Laboratory of Economics and Management
Sant'Anna School of Advanced Studies

Piazza dei Martiri della Libertà, 33 - I-56127 PISA (Italy)
Tel. +39-050-883-341 Fax +39-050-883-344
Email: lem@sssup.it Web Page: http://lem.sssup.it

LEM
Working Paper Series

Financing Technology-Based Small Firms in Europe: A review of the empirical evidence.

Valérie Revest* **Sandro Sapio****

* LEFI, Université Lyon 2 and CEPN, Université Paris XIII.

** Department of Economic Studies, University of Naples Parthenope and LEM, Sant'Anna School of Advanced Studies, Pisa.

2008/23 **November 2008**

Financing Technology-Based Small Firms in Europe:
A review of the empirical evidence.

Valérie Revest[*] **Sandro Sapio**[**]

Abstract

This paper reviews the empirical evidence of the financial sources used by technology-based small firms (TBSFs) in Europe. We shed light on cross-country differences and similarities in the capital structures of TBSFs, in the organization and dynamics of the venture capital industries and high-tech stock markets, as well as in policy-making. We focus on the main European economies, i.e. France, Germany, Italy and the UK. The evidence of a pecking order among capital sources, the rather conservative investment behaviors of venture capital funds in all countries, and the differential performances of hi-tech stock markets cannot be accounted for by the market-based vs. bank-based taxonomy widely used in the research on financial systems.

Keywords: Technology-based small firms, capital structure, venture capital, high-tech stock markets, public support.

JEL Codes: G24, G28, G32, M13.

1. Introduction

Hereby we review the empirical evidence about the financial sources used by technology-based small firms (TBSFs) in Europe. TBSFs are defined as small business whose products or services depend largely on the application of scientific and technological knowledge (Allen 1992). Typically, these companies enjoy rich endowments of intangible assets, but they lack 'hard' and collateralisable assets,

[*] LEFI, Université Lyon 2 and CEPN, Université Paris XIII. Email: valerie.revest-arliaud@univ-paris13.fr.

[**] Department of Economic Studies, University of Naples Parthenope and LEM, Sant'Anna School of Advanced Studies, Pisa. Email: alessandro.sapio@uniparthenope.it.

and their track record is short. Moreover, the firm founders often have science or technology background, thus they suffer from limited financial and marketing expertise.

This exercise is motivated by at least two observations. On the one hand, Schumpeter pointed out how entrepreneurial firms and new entrants play a fundamental role in innovative activities, as they generate novelties which disrupt the quasi-rents enjoyed by previous innovators. Such a 'creative destruction' process is the core of a Schumpeter Mark I technological regime (Nelson and Winter 1982, Kamien and Schwartz 1982, Breschi, Malerba and Orsenigo 2000). Small firms in high-technology sectors are thus major agents of technical change. On the other hand, the rate and direction of technical change are affected not only by product market competition, but also by the rate and criteria by which financial intermediaries and markets allocate resources among firms (Dosi 1990, Aoki and Dosi 1992). Schumpeter himself envisioned a 'double agency' in capitalist development, with banks and financial markets playing the essential role of 'bridges' or 'facilitators' of the innovative efforts carried out by entrepreneurs (Schumpeter 1911).

This paper is meant to be a guide through the main facts of TBSFs finance and their economic interpretations, potentially useful for both academic scholars and policy makers. We seek to shed light on cross-country invariancies and specificities in the capital structures of TBSFs, in the organization and dynamics of the venture capital industries and high-tech stock markets, as well as in policy-making. In a comparative perspective, analyzing the main European countries (France, Germany, Italy and the UK) is most useful, as their financial systems are usually classified within different categories – market-based vs. bank-based (Rybczynsky 1974, Zysman 1983) – and the finance-innovation nexus is not independent from the features of a financial system (Dosi 1990). Nevertheless, as Europeans we find it worth to focus on Europe since it lags behind the US in the exploitation of new technological knowledge for commercial uses (Dosi, Llerena and Sylos Labini 2006).

Our review of the literature on high-tech small business finance sheds light on four main pieces of evidence. *First*, one finds empirical support to the pecking order hypothesis, namely the proposition that firms establish a hierarchy among financing sources. TBSFs resort to bank loans only once they fall short of internal funds, and eventually to equity issues. This pattern holds across different varieties of capitalism, at odds with a priori expectations that banks should play much larger an influence in bank-based financial systems, such as Germany, and equity in market-based systems as the UK. This pattern is robust across countries seemingly because entrepreneurs in technology-based sectors are credit rationed: the information asymmetries between the firm and the lending institutions are exacerbated by the complexity of innovative high-tech projects.

Second, while venture-backed companies could partly overcome such informational imperfections, the European venture capital industry is relatively underdeveloped as compared to the US one, with the UK being somewhat an exception. Moreover, there is evidence that European

venture capitalists have a bias towards large deals and companies in traditional sectors, and prefer trade sales over IPOs as exit strategy.

Third, similarly limited has been the development of trading in high-technology stocks, if compared with the NASDAQ. The EASDAQ and the so-called 'New Markets' (NMs) established in France, Germany and Italy in the late Nineties have proven unviable in the wake of the New Economy crisis. The UK Alternative Investment Market has on the contrary managed to survive and grow. Such differential performances cannot be easily reconciled with a financial systems view, because the EASDAQ collapsed even though it was embedded in the British financial system and based on the NASDAQ regulations. Furthermore, the technological diversification of the listings seems to be a necessary but not sufficient condition for a successful NM. Much more decisively, the average 'quality' of companies which went public on NMs was probably low, due to credit rationing and the lack of venture-backed IPOs.

Fourth and last, the comparative analysis of national policies underlines that the TBSFs need customized financial support, better if allocated via discretionary (i.e. non-automatic) rules. This is still rarely the case in Europe. Public venture capital is also shown to perform an important certification role and does not seem to crowd out private venture capital investments. Public support policies are pervasive and beneficial even in a supposedly market-based system such as the UK.

The issues summarized above are described and discussed in the following sections, devoted to the financial structure of TBSFs (Section 2), venture capital (Section 3), stock markets for hi-tech companies (Section 4), and public support policies (Section 5). The concluding Section 6 wraps up and outlines an agenda for future research.

2. The financial structure of TBSFs

The issue of the financial structure of TBSFs is an increasingly relevant segment within the literature on the determinants of the capital structure of firms, a field pioneered by Modigliani and Miller (1958). The Modigliani-Miller theorem showed that under certain conditions - i.e. absence of taxes and bankruptcy costs, perfect information, full rationality, and market efficiency - the value of a firm is invariant to how the firm is financed – whether through debt or equity. If this is true, there is no reason to expect that any source of funding be used more frequently than others. More precisely, suppose one can represent the financial structure of a firm as a vector, whose entries are the shares of own funds, loans, and equity raised by the firm. Under the MM theorem, there is no financial structure that is better than others: therefore, the conjecture is that all structures have the same probability to be observed in a given sample of firms. In a macroeconomic perspective, this implies that there is no reason to observe any cross-country pattern in financial structures.

The opposite conjecture is inspired by the observation that one finds considerable cross-country variance concerning (a) how people accumulate wealth and transfer income over time, (b) how companies obtain external sources of financing, (c) how people deal with financial risks, (d) the institutions which offer financial services, their legal and economic nature, their way of functioning, and who are their owners (Schmidt and Tyrell 2004). Relatedly, financial systems are commonly classified as bank-based or market-based (Rybczynsky 1974, Zysman 1983, Mayer 1998, Allen and Gale 2001). Our sample of European countries includes two purported archetypes within this taxonomy. On the one hand, there is wide evidence that the UK scores extremely well according to all of the main indicators of financial development, such as the capitalization/GDP ratio, the value traded ratio, and the turnover ratio (Demigurc-Kunt and Levine 1996, Rajan and Zingales 2003). On the other hand, in their analysis of the German financial system Schmidt and Tyrell (2004) report very high values of the banking assets/GDP ratio, the persistence of conservative investment behaviours, and that the stock market is still smaller than the bond market. Italy and France lay in between these two extremes, but with a significant trend towards introducing more elements of a market-based system (Capolupo and Celi 2004).[1] One might therefore expect to observe widely different financial structures in firms which operate in different countries, according to the different varieties of capitalism (Hall and Soskice 1991). Consistent with the bank-based/market-based taxonomy, firms resorting mainly to bank loans should prevail in Germany, whereas firms collecting funds mainly on the stock market should be the rule in the UK.

Yet, there is robust evidence that firms in different countries establish the same hierarchy between financial sources. So far as they can, firms rely on internal finance - such as the personal wealth of the founder, money from relatives and friends, and retained profits if any. If a company falls short of internal funds, it resorts to debt and, as a last option, to equity issues. This behaviour has been termed the *pecking order hypothesis* (POH) (Donaldson 1961, Myers 1984). The empirical evidence on TBSFs, reviewed in the upcoming sections, confirms that a pecking order behaviour is enacted by technology-based small ventures too. This seems to violate the predictions of the MM theorem, as the distribution of financial structures across firms follows a clear pattern and is not random. At the same time, this pattern is observed in very different financial systems.

2.1 The pecking order hypothesis: empirical evidence

The evidence of a pecking order behaviour by TBSFs revolves around two sets of questions. What are the shares of internal vs. external funds in the observed financial structures? And how many TBSFs

[1] Some doubts about the empirical relevance of the bank-based/market-based dichotomy are expressed by Carlin and Mayer (2000) and by Krahnen and Schmidt (2004). Even in Germany there is a (weak) drive towards a more market-based system: for instance, the non-bank financial intermediaries and institutional investors have become more influential after the Nineties (Schmidt and Tyrell 2004).

use their own funds as the main source of finance? An early work on TBSFs was performed by Moore (1994), based on survey data for 89 UK hi-tech companies. Moore showed that only 7% of start-up finance was raised as bank loans – as compared to an estimate of 40% for SMEs in general. The survey by Giudici and Paleari (2000) on a sample of Italian small firms involved in high-technology sectors and activities showed that about 73% of the startups is financed by means of the personal wealth of the entrepreneur.[2] Consistently, in Scellato and Ughetto (2007) the personal wealth of the founder and the internal cash flow were the main modalities for start-up financing in 79% of Italian SMEs actively involved in R&D, whereas the whole sample average was equal to 47%. Colombo and Grilli (2007) analyzed a sample of 386 Italian start-ups operating in hi-tech manufacturing and services for the years 1999 and 2001. Personal capital was shown to be by far the most important source of start-up financing: only 22% of firms relied on debt financing at start-up time, and the average amount of bank debt obtained was less than half the average amount of personal capital invested in start-ups. However, the few firms which obtained private equity collected on average up to six times more funds than companies resorting to bank loans. Then the last financial source in the hierarchy might as well account for a large share of a firm's capital.

The empirical picture is similar for France. The French enquiry dedicated to innovation financing FIT (*Enquête sur le Financement de l'Iinnovation Technologique*) for the period 1997-1999 (L'Homme, 2001) suggests that TBSFs self-finance 73.8% of their R&D projects. Whenever two resources are mobilized, the second one is often public financing, which represents a 11.2% share of the projects' value. Only 7% of the innovative firms use bank financing. According to Savignac (2006) during the period 1998-2000 bank loans have represented 26% of new financing operations for innovating firms.[3] Relying on a study of 68 ICT firms listed on the French New Market between 1998 and 2000, Fernandez and Lantz (2001) highlight the scarcity of bank loans especially for the "dotcom" companies. Carpentier et al. (2007a) launched a survey on a sample of 281 biotechnology firms with less than 500 employees between 1985 and 2005.[4] Funds provided by the managers and their family are found to play a decisive role not only at the stage of the creation, but also after.[5] A comparison of the biotech sector and the NTIC sector, suggests that self-financing and private financing constitute in

[2] Giudici and Paleari selected 249 firms, smaller than the limit size established for SMEs by the EU directives issued by the European Commission in July 1996, and with the characteristics of innovative firms – i.e. high proportion of qualified employees, high R&D intensity, product innovation. The final sample included 46 firms who responded to a questionnaire in 1997.

[3] Savignac relies on the enquiries CIS2, CIS3 and on data from the *Banque de France* (CDB).

[4] Source: Adebiotech association 1997, 2000, 2003 and 2005.

[5] The share of financial resources coming from relatives and friends remains important in biotechnology, notably at the beginning, even if it was shown that the French biotechnology companies were characterized by heterogeneity of their trajectories (Mangematin et al. 2003).

the two sectors the two primary sources of funding, in order of importance, followed by public financing (Carpentier et al., 2007b).[6]

A second research line deals with the econometric relationship between debt and the size, age, and technology intensity of the firms. Adedeji (1998) performs a test of the pecking order hypothesis on a sample of 224 UK firms for the 1993-1996 period. Results show that larger firms who are little involved in knowledge-intensive activities display greater reliance on credit channels. Ozkan (2001) used the same dataset, but for a longer observation period (1984-1996) and a larger panel (390 firms): the size effect vanishes, but firms with higher growth opportunities (as proxied by the market-to-book ratio) and greater profitability are on average characterized by lower leverage – consistent with retained profits being among the major sources of investment financing. Jordan et al.'s (1998) analysis of FAME data for the 1989-1993 period shows how firms pursuing an innovation strategy are characterized by lower debt than firms following other competitive strategies. Bah and Dumontier (2001) compare the debt levels and structures of 60 firms with R&D intensity above 5% and 176 non-R&D firms from the January 1998 issue of the Worldscope database. Comparing the two groups and controlling for size, R&D-based firms turn out to display lower indebtedness. Atanasova and Wilson (2004) estimate the supply and demand for bank loans using a panel of 639 UK SMEs observed between 1989 and 1999, with sectoral controls. Internal funds and inter-firm credit are found to be important substitutes for bank credit. Audretsch and Lehmann (2004) analyze the capital structure of 341 firms listed on the Neuer Markt between 1997 and 2002. The authors examine whether debt and equity are complements or substitutes for young high-tech firms, and find that venture-backed firms have significantly less debt than non venture-backed ones. Therefore, venture capital is considered as a substitute rather than a complement for debt.

