Constraints on innovation finance in North Jutland, Denmark

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Abstract:

Responses from 3400 interviews in 1999-2006 are used to examine empirically the nature of financial constraints in a less developed region in Denmark, North Jutland. The results show that there is considerable variation over time. Some of this variation is explained by changes in business cycles. Size of the firm seemed important for the financial constraint in 2002-2006, where small firms were more constrained. There is only weak indication that innovative firms were more financially constrained. Policy implications are derived pointing to a dilemma between enhancing flexible, differentiated policy instruments and the generating of knowledge among firms about options of financial support.

1. Introduction[1]

It has long been recognized that firms experience problems in obtaining external finance. According to the literature, difficulties in obtaining external finance is a barrier to the creative potential of firms. In particular, innovation projects are said to be starved of finance.

Many documents prescribe required actions. A wide range of government programmes have been developed and implemented as a response to the lack of development due to this financial gap (HM Treasure and SBS, 2003, Martin and Scott, 2000). Whereas general instruments such as tax deductions for specific types of expenditure may alleviate part of the problem, such instruments generally fail to 'hit the right target' if the financial constraint is specific to different types of firms. The nature of the financial gap is not necessarily just a mis-match of overall supply and demand, but may be very differentiated between firms, and also vary over time and regions (Harding, 2000), which have made some policy makers and academics to plea for more specific policies[2]. Governments have therefore been creative in developing schemes that they believe effectively provide financial help for firms that need external finance the most, and which, from a socio-economic point of view, are considered worthy of support. Regional poli-

[1] Comments from participants at the RSA Conference "Regional Growth Agendas" Aalborg, Denmark, May 28-31, 2005, and well-chosen comments on an earlier draft from two anonymous referees are gratefully appreciated.

[2] Tödtling and Trippl (2005) put a similar argument generally on regional innovation policy, claiming that policies have often been copied from successful, high-tech regions and applied to peripheral regions, rendering inexpedient effects. It is argued that innovation barriers are different in different types of regions, therefore policies should be differentiated accordingly.

cies in general thus often involve elements of financial help in various forms, ranging from subsidies to supporting special financial institutions.

This creativity ranges from copying schemes from other countries to developing advanced expert systems to help both firms and public authorities take advantage of a wide range of specific financing options. The latter approach is based on the belief that financial gaps may be differentiated. Still, this poses a challenge for policy makers, because determining the characteristics of financially constrained firms is not as straightforward as it might seem.

This paper contributes to an understanding of the nature of financial constraints in a less developed region in Denmark, North Jutland. It is maintained that, in order to understand the financial constraints to innovation and small firms in general, and in less prosperous areas in particular, it is necessary to discuss potentially disadvantageous (seen from the perspective of the financier) characteristics of firms in more detail, and to try to find out whether these characteristics are 'natural' obstacles to innovation financing.

While based on a general discussion of these characteristics, the paper focuses more specifically and empirically on firms' perception of whether there is a financing gap in a peripheral area, North Jutland, Denmark[3]. On the one hand, such firms may experience problems in obtaining finance for their innovation projects because of their peripheral location, as explained later. On the other hand, most of the area in our case is an Objec-

[3] The region has been characterized as peripheral for decades, and is still has characteristics of peripheral regions, such as unemployment rates substantially above country averages and lower incomes. There are, though, signs of a catching-up process in later years, see the Stoerring and Dalum chapter in this volume.

tive 2 area[4], which gives firms an extra financing option. The aim of the study is to determine whether there is still a financing gap in North Jutland, in spite of many years of Objective 2 support, and if so, the precise nature of that gap. It should be emphasized that the paper is not aimed at evaluating the effectiveness of Objective 2 support as such, but rather to assess the general situation with regard to innovation financing in the region and whether this situation has changed over time. Specifically, *the extent to which firms point to financial constraints on their innovation projects and what type of firm sees financing as a constraint.*

Earlier empirical studies have primarily focused on indications of financial constraints in a region at a given point in time, often with difficulties of interpretation of the results due to the lack of a benchmark. The benchmark most often used has been other regions in the country concerned, often disregarding the fact that economic activity varies between regions; that the nature of financial constraints can vary across regions; and that the extent and nature of financial constraints is dynamic. To this end, this paper contributes with a longitudinal study of how a panel of more than 400 firms report financial constraints in eight successive surveys, 1999-2006. The paper also contributes with a closer linking of innovation and potential financial constraints.

The paper starts with a theoretical discussion of innovation financing. In section 3, different characteristics of the firm are discussed in relation to innovation financing. Section 4 presents the empirical results of an analysis of innovation financing constraints in

[4] Objective 2 support is a European Commission funded programme for promoting development in peripheral regions.

North Jutland generally and according to the firm characteristics discussed in section 3. Finally, section 5 discusses policy implications.

2. Contemporary understanding of innovation financing

2.1. What is special about financing innovations?

The long-run survivability and growth of firms often depends critically on innovation performance. This in turn depends on the ability to learn, to change production processes and organization, and to develop and introduce new products. The learning capabilities, which underpin innovation performance, depend primarily on the creation and maintenance of intangible assets: human capital, skills, new organizational forms, improved monitoring and understanding of markets, and so on. These in turn require the commitment of resources, e.g. to training, R&D, product design, organization skills and capabilities. This kind of resource commitment is investment in the strict sense - that is, it involves the use of finance in the present period or periods to create assets, which will deliver benefits over future time periods. To understand the crux of the innovation financing problem, one must first recognize that a major problem in the innovation process is that the flow of such benefits is generically difficult to predict and in general highly uncertain. At the same time, most of the assets that are thus created are intangible

- they are not capitalised in the balance sheet of the firm, and are often treated for accounting purposes as current costs, which affect current profitability.

