

Firm Foundations and the Role of Financial Constraints

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ABSTRACT. Improving the economic conditions for small and medium sized firms as well as start-ups is high on the agenda of policy makers. In this paper we discuss some policy options for fostering the creation of new enterprises. The discussion focuses on measures which aim at helping start-ups to overcome liquidity constraints. In order to provide the background for this discussion the paper provides some new empirical results on the determinants of firm foundations as well as some stylised facts on the occurrence of liquidity constraints in West-Germany. We analyse the regional distribution of start-up intensity and offer several hypotheses to explain this distribution. To a large extent, the regional distribution of start-ups can be explained by the existing industry structure, regional human capital as well as the regional public traffic infrastructure. Moreover, we show that liquidity constraints occur more often in small and young firms.

1. On the importance of firm formation

In market economies, great importance is attached to the dynamics of firms, i.e., to the establishment of new firms and the disappearance of some of the existing firms. Business start-ups – generally small firms – can be regarded as a kind of counterbalance to the overall trend towards concentration. Moreover, they constitute an important way of entering the market. Thus, new firms make a considerable contribution towards maintaining the efficiency of markets. On the other hand, sanctioning the failure of firms also has an important function. Inefficient, unproductive firms go bust.

The creation of new firms is important for the employment trend, as well. According to the so far findings of empirical economic research, approximately one out of three new jobs in firms is created through start-ups (see Hamermesh, 1993).¹

As stated by the most recent census of work places in the Federal Republic of Germany, 13.5% of the places of work existing on May 25, 1987 had been created not later than 17 months ago. At the time, they employed 5.3% of all wage and salary earners.² Although many start-ups leave the market during the following years, cohort analyses³ done, for example, by Boeri and Cramer (1991), Brüderl et al. (1993), Wagner (1994) and Gerlach and Wagner (1994) show that these job losses are roughly offset by the expansion of the surviving start-ups, but the growth dynamics differ tremendously between firm groups. Besides, with respect to the impact start-ups have on employment, one must always consider to what extent they put existing firms out of business.

Many structural changes take place via start-ups and business failures. In innovative sectors in particular, start-ups play an important role. For instance, in the German high-tech sector in 1992, as many as 13% of the enterprises were not older than one year (e.g. Brujmann et al., 1993). Especially in the increasingly important business services, foundation rates are much higher than in other sectors of the economy (e.g. Nerlinger and Berger, 1995). Moreover, start-ups are particularly important in industries where small enterprises dominate innovation activities. Studies from the United States show that this holds for the branches data processing systems, electronic components, measuring and control instruments and process control (Acs and Audretsch, 1992). Similarly, SMEs often play a crucial role for the development and diffusion of new technologies. Recent empirical results for Germany can be found in Harhoff and Licht (1996). Hence, start-ups are not only important in terms of strengthening competition in existing markets and direct employment effects, but also regarding the long-run competitiveness.

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Therefore, boosting firm foundations is an important topic for policy makers in Germany and elsewhere in Europe. Furthermore, policy interventions which seem to be justified as market failures arising from market imperfections are most likely present to start-ups. Seen from an economic perspective individuals will start a new venture if the long-run expected profits exceed expected opportunity costs. Therefore, policy interventions should attempt to influence expected income and expenditure streams of start-ups.

Expected profits from starting a new venture vary over time and space and differ sharply across potential founders. Available empirical studies on the determinants of the number of start-ups exploit all three types of variation. Variations of foundation numbers across time and regions are probably due to variations in aggregate demand affecting expected income and expected opportunity cost via unemployment risk. Temporary availability of policy measures can also induce time shifts of foundation rates. Variations across individuals can be used to address the role of human capital, individually expected income and liquidity restrictions (see e.g. Evans and Jovanovic, 1989; Pfeiffer and Pohlmeier, 1992). To address the effects public infrastructure supply and local taxes have on foundation rates variation across space provides the most useful source of information.

The income and the expenditure streams of start-ups differ in their time dimension, thus liquidity constraints matter. If capital markets are imperfect due to asymmetric information or market power some profitable start-ups will not take place. Therefore, the number of start-ups will be too low seen from the perspective of the whole economy. Given recent empirical studies on the effect of liquidity constraints on investment and innovation (e.g. Audretsch and Elston, 1994; Fazzari et al., 1988; Harhoff, 1996; Himmelberg and Peterson, 1994) one can conclude that small and medium sized firms are particularly hit by imperfect capital markets. Empirical evidence on financial restrictions for start-ups is hard to give as only those new ventures are observable which overcome the liquidity barrier. On the other hand data sets surveying employed and unemployed individuals, of whom some might start an enterprise in the period at hand, regularly suffer from

shortage of information on the liquidity status of potential founders.

The paper proceeds as follows. Section 2 presents some new empirical evidence on the regional distribution of start-ups in West-Germany and tries to explain this distribution by various regional factors (e.g. public infrastructure, local taxes). In section 3, we give some empirical content to the role liquidity constraints might have. Survey data covering small and medium-sized companies from manufacturing is employed to shed some light on the relation of firm size and firm age to liquidity constraints. Public policy options arising from our empirical results are discussed in the concluding section. This section is mainly devoted to public policy options dealing with the reduction of liquidity constraints.

