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The Effects of New Business Formation on Regional Development over Time

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July 2004

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Contents

Abstract

In our analysis of the impact of new business formation on regional employment change we identified considerable time lags. We investigated the structure and extent of these time lags by applying the Almon lag model and found that new firms can have both a positive and a negative effect on regional employment. The results indicate that the indirect effects of new business formation (crowding-out of competitors, improvement of supply conditions and improved competitiveness) are of greater magnitude than the direct effect, i.e. the jobs that are created in the new entities. The peak of the positive impact of new businesses on regional development is reached about eight years after entry.

JEL-classification: M13, O1, O18, R11
Keywords: Regional growth, new businesses, entrepreneurship, time lags.

Zusammenfassung

"Der Einfluss von Gründungsprozessen auf die Regionalentwicklung im Zeitablauf"

Für den Einfluss von Gründungsaktivitäten auf die Regionalentwicklung lassen sich erhebliche Zeitverzögerungen feststellen. Wir analysieren das Ausmaß und die Struktur dieser Zeitverzögerungen mit dem Almon-Lag Verfahren. Die Ergebnisse zeigen, dass Gründungen sowohl einen positiven als auch einen negativen Einfluss auf das Beschäftigungsniveau haben können. Allgemein scheinen die indirekten Effekte des Gründungsgeschehens (Verdrängung etablierter Konkurrenten, Verbesserung des Angebots und gesteigerte Wettbewerbsfähigkeit) stärker ausgeprägt zu sein als der direkte Effekt, gemessen als die in den neuen Firmen entstandenen Arbeitsplätze. Das Maximum des positiven Einflusses der Gründungen auf die Regionalenwicklung wird nach ca. acht Jahren erreicht.

JEL-Klassifikation: M13, O1, O18, R11
Schlagworte: Regionalentwicklung, Unternehmensgründungen, Entrepreneurship, Time Lags.

1. Introduction[1]

Does a high level of new business formation in a region stimulate economic development?[2] While most people believe that this is the case, a clear and indisputable empirical proof for this hypothesis is still lacking. Some results of recent research suggest that the unclear evidence concerning the relationship between the level of new business formation and economic growth could be attributed to long time lags that are needed for the main effects of the entry of new entities to become evident. In their analysis of the relationship between new business formation and employment growth in West German planning regions, AUDRETSCH and FRITSCH (2002) found that start-ups that occurred in the years 1983-85 could contribute to explaining employment change in the 1993-98 period. VAN STEL and STOREY (2004), in an investigation of the relevance of such time lags for British regions, arrived at the conclusion that the strongest employment effect can be attributed to new business formation activity that occurred about five years earlier.

This paper investigates the time lag of the effect of new business formation on regional growth for West Germany.[3] As a starting point, we first review the possible direct and indirect effects of the setup of new businesses on regional development (section 2). We then provide an overview of the empirical evidence attained thus far (section 3) and deal with data and measurement issues (section 4). Our results concerning the time lag distribution of the effects that new firm formation has on regional employment are reported in section 5. Finally,

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[1] We are indebted to ZOLTAN ACS, GERD RONNING, ANDRÉ VAN STEL and DAVID STOREY for helpful comments on earlier versions. Financial support from the German Science Foundation (grant FR 242/7-1) is gratefully acknowledged.

[2] For an analysis at the regional level, there are important differences between new firms and new establishments. One of these differences relates to the location of entrepreneurship. While both the set-up of new firms as well the set-up of subsidiary establishments involve some entrepreneurship, this entrepreneurship will be mainly sited at the firm's headquarters. The erection of a new branch plant in a region may, therefore, not be regarded as an indication for entrepreneurship there. Moreover, the location decision for a subsidiary could be influenced by factors that are rather different from those that determine the location of a new firm's headquarters. Restricting the empirical analysis to the firm level by including only new headquarters could make largely sure that the focus is on the effect of entrepreneurship. A potential disadvantage of such an analysis could be that it neglects the important effect that new branch plants may have for regional development. In this paper, we use the term 'new business' as the overall category for both new firm headquarters and new subsidiaries. Our empirical data include these two categories of new entities.

