Centre Emile Bernheim
Research Institute in Management Sciences

Solvay
Business School

The Financial Architecture of Technology-Based Small Firms in Belgium: An Explorative Study

A. Bozkaya and B. van Pottelsberghe de la Potterie

The objective of this paper is to analyze the funding structure of technology-based small firms (TBSFs).
We rely on an original survey on the financing of 103 TBSFs in Belgium. The results show that personal funds of the founders are the primary source of seed-financing in 82 percent of the cases. Government subsidies of all kind and commercial bank loans are the main source of capital during early stages while business angels and venture capitalists play a greater role in later stages of development. There is also evidence that suggests an evolution of the mix of "internal" and "external" sources of finance. Our findings based on entrepreneurs' scores in raising external equity-finance suggest an "equity gap," rather than a "management gap."

CEB Working Paper N° 04/027
September 2004

Université Libre de Bruxelles – Solvay Business School – Centre Emile Bernheim
ULB CP 145/01 50, avenue F.D. Roosevelt 1050 Brussels – BELGIUM
e-mail: ceb@admin.ulb.ac.be Tel. : +32 (0)2/650.48.64 Fax : +32 (0)2/650.41.88

ULB

"The Financial Architecture of Technology-Based Small Firms in Belgium: An Explorative Study"

Solvay Business School

Ant Bozkaya and Bruno van Pottelsberghe

Belgium CEB/DEA Discussion Paper September 04

ABSTRACT

The objective of this paper is to analyze the funding structure of technology-based small firms (TBSFs). We rely on an original survey on the financing of 103 TBSFs in Belgium. The results show that personal funds of the founders are the primary source of seed-financing in 82 percent of the cases. Government subsidies of all kind and commercial bank loans are the main source of capital during early stages while business angels and venture capitalists play a greater role in later stages of development. There is also evidence that suggests an evolution of the mix of "internal" and "external" sources of finance. Our findings based on entrepreneurs' scores in raising external equity-finance suggest an "equity gap," rather than a "management gap."

INTRODUCTION

Over the past two decades the locus of innovation has moved out of the central research and development (R&D) laboratories of large corporations to a more diffused environment comprising of start-up companies (Gompers, Lerner and Scharfstein, 2004), where the quantity of innovation per given amount of funds appear to be greater (Kortum and Lerner, 2000). The role of entrepreneurial firm as an engine of economic growth has gathered the attention of a vast number of researchers and policy makers. Zoltan Acs (1999, pp.1-20) reviews the literature on small business economics and claims that much of this attention stems from the belief that entrepreneurial firms play a crucial role in experimentation and innovation that leads to technological change, productivity and economic growth. How entrepreneurs finance their small, young firms is a central issue in both economic and financial literature, and in policy making. Freear, Sohl and Venkatachalam (2004) conclude that the supply of capital to bring to market a technically and commercially viable innovation requires an assurance to funding sources that their financial interest in innovation is secure.

We attempt to contribute to the area of entrepreneurial finance studies investigating how various financial arrangements of small entrepreneurial firms are structured and evolve. Our objective is twofold: Firstly, to examine how TBSFs are financed during their stages of development. Secondly, to report the perceptions of Belgian TBSF entrepreneurs in raising external "equity-finance" at early stages with particular reference to business angels (BAs), and venture capitalists (VCs). This paper is based on 103 questionnaire responses including 25 interviews with TBSF entrepreneurs and senior managers. We found that a large number of Belgian TBSFs experience difficulties in accessing external sources of finance at "seed," "start-up," and "early-growth" stages. Internal finance is critical for entrepreneurs to start and sustain TBSFs. As we do not expect major structural changes in the European financial market factors in the near future to provide "risk" capital to early-stage TBSFs, we believe that personal funds will remain the primary source of capital. In this context, we recommend to focus on further research on the tax situations of the entrepreneurs themselves along with the tax policies considered to increase BA and VC investments.

THEORIES

The theories on access to capital primarily focus on the role of information problems. The a*symmetric information* (Akerlof, 1970), *moral hazard* (Jensen and Meckling, 1976), and *adverse selection* (Leland and Pyle, 1977; Myers and Majluf, 1984) suggest that external finance for small and medium-sized enterprises is more costly and less flexible. The Bank of England (2001, pp.81-106) study reviews the economic literature on the financing of TBSFs, and suggest that -- given their novel technology and limited operating history -- capital market imperfections may apply with particular severity to these innovative, small and young firms. As external finance is more costly due to capital market frictions

(Stiglitz and Weiss, 1981), Myers and Majluf (1984), and Stewart Myers (1984) propose a "pecking-order view of finance" framework which suggests that firms finance their needs in a hierarchical fashion. In other words, capital structure may be driven by firms' desire to finance new investments first internally (initially by personal savings and then mostly by a build-up retained earnings), then by "low-risk debt" (i.e. banks, government borrowing), and finally by equity. Focusing more on the role of information problems, Douglas Diamond (1991) in his "reputation-based theory," emphasizes the fact that even if the initial financier's information is private (Rajan, 1992), as time goes on, outsiders can obtain information, enabling the firm to obtain relatively cheap arm's length financing. This theory assumes that young firms are likely to have strong moral hazard because they have limited reputations (Rosen, 1998). In other words, entrepreneurs have better information on project specific aspects such as the technological feasibility, but some finance providers (i.e. VC) may have greater information on the project's marketability and operational implementation. These financial intermediaries play a critical role in private markets as information producers who can assess small business project quality and address information and agency problems through the activities of *screening*, *contracting*, and *monitoring* (Gompers and Lerner, 2001, pp.41-59). In such cases, VCs may be able to mitigate information asymmetries through a set of procedures and tools, giving signals to other external investors to provide funds (Hellman and Puri, 2002 and the references therein).