2. Determinants of the formation of new firms

2.1. Definition of regional start-up intensity

In order to analyse the causes of regional differences in the formation of new firms multiple regressions are used to relate the foundation rates in each of the German urban administrative districts (Stadtkreise) and rural districts (Landkreise) to various factors potentially influencing start-up intensity. The number of start-ups is based on the ZEW's Foundation Panel (see appendix). In this data set new firm entries are systematically recorded since 1989. Given the set of information for each new firm we calculated the number of start-ups in each district in West-Germany. To avoid the danger of an unusual number of start-ups which sometimes occur in certain districts in short time intervals, we decided to work with two three-year-averages. Therefore, we calculated the average number of start-ups for the years 1989–91 as well as the ones for 1991–94. A further rationale for this time split is given by the fact that the years 1989–91 are boom years whereas 1992–94 covered a recession. Moreover, German reunification might have had a different impact on each of the two periods.

The size of the regional districts varies considerably. As a consequence, one has to control for the effect solely based on the region size. The number of inhabitants with an age between 15 and 65 for each district is chosen as the standardizing

factor for the number of start-ups. Because most new firms are founded by individuals which are characterized by low regional mobility this variable can be seen as a reliable indicator for the regional potential of founders. We use this figure at the end of 1989 to standardize first period's foundations resp. 1992 for 1992–94. This data as well as the data for the exogenous variables are taken from the regional data set of the "Bundesforschungsanstalt für Landeskunde und Raumordnung (BfLR)".

2.2. Hypotheses

In theoretical and empirical literature a multitude of different hypotheses about the determinants of firm start-ups are discussed. We will give a short introduction of those of which we are able to test with data available.

As mentioned above, the indicator for potential firm founders is the number of inhabitants aged between 15 and 65. The probability for one of them to start a business will be greater if he is already a member of the economically active population, which we take into account with the labour force participation rate. It should be noted that in our case the nominator of this rate consists of the numbers of employees subject to social insurance contribution and of the unemployed registered by the local Labour Office due to data restrictions. Furthermore, the concepts to measure the nominator and denominator of this indicator are different. On the one hand, wage and salary earners are measured by their location of work, and on the other hand inhabitants by their place of residence. So this rate will also be an indicator for a surplus of commuters into the district. For both reasons one can expect a positive effect of this variable.

Instead, a high proportion of part timers probably reduces the pool of potential founders because – at least at time of measurement in 1989 – the overwhelming majority of part timers wants to work fewer hours. However, setting-up and running a business as a rule requires a disproportionate high time input.

To start a business requires a lot of specific qualifications which can only be acquired by education to some extent. Learning on the job is therefore more important. So entrepreneurial

ability should first be positive correlated with age. However, since it often needs some time to receive the entire profit from a business, the attractiveness of self-employment will decline at the higher age.⁴ Therefore, one could assume a higher probability for individuals in the age between 30 and 50 to establish their own firm. According to qualification, a second important hypotheses responds to the firm's size the founder was employed before. Empirical evidence exists that employees in small establishments are more likely to start a business than employees in big ones (see Storey, 1982). The main cause for this correlation is seen in the wider range of tasks of the first group, which allow them to acquire more entrepreneurial know-how. The lower wages in small firms on average might be a second reason. We use the employment share of work places with 2 to 49 employees to control for these effects. However, a possible influence of this variable could also result from representing a sectoral structure characterized by low entry barriers.

The latter effect will be captured by our variables controlling for the employment shares of the retailing/wholesaling and the service sector only to a certain extent. However, high birth rates can be observed especially in these sector. Furthermore – as a third aspect of qualification – most business founders had worked in the same trade before. Although this is of greater importance in manufacturing due to higher qualification requirements in this sector, a positive correlation between the share of the retailing/wholesaling resp. the service sector and the formation intensity is expected.

Of course, other things equal, formation rates should be low in regions where costs are high and therefore profits are low. Two essential expenditures of an enterprise are wages and taxes. Unfortunately, we can measure the first factor only by the mean wage and salary of an employee in manufacturing firms with more than twenty employees. Regional variation of the tax burden in Germany is primarily caused by the 'gewerbesteuer' (local tax rate).

Empirical evidence exists that unemployed individuals have a higher probability to enter self-employment (e.g. Evans and Leighton, 1990). This effect can be explained by the lower opportunity costs of starting a new firm. However, at the

aggregate level the unemployment rate is also a measure of aggregate regional demand. Because of these contradicting effects, the expected sign of the unemployment rate is a priori uncertain. But, an increase in regional population is expected to have a positive effect on the level of regional demand.

To take agglomeration effects (e.g. well-developed infrastructure) into account we use dummy variables for urban administrative districts and for rural districts. Because in Germany urban administrative districts are located in congested urban areas as well as in rural areas we also use the time needed to travel by train to the closest major agglomeration as an indicator of regional infrastructure. Moreover, we consider whether a good connection to the motorway system is available in rural districts. In addition, dummy variables are included for the Bundesländer and the observation period 1989–91.

