Finance and Innovation System or Chaos

Meant for
DRUID Working Paper

by
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Contents

1. Getting started[1]

> "My main conclusion is that we still do not know enough about the workings of national innovation systems to design effective policies for improving the flow of finance - and technology transfers - to SMEs. ...it may be that we should be promoting the role of intermediares and brokers in the financing and technology transfer process, if research can identify effective means for doing so". (Bannock, 1995, p.8)

The above is part of the conclusion made by one of the speakers at the EIMs workshop on Innovation Financing in Luxembourg, december 1995. It points out that more research is still needed in order to know how to improve financing of innovation in european nations. This is echoed in The Green Paper on Innovation from The Commission of december 1995 in which it is stated that

> "The Community's ability to innovate depends largely on the effectiveness of its innovation financing system.....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.....the results of SME surveys show that the European innovation financing system is full of holes,.....(p.28-29)

Thus, it is recognized that innovation financing is very important in promoting innovation. It is also pointed out that more research is needed to guide the policies. This expressed need is in contrast to the limited amount of research within the area. Although there has been some contributions (e.g. Prakke, 1988, Dosi, 1990, Christensen, 1992, OECD, 1993, 1996a) most of these are limited in scope and/or focus on a specific set of problems like the development of the venture capital industry.

There are several reasons for this deficiency. One is probably the intrinsic impossibility of estimating the optimal level of innovation financing. Financial instutions function as selection mechanisms by not financing projects assessed as not commercially viable. However, this assessment is an ex ante selection based on guesses about the future whereas the actual outcome is only possible to measure ex post. In other words there should be financial barriers to innovation but it is not possible to estimate to which degree there should be barriers. This impossibility mean that arguments for market failure and policy action towards correcting these failures are empirically shaky and therefore often based on deduction.

Another reason why studies on this issue are few is that it is rarely possible to seperate the financing of innovation and financing of the firm as a whole. When financiers assess a project proposal they take into consideration what is the viability of all the activities (in some cases including possible other potential businesses of this potential customer like insurance) of the firm

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1 This paper builds on work done in a research project for The European Commission. It is part of a TSER-project called Innovation Systems and European Integration (ISE). A draft report is due by the end of february and is to be presented in Athens in march. Due to space limits this paper present selected issues from the work on the draft report. Likewise we have reduced the number of countries dealt with. We have also chosen to limit the amount of statistics in this presentation, mainly due to space limits.

and not just the innovation project. This complicates studies of innovation financing.

Finally, one should also mention the lack of statistics. This goes not only for the limited information in the data we have on some of the areas relevant for innovation financing (like in different surveys of barriers to innovation) but also for what we have statistics for at all. There is no doubt, for instance, that the informal venture capital and the corporate venture capital is of great importance. However, we are not in a position to quantify the importance of these sources and the policies aimed at improving access to these sources are sparse.

Our ambition with the present study is to add to the existing pool of knowledge on innovation financing in a way that could contribute to the design of effective means of improving innovation financing.

We try to fulfill this ambition in the following way:

First, it is important to specify the institutional context of innovation financing. Different financial systems support different types of investments differently. We shall in our first analysis consider what types of interaction/transactions are promoted in each system. The process of european integration and the consequences for innovation has been investigated previously. Here we highlight some of the basic properties and changes of financial systems in the past ten years in order to investigate if there is a similar integration process with respect to financial systems. The general believe is that many European countries have moved towards the UK/US-mode of financial system. In other words there is a convergence trend of financial systems. We expect to get closer to the hard facts behind this believe. The hypothesis underlying the research is that the macro aspects and the micro aspects of the problem are interrelated. It matters for the interaction between borrower and lender what the institutional context is. This is in turn of great impact on innovation.

In order to arrive at some policy conclusions we then consider the scope for policies through discussion on how to change financial systems or in other words explanations to why national financial systems differ.

Third, we discuss possible best practices of financial systems with respect to innovation financing by differentiating between different kinds of transactions, different types of firms and different types of capital.

Fourth, we shall embark on one specific institutional arrangement for innovation financing. At least in its original concept the venture capital industry is adequate for innovation financing. A closer look may reveal pros and cons of this solution.

As mentioned our agenda is to see the findings in relation to policy. Before going too far in policy recommandations one should bear in mind that it is not the only task of the financial system to finance innovations- far from it. But given the increasing importance of firms not beeing static in a dynamic world, and given the importance of innovation in growth and job creation, governments are interested in promoting innovations. It is an important policy issue precisely what type of financial system Europe need in order to promote innovations? Is there a “best practice”, or should financial systems entail several of the features of both market based and credit based systems in

order to improve the dynamics and limit sensibility of the system?

2. A picture of financial systems[2]

2.1. Introduction

In this section we shall take a closer look upon differencies between national financial systems: This is an intermediary step towards discussing the ability of different systems to support different types of investments and different types of firms. After a mainly quantitative description of differences between national financial systems in some major European countries[3] and the US and Japan, which typically are presented as representative countries of different types of financial systems, we turn to discuss qualitative features of different systems in section three.

2.2. A taxonomy and description of financial systems

Financial systems are traditionally divided into two main types (OECD, 1993; Zysman, 1983):

i) a system based on capital markets, and
ii) a credit based system.

In a stylized *capital market based* system stocks and bonds are the predominant source of long-term industrial funds. In such a system the central function of bank lending is to serve short-term purposes. Borrower and lender often meet across competitive markets with the help of intermediary institutions. Entrance to and exit from different financial holdings are quite simple processes, making this the most common ways for lenders to execute their influence (Zysman, 1983, p. 70-72).

In a stylized *credit based* system capital markets play a relatively weak role in providing long-term capital compared to financial institutions. In credit based systems there are fewer arrangements for an easy exit, which makes financial institutions more loyal to their borrowers. Consequently, "voice" is the common way for lenders to execute influence in customer companies (Zysman, 1983, p. 70-72).

In relation to innovation financing, venture capital is typically a major source of funding for high risk/uncertain projects in the market based systems.[4] In the credit based systems, intrapreneurship (entrepreneurs inside companies, i.e. internal financing) and/or bank consortia play a major role in providing risk capital (OECD, 1993, p. 69).

The purpose of the present section is to explore:

i) whether it is possible to find distinctive features of national financial systems as described

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2 We thank John Zysman for valuable comments on this section.

3 France, Italy, Netherlands, Spain and United Kingdom. Germany is not included due to lack of detailed data.

4 See section 5 for a more elaborate discussion of venture capital.

in table 2.1 below, and
ii) whether the differences between the systems have changed in the past decade.