2.2 Explaining the pecking order behaviour

Two explanations for the POH have been advanced. The first, sometimes named the *funding gap hypothesis*, posits that there are information asymmetries between the firms and the potential investors, which give rise to moral hazard and agency conflict problems (Jensen and Meckling 1976, Myers 1977, Stiglitz and Weiss 1981). Information asymmetries are very likely to arise due to the inherent uncertainty of the innovation process and the insufficient understanding of technically complex projects by lending institutions. This is even more true if TBSFs are drivers of technological revolutions: the expertise of financial institutions might be deeply rooted within the existing technological paradigm, making them unable to understand the implications of the new one (the so-called 'paradigm blindness': see Perez 2004). As a result, financial intermediaries can be unable to

[6] See also the survey by the *Banque de France* (Planes 2002), the French national enquiries on Research and Development ("Enquêtes R&D" 2000, 2001, 2002), and Lhuillery (2001) on biotechnology.

distinguish between potential successes and potential failures (Planes 2002) and the access to external financial sources by TBSFs is severely limited (Hubbard 1998, Hall 1992, Hao and Jaffe 1993, Himmelberg and Petersen 1994).[7]

On the other hand, firm founders themselves can be reluctant to apply for loans or to go public, more so if the founder is an inventor who might be unwilling to share the monetary and scientific rewards coming from the innovation. This hypothesis goes by the name of *control aversion*. Myers (1984) hypothesized that the capital structure might not be neutral when firm owners desire to maintain a high level of autonomy vis-à-vis banks and financial markets (see also Cressy 1995, Chittenden et al. 1996, Cressy and Olofsson 1996).

Some signs of a control aversion in small and young hi-tech companies have been detected. Watson and Wilson (2002) show that the empirical support for the POH is greater in more closely-held (i.e. owner-managed) UK firms. Commonality of interests between managers and shareholders is noted to be an important determinant of the pecking order behavior. Vos et al. (2007) propose a "financial contentment" explanation of the POH. Based on a UK SME sample for 2004, the authors claim that some characteristics of owners, such as age, experience and education, are negatively correlated to the share of external funds. In such a story, entrepreneurs refrain from using outside sources of finance, as if guided by their business 'wisdom'.

Wider empirical support exists for the competing explanation, grounded on the capital market failure. Direct assessments of the extent of credit rationing use data on the outcomes of loan applications. In this approach, credit-constrained firms are those wishing to receive a larger amount credit at the current market interest rate – or even willing to accept a small increase in the interest rate – but their loan applications are rejected by a financial intermediary. The evidence is that a loan application is more likely rejected if it comes from a TBSF. Westhead and Storey (1997) analyzed a survey of 171 SMEs located on and off UK science parks, and found evidence of credit rationing for R&D intensive companies. Guiso (1998) analyzed data from the Bank of Italy "Survey on Investment in Manufacturing", including about 1000 firms with at least 50 employees (1988-1997 period), and collected information on loan applications by means of a questionnaire. Loan applications by firms in sectors with more than 40% process or product innovators are more likely to be rejected. Freel's (2007) sample includes 256 small firms which applied for bank loans, drawn from the Survey of Enterprise in Northern Britain (1998-2001). The credit rationing evidence is confirmed for small innovators. As a further direct piece evidence, in Giudici and Paleari's (2000) survey more than 90% of the entrepreneurs in their sample do not resort to bank credit because they believe that banks are

[7] The lack of participation to capital markets by small firms has also been explained in terms of a *discouraged borrower* hypothesis (Jappelli 1990, Kon and Storey 2003), according to which entrepreneurs might not participate to the credit market because they expect to be credit-rationed.

unable to correctly evaluate hi-tech projects and the growth prospects faced by start-ups. As a result, some potentially successful projects fail to be financed.

Several indirect tests of the credit rationing hypothesis can be found in the literature. Bah and Dumontier (2001) and Watson and Wilson (2002) provide evidence that R&D-intensive firms tend to establish a pecking order even within debt types, i.e. there exists a short-term bias in the debt composition (see also Deakins and Hussein 1994). This is consistent with a credit rationing story: even though entrepreneurs are willing to apply for the long-term loans required for strategic planning, banks are very likely to reject long-term loan applications of companies lacking "hard" collateral. Grilli's (2005) analysis of 179 Italian start-ups involved in Internet services shows that the success of bank loan applications is not significantly related to indicators of high entrepreneurial quality, such as the educational background and the working experience. However, educational variables have a significantly positive impact on the likelihood to apply for a loan. Hence, better skilled entrepreneurs do apply to obtain bank credit but are rationed.

The relevance of informational asymmetries has also been stressed within the literature on financial networks. Social ties are powerful tools for companies which seek to overcome the informational barriers to finance. As observed by Fried and Hisrich (1994), most venture capital funded proposals come by referral. A bankers' adage reported by Uzzi (1999) goes that "A relationship is worth a basis point." Most of the literature on financial networks deals with US firms, but does not focus on high-tech sectors (see Uzzi 1999, Mizruchi and Stearns 2001, Godley and Ross 1996 among others). Notable exceptions are the paper by Ostgaard and Birley (1996) on UK new firms and by Shane and Cable (2002), who analyzed seed-stage hi-tech companies which exploited MIT patents.[8]

The reviewed evidence of a pecking order between funding sources is robust across the European countries under scrutiny. It is worth noting that even in Germany banks appear unable to bridge the funding gap that hampers the growth of TBSFs, and that equity is hardly accessible to TBSFs even in the financially developed UK. Hence, the issue here is not whether bank-based or market-based systems perform better. The cross-country invariance of the detected capital structure pattern seems to suggest that capital market failures are pervasive enough, as to go beyond the institutional differences among countries. However, banks in the German economy may still play a crucial role, although indirectly, by channelling funds through venture capital. Mayer, Schoors and

[8] Also interesting would be to assess whether spin-off companies enjoy easier access to credit and lower cost of financing, as might be the case due to reputation advantages and certification effects.

Yafeh (2005) show how banks represent a major source of venture capital finance in Germany.[9] We thus turn to review the evidence about the European venture capital industry.

3. The venture capital industry

The main features of venture capital and its expected impact on new firms creation and growth have been described and discussed at length by a number of scholars (Tyebjee and Vickery 1988, Lerner 1995, Garmaise 1997, Gompers and Lerner 1997, Giudici and Roosenboom 2004, Antonelli and Teubal 2008 among the many). Conventional wisdom mandates that the productivity gap between the USA and Europe could be filled if European venture capital converged to the American level of development. A comparison among the American and European venture capital industries is offered by Figure 1 (Annex). Two facts stand out clearly. On the one hand, in spite of the strong growth experienced along the Nineties, the European VC industry still lags behind the American one. On the other hand, European venture capital was far less affected by the 2000/2001 financial crisis. One can conjecture, following Bottazzi and Da Rin (2003b), that the European delay in supporting high-tech sectors is not related to the size of venture capital *per se*, but rather to a bias towards speculation and against advice activities. Venture-backed firms are supposed to grow faster by virtue of the advice by venture capitalists, who are endowed with superior technical and marketing knowledge than banks. Still, whether venture-backed companies perform better than non-venture-backed companies in terms of corporate growth, and whether they benefit from certification effects is controversial even during the bubble years. But the sharp drop after the Internet bubble testifies that this is partly a problem for American venture capital too. Beyond such a crude and aggregate comparison, the evolution of venture capital has been rather heterogeneous across European countries, marking a rather clear divide between the UK, where the VC industry is larger and more mature, and the countries in continental Europe.

3.1 The emergence and development of venture capital in Europe

The birth of the European venture capital industry dates back to the Seventies, but its full emergence occurred only during the second half of the Nineties. An attempt to initiate early-stage venture capital in Germany, dating back to 1975, relied on the creation of the Deutsche "Wagnisfinanzierungsgesellschaft" WFG, a VC fund participated by large German banks and the government. That experiment resulted in a complete failure with a rate of return below 25% (Becker and Hellmann 2005).[10] Until 1990, only few quasi-public venture capitalists existed (Tykvova 2003). Similarly, in France and in Italy the capital raised was not sufficient to cover the needs of innovating

[9] The data come from EVCA. The database includes 187 German funds and they refer to the year 2000.

[10] The main reasons mentioned were inappropriate contracting and governance structures and a divergence of interests between the shareholders of the WFG. While the government was interested in the commercialisation of new technologies, the banks did not want to discredit their reputation and were very reluctant to bear the entailed risk.

firms (Dubocage and Rivaud-Danset 2003). The development of venture capital in Italy before the mid-Nineties was prevented by institutional constraints (Bonini and Zullo 2002). First, banks were not allowed to invest in private equity. A second problem was the lack of any adequately detailed legislation on portfolio management by closed-end funds. In contrast, the UK was the European country where the venture capital form of corporate governance took off earlier (Bruton, Fried, and Manigart 2005): the number of venture-backed companies in the UK increased rapidly from 350 in 1984 to 1221 in 1990 (BVCA).

Consistently, the amounts invested in UK dominate largely those of other European countries (Annex, Figure 2). Nowadays, the UK private equity industry is the largest in Europe, accounting for about half of total annual private equity investment in Europe (BVCA Annual Reports). However, in the late Nineties the German VC industry came to dominate the others in terms of amounts invested (Figure 2). Three main institutional factors explain the growth of the German VC investments during the Nineties. First, commercial banks have played an important role in the German venture capital market by creating their own funds (Vitols 2004, Tykvova 2007).[11] Second, the development of VC was closely linked to the establishment of the Neuer Markt (1997), a stock market dedicated to young innovative firms. The Neuer Markt provided at that stage an attractive exit channel for venture capitalists (Tykvova 2003, Engel 2002). Third, the VC industry in Germany was also supported by the existence of numerous public VC funds (Basha and Walz 2002, Tykvova 2003). The ranking among countries changed as an outcome of the end of the New Economy bubble. While France lagged behind Germany in 2000 (3796 million Euros in Germany against 3039 in France, see Figure 2), in 2006 the amounts invested equalled 1593 million Euros in France against 940 million Euros in Germany. All along the timeline, the Italian VC industry emerges as the less developed: its peak was reached in 2000, with 6464 investments in 490 firms, for a total value of 2968 Euro millions (EVCA, Figure 6).

It has been noted how the European venture capital sector fared better than the American one in terms of resilience. This is however mostly due to the ability of the UK venture capital industry to rapidly recover after the Internet bubble crash. As shown by Figure 3, the amounts invested have sharply increased since 2003, and in addition, the post-bubble years have witnessed an above average involvement of VC by company, as compared to the Eighties and the Nineties. This can be seen as evidence of the sector's maturity (Teubal and Luukkonen 2006), and might be related to the investments by pension funds, which peaked in 2005 with 12670 million Euros (EVCA Yearbook, 1995-2007; see also Mayers, Schoors and Yafeh, 2005). On the contrary, Germany has been heavily affected by the reversal of the trend. Insider trading scandals and accounting frauds tarnished the reputation of the Neuer Markt and contributed to accelerate the drop of the amounts invested by VC

[11] Corporate venture capitalists are also present in Germany. They are usually subsidiaries of their industrial parent companies.

funds after the burst of the bubble (Burghof and Hunger 2004). The VC investments curve only stabilised in 2004, and in 2006 the amounts invested were back to the 1997 levels (Figure 4). The post-bubble period in Italy has been characterized by a substantial drop in the number of investments (-55%) and firms targeted, while it has been milder in France (Figure 5). We conjecture that the greater stability of the French VC industry, as compared to the German one, be the effect of the Law on Research and Innovation of July 12, 1999, that might have mitigated the negative effect of the bursting of the bubble by allowing the creation of the new TBSFs.

In terms of investment numbers, the UK is the only country where early stage financing has been increasingly relevant during the period under study, but only in terms on investment numbers:. it represented 16% of the overall number of investments in 1996 and reached 37.9% in 2006. Nevertheless, the share of early stage investments out of the total amount of venture capital investments is less than 10% today, as expansion stage represents 29.3% and MBO/MBI 61.5%.[12] The relative gap regarding the amounts invested between the seed/start-up stage and the expansion stage is the largest, if compared to the other countries (Annex, Figure 3). Investments in technology-intensive sectors have increased in the last years (BVCA 2002, 2003). The reported evidence reveals that even before the Internet bubble, venture capitalists gave priority to large deal sizes and large companies (Murray 1999, Jeng and Wells 2000, Baygan 2003).[13] Mason and Harrison (2004) report that UK venture capital investors started to increase their focus on early stage hi-tech ventures in both absolute and relative terms in the mid-Nineties. A slight change of attitude toward technology-based investment projects was also detected by Lockett et al. (2002). This was the joint effect of the emergence of attractive investment opportunities in high-tech sectors, and of the decreasing supply of later-stage investment proposals. This tendency is confirmed by the analysis of the evolution of VC investments by sector (Table 1). The UK represents the only country where new high technology sectors continued to receive important amounts of money after 2000. This is particularly the case for communications, computer-related and biotechnology sectors. At the same time, also other sectors experienced growth in funding: medical/health related, consumer related, industrial products, financial services. A similar trend can be observed in Italy, when the decline of investments in communication and computer sector is partly offset by an increase in medical/health, consumer-related and industrial products. Conversely, investments in traditional sectors have progressively increased during the post bubble period in France and Germany (Tables 2, 3, 4). The effect is particularly clear for Germany which since 2002 has concentrated its venture capital investments in traditional sectors, such as industrial products and

[12] Jeng and Wells (2000) who analyzed the 1986-1995 decade observed that the share of early share investment s out of the total amount of venture capital investments declined over time.

[13] Similar conclusions have been reached by Mayer, Schoors and Yafeh (2005) in a probit analysis of venture capital data from several countries.

services, chemicals and material. In France, the same trend can be observed, although to a lesser extent, after 2000.

3.2 The long-term impact of European venture capital on corporate performance

By promoting the development of the European venture capital industry, policy-makers have sought to stimulate the sectors which in the early Nineties seemed better suited to enhance the long-run growth of aggregate productivity and provide a solution to structural unemployment. At the microeconomic level, one way venture capital could prove useful is by supporting corporate growth. Welfare-enhancing effects are also an implication of the certification hypothesis (Booth and Smith 1986, Megginson and Weiss 1991), according to which venture-backed IPOs should be affected by less severe underpricing, because venture capitalists act as third-party agents who certify the company's financial soundness and assure investors that the price of the shares reflects all available and relevant information. To date, the empirical evidence on both issues is mixed.