[3] As compared to the data analyzed by AUDRETSCH and FRITSCH (2002), we have a longer time series of data available and we perform the analysis for smaller spatial units (districts instead of planning regions).

we discuss implications of our findings for public policy and propose some issues for further research (section 6).

2. Possible effects of new business formation on regional growth

The relationship between new businesses and economic development is quite complex. Analyzing this relationship requires a comprehensive approach that should include more than the development of employment in the new units and should particularly account for the related supply-side effects. Figure 1 provides an overview of the different types of impacts that new firm formation may have on economic development.

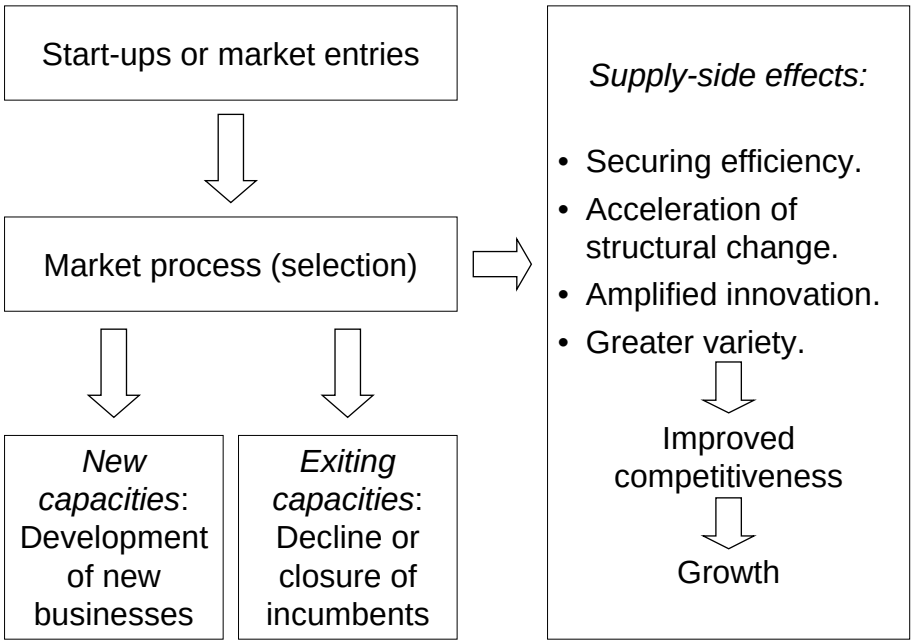

Figure 1: New business formation and the market process

New businesses represent an entry of new capacities into the market and are therefore an essential element in the market process. One contribution that new businesses make to economic development is found in the evolution of the newcomers, which may be labeled as the *direct effect* of new capacities. Two types of *exits* may result from the entry of new capacities. First, there are new businesses which fail to be sufficiently competitive and thus have to leave the market after some time. Second, there is the crowding-out of incumbents by their new competitors, which leads to declining market shares or market exit. Further effects that are rather indirect in nature result from intensified competition due to entry and pertain to

the supply-side of the market. There are four main kinds of such *indirect supply-side effects* resulting from new firm formation:

- First, *securing efficiency* by contesting established market positions. Not only the actual entry but also the very possibility of entry forces the incumbents to behave more efficiently (BAUMOL, PANZAR and WILLIG, 1988).

- Second, *acceleration of structural change*. It can frequently be observed that structural change is accomplished by a turnover of the respective economic units, i.e. by entries of new businesses joined by exits of incumbents. In this case, the incumbents do not undergo necessary internal changes but are substituted by newcomers.[4] This type of process has been put forward by J.A. SCHUMPETER'S (1911/1934; 1942) concept of „creative destruction" and by Alfred MARSHALL'S (1920) analogy of a forest in which the old trees must fall in order to give way to the new ones.

- Third, *amplified innovation*, particularly the creation of new markets. There are many examples of radical innovations that have been introduced by new firms (ACS and AUDRETSCH, 1990; AUDRETSCH, 1995). One major reason for this pronounced role of new firms in introducing innovation could be that incumbent suppliers are more interested in exploiting the profit possibilities of their given product program than they are in searching for new opportunities (GEROSKI, 1995, 431). Another explanation could be that to set up one's own business may appear to be the only or the most promising possibility to commercialize knowledge (AUDRETSCH, 1995).