Jeffrey Sohl (2003) argues that a funding gap exists for start-up and early-stage companies, and an information gap means that many promising new ventures may remain overlooked or forgotten. The capital market factors associated with small entrepreneurial firms make seeking and finding external finance extremely difficult at their earlier stages due to the equity gap (Wetzel and Freear, 1994). Colin Mason (1996) summarizes that the equity gap occurs at the seed, start-up and early growth stages as VCs' fixed costs associated with investment appraisals and monitoring make it non profitable for small amounts of institutional equity investment. He further comments that commercial banks, on the "debt-finance" side, are reluctant to make unsecured lending during these very early stages of development. Freear, Sohl and Wetzel (1994) suggest that these market inefficiencies -- fragmentation of the market place where financial markets cannot freely provide all information about fund sources and investment opportunities to the buyers and sellers of the markets -- have led capital providers to claim that the gap is a demand-side problem, since investment proposals and entrepreneurs are often of a low quality -- the management gap.

Colin Mayer (2002) shows that the initial development funds of an innovative enterprise almost always come from personal savings and "almost internal" funds such as friends and relatives. For debt-financing, commercial banks are the main supplier of funds to these *information opaque* small businesses (Berger and Udell, 1998). Governments have long had a role in financing the development of private sector technology companies (Lerner, 1999, 2002). Lewis Branscomb and Auerswald (2002, pp.1-11) find that most funding for technology development in the phase between invention and innovation comes from angel investors, corporations, and the federal [U.S] government. On equity-financing side, angel capital has been found to be a major source of funding for early-stage entrepreneurial ventures (Mason and Harrison, 2001; Freear, Sohl and Wetzel, 2002). Venture capital firms are important intermediaries supporting new high-growth firms (Hellman and Puri, 2002). Paul Gompers and Lerner (2001, pp.67) calculate that over the years, VC firms have created almost one-third of the total market value of all public companies in the U.S. VCs, however, play a greater role in the early growth stage rather than seed or start-up stages (Wright and Robbie, 1998 and the references therein).

METHODOLOGY

We conducted mail surveys and semi-structured face-to-face interviews in Belgium in the fourth quarter of 2003. We have 103 observations over 607 unquoted Belgian TBSFs. We employed a combination of

methods to compile company specific information from Belgian universities/higher education institutes; research centers; science parks; incubators; trade associations and organizations; published company articles; news clips; *Bel-First* Belgian Companies Database; internet search; and personal interviews. These companies were established between the years 1985 and 2002. They represent both manufacturing (63 percent) and services (37 percent) companies that are active in aerospace; pharmaceuticals; instruments; information-communication technology (ICT); and other high-tech (chemicals, sustainable energy, transportation, electrical and mechanical machinery, and electro-mechanical equipment) industries as per the "high-technology" and "medium-high technology" industry classification based on global technology intensity guidelines of the Organization for Economic Co-operation and Development (OECD, 1997a). Panel A of [Table 1]-TBSF Characteristics summarizes our sample data industry re-classification based on OECD (1997a) with matching ISIC Rev.3 industry codes. We validated 103 TBSFs used in this study against measurable parameters of control and size. They are independently owned (i.e. less than 25 percent of their equity is owned by one or jointly owned by several enterprises not satisfying the same criteria) and employ less than 50 employees with a turnover of €7 million maximum or total assets capitalization of €5 million (EC, 1996).

In order to investigate the sources of finance and observe any life-cycle pattern in the financing choices of our entrepreneurs, we constructed a matrix with 4 stages of development (seed; start-up; early-growth; and development/expansion) in a row. The column of the matrix included 10 sources of funds, namely: personal funds; family and friends' funds; retained earnings; commercial bank loans; government subsidies of all kind; non-financial institutional funds; other debt-finance funds; business angel funds; venture capital funds; and other equity-finance funds. We clearly defined and explained each stage in the questionnaire based on Mayer (2002). We also collected information using a combination of *Likert-Scale* and open-ended questions to detail our respondents' perception on the availability, appropriateness and accessibility on BA and VC financing at early-stages of development.

We conducted 3 pilot interviews with entrepreneurs in biotechnology and ICT. These interviews are not included in the final study. We posted 35 personalized letters to entrepreneurs active in aerospace, pharmaceuticals, ICT, and instruments industries with a request for a 30-minute interview. A total of 28 (80 percent response rate) firms accepted to participate in the study, and interviews were conducted in their premises during the last quarter of 2003. Further analysis of interview information based on technology and size criteria proved that 3 interviews (11 percent) needed to be excluded. We mailed 582 personalized letters and questionnaires in 2 batches of similar size in Dutch, French or English. We received a total of 86 responses (14 percent). After validations, we used 78 (13.4 percent) mail questionnaires to be analyzed in this study. These questionnaires were added to 25 interviews making the total number of observations 103 (see Bozkaya, Romain and van Pottelsberghe, 2003 for methodology).