The earliest evaluation of the impact of venture capital on the growth of TBSFs was performed by Bottazzi and Da Rin (2003a). Using a sample of 538 non-financial firms listed on the French, Italian and German high-tech stock markets between 1996 and 2001, the authors regressed the employment and sales growth rates on the amounts of venture capital received, including controls. Strikingly, the venture capital coefficient was never significant, implying that venture-backed and non-venture-backed companies grow at the same rate. That exercise suffered from a number of problems. For instance, whether a company receives VC is endogenous to the growth performance, and there is unobserved heterogeneity which may bias the estimates. Bottazzi and Da Rin (2003a) tried to solve these issues by means of a matching method and of a difference-in-difference estimator, but the corresponding loss of efficiency does not allow to obtain significant estimates. Evidence of a growth-enhancing role for VC was found by Audretsch and Lehmann (2004), who used a quantile regression method on a sample of 341 companies listed on the Neuer Markt between 1997 and 2002. The share of equity held by venture capitalists pre-IPO has a positive and significant effect on employment growth, except for the higher-performing firms. This might indicate that venture capital has a disciplining influence in poorly performing firms, and that non-credit-rationed top-quality firms would excel even without venture capital.

The effectiveness of venture capitalists as certifying agents is under question. Some works offer a positive outlook on venture capital. Chahine, Filatotchev and Wright (2007) found that venture-backed IPOs in UK and in France suffered lower underpricing than non-venture backed IPOs, supporting the certification hypothesis. Goergen et al. (2002) showed that, although IPOs on the Neuer Markt were highly underpriced, underpricing in the Nuovo Mercato and Nouveau Marché was not far from those reported on the main markets, and about 60% of the IPOs on the French NM were actually

overpriced. Other pieces of evidence cast doubts on the certification hypothesis. Manigart and De Maeseneire (2003) analyzed all IPOs floated on the markets within the Euro.NM network and on the EASDAQ until the end of 1999, and found an average initial underpricing of 36%. The estimate provided by Arosio, Bertoni and Giudici (2001) on the Nuovo Mercato IPOs is 24%, while the paper by Arosio, Giudici and Paleari (2000) regarding Internet IPOs in German and French NMs reports extremely high values between 70 and 85%. These percentages are much higher than those found on the main markets in the same period (16% according to Rajan and Servaes 1997). Also, these results are consistent with the work of Franzke (2005) who finds that in Germany venture backed IPOs are more underpriced that non-venture backed IPOs. On average, firms are underpriced by about 75% compared to about 39% when backed by a less prestigious venture capitalist, or 48% when non-venture backed. One explanation for this relies on the work by Hamao et al. (2000), according to whom the affiliation of venture capital funds with major financial institutions can lead to conflicts of interest. The underwriting banks would be interested in setting a higher offer price. The IPO's investors anticipate this conflict of interest and in order to compensate, they ask for more underpricing. Loughran and Ritter (2004) observe that in recent years the objective function of issuers has changed and they have become more willing to leave money on the table. Instead of maximizing IPO proceeds, issuers increasingly emphasize the analyst coverage. Finally, Coakley, Hadass and Wood (2007) have studied a sample of 591 venture-backed and non-backed LSE IPOs held between 1985 and 2003. While the certification hypothesis cannot be rejected for most sample years, careful scrutiny of the Internet bubble years (1998-2000) brings evidence of an increasing trend in the size of underpricing, more so in high-tech sectors such as IT and telecommunications. As argued by the authors, the behaviour of venture capital funds, faced with huge speculative opportunities as in the late Nineties, is rather consistent with an alternative 'exploitation hypothesis'. The reviewed evidence seems to bring support to Bottazzi and Da Rin's (2003b) conjecture that venture capital in Europe provides more money than advice.

4. Stock markets for high-tech companies

The provision of market-based support for European SMEs became something of a hype in the mid/late-Nineties, when a wave of NASDAQ 'copies' emerged as competitive responses to the EASDAQ, a NASDAQ-like market promoted by the European Commission and the EVCA (Commission of the European Union, 1993, 1995). The public officials saw in the American model of high-tech finance a credible solution to the structural unemployment faced by the European Union. Dedicated trading platforms for the quotation of TBSFs were hoped to create profitable exit opportunities for venture capitalists and, in turn, new (economy) jobs and faster productivity growth in European countries.

The venture capital-IPO markets connection in Europe does not seem to be very lively. The AIFI data on the Italian VC industry suggest that the most preferred modality to cash-out is the trade sale. Between 1997 and 2002, only 75 out of 873 divestments in Italy occurred through IPOs (i.e. 8.6%), against 466 trade sales (53.3%). The evidence in Baygan (2003) confirms this trend even in such a more financially developed country as the UK. Moreover, the history of NMs in Europe is constellated with notable failures (e.g. the EASDAQ, the Neuer Markt), one durable experience (the AIM in the United Kingdom) and few recent new attempts. The question thus arises as to what lies behind these partly unsatisfactory outcomes. We shall look into this issue in the upcoming sections, which describe the rise and fall of the European "new markets" and some indicators of their ability to attract TBSFs and support their growth.

4.1 Historical evolution

Within the European context, the first attempts to set up second-tier markets for growing firms date back to the late Seventies and the early Eighties. The pioneering markets for TBSFs were based on the so-called feeder principle: their goal was to select the most profitable young companies and feed them upward to the main markets. The quotation of TBSFs was favoured by low entry requirements and low information standards. Posner (2004, Table 1) reports an exhaustive list of the stock markets based on the feeder principle. The pioneer markets were the 'Compartiment Spécial', opened in France in 1977, followed by the Italian 'Mercato Ristretto' (1978), the Unlisted Securities Market (USM) (1980, UK), the Third Market (1987, UK), and 'Bors 3' (Germany, 1982).[14] Those early experiences were however unsuccessful. The Third Market underwent serious trouble in the wake of the 1987 stock market crash, and was finally shut down in 1990 (Licht 1997); USM closed in 1995 (Mallin and Ow-Yong 1998; Weber and Posner 2000; Ritter 2003). The liquidity of these markets was low, as most investors perceived that feeder markets housed only poorly-performing companies, and preferred to wait for the best ones to be promoted to the main market (Posner 2004).

In 1993, the European Union passed the Investment Services Directive (ISD), a legislation aimed at integrating national investment services, including stock exchanges, by extending the principle of mutual recognition to service providers. By virtue of the ISD, an exchange regulated in one EU country could operate in another via electronic networks and computer terminals. This enabled the creation of a pan-European stock exchange for young high-tech companies, which was promoted by the European Commission together with the EVCA (Licht 1997, Weber and Posner 2000, Posner 2004). The new market, the EASDAQ, was inaugurated in 1996. It was based on the NASDAQ principle, which entailed low entry requirements, but strong informational standards. The NASDAQ

[14] The Netherlands, Norway, Sweden, Belgium, Spain also inaugurated markets based on the feeder principle.

structure was imitated because it was perceived as the most efficient financial architecture, and one able to promote job creation and competitiveness in Europe.

The creation of the EASDAQ was felt by national exchanges as a threat: the risk that financial activity might migrate to the new pan-European exchange led most national exchanges to set up their own versions of stock markets for TBSFs at the domestic level. The London Stock Exchange anticipated by creating the Alternative Investment Market (AIM) in June 1995. The Paris Bourse responded in 1996 by inaugurating the Nouveau Marché, and in 1997 the Deutsche Börse established the Neuer Markt. Finally, trading on the Italian Nuovo Mercato began in June 1999.[15] All of the "New Markets" were designed according to the NASDAQ principle, except the AIM, which is a feeder.

Admission and listing requirements on NMs have been summarized and analyzed by Clatworthy and Peel (1997), Bottazzi and Da Rin (2002), Goergen et al. (2002), Posner (2004), Brav (2005) and Mendoza (2007) among others. The AIM allows companies with less than 3 years of accounting profits to join, and no minimum requirements are set with respect to capitalization, assets, and free float. It has been noted how the AIM improves upon the USM in terms of accessibility (Brav 2005). On the Nouveau Marché, candidate firms should exhibit a book equity value not lower than € 1.5 million. The IPO proceeds should be no lower than € 5 million, of which at least 50% from primary newly issued shares. The floating capital should be equal to at least 20%. On the Nuovo Mercato, admission only required a trading history of at least 1 year, a minimum offer of 5 million Euros, at least 1.5 million Euros in net worth, free float of at least 20%. No minima were required as regards income, past profitability, or market capitalization. More stringent were the admission requirements on the EASDAQ: admission could only be granted to companies with no less than ECU 3.5 millions in total assets and ECU 2 millions in capital and reserves; at least 20 percent of the total capital value had to freely float. Finally, the listings requirements on the Neuer Markt were as strict as for an admission to the Official trading. Issuers were required to hold equity capital equal to € 1.5 million at least. The aggregate proceeds had to amount to € 5 million and the minimum nominal value of the issue had to be equal to € 250 000 with a minimum number of 100,000 shares (see Burghof and Hunger 2004, Posner 2004).

Despite these differences in admission criteria, regulatory requirements as regards information disclosure are tight on all the high-tech stock exchanges. Companies are required to appoint one or more sponsors (Nominated Adviser – Nomad – on the AIM), who certifies the company's compliance with the financial requirements and offers oversight and advice in the quotation process and in the communications to the regulatory authorities. Listing firms also appoint one or more market makers

[15] Other stock markets based on the NASDAQ principle would be created in Europe since then: EuroNM Belgium (1997), EuroNM Amsterdam (1997), SWX New Market (Switzerland, 1999), Austrian Growth Market (1999), Nuevo Mercado (Spain, 2000), OMX First North (Nordic and Baltic Countries, 2003).

(Nominated Brokers on the AIM, the sponsor on the FNM) matching buyers and sellers of a company's shares, and thus provides liquidity. Accounting information has to be provided according to the GAAP or IAS standards. Finally, disposal of shares by insiders is constrained by a lock-up rule. The duration and the extent of lock-up rules vary across markets.[16]

Let us now give a look at the historical evolution of the main European NMs, namely the AIM, the Neuer Markt, the Nouveau Marché and the Nuovo Mercato, as well as at NASDAQ data for comparison (Table 5 in the Annex). For each market and for each year between 1995 and 2006, the number of member companies as well as the capitalization (in millions of local currency) are displayed. As can be easily grasped, none of the European markets comes even close to match the size of the NASDAQ (last column). The British feeder, AIM, appears as the most successful among the European markets. Participation to AIM has witnessed a continual growth, from 121 members in 1995 to 1634 in 2006. Notwithstanding wide fluctuations in the number of market participants, new admissions have been numerous in every year, with a peak in 2005 (519 new members) and only a mild slow-down in the years after the Internet bubble. Worth noting is also the increasing trend over the first decade of the new century. Similarly, while signs of the Internet bubble can be seen quite clearly, one can also appreciate the subsequent crash. Yet again, the market managed to rapidly return on a fast growth trajectory, reaching a capitalization of roughly 58000 £m in 2006.[17]

The "new" markets created by national exchanges in continental Europe experienced very successful growth performances only in the early years. In 2000, the Nouveau Marché benefited from the boom in Internet stocks, recording 52 introductions and the capitalization reached a level of nearly 25000 million Euros. In the same period, the number of quoted companies on the German NM increased from 17 in 1997 to more than 300 in 2000. Such a strong performance urged the London Stock Exchange to make the AIM rules more rigorous, and to set up the TechMARK segment in 1999, aimed to allow a clearer identification of innovative and R&D-intensive companies within the official listing.[18] The early history of the Nuovo Mercato – the 1999-2001 period – was characterized by fast growth in terms of both market participants and exchanged volumes. Year 2000 was the boom year: new admissions to the NM accounted for nearly 70% of total new admissions to Borsa Italiana; the

[16] Lockup rules typically apply to directors and employees of companies whose main corporate activity has been generating revenues for less than a certain number of years. They must agree not to dispose of their interests for a given period (one year on the French and Italian NMs, 18 months on the EASDAQ) after joining the market. The lock-up provision applied on at least 80% of the shares on the Nouveau Marché and on the Nuovo Mercato.

[17] These patterns go hand in hand with the fast post-bubble recovery of the UK venture capital industry described in the previous section.

[18] It is worth noting that prior admission to the LSE main market is an eligibility requirement according to the "TechMARK eligibilityguidance". For more information, see www.londonstockexchange.com/techmark.

value of total transactions per day reached its highest: market capitalization was almost 2% of GDP. The performance of the EASDAQ was dismal even in those early years: the number of listed companies was a bare 23 after one year of operation.

During the following years, the burst of the so-called "Internet bubble" spread to the European markets as well. But unlike the AIM, the other stock markets did not recover. The crisis of the Neuer Markt started in early 2000, when several companies had to confess that they could not meet the earning forecasts declared in the introduction prospectuses. Then rumours spread that several companies were threatened by bankruptcy. These rumours contributed to a general downward trend of the stock prices. Between summer 2001 and 2002, there were 58 delistings versus just one new IPO, and by the end of 2002 all of the listed companies moved to the official list or to OTC trading. The Deutsche Börse announced the dissolution of the Neuer Markt at the beginning of 2003.[19] The EASDAQ ceased operations in 2003, due to its inability to attract liquidity. The French NM saw its capitalization decline to 6000 million Euros in 2004, and recorded only a dozen introductions in 2002, and none between 2003 and 2005. A growing number of firms were removed from the listing after 2002. In January 2005, a major reform in the quotation system implied the end of the French market segments: the first market, the second market and the French NM have been replaced by a single official list (Eurolist by Euronext), and a new unregulated market, Alternext, has been created, which is closely modelled on AIM (Jenkinson 2005).[20] The decline of the Italian NM was sharp too. The value of transactions per day fell by almost two thirds between 2000 and 2002. The Numtel index lost 45% by the end of 2001, and a further 50% by the end of 2002. Only 2 new IPOs were held between 2002 and 2005. Starting in 2003, some companies were revocated (10 between 2003 and 2005) because of failures to meet market requirements, bankruptcies, and frauds. By 2005, the total number of NM members was 38, lower than in 2000 (40). Capitalization dropped in both absolute and relative terms (from 1.9% of GDP in 2000, to slightly more than 0.5% of GDP from 2002 on). In September 2005, the name of the market was changed into MTAX. Far from a simple name change, admission requirements are now very similar to those of the main market MTA (see TUF - Testo Unico della Finanza).

[19] The stock exchange was re-structured in two segments, Prime Standard and General Standard. Although the former inherited the Neuer Markt information disclosure rules, it includes companies from the main market along with previous Neuer Market members. In 2005, Deutsche Borse created a further segment, Entry Standard, specifically targeted at SMEs. While successful – market capitalization was about 9.5 billion Euros as of October 2007, with 109 listed companies – this segment has mainly attracted companies in the financial and real estate sectors (source: Deutsche Borse).