The countries included in the analysis are divided into two major groupings on the basis of their characteristics in the initial stage of the period analysed.

Table 2.1: A static typology of national financial systems

Major grouping	Market based	Credit based
Countries	US, UK, Netherlands	Japan, France, Italy, Spain
Debt/equity	Relatively low	Relatively high
Major financing instruments	Retained earnings and, to a lesser extent, bonds and new equity issues	Loans and retained earnings
Price mechanism of capital allocation	Market processes (including speculation) determine key prices	Markets are imperfectly cleared by prices

Source: Zysman, 1983; OECD, 1993.

2.2.1. The importance of debt and bank credits in financing firms

The first feature mentioned in table 2.1 is the debt/equity-ratio. The debt/equity-ratio in credit based financial systems is relatively higher than in market-based systems due to assumed close relationships between lenders and borrowers, and due to the fact that some firms have difficult access to funds on the capital market. Financial institutions tend to allow firms a higher debt/equity ratio because monitoring of firms is easier - and more necessary (Christensen, 1992, p. 151).

Figure 2.1: Debt/equity ratio in firms
Calculated from OECD, Financial Statistics, part III, 1993 and 1994.

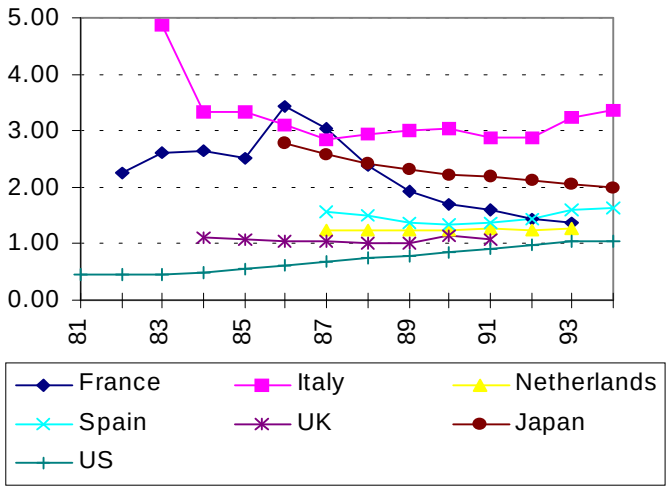


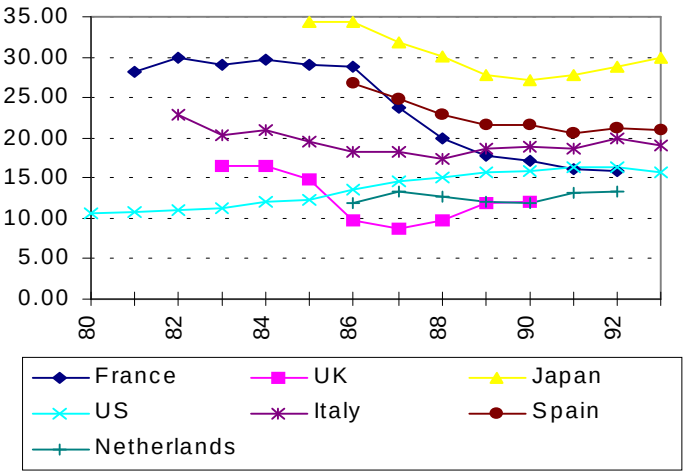
Figure 2.1 reveals that the difference in debt/equity ratios between the major European countries (with the exception of Italy which has a disproportionally high number of very small firms) and the US and Japan has decreased radically since the mid-80's. Looking at the initial capital structure the US stands out with a very low debt to equity ratio, which is characteristic for market based systems. The debt to equity ratio in the Netherlands and United Kingdom is just above 1, and combined with the fact that bank financing amount to just 10-15 per cent of total liabilities in these countries, this indicates a market based structure for these countries as well. Italy, Japan and France have debt to equity ratios above 2 in the early 1980's - a clear indication of a credit based system, while Spain is in between but with bank and trade credits accounting for 40 per cent of total liabilities, which is a quite strong credit orientation.

The general picture is one of convergence where countries starting out with a high debt to equity ratio experiences an increase in equity, which reduces the debt to equity ratio,[5] while the US, which has the lowest debt/equity ratio during the whole period, experiences an increase in the ratio due to a stagnation in equity and a moderate increase in debt. In the middle group are the UK and Netherlands, where debt and equity have had parallel growth rates in the observed period. This development is making it increasingly more difficult to make a clear distinction between credit based and market based financial systems based on the debt/equity ratio alone.

A second factor determining patterns of financial systems is the major financing instruments. According to table 2.1 loans are a major source of capital in credit-based systems, while it, apart from retained earnings, is bonds and new equity issues, which are the most important financing instruments in market based systems. Figure 2.2 show the relative importance of bank credits in financing industry measured as short and long term bank credits as a percentage of the total liabilities. A high percentage of bank credits indicates a financial system oriented towards credit, while a low percentage indicates a market based financial system.

With the exception of Japan, which is in a category of its own with regards to the relative importance of bank credits, the difference between the countries has diminished since the mid-80's. The decreasing importance of back credit in France, Japan, Spain and to a lesser degree Italy (i.e. countries with credit based systems) is due to either a stagnation or slow growth in bank credits, while the US and, to a lesser degree the Netherlands, with their market dominated systems, have had a higher growth rate of bank credits compared to liabilities. The tendency for the UK, which started out with a relatively high importance of bank credit considering the status as a market based system, is less clear since the lack of data from 1990 and onwards makes it impossible to determine whether the growth in the relative importance of bank credits is a lasting tendency.

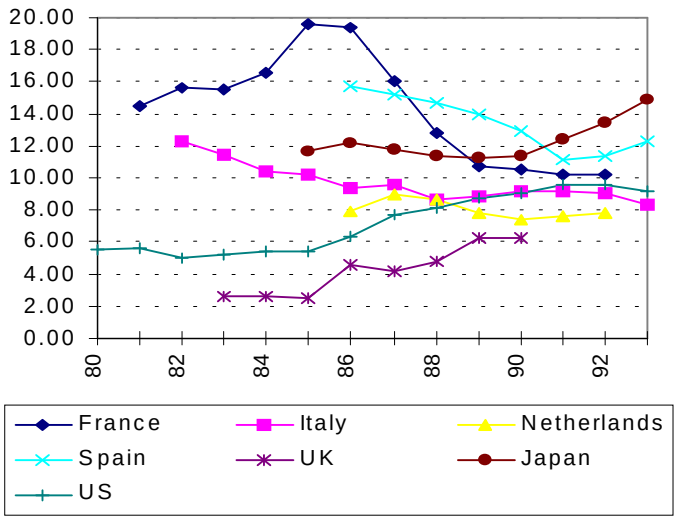
Figure 2.2: The relative importance of bank credits in financing industry
Calculated from OECD, Financial Statistics, part III, 1993 and 1994



Capital markets play a relatively weak role in providing long-term capital compared to financial institutions in credit based systems. Statistics on the share of long term bank credits to total liabilities (figure 2.3) show that the tendency of convergence - and the exceptional role of Japan - which was evident from figure 2.2 showing the relative importance of total bank credit to total liabilities, is also evident here.