Sample Characteristics: TBSF Size, Age and R&D

[Table 1]-TBSF Characteristics presents the firms' start-up (Panel B), size (Panel C), age (Panel D), and R&D (Panel E) characteristics. The results show that Belgian universities play an important role in the genesis of TBSFs. It is also important to note that a few number of high technological intensive companies originated from large Belgian corporations. The Belgian Company Code allows various legal forms for the incorporation of a new company. The most widely used for equity funds is the Belgian company limited by shares ("*societe anonyme,*" SA or "*naamloze vennootscha,*" NV). The SA/NV must have at least 2 shareholders and the minimum share capital required is €61,500 (EVCA, 2002, pp.102). The sample shows that TBSFs were mostly established as SA/NV (72 percent) that would allow them for future equity investments. It is interesting to note that TBSFs which have actually received VC financing in any stage of their development originally established as a SA/NV. A start-up capital at establishment of

less than €150,000 is consistent across all industries representing an average of 64 percent. It is also interesting to note that 85 percent of the sample was originally established by less than 5 founders.

Our data also suggests that TBSFs in Belgium are "micro" enterprises in size. Years 2000-2002 averages shows that 60 percent of these firms have less than 10 employees; 65 percent has less than €1 million turnover; and 55 percent has less than €1 million total asset base. The average age of all TBSFs' in our sample is 6.74. The ICT average age of 5.32 years reveals that 84 percent of ICT firms were in the early-growth and development stages. The claimed current stages of TBSFs' by responders (83 percent are in their early growth and development stages) suggest that our survey design actually captures the historical financing choices of entrepreneurs during their life-cycle.

The R&D activity is one of the important indicators of innovative enterprises. Our findings suggest that a very large number (87 percent) of these TBSFs are active in R&D activities. This search for new knowledge is not performed only in house, as 57 percent of those firms are involved in active cooperation with a higher education institution. It is also important to note that more than half of the TBSFs (58 percent) received public support for their R&D activities through government R&D subsidies and 19 percent benefit from R&D tax credit. The pharmaceuticals, aerospace and instruments sectors take R&D subsidies to partially finance their capital intensive and long-term product development. It is therefore correct to state that the public funds play an important role in the financing of R&D activities of TBSFs in Belgium.

RESULTS

This section attempts to provide the results of our survey answering our original research questions: 1) How are Belgian TBSFs financed during their stages of development? 2) What are the perceptions of Belgian TBSF entrepreneurs in raising external equity-finance at early stages with particular reference to BAs and VCs?

The Financial Architecture of TBSFs and Evolution of Finances

The evidence presented in Panel A of [Table 2]-Financial Architecture of TBSFs suggests that personal funds of the founders are the primary source of seed-financing in 82 percent of the study cases. This is consistent with the theoretical arguments and recent pan-European studies that show personal funds and internal finance are critical for entrepreneurs to start new technology-based firms. (see, Camarero and Lazaro, 1995 for Spain; Landstrom and Olofsson, 1996 for Sweden; Audretsch and Vivarelli, 1996, and Giudici and Paleari, 2000 for Italy; Lumme, Mason and Suomi, 1998 for Finland; APCE, 2000 for France; and Bank of England, 2001 for UK). The next biggest equity in seed-financing is family and friends (almost internal) funds (35 percent). The data also reveals that family members and friends invest in seed-financing only when principal owner(s) invest from their own personal funds. The low-risk debt funds mostly in the form of government subsidies of all kind are the secondary source of seed stage finance. This result is different from the study of Manigart and Struyf (1997) that was based on a survey of 18 Belgian start-ups. They identified no significant role of government in the financing of small Belgian start-ups. In addition to a number of other reasons, this may be because of government schemes initiated in Belgium in late 1997 (OECD, 1997b) in order to assist innovative start-ups.

Commercial banks also play an important role in funding Belgian TBSFs. Some 43 percent of our firms borrowed from a bank at any stage of their development. Bank loans are the primary source of capital (40 percent of cases) for TBSFs during the early development stages. Loans (28 percent) together with government subsidies (33 percent) constitute a bigger portion of total external finance also in start-up

stage. Although VC is not a primary source of funding, it starts being significant in the start-up phase and always (at any stage) outperforms the reliance on BAs' funding. Panel B of [Table 2] shows that VCs provided the highest average amount of funds (€919.5 thousand) to TBSFs. Commercial banks follow this with an average of €569.4 thousand. This may suggest that TBSF entrepreneurs, in addition to investing directly from their personal savings (€124.4 thousand), use their personal wealth as collateral to borrow from the banks. It is worth mentioning that when the level of uncertainty decreases (or a reduced asymmetric information), the average amount provided for second rounds increases by 50 percent for BAs and by 200 percent for VCs (from less than €1 million to more than €3 million).

Our survey also suggests that TBSFs did not rely on "financial bootstrapping" methods (discussed in Winborg and Landstrom, 2000) as alternative sources of finance. Only 2 respondents during our interviews mentioned the usage of these "creative" financing methods such as extensive use of trade credit or credit cards as financial tools in their early stage financing. Less than 3 percent of these TBSFs indicated the use of trade credit at later development stages.

