 20 world software companies (by sales) is a German company, SAP. Software companies are one example of the type of high risk companies that find it difficult to find finance in Germany. Between 1990 and 1996 there was only one software IPO in Germany (see Chart 2). Although the number of software IPOs in Germany exploded in the

latter part of the 1990s, reaching a high of 50 in 2000, there were only three IPOs in this industry in 2001, and no software IPOs since then. The UK also experienced a substantial increase in software IPO activity in the late 1990s. However, the increase was less dramatic since there was a higher historical base of activity. Between 1990 and 1996 there were 60 software IPOs in the UK. Although activity dropped strongly after 2000, there still were 15 software IPOs in 2001 and seven in 2002 (compared with the complete drop off in activity in Germany).

In practice it appears that two kinds of software and IT services companies actually came to the market in Germany in the 1997-2001 period. On the one hand, companies that can be classified as "conventional" (mainly IT services companies as well as software companies in mature sectors) arguably did not need risk capital for their moderate growth strategies. These companies took advantage of the financial euphoria and raised capital on the Neuer Markt.

On the other hand, a number of companies that could be classified as entrepreneurial (mainly companies trying to develop standardized software in newer areas such as internet and security applications) also had IPOs (Engelhardt 2004). Although these entrepreneurial companies raised risk capital, the characteristics of their founders were quite different than those of the founders of successful entrepreneurial software companies in the US displayed in Table 9 above. The founders of only one of the companies (IXOS Software) fit the profile of the successful entrepreneurial US software company of mid-career employees with substantial experience with at least one other high tech company. Most founders in Germany were in their 20s or early 30s, and their work experience was typically independent consulting experience, experience at a traditional company (machine building or financial services), or research jobs at a university or research institute (see Table 11).

Two further pieces of evidence can be taken in support of the Varieties of Capitalism-based "temporary disequilibrium" argument. One is that the proportion of companies that could be classified as "entrepreneurial" as opposed to "conventional" was rather low in Germany in comparison with the UK. Only 27 percent of the German software companies were clearly entrepreneurial, as opposed to 44 percent in the UK. Secondly, German entrepreneurial software companies failed to achieve major market share in new industries. The largest software company in terms of sales in Table 11 above was about € 100 million in 2002 (Engelhardt 2005). The sales of leading internet software companies in the US, in contrast, reached \$ 1 billion or even more in 2002, such as Verisign (\$ 1.2 billion) and BEA Systems (\$ 1 billion).

**TABLE 11: Characteristics of Founders of German Entrepreneurial Software Companies on the Neuer Markt**

Company	Founding Year	IPO Year	Founder Name	Age at Founding	Work Experience Prior to Firm Foundation
Intraware	1994	2000	Lars Bornemann	26	Apprenticeship as Betriebswirt
			Joachim Weber	25	Lecturer at Fachhochschule Fulda
LS telcom	1992	2000	Manfred Lebherz	28	Doctoral studies at U. Karlsruhe
			Georg Schöne	32	Doctoral studies at U. Karlsruhe, Dose Maschinenbau (3 yrs)
b.i.s. börsen-informations-systeme	1990	1999	Eberhard Mayer	33	Programmer at FAG Kugelfischer, Berliner Bank
CYCOS	1984	2000	Klaus Pfeleiderer	28	Electrical Engineer Studies at RWTH Aachen
IBS	1982	2000	Klaus-Jürgen Schröder	32	Researcher at RWTH Aachen
PIRONET	1995	2000	Mehrdad Piroozram	23	Apprenticeship with Kaufhof Holding
Wapme Systems	1996	2000	André Borutta	29	Apprenticeship with Mercedes-Benz, Economics Studies at Fachhochschule Düsseldorf
			Wilhelm Kapell	31	Apprenticeship with Dresdner Bank, Economics Studies at Fachhochschule Düsseldorf
EASY Software	1990	1999	Markus Hanisch	27	Sales Departments of Mannesmann and Philips
			Dirk Vollmering	46	IBM (System Consulting, 4 years), rhv Softwaretechnik
MIS	1988	1999	Peter Raue	31	Independent Consultant
			Jiri Vodicka	28	Consultant Experience (2 years)
Nemetschek	1980	1999	Georg Nemetschek	45	Civil Engineering Professor, Consulting
IXOS	1988	1998	Eberhard Fäber	45	CEO of PCS Computersysteme GmbH (18 yrs)
			Hans Strack-Zimmermann	45	Siemens, Public Research Institutes
mb Software	1975	1998	Bernhard Mursch	27	Studies in Civil Engineering
CAA	1990	2000	Gabriele Müller	30	IT consultant
			Hans-Peter Schmidt	31	Researcher at Fraunhofer Institute
BROKAT Infosystems	1994	1998	Stefan Röver	29	Software consultant
			Boris Anderer	36	McKinsey consultant (5 yrs)
			Achim Schlumpberger	29	IT consultant
			Michael Schumacher	33	IT consultant