5 An economic factor behind the tendency towards a decreasing debt to equity ratio in the majority of countries is a decreasing ratio of inflation in the 1980's in all countries involved in the analysis (OECD, 1996a). The tendency is expected to continue due to an increased demand for security - as expressed by low debt/equity ratios - from banks in their loan policies after a number of bank failures in the early 90's.

Figure 2.3: The share of long term bank credits to total liabilities
Calculated from OECD, Financial Statistics, part III, 1993 and 1994



domestic equity in relation to GDP. UK stands out with a domestic equity equal to GDP in 1992 and remarkably larger than GDP in 1993. The high level of domestic equity in the UK is in accordance with the low debt to equity ratio illustrated in figure 2.1.

Using another indicator we can verify the impression from figure 2.4: The UK equity market is the fastest growing market. Figure 2.5 show a growth rate of 10 per cent per annum from 1993 to 1995. The remaining countries show more moderate growth rates - in the Dutch and Spanish cases after very high growth ratio in the late 1980's.

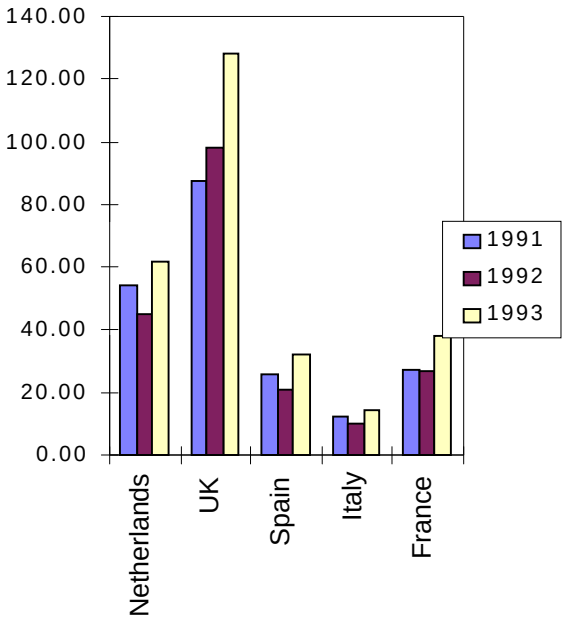
The fact that UK has the most developed equity market is in accordance with the traditional separation between market based and credit based financial systems. There are considerable differences between the other (traditionally credit based) European countries when considering the importance of equity markets, but the characterisation of the Netherlands as a market based system is being confirmed.

The development indicates that the countries traditionally characterised as having credit based financial systems, with the exception of Japan, are moving towards a situation with less importance played by long-term bank credits. This is a consequence of bank credits playing a diminishing overall role since an analysis of bank credits alone show that long-terminism is being more predominant.[6]

2.2.2 Equity markets[7]

Debt and bank credits are just one side of the story about characteristics of financial systems, the other side being equity markets. Figure 2.4 illustrates the size of the equity markets by measuring the

Figure 2.4: Size of equity markets: domestic equity (value at year end) to GDP (percentage)
Calculated from European Stock Exchange Statistics, Annual Reports 1991-93, and Eurostat, Basic Statistics of the Community 1995



6 Calculated from OECD Financial Statistics, part III 1993 and 1994.

7 This section only concerns the major European countries since data is not available for the US and Japan.

Figure 2.5: Growth of domestic equity markets (no. of new domestic companies to total no. of domestic companies listed)
Calculated from European Stock Exchange Statistics, Annual Reports 1990-95.

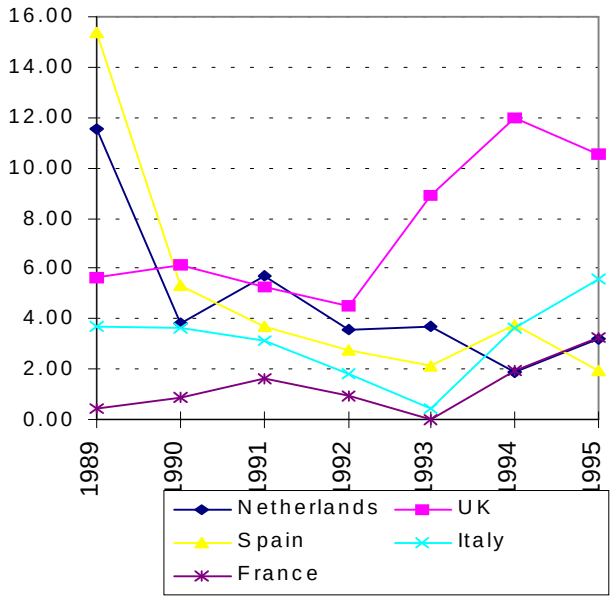
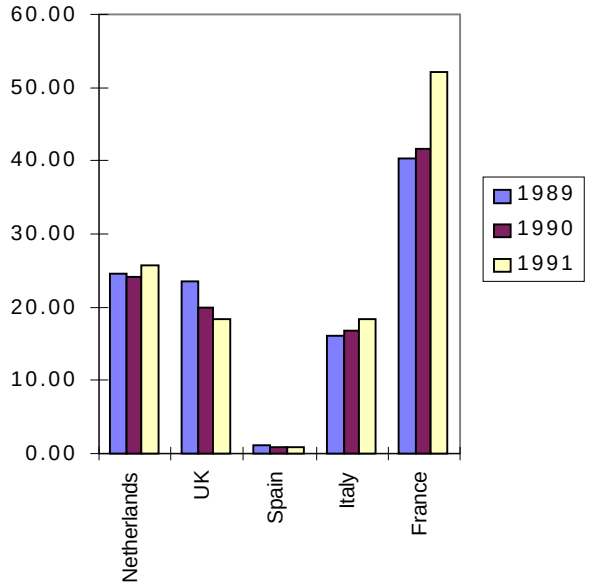


Figure 2.6: No. of companies with shares traded on parallel or unlisted sercurities markets to no. of companies on main markets
Calculated from European Stock Exchange Statistics, Annual Reports 1991-93



The equity market cannot be explored by listed shares only though. Figure 2.6 shows the size of the domestic markets for traded shares on parallel or unlisted markets measured as number of companies with shares traded on these markets as a percentage of total number of companies on listed securities markets.[8] France has the largest parallel and unlisted markets compared to the listed market, while the Netherlands, United Kingdom and Italy have markets amounting to15-25 per cent of the listed markets. Unlisted and parallel markets play a very small role in Spain, but as illustrated in figure 2.7 the markets grew rapidly in 1989-'90.