In order to detail the financial architecture of TBSFs, we measured the composition of a "basket" of finance. This basket takes into account the combinations of TBSFs' presence based on 3 different groups of source of finance: 1) internal finance; 2) external debt-finance; and 3) external equity-finance. The presence based on these 3 groups of sources is then calculated at different stages of development and presented in Panel C of [Table 2]. The results suggest that only 16 percent of TBSFs managed to create a financial basket combining internal finance with the external debt-finance at seed stage. The case in which TBSFs create a combination with internal finance and external equity-finance drops to 9 percent at the same stage. The usage of external finance without any internal sources of finance represents only 3 percent of the cases at seed stage. It seems that TBSFs in our sample are financed more by debt capital. This presence in finance table should be interpreted with caution as the lower presence cases of combination in finance at later stages are due to the decline in the use of internal finance (mostly in the form of personal funds). It still seems that TBSFs are having difficulties in setting the financial architecture for their firms at early stages. This may be due to the financial environment that they operate in or to their preference to "control" their company rights. The data supports this assumption of control as 83 percent of BA-financed and 64 percent of VC-financed firms are controlled by the sole entrepreneur (Bozkaya, Romain and van Pottelsberghe, 2003).

We used the sample data based on percentages of cases in funding (internal, external-debt and external-equity) at 4 discreet stages of development to plot [Chart 1]-Evolution of Internal and External Sources of Finance. The results of this study suggests that as firms get "older," the proportion of internal finance decreases while external finance first increases at start-up, peaks at early growth, and gradually decreases at later stages of development. Our data suggests a possible case where an innovative entrepreneur starts-up a TBSF mostly with personal funds, and in most cases receive government funding or enter into a relationship with a commercial bank (against tangible personal assets) at early-stage technology development. As time goes on, the TBSF develops reputation (survival), and other key finance providers such as BAs and VCs become willing to supply funds. The older firms in our sample also supports the view that once the firms raise equity finance during their early-growth stages, they are willing to re-enter into a relationship with commercial banks to obtain "cheaper" financing. In short, these preliminary results partially support the results and interpretations of Fluck, Holtz-Eakin and Rosen (1998) that shows a life-cycle pattern in the financing choices of entrepreneurs.

Belgian TBSF Entrepreneurs' Viewpoint on Equity-Finance

Panel A of [Table 3]-Scores of Belgian TBSF Entrepreneurs on Separate Items of BA and VC Financing presents the results of 99 respondents on BA financing difficulties at early stages. The scores suggest that

limited government policies to promote private BA funds are the primary reason for difficulties faced in early stage angel financing (52 percent). The small size of Belgian angel market and limited reliable information on BAs are other main reasons (52 and 48 percents, respectively). Entrepreneurs' favorable scores on accessibility to commercial and professional infrastructures coupled with their good quality business plans suggest that BA financing difficulties in their early stages of development may not relate to their managerial qualities. The evidence may suggest that, according to the scores of our respondents, BA difficulties at early stages are more of supply-side problems (i.e. equity gap) rather than demand-side problems (i.e. management gap). This perception is obviously biased towards the "entrepreneurs' vision," but witnesses nevertheless a pessimistic view on financial suppliers.

We also asked the entrepreneurs to rate what makes VC financing difficult for their high-tech start-ups at early stages. Panel B of [Table 3] details the responses of 99 participants. The results suggest that the reliance on VC funding is hindered by different factors. For about 61 percent of the TBSFs, VC is difficult to use because of VCs' expectations of quick exits. Our TBSF entrepreneurs believe that VCs' expectations of high rates of return (59 percent); unwillingness of VCs to provide small amounts of capital (58 percent); and VCs' lack of interest in early stage investments (55 percent) are other major obstacles in early-stage VC financing of entrepreneurship. It also seems that supply-side problems associated with the nature of VC financing are perceived more of an issue than the demand-side challenges such as managerial and entrepreneurial skills. Only 13 percent of our entrepreneurs agreed that the poor quality of their business plan and presentation to raise VC funds may present difficulties in VC fund raising.

CONCLUSION

Our objective is to detail the funding structure of TBSFs. We examined how TBSFs in Belgium are financed during their stages of development. We also examined the attitudes and perceptions of Belgian TBSF entrepreneurs in raising early-stage funding from BAs and VCs. The evidence based on an original survey of 103 Belgian unquoted TBSFs suggests that most of these firms experience difficulties in accessing external sources of finance at early stages of development. Internal finance is critical for entrepreneurs to start TBSFs in Belgium. The personal funds of the founders are the primary source of seed-financing in 82 percent of study cases. Commercial banks and the government play an important role in early-stage technology development. BAs and VCs play a greater role in later stages of development. This is consistent with the view that, because of capital market imperfections, internal finance is the principal source of funding for the small and innovative start-ups in their early stages. We believe that the evidence of this study can be rationalized using the elements of Myers' (1984) pecking-order view of finance framework. Our results also suggest that the financial structure of TBSFs change during their stages of development. We find that as firms get older the proportion if internal finance decreases while external finance portion first increases at start-up, peaks at early growth, and gradually decreases at later stages of development. This can be partially explained by appealing to the elements of Diamond's (1991) reputation-based theory.

Our observations based on respondents' scores suggest that limited government policies promoting BA funds, small size of Belgian angel market and limited reliable information on BAs are main reasons why the entrepreneurs believe that BA financing has difficulties in their early stages of development. Scores of entrepreneurs suggest that the lack of VC firms' interest in early-stage investments coupled with their unwillingness of providing small amounts of capital are the main reasons why VC plays a greater role in the early growth stage rather than seed and start-up stages. VCs, however, provide the highest average amount of funds to TBSFs (€919.5 thousand) at any given stage.

The scores of Belgian TBSF entrepreneurs on separate items of external sources of equity-finance (BAs and VCs) relating to the management gap suggest that investment proposals and entrepreneurs are not of a low quality. This leads to a conclusion that the gap is more of equity (supply-side) rather than management (demand-side). However, we should keep in mind that this view reflects mainly the views of the entrepreneurs themselves, which might obviously be biased in their own favor. The data accumulated in this study suggests that TBSF entrepreneurs, in fact, are not aware of financial bootstrapping methods (i.e. trade credit or credit cards) as alternative sources of finance.