- Fourth, innovative entry may lead to a *greater variety* of products and problem solutions. If the product programs of the newcomers differ from those of the incumbents, or if they introduce significant process innovation, this leads to the availability of a larger spectrum of goods and problem solving methods. Such an increased variety implies a higher probability of finding a supply with a better match for customer preferences than the supply that was available beforehand. Increased variety due to new supplies may stimulate

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[4] Such a process could, for example, be observed in the transformation of former socialist economies of Central and Eastern Europe where new firms – the bottom-up component – had a considerably stronger impact on structural change, cf. BREZINSKI and FRITSCH (1996) and the contributions in PFIRRMANN and WALTER (2002).

an intensified division of labor as well as follow-up innovation and can in this way generate significant impulses for economic development.

These supply-side effects of the new business formation process augment the regional knowledge stock and may lead to significant improvements in the *competitiveness* of an economy, industry, or region. In this indirect way new business formation processes may stimulate *economic growth.*

While the direct impact of new business formation on employment, namely the setting-up of new capacities, is positive by definition, the net effect in terms of employment in new capacities minus employment in exiting capacities may well be negative. Such a negative net effect of market entry on employment can be expected if the market mechanism results in a "survival of the fittest" scenario while the market volume remains constant. In this case, the surviving firms will be able to provide a given amount of output more efficiently than before and, insofar as labor productivity rises, this implies less employment. However, while such a labor-saving effect of increased efficiency may occur, it also concurrently results in improved competitiveness which may lead to rising output. Such a labor saving effect can be regarded favorable from a growth perspective due to the fact that it provides resources for growth in other markets. It follows that with a well-functioning selection mechanism, an increase of employment can mainly be expected from growth induced by the supply-side effects of the new firm formation process. The magnitude of these supply-side effects should depend on the quality of the newcomers as well as on the efficiency of the market process. Quality of newcomers in this context means their competitiveness and thus the challenge that they pose to the incumbents. A main determinant of this challenge is their innovativeness, i.e. to what degree their supply is of a new or higher quality or is produced with lower costs than that of the incumbents.

The efficiency of the market process with regard to the effects of entries may be judged according to the following two criteria:

- How quickly and how intensely do the incumbents react to an actual or a potential entry?

- How reliably does the market mechanism discriminate between the better and the inferior solution, i.e. how far does the selection by competition result in a "survival of the fittest" scenario?

According to these criteria, the market process can be judged to be more efficient the more reliably a superior solution turns out to be economically successful. In the case that the market selection process favors an inferior alternative, no competitiveness-increasing supply-side effects will emerge. Two issues must be considered with regard to the speed and intensity of the reaction of incumbents. On the one hand, market processes should be fast so that improvements become effective without unnecessary delay. On the other hand, anticipation of a more or less immediate reaction of the incumbents may deter entries and result in a relatively low level of new firm formation. Particularly if innovative newcomers have to expect rather speedy imitation of their advancement, this will reduce their expected profit and therefore also diminish the incentive for innovative entry. Therefore, market entry and its associated effects on economic development depend on the selection mechanism, which may foster or hamper the innovative success of new businesses.

The emergence of the supply-side effects of new business formation does not necessarily require that the newcomers be successful. As long as entry induces improvements on the side of the incumbents it will generate positive supply-side effects, even if the new businesses fail and have to exit the market soon after entry. As far as the overall outcome of the supply-side effects is concerned, it is irrelevant whether the improved supply is provided by the newcomers or by the incumbents. Therefore, even the failed start-ups can make a significant contribution to the improvement of supply and competitiveness. Insofar as competition leads to a “survival of the fittest” scenario, one could expect that high turnover in the stock of firms or establishments results in relatively large improvements of supply and competitiveness (see CAVES, 1998, for a review of the evidence). A high probability of failure could, however, have a negative effect if it were to discourage potential market entry, thereby resulting in the situation that a certain kind of innovation does not occur.