The quite developed parallel and unlisted markets for especially France could be interpreted as an indication of a potential for a stronger market orientation, i.e. a further evening out of the differences between what used to be credit based and market based financial systems.

8 When the parallel and unlisted markets are considered small numbers makes the percentages very sensitive.

2.2.3 Integration and internationalisation

The introduction of the European Monetary System (EMS) in 1979 marked the beginning of a process of deregulation and integration through diminishing capital control in Europe. An aimed consequence of the deregulation is that the role played by market mechanisms in determining where economic agents chose to invest and obtain their capital is strengthened. Controls on deposit and lending rates have been relaxed and most controls of foreign currency transactions and international capital movements have been lifted. OECD (1993, p. 43) views liberalisation and globalization as enhancing the overall efficacy and flexibility of the financial systems and as introducing more uniformity into national financing conditions.

The fact that most countries have experienced an increasing inter-nationalisation of bank credits (figure 2.8) indicates that internationalisation and integration has played a role in the development of the credit markets in the past decade. But bank credit is still largely a national affair, especially for the larger countries while the Netherlands have experienced a drastic increase in foreign bank credits since the mid 80's.

Figure 2.7: New companies with traded shares on parallel or unlisted securities markets to total no. of companies with traded shares on parallel or unlisted markets

Calculated from European Stock Exchange Statistics, Annual Reports 1990-92

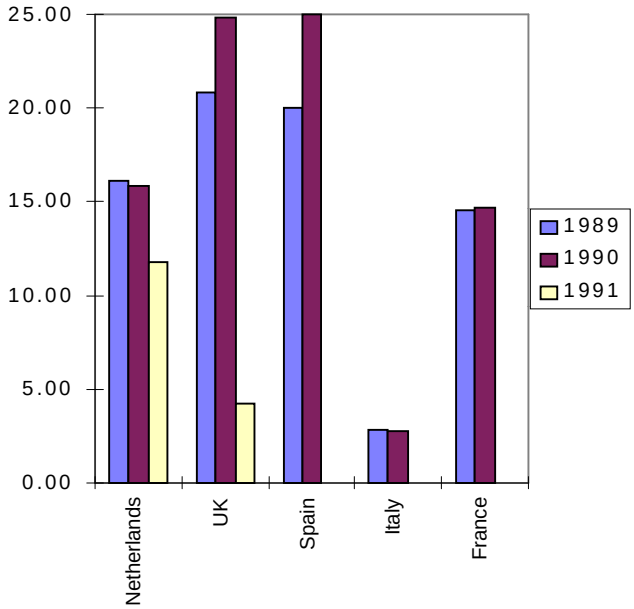
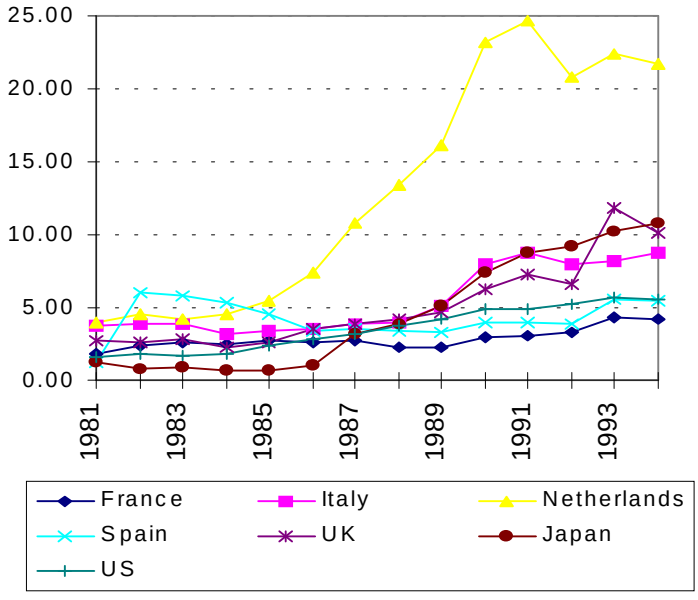


Figure 2.8: Cross-Border Bank Credit to Nonbanks by Residence of Borrower (percentage of GDP)

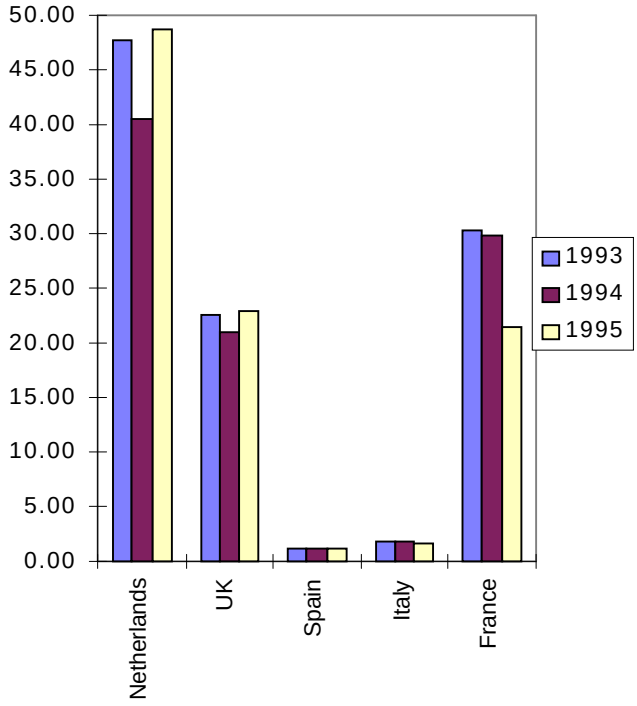
Calculated from International Monetary Fund, International Financial Statistics, Yearbook 1995 and OECD, National Accounts, Main Aggregates, 1960-1994



The time series available for internationalisation of equity markets are shorter than for bank credits which hampers the possibilities of analysing the tendency over a longer period of time. Again it is the smallest country, the Netherlands, which shows the highest degree of internationalisation with almost half of the companies listed on the national securities markets being foreign, while the United Kingdom and France have 20 to 30 per cent foreign companies listed on their national securities markets.

