Regional Studies, Vol. 28.4, pp. 359–365.

The Geography of Firm Births in Germany

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(Received April 1993)

AUDRETSCH D. B. and FRITSCH M. (1994) The geography of firm births in Germany, *Reg. Studies* **28,** 359–365. The linkages between the extent to which increasing returns to production exist within a spatial unit of observation and the tendency towards increased concentration of economic activity, measured in terms of the birth of new firms, is the focus of this paper. Based on 75 regions in west Germany, we find considerable evidence suggesting that birth rates are greater in regions exhibiting characteristics reflecting convexities in production. This provides support for the theory that the location of new economic activity tends to occur in the geographic space where such production convexities are the greatest.

Theory New firms Spatial variations West Germany

AUDRETSCH D. B. et FRITSCH M. (1994) La géographie de la naissance d'entreprises en Allemagne, *Reg. Studies* **28,** 359–365. Cet article porte sur les liens entre l'importance des rendements croissants au sein d'une aire géographique délimitée et la tendance à la concentration accrue de l'activité économique, mesurés en fonction de la naissance de nouvelles entreprises. A partir de 75 régions situées en Allemagne, on fournit d'importantes preuves qui laissent supposer que les taux de natalité sont plus élevés dans les régions qui témoignent des caractéristiques reflétant des convexités de production. Cela vient corroborer la théorie suivante: la localisation de la nouvelle activité économique a tendance à se produire dans les espaces géographiques où de telles convexités de production sont à leur maximum.

Théorie Nouvelles entreprises
Variation géographique Allemagne

AUDRETSCH D. B. und FRITSCH M. (1994) *Die Geographie der Firmengründungen in Deutschland, Reg. Studies* **28,** 359–365. Die Verknüpfungen zwischen dem Ausmaß, in dem zunehmende Rückkehr zur Produktion in einer räumlichen Forschungseinheit besteht und der an der Gründung neuer Firmen gemessenen Tendenz zu vermehrter Konzentration auf wirtschaftliche Tätigkeit steht im Brennpunkt des Interesses dieses Aufsatzes. Unter Bezugnahme auf 75 Regionen in Westdeutschland war es möglich, beträchtliche Beweise anzuführen, die auf höhere Gründungsraten in Gebieten mit Eigenschaften hinweisen, welche Wölbungen der Herstellung widerspiegeln. Dies stützt die Theorie, daß der Standort neuer wirtschaftlicher Tätigkeit meist in geographischen Räumen ist, wo derartige Produktionswölbungen am größten sind.

Theorie Neue Firmen
Räumliche Variationen Westdeutschland

INTRODUCTION

In proposing a new theory of economic geography, KRUGMAN, 1991a, p. 5, asks, 'What is the most striking feature of the geography of economic activity? The short answer is surely concentration . . . production is remarkably concentrated in space.' What explains such an asymmetric distribution of economic activity?[1] Here KRUGMAN, 1991a, 1991b, is unequivocal—the existence of increasing returns to scale in production. By increasing returns, however, Krugman does not necessarily mean at the level of observation most familiar in the industrial organization literature—the plant, or at least the firm—but rather at the level of a spatially distinguishable unit, say a region or area. In fact, it is assumed externalities across firms and even industries that yield convexities in production. In particular, KRUGMAN, 1991a, 1991b, focuses on convexities arising from spillovers from: (1) a pooled labour market; (2) pecuniary externalities enabling the provision of nontraded inputs specific to an industry in a greater variety and at a lower cost; and (3) information or technological spillovers.

While KRUGMAN, 1991a, 1991b, 1991c, was able to theoretically link these three sources of convexities within a spatial unit of production, virtually no empirical evidence exists supporting or refuting his model. The purpose of this paper is to shed at least some light on the validity of Krugman's theory of geography. We do this by linking characteristics reflecting these three sources of convexities at a spatial level in (west) Germany to one aspect of the process of the concentration of economic activity—the rate at which new firms are being established, or what we call firm birth rates. Presumably a relatively high rate of firm births indicates a process of

resources concentrating within that region, while a relatively low rate of firm births would indicate the opposite—a deconcentrating process.[2]

In the second section of this paper, we present the theory linking regional characteristics, and in particular the three types of spillovers mentioned above, to firm birth rates. Measurement issues are discussed in the third section. Using a database capturing the birth rates for 75 different regions in west Germany, we test the hypotheses in the fourth section. In the final section a summary and conclusion are presented. We find considerable evidence consistent with Krugman's theory that regional characteristics reflecting convexities in production are linked to higher birth rates.