[20] By the end of 2006, the number of listed firms on Alternext was 72, and the cumulated amount of capital raised was 527642 million Euros (source: Euronext Paris Statistics). Such a successful performance might however be the outcome of fiscal subsidies and financial guarantees awarded by the French Ministry of Finance to TBSFs listed on the Alternext market (Faulconbridge et al. 2007).

4.2 Assessing the performance of high-tech stock markets

The performance of a stock market for high-tech companies can be evaluated along many dimensions. If institutions like the "new markets" are to be effective in supporting investments in technology-based start-ups, a basic condition is that such markets be viable. Put another way, the market has to be able to develop and eventually achieve a high degree of maturity. Reviewing the history of high-tech stock markets has revealed that the long-term viability is not easy to achieve, even in countries with market-based financial systems. The UK had to undergo at least a decade of trials and errors, and the 1987 stock market crash might have proven a useful experience when the stock market crashed again in 2000/2001.

Conditional on viability, a common criterion to assess the performance of a "new market" is that it displays a satisfactory *ex-post* rate of access by small, young firms involved in high-technology business. Based on this 'TBSF access' criterion, one could envision a perfectly performing NM as one where 100% of its members are small and young companies, involved in technology-based business and belonging to high-tech industries. The NMs with the lowest average age and size of listed companies, and with a sector distribution skewed to high-tech activities, should be seen as the best performing – conditional on their long-term viability. Another common way to envision performance of NMs is in terms of the post-IPO long-term impact on the growth rates, on job creation and on the stock price returns of quoted TBSFs.

4.2.1. Size, age and sector distributions

The evidence about the size distribution of companies listed on "new" markets is mixed. Listing companies on the Nuovo Mercato were rather small. Bottazzi and Da Rin (2002) report that median values for sales and assets of respectively 21.7 and 25.4 Euro millions. Similarly, the figures in Clatworthy and Peel (1997) indicate that in 1997, 10% of AIM firms earned less than 0.25 £m in sales, and 18% less than 1 £m, whereas 25.3% had sales exceeding 11.2 £m. However, the Neuer Markt attracted relatively large companies. It has also been noted that in the most recent years, the AIM has increasingly focused on mid-caps, whose number in AIM have quadrupled since 2004 (Mendoza 2007). Yet, as of January 2006 only about 10% of firms had a market value greater than 100 £m. It is worth noting that size is rather concentrated: the 10% largest firms keep hold of 55.2% of the total AIM equity market value. Similarly, the telecommunication company Tiscali alone accounted for about 45% of the total capitalization of the Italian NM.

The data on the sector composition of companies listed on the AIM show that hi-tech companies never accounted for more than 25% of market turnover, and most often their incidence was below 20% (see Mallin and Ow-Yong 1998, AIM Market Statistics). As noted by Ellul and Pagano

(2006), such a sectoral composition is roughly similar to the main market one. The AIM therefore does not seem particularly able to attract IPOs of technology-based companies. Charlesworth (2000) showed that, by the end of 1999, more than 80% of EASDAQ companies belonged to technology-based sectors, such as software (17.8%), electronics (16.1%), IT (16.1%), biotech and medical equipment (14.3%), telecommunications (10.9%), and specialized equipment (8.9%). On the Nuovo Mercato, ICT and telecommunication companies held the lion's share. Petrella (2001) shows how telecommunications had the highest emission share (over 40%). Media-culture-advertising, biotech and IT also had relevant shares. On the other hand, R&D indicators contradict this picture. As Bottazzi and Da Rin (2002) report, the median R&D intensity was a bare 1%, whereas the median R&D labour share was extremely low. Another surprising fact – in view of the supposedly innovative nature of listing companies - is the rather negligible values of median intangible assets. The picture was similar for the French market. Companies on the Nouveau Marché were quite heterogeneous with regards to their propensity to innovation: the share of intangible assets out of total assets was 2.8%, against 20.8% for tangible assets. The percentage of tangible asset is largely superior to the percentage of intangible asset also for companies on the German new market, despite the presence of several companies involved in the software and IT sectors. This evidence could be explained with the fact that TBSFs are financially constrained and lack resources to carry out formally intangible investments (Poutzouris et al. 2000).

The available information on the age structure of AIM members suggests a strongly skewed pattern in favour of younger business, resulting from a dynamics over the history of the market which seems to have increased the share of young companies. Data on early times (Clatworthy and Peel 1997, Table 4, September 1997) suggest an approximately bell-shaped age distribution, with older firms even being over-represented: 4.4% of firms was of age less than 2 years, 28.5% less than 5 years, 22.5% older than 20 years, and there was a remarkable 10.6% of firms older than 50 years. Ellul and Pagano (2006) analyzed AIM IPOs held between July 1998 and December 2000, and showed that the age of AIM companies at IPO was less than or equal to 1 year in 30% of the cases, whereas the share of companies older than 10 years was 14.8%. Over time, the balance seems to have shifted even more towards younger firms: as of January 2005, about 40% of the listed companies were aged less than 2 years, and the share of companies older than 10 years was negligible. Notably, the comparison with the age structure of companies quoted on the LSE main market (MM) reveals a strong negative correlation across age classes: AIM members are on average younger than their main market peers. This was true also of the Neuer Markt: the average age at IPO between 1997 and 2000 was of 7.7 years, versus 49 years on the main market. A similar value (8.9 years) was found for the Nouveau Marché (Goergen et al. 2002). The median age at IPO on the Nuovo Mercato was about 13 years.

4.2.2. Long-run abnormal returns and growth rates

Bottazzi and Da Rin (2002), Goergen et al. (2002) and Giudici and Roosenboom (2004b) have performed comprehensive analyses of the long-term performance of IPOs on the "new" markets, measured by the sum of the abnormal returns over a long time horizon. On average, companies that went public on NMs exhibited very low returns and many of them lost nearly all their value in the long term. The figures reported by Goergen et al. (2002) are revealing: the underperformance over the first two years was 20% for firms listed on the Nouveau Marché, and up to 60% for the German and Italian NMs. For comparison, the underperformance on the main markets ranges between 10% (Chahine 2004 on France) and 12% (Ljungqvist 1997 on Germany) in the first three years. However, the sign of the abnormal returns switches to positive once the impact of the burst of the New Economy bubble is removed. The divergence of opinion hypothesis (Miller 1977) might be relevant here: investors at IPO are overoptimistic and they set market prices above the fundamental value, but later on prices decline gradually as more pessimistic investors enter the market. Evidence on the TBSFs sales and employment growth has been reported for venture-backed companies quoted on European NMs (cf. Section 3.2). These represent only a subset of quoted TBSFs, yet a rather large one - about half of the NM companies according to Bottazzi and Da Rin (2003a). One can thus conjecture that the mixed evidence on growth performances is true also for non-venture-backed TBSFs.

4.2.3. Some critical remarks

However useful, implications from the above performance assessments have to be drawn with care. A 100% share of young, small and high-tech listed companies might appear desirable, yet the amount of risk in a NM including only TBSFs might be so high, as to discourage investments. The reason is that high-tech start-ups are characterized by naturally high failure rates, even higher than other young SMEs, as their business projects are extremely novel. If the market degree of risk is high enough, even the very viability of the market can be at stake. This suggests that the quotation of a fair share of 'traditional' companies could bring liquidity to the NM and dilute an otherwise overly high amount of risk. This seems to be the case of AIM. Further, a well-performing NM is also one which allows the birth of high-tech companies established by (possibly high-skilled) entrepreneurs who are at the same time credit-rationed, but not wealthy enough to rely on own funds alone. Inspecting the age, size and sector distributions of listed companies is not enough to assess this. Finally, surprisingly few are the papers dealing with informational efficiency. Bohl and Reitz (2004) and Pierdzioch and Schertler (2007) are perhaps the only works on this issue. Both find that NM stock prices are predictable, but none of them is conclusive about efficiency. Pierdzioch and Schertler (2007) note that the market might be predictable because collecting reliable information on TBSFs is very costly, thereby preventing the exploitation of arbitrage opportunities. Paying more attention to efficiency might also allow a better evaluation of the results on long-term abnormal returns, reviewed in the previous subsection: these are most likely biased, as the samples include the Internet bubble.

4.3 What lies behind the failures?

The debate on why stock markets for TBSFs collapsed is still open (Board and Wells 2006). Candidate explanations have to do with informational, regulatory and technological imperfections. First, the poor performance of the NMs might have been the outcome of a 'second-level' competitive process, namely competition among markets. The European markets for high-tech firms opened roughly at the same time, in response to the threat posed by the EASDAQ. The ensuing competition among exchanges diluted the amount of liquidity available to each of them. Moreover, downside competition among exchanges led the market authorities to allow for quotation of firms that were perhaps too young to go public or simply unfit for long-term survival (see Revest 2008 for France). There is some evidence that, during the Internet bubble, when the results of the Neuer Markt were far better than those of the French New Market, the French authorities decided to admit unreliable firms characterised by unviable projects, unskilled managers, or deficient potential demand. Similar problems were undergone by the German and Italian NMs.

Second, it has been argued that "new" markets were poorly diversified. This might be true of markets such as the EASDAQ, which listed firms from a very narrow range of economic activities, a feature which did anything but help the market recover after the bubble crash (see Mendoza 2007 for a shared view). Still, "new" markets in France, Germany and Italy, which had a much weaker technology focus, collapsed too, suggesting that diversification is a necessary but not sufficient condition for success.

Third, the adequacy of the market architecture (the quotation system, the role of market makers) has been questioned, e.g. in the case of the Nouveau Marché. Many French ITMs expressed a negative opinion about the double quotation system on the Nouveau Marché comprising both an order-driven market and market making (Revest 2001, p. 198). An investigation by Ernst & Young in collaboration with the ANVAR and the SNM revealed a negative appraisal of market making from the 28 French NM-quoted firms. These firms complained that ITM acted too prudently and they regretted the lack of real market making. The limits of the French market making system have been emphasized during periods of high volatility. During these periods, ITM did not post prices and consequently could not buy or sell anything: "Because of the lack of punishment, nothing was done to improve the ITM's respecting of obligations" (Perwald 2002, p. 270).

Finally, if the POH is due to credit rationing and informational asymmetries, the firms which manage to go public and collect funds on the stock market do not necessarily belong to the 'top-flight'. That is, some of the best projects might have been rationed out. Moreover, as the trade sale is the prevailing exit strategy for venture capital investments, some of the best VC-backed companies might be acquired by larger business out of the stock market. The average 'quality' of the companies which

go public on NMs is thus lower than it would be with perfect information and perfect markets. If the negative impact of credit rationing is deep enough, NMs might prove unviable even if the market architecture is properly designed and even if the listing is adequately diversified.

5. Public financial support to TBSFs

The empirical literature on the financial structure of TBSFs is not yet conclusive about the weight of public funds. As a matter of fact, while public support can be provided directly – e.g. through grants or via public venture capital - part of the public financial support does not actually show up in the capital structure: for instance, the State can give collateral, thereby allowing some illiquid companies to obtain bank credit. Hence, any available measure of the share of public funds in the capital structure is likely to underestimate the incidence of public money.

The debate is still open about whether the State should support TBSFs at all. If the POH and the related funding gaps are a market failure story, then public policies are expected to improve the social welfare by achieving a more efficient allocation of resources. Yet, a careful reading of the stylized facts on industrial dynamics suggests that providing finance to firms characterized by extremely high failure rates might result in a waste of public money (Holtz-Eaking 2000; Santarelli and Vivarelli 2002). Moreover, if the State becomes a player in the venture capital industry, the quality of incentives for private investments can worsen: public VC might crowd out private VC investments, and as an outcome, the overall cake of available funds may shrink. While empirical testing of the former hypothesis is challenging, as it requires counterfactuals, the works to be reviewed here tend to reject the crowding-out hypothesis and underline the beneficial impact of public VC programmes.

Supposing that public support to TBSFs is potentially useful and not wasteful, the question is: how to make it effective? The discussion in the literature mainly revolves around whether TBSFs and 'non-hi-tech' SMEs should compete over the same pool of resources, and whether public bodies should discriminate among grant applications on the grounds of a preliminary quality assessment. The evidence suggests that customized and discretionary (i.e. non-automatic) support measures are best performing. In what follows, we shall deal with the main national and regional policy measures to support TBSFs, and we shall therefore focus on how the European countries have tried to stimulate the creation and the development of the VC industry.

5.1 Supporting TBSFs and the role of regions

An increasing stream of works deals with the role of institutions and public policies to support the creation and growth of innovative ventures (Mayer 2002, Lerner 2002). In recent years, public programs have played an increasingly active role in financing hi-tech small firms. The European

governments have been trying to design support schemes similar to Small Business Innovation Research Program which has prompted new firm formation in US high-tech sectors (Lerner 1996, Megginson 2004). The actions taken and their timing have partly reflected the underlying institutional differences.

In France, several public measures to support innovation since the early Nineties have been directed towards the needs of young innovative firms (Carpentier et al. 2007b). One of the most important laws in this field was the Law on Research and Innovation of July 12, 1999, that promotes the transfer of knowledge towards companies and the creation of new innovating companies. More recently, the emergence of a legal status for the "Young Innovative Firm" (Jeune Entreprise Innovante, JEI) and the research tax credit (Finance Act 2004) have generated some positive effects.[21] According to France Biotech (2006), 1600 firms have adopted this statute. Among them, 74% of biotech companies have opted for the status of JEI. One important characteristics of the TBSFs public support in France during the Nineties was the "drastic reduction" of large-scale public programs, that accompanied by a reorientation of the public policy on innovation (Mustar and Larédo 2002). The choice of French authorities was clearly to replace large-scale programs supporting innovation (in the civil sector) with a large array of specific grants and numerous forms of intermediation. In addition, the beginning of the Eighties saw the emergence of new public actors as the regions (Decentralisation Act, 1982) and the European Commission (Framework Programme, 1984).