Foreign companies play a disappearingly small role in Spain and Italy where the equity markets are quite small and undeveloped.

Figure 2.9: No. of foreign companies to total no. of companies listed on national securities markets
Calculated from European Stock Exchange Statistics, Annual Report 1993-95



2.3 Concluding remarks

The above analysis shows, that even though there are reminiscences of two distinctive types of financial systems, it is becoming increasingly more difficult to divide national financial systems into two main categories according to their orientation towards either market transactions or bank credit based on quantitative statistics alone: both means of raising funds are present in all countries, and there are tendencies of increasing importance of credit in traditional market based systems, and increasing importance of market transactions in traditional credit based systems.

Even though there are clear signs of convergence between national financial systems in quantitative statistics, this cannot be perceived as the total picture of the development of the national financial systems though. The reasons why differences still occur are discussed in the following section.

3. Explaining the differences

Above we have shown that differences between financial systems diminish although they are still there. But we have not explained neither why they seem to be still smaller nor why they have not completely disappeared in the past decade. This section attempts to answer these questions.

3.1 Reasons for convergence

A number of scholars have pointed to the fact that financial systems converge and many claim that they will continue to do so. Arguments for this point of view are based on internationalization trends in general. That is, it is claimed that information technologies render the opportunities for financial institutions to do their trade more or less borderless and around the clock. In addition, the information technology facilitates the introduction and use of financial innovations which often come about as a reaction to regulations.

A second argument for why financial systems converge is the growth of multinationals. These firms are able to reshuffle their capital between divisions and raise capital on financial markets abroad (cf. the increasing amount of cross-border credits displayed in table 2.8). The growing

importance of these multinationals in turn limit the national authorities in credit allocation.

Third, not only the cross-border trade with physical products and related monetary transfers have increased. Especially the pure monetary transfer has increased. One of the reasons behind this trend is a general increase in risk and a derived wish to use hedging instruments and to diversify portfolios on assets in several countries. The possibilities of this has been facilitated by the development of information technologies.

Finally, it should be mentioned that entry of foreign financial institutions have increased in a long time perspective. This trend has though been more or less intense according to which part of the financial sector and which time period. The insurance companies have managed to establish retail networks in many countries as opposed to the mortgage business. The banking sector has tried an internationalization process but has decreased these activities in the first half of the 1990s. Now it seems as if a number of banks are trying again.

3.2 The origin of financial systems, reasons for divergence and room for policies

Differences between financial systems today may be explained by factors related to both the quantitative character of the society of which the financial system is a part but also to the nature of the financial system itself. As illustrated above there are still differences between nations although these have diminished. We shall discuss in the following some explanations to why there are differences. These explanations will not so much be related to the specific nations although we recognize there may be specific events in the nations which are important in such an explanation. In stead, we try to keep the explanations as general as possible in order to arive at generic types of explanations.

Some of the most important reasons why there are limits to the convergence process are the following. First of all there are hindrances to a physical establishment of financial institutions abroad. These hindrancies include entry costs (building up reputation, knowledge about tax system, legislation and customers) - costs that are substantial for banks in foreign markets - especially in small markets. In particular, customers confidence in foreign banks has proven to be smaller than in a domestic bank. This links to another hindrance which is the funding of the financial institution. Most often access to first order savings are restricted for foreign banks who then have to rely on funding in their home market.

Furthermore, in some countries the structural characteristics of the national industry may be a barrier for foreign banks in that a relatively large number of small and medium sized firms (as in Italy and Denmark) mean high costs on monitoring and credit judgement compared to the volume of lending. Asymmetries in information is likely to be higher and many firms wants non-standardized services. Industrial finance is thus characterized by labour-intensity and the limits to produce the services in a standardized, central manner. This in turn limits the crowding-out of small, national financial institutions by large, internationally active institutions (Vitols, 1995, p.26).

A very important reason is that - in spite of deregulation and harmonization - regulation of certain areas of the financial systems persist to be national. Thus, Vitols (1995, p.6) list four areas where the state maintains significant regulatory discretion:
'the regulation of corporate governance, which involves the relationship between financial

institutions and non-financial companies;
the regulation of household savings, which affects financial institutions' and non-financial companies' access to funds;
the regulation of financial sector internal governance, which affects the goals and capacities of financial institutions; and
the regulation of special-purpose credit institutes, which influences the risk profiles faced by financial institutes or allow the state to directly allocate resources to the non-financial company sector'.

A further aspect of the latter issue is how efficient regulation is in the first place. Seen from a policy perspective it is of utmost importance to what extend regulation is able to change financial systems. Opinions on this issue differ a lot. Thus, Cox (1986, p.14-15) argues that truly, as Zysman (1983) pointed out, governments have to recognize that the structure of financial systems is a constraint on implementation of policies. The scope of possible policies is limited by the existing institutional set-up of financial systems and policies that are not compatible with this set-up are likely to render disfunctional political conflicts and failure of industrial policy. This allow us to some extent to understand the relative economic successes of post-war Japan, Sweden, France and West Germany. As Cox mentions

> "These countries have fashioned policies which have not challenged the structure of the financial system. Other countries - Britain in particular - have attempted to implement industrial policies without the requisite financial structure of controls to facilitate a positive state role, and this has led to disfunctional and economically wasteful political conflict." (ibid., p.14)

But Zysman and Cox do not agree on a fundamental causality in this regard. Whereas Zysman argues that for instance France and Japan have state-led economies due to their credit based, government influenced financial systems, Cox reverses the argument. In his view the credit based, government influenced financial systems in Japan and France are results of a deliberate choice to have state-led economies. The U.S. and the U.K. have capital market systems because they choose not to be state-led economies.

Probably the truth is somewhere in between these arguments. The financial system should not be viewed as an immutable, constraining entity. Governments have scope for changing financial systems and adjust financial institutions to industrial policy rather than adjusting policies to the structures of financial systems. But, on the other hand, such a change does not take place over night. Financial systems have grown in importance relative to the rest of the economy in most of the western economies. In addition, financial systems have become more interrelated than hitherto was the case. Both these facts give a certain inertia in changing financial systems.

Furthermore, this inertia is enhanced by a financial system lock-in effect. This effect has to do with the development of competence and division of labour within financial institutions. If a certain kind of transaction frequently occurres in one type of system competences and economies of scale in undertaking this transaction will improve further, enhancing competitiveness in that particular business. Implementing policies that requires new kinds of transactions may be costly because it takes time to build competence in undertaking these transactions efficiently.