WHY DO BIRTH RATES VARY SPATIALLY?

While there is a growing literature identifying the determinants of new business startups on a regional basis (AUDRETSCH and VIVARELLI, 1994; REYNOLDS, 1991, 1992; FRITSCH, 1992; GUDGIN, 1978; and MOYES and WESTHEAD, 1990), KRUGMAN's theory, 1991a, 1991b, can be adapted to link firm births to the degree to which three types of spillovers occur within a region. The first emanates from the observation by MARSHALL, 1920, that a pooled labour market, most commonly associated with agglomerations, yields increasing returns at a spatial level. According to MARSHALL, 1920, the extent to which a region is agglomerated and degree to which a pooled labour market exists, provides a strong motivation in the location choice of a new business:

> Employers are apt to resort to any place where they are likely to find a good choice of workers with the special skill which they require; while men seeking employment naturally go to places where there are many employers who need such skills as theirs and where therefore it is likely to find a good market. The owner of an isolated factory, even if he has good access to a plentiful supply of general labour, is often put to great shifts for want of some special skilled labour; and a skilled workman, when thrown out of employment in it, has no easy refuge.

Thus, as KRUGMAN, 1991a, points out, it is actually the interaction of increasing returns and uncertainty that bestows advantages to the pooling of labour markets associated with agglomerations.

Agglomerations, according to MARSHALL, 1920, are also conducive to a greater provision of non-traded inputs. Such inputs are provided at both a greater variety and a lower cost. According to Marshall:

> Subsidiary trades grow up in the neighbourhood, supplying it with implements and materials, organizing its traffic . . . For subsidiary industries devoting themselves each to one small branch of the process of production, and working it for a great many of their neighbours, are able to keep in constant use machinery of the most highly specialized character, and to make it pay its expenses.

The third source of convexities emanates from economies in information flows, or what JAFFE, 1989, and ACS *et al.*, 1992, term as technological spillovers.[3] In fact, ACS *et al.*, 1994, found that such technological spillovers are more beneficial to new small firms than to incumbent large enterprises. Thus, new businesses are most likely to locate in regions where such spillovers are the greatest.

But how can these concepts be operationalized into measures that can then be linked to regional birth rates? A rich and long tradition exists which sheds at least some light on how to capture the extent to which pooled labour markets, non-pecuniary transactions, and information spillovers exist (KEEBLE *et al.*, 1990; REYNOLDS, 1991; STOREY and JOHNSON, 1987). For example, such spillovers are likely to be most prevalent in areas with a high population density. One reason for this is that the infrastructure of services and inputs is more developed in regions that are more densely populated. As KRUGMAN, 1991a, p. 484, argues, 'The concentration of several firms in a single location offers a pooled market for workers with industry-specific skills, ensuring both a lower probability of unemployment and a lower probability of labour shortage. Second, localized industries can support the production of nontradable specialized inputs. Third, informational spillovers can give clustered firms a better production function than isolated producers.' That is, economies of localization and urbanization yield reduced costs of making transactions. This would suggest that regional birth rates should be positively related to population density and, in particular, to population growth. Such agglomerations would also tend to exist where output per person is relatively high.

The relationship between the unemployment rate and firm births is considerably more convoluted. On the one hand, high regional unemployment rates would indicate slack growth, thereby dampening incentives for new firms to locate within the region. On the other hand, the pool of potential resources available to new entrants will tend to be higher as unemployment rises. In fact, the empirical evidence reflects these two conflicting forces. In reviewing the empirical evidence, STOREY, 1991, p. 177, found that, 'The broad consensus is that time series analyses point to unemployment being, *ceteris paribus*, positively associated with indices of new firm formation, whereas cross sectional, or pooled cross sectional studies appear to indicate the reverse. Attempts to reconcile these differences have not been wholly successful.' These explanatory variables and their

Table 1. *Variables explaining birth rates*

Variable	Expected sign
Unemployment rate, 1985 (%)	?
Change in unemployment rate, 1984–86 (%)	?
Population density, 1985 (measured as square root)	+
Population growth, 1980–85 (%)	+
Share of labour force accounted by unskilled and semi-skilled workers, 1985 (%)	−
Gross value added per person, 1986	+
Mean establishment size, 1986	−

expected impact on birth rates within a spatial model are summarized in Table 1.