There may be an important number of capital market factors such as financial system, innovation policies, government schemes, tax systems, venturing practices, risk-reward relationship, financial cycles, and potential exit alternatives that are crucial financial prerequisites for the successful creation and development of technology-based firms. As we do not expect major structural changes in these capital market factors in the near future, we must come to the conclusion that personal funds will remain the main source of capital for seed and early stage start-up's. In this context, we support Rosen's (1998) recommendation to focus on further research on the tax situations of the entrepreneurs themselves along with the tax policies considered to increase private equity investments.

Implications

BAs and VCs are the major suppliers of funds to entrepreneurial firms. Controlling the size of the economy in 1995, the U.S VC financing was 8 times the comparable continental European figure (Gompers and Lerner, 2002, pp.326). The current low allocation of Belgian private equity money in early stages still remains a challenge for further research. A number of issues (i.e. sources of capital, legal and fiscal environment, exiting) still remain to be tackled in improving the flow of early stage private equity funds to TBSF entrepreneurs. Josh Lerner (1999, 2002) assesses the theoretical motivations and empirical implications for public programs to subsidize high-technology firms at their early stages. A growing number of European governments have begun to investigate the ways in which policy measures can catalyze the growth of private equity and the companies in which they invest. In this framework, it is worthwhile to study the U.S programs such as the Small Business Innovation Research (SBIR), and the Small Business Investment Companies (SBIC) in details to formulate appropriate alternative programs.

Our findings based on entrepreneurs' scores in raising external sources of capital indicate more of supply-side, equity gap, rather than demand-side, management gap, problems. We suggest extending the original evidence of this primary work for Belgium in new studies to better understand *the* gap. It seems, however, that Belgian TBSFs are having difficulties in setting the financial architecture for their firms at early stages. This may be due to the financial environment that they operate in, or to their preference to "control" their company rights. We suggest extending our preliminary findings in a future research to better examine the financial framework conditions in this area. The evidence based on entrepreneurs' scores on the government's role in the financing of TBSFs clearly indicates an urgent need for stimulating new credit-guarantee schemes. In addition, our respondents agree that government policies should be revised to improve accessibility by improving government administration and bureaucracy of available schemes.

REFERENCES

Acs, Z. J. (1999) "The New American Evolution." In *Are Small Firms Important? Their Role and Impact*, ed. Z. Acs, 1-20. Boston, MA: Kluwer Academic Publishers.

APCE (2000) "Start-up en France, des mythes aux realities (Startups in France: From myth to reality)." Paris, France: Agence pour la creation d'Entreprise-APCE.

Akerlof, G. (1970) “The Market For Lemons': Quality Uncertainty and the Market Mechanism.” *Quarterly Journal of Economics* 3: 488-500.

Audretsch, D.B. and Vivarelli, M. (1996) “Firm Size and R&D Spillovers: Evidence from Italy”, *Small Business Economics* 8: 249-258.

Bank of England (2001) *Financing of Technology-Based Small Firms.* London, UK: Domestic Finance Division Report.

Berger, A. and Udell, G. (1998) “The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle.” *Journal of Banking and Finance* 22: 613-673.

Bozkaya, A.; Romain, A. and van Pottelsberghe, B. (2003) “Surveying Technology-Based Small Firms: A Perspective from Belgium,” *Hitotsubashi University (Japan) IIR Working Papers* # WP#03-23.

Branscomb, L. M. and Auerswald, P. E. (2002) *Between Invention and Innovation: An Analysis of Early-Stage Technology Development.* Washington, DC: US Department of Commerce National Institute of Standards and Technology Report NIST GCR 02-841.

Camarero, M and Lazaro, P. (1995) *The Opinion of 100 Spanish SMEs Concerned with Innovation.* Madrid, Spain: COTEC Foundation Study#5.

Diamond, D.W. (1991) “Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt.” *Journal of Political Economy* 99: 688-721.

European Commission-EC (1996) *Commission Recommendation of 3 April 1996 Concerning the Definition of Small and Medium-sized Enterprises (96/280/EC).* Brussels, Belgium: Official Journal L 107 of 30/04/1996.

European Private Equity and Venture Capital Association-EVCA (2002) *Annual Survey of Pan-European Private Equity and Venture Capital Activity.* Brussels, Belgium: EVCA Year Book 2002.

Fluck, Z.; Holtz-Eakin, D.; and Rosen, H. (1998), “Where Does the Money Come from? The Financing of Small Entrepreneurial Enterprises.” *New York University (USA) Working Paper Series*.

Freear, J.; Sohl, J.E. and Wetzel, W.E. Jr. (1994) “Angels and Non-angels: Are There Differences?” *Journal of Business Venturing* 9: 109-123.

Freear, J.; Sohl, J.E. and Wetzel, W.E. Jr. (2002) “Angels on Angels: Financing Technology-Based Ventures – A Historical Perspective.” *Venture Capital* 4(4): 275-287.

Freear, J.; Sohl, J.E. and Venkatachalam, A. R. (2004) “Leveraging intellectual property in the financing of entrepreneurial ventures: a technology-based solution to the perfection of security interests.” *International Journal of Entrepreneurship and Innovation Management* 4 (2/3): 178-193.