Having said this about regulation it is clear that national regulation and legislation differ widely. These differences have important implications for division of labour between financial institutions, for the possibilities of exercising corporate control, for their concentration, capital-reserve requirements and consequently for their industrial investments. In general the capital market oriented financial systems, notably the U.S., impose the most extensive restrictions on banking. The Japanese banking sector is also heavily regulated - probably even more regulated than the U.K. banks. The U.K. have a number of restrictions on the market for corporate control. It may sound a bit paradoxical that market oriented systems have such extensive regulations but it reflects that a well-functioning "pure" market requires the establishing of well-defined rules of the game.

Additional explanations relate to the fact that nations differ in the diversification of financial institutions, concentration of capital, the structures of industry and the openness of the economy.

Although we believe that the factors pointed to above are important driving forces in the dynamics of financial systems, then set of explanations provided here are not giving us the full picture for all countries. To explain the institutional set-up of a single country it is necessary to be much more specific. A further differentiation of type of transaction and type of firm to be financed is needed.

4. Complicating the picture

4.1. Introduction

In this section we include more details on the financial systems and their ability to finance innovations. We turn from a mainly structural comparison of financial systems to a view emphasizing the capacity of different systems and financing sources to finance different types of transactions and different types of firms. In order not to confuse the discussion we treat these two dimensions in turn (although they could in principle be combined).

The first dimension is then a discussion on what financing mechanisms are better at financing one-time, standard transactions versus more discretionary transactions. In table 2.1. we list some of the major financing instruments in a typology of financial systems. We discuss the internal finance, financing through intermediares and financing through markets. The second part of our inquiry is to set up a framework for analysing capabilities of financial systems to finance different kinds of investments. We shall in that section return to the statistics in section 2 and suggest how these can be used in the framework.

4.2. A micro-view on financing different transactions

Financing innovations is an uncertain activity and agents recognize this in advance and take appropriate measures to reduce or compensate for the uncertainty. Thus, while making a contract initial uncertainty on what is to follow is substantial. But recognizing that the contract is "incomplete" at the outset in the sense that not all possible future states of nature are taken into account makes agents ensure that contracts can be adapted to changing conditions.

The purpose of investment determines the degree of incompleteness of contracts and the likely

needs for ex post adjustments. For example, the degree of asset specificity has an impact on whether there is a secondary market for the assets and consequently how worthy they are as collateral. The large proportion of human capital in production is one example of such specific assets which will induce a high degree of discretionary contracting. Another example is the one-time type of transaction. If a certain type of transaction occurs frequently, the skills to evaluate its likely outcome cost effectively are often available or are generated over time, while the unfamiliar kinds of transaction may incur greater costs for screening and monitoring than anticipated (Neave, 1991, p.27). Learning by doing is, in other words, important as a means of reducing costs in transactions in that some kinds of transactions may be subject to standardization of screening techniques while other, less frequently occurring transactions, may need discretionary treatment.

Whether one or another kind of transaction is regularly occurring or not depends on the specific institutional surroundings. The traditions and production structure of the national industry are thus contributing to what are the most common kinds of transactions. Financiers are likely to be reluctant to enter unfamiliar transactions unless they are relatively certain on the outcome or, the outcome seems to be well over average. Competition may force financial institutions to minimise operating costs and this is mainly possible in familiar transactions[9].

Capabilities to handle these different kinds of transactions differ according to which type of financing mechanism is chosen. In general, the more transactions are characterized by uncertainty and discretion the more screening and monitoring capabilities is needed (Williamson, 1988). Vice versa frequently occurring standard transactions under risk need limited screening and monitoring, and learning effects are reduced to a minimum.

The *market based* way of financing implies the least developed governance capabilities as continuous supervision is difficult when buyers and sellers in the market are anonymous and dealing on a once and for all basis. The standardized way of trading and the small amount of screening and monitoring possibly make the market way of financing superior in terms of costs. Calculable, homogeneous and simple forms of transactions are thus channeled through this market.

In contrast, financing by *intermediaries* or *internal* financing provides greater capabilities for learning and ex post adjustment of the incomplete contracts resulting from uncertainty. In an intermediary or internally in an organization both initial screening procedures and subsequent monitoring and reporting requirements are more thorough than in the corresponding market governance mechanism.[10]

In summation, the preliminary conclusion from the above is that intermediaries or internal financing are the most relevant mechanisms of financing when investing in innovations because they are better capable of dealing with uncertainty compared to the market way of financing.

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9 Another strategy is to specialize in order to screen only a few types of transactions and to accumulate knowledge in this special activity within the organization.

10 In principle differences between the intermediary way and the internal way of financing are smaller than those between markets and intermediaries. However, there is a difference, mostly a matter of degree, between capabilities for continuously monitoring. Another difference is that opportunistical behaviour is less likely to occur and presumably is less costly when it does. Finally, internal financing rules out any legal problems connected to ex post adjustment.

Intermediares may at first sight be superior to markets in promoting innovations.

However, this is a too crude conclusion which must be further elaborated.

4.3. More on capabilities - the systemic view

Finance is not just finance and innovation is not just innovations. This is the starting point for changing the way financial systems are treated in this section compared to the one in chapter two. Here we focus on the ability of financial systems to provide different kinds of finance for different kinds of innovations. The reason is that this approach render answers to some of the policy issues within this area. Surveys in different nations show that not all investments suffer from underfinancing and that it is not all kinds of capital that is demanded.

We identify from a range of national surveys three kinds of innovations with special financing problems.[11]

One is the seed/start-up financing. These investments are undertaken by small firms; most often characterized by relying on a single product. The internal organisation is often without specialized divisions. The debt-equity ratio of the firm is often high and possibilities for providing collateral are sparse.

Another type of innovative investments with special financing problems is performed by small/medium sized firms who needs capital for expansion. This expansion could be described as going from an organic growth path to discontinuity and in many cases the survival of the firm is on stake. Examples of this kind of investments include major foreign market innovations and diversification far from existing, main product field.

The third type of innovations are in principle possible for all size groups of firms, but are most often done by large firms. Normally large firms does not have problems with financing. However, this type of investments are characterized by a large share of R&D and other intangibles. They are clearly at the upper-end of the radicallity scale of innovations. Often the investments are done in cooperation/network/MBO-LBO with one or more other firms which complicates the assessment of the viability of the investments as the other firms are subject to credit evaluation.