The rationale for most initiatives aimed at improving the availability of finance for innovation is that financial obstacles inhibit the creation of the intangible assets needed for good innovation performance. These obstacles take two broad forms. On the one hand, firms may be unable to access external finance to support intangible asset creation and the overall innovation process. On the other hand, there may be obstacles, which prevent or inhibit firms from allocating internal resources to such activities. This paper focuses on the former. It is important to note that the generic problems outlined above may be more differentiated and more or less severe according to the specific characteristics of the firm concerned, which is discussed further in section 3. This, in turn, may require policies to be differentiated accordingly.

2.2. Intellectual heritage - creative destruction and change of business as usual

Our understanding of innovation financing goes back to the writings of Joseph Schumpeter (1911/1934), who was one of the first to theorize on the special problems associated with financing innovations. Schumpeter is the one "classical" theorist who addresses the question of financing innovations most directly in his writings. In his view, the innovation process is the prime mover of capitalistic development, development being something qualitatively new caused by endogenous, spontaneous and discontinuous changes in the

channels of circular flow (Schumpeter, 1912/1934, p.63-64). The innovation process is thus a discontinuous process (Schumpeter, 1939, p.181). Deviations from circular flow are made possible by the credit system.

Creativity is important in another way. According to Schumpeter, while the entrepreneur is the driving force behind the process of innovation, he must be able to convince the banks, or "capitalists", to provide him with credit for financing the innovation. This function is important enough to be the "differentia specifica" in the system (Schumpeter, 1912/1934, p.69, 107).

In summary, Schumpeter provided an enlightening and original contribution to the theory of financing innovations. One can only wonder why the many "Schumpeterian" innovation theorists have largely ignored the "differentia specifica" in Schumpeter's innovation theory - the importance of credit for the financing of new combinations. Modern innovation theory involves both elements of Schumpeterian theory and institutional theory.

2.3. The geography of innovation financing

Increasingly there has also been interest in both the geography of innovation (Feldman, 1994) and in the geography of finance (Martin, 1999, Mason and Harrison, 2002, Zook, 2002). The research has primarily focused upon venture capital. By adding the spatial dimension, the new economics of geography has shown that the supply of financial cap-

ital is spatially heavily skewed, with a relatively large share being invested in metropolitan areas (Martin et al., 2002; Mason and Harrison, 2002).

There are several reasons why the characteristics of a region can influence on the possibilities for firms to obtain financial capital for innovation. One obvious explanation why investments tend to be spatially uneven is that also the investment opportunities and business activities are unevenly distributed. Start-up rates may be higher in metropolitan areas and the concentrations of high-tech industries likewise tend to be higher in urban areas, which may spur demand for external capital. Related, because highly innovative firms may represent greater uncertainty and require more intense monitoring, financial institutions may benefit from organisational, cultural, social and geographical proximity to investee firms as this may facilitate transfer of the relevant knowledge for supervision of the firms. As this knowledge is often informal and network based, and therefore transferred most efficiently through face-to-face contact, geographical proximity may be important for innovation financing. This implies that transaction costs are higher if the financier is not close to the firm, and it may also be argued that such transaction costs are higher in small firm investments. Such firms often lack managerial skills and organisational capabilities, which may render more needs for guidance (this is elaborated in the next section). This in turn may urge financial institutions to restrict their geographical scope of their investments (Christensen, 2007).

Because of this uneven distribution of financial resources, firms in peripheral areas can be said to be disadvantaged (Murray, 1998; OECD, 1996). On the other hand, the above-mentioned demand characteristics of a region may explain parts of this phenom-

enon, and the ability for financial institutions to communicate and make transactions across distances may alleviate the problems. It is also debatable what are the implications of an uneven distribution of both the supply and demand side and of the advantages of geographical proximity. It is not clear if financial capital should be more concentrated around innovative clusters to gain from agglomeration effects or if financial capital should be more regionally dispersed to precisely stimulate the upsurge of regional growth industries (Martin et al., 2002). Even taking this into account findings generally support the notion that firms located in the less favoured regions are more likely to be financially constrained, but as indicated the picture is not black and white and needs to be differentiated.

In the next section, these arguments are complemented with arguments about why certain firms may be particularly financially constrained, and why location in peripheral regions may pose particular problems in this respect.

3. Characteristics of the firm and perceived possibilities for financing innovations

3.1. Identification of the generic problems

Firms are affected by potential financing constraints in different ways. A number of surveys in Denmark and elsewhere have identified the most typical, financial constraints

to SME development, including their extent. The consensus seems to be that firms facing financial constraints share one or more of the following characteristics: they are small, new, innovative, growth-oriented, based on intangibles, and demand equity in combination with competencies.

A particular type of firm experiencing financial constraints is the research/high-tech new firm, which requires relatively little capital. However, such risky, small investments are not really attractive to most sources of finance because the fixed costs on the due diligence prior to investment are too high compared with the business potential (Murray, 1999).

With respect to industry affiliation and innovation intensity, there are several possible hypotheses. First, it is possible that high-tech firms experience severe financial constraints due to the more explorative nature of the innovation process and subsequent high failure rates. An alternative hypothesis is that medium-tech innovations are likely to suffer from under-financing because they are too risky for banks, the potential return is too small for venture capital firms, and they do not fulfil the requirements for government aid (OECD, 1993, p.59). Other surveys (Jacobs, 1991) also found that small, basic businesses feel that their needs are not glamorous enough to attract venture capital. On the other hand, commercial banks think they are too risky. Finally, one could argue that traditional, low-tech firms are likely to suffer from under-financing because financiers see innovations and new technologies as not only associated with high returns but also as a prerequisite for long-term survival and growth.