2.3. Estimation results

Table I reports the regression results of the pooled data set for the two periods under consideration. For the interpretation of the coefficients on the relationship between a determining factor and the foundation rate it is important to note the measurement level as well as to take into account that the foundation rate is converted to log due to methodological reasons. The exogenous variables are either measured as shares or dummy variables or given in logs. For all variables which are measured as shares the strength of the relationship also depends – multiplicatively – on the actual value of the factor of influence. The coefficient of a dummy variable of, say e.g. -0.056 means that the formation rate of districts, where the dummy variable has the value one, is approximately 5.6% lower compared with the other districts – other things being equal. In the case of variables measured as logs of absolute values (e.g. local tax rate) the coefficient has to be interpreted as an elasticity.

We pool the observation for the 327 regional districts over the periods 1989–91 and 1992–94 as separated estimations for both periods do not yields rather different results. This leads to the conclusion that the separation between the two periods does not imply a distortion of the regional

distribution of start-ups in West-Germany, although there is a remarkable difference in the total number of start-ups for these periods. Moreover, we carefully test for potential distorting effects of outliers using robust regression methods as well as least absolute deviation regressions. As the results are rather similar they are omitted here.

The estimates bear out most of the ex-ante assumptions about the influence on the dynamics of the formation of new firms. The first group of variables is thought to capture *effects of aggregate demand* on the incentives to start a new business.

- First of all, as indicated by the time dummy, foundation rates during the boom period 1989–91 are on the average about 34% above the foundation rates in the recession period 1992–94. This decrease is more or less uniform at the level of the 'Laender'. Looking at regions below this aggregation level, we can observe some differences in the regional distribution of start-ups between these periods. Counties which are located directly at the former border between East- and West-Germany have start-up shares which are below average in the first period and on the average in the second period. But, this regional shift is of a minor magnitude as it already vanishes at the 'Laender'-level. However, we cannot rule out the possibility that transformation has affected start-up activity in West-Germany as a whole.
- In addition, the favourable role played by a growing regional demand is obvious from the effect worked out through the regional unemployment rate as well as the increase of the population and the wage level. But, the latter two variables are only weakly significant. On the other hand, the unemployment rates – interpreted as indicator of the unemployment risk faced by employees – are overcompensated by the differences in regional demand also reflected in unemployment rates. Given the similarity, the positive sign of the coefficient of the wage level seems to be a surprising result at first sight, as it should be expected that higher wages will increase the opportunity cost of starting a new venture. Our interpretation as a demand effect seems to be more in line with the data.⁵

TABLE I
Determinants of business start-ups in former West-Germany 1989–94 results from a pooled cross-section OLS-regression at regional level

Determinants (right hand side variables) ^a	Coefficients	t-values
Observation period 1989–91 (Dummy)	0.296	9.92***
Demographic trend in 1985–89 resp. 1989–1992 (yearly average)	2.970	1.70*
Unemployment rate in 1989 resp. 1992	–2.792	–3.94***
Average yearly labour income in industry in 1989 resp. 1993 (log of DM)	0.161	1.51
Labour force participation rate in 1989	0.994	7.63***
Share of employees working part time ^a	–2.512	–3.89***
Share of the labour force between 30 to 50 in 1989 resp. 1992	1.830	1.92**
Share of employees with no vocational training ^{a, b}	0.746	2.40**
Share of employees with “A level” and vocational training ^{a, b}	2.627	1.08
Share of employees holding a degree of senior technical college (FH) ^{a, b}	3.992	2.30**
Share of employees with university degree ^{a, b}	–2.184	–2.03**
Employment share of places of work with 2 to 49 employees in 1987	0.906	4.06***
Employment share of retailing/wholesaling ^a	2.122	6.97***
Employment share of services ^a	0.781	3.04***
Rate of trade tax (Gewerbesteuerhebesatz), in logs	–0.124	–0.79
Urban administrative district (Dummy) ^c	0.011	0.24
Rural district (Dummy) ^c	–0.056	–2.19**
Rural district and unfavourable connection to motorway (Dummy)	–0.095	–2.61***
Time needed to reach closest major agglomeration by train, in min. (in logs)	–0.034	–2.62***
Dummies for Bundeslaender	F (6,628)	=18.84***
Constant	–2.416	–1.90*
Number of observations	654	
R ² adj./Mean square error	0.538	0.223

Endogenous variable is the number of firm start-ups per 1000 inhabitants aged between 15 and 65 (in logs).

* (**, ***) indicate significance level 10% (5%, 1%). T-values are based on heteroscedasticity-consistent standard errors. Data is pooled over the periods 1989–91 and 1992–94 for 327 districts (NUTS3-level) resulting in 654 observations. The former West-Berlin is deleted from our sample due to possible effects of unification.

^a Based on employees subjected to social insurance contribution in 1989.

^b Reference group: Employees with secondary school and vocational training (only available for 1992).

^c Reference group comprise administrative districts surrounding cities in non rural areas.