Source: Company IPO Prospectuses

## 5. Conclusion: High-Tech Policy Alternatives for Germany

This paper has argued that the failure of the "Neuer Markt" experiment was not primarily the result of lax regulation, but rather a classic illustration of the difficulties of transplanting individual institutions from LMEs into CMEs. In this case, an institution that works well in the US and UK, that is, a growth stock market with high reporting standards and minority shareholder protection, failed to successfully promote high-tech IPOs in the long run in Germany. The paper has linked these shortages to the structure of the German labor and financial markets, in particular the low-risk orientation of both investors and experienced mid-career scientists and managers. The brief period of apparent success of the Neuer Markt can be attributed to a short-lived increase in risk capital availability in the late 1990s.

The failure of the Neuer Markt raises the question of what types of policies for promoting the development of high tech industry are realistic in the German context. The VOC analysis provided above suggests three alternatives. The first alternative is to stick to the status quo ("no new policies"). One justification for this would be the argument that Germany's comparative institutional advantage lies in medium-tech industry. Due to large expenditures on R&D by industries such as motor vehicles, chemicals and machine tools, German R&D investment is only slightly behind the US in terms of a percentage of GDP (2.5 percent versus 2.7 of GDP, respectively, in 2000 according to OECD statistics). As a result, Germany should concentrate on rapidly diffusing and effectively using high technology products (such as software and computer hardware) developed in the US rather than trying to replicate capacity.

A second alternative would be to reinstate policy measures to increase the supply of risk capital, but this time in conjunction with a radical deregulation of labor markets. This would represent an attempt to simultaneously shift Germany's position in both labor and financial markets from low to high risk-reward expectations (i.e. from the "conventional company equilibrium" to the "entrepreneurial company equilibrium"). The expectation here would be that an increase in the supply of risk capital would be more effective in conjunction with the opening of labor markets, including labor markets for managers and scientists. This solution, however, appears to be politically infeasible in the near future, as illustrated by the moderate approach to labor market reform followed by the Hartz Commission (Vitols 2004).

A third alternative might be the "Ericsson solution", named after the approach followed by the Swedish telecommunications equipment company over the past decade (Casper 2005; Casper and Whitley 2004). Despite the fact that Sweden is a CME in many respects similar to Germany (including in labor market wage coordination), Sweden has achieved greater success in promoting high tech startups than Germany. One reason is that Ericsson, one of the largest employers in Sweden, provides a reemployment guarantee to employees leaving

the company to work for a startup in the event of failure of the startup. This policy is positive not only in the sense that it reduces individual risks for employees wishing to start a firm. It also helps break the vicious circle of low mobility by creating a pool of personnel moving back and forth between companies. This solution would require agreement by Germany's leading technology companies, such as Siemens and SAP, to jointly implement such a policy in order to help address the problem of a relatively closed labor market for scientists and managers. These startups could potentially be financed in part by the venture capital subsidiaries set up by these large companies (Corporate Venture Capital).

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