During the Nineties, the German government also instituted a series of new technology policy actions designed to help the development of small entrepreneurial technology firms. These news policies promoted 'institutional adaptiveness' by providing new opportunities for firms (Casper, 2000). They rely increasingly on regional competition and on the role of networks. Biotechnology was the first high-tech sector targeted by these new policies. The BIOREGIO competition (1995) awarded monetary prizes to the regions offering the best regional commercialization networks (Casper 2000, Dohse 2000, Lehrer and Asakawa 2004). Two main reasons explain the use of a "regional tool". First, the federal financial resources were limited. Second, the regional investment was very powerful knowing the tradition of the federalist Germany where Länders control the universities and partial funding of many research centers (Lehrer and Asakawa, 2004, Zechendorf 2006). So, the aim of BIOREGIO was to create biotechnology clusters, able to transform academic knowledge to products or services, as the Silicon Valley has done it for ICT. Investment into the German Biotech industry increased from DM 75 million in 1996 to DM 165 million in 1997 and approximately DM 425 million in 1998 (Ernst & Young, 1998). Appreciating the results of BIOREGIO, the ministry has generalized

[21]To be legally recognized as a young innovative firm, the firm must be less than 8 years old and spend a minimum amount for research. Under such conditions, the firm will pay less taxes during the early years of its life.

this tool of contest to other technology sectors such as multimedia or nanotechnology. The BIOREGIO contest served as a model for further interregional competition designed to promote start-ups (Wilson and Souitaris, 2002).

In Italy, public agencies have been created at both the national and the regional level. For instance, Sviluppo Italia (SI), a public agency, manages a system of closed-end regional investment funds (*Fondi regionali di investimento*) which operate at the regional level. Their goal is to provide support to SMEs in the seed, start-up and early growth stages. SI has promoted a special Italian regional fund, called *Fondo Early Stage*, targeting SMEs based in Tuscany at the seed and start-up stages. The results of the existing studies on the effectiveness of public policies in Italy are mixed. A number of research papers have focused on the effects of the Law 488/92. This law sets out procedures for the provision of subsidies, aimed to promote private R&D investment by SMEs in the less developed areas of Italy. Altobelli et al. (2006) have stressed that the 488 Law has enhanced the growth of local industrial clusters, yet other authors have criticized this tool on the grounds of its poor ability to award funds to high-quality projects, for its vague objectives vis-à-vis industrial policy (Potestio 2004), and for its lack of specialized focus on SMEs (Altobelli et al. 2006). Italy has never had – and still does not have – any scheme targeted exclusively upon TBSFs. All of the support measures are typically available also to other types of enterprises (Colombo and Grilli, 2006). Overall, the literature sheds light on the need for more specific and customized programs (Colombo, Giannangeli and Grilli 2007).

The UK government has adopted specialized measures to spur innovation through grants, such as the SMART Award and, more recently, the Research & Development Grant. Those awards concern both product and process innovation, at all stages of development of the innovative process. The Science Enterprise Challenge attempts to fill the gaps which frequently borrowers have in terms of financial expertise. Such a programme, active since 1999, involves a network of universities and promotes the creation of tight links between the business and the research communities (see also Dimov and Murray 2001; Smallbone, Baldock and Burgess 2002). Public venture capital initiatives are represented by the Regional Venture Capital Funds, which since 2001 provide risk capital to SMEs with growth potential (Dimov and Murray 2001). Other measures, such as the Small Firms Loan Guarantee Scheme (SFLG), are more directly targeted at overcoming market failures which cause hi-tech small firms to be credit rationed. Less clear is the UK government policy as regards fiscal incentives to TBSFs. It is commonly held that tax reliefs could greatly help mitigating the adverse impact of the "finance gap" on SFEs (Bolton 1971, Watson 1990), and *a fortiori* on TBSFs. The few studies on this issue tend to shed a negative light on UK fiscal policies (Poutziouris et al., 1999, 2000). According to the authors, the UK fiscal system is regressive, and that small and young firms in technology-based manufacturing and service activities bear a heavier tax burden.

5.2 Public venture capital initiatives

Despite the origins of the much celebrated US venture capital can be traced back to a private initiative,[22] the involvement of public agencies in the venture capital business has been strong and helpful for the subsequent development of the industry - through the Small Business Investment Companies (SBICs) which operated in the Sixties and Seventies, the Small Business Investment Research (SBIR) Programme since 1982, and several other initiatives taken by numerous Departments of the Federal Government, as well as at the State level (see Lerner 1996 for a list).[23] In importing the American model of innovation finance, the European governments and the European Commission have strongly intervened in the venture capital sector, too.

The innovation policies pursued by the French government have been crucial in the emergence and growth of the French venture capital industry (Battini 1999). At the end of the Eighties, efforts toward venture capital have resulted in the creation of "specialized legal vehicles" to manage the funds provided by the institutional investors.[24] Those new legal forms enabled greater visibility and transparency for the benefit of investors and firms. Meanwhile, at the end of the Eighties, fiscal incentives have been designed with the aim to encourage investments in risky companies. Beside the indirect incentives measures, VC was supported by large French public organizations as CDC ("Caisse des Depôts et Consignation")[25] and OSEO-ANVAR.[26] The goal of the government was not only to finance directly innovative firms but also to stimulate private investments, through a leverage effect on quantity. The role played by certification programs on public financing companies in stimulating investments has been already emphasized (Lerner 2002). At the end of the Eighties, a leverage effect has been observed in France - with a multiplier effect of 2 for the Agency for the Valorisation of Research (ANVAR) (Dubocage and Rivaud-Danset, 2003).

The role of the State in supporting the development of venture capital in Germany has also been strong, especially in the Nineties. The importance of government sponsored guarantee and co-investment mechanisms is one of the main characteristics of the German VC (Dubocage and Rivaud-Danset, 2003). The German government had funded substantial programs to inject venture capital into the NTBF's (Wupperfeld, 1997, Lehrer, 2000). Two mechanisms to promote venture capital have been implemented in the Nineties through the programme BTU - *capital investment for young technological*

[22] Namely American Research and Development, founded in 1946 (Gompers and Lerner 2001).
[23] Lerner (1996) reports that the SBICs poured $3 billion into the sector of young firms between 1958 and 1969, a sum equal to about three times the total private venture capital investments in the same period. As of september 2004, SBA's (Small Business Administration) total financial exposure in the SBIC programs for cohorts 1994 through 2004 was $ 11,25 billion for the participating securities and $ 2,84 billion for debenture (SBA, 2004).
[24] The *SCR* (*Sociétés de Capital Risque*) - Societies of Venture Capital- in 1985, the *FCPR* (*Fonds Commun de Placement à Risque*) - Common Investment Funds at Risk - in 1983, and the FCPI (*Fonds Communs de Placement dans l'Innovation*) - Investment Funds in Innovation - in 1997.
[25] For instance, "CDC Entreprise" is the major institutional investor for French technological venture capital.
[26] ANVAR ("Agence Nationale de Valorisation de la Recherche") is the national agency for promoting research.

firms (Champenois 2006). The first was implemented by the public bank *TBG*, the *Technologie-Beteiligungsgesellschaft*. The *TBG* co-finances technology-intensive firms[27]. The second phase of the program BTU consists of a system of refinancing of funds invested up to 75% by another public bank, the *KFW, Kredit Für Wiederaufbau* – organization credit for reconstruction. The KFW offers refinancing for VC funds at very attractive conditions. In addition, in 1997, the ministry of the economy put in place a new mechanism called FUTOUR. In this case, public funds are awarded a grant to cover a very large share of the expenses of the company especially in the seed and creation phase. Generally, actors of the German VC believed that these programs played an important role in jump-starting the German VC market (Fiedler and Hellman, 2002). Yet, after the burst of the Internet bubble, the rules have been tightened and capital risk has displayed lower capacities for financing innovation (Champenois, 2006).

As to Italy, the most salient fact relates to the structural transformation of the Italian financial system, which used to be based on a tight separation between banking and industry until the mid-Nineties. This separation prevented opportunities for the development of private equity. In 1993, the Nuova Legge Bancaria (New Bank Law) allowed for equity investments by banks and other credit institutions. In addition, a law on closed-end funds (Legge n.344/1993) was passed, and further legislation followed after 1997 (see also Tantazzi 2001). Despite these reforms, however, and the Italian financial system seems to still be very much dependent on banking (Calcagnini, Scalera and Zazzaro 2005). Public support to TBSFs is also provided by the Italian Business Angel Network (IBAN), established in 1999, which includes 8 Business Angel Networks, located all over Italy (BAN Brescia, BAN Bologna, BAN Toscana Sud, BAN Umbria, BAN Lazio, BAN Sardegna, BAN Caserta/Campania, BAN Puglia). The capital shares of these BANs are typically held by the Regions, by regional development agencies and by private banks.

As compared to the other European countries, the British government has been a late-mover with regards to the adoption of policy actions in support of the venture capital industry (Dubocage and Rivaud-Danset 2004). During the Nineties, one could observe a lack of dynamism in high tech-oriented VC. Venture capitalists neglected the essential complementarity of technological and financial expertise in managing venture capital projects and revealed a strict preference for low-risk projects. At the same time, UK policy-makers blindly trusted the market's ability to achieve a socially optimal allocation of investment resources.[28] Despite the significant delay in taking effective actions, in the last decade the UK has made significant steps toward overcoming the main financial hurdles to hi-tech start-up creation. Some of the major efforts by the UK government have been targeted directly

[27] The principle of supplementing operates as follows: for every Euro invested in an innovative firm by private investors, the *TBG* brings an additional euro to a maximum of one million and half euros. Between 1974 and 2002, *TBG* has allocated a total of 372.8 million Euros as seed capital.

[28] See Oakey (1995) for a consistent assessment of the passive role of UK policy-makers.

at the venture capital industry. For instance, the Venture Capital Trust scheme[29] has been established back in 1995 to encourage, via tax reliefs, the formation of venture capital funds and their collection of investment funds.[30] A shared consensus emerges on public venture capital in the UK, holding that public bodies have not been able to seed the venture capital industry - they have been followers, rather than leaders, along the industry's development trajectory; and that, however, they have by and large been successful in overcoming the market failures, and have even contributed to galvanize the industry by encouraging private investments via their certification role (Jeng and Wells 2000, Leleux and Surlemont 2003, Mayer, Schoors and Yafeh 2005).

6. Conclusion

The foregoing survey has offered a bird's eye view on the status of both private and public sources of financial support to technology-based small firms in European countries. We have learned a few lessons on the comparison among European countries and on the relative performance of Europe vis-à-vis the United States.

The single, most robust piece of evidence on TBSF finance is that the main determinants of funding gaps are invariant across European countries. As a matter of fact, the most radically innovative projects are overlooked not just by banks, which lack technological competencies; but also by venture capitalists, which tend to be short-run oriented, as revealed by the empirical tests of the exploitation hypothesis; and by specialized stock markets, which are not liquid and transparent enough. Venture capitalists themselves have kept significant amounts of liquidity and information out of IPO markets, as they have mainly opted for trade sales even in a market-oriented country such as the UK. One is led to conclude that when it comes to explain the cross-country differentials in the birth of new TBSFs and in their growth performances, whether a country's financial system is close to the bank-based or to the market-based prototypes matters very little. Much more decisive for understanding TBSF finance is the extent of informational gaps and how they have been dealt with by public agencies. In a market-based system such as the UK, one would expect a competition-driven process of resource allocation among investment opportunities. The UK is however the country where greater attention has been paid to high-tech firms by policy-makers, albeit with a significant delay. Public venture capital funds in the UK have played important certification and signalling functions and have mainly targeted small, credit-rationed high-tech companies.

Going through the evidence on private- and public-equity, one can easily realize that the comparison between Europe and the United States is an unfair comparison. First, it took about 40

[29] See www.hmrc.gov.uk for further information on eligibility criteria.
[30] Further tax exemptions, more specifically targeted at investments in high-risk projects, are provided by the Enterprise Investment Scheme that includes an income tax relief and a deferral relief for capital gain taxes.

years for American venture capital to really take off – the data in Gompers and Lerner (2001) are revealing (cf. Fig. 1 of their paper). Although Europe clearly lags behind in venture capital commitments, such a delay might not be pathological. European venture capital might just need more time – after all, the history of European venture capital is shorter. One may argue that, as followers, European countries should have exploited the America experience and climbed the learning curve faster. Yet, if the evolution of financial systems is constrained by path dependencies, as increasingly suggested in the literature (Bianco, Gerali and Massaro 1997, Holzl 2003, Vitols 2004), different countries have little to learn from each others' experiences. Second, Europe is politically fragmented, unlike the United States, and the national stock exchanges have spawned a large number of competing stock markets for high-tech companies, unlike the NASDAQ which is leader. Comparing the NASDAQ with any of the European NMs sounds like comparing a monopolist and a competitive firm: not surprisingly, the latter is smaller. The European Commission's attempt to set up a pan-European high-tech market and the on-going processes of stock market integration in Europe (e.g. Euronext) suggest that the benefits from concentration in the 'market of financial markets' are clear to both policy-makers and stock exchanges.

The European experience with TBSFs finance makes it clear that institutional forms adopted in one country need not prove successful across borders. Seduced by the NASDAQ mythology, the European Union and the stock exchanges in continental Europe have set up high-tech markets based on the NASDAQ principle and have deliberately chosen not to treasure their own (albeit unsuccessful) experience with feeder markets. More generally, the non-bank financial intermediaries and institutional investors have become more influential in Europe since the Nineties, at both the national and supranational policy-making levels (Schmidt and Tyrell 2004, Capolupo and Celi 2004, Posner 2004). Will the drive towards market-based systems prove decisive for TBSF support? As a matter of fact, whether venture capital and high-tech stock markets are growth-enhancing is still under debate. The firm-level evidence reviewed here is not conclusive on this issue, and the cross-country econometric evidence reveals that bank-based and market-based systems tend to grow at the same average pace (see Levine 1997). Rather, based on the institutional complementarity concept (Aoki 2001) we conjecture that future attempts at setting up market-based support for high-tech SMEs are doomed to fail, unless they are conceived as part of broader (and painful) reforms involving also sectors outside of the financial system. Instrumental to enhancing the liquidity of high-tech stock markets are policies that redistribute wealth to households with high propensities to hold equity. This however will require radical change in the education and welfare systems (Vitols 2004), in the organization of research activities (Antonelli 2008), in fiscal policies, and in labour market regulations towards greater flexibility of the workforce (Da Rin et al. 2006). All these reforms entail large social

costs – let alone the sheer losses from exposing citizens to the extreme risks of international finance.[31] Future research on innovation finance may pay more attention to these issues.

Acknowledgements.

We acknowledge financial support from DIME – Dynamics of Institutions and Markets in Europe, 6th Framework Programme of the European Union. Giovanni Dosi helped us shape this paper with precious comments and suggestions. All errors remain our own responsibility.

References

Adedeji A. (1998), "Does the pecking order hypothesis explain the dividend payout ratios in the UK", *Journal of Business Finance & Accounting* 25(9-10): 1127-1155.

AFIC, Rapports annuels sur l'activité du capital investissement en France, 2001-2006

AIFI, "Il mercato italiano del private equity e del venture capital", annual reports (1997-2006).