Numerous analyses have pointed out that problems with financing innovations are first and foremost an SME problem. Apart from the problems associated with a small firm, size in itself may be considered a disadvantage by financiers (as explained in more detail later). For example, Mason and Harrison (1994, p.65) suggest that

> '..business size and the associated perception of security is an important determinant of bank attitudes in its own right, with bank managers regarding the bigger businesses as better than the smaller businesses.'

However, it is debatable whether the mere size of firms determines how much they feel financial constraints. Thus, The European Commission Green Paper (1995) commented that

> 'Financing is the obstacle to innovation most often quoted by firms, *whatever their size*, in all Member States of the European Union and in virtually all sectors.' (p.28)

Based on a similar approach, Canepa and Stoneman (2004) use data from the CIS II and CIS III surveys to analyse the financial constraints on innovation, and find that firms in newer, high-tech industries are particularly constrained. They also demonstrate that the evidence on firm size is less conclusive in some countries, but generally indicates that small firms are more likely to be financially constrained. The results from CIS III indicates that, for Denmark, while very large firms have less financial constraints, the size effect is not significant in other size groups. Thus, 10% of firms with 50-250 employees list lack of financing as an obstacle to innovation, the corresponding number for firms

with 10-50 employees being 12%. Innovative firms seem to be more constrained than non-innovative firms (Analyseinstitut for Forskning, 2003).

Christensen (1997) uses CIS I data to analyse the characteristics of firms which regard lack of finance as an obstacle to innovation activities. It was found that highly innovative firms are more likely to be hampered by lack of finance. There is much less evidence that belonging to a high-tech sector in itself can explain financial constraints. Even though there tend to be sector-specific constraints, the results suggest that there are highly innovative firms in all sectors, and that this is more likely to explain constraints on innovation financing[5].

It would be fair to say that, in spite of the consensus in Danish surveys mentioned above, there is some contradictory evidence in the investigations, especially with regard to firm size. This calls for further analysis and discussion. This is done in two steps. The first step is to discuss whether small firms have inherent characteristics, which may make potential investors reluctant to finance them. Considerations on the possible impact of the localization in peripheral regions are added to this discussion. The second step (section 4) is to use data from successive surveys of North Jutland firms to investigate whether the size of the firm, the innovation intensity, or other firm characteristics influence the perception of a financing gap. Since the data have been collected from successive surveys, it is also possible to examine whether there has been any change in this perception over time.

[5] It should be remembered, but is often overlooked, that focusing solely on the firm as the unit of analysis neglects the fact that large firms and high-tech firms often demand larger amounts. Therefore, the financial gap measured by the number of firms rather than in monetary terms, may be underestimating the problems.

3.2. Innovation characteristics and financial constraints of small firms

In the previous section, we saw that, although the evidence is mixed, according to some surveys the mere size of the innovating firm has implications for the possibilities of obtaining external finance. There are several, interrelated, arguments for this, which have to do with the relatively weak capabilities of SMEs as regards developing, managing, financing and utilising innovation and technology.

Rothwell and Dodgson (1994) compare SMEs with large firms on the basis of empirical studies of SME activity. Their conclusion is that SMEs' advantages lie mostly on the behavioural side - they are flexible, responsive to external changes, and have effective internal communication. On the other hand, they often lack human resources, such as managerial and technical skills, and they have material disadvantages, e.g. no in-house R&D division and lack of financial resources. These comparative disadvantages lead in turn to a number of special financing problems for small firms.

First, the economic performance of a small firm varies much more than that of a large firm. This implies that, while small firms on average grow faster, they are much more heterogeneous. According to Gibrat's Law of Proportionate Effects (Gibrat, 1931), growth rates for a firm are proportionate, i.e. a firm is equally likely to grow at a certain pace, regardless of size. Empirical testing of Gibrat's law shows, however, that growth

tends to decrease with size, as does the variance. Thus, the volatility of growth rates and profits decreases with increasing firm size.

This may reflect a wider range of products and customers in the large firm, as opposed to a higher propensity to have a single customer, single product in the small firm. Consequently, the small firm is more sensitive to unexpected changes in its environment; moreover, such changes are more likely to occur. The demand for the products, and the revenues and required outlays of a small firm are large compared with its capital base, whereas the large firm has a more incremental development (Storey, 1990). Stages in the development of a firm do not, in other words, indicate a smooth development for a small firm. Rather, they can be seen as a sequence of changes in the nature of the business. As the project agenda changes, the firm faces a range of new challenges of managerial character, challenges to resources, organizational change, external relationships, and market assessment. These transitions are highly risky, because they involve major changes in many aspects of the firm, and financiers may be reluctant to take the risk of changing a consolidated stable business into a new high-risk firm (ACOST, 1990). Greiner's (1972) 5-stage growth model even describes the transition between stages in the growth of a small firm as a series of different types of crises. Thus, when even successful innovative firms face discrete (and relatively large) increases in demand and production requirements, the expansive firm may face major problems (Hall, 1990). Moreover, turnover rates in the population of small firms are very high and failures frequent.

Second, as briefly mentioned above, there is a higher risk of default in small, innovative firms. This is associated with a large ratio of expenditure on a single innovation project to the capital base of the firm, and with the sensitivity and step-wise growth rate described above. Added to this is that the small firm usually has a smaller management team, and in some start-ups management consists solely of the owner. This makes the firm very reliant on the skills of a few persons, and thus also sensitive to unexpected changes in management. Moreover, financiers often look closely at management competence when screening innovation projects, and this is quite sensible. Being responsible for the often volatile development of a small firm requires skilful management and adequate organizational changes to new situations, as does producing a creative environment able to foster new ideas and innovations to sustain competitiveness and growth in the firm. Small firms often have deficiencies in this area, since they often do not have the same management resources and are not as flexible in reacting to major market changes as larger, multi-product firms[6]. In addition, these problems may be enhanced if the firm is located in a peripheral area, because recruitment of talented managers is difficult and more costly (Sunley et al., 2005, p.263). In the case of the small firm, this recruitment problem represents an additional difficulty, because small firms may not be regarded as attractive due to limited career possibilities.