Giudici, G and Paleari, S. (2000) “The Provision of Finance to Innovation: A survey Conducted Among Italian Technology-Based Small Firms.” *Small Business Economics* 14.1: 37-53.

Gompers, P. and Lerner, J. (2001) *The Money of Invention*. Cambridge, MA: Harvard Business School Publishing.

Gompers, P. and Lerner, J. (2002) *The Venture Capital Cycle*. Cambridge, MA: MIT Press.

Gompers, P.; Lerner, J.; and Scharfstein, D. (2004) “Entrepreneurial Spawning: Public Corporations and the Genesis of New Ventures, 1986 to 1999 Reconciling Theory and Evidence.” Forthcoming *Journal of Finance* April 2005.

Hellman, T. and Puri, M. (2002) “Venture Capital and the Professionalism of Start-up Firms: Empirical Evidence.” *The Journal of Finance* LIX (5): 169-197.

Jensen, M. C. and Meckling, W. H. (1976) “Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure.” *Journal of Financial Economics* 3: 305-360.

Kortum, S. and Lerner, J. (2000) “Accessing the Contribution of Venture Capital to Innovation”, *RAND Journal of Economics* 31(4): 674-692.

Landstrom, H and Olofsson, C. (1996) “Informal VC in Sweden.” In *Informal VC: Information, Networks and Public Policy*, ed. R.T. Harrison and C. M. Mason, 273-285. Hemel Hempstead, UK :Woodhead-Faulkner.

Leland, H. and Pyle, H. (1977) “Informational Asymmetries, Financial Structure, and Financial Intermediation.” *Journal of Finance* 32(2): 371-387.

Lerner, J. (1999) "The Government as Venture Capitalist: The Long Impact of the SBIR Program." *Journal of Business* 72 (3): 285-318.

Lerner, J. (2002) "When Bureaucrats Meet Entrepreneurs: The Design of Effective 'Public Venture Capital' Programmes." *The Economic Journal* 112: F74-F84.

Lumme, A., Mason, C. and Suomi, S. (1998) *Informal Venture Capital: Investors, Investments and Policy Issues in Finland*. Boston, MA: Kluwer Academic Publishers.

Manigart, S. and Struyf, C. (1997) "Financing High-Technology Start-ups in Belgium: An Explorative Study." *Small Business Economics* 9.2: 125-135.

Mason, C.M. (1996) "Informal Venture Capital: Is Policy Running Ahead of Knowledge?" *International Journal of Entrepreneurial Behaviour and Research* 2(1): 4-14.

Mason, C. M. and Harrison, R. T. (2001) "The Size of the Informal Venture Capital Market in the United Kingdom." *Small Business Economics* 15: 137-148.

Mayer, C. (2002), "Financing the New Economy: Financial Institutions and Corporate Governance." *Information Economics and Policy* 14: 311-326.

Myers, S. C. (1984) "The Capital Structure Puzzle." *Journal of Finance* 39: 575-592.

Myers, S.C. and Majluf, N.C. (1984) "Corporate Financing and investment Decisions When Firms Have Information That Investors Do Not Have." J*ournal of Financial Economics* 13 (2): 187-221.

OECD (1997a) "Revision of the High-Technology Sector and Product Classification." Paris, France: *OECD STI Workshop Papers*.

OECD (1997b) "Government Venture Capital for Technology-Based Firms." Paris, France: *OECD GD Workshop Papers.*

Rajan, R.G. (1992) "Insiders and Outsiders: The Choice Between Informed and Arm's Length Debt." *Journal of Finance* 47: 1367-1399.

Rosen, H. S. (1998) "The Future of Entrepreneurial Finance." *Journal of Banking and Finance* 22: 1105-1107.

Sohl, J. (2003) "The Private Equity Market in the USA: Lessons from Volatility." *Venture Capital: An International Journal of Entrepreneurial Finance* 5 (1):29-46.

Stiglitz, J.E. and Weiss, A. (1981) "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 71: 393-409.

Winborg, J. and Landstrom, H. (2000) "Financial Bootstrapping in Small Business: Examining Small Business Managers' Resource Acquisition Behaviour." *Journal of Business Venturing* 16: 235-254.

Wetzel, W.E., Jr. and Freear, J. (1994) "Promoting Informal Venture Capital in the United States: Reflections on the History of VC Network." In *Informal VC: Information, Networks and Public Policy*, ed. R.T. Harrison and C. M. Mason. Hemel Hempstead, UK: Woodhead-Faulkner.

Wright, M and Robbie, K. (1998) "Venture Capital and Private Equity: A Review and Synthesis." *Journal of Business Finance and Accounting* 25: 521-570.