A main problem related to the empirical assessment of these outcomes is the correct identification of the various indirect effects. This is particularly difficult because such indirect effects, like the exit of an incumbent competitor or an improvement of their supply, may not necessarily occur in the same region or even country where the new business was founded. Since an innovation can also be applied in other industries, it may well have an impact outside the industry of origin. An analysis that measures only the effects of new business formation within the respective industry or region is therefore incomplete and will underestimate the total impact. Due to these problems in identifying the diverse indirect effects, a comprehensive assessment may be impossible. This holds particularly true for long-term

effects on the supply-side which become effective only after a considerable time lag. Therefore, any measurement of the indirect effects of new business formation on economic development will be incomplete.

3. Review of the evidence

The empirical evidence regarding the impact of new business formation on economic development is somewhat diffuse. One reason for the mixed results may be that different indicators for market dynamics as well as for economic development are used. While some studies examine the effects of entries and exits separately, others use such measures as independent variables which combine the information on entry and exit in order to describe the 'turnover' of establishments or firms in an industry or region. A frequently used turnover measure is turbulence, i.e. the sum of entries and exits. Another indicator of this type is net-entry understood as entries minus exits. Common measures for economic development are changes in employment, unemployment, value added of production and productivity. A number of studies are limited to economic sub-sectors, such as manufacturing, or compare different sectors. Only some of them have regions or countries as the units of analysis.

One way of assessing the impact of new firms or establishments on economic performance is to estimate the contribution of entries and exits on productivity (see BALDWIN, 1995; DISNEY, HASKEL and HEDEN, 2003; FOSTER, HALTIWANGER and KRIZAN, 2001, and the review by CAVES, 1998). A standard result of this type of analysis is that a considerable part of the productivity improvement can be attributed to the entry of new units with above-average productivity and the exit of units with relatively low productivity. A significant portion of improvements in productivity is due to the turnover of units and takes place within multi-plant firms that close down low-productivity plants and set up highly efficient new ones (DISNEY, HASKEL and HEDEN, 2003).

Most of the studies with regions as units of analysis relate the regional entry rate to employment change or to unemployment. A considerable number of these studies are restricted to the headquarters of new firms and do not take into account new subsidiaries. A clear positive impact of new business formation on employment has been found in studies about the USA (ACS and ARMINGTON, 2004; REYNOLDS, 1994, 1999), however the magnitude of the relationship seems to vary over time. Empirical proofs of a clear positive relationship in other countries are relatively rare (see CARREE and THURIK, 2003, 457-463 for an overview).

ASHCROFT and LOVE (1996) detected evidence that entrepreneurship had a positive effect on employment change in Great Britain in the 1980s. DAVIDSSON, LINDMARK and OLOFSSON (1994a, b) identified some impact of regional new business formation in Sweden on a complex indicator for economic well-being. Studies about Sweden by FOELSTER (2000) and BRAUNERHJELM and BORGMAN (2004) found a positive impact of increased self-employment rates on regional employment.[5] And BRIXY (1999) showed that new business formation had a strong positive effect on regional employment in East German regions in the first years of the transformation process. However, analyses about the Netherlands (EIM, 1994) and of West Germany (AUDRETSCH and FRITSCH, 1996; FRITSCH, 1996, 1997) for the 1980s found no such relationship.

AUDRETSCH and FRITSCH (2002) suggested that the lack of clarity with regard to the impact of new business formation on regional development may be attributed to relatively long time lags that are required for the main effects of the new entries to become evident. They found that the level of start-ups in the 1980s could not contribute to explaining employment change in the 1980s, but could explain changes in the 1990s. VAN STEL and STOREY (2004), in their analysis for British regions, investigated the relevance of such time lags somewhat more systematically. They confirmed that the regional growth rate is positively shaped by new business formation from several of the earlier periods. According to their results, the magnitude of the effects over time takes the form of an inverse U with a peak for the start-up activity from five years earlier. After ten years no effect of new firm formation on regional employment could be identified. AUDRETSCH and KEILBACH (2004) analyzed the impact of the regional level of entrepreneurship on growth in West German regions in the framework of a production function and found a positive impact that is quite pronounced. Because their analysis was only for one year, they were not able to examine the significance of a time lag in the relationship.

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[5] These two studies used the share of self-employed firms without any additional employees as measure for the level of entrepreneurship in a region assuming that this measure may indicate the share of recently established firms.