The debate on allocation of talented people and skilful managers to firms in peripheral regions has intensified with the recent discussion on whether talent is attracted more to places than jobs. It is maintained in this debate that a concentration of creative and in-

[6] This contrasts the finding from Rothwell and Dodgson (1994) mentioned above. A number of studies point to that the picture of a large firm as being inflexible is overstated. Rather, the fact that such firms often rely on more different products in stead of just one, makes larger firm able to shift quickly among their core products according to the development in the market.

novative people will in turn attract firms. The debate intensified with the publication of Richard Florida's book 'The rise of the creative class' (Florida, 2002), and has led to a growth in literature on 'place marketing' (Hospers, 2004). Peripheral regions may be disadvantaged in this respect as urban areas often attract talent. On the other hand, some peripheral regions are attractive due to other factors that exactly those in the city, such as nature, quite surroundings etc.

Third, banks or other financing sources dealing with a small firm experience greater asymmetries in information. A larger firm will usually have a past record to rely on, or it may have a certain reputation. A lot of the information on large firms is even available to the public if the firm is listed. Both the technical and the market uncertainty may be more difficult to assess in a new, small firm, as there is little experience to build on. Therefore, when evaluating small firms, management is very important.[7] For some types of financing the firms in peripheral regions may be argued to represent particular difficult cases in this respect. Parts of the asymmetries in information may be reduced by closer monitoring and build up of trust, which is facilitated by geographical proximity. Also referrals from business professionals may be eased if the financing institution is close to the investee firm (Sorenson and Stuart, 2001, Florida and Kenney, 1988). For banks this problem is not that severe due to their extensive net of local branch offices (at least in Denmark). But for other financing sources with concentration of offices in metropolitan areas, the informational asymmetries in small firms may be enhanced by the

[7] In addition to the personality of the entrepreneur, the difference in mentality between managers of small firms and large firms may also hamper possibilities for obtaining finance, because the former tend to view rules and procedures in financial institutions as bureaucratic and slow compared with their own flexible and fast-responding firm. The organization and speed of response in the large firm is more like that of a bank (Storey, 1990, p.11).

peripheral location. This goes for venture capital, which in Denmark, as in most other countries, is heavily concentrated in Greater Copenhagen[8].

Fourth, small firms are faced with higher interest rates, and higher demands for collateral and credit rationing. Hall, G. (1990, p.55) summarizes a review of various empirical studies:

> "There is little doubt that, compared to large firms, small firms are usually required to pay a higher rate of interest and offer a higher level of security. This reflects, partly, the greater risk inherent in the small-firm sector and, partly, the endemic conservatism of bank managers. The latter, furthermore, are inefficient at undertaking financial appraisals.[9]"

It is unclear, however, whether the latter explanation - that banks are inefficient - is true. It may well be that it makes sense to be tougher on small firms due to their higher failure rates. Thus, ACOST (1990, p.1) states that "Smaller firms do suffer disadvantages in raising external risk capital, there is a definite equity gap, but the extent to which less advantageous borrowing terms faced by small firms reflect rational risk assessment by lenders remains unclear". The additional requirement of collateral is often reinforced if

[8] More than 90% of capital under management is in this area, but investments are more dispersed. The share of Danish venture capital investments going to firms in North Jutland is below the share of firms in Denmark, whereas funds from a loan guarantee scheme, which is distributed through the (local) banks goes to North Jutland in a proportion corresponding to the share of firms, and in some years even exceeding this share.

[9] Maxwell (1990, p.11) reports studies which show that small businesses in Ireland have to provide collateral in the ratio of 3:1 to cover bank borrowing. The similar figures for the U.K. are 1.5:1 and for the U.S. 1.2:1. In addition, small firms have to pay an extra interest rate of 3.75%. Other, later studies have found similar results. For Denmark specifically it was found in a survey (Håndværksrådet, 2003) that small firms are treated differently (worse) than large firms and that this is more pronounced in peripheral areas.

the firm is located in a peripheral area.[10] This point was made explicit by The Bank of England (2004) who commented that firms in deprived areas represents a greater credit risk than firms elsewhere.

In addition to the greater uncertainties described above, there are two other reasons for this requirement of higher pay-back. One is the initial costs of, for example, a bank if it enters an engagement. These costs are not only related to the initial due diligence, but also associated with monitoring and administration. Therefore, a large loan will yield a larger profit for the bank compared with the fixed costs. Small firms thus often hit the lower limit in the case of investment from financiers. The other reason is the limited market power of a small firm when negotiating with banks. As a result, small firms have to undertake projects with higher profitability than large firms, which means that some areas of production are inaccessible to small firms. It is an open, but interesting question, whether some small firms deliberately choose risky projects because they need higher profits, and therefore create a self-reinforcing high risk - high interest rate circle.

Fifth, the group of small firms is very heterogeneous. Small firms differ from each other on a number of parameters, and this makes it very difficult for loan officers in banks or other investors to develop routines and expert systems to assess small businesses.[11]

[10] For example, mortgage institutions in Denmark differentiate the maximum share of the total price of real estate they finance according to postal codes – firms and private persons in urban areas may obtain up to 80% financing, whereas less attractive areas may only be offered up to 60%. Many insurance companies pursue a somewhat similar policy. This imposes additional costs on firms in peripheral areas.