Allen J. (1992), *Starting a technology business*, Pitman, London.

Allen F., Gale G. (2001), "Comparative financial systems: a survey", Wharton School Center for Financial Institutions Working Papers 01-15.

Altobelli C., Bianchi A., Carapellotti F., Gallo R., Guglielmetti P. (2006), "Incentivi '488' all'industria negli anni 1996-2004: effetti settoriali e territoriali", *L'Industria*, Jan-Mar, 1: 85-102.

Antonelli C. (2008), "The new economics of university: A knowledge governance approach", *Journal of Technology Transfer* 33(1): 1-22.

Antonelli C., Teubal M. (2008), "Knowledge-intensive property rights and the evolution of venture capitalism", *Journal of Institutional Economics* 4: 163-182.

Aoki M. (2001), *Toward a comparative institutional analysis*, MIT Press

Aoki M., Dosi G. (1992), "Corporate organization, finance and innovation", in Zamagni V. (ed.), *Finance and the Enterprise*, Academic Press.

Arosio R., Bertoni F., Giudici G. (2001), "The good, the bad and the ugly: everyone wants to join the Nuovo Mercato", Social Science Research Network, EFMA 2001 Lugano Meetings.

Arosio R., Giudici G., Paleari S. (2000), "Why do (or did?) Internet stock IPOs leave so much money on the table?", Social Science Research Network.

Atanasova C., Wilson N. (2004), "Disequilibrium in the UK corporate loan market", *Journal of Banking and Finance* 28(3): 595-614.

Audretsch D., Lehmann E. (2004), "Financing high tech growth: the role of banks and venture capitalists", *Schmalenbach Business Review* 56: 340-357.

Bah R., Dumontier P. (2001), "R&D Intensity and Corporate Financial Policy: Some International Evidence", *Journal of Business Finance & Accounting* 28(5-6): 671-692.

[31] Posner (2004) estimates that in Germany, about 50% of the losses from the 2000/2001 stock market crash have been born by households.

Bank of England Report (2001), "Financing of technologies based small firms", EC2R 8AH.

Bascha A., Walz U. (2002), "Financing practices in the German Venture capital industry. An empirical assessment", CFS W.P., N°2002/08.

Battini P. (1999), *Capital- Risque: mode d'emploi*, Editions de l'Organisation.

Baygan G. (2003), "Venture capital policy review", Directorate for Science, Technology and Industry, OECD.

Bianco M., Gerali A., Massaro R. (1997), "Financial systems across "developed countries": convergence or path dependence?", *Research in Economics* 51(3): 303-331.

Becker R., Hellmann T. (2005), "Lessons from the German experience" in V. Kanniainen and C. Keuschnigg (eds.), *Venture Capital, Entrepreneurship and public policy*, CESifo Seminar Series.

Board J., Wells S., (2006), "The LSE's AIM market: effect on returns and trading of Canadian stock. Maintaining a competitive capital in Canada", Report for The task force to modernize securities legislation in Canada.

Bohl M.T., Reitz S. (2004), "Do positive feedback traders act in Germany's Neuer Markt", viadrina.euv-frankfurt-o.de.

Bolton J. (1971), "Small Firms: Report of the Committee of Inquiry on Small Firms", Her Majesty's Stationery Office.

Bonini S., Zullo R. (2002), "Venture capital ed imprenditorialità. Prospettive di crescita a confronto", Ente Luigi Einaudi, Quaderni di Ricerche n. 30.

Booth J., Smith R. (1986), "Capital raising, underwriting, and the certification hypothesis", *Journal of Financial Economics* 15(1-2): 261-281.

Bottazzi L., Da Rin M. (2002), "European venture capital", *Economic Policy*, April: 231-269.

Bottazzi L., Da Rin M. (2003a), "Venture capital in Europe and the financing of innovative companies", in *Economic Policy*, ed. by G. De Menil, H. Sinn, R. Portes, Blackwell Publishing.

Bottazzi L., Da Rin M. (2003b), "Financing entrepreneurial firms in Europe: Facts, issues, and research agenda", CESifo Working Paper No. 958.

Brav A. (2005), "How does access to the public capital market affect firms' capital structure?", Wharton School, University of Pennsylvania.

Breschi S., Malerba F., Orsenigo L. (2000), "Technological regimes and Schumpeterian patterns of innovation", *Economic Journal* 110 (463): 388-410.

Bruton G., Fried V., Manigart S. (2005), "Institutional Influences on the Worldwide Expansion of Venture Capital", *Entrepreneurship Theory and Practice* 29(6): 737-760.

Burghof H.P., Hunger A. (2004), "The Neuer Markt: an (Overly) Risky Asset of Germany's Financial System" in *The Rise and Fall of Europe's New Stock Markets*, G. Giudici and P. Roosenboom (éds.), *Advances in Financial Economics* 10: 295-329.

Calcagnini G., Scalera D., Zazzaro A. (2005), "Quale banca per le medie imprese?", *L'Industria* Apr-Jun, 2: 285-302.

Capolupo R., Celi G. (2004), "Il finanziamento dello sviluppo: teorie ed evidenza empirica", University of Bari working paper.

Carlin W., Mayer C. (2003), "Finance, investment and growth", *Journal of Financial Economics* 69 : 191-226.

Carpentier C., Liotard I., Revest V. (2007b), “La promotion des firmes françaises de biotechnologie : le rôle de la propriété intellectuelle et de la finance”, *Revue d’Economie Industrielle*, Recherche et innovation dans les sciences du vivant : enjeux et perspectives, n°120, décembre.

Carpentier, C, Le Guehennec, C., Liotard, I. Raffo, J., Revest V. (2007a), "Les trajectoires économiques des start-ups de biotechnologie: Le rôle de la finance et de la propriété industrielle." Mire.

Casper S. (2000), “Institutional adaptativeness, technology policies, and the diffusion of new business models: the case of German biotech”, *Organization Studies* 21(5): 887-914.

Chahine S. (2004), “Long-run abnormal return after IPOs and optimistic analysts' forecasts”, *International Review of Financial Analysis* 13(1): 83-103.

Chahine S., Filatotchev I., Wright M. (2007), “Venture Capitalists, Business Angels, and Performance of Entrepreneurial IPOs in the UK and France”, *Journal of Business Finance & Accounting* 34(3-4): 505-528.

Champenois C. (2006), “Capital risque et intermediation: les fondements de l’essor entrepreneurial dans les biotechnologies en Allemagne. L’exemple de la région Berlin/Brandebourg”, *Education et Formation* 73: 101-112.

Charlesworth R. (2000), "EASDAQ key statistics", www.fisd.net.

Chausson Finance, l’indicateur, 1999-2005

Chittenden F., Hall G., Hutchison P. (1996), “Small firm growth, access to capital markets and financial structure: Review of issues and an empirical investigation”, *Small Business Economics* 8(1): 59-67.

Clatworthy M., Peel M. (1998), “The characteristics of new equity markets for SMEs”, *Journal of Small Business and Enterprise Development* 5(1): 79-92.

Coakley J., Hadass L., Wood A. (2007), “Post-IPO operating performance, venture capital and the bubble years”, Journal of Business Finance & Accounting 34 (9-10): 1423-1446.

Colombo M., Giannangeli S., Grilli L. (2007), “A longitudinal analysis of public financing and the growth of New Technology-based Firms: do firms’ age and applicants’ evaluation methods matter?”, http://innovationstudies.polito.it.

Colombo M., Grilli L. (2006), “Supporting high-tech start-ups: Lessons from Italian technology policy”, *International Entrepreneurship and Management Journal* 2(2): 189-209.

Colombo M., Grilli L. (2007), “Funding Gaps? Access to bank loans by high-tech start-ups”, *Small Business Economics* 29(1-2): 25-46.

Commission of the European Union (1993), “Financial Problems of SMEs”. Brussels, COM(93)528, November.

Commission of the European Union (1995), “Reporting on the feasibility of the creation of a European capital market for smaller entrepreneurial managed growing companies”. Brussels, COM(95)498, 25 October.

Cressy R. (1995), “Business borrowing and control: A theory of entrepreneurial types”, *Small Business Economics* 7(4): 291-300.

Cressy R., Olofsson C. (1996), “European SME financing: An overview”, *Small Business Economics* 9(2): 87-96.

Da Rin M., Nicodano G., Sembenelli A. (2006), “Public policy and the creation of active venture capital markets”, *Journal of Public Economics* 90(8-9): 1699-1723.

Deakins D., Hussain J.G. (1994), "Financial information, the banker and small business: a comment", *British Accounting Review* 26: 323-335.

Demirguc-Kunt A., Levine R. (1996), Stock markets, corporate finance, and economic growth: an overview, *The World Bank Economic Review* 10(2): 223-239.

Dimov D., Murray G. (2001), "Literature survey on venture capital support schemes in Europe", IFISE Project.

Dohse D. (2000), "Technology policy and the regions – the case of the BioRegio contest", *Research Policy* 29: 1111-1133.

Donaldson G. (1961), "Corporate debt capacity: A study of corporate debt policy and the determination of corporate debt capacity", Harvard Business School, Division of Research.

Dosi G. (1990), "Finance, innovation, and industrial change", *Journal of Economic Behavior and Organization* 13: 299-319.

Dosi G., Llerena P., Sylos Labini M. (2006), "Science-Technology-Industry links and the 'European paradox': Some notes on the dynamics of scientific and technological research in Europe" in Lorenz E., Lundvall B.-A. (eds.) *How Europe's Economies Learn*, Oxford University Press.

Dubocage E., Rivaud Danset D. (2003), "L'émergence du capital risque: la politique publique française", *Les notes de l'IFRI*, N°55, La documentation française, Paris.

Dubocage E., Rivaud-Danset D. (2004), "The development of venture capital in Europe. The role of public policy". Mimeo.

Ellul A., Pagano M. (2006), "IPO Underpricing and After-Market Liquidity", *Review of Financial Studies* 19(2): 381-421.

Engel D. (2002), "The impact of venture capitak on firm growth: an empirical investigation", Discussion Paper 02-02, ZEW.

Euronext statistics (1996-2004).

EVCA (2005), *Venture Capital Yearbook*, Brussel.

EVCA statistics (1996-2006).

Faulconbridge J.R., Engelen E., Hoyler M., Beaverstock J.V. (2007), "Analysing the changing landscape of European financial centres: the role of financial products and the case of Amsterdam", *Growth and Change* 38(2).

Fernandez V. Et Lantz J.S. (2001), "Structure financière des dotcom et rôle de l'intermédiation financière en capital investissement, Réseaux, 2, n°106, p. 180-197.

France Biotech (2005), Panorama annuel.

Franzke S. (2005), "Underpricing of venture-backed and non-venture-backed IPOs: Germany's Neuer Markt", CFS Working Paper 2001/01 revised.

Freel M. (2007), "Are small innovators credit rationed?", *Small Business Economics* 28: 23-35.

Garmaise M. (1997), "Informed investors and the financing of entrepreneurial projects", Stanford University Working Paper.

Giudici G., Paleari S. (2000), "The provision of finance to innovation: A survey conducted among Italian technology-based small firms", *Small Business Economics* 14: 37-53.

Giudici G., Roosenboom P. (2004), "The long term performance of initial public offerings on Europe's new stock markets", in The Rise and Fall of Europe's New Stock Markets, G. Giudici and P. Roosenboom (éds.), *Advances in Financial Economics* 10: 329-354.

Godley A., Ross D.M. (1996), Introduction: banks, networks, and small firms finance, *Business History Review* 38: 1-10.

Goergen M., Khurshed A., McCahery J.A., and L. Renneboog (2002), "The rise and fall of the European New Markets: On the short- and long-run performance of high-tech initial public offerings", CentER Discussion Paper n. 2002-101, Tilburg University, the Netherlands.

Gompers P., Lerner J. (1997), "Venture capital and the creation of public companies: do venture capitalists really bring more than money", *Journal of Private Equity*, 1, p. 15-32.

Gompers P., Lerner J. (2001), "The venture capital revolution", *Journal of Economic Pespectives* 15(2): 145-168.

Grilli L. (2005), "Internet start-ups access to the bank loan market: evidence from Italy", *Applied Economics* 37(3): 293-305.

Guiso L. (1998), "High-tech firms and credit rationing", *Journal of Economic Behavior and Organization* 35: 39-59.

Hall B. (2002), "The financing of Research and Development", *Oxford Review of Economic Policy*, 18: 35-51.

Hall B. (1992), "Investment and Research and Development at the firm level: does the source of financing matter? NBER Working Paper, N° W4096.

Hall P.A., Soskice D. (1991), *Varieties of capitalism: the institutional foundations of comparative advantage*, Oxford University Press.

Hamao Y., Packer F., Ritter J.R. (2000), "Institutional affiliation and the role of venture capital: Evidence from initial public offerings in Japan", *Pacific-Basin Finance Journal* 8(5): 529-558.

Hao K., Jaffe A. (1993), "Effect of liquidity on firms' R&D spending", *Economics of Innovation and New Technology* 2(4): 275-282.

Himmelberg C., Petersen B. (1994), "R & D and Internal Finance: A Panel Study of Small Firms in High-Tech Industries", *The Review of Economics and Statistics* 76(1): 38-51.

Holtz-Eakin D. (2000), "Public policy toward entrepreneurship", *Small Business Economics* 15(4): 283-291.

Holzl W. (2003), "Convergence of financial systems: an evolutionary perspective", Vienna University of Economics and Business Administration working paper no. 31.

Hubbard R. (1998), "Capital market imperfections and investment", *Journal of Economic Literature* 36: 193-225.

Jappelli T. (1990), "Who is credit constrained in the US economy?", *Quarterly Journal of Economics*, Feb.: 219-234.

Jeng L., Wells P. (2000), "The Determinants of Venture Capital Funding: Evidence Across Countries", *Journal of Corporate Finance* 6: 241-289.

Jenkinson T. (2005), "Public of private equity? How accelerated IPOs can increase competition in offerings", Oxford University.

Jensen M., Meckling W. (1976), "Theory of the firm: managerial behavior, agency costs, and capital Structure", *Journal of Financial Economics*.

Jordan J., Lowe J., Taylor P. (1998), "Strategy and financial policy in UK small firms", *Journal of Business Finance & Accounting* 25(1-2): 1-27.

Kamien M., Schwartz N. (1982), *Market Structure and Innovation*, Cambridge University Press.

Krahnen J.P., Schmidt R.H. (eds.) (1994), *The German financial system*, Oxford University Press.