MEASUREMENT ISSUES

The birth rates are identified from social insurance statistics. While the social insurance statistics are collected for individuals, the records identify the establishment at which the individual is employed. About 90% of employment in the west German private sector is covered in the social insurance statistics.[4]

The birth of a new business is indicated by the emergence of a new establishment identification number in the database. However, certain problems may emerge from this procedure. It is possible, although not at all certain or even likely, that the emergence of a new identification number in fact is the result of a takeover and not the formation of a new firm. This might tend to be the case where existing establishments are reorganized.[5]

Records for which establishment employment exceeds 50 were discarded on the grounds that they were too large to be likely to represent a new firm. Such records are more likely to reflect the opening of a branch owned by an existing firm. Similarly, identification numbers appearing only once in the database for a single year were also discarded, on the grounds that they were likely to be an error or not a viable startup. Only new identification numbers appearing for at least two years were counted as a firm birth.

Birth rates were calculated for each of 75 distinct economic regions. These regions are distinguished on the basis of 'planning regions' (*Raumordnungsregionen*) in west Germany and are shown in Fig. 1. The birth rates are measured in two different ways. There is little contention that measuring the absolute number of new establishments and then comparing them across regions would be more misleading than revealing. This is because the economic regions are not homogeneous with respect to size. Two approaches have generally been adapted in attempting to compare birth rates across regional markets. The first method standardizes the number of entrants relative to the number of firms in existence and can be termed as the ecological approach because it considers the amount of startup activity relative to the size of the existing population of businesses. Of course, some regions may tend to have more employees per establishment than do other regions. Since ultimately people and not establishments start businesses, such heterogeneity with respect to mean establishment size would result in a measurement bias overstating birth rates in regions where the mean establishment size is relatively high and understating it in those regions where it is relatively low. Thus, it is important to include a measure of mean establishment size along with the explanatory variables to control for measurement biases inherent in the ecological approach.

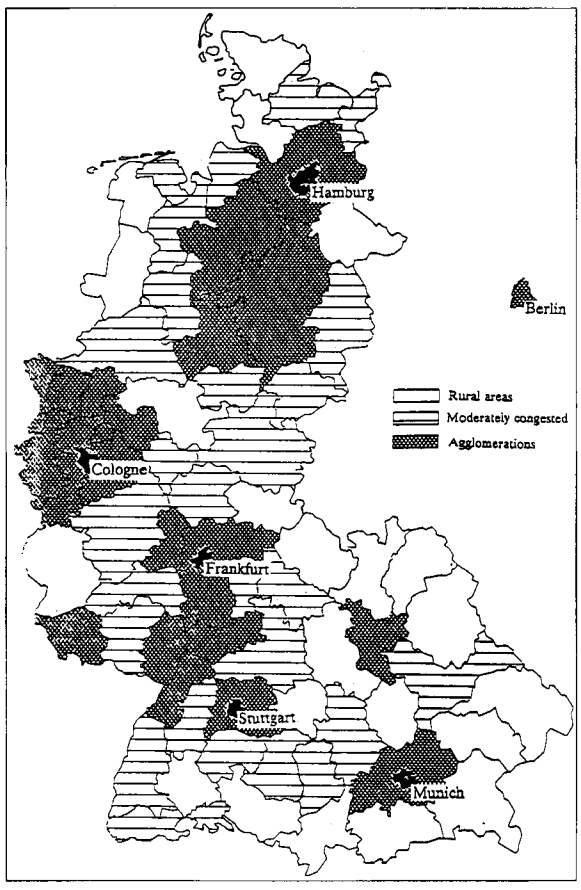

Fig. 1. *The planning regions of West Germany*

The second method, which can be characterized as the labour market approach, is to standardize the number of new establishments with respect to the size of the work force. The labour market approach has a particular theoretical appeal, in that it is based on the theory of entrepreneurial choice proposed by EVANS and JOVANOVIC, 1989. That is, each new business is started by someone. The labour market approach implicitly assumes that the entrepreneur starting a new business is in the same labour market within which that new establishment operates.[6] In any case, the labour market approach has the attract-

ive property that there is a clear lower bound of 0·00 and a clear upper bound of 1·00, which would represent the extreme (and absurd) case where every worker within a region has started his/her own business.