[11] Nevertheless, there is currently a lot of research on this issue, as well as evaluation of the practical use of such credit decision systems for small businesses. This applies not only to the credit assessment of the individual firms, notably developed in the credit scoring literature, but also to the previous step, when the firm is recommended which source of finance to approach. See, for example, the toolbox developed by CRESCENDO (2005) and one of EU/Gate2Growth to support regional policymakers and firms in decisions on regional financing options.

Furthermore, another difficulty with innovation financing in small firms stems from a general problem of competence mis-match between borrower and lender. On the one hand, firms (especially small firms) have little knowledge of methods of financing innovations, and they tend to focus more on the technical possibilities of their project than on financial management. They also lack awareness of financing options generally (Mason and Harrison, 2001, 2003, 2004). In financial institutions, on the other hand, decision makers are reluctant to obtain project- and branch-specific knowledge and to use this information as criteria for judging a project. Rather, they focus on past balance sheets, solidity, budgets, liquidity forecasts, etc. - in other words, financial management. The large firm is closer in culture to the financial world, since they often have a separate financial department and the organization may be more similar to that of a bank. Although hard to prove it may well be that cultural differences between rural areas and metropolitan areas also impact.

Whereas it may not be a general rule for peripheral regions, then at least in our case, North Jutland, the average size of firms is substantially below that of the rest of Denmark. This may in itself enhance the above arguments why small firms may be financing constrained, and it may link the arguments on firm size to the regional perspective.

The implication of this discussion of small-firm financing is that we would expect to see more small firms experiencing financial constraints on innovation. Similarly, from the discussion in section 3.1, we would expect to find that financial constraints on innovation are positively correlated with innovation intensity. In particular, we would expect such problems to be pronounced in peripheral areas such as North Jutland.

4. Financial constraints on innovation in North Jutland

4.1 Introduction

This section examines empirically the characteristics of financially constrained innovative firms in North Jutland. First, we look at the overall importance of finance relative to other possible obstacles to innovation. The analysis compares the development of these factors between 1999 and 2006.[12] Subsequently, we focus on the influence of innovation intensity or firm size matter on how firms perceive finance as a constraint.

4.2 The data

The data are based on telephone interviews with the management of private firms in North Jutland. This data collection is part of a quarterly regional business cycle indicator established in 1998 in North Jutland[13]. Every 3 months, a representative panel of managers in 1000 firms in the private sector are interviewed about their view of the past and future development of, among other things, production, employment, profits and competitiveness. A minimum of 10% of the panel is replaced in each round to avoid panel effects. Only firms with at least 5 employees are selected. The interviewed firms

[12] While this has a purpose in its own right, it also partly compensates for the fact that, when broken down into sub-catagories, the number of observations in the data set is reduced. If, however, the patterns are stable over time, it will allow us to base our conclusions on a relatively small number of observations.
[13] The results and further explanation (in Danish) can be obtained from www.business.aau.dk/njk

represent approximately 30% of employment in the region. Once every year the interviews are extended to also include innovation. These questions, which also include specific questions on financing innovation, are only put to firms within the manufacturing sector and business services, including the financial sector. These two sectors make up approximately 40% of the total, in 2006 (4th quarter) 426 firms out of 1007 interviewed. We thus have approximately 3400 interviews on innovation constraints. It is from this annual addition that we have obtained our results, which are weighted to make the realised sample representative of the population.

4.3 The importance of access to financial capital relative to other conditions for innovation

Although the external financing of innovation processes is often seen as crucial, and is high on the policy agenda, it should be remembered that the innovation process is dependent on a range of different conditions. To put external financing into perspective, in the following we show firms' assessment of different factors conducive to innovation. The results for manufacturing are shown in figure 1. The results for business services largely resemble those of manufacturing firms. These questions are only put to firms that claim to have plans to innovate, which make up around half of the respondents ranging over the 8 surveys from 46% to 59%.

FIGURE 1 ABOUT HERE

At first sight, external financing seems to be ranked low in relative importance; in 2006, this was seen as crucial by only 5% of the firms and generally ranked low compared with the other factors[14]. Moreover, the ranking of the five conditions is consistent over time, except in 1999. Skilled personnel is clearly the most decisive factor[15]. Framework conditions such as access to external financing are still important to the innovation process, although the relative importance is perhaps not so great in these results, as reflected in the policy agendas. Including firms which attach 'great importance' to external finance illustrates this importance; the shares then rise to between 50% and 27%, as shown in figure 2.

FIGURE 2 ABOUT HERE

[14] This conclusion is supported by a recent survey on product innovations in the manufacturing industry (Christensen et al., 2004). 1732 firms were interviewed about potential obstacles to innovation, among other things. Generally, there were few obstacles to innovation, and external finance was only mentioned by a minority of the respondents.

[15] In order to ease comparison, the questions were consistent over time. However, in 2000 there was a minor adjustment with regard to the question on financing. Whereas in 1999 this was put in general terms, from 2000 the question was specifically on *external* financing. This difference could negatively affect the share of firms assessing this factor as important.

Including this share of the firms substantially increases the share of firms, which see external financing as important to their innovation processes[16]. The results show an increase in 2002-2004 in the share of firms, which regard external finance as important[17]. In the following two years firms see external finance as less important compared to previously. The pattern over time is consistent with common beliefs about the development of the capital market. In Denmark, the capital market has, since the beginning of the century, been characterized by more risk capital and increased competition among financiers, with more players in the market and more financial instruments. After 2002, business cycles in Europe worsened (less so in Denmark, but the downswing in major trading partners like Germany also affected some export-oriented Danish firms), and the lessons from the crash of the IT industry led to more cautious investment policies. Data from The Growth Fund, which monitors the development of the market for innovation finance in Denmark, confirms that the market has become tighter in the period from 2002 onwards. They report that new investments have gone down, and that their own involvement has gone up, reflecting the fact that private investors have become more cautious (The Growth Fund, 2004, 2005). Despite the general downswing of business cycles, it did not affect all firms equally. The data from the business cycle indicator

[16] Canepa and Stoneman (2003) even find that, in the CISII and CISIII data, the financial constraint is reported extensively compared with other constraints to innovation. The questions in CIS are phrased a bit differently than in the present survey, since the focus here is more on conditions for innovation.