- Moreover, regional human capital is important for start-up intensity. However, the relation between regional human capital and the start-up intensity is not uniformly increasing with the level of human capital. The results suggest a highest probability for founding a new venture for employees holding a degree from a senior technical college, which combines a high qualification with a practical background, as well as for employees with no vocational training and therefore very low chances on the labour market. Employees with university degrees show by far the lowest probability for a start-up.⁶ This can be attributed to the high wages and good career opportunities for employees with university degrees in the public sector and large firms.
- Furthermore, according to the calculations there is a close, positive relationship between an *economic structure characterised by small firms* and formation intensity. Since there was no significant influence of places of work with one employee, this relationship is more likely to be attributable to the higher founder potential in such an economic structure than to lower barriers to market entry.
- Our data confirms that founders are usually 30 to 50 years old and working full time. Moreover, the higher the labour force participation rate the higher is the foundation rate.
- We found no negative effect of high local taxes on foundation activities. One reason could be that primarily the location decisions of industry firms are affected by the local tax rates. But, on

the average, these sectors have only a share of 11% of all foundations.

- As for the analysis of the sectoral economic structure, the only significant influence observed concerned the *share of workers employed in retailing/wholesaling* as well as *services*. One reason for the positive influence of the share of these workers is likely to be the comparatively high fluctuation of firms in the respective sectors. In the ZEW's business start-up panel retailing/wholesaling accounts for 31% and services for 41.5% of all start-ups. One reason could be that primarily the location decisions of industry firms are affected by the local tax rates. But, on the average, these sectors have only a share of 11% of all foundations.
- Especially low foundation rates are observed in rural regions whereas no difference is present between large cities and their surrounding districts. In rural regions access to the motorway system seems to be highly important as the lowest start-up intensity is usually found in rural region with no direct access to the motorway system. Moreover, start-up intensity decreases the more time-consuming a train ride to the main agglomerations in Germany is.

The patterns found so far are fully in accord with the empirical results for other time periods as well as most other countries. In recent years the foundation rates in (West-) Germany decreased in nearly all regions. And the actual foundation rates in nearly all sectors of the economy are well below the peak of the late eighties. Moreover, only small regional differences in the slowdown of business start-ups can be found. In addition, the factors highlighted are more or less constant over short periods of time and, therefore, are not able to explain cyclical movements in foundation rates. One prominent factor often mentioned in policy discussion is the lack of capital on the side of potential founders.

3. Financial restrictions of firms – some empirical facts

3.1. The situation of start-ups

The founders of firms face a multitude of problems and restrictions, causing the outcome of the

“leap into self-employment” to be uncertain. Start-ups mostly consist of small or even micro firms and the specific problems that go with them. As shown by Pfeiffer (1994) the founders of these firms themselves virtually always come from small firms. This may be because employees in small firms are better integrated in the overall structures of the firm, acquire greater know-how of its organisation and its relevant market than employees in large, complex firms. Another reason might be the incentive to leave a small firm is markedly greater due to the return being lower than in large firms, the greater risk of losing one's job because of firm closure and slimmer career prospects.

Besides the difficulties of establishing themselves as start-ups in the market, attracting customers and distinguishing themselves from existing suppliers through differentiation, small and fledgling firms are facing two main problems. One is the difficulty to find new, qualified workers and to ensure that they will stay with the firm. However, the problem of insufficient capitalization seems to be even worse. It can be considered the key problem of fledgling and small firms.

Not only does a shortage of the requisite capital frequently gets fledgling firms in trouble or lead to failure but it also is an important constraint preventing potential business formations from materializing in the first place (see Becker, 1982; Albach, 1987; Schmude, 1994). Potential and actual founders have too little equity capital and this shortage of equity capital then becomes one of the most important barriers to raising outside capital.⁷ This is due to the fact that in connection with collateral usually required by banks, a certain equity/debt ratio is deemed necessary by the banks.

From the point of view of the overall economy, start-up projects should be implemented if the expected return on the invested capital is higher than the interest rate at which the required capital could be raised on the capital market. The greater the risk of a given project, the higher the optimal rate of interest to be paid for the project on the market. If lenders and borrowers possess the same information about the project and are equally able to evaluate these pieces of information, then all start-up projects that make sense from the overall economy point of view will be able to be financed.

But as a rule the precondition of equally informed borrowers and lenders is not met. In the case of high-risk projects, external lenders often not only demand a risk premium in the form of higher interest, they limit credit facilities or refuse to grant the loan. The latter is known as “credit rationing”. The theoretical basis for credit rationing was provided by Stiglitz and Weiss (1981), among others.⁸ Stiglitz and Weiss show that credit restrictions may also occur if banks are not subject to any statutory or institutional regulations on interest rates (e.g., through court rulings on “usurious interest”). Moreover, the trend towards credit restrictions is reinforced if there is imperfect competition among the lenders and if banks, as in Germany, confine themselves to financing comparatively safe projects.

The acuteness of the problem of capital restriction is indicated by using the data of the Mannheim Innovation Panel (MIP). Ideally, to shed some light on the relation of financial constraints and foundation rates, data on founders as well as (potential) founders which have not established new firms, probably due to financial constraints, seems worthwhile. Unfortunately, such data do not exist for obvious reasons. Therefore, we are restricted to the data of existing firms. Since start-ups are fledgling and small firms, we pay particular attention to the size and the age of a firm when examining the relevance of capital restrictions.