In relation to these three types of innovative investments we assess three different types of capital most often (again based on different national surveys) demanded by firms:
- long-term debt financing
- equity on a market basis
- venture capital

Accordingly we can for each country use this analytical framework, as displayed in the table below, on our data in chapter 2 (and in the next chapter). We shall not embark on this exercise in this paper. Only claim that it is possible if the catagorization is supplied with more careful,

11 To some extent these innovations could be placed on a continues scale with respect to size of firm, stage of development of innovation project (product life cycle), radicality of innovation.

qualitative studies of the countries.[12]

Country: XXXX	Seed/start-up	Discontinuities	Science-based
long-term debt financing			
equity on a market basis			
venture capital			

We recognize that there is no one-to-one relationship between our data and the catagories in the table above. In particular we are not able to analyze the debt financing distributed on the above mentioned types of investment. Nevertheless we get a satisfactory indicator in most cases. Coupled with more in-depth studies we get a perception of what deficiences in which countries. Preliminary analyses reveal that indeed there are still holes in the European innovation financing system as claimed by The Commission (cited in the introduction).

5. Is venture capital the answer?

The above sections have discussed characteristics of different financial systems. In this section we will focus on the specific characteristics of financing innovations. Innovation financing differs from standard investments in the nature of the risk or uncertainty related to an innovation project. The discussion of risk and uncertainty can be dated back to Knight (1921/1985) who made a distinction between the two concepts according to whether it was possible to calculate or measure a future outcome: if some sort of measurement is possible, it is risk we are dealing with, while uncertainty relates to situations where no calculation or measurement is possible.[13]

Since innovation projects per definition are uncertain with respect the outcome, both in relation to the technical features, the markets conditions and the general business climate[14] (Freeman, 1982; Keynes, 1936), they cannot be dealt with as standard investment projects: the financier must be extra-ordinary risk willing, and in relation to this have an understanding of the special

12 Like those done by Vitols on Germany, France and the UK.

13 Knight presents three different methods for determining measurable risk and unmeasurable uncertainty. Risk can be assessed on the basis of either a priori knowledge (mathematical and logical instances, e.g. throwing a dice or coin, i.e. calculations of probability); or it can be assessed on the basis of statistical calculations which are common in relation to ordinary investment projects (it is not possible to establish the theoretical probability of all outcomes a priori, but the outcomes can be classified and an empirical calculation of the probable outcome can be calculated). The third method concerns the assessment of unmeasurable uncertainty of the basis of estimates. In this case there are no possibilities of classification and no possibilities of calculating quantitative probabilities. In stead a *subjective estimate* is the basis for determining the uncertainty that guides the actions of the agent (investor).

According to this an agent can, within certain limits, predict future outcomes of an investment project with a reasonable degree of certainty, but engagement in innovation projects is not within these limits.

14 Due to a long time span from initiating the project to the market introduction.

characteristics of an innovation project (due to the need for special capabilities mentioned in section 4.2).

A special kind of institution well fitted for financing innovations is venture capital. Venture capital originated as risk capital supplemented with extended competence on the investor side. According to its original definition venture capital is the most early and most risk willing capital invested in firms, and it is most often invested as equity. Venture capitalists are characterised by financing new, fast growing firms, as well as participating actively in managing the firm. The venture capitalists accept a high risk with the expectation of an extraordinary return of the investment. It is long term capital, often operating with a 5-10 year time horizon (Lubar, 1990, p. 257-259).

Based on these characteristics of original venture capital, this section will analyse the European venture capital industry and its ability to finance innovation.

The venture capital industry consists of institutional investors engaged in providing venture capital, i.e. high-risk and high-reward finance, to fast growing businesses.

Venture capital originated in the United States and, as stated in section 2 on financial systems, venture capital is traditionally seen as more dominant in the anglo-saxian market based systems than in credit based systems. In accordance with this perception, table 5.1 illustrates that the venture capital industry in the United Kingdom is by far the largest and most developed in Europe.

Table 5.1: Venture capital in EU countries (ECU Mill.)

	New funds 1990	New funds 1991	New funds 1992	New funds 1993	New funds 1994	New funds 1995	Cumul funds raised 1990	Cumul funds raised 1991	Cumul funds raised 1992	Cumul funds raised 1993	Cumul funds raised 1994	Cumul funds raised 1995	Cumul. funds % of GDP 1995
France	972	1182	857	834	1055	793	5300	6528	7501	8570	9670	10590	0,89
Italy	190	224	443	308	315	264	1297	1511	4020	3802	3949	3824	0,46
Nether-lands	83	108	91	133	259	257	1475	1579	1560	1702	1847	1.907	0,63
Spain	156	149	182	199	60	142	679	1006	1158	1232	1207	1323	0,31
UK	2050	1311	1249	1239	3844	1841	14855	16272	16716	17038	20882	21517	2,56

Source: EVCA (1992, 1994, 1996).

But the investments made by the British venture capitalist are in general very large (on average above 1 mill. ECU) and less than 10 per cent of the investments in the 1990's have been seed or start-up investments. In amount this corresponds to less than 5 per cent of the total venture investments in the UK. The remaining investments are mainly expansion capital or buy-outs. It is the less developed markets in Spain and Italy, as well as the Dutch market, which allocate a considerable part of their investments to early stages (EVCA 1992, 1994, 1996).

Table 5.2: Stage distribution of investments 1995 (amount in percentage / number of investments in percentage)

	Seed	Start-up	Expansion	Replacement capital	Buy-out	Total investments (ECU Mill. / Number of investments)
France	0 / 1	3 / 10	36 / 53	21 / 16	40 / 21	850,862 / 994
Italy	0 / 1	17 / 52	56 / 31	14 / 11	13 / 6	253,425 / 220
Netherlands	1 / 3	15 / 33	61 / 47	0 / -	23 / 17	467,225 / 280
Spain	0 / 1	11 / 24	72 / 67	3 / 1	15 / 18	162,514 / 218
UK	0 / 0	1 / 5	25 / 50	4 / 6	70 / 39	2,632,841 / 1,716

Source: EVCA (1996)

A connection between the stage distribution of the investments (and the risk-willingness) and the sources of funding can be assumed. In the US more than 75 per cent of venture capital is provided through limited partnerships, with pension funds contributing the bulk of the total financial commitments, while in other countries, pension funds are either not allowed or restricted to invest in the private equity market (OECD, 1996b). Government agencies play a considerable role as venture capital investors in the countries which are relatively focused on earlier stages of business development (Italy and Spain), while pension funds and, maybe more symptomatic, realised capital gains made avaliable for reinvestment play a major role in France and the United Kingdom where expansion and other developed stages are predominant (EVCA, 1992;1994;1996).