[17] The results can be validated through a comparable survey reported in Christensen et al. (2004). In this survey, 421 North Jutland firms in the manufacturing sector were interviewed about their innovation, R&D, collaboration, etc. When asked about the importance of improved external finance for potential decisions to increase investments in R&D, 4% reported this as having decisive importance and 31% said it had great importance. As the survey was carried out at the beginning of 2004, the comparable year in our survey is 2003. The 3% and 33% in that year corresponds closely to the Christensen et al. (2004) survey.

shows that the great majority of North Jutland firms – especially small and medium-sized firms – did rather well. However, the perception of financiers was influenced more by the general picture than the differentiated development. From 2004-2006 business cycles has improved and interest rates have been low. This may have contributed to easier access to, and less need for, external finance.

In principle, respondents who have not actually experienced problems in obtaining this type of external financing could answer the question posed. Therefore, respondents were first asked which type of financing is most important. They were then asked if they actually experienced problems in obtaining this financing. Figure 3 shows the results of this latter question.

FIGURE 3 ABOUT HERE

The results show that, in 2004, 4 out of 10 firms actually experienced financial constraints on their development. In 2006 this share dropped to one of four. Whether or not this indicates general problems is debatable[18]. What is certain is that there is an increase

[18] It should be emphasized that the filters for selecting respondents in figure 2 and 3 means that the num-

from 2002 to 2004, which may be consistent with the general impression that, for example, the venture capital market in Denmark has become more reluctant in recent years to invest in innovation and early-stage ventures[19], and it is also consistent with the development shown in figure 2. The development in figure 2 is also consistent with the drop in the share of firms experiencing financing constraints 2005-2006, as depicted here.

Moreover, an additional, related question was posed in the 2005 business cycle survey. 1009 respondents answered the question "Is access to finance better, the same, worse in North Jutland compared to the rest of Denmark". This is certainly not an objective measure, but does indicate a perception of whether firms see themselves as better of than in the rest of the country or the opposite. The results showed that only a small fraction (4%) see the access to finance as better than in other parts of Denmark. The majority (53%) see it as the same but one out of four (24%) firms actually see financing options as worse than in other parts of Denmark.

4.5 Financing constraints in firms with different innovation intensity

ber of respondents is reduced drastically. In 2004 for example, the number of respondents with innovation plans (and answering the question on the relative importance of external financing) was reduced from 218 to 77 who assessed problems in obtaining finance. The differences between 'yes' and 'no', however, are statistically significant at the 5% level.

[19] Statistics for the venture capital market show that in that period there has been a downward trend in the share of new investments relative to follow-on investments, and that the average size of investments has increased. Moreover, the share of investments in the seed phase decreased relative to start-up and expansion investments (The Growth Fund, 2005).

Many earlier studies have approached research in innovation financing by considering whether firms in particular industries are more or less constrained (see, for example, Canepa and Stoneman, 2003). A simplistic grouping of firms in what is usually regarded as high-tech and low-tech industries will, however, miss much of the essence in the potential correlation between innovation and financial constraints. There are high-tech firms in the majority of sectors and industries. Since for this survey we have information on the actual innovation activity at the level of the individual firm, this is used instead of the indirect indicator, industry affiliation.

In the above, we discussed different hypotheses about the correlation of innovation intensity with financing constraints. Figure 4 shows whether highly innovative firms are hindered by financial constraints. We divide firms into those which have introduced one innovation, several innovations and no innovations, and cross these categories with assessments of the importance of external financing for innovation.

FIGURE 4 ABOUT HERE

The results show that there are no big differences and the patterns are not consistent over time. The results should be interpreted with care, however. While it could be argued that results in figure 4 indicate that there are no big differences between the three groups, we do not know whether firms consider financing important because they have actually experienced this or whether they only consider it important in the event that

they carry out innovation activities in the future. Therefore, we complement the analysis with a similar crossing of the innovation indicator and the question on whether they have experienced problems in obtaining finance. Although this again reduces the number of observations, if there is a consistent pattern over time it may allow us to conclude whether it is more important to very innovative firms to have access to external finance.

The results indicate that there is a difference in 2003 and 2004 between non-innovative and innovative firms, the latter being more finance-constrained than non-innovating firms. Apart from this there is no consistent pattern over time.

These analyses lead to the conclusion that, in the longer term, there is no strong evidence that differences in access to finance are dependent on whether the firm is innovative or not. However, there was some difference in opinion when firms were asked to assess the importance of finance as an obstacle to innovation in 2002/3-2004. This was not so clear-cut when we analysed the actual problems of obtaining capital, on the other hand.

4.6 Financing constraints in firms of different size classes

Not all small firms suffer from the disadvantages listed in section 3.3, of course. But the evidence from the North Jutland survey suggests (figure 5) that firms of different size assess lack of finance differently.

FIGURE 5 ABOUT HERE

Generally, in 1999 to 2001, small firms tend not to see external finance as that important for innovation. After 2001, large firms are clearly not finance-constrained to the same extent as other firms, which is consistent with the development in the capital market and firm characteristics discussed above. It is also consistent with the general belief that, after the burst of the IT bubble, financial institutions focused more on consolidated, larger businesses, resulting in a finance gap in the SME segment. This may in turn justify targeting public initiatives and incentives for innovation financing on small and medium-sized enterprises. The financial gap is, however, in that case related to a more general trend, which may apply to all regions. The following section discusses policy implications in more detail and in closer relation to specificities of a peripheral region.