3.2. Capital restrictions according to the self-assessment of firms

In the Mannheim Innovation Panel in 1993, firms were asked to make a subjective classification of quite a lot of potential obstacles to innovation on a five-point scale ranging from “very important” to “unimportant”.⁹ The questionnaire was also answered by firms that had not implemented any innovations or were not planning any. The subjective assessment the firms made of the factors impeding their innovation activities, most probably does not refer solely to the innovation activities. It also reflects factors affecting other activities of the firm.¹⁰ What is of interest in connection with this study, are the responses on obstacles for innovation which are discussed with the “shortage of equity and/or of outside capital”. To avoid mixing the special features of the firms in the New Laender (the former GDR), currently in a process of transformation, with the financial problems of SMEs in general, we are only looking at the results for former West Germany.

According to the assessment of the firms polled (Table II), by and large, the smaller the workforce, the greater the importance attributed to the problem of shortage of capital. If the answers are divided into shortage of equity capital and shortage of outside capital, it becomes evident that firms believe the availability of equity capital to be the major problem.

Differences in the assessment of shortage of capital also emerge in connection with firms’ R&D intensity. In particular innovative small

TABLE II
Self-assessment of financial restrictions and firm size^a

Firm size	Self-assessment of the financial constraints (financial constraints are important obstacles to innovation activities) in %		
	Capital	Equity capital	Outside capital
5–49 employees	43	42	23
50–249 employees	33	28	25
250–499 employees	25	25	16
500–999 employees	21	26	12
≥ 1,000 employees	19	21	14
Total	39	37	23

^a Data is weighted by the inverse of the product of the inclusion and participation probabilities; number of observations = 1919.
Source: ZEW, Mannheim Innovation Panel.

enterprises are acutely aware of both the barriers to equity and to outside capital. The higher the share of R&D expenditure in turnover, the more important the shortage of capital gets in the assessments.

The subjective shortage of capital depends more on the size than on the age of a firm. To check this relationship, data on the firm formation taken from the CREDITREFORM data bases were added to the data sets at hand. In contrary to the firm size, no monotone relationship was identified between the age of firms and the number of times shortage of capital was viewed as the most important obstacle to innovation (Table III).

The highest percentage is found in the second age class (age of the firms 5–10 years). More than half of the firms in this age classification mentioned shortage of equity capital as an important barrier to innovation activities and in the same size class around 45% noted shortage of outside capital. Firms which are older than 10 years show a declining shortage of capital. This inverse U-shaped relationship between firm age and the (subjective) shortage of capital seems to be a rather surprising result. Especially in the light of the fact that within this period a lot of firms already have gone out of business. So, the survivors should have been expected to have faced better financial prospects than the average firm immediately after foundation.

A possible explanation for this result is that financial restrictions cause potential start-ups not to be founded in the first place. In that case formation projects fail to be carried out due to the restricted access to capital. Once a firm has been

set up, the situation is initially not considered to be that precarious, as an important obstacle has been overcome after all. During the period of growth following the initial years, the financial restrictions make themselves felt to a greater degree and firms that are still in business after five years are hit especially hard. Another explanation rests on the observation that firms often start to grow after several years of existence. Financing this business expansion puts firms into trouble.

3.3. Credit rating of firms according to CREDITREFORM

The subjective self-assessment made by firms with respect to the significance of financial restrictions to innovation activities alone is an insufficient proof of the hypothesis of inadequate access to the capital market for start-ups. By definition entrepreneurial activity means the allocation of scarce resources in such a way that they are put to best use. From this viewpoint, it would be rather surprising if firms are abounded with the scarce resource “capital”. Without further proof, the results mentioned above should essentially be interpreted as saying that the difficulties involved in raising equity capital are considered more important than those concerning outside capital. Moreover, the results also point towards the more severe problem of financing uncertain projects of SMEs. To substantiate the hypothesis of capital restriction, we are going to give an outside assessment of the creditworthiness of firms.

Such an external assessment exists for the firms belonging to the Mannheim Enterprise Panel,

TABLE III
Self-assessment of financial restrictions and firm age^a

Age of the firm	Self-assessment of the financial constraints (financial restrictions are important obstacles to innovation activities) in %		
	Capital	Equity capital	Outside capital
< 5 years	42	40	21
5–10 years	58	52	45
10–20 years	40	37	24
≥ 20 years	35	34	16
Total	40	38	23

^a Data is weighted by the inverse of the product of the inclusion and participation probabilities; number of observations = 1919.
Source: ZEW, Mannheim Innovation Panel.

which is based on data from the CREDITREFORM. This data on the credit rating of enterprises was assigned to the enterprises of the Mannheim Innovation Panel. Consequently there is an external assessment of credit availability to firms. Since CREDITREFORM is the largest credit reporting agency in Germany, it is furthermore likely that suppliers as well as banks take the CREDITREFORM classification into account when deciding whether to grant a loan or supply credit.¹¹

On the basis of this extended set of data the first step was to check whether there is a positive correlation between the firms' self-classification and the classification made by CREDITREFORM. If one looks at the entire set of data, a comparatively high correlation between self-classification and "objective" data is observable. But in some subgroups the correspondence is variable. This leads to the conclusion that the results mentioned above by and large point in the right direction. When looking at the distribution of "excellent" credit ratings by size classifications (Table IV) and when examining the distribution of this category by firm age (Table V), the results are qualitatively the same as for the subjective assessment of shortage of capital.