ILLUSTRATIONS

Table 1 - TBSF Characteristics

		Aerospace	ICT	Instrumnts	Pharma.	Oth. Hi-Tech	All Indstry.
Panel A	ISIC Rev. 3 industry codes	353	30, 32	33 excl.2423	2423	31, 34, 359, 29 24 excl.2423	-
	No. of Observations (#)	7	56	7	25	8	103
Panel B	Genesis of Establishment:						
	Company Start-up (%)	29	75	29	24	63	54
	University Spin-off (%)	71	20	71	72	25	41
	Corporate Spin-off (%)	0	5	0	4	13	5
	Company Legal Form:						
	Incorporated-SA/NV (%)	71	64	86	84	75	72
	Limited Co.-SPRL (%)	29	32	0	12	13	23
	Other (%)	0	4	14	4	12	5
	Start-Up Capital:						
	10,000-149,999€ (%)	57	68	43	60	63	64
	150,000-249,999€ (%)	14	18	29	12	0	15
	250,000-350,000€ (%)	29	5	14	0	0	5
	> 350,000€ (%)	0	9	14	28	37	16
	No. of Founders:						
	1-4 (%)	86	88	86	76	98	85
	5-8 (%)	14	12	14	20	1	14
	> 8 (%)	0	0	0	4	1	1
Panel C	Staff Size (Yr2000-02 Avg.):						
	1-10 (%)	72	61	79	69	52	60
	11-25 (%)	14	21	17	22	24	21
	26-50 (%)	14	15	3	5	19	13
	> 50 (%)	0	3	1	4	5	6
	Turnover (Yr2000-02 Avg.):						
	< 1,000,000€ (%)	71	57	61	65	64	65
	1,000,000-2,999,999€ (%)	11	16	14	16	17	17
	3,000,000-4,999,999€ (%)	11	13	8	8	4	6
	5,000,000-7,000,000€ (%)	0	8	6	6	8	5
	> 7,000,000€ (%)	0	4	4	3	4	4
	N.A	7	2	7	2	3	3
	Assets (Yr2000-02 Avg.):						
	< 1,000,000€ (%)	54	56	55	51	62	55
	1,000,000-2,999,999€ (%)	15	15	16	18	16	15
	3,000,000-5,000,000€ (%)	4	6	4	8	5	5
	> 5,000,000€ (%)	14	11	13	16	10	13
	N.A	13	12	12	7	7	12
Panel D	Age-12/31/02 (Avg. Yrs):						
	Min	2.00	1.00	2.00	1.00	2.00	-
	Max	6.00	17.00	18.00	18.00	18.00	-
	Mean	3.29	5.32	7.86	6.24	10.75	6.74
	Standard Deviation	1.50	3.62	6.67	5.41	5.68	-
	Claimed Current Stage:						
	Seed (%)	0	4	0	8	0	4
	Start-up (%)	14	12	14	20	0	13
	Early-Growth (%)	72	45	43	36	25	43
	Development (%)	14	39	43	36	75	40
Panel E	R&D Activity:						
	Performs R&D (%)	100	80	86	96	100	87
	Collaborates w/ universities (%)	71	32	71	76	50	57
	Takes R&D subsidies (%)	71	38	57	84	13	58
	Use R&D credit (%)	14	11	29	33	13	19

Source: TBSF Survey data, and own calculations; OECD (1997a); and Bank of England (2001).

Table 2 – Financial Architecture of TBSFs

Panel A	SOURCES OF FINANCE	Seed	Start-up	Early Growth	Developmnt
	No. of Observations (#)	103	99	85	41
	Internal Finance:	% of Cases during the Stages of Development			
	Personal funds of Founders (%)	82	48	28	17
	Family and friends funds (%)	35	18	12	7
	Retained earnings (%)	0	0	5	7
	External Debt-Finance:				
	Commercial bank loans (%)	8	28	40	36
	Government subsidies of all kind (%)	20	33	17	14
	Non-financial institutions funds (%)	1	8	9	10
	Other debt-finance funds (%)	1	2	3	5
	External Equity-Finance:				
	Business angel funds (%)	10	20	17	5
	Venture capital funds (%)	13	26	30	21
	Other equity-finance funds (%)	2	2	3	4

Panel B	AMOUNT of FUNDS PROVIDED to TBSFs	#	Min	Max	Median	Mean	Std. Dev
			Amounts in x000 Euro (K€)				
	Personal funds of Founders (K€)	75	4.0	1,250.0	45.9	124.4	232.9
	Family and friends funds (K€)	10	20.0	1,000.0	27.5	167.3	304.1
	Commercial bank funds (K€)	39	5.0	5,000.0	100.0	569.4	1,117.9
	Business angel funds-First round (K€)	39	25.0	5,000.0	200.0	478.8	1,005.9
	Business angel funds-Second round (K€)	9	20.2	3,700.0	150.0	760.1	1,327.5
	Venture capital funds-First round (K€)	34	12.0	9,000.0	193.8	919.5	1,846.9
	Venture capital funds-Second round (K€)	15	23.8	25,500.0	385.0	3,105.0	6,936.7

Panel C	PRESENCE in FINANCE: Combinations of Internal & External Sources of Finance			Seed	Start-up	Early Growth	Developmnt
				#103	#99	#85	#41
	Internal[1]	Ext.-Debt[2]	Ext.-Equity[3]	% of Cases during the Stages of Development			
	ONE Group of Financing Only						
	1	0	0	55	18	13	3
	0	1	0	4	17	17	12
	0	0	1	6	13	14	9
	TWO Groups of Financing Only						
	1	1	0	16	12	9	7
	1	0	1	9	6	3	2
	0	1	1	3	12	12	6
	ALL Three Groups of Financing						
	1	1	1	6	7	11	8

Source: TBSF Survey data, and own calculations. [1]Internal Finance includes personal funds, family&friends funds, and retained earnings.[2]External Debt Finance includes bank loans, government subsidies, non-financial institution funds, and other debt-finance funds. [3]External Equity Finance includes angel funds, venture capital funds, and other equity-finance funds.