5. Policy implications and discussion

Various government initiatives have been developed to plug the financing gaps, both national programmes and regional efforts. It should be remembered that it is not possible to precisely determine the need for policies ex ante. Whether capital markets are un-

duly restrictive in financing innovative firms may therefore also be questioned. Many observers believe that there is a market failure with respect to innovation financing, and that some level of effort is necessary. However, some research does question the general belief that the government has a pivotal role to play in alleviating financial constraints de Meza (2002).

Our results for North Jutland show that, while lack of external finance is an obstacle to innovation in a relatively small share of firms, the situation worsened in 2002-2004. Innovation financing was increasingly seen as relatively important and an actual obstacle to innovation in that period. Afterwards the financial constraint was alleviated. Based on the results presented above, we may conclude that, contrary to expectations, small firms did not differ much in their assessment of financial constraints before 2002. The results were not as strong as prescribed by the discussion on disadvantageous characteristics. However, from 2002 onwards the picture becomes clearer, size seemed to matter in 2002-2006. Although there is some indication that innovative firms were more financially constrained in 2003-2004, we concluded that there is no strong evidence that innovative firms should be particular financially constrained.

Half of the firms in North Jutland state that financing constraints are the same in North Jutland as in the rest of Denmark. However, every four of the firms see firms in North Jutland as particular constrained; only 4% think the region offers better possibilities.

Changes in the business cycles and in attitudes among financiers may explain some of the variations. For example, the IT bubble may have induced cautious behaviour, which

has resulted in inertia to change. The positive business climate may not have been enough to change investment behaviour in the short run but seems to have changed in the past couple of years.

Above a number of arguments why firms in peripheral regions and with special characteristics may be worse off than others. There are a number of specificities in the North Jutland region, which may help explain the results. On the negative side, this includes the fact that the region has for many years lagged behind the rest of the country, e.g. it has had a consistent above-average rate of unemployment and lower start-up rates. The absence of company headquarters and major financial institutions (except for one regional bank) is another example. On the positive side, there is Objective 2 support, which, according to two evaluations, has been an important source of support for innovation in SMEs[20]. With respect to Objective 2 support, we are unable to adequately assess the direct importance of this scheme. However, there has been decision taken in the region that some of the remaining Objective 2 funds should be transferred to a loan fund with less strict lending criteria. The present analysis formed part of the basis for this action.

The analysis may have implications for at least two policy issues. First, how eligibility in policy programmes is determined. In the majority of programmes, the target group is the small firm/innovative firms segment. However, while there may in some cases be a rationale for this, our results indicate that options for other types of firms should also be developed. Whether these options are general or differentiated depends on the specifici-

[20] A mid-term evaluation of the programme 2000-2003 (Christensen, 2004) found that around 850 new jobs were created in the 175 subsidised projects, giving average public support per job of DKK 600,000. Additional revenues in these firms were estimated at DKK 8 million per DKK 1 million in public support.

ties of demand. Our results do not provide a strong case for very active policies, at least in the first part of the period studied. Second, and related, the variations in the results over time may point towards the design of flexible policy instruments. This in turn may involve a dilemma in relation to generating knowledge among firms about the options of financial support through continuous and sustainable schemes.

These are general considerations but there may also be policy implications related to the geographical aspect. As mentioned in the introduction Tödtling and Trippl (2005) argue that innovation policies may have to be different in peripheral regions. One reason for this is that firms in these regions may have less absorptive capacity and specific demands for innovation support. Even within the North Jutland region there are vast differences between firms in terms of being located in rural areas or the main city of the region, Aalborg, and in terms of being in a high-tech cluster, such as that of the wireless telecommunication technology cluster around Aalborg. Differentiated policies and a range of different instruments may therefore be needed if all firms should be targeted with an offer to support innovation activities. With respect to policies on innovation financing our results indicate both changes over time in the degree to which financial constraints is a hindrance to innovation and also a change in the specific type of firm with the most severe financing constraint. A prerequisite for policy makers to react to such changes is a close monitoring of the market development. The extensive and frequent survey from which our data in this paper is derived make up an important instrument in this connection.

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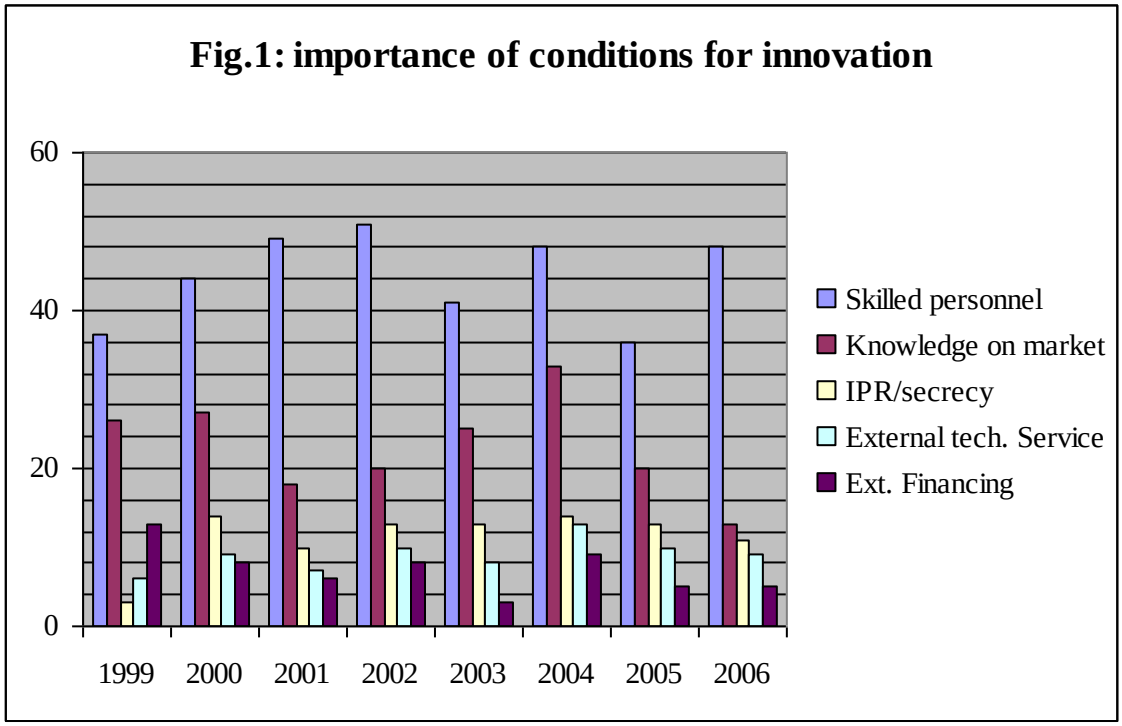