Obviously, age and size effects do not occur separately, but rather simultaneously. Table VI shows simultaneous occurrence of size and age effects as results of a multiple probit regression model for the different indicators discussed above, after controlling for industry affiliation and specific effects for firms which are members of

TABLE IV
External credit rating assessment and firm size^a

Firm size (no. of employees)	Share of firms with an excellent credit rating, in %
5–49	2.2
50–249	9.0
250–499	20
500–999	35
≥ 1,000	41
Total	5.2

^a Data is weighted by the inverse of the product of the inclusion and participation probabilities; number of observations = 1915.

Source: ZEW, Mannheim Innovation Panel.

TABLE V
External credit rating assessment and firm age^a

Firm age	Share of firms with an excellent credit rating, in %
< 5 years	3.9
5–10 years	2.8
10–20 years	2.0
≥ 20 years	8.0
Total	5.2

^a Data is weighted by the inverse of the product of the inclusion and participation probabilities; number of observations = 1911.

Source: ZEW, Mannheim Innovation Panel.

large industrial enterprise groups. With respect to the firms' self-assessment and to the external CREDITREFORM indicator, firm size is strongly correlated with the credit constraints. Irrespective of the indicator chosen, similar relationships are revealed. The results relating to the age profile are somewhat mixed.

The differences essentially consist in the functional form of age dependence. The bigger the firms, the smaller the share of firms complaining about a shortage of equity capital. This holds regardless of the measure used. The classification of the firms by CREDITREFORM depends to a much greater extent on size than the firms' self-assessment. According to the self-assessment, the share of firms lacking capital decreases disproportionately slowly as the firms get older. The CREDITREFORM indicator shows a near-linear age profile. In the quadratic specification reported in the table, neither the linear nor the quadratic term is significant. However, the likelihood-test for joint significance of both terms is highly significant.

These results confirm the assumptions made above that age and size effects occur simultaneously. Thus, there is a case for the statement that a shortage of financial resources constitutes a severe restriction on potential founders and a difficult problem for fledgling firms.

4. Some explanations

One can look for the cause of the phenomenon of financial restrictions for fledgling, small firms in

TABLE VI
Firm age, firm size and financial constraints, probit regression models

	Equity capital		Outside capital		Credit rating	
Summary statistics:						
– McFadden R2	0.047		0.038		0.228	
– Log. likelihood	–1132.7		–894.2		–839.8	
– Number of observations	1911		1911		1911	
	Coef. t-values	LR-test chi ² /Prob	Coef. t-values	LR-test chi ² /Prob	Coef. t-values	LR-test chi ² /Prob
Number of employees (in logs)	–0.18 –2.50	49.50	–0.12 –1.49	20.24	–0.61 –5.99	246.74
Squared number of employees	0.01 0.77	0.000	0.00 0.38	0.000	0.02 2.55	0.000
Age of the firms (logs)	–0.39 –2.519	6.55	–0.53 –3.266	12.58	–0.06 –0.31	17.89
Square age of the firms (logs squared)	0.06 2.55	0.039	0.075 2.91	0.002	–0.01 –0.51	0.000
Industry dummies	Chi(14) =	42.8	Chi(14) =	28.8	Chi(14) =	44.0
Group members	Chi(2) =	2.6	Chi(2) =	3.7	Chi(2) =	20.3

Source: ZEW, Mannheim Innovation Panel.

t-values are given below the coefficients. Heteroscedasticity-robust standard errors are used.

two directions. First, the specific type of a start-up project or an innovation plays a part, second, the special features of the German capital market may also be exerting an influence.

The discrepancy between the information each side possesses or between the abilities to evaluate this information is probably particularly marked when it is a matter of financing the establishment of new enterprises operating in an innovative area. Start-ups have no history on which potential lenders can base their expectations. Start-up projects aimed at developing new products or opening up new markets elude the usual risk assessments – in these cases, there is a genuine feeling of uncertainty. Moreover, innovative projects in particular cannot provide absolute cover, since often only a small share of the project costs is based on the expenditure on fixed assets, for which the lender can secure a right of ownership. In addition, the fixed assets which are acquired are frequently project-specific, therefore their resale value is likely to be lower than the cost price. Especially small firms are soon threatened with bankruptcy, and thus the default risk for

investors is greater than in the case of large firms with internal risk spreading. Moreover, immediately from the start of a new business the owner needs funds for day-to-day operations. Therefore, if no additional (family) income is available some part of the investment is pure consumption. This problem is aggravated if there is a strong probability that the owner will face a period of unemployment when the firm goes bankrupt.