RESULTS

Using the ecological approach to measure birth rates over the period 1986–89, the regression results are shown in Table 2. Both the 1985 unemployment rate and the change in the unemployment rate between 1984 and 1986 have a positive influence on birth rates. Similarly, both the 1985 population density (measured as a square root) and the population growth between 1980 and 1985 have a positive impact on birth rates. This is certainly consistent with KRUGMAN's, 1991a, 1991b, theory linking agglomerations to a concentration of economic activity.

The 1985 share of the labour force accounted for by unskilled (and semi-skilled) workers has a negative coefficient, suggesting that new firms have a higher propensity for locating in regions where workers tend to be highly skilled than in those regions consisting mainly of unskilled workers. This is also consistent with KRUGMAN's, 1991a, 1991b, theory, in that the externalities associated with labour market pooling and information spillovers are more likely to play an important role for highly skilled workers than for unskilled workers.[7]

Similarly, birth rates tend to be higher in regions where the 1986 gross value added per person is greater. This is consistent with KRUGMAN's, 1991a, 1991b, notion that new economic activity tends to locate in those regions where production convexities yield the greatest returns to that activity.

Finally, as explained in the previous section, inclusion of the mean establishment size controls for the bias inherent in the ecological measure of birth rates. The greater the mean establishment size, the fewer are the number of establishments for any given workforce size. Thus, the calculated birth rates tend to be systematically higher for those regions where mean establishment size is relatively high compared to what the other explanatory variables included in the regression equations would have predicted.

It should be noted that there are considerable variations across sectors. For example, the unemployment rate apparently exerts no significant effect on birth rates in services, while a positive relationship emerges for manufacturing, as it does for all sectors taken together. Similarly, the impact of *per capita* value added cannot be considered statistically significant in the service sector, while it has a clear positive influence on birth rates in both manufacturing and the overall economy. There is also evidence, consistent with the findings of KEEBLE *et al.*, 1993, for the United Kingdom, that the impact of population growth is greater in the service sector than in manufacturing.

The regression results for the 1986–89 birth rates measured using the labour market approach are shown in Table 3. There are two major differences that emerge when the labour market approach is substituted for the ecological approach. Probably the most striking difference is that the coefficients of the unemployment rate are negative, suggesting that

Table 2. Regressions explaining birth rates for the ecological approach

	All sectors	Manufacturing	Services
Unemployment rate	0·002	0·003	0·001
	(2·41)[1]	(2·80)	(0·58)
Change in unemployment rate	0·002	0·001	0·001
	(3·33)	(2·04)	(2·23)
Population density	0·001	0·001	0·001
	(3·40)	(2·54)	(1·79)
Population growth	0·049	0·031	0·072
	(2·94)	(1·78)	(3·91)
Share of unskilled workers	−0·002	−0·001	−0·001
	(−1·95)	(−2·31)	(−1·63)
Per capita value added[2]	0·014	0·007	0·002
	(2·25)	(1·76)	(0·43)
Mean establishment size	0·003	0·003	0·006
	(1·84)	(1·46)	(3·30)
Intercept	0·253	0·031	0·332
	(6·79)	(1·78)	(8·05)
R^2	0·669	0·552	0·473
F	22·32	14·025	10·475

Notes: 1. t—statistics in parentheses.
2. The coefficient has been multiplied by 1,000 for presentation purposes.

Table 3. Regressions explaining birth rates for the labour market approach

	All sectors	Manufacturing	Services
Unemployment rate	−0·074	−0·061	−0·149
	(−0·97)[1]	(−2·77)	(−2·15)
Change in unemployment rate	0·113	−0·015	0·106
	(2·83)	(−1·32)	(2·93)
Population density	0·111	0·013	0·096
	(3·81)	(1·53)	(3·63)
Population growth	3·026	0·211	1·602
	(2·23)	(0·55)	(1·31)
Share of unskilled workers	−0·139	−0·005	−0·119
	(−2·17)	(−0·27)	(−2·05)
Per capita value added[2]	0·099	−0·027	0·090
	(1·95)	(−1·86)	(1·97)
Mean establishment size	−1·668	−0·167	−0·811
	(−11·99)	(−4·21)	(−6·45)
Intercept	45·546	6·448	26·873
	(14·99)	(7·42)	(9·79)
R^2	0·839	0·471	0·635
F	56·271	10·405	19·411