Kon Y., Storey D. (2003), "A theory of discouraged borrowers", *Small Business Economics* 21(1): 37-49.

L'Homme Y. (2001), "Le financement de l'innovation technologique dans l'industrie", *Le 4 pages des Statistiques Industrielles*, n°156, novembre.

Le Déaut, JY. (2005), "La place des biotechnologies en France et en Europe", rapport de l'Office parlementaire d'évaluation des choix scientifiques et technologiques, Assemblé Nationale.

Lehrer M. (2000), "Has Germany finally fixed its high-tech problem? The recent boom in German Biotechnology-based entrepreneurship", *California Management Review* 42(4), p. 89-107.

Lehrer M., Asakawa K. (2004), "Rethinking the public sector: indiosyncrasies of biotechnolohy commercialization as motors of national R&D reform in Germany and Japan", *Research Policy*, 33, p. 921-938.

Leleux B., Surlemont B. (2003), "Public versus private venture capital: seeding or crowding out? A pan-European analysis", *Journal of Business Venturing* 18: 81-104.

Lerner J. (1995), "Venture capitalists and the oversight of private firms", *Journal of Finance* 50(1): 301-318.

Lerner J. (1996), "The government as venture capitalist: the long-run impact of the SBIR program", NBER Working Paper 5753.

Lerner J. (2002), "When bureaucrats meet entrepreneurs : the design of effective 'public venture capital' programmes", *Economic Journal* 112(477).

Levine R. (1997), Financial development and economic growth: views and agenda, *Journal of Economic Literature* 35: 688-726.

Lhuillery, S. (2001), « Les entreprises de biotechnologie en France en 2001 », Note Recherche 03.01, ministère de la Recherche, MJENR – Direction de l'évaluation et de la prospective.

Licht A. (1997), "Stock market integration in Europe?", Harvard Law School.

Ljungqvist A. (1997), "Pricing initial public offerings: further evidence from Germany", *European Economic Review* 7: 1309-1320.

Lockett A., Murray G., Wright M. (2002), "Do UK venture capitalists *still* have a bias against investment in new technology firms", *Research Policy* 31(6): 1009-1030.

Loughran T., Ritter J.R. (2004), "Why has IPO underpricing increased over time", *Financial Management*

Mallin C., Ow-Yong K. (1998), "Corporate governance in small companies: the Alternative Investment Market", *Corporate Governance* 6(4): 224-232-

Mangematin V., Lemarié S., Boissin J.P., Catherine D., Corolleur F., Coronini R ., Trommetter M. (2003), Development of SMEs and heterogeneity of trajectories : the case of biotechnology in France, *Research Policy* 32(4): 621-638.

Manigart S., De Maeseneire W. (2003), "Initial returns: underpricing or overvaluation? Evidence from EASDAQ and Euro.NM", Vlerick Leuven Gent Working Paper Series 2003/11.

Mason C.M., Harrison R.T. (2004), "Does investing in technology-based firms involve higher risk? An exploratory study of the performance of technology and non-technology investments by business angels", *Venture Capital* 6(4): 313-332.

Mayer C. (1998), Financial systems and corporate governance: a review of the international evidence, *Journal of Institutional and Theoretical Economics* 154(1): 144.

Mayer C. (2002), "Financing the new economy: financial institutions and corporate governance", *Information, Economics and Policy*, 14(2).

Mayer C., Schoors K., Yafeh Y. (2005), "Sources of funds and investment activities of venture capital funds: evidence from Germany, Israel, Japan and the United Kingdom", *Journal of Corporate Finance* 11(3): 586-608.

Megginson W. (2004), "Toward a global model of venture capital", *Journal of Applied Corporate Finance* 16(1): 89-107.

Megginson W., Weiss K. (1991), « Venture capitalist certification in IPO's », *Journal of Finance*, 879 – 903.

Mendoza (2007), "Securities regulation in low-tier listing venues: the rise of the Alternative Investment Market", mimeo.

Miller E. M. (1977), "Risk, uncertainty and divergence of opinion", *Journal of Finance*, 54, p. 165-201.

Mizruchi M.S., Stearns L.B. (2001), Getting deals done: the use of social networks in bank decision making, *American Sociological Review* 66(5): 647-671.

Modigliani F., Miller M. (1958), "The Cost of Capital, Corporate Finance, and the Theory of Investment", *American Economic Review* 48(2): 261-297.

Moore, B. (1994), 'Financial Constraints to the Growth and Development of Small High-technology Firms', in A. Hughes and D. J. Storey (eds.), *Finance and the Small Firm*, Routledge, London, pp. 112–144.

Murray G. (1999), "Early-stage venture capital funds, scale economies and public support", *Venture Capital* 1(4): 351-384.

Mustar P., Larédo, P. (2002) "Innovation and research policy in France (1980-2000) on the disappearance of the Colbertist state", *Research Policy* 31: 55-72.

Myers S. (1977), "Determinants of corporate borrowing", *Journal of Financial Economics* 5.

Myers S. (1984), "The capital structure puzzle", *Journal of Finance* 39(3): 575-592.

Nelson R., Winter S. (1982), *An Evolutionary Theory of Economic Change*, The Belknap Press of Harvard University Press, Cambridge, MA.

Oakey R.P. (2005), *High technology new firms: variable barriers to growth*, Paul Chapman Publishing.

Ostgaard T.A., Birley S. (1996), New venture growth and personal networks, *Journal of Business Research* 36: 37-50.

Ozkan A. (2001), "Determinants of Capital Structure and Adjustment to Long Run Target: Evidence From UK Company Panel Data", *Journal of Business Finance & Accounting* 28(1-2): 175-198.

Perez C. (2004), “Technological revolutions, paradigm shifts and socio-institutional change”, in Reinert E.S. (ed.), *Globalization, economic development and inequality: an alternative perspective*, Edward Elgar Publishing.

Perwald K. (2002), *Le NM : un outil évolutif pour le financement des entreprises de croissance*, Paris 1, thèse de Droit Privé.

Petrella G. (2001), “Sistemi finanziari e finanziamento delle imprese innovative: profili teorici ed evidenze empiriche dall’Europa”, *Quaderni ref* n.4.

Pierdzioch C., Schertler A. (2007), “Sources of predictability of European stock markets for high-technology firms”, *European Journal of Finance* 13(1): 1.27.

Planes B. (2002), “Le financement de l’innovation des entreprises industrielles, le poids des contraintes financières”, *Le 4 Pages des Statistiques Industrielles*, N°163, aôut.

Posner E. (2004), “Copying the Nasdaq stock market in Europe: Supranational politics and the convergence-divergence debate”, Working Paper PEIF-16.

Potestio P. (2004), “La struttura degli incentivi agli investimenti delle imprese nelle aree depresse: una valutazione critica della legge 488/92”, *L’Industria*, Jan-Mar, 1: 157-172.

Poutziouris P., Chittenden F., Michaelas N., Oakey R. (2000), “Taxation and the performance of technology-based small firms in the UK”, *Small Business Economics* 14(1): 11-33

Poutziouris P., Chittenden R., Michaelas N. (1999), "Modelling the impact of taxation on the small business economy: The NatWest MBS tax index for the self-employed, sole traders and partnerships", *Environment and Planning C: Government and Policy* 17(5).

Rajan R., Zingales L. (2003), Banks and markets: the changing character of European finance, NBER Working Paper 9595.

Rajan R., Servaes H. (1997), “Analyst following of initial public offerings”, *Journal of Finance* 52: 507-529.

Revest V. (2001), “Le Nouveau Marché : la construction d’une identité”, *Revue d’Economie Industrielle*.

Revest V. (2008), “The failure of the French New Market and the dynamics of rules”, in *Markets and the Organisation of Exchange,* the Manchester University Press Series, New Dynamics of Innovation and Competition, edited by Metcalfe S., Harvey M. and Rivaud-Danset D., mimeo.

Ritter J.R. (2003), “Differences between European and American IPO markets”, *European Financial Management*, 9, p. 421-434.

Rybczynsky T. (1974), “Business finance in the EEC, USA and Japan”, Three Banks Review.

Santarelli E., Vivarelli M. (2002), “Is subsidizing entry an optimal policy?”, *Industrial and Corporate Change* 11(1): 39-52.

Savignac F. (2006), Le financement des entreprises innovantes, thèse de doctorat, université Paris I, Panthéon, Sorbonne.

SBA (2004), US Small Business Administration Investment Division, Small Business Investment Company Program, financial performance report for cohorts 1994-2004.

Scellato G., Ughetto E. (2007), "The Basel II reform and the provision of finance for R&D activities in SMEs: an analysis for a sample of Italian companies", forthcoming, *International Small Business Journal*.

Schmidt R.H., Tyrell M. (2004), What constitutes a financial system in general and the German financial system in particular?, in Krahnen J.P., Schmidt R.H. (eds.) (1994), *The German financial system*, Oxford University Press.

Schumpeter J. (1911), *The Theory of Economic Development: an inquiry into profits, capital, credit, interest and the business cycle*.

Shane S., Cable D. (2002), Network ties, reputation, and the financing of new ventures, *Management Science* 48(3): 364-381.

Smallbone D., Baldock R., Burgess S. (2002), "Targeted support for high-growth start-ups: some policy issues" *Environment and Planning C: Government and Policy* 20(2) 195 – 209.

Stiglitz J., Weiss A. (1981), "Credit rationing in markets with perfect information", *American Economic Review* 71(3): 393-410.

Tantazzi A. (2001), "Il sistema bancario e la Borsa nello sviluppo italiano", *L'Industria*, Oct-Dec, 4: 715-726.

Teubal M., Luukkonen T. (2006), "Venture Capital Industries and Policies: Some Cross-Country Comparisons, Discussion Papers 1006, The Research Institute of the Finnish Economy.

Tyebjee T., Vickery L. (1988), "Venture capital in Western Europe", *Journal of Business Venturing* 3(2): 123-136.

Tykvova T. (2003), "Is the behavior of German Venture capitalists different? Evidence from the Neuer Markt", CFS W.P., N°2003/24.

Tykvova T. (2007), "German banks as venture capitalist", in *Venture Capital in Europe*, ed. by Gregoriou G., Kooli M., Kraeussl R., Elsevier.

Uzzi B. (1999), Embeddedness in the making of financial capital: how social relations and networks benefit firms seeking financing, *American Sociological Review* 64: 481-505.

Vitols S. (2004), Changes in Germany's bank-based financial system: a varieties of capitalism perspective, WZB Berlin.

Vos E., Yeh A., Carter S., Tagg S. (2007), "The happy story of small business financing", *Journal of Banking and Finance* 31(9) : 2648-2672.

Watson R. (1990), «Employment Change, Profits and Directors' Remuneration in Small and Closely-Held UK Companies", *Scottish Journal of Political Economy* 37(3): 259-274.

Watson R., Wilson N. (2002), "Small and Medium Size Enterprise Financing: A Note on Some of the Empirical Implications of a Pecking Order", *Journal of Business Finance & Accounting* 29(3-4): 557-578.

Weber S., Posner E. (2000), "Creating a pan-European equity market: the origins of EASDAQ", *Review of International Political Economy* 7(4): 529-573.

Westhead P., Storey D.J. (1997), "Financial constraints on the growth of high-technology small firms in the UK", *Applied Financial Economics* 7.

Wilson D., Souitaris V. (2002), "Do Germany's federal and land government (still) co-ordinate their innovation policies?", *Research Policy*, 31, p. 1123-1140.

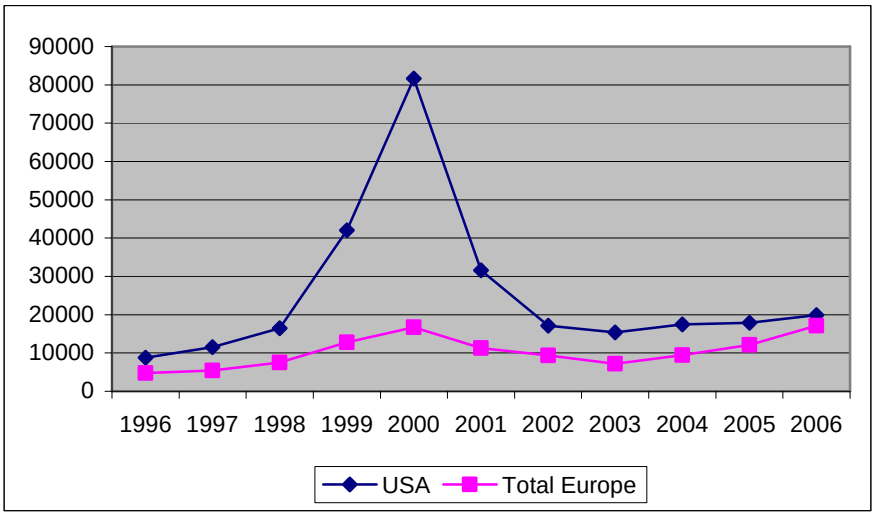
Wupperfeld U. (1997), "The venture capital market in Germany", in K. Koschatzky ed., *Technology based firms in the innovation process*, Physica-Verlag, Heilderberg, p. 107-124.*

Zechendorf B. (2006), "La politique d'innovation dans trois pays européens: le cas de la biotechnologie", *Education et Formation*, n°73.

Zysman J. (1983), *Government, Markets and Growth*, Cornell University Press, Ithaca, NY.

ANNEX

Figure 1 : Venture capital investment amounts in Europe* and in the USA : 1996-2006 (€ millions). Sources: AIFI, AFIC, BVCA, EVCA, NVCA**



* "Total Europe" includes France, Germany, Italy (when available) and UK.

**For the American data, it has been used the exchange rate quoted on October 30, 2008.

Figure 2: Venture capital investment amounts in European countries: 1996-2006 (€ millions). Sources: AIFI, AFIC, BVCA, EVCA

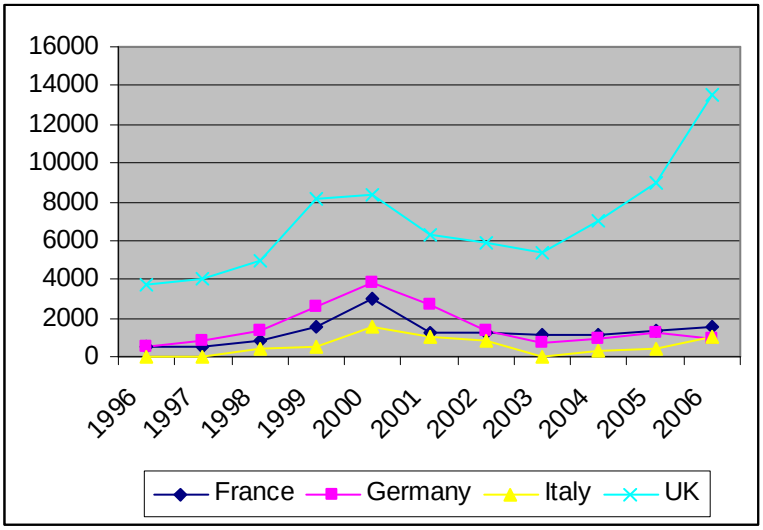


Figure 3: UK venture capital investment amounts by stage: 1996-2006 (€ millions). Source: BVCA.