Apart from the above difference in sources between the less and more developed venture capital markets, banks are major investors in relation to venture capital: in the Netherlands and Spain more than 50 per cent of the venture capital raised in 1995 was raised by banks. Only in Italy and the United Kingdom banks raised less than 20 per cent of the venture capital.

The sectoral distribution of the investments is an important factor in establishing an understanding of the differences between the national venture capital markets. According to the standard definition of venture capital, the target companies are high-tech with a significant growth potential. There is a large sectoral dispersion of venture investments in all countries, but investments in "consumer related" companies and "industrial products and services" seldom account for less than ten per cent of the invested amount each. The technology related sectors account for a very small fraction of the venture investments with the exception of the Netherlands, which invests 10-15 per cent of the venture funds in "computer related" companies (EVCA, 1992, 1994, 1996).

Even though there are quite large differences between the countries the analysis reveals an image of an European venture capital industry which is *not* primarily directed against early stage investments in high-tech sectors. A reason for this, compared to the original concept, risk-averse behavior of the venture capitalists could be a lack of appropriate exit routes for high-risk investors.

A common feature for all countries included in the present analysis is the lack of funds going to early stage investments in high-tech sectors, which is contrary to the fundamental characteristics of venture capital as high-risk capital. Venture capital is most developed in size in the United Kingdom, but when the original target group of venture capital is considered, the UK is among

those with less focus on early stage investment. The smaller, less developed markets have a much larger focus on the early stage.

According to the above analysis, formal venture capital as a major source for high-risk innovation financing in early stage businesses is not the case in the present day Europe: in the countries with venture capital markets of a considerable size, the investments are primarily expansion capital or other types of late stage capital, and there is a tendency to focus on established, low-tech industries - characteristics that are opposite to the original venture capital ideas. There are signs of an emergence of informal venture capital in a number of European countries, which act in accordance to many of the original characteristics of venture capitalists. This is a relatively unexplored area in terms of research, which is mainly due to the "invisible" character of these informal transactions though, but analyses carried out in the United States[15] estimate that informal venture capitalists finance as many as twenty times the number of firms financed by institutional (formal) venture capitalists. Therefore informal venture capital represent, along with corporate venture capital (see e.g. Bannock (1995)), an area where future reasearch is needed in relation to innovation financing.

6. Conclusions and more on policy perspectives

A central theme in the above discussion has been the ability of financial systems to enhance processes at a micro-level, which are beneficial for innovation financing. More specifically it has been argued that the intrinsic uncertainty in innovations, the importance of interactive learning processes and the tacit knowledge in innovation, points to the need for some degree of relationship banking. Similar arguments has been put forward previously. For instance Colin Mayer (1988, p.1183) claimed that

> "The distinctive feature of successful financial systems is their close involvement in industry. A primary characteristic of a market based system is an arm's length relation between investor and firm. There are well documented exceptions, but the basic requirement of a market, that investors be treated equally, acts against the close involvement of any one party. ... The fundamental challenge that faces any institution or government that can affect the practice of finance is to encourage the emergence of closer relationships and to direct the wealth of talent that has now been concentrated in British financial institutions into direct participation in corporate activities. In the process, the apparent attractions of intensifying competition in financial markets may have to be resisted. The benefits of competition may only be attained at the expense of longer term economic prosperity."

We do not believe, though, that a universal best practise exist. Different financing mechanisms are suitable for different types of transactions and firms. We therefore also argue that it is important to have a differentiated view on financial systems. Generalizations of the ability of financial systems to finance innovations are likely to render too naive conclusions. In stead it is important to recognize that some types of investments - e.g. innovations - are best supported financially in

15 See Harrison and Mason (1996) for a presentation of surveys of informal venture capital.

one way - often long-term equity in combination with competencies - rather than just finance in general.

Even innovations could be sub-grouped. Recent studies of innovation activity show that innovation is very different across different size groups and in particular across sectors.

These two properties put more macrooriented policies within this area in perspective. It may well be that policies aimed at some objectives does not coincide with improving innovation financing. This may justify macropolicies. But seen from the perspective of innovation financing the above points to the need for a much more disaggregated policy where e.g. sectoral differences in innovation processes - and different needs for financial support - is taken into account. Such policies may be welfare improving because it avoids subsidies in areas where the private market is well-functioning already.

Having said this we should recall that determining exactly what is the need for policies is not possible ex ante. But policy makers nevertheless put up both regional, national and super-national programmes for supporting innovation financially. It is widely recognized that there is a market failure and some level of effort is necessary. Thus, in The Green Paper of The Commission actions are porposed at both National and Community level. At the national level its is proposed to develop mechanisms for innovation risk insurance especially for technology based firm and encouraging banks to provide long-term loans, including equity loans and to establish partnerships with expert bodies in appraising innovation projects, i.e. expanding the banks competence in relation to innovation financing. Also the need for promoting informal venture capital through "Business Angels" is included in the proposals by the Commission. The development of stock markets, both national and pan-European, is to be facilitated through directives removing remaining obstacles. Finally different types of funds are suggested at the Community level. On the macro policy level, appropriate fiscal treatments of investments, tax reliefs etc. is recommended (p. 42-4).

The Commission acknowledges that the answer to the innovation financing problem is not to be found in either a credit based or a market based, but that both types of finance has to coexist in order to provide the necessary institutional variety. The problems of raising capital for technology based firms is seeked to be dealth with through insurances and guarantees, a strategy which, apparantly with promising preliminary results, has been carried out in Denmark through the so-called development companies with public guarantees covering 50 per cent of losses on risk investments.

In opposition - or rather as supplement to - the suggestions made by The Commission it could be argued that these suggestions are rather one-sided. They reflect a belief in the efficiency of supply side changes, which to some extent can be justified by empirical evidence on the lack of particular types of financing for innovative investments. However, we think that initiatives on the demand side should go hand in hand with supply side changes. In other words many firms may need an upgrading of competencies which make them able to present more viable projects in the first place but also makes them more competent in carrying the projects through. Various models of government initiatives have been tried out at a regional level but to our knowledge the experience has not been systematically evaluated and used.

In the introduction it was claimed that the European system of innovation financing is full of holes and more research is needed to improve our knowledge of the functioning of that system. We do not claim to have made a major contribution to this knowledge. But we do hope to have illustrated our opinion of an appropriate research agenda and in work to come in the coming half a year we shall persue some of the challenges put up in this paper. Thus, we shall take a closer look upon e.g. the characteristics of innovations with special financing problems; the development of government support for innovations and we shall dig further into the actual financial systems as indicated in chapter 4.

Even so many things remain to be done as indicated throughout the paper. These things include improved understanding of corporate venture capital and informal venture capital by individuals.

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