When providing capital German banks are risk-averse and try to play it safe. This behaviour, for reasons already explained, has a particularly restrictive effect on start-ups and innovative projects. A largely unrestricted stock market, including high-risk securities, or a market for junk bonds, like in the United States, for example, are unheard of in Germany. On account of the marked risk-aversion on the part of investors and the emphasis placed on creditor protection, one does not expect to find such a set of instruments in Germany, either.

Another cause of insufficient supply of risk capital for start-ups could be the fact that in terms of taxation, stakes in real capital companies are

in a disadvantageous position compared to other forms of investment. Moreover, business angels face severe problems when they decide to sell their share of a successful project. Even in political discussions on venture capital the crucial importance of the exit option is often neglected. Here again, tax regulations and liability rules act as obstacles to exit and, therefore, to outside capital.

5. Possible policy approaches

Clearly, special assistance for start-ups always constitutes an intervention in the market. Such policy measures change the allocation of financial resources by the market; start-ups, via promotion, gain a relative competitive edge over existing firms. Some authors (e.g. Albach and Kuron, 1987; Schmude, 1994) feel that promotion considerably relieves the need for sound financing of start-ups. They believe that as a result firms cannot bear enough risks – and fledgling firms are especially crisis-prone – and that this creates the danger of mistakenly channelling funds to overly risky firms, because the personal risk of the founder is minimized.

Furthermore, assessing the chances of success of a start-up project is a difficult task. However, these observations are not necessarily arguments against promotion schemes. For a shortage of transparency, a shortage of information about promising projects may also lead to an inefficient allocation of financial resources by the market. The absence of special segments of the stock market for the provision of venture capital, the absence of markets for equity participation in companies certainly contribute to an insufficient allocation of capital. In these cases, government intervention may make sense in economic terms, depending on the circumstances. In principle, there are two starting points for policies attempting to improve the capitalization of fledgling firms. Start-ups can be promoted directly or the framework for private involvement in the field of risk and equity participation capital can be improved.

In Germany there are many support programmes to finance the formation of new firms. The most important one is the equity capital assistance programme. Like a few other selective programmes, it provides promotional funds which can be used to assume liability, that is to say equity

capital, to the founders. The bulk of the programmes provides firms with loans at special terms just like outside capital. The modalities – grace and/or interest-free periods, maturities, interest rates and so on – vary according to the programme and are relatively flexible.

Generally, potential founders submit their application via their bank. Due to this procedure, banks (“Geschäftsbanken”) play a tremendous role in selecting applications for promotion. Since banks usually also contribute quite a sizeable part of the amount to be invested in the form of outside financing, once the formation project is promoted, and therefore bear a considerable default risk, the banks’ risk-averse practice of granting capital is reflected in the applications the actual promotion institution receives. In addition to this filter created by the banks’ behaviour, all programmes require reviews of each individual case, which are usually done at the request of the promoting institutions by the chambers of industry and commerce or by professional associations.

Programmes aiming at providing assistance by means of equity capital are of special importance. Increasing the amount of equity capital, no matter how it is done, not only results in an immediate injection of capital, but also in an improved scope for outside financing through a boost in the credit standing of the firm that is being promoted. If the firm has any collaterals banks usually demand, they may be used for taking out loans, and guarantees do not have to be used to obtain these promotional funds, the equity ratio of the firm concerned rises. Through appropriate grace periods, possibly in conjunction with a temporary exemption from interest payments, the firm’s liquidity squeeze in the initial years can be eased. Promotional funds in the form of equity are not covered. The liability of the founder is limited to his assets, which, however, in the event of bankruptcy are first used to service liabilities. The default risk inherent in this kind of promotion is definitely a problem.

Promoting the establishment of new firms by means of granting loans essentially aims at channelling outside capital to the firms at extremely favourable terms. Apart from the direct injection of finance, the main result is the easing of the liquidity squeeze, which is a consequence of these special terms. These loans must, however, be

covered by the usual collaterals banks demand. Thus, the firms that are to be promoted have to have these collaterals or else they have to claim guarantees, possibly from an appropriate programme. This form of financing causes the firms' equity ratio to fall, their scope for other outside financing decreases. In the event of the firm failing, these promotion funds are covered in the framework of the bankruptcy proceedings up to a certain percentage. The likelihood of a complete loss is considerably smaller than in the case of equity capital assistance. Firms solely receiving promotion in the form of outside capital are forced to contribute a higher share of genuine equity capital. Since the individual risk for the founder is greater that way compared with promotion via equity capital alone, there may be an incentive for less risky business establishment plans.

These reflections lead to certain demands that a government "risk capital fund" to support the creation of new firms has to meet:

- Promotion should focus on granting equity capital surrogates.
- During the initial years the liquidity squeeze should be eased considerably through exemption from redemption and interest.
- Applications for promotion should be submitted directly to the promoting institution, **not** to the bank affiliated to the firm in question.
- The valuation of the applications by professional associations should essentially be based on the contents of the project.
- The share in total financing attainable through promotion should be flexible and depend on the project.