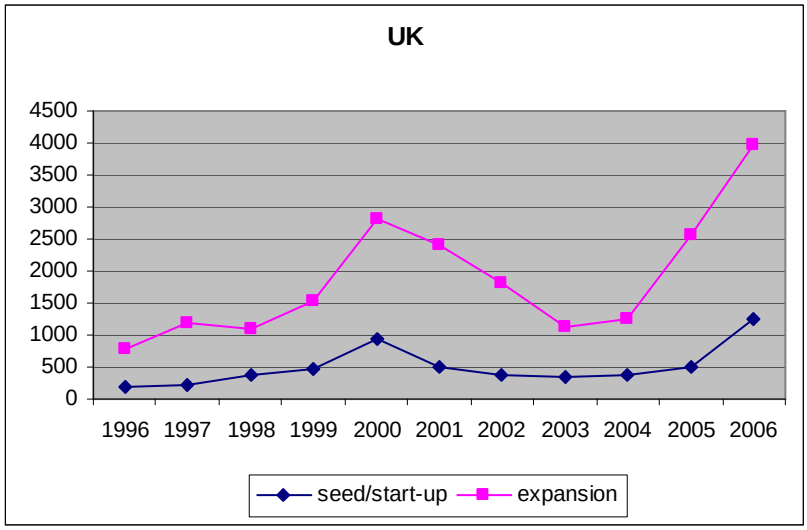


Table 1. Sector distribution of UK venture capital investments (%). Source: EVCA Yearbook: 1995-2007

Sectors	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Communications	10.03	14.01	7.75	16.34	14.84	18.22	18.70
Computer related	10.90	12.76	3.82	5.31	5.40	5.92	10.10
Other electronics related	2.36	1.94	2.00	2.11	1.08	0.79	0.40
Biotechnology	0.66	1.18	1.50	1.87	0.90	0.73	0.50
Medical / Health related	14.46	8.63	9.60	4.39	5.61	5.57	8.40
Energy	0.96	2.47	0.70	1.40	2.17	2.07	3.00
Consumer related	25.79	23.08	30.80	26.26	25.78	31.11	16.30
Industrial products and services	9.49	0.20	6.17	2.63	3.03	5.13	7.80
Chemicals and materials	1.01	1.28	1.10	1.02	2.84	0.20	1.40
Industrial automation	2.94	1.02	0.09	0.80	0.16	2.55	1.00
Other manufacturing	9.28	2.95	9.78	9.94	10.39	9.50	5.50
Transportation	1.47	5.93	5.52	6.77	1.35	2.22	3.90
Financial services	1.47	3.70	5.95	2.93	5.56	5.74	3.70
Other services	4.55	6.50	9.34	9.41	12.24	3.53	9.40
Agricolture	0.00	0.18	0.02	0.00	0.08	0.23	0.00
Construction	2.20	7.16	0.94	0.93	1.12	0.70	0.80
Other	2.43	7.01	4.93	7.89	7.45	5.81	9.10
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Figure 4: German venture capital investment amounts by stage: 1996-2006 (€ millions). Source: EVCA.

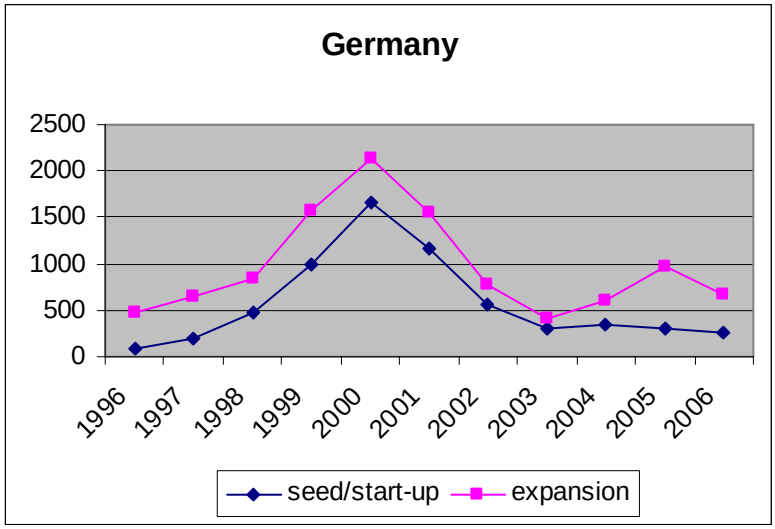


Figure 5: French venture capital investment amounts by stage: 1996-2006 (€ millions). Source: AFIC.

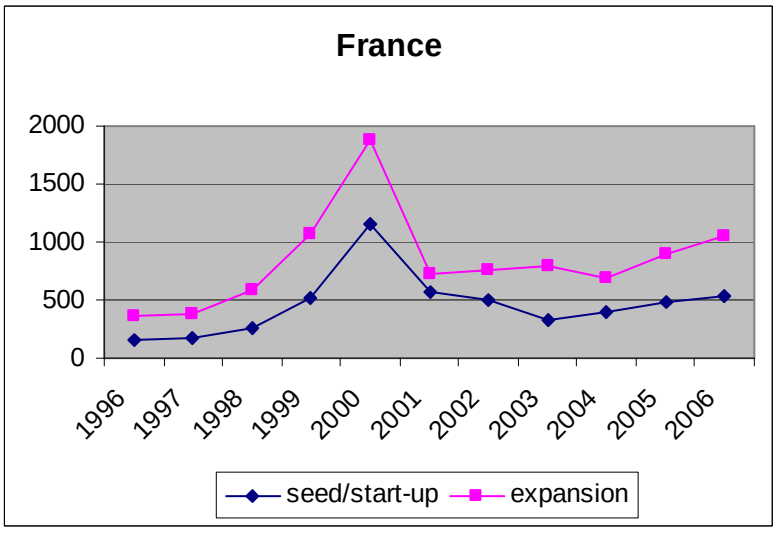


Figure 6: Italian venture capital investment amounts by stage: 1996-2006 (€ millions). Source: AIFI.

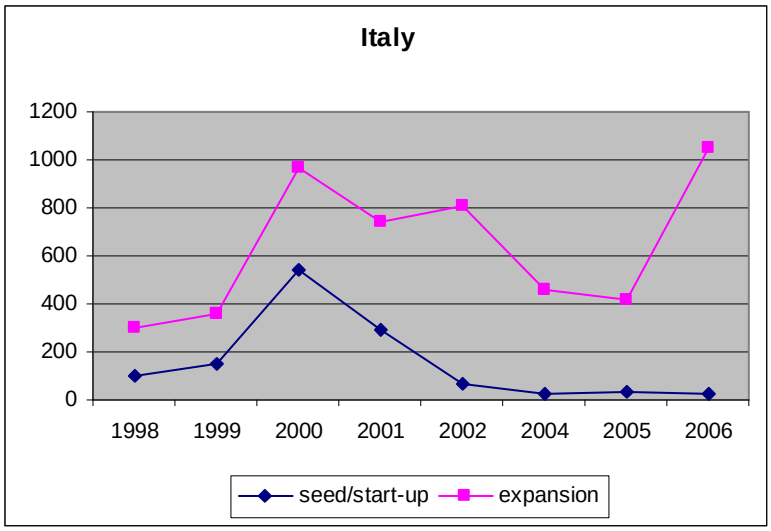


Table 2: Sector distribution of German VC investments (%). Source: EVCA yearbook 1995-2007

Sectors	2000	2001	2002	2003	2004	2005	2006
Communications	11.80	8.22	6.46	11.17	3.01	13.37	3.10
Computer related	22.52	15.00	10.09	4.65	2.82	5.14	3.44
Other electronics related	2.59	1.36	1.18	2.52	3.17	4.40	3.34
Biotechnology	10.61	11.22	8.61	4.28	4.00	3.62	1.79
Medical / Health related	5.16	5.39	5.80	3.65	19.77	8.76	3.95
Energy	0.29	1.16	0.60	0.54	1.33	2.65	0.56
Consumer related	13.97	14.48	7.59	10.37	19.17	17.03	6.40
Industrial products and services	7.36	14.25	25.07	10.74	10.57	10.80	16.71
Chemicals and materials	1.45	15.32	17.04	6.49	1.83	3.09	22.12
Industrial automation	4.53	1.20	1.66	3.71	2.65	9.19	1.73
Other manufacturing	0.75	1.04	2.51	2.35	1.99	4.57	5.66
Transportation	0.24	0.63	0.20	5.63	0.26	2.27	0.27
Financial services	5.15	3.23	0.56	0.09	0.34	0.19	1.76
Other services	7.19	2.62	3.07	29.53	17.92	10.87	23.84
Agricolture	0.15	0.07	0.12	0.03	0.01	0.02	0.08
Construction	1.20	1.71	2.28	0.34	0.62	1.33	2.78
Other	5.02	3.11	7.15	3.92	10.56	2.69	2.47
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 3: Sector distribution of French venture capital investments (%). Source EVCA yearbook 1995-2007

Sectors	2000	2001	2002	2003	2004	2005	2006
Communications	17.79	13.80	13.83	13.72	14.79	13.92	4.49
Computer related	13.95	8.67	5.26	7.03	7.19	4.04	3.79
Other electronics related	12.37	5.01	0.61	2.51	1.03	1.88	2.68
Biotechnology	3.09	2.27	2.10	2.49	2.74	2.81	1.65
Medical / Health related	2.65	6.25	4.98	9.50	4.46	5.18	7.42
Energy	0.14	4.06	0.10	0.07	0.48	2.39	0.72
Consumer related	17.09	18.27	15.73	10.19	28.14	16.09	12.73
Industrial products and services	12.93	18.01	36.17	6.89	3.82	20.12	13.07
Chemicals and materials	0.76	4.52	0.52	3.86	1.97	4.31	5.97
Industrial automation	0.62	0.68	0.47	5.44	0.27	0.31	2.09
Other manufacturing	3.21	5.03	1.95	3.56	2.24	1.18	1.35
Transportation	0.82	0.96	0.39	6.50	4.46	1.65	0.42
Financial services	0.50	0.66	1.80	1.45	1.50	1.97	3.18
Other services	7.40	4.72	11.47	6.54	21.54	12.92	32.36
Agriculture	0.22	1.56	2.55	0.25	2.04	1.12	0.47
Construction	3.23	3.92	2.06	11.15	1.62	5.68	5.95
Other	3.22	1.59	0.00	8.85	1.72	4.42	1.67
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 4: Sector distribution if Italian venture capital investments (%). Source EVCA yearbook 1995-2007

Sectors	2000	2001	2002	2003	2004	2005	2006
Communications	21.89	38.00	6.81	38.23	12.62	13.70	10.28
Computer related	6.28	6.03	2.53	0.59	0.78	3.13	1.20
Other electronics related	0.21	0.81	0.83	0.68	0.86	1.65	0.48
Biotechnology	0.55	0.27	0.13	0.43	0.04	0.26	0.11
Medical / Health related	2.24	0.62	1.31	3.11	2.75	2.15	7.27
Energy	2.06	8.88	2.18	0.10	0.13	2.13	0.69
Consumer related	19.22	8.34	28.54	12.21	23.78	41.63	25.15
Industrial products and services	4.25	4.91	8.30	19.90	14.87	17.75	28.49
Chemicals and materials	1.32	3.33	4.75	2.14	7.30	0.59	0.24
Industrial automation	0.22	4.34	2.04	0.43	0.03	0.58	2.21
Other manufacturing	26.83	11.42	14.53	16.92	15.29	4.63	5.58
Transportation	1.81	0.20	0.04	1.27	14.75	2.21	2.90

Financial services	2.38	6.22	7.83	0.12	0.10	0.17	4.33
Other services	4.18	3.98	0.56	0.16	1.33	6.89	5.82
Agriculture	0.22	0.08	0.00	0.00	0.00	0.00	0.00
Construction	0.81	0.94	5.34	0.24	0.80	0.19	2.06
Other	5.54	1.63	14.29	3.47	4.58	2.32	3.19
TOTAL	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 5. Historical evolution of high-tech stock markets in Europe and the US, 1995-2006. Sources: AIM Market Statistics, Euronext Statistics, Burghof and Hunger (2004), Borsa Italiana, World Federation of Exchanges.

	AIM		**Nouveau Marché**		**Neuer Markt**		**Nuovo Mercato**		**NASDAQ**	
Years	**n.c.**	**cap.(£ m)**	**n.c.**	**cap.(€ m)**	**n.c.**	**cap.(€ m)**	**n.c.**	**cap. (€ m)**	**n.c.**	**cap. ($ m)**
1995	121	2382.4	-	-	-	-	-	-	n.a.	n.a.
1996	252	5298.5	18	765	-	-	-	-	5556	1511824.4
1997	308	5655.1	38	1508	17	n.a.	-	-	5487	1737509.7
1998	312	4437.9	81	4201	64	26	-	-	5068	2243734.0
1999	347	13468.5	111	15226	201	111.28	6	6981	4829	5204620.4
2000	524	14935.2	118	24275	339	120.99	40	22166	4734	3597085.9
2001	629	11607.2	164	15011	327	49.93	45	12489	4063	2739674.7
2002	704	10252.3	153	6813	264	29.36	45	6438	3649	1994494.0
2003	754	18358.5	137	7904	-	-	43	8265	3294	2844192.6
2004	1021	31753.4	128	6197	-	-	40	6674	3229	3532912.0
2005	1399	56618.5	-	-	-	-	38	9120	3164	3603984.9
2006	1634	94364.0	-	-	-	-	-	-	3133	3865003.6

Notes: n.c. = number of companies; cap. = capitalization; €m = million Euros; £m = million pounds; $m = million US dollars. Data on NASDAQ capitalization exclude investment funds, rights, warrants, convertibles, foreign companies and include common and preferred shares, shares without voting rights, otherwise stated.