Notes: 1. t-statistics in parentheses.
2. The coefficient has been multiplied by 1,000 for presentation purposes.

regions with high levels of unemployment are associated with lower, and not higher, birth rates (although the coefficient for the regression using all sectors of the economy cannot be considered statistically significant). Taken together, the ecological and labour market approaches suggest that, while a high unemployment rate results in a high rate of startups relative to the number of establishments already in existence, the propensity of workers to start a new business in a high unemployment region tends to be relatively low. There are two possible interpretations for the negative relationship between the propensity of workers to start a business and the unemployment rate. The first is that the propensity to start a business is lower for unemployed than for employed workers. Thus, as workers shift from being employed to being unemployed, the overall entry rate tends to decline. The alternative explanation is that the propensity to start a business, regardless of employment status, is negatively influenced by higher regional rates of unemployment.

The second major difference is that the sign of the coefficient for mean establishment size is negative for the labour market approach, but positive for the ecological approach. This discrepancy can be reconciled by the evidence suggesting that the propensity to start a business is greater for workers with experience in a smaller firm than in a large firm (EVANS and LEIGHTON, 1990). However, the bias inherent under the ecological approach leads to an understatement of startup activity in regions where the mean establishment size is relatively low, and an overstatement in regions where it is relatively high. This bias more than offsets the differential in the propensity for a worker to become an entrepreneur between large and small establishments.

CONCLUSIONS

KRUGMAN's, 1991a, 1991b, new theory of economic geography provides a useful lens for linking the birth of new businesses to regional characteristics. In particular, Krugman's model points to the importance of agglomerations in generating convexities in production within a spatial unit. The results of this paper generally are consistent with Krugman's theory. The greatest source of ambiguity revolves around the relationship between unemployment and birth rates being conditional on the manner used to measure birth rates. Under the ecological approach, regions with higher unemployment rates are found to be associated with greater startup activity. However, under the labour market approach the opposite result emerges. It must be remembered that each measurement approach brings with it a distinct implicit question being raised. That is, under the labour market approach, the implicit question is, 'How does unemployment impact the propensity of workers to become entrepreneurs?', while under the ecological approach the relevant question is, 'How does unemployment impact the generation of new establishments relative to the stock of existing ones.' These are not at all identical questions.

An implicit assumption throughout this paper has been that birth rates reflect, at least to some degree, the process of concentrating economic activity within a region. Certainly, such an assumption is consistent with the findings of REYNOLDS and

MAKI, 1991, that high birth rates tend to be associated with greater subsequent growth rates within US regions. However, preliminary evidence for west Germany suggests that a lower and not a higher rate of startup activity is associated with subsequent growth rates (AUDRETSCH and FRITSCH, 1992). This raises the question of what exactly is the impact of new firms in contributing to, or perhaps even detracting from, growth rates within geographic space.

NOTES

1. Economic theory has had only little to offer in explaining the spatial distribution of economic activity. KRUGMAN, 1993b, p. 483, has concluded that, 'The study of economic geography—of the location of factors of production in space—occupies a relatively small part of standard economic analysis. . . The study of economic geography plays at best a marginal role in economic theory.'
2. For example, there is evidence that higher birth rates are associated with higher subsequent growth rates within regions of the United States (REYNOLDS and MAKI, 1991).
3. According to MARSHALL, 1920, information flows become eroded as the distance between the parties increases: 'The mysteries of the trade become no mystery; but are as it were in the air . . . Good work is rightly appreciated, inventions and improvements in machinery, in processes and the general organization of the business have their merits promptly discussed. If one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further own ideas.'
4. Excluded are civil servants, people working for themselves, family workers, and people who do not work a sufficient number of hours in order to qualify for compulsory insurance contributions.
5. FRITSCH, 1992, concludes that the number of such cases is likely to be negligible relative to the total number of startups recorded each year.
6. It should be pointed out that the labour market approach does not assume away the phenomenon of cross-market worker mobility. This approach recognizes that labour is mobile, both in terms of spatial and product markets. However, it is assumed that some experience as an employee in the market has been gained before starting a new business.
7. It should be noted that KEEBLE *et al.*, 1993, find that in the United Kingdom growth is higher in the accessible rural areas than in the densely populated urban areas.

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