(N=1999-2006: 138/156/143/126/127/119/118/136)

Share of firms with plans to innovate within the next year which see conditions for innovation as crucial

Scale: crucial, great importance, some importance, minor importance, no importance

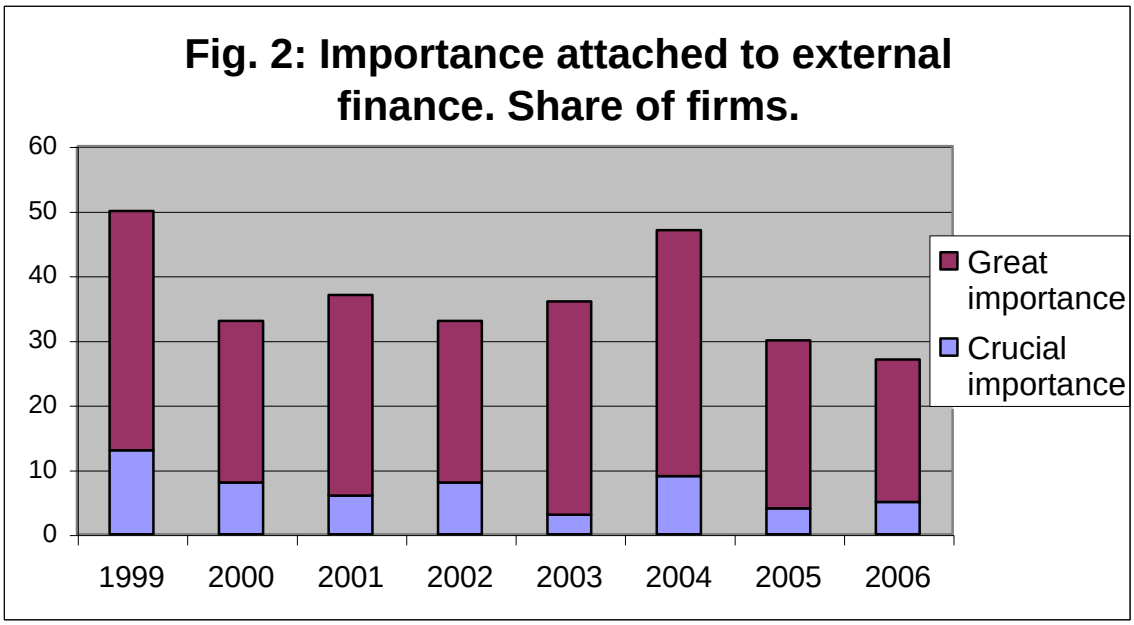
Fig. 2: Importance attached to external finance. Share of firms.
60
50
40
30
20
10
0
1999
2000
2001
2002
2003
2004
2005
2006
Great importance
Crucial importance

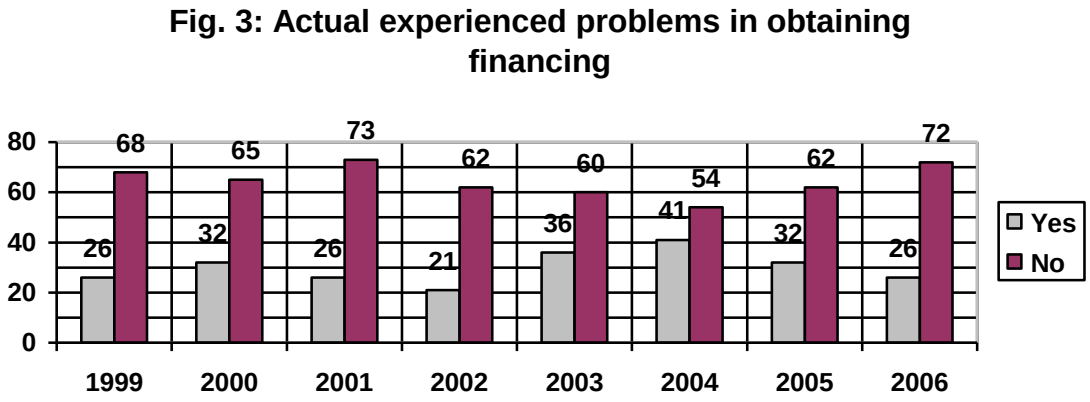
Fig. 3: Actual experienced problems in obtaining financing
80
60
40
20
0
26
68
32
65
26
73
21
62
36
60
41
54
32
62
26
72
1999
2000
2001
2002
2003
2004
2005
2006
Yes
No

Fig. 4: Financing constraints in innovating and non-innovating firms

Figure 5: Financing constraints. By size.