From the point of view of "ordoliberalism" (Ordnungspolitik) it is far less problematic to design an improved environment for private investment, which will be allocated by the market. To that end, measures are required enabling investors in equity participations to better spread the risks, and thus cover them. The obvious thing would be intermediary forms of equity investment companies or "SME-funds" as listed investment companies. Direct equity participations through equity investment companies have the advantage of firms being free to choose their legal form. To make such equity investment companies more attractive, there need to be tax incentives for

private investors investing in the share capital of equity investment companies. These incentives should have the following characteristics:

- Participations and alternative forms of investment should be subject to equal tax treatment.
- Income from participations in SMEs should enjoy tax privileges.
- Inheritance and gift taxes on investment in participations should be reduced considerably.

A possible institutional solution to the information problems of those offering capital (see Gerke et al., 1995 for details) is the establishment of an "information exchange" for small firms. Such a market segment should aim at bringing together those providing and those needing capital on a standardized platform for them to compare essential information, without simultaneously acting as a broker.

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Appendix: Data sources

Three different data sources have been used for this paper. Data on the number of start-ups is taken from the Foundation Panel data set run by the ZEW. *The Foundation Panel* was started in 1989. The panel comprises all enterprises which were contacted for the first time by CREDITREFORM, which is Germany's largest credit rating agency. Accumulated over 5 years (1989–1994), the panel consists of data from about 340,000 start-ups. For each entry in this data base information on industry affiliation, number of employees, ownership status as well as detailed information on the date of foundation is available. Moreover, as the data set also provides information on the name and address of firms it is very simple to calculate the number of start-ups at any regional level and for each point in time. It should be noted that not all

new firms are covered by CREDITREFORM. Especially firms of the sector 'Freie Berufe' (medical services, lawyers, tax consultants, etc.) and very small firms are underrepresented. Nevertheless, approximately 40% of all new firms in the ZEW Panel were one-man businesses at the time of foundation. The role of liquidity constraints is addressed to data from the *Mannheim Innovation Panel*. The Mannheim Innovation Panel (MIP) was conducted in Germany in the summer of 1993 (see Harhoff and Licht, 1993). The data collected by the "Zentrum für Europäische Wirtschaftsforschung" (ZEW) and the "Institut für angewandte Sozialforschung" (infas). We use data from the first wave of the Mannheim Innovation Panel conducted in Germany in 1993. The questionnaire follows the guidelines of the OSLO-manual (OECD, 1992) and is based on the harmonised questionnaire for innovation surveys developed by EUROSTAT (see Smith, 1992). The questionnaire asks for various information to describe innovation activities on the firm level like source of information, obstacles to innovation, appropriability mechanisms as well as R&D and total innovation expenditures. The Mannheim Innovation Panel (MIP) is closely related to other panel data bases at the ZEW. All are based on data from CREDITREFORM. As all enterprises in this data bases had a unique identifier, we can easily merge the data from the innovation survey with data obtained by the credit rating agency. This has been done to obtain credit rating assessments from CREDITREFORM for the participants at the innovation survey. Finally, *regional data* is obtained from the "Bundesanstalt für Landeskunde und Raumforschung" and other various official data sources.

Notes

¹ The importance of start-ups to the employment trend is denied by some authors. This can essentially be explained by the fact that most of the time the analyses are restricted to the manufacturing sector, and by an inadequate coverage of start-ups, since statistics including only firms with over twenty employees are frequently used as a basis (Schulz, 1995). As a rule though, start-ups are very small firms and their contribution to employment is conspicuously smaller in the manufacturing and the energy/mining sector than in the other sectors (see Cramer and Koller, 1988; Acs and Audretsch, 1990 as well as Brüderl et al., 1993).

² The figures only refer to the following industries:

energy/mining, manufacturing, construction, wholesaling/retailing, transport/telecommunications, banking/insurances and services.

³ A start-up cohort comprises all firms that were established during a given period (usually one year).

⁴ This is at least plausible for Germany where a well-developed old age social security system exists.

⁵ One has to take into account that we measure the average level only for the firms of the industrial sector with more than 20 employees.

⁶ It should be noted that our data do not fully cover self-employment in the medical services, consultancy firms and other "Freie Berufe" (see appendix).

⁷ We use 'equity capital' for contributions of owners and shareholders as well as from withhold profits. 'Outside capital' is an obligation for the firm. In this case financiers are not owners. In the case of bankruptcy outside capital has to be served. This is not the case for equity capital.

⁸ Empirical evidence of the existence of credit restrictions was provided in recent years by the publications by Audretsch and Elston (1994) concerning the investment behaviour of listed German companies or by Himmelberg and Petersen (1994) with regard to R&D activities of small high-tech enterprises in the U.S. A survey of the theoretical literature can be found in Jaffe and Stiglitz (1990).

⁹ Further details are provided by Felder et al. (1994).

¹⁰ König, Buscher and Licht (1995) obtain a negative correlation between the self-assessment of financing constraints and investment per employee even after controlling for firm size and several other factors which are usually used in empirical investment equations.

¹¹ From the detailed data provided by CREDITREFORM a binary variable was formed indicating whether the granting of loans is recommended without reservations or not.

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