Table 3-Scores of Belgian Entrepreneurs on Separate Items on BA and VC Financing

Panel A: Business Angel (BA) Financing

Average Percentages (%) with a 4 or 5 (agree) on a 0 to 5 *Likert-Scale* (#99)

Statement: *"BA financing for my high-tech start-up company has difficulties because of:"*

	%
Limited government policies to promote BA investment	52
Small size of BA financing market in Belgium	52
Limited reliable information on the activities of BAs	48
Concern of BAs' over high perceived risk	44
Administration & bureaucracy of government-supported programs	41
Lack of understanding the role of BAs	41
Lack of technology and industry knowledge of BAs	40
Limited exit options for BAs	37
Misperceptions against private equity investment in Belgium	33
Lack of BA networks in Belgium	32
"Due Diligence" difficulties faced by BAs	26
Lack of Professionalism in BA entities	20
Cost of access to commercial & professional infrastructure	16
Poor quality of our business plan & presentation to raise BA funds	15

Panel B: Venture Capital (VC) Financing

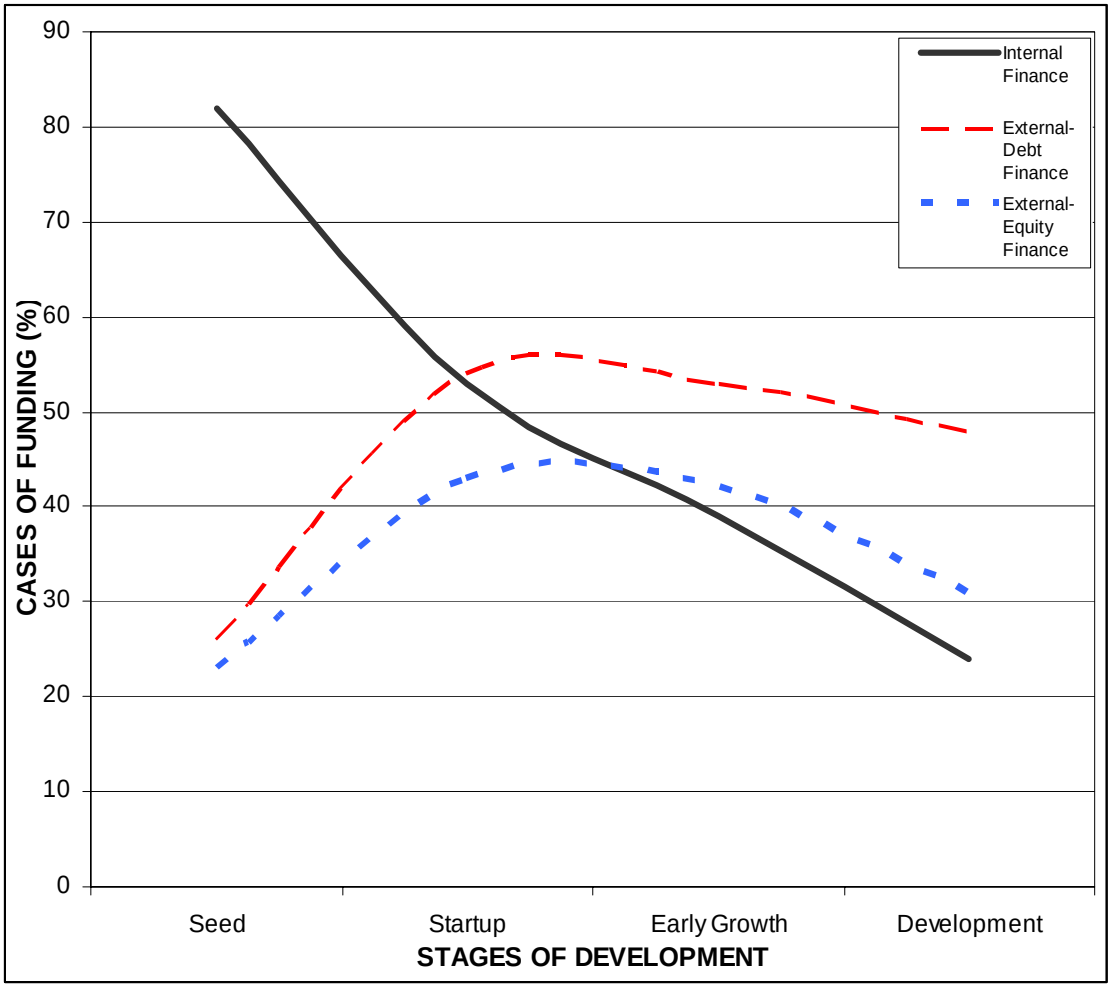
Average Percentages (%) with a 4 or 5 (agree) on a 0 to 5 *Likert-Scale* (#99)

Statement: *"VC financing for my high-tech start-up company has difficulties because of:"*

	%
VCs expectation of quick exit	61
VCs expectations of high rates of return	59
Unwillingness of VCs to provide small amounts of capital	58
Lack of VCs' interest in early-stage investments	55
Limited public policies to support VC participation	54
Administration & bureaucracy of government-supported programs	47
Lack of Belgian VC executives' specific knowledge & skills	46
Our concerns over "loss of control" in the company	40
Lack of understanding of specific technology by many VCs	34
Lack of our market information on Belgian VC activities	31
Lack of our company's registered patents	30
"Due Diligence" difficulties faced by VCs	27
Lack of our entrepreneurial & managerial skills	24
Poor quality of our business plan & presentation to raise VC funds	13

Source: TBSF Survey data, and own calculations.

Chart 1 - Evolution of Internal and External Sources of Finance during the Stages of Development



Source: TBSF Survey data, and own calculations.