AUDRETSCH, CARREE and THURIK (2001) investigated the impact of changes in self-employment on unemployment for 23 OECD countries on a national level.[6] While they found some unemployment-reducing effects of increased self-employment, their analysis also shows that such a relationship does not hold true for all of the countries in their sample. Remarkably, the effect tends to be larger for longer time spans. Regressions with change of unemployment and entrepreneurship measured over a period of eight years show a stronger relationship between these indicators than do regressions for values calculated over a four-year period. If calculations are based on a twelve-year period, the impact of changes of self-employment on the unemployment rate becomes even more pronounced.

A number of studies analyzing the effect of turbulence on regional productivity also found positive effects (see CALLEJON and SEGARRA, 2000; BOSMA and NIEUWENHUIJSEN, 2002). If the impact of entry or turbulence is investigated for the large economic sectors separately, the effect found in services often tends to be somewhat stronger than that in manufacturing, where it may not even be statistically significant (ACS and ARMINGTON, 2004; BOSMA and NIEUWENHUIJSEN, 2002). This supports GEROSKI'S (1995) assessment that new firm formation does not appear to play an important role for the economic performance of manufacturing industries.

We conclude from the available evidence that there is a positive impact of new business formation on economic development and that there may nevertheless be considerable time lags involved. However, the magnitude of the overall effect as well as the length and the structure of this time lag remain unclear.

4. Data and measurement approach

Our data on new business formation and regional development of employment is from the establishment file of the German Social Insurance Statistics (see FRITSCH and BRIXY, 2004, for a description). This database provides information about all establishments that have at least one employee subject to obligatory social insurance. Currently, the information on West

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[6] Unemployment may be a quite problematic indicator for the effect of new firm formation or self-employment on economic development because it is shaped by demographic factors such as age of the work force, development of labor-force participation rates and mobility between regions or countries.

Germany is available on a yearly basis for a relatively long time period of 20 years, from 1983 to 2002. Because the database records only businesses with at least one employee, start-ups consisting of only owners are not included. We exclude new businesses with more than 20 employees in the first year of their existence; as a result, a considerable number of new subsidiaries of large firms contained in the database are not counted as start-ups.[7] Although the database only includes information at the establishment level, comparison with information on the regional distribution of headquarters of newly founded firms reveals a rather high correlation, thus allowing our data to also be regarded as an indicator for regional entrepreneurship (see FRITSCH and BRIXY, 2004, and the analyses in FRITSCH and GROTZ, 2002).

Other data used in the analysis is from publications of the GERMAN FEDERAL STATISTICAL OFFICE ('STATISTISCHES BUNDESAMT'). We restricted our analysis to West Germany because of two reasons: First, many studies indicate that East Germany was a special case in the 1990s with very specific conditions that cannot be directly compared to West Germany (cf. BRIXY and GROTZ, 2004; FRITSCH, 2004). Second, in order to determine the indirect effects of new business formation, we rely on a long time period for West Germany for which data is not existent for East Germany.[8] Our spatial units of analysis are the 326 West German districts ('Kreise'). Districts can be quite different in character: some are core cities, others are part of an agglomeration's suburban ring and some comprise the core of a smaller city as well as the surrounding area. The advantage of choosing districts as spatial units of analysis is that the sample contains a higher number of cases which allows for more sophisticated empirical analyses. A severe disadvantage could be that certain influences prove to be relevant for larger spatial units than districts, resulting in autocorrelation across regional borders. We indeed have found quite a considerable degree of spatial autocorrelation that we have explicitly accounted for in our analysis.

Our indicator for regional development is relative employment change in the private sector (measured as a percentage). To avoid disturbances by short-run fluctuations, we use the

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[7] The share of new establishments in the data with more than 20 employees in the first year is rather small (about 2.5 percent). Applying a definition without a size-limit does not lead to any significant changes of the results.

[8] We excluded the Berlin region due to changes in the definition of that region during the inspected time period.

change rate over a two year period as the dependent variable (employment of *t*+2 relative to employment in *t*). Variables for new business formation activity are the yearly start-up rates calculated according to the "labor market" approach, i.e. the number of start-ups per period is divided by the number of persons in the regional workforce at the beginning of the respective period.[9] An important adjustment was made to control for the fact that not only does the composition of industries differ considerably across regions, but that the relative importance of start-ups and incumbent enterprises also varies systematically across industries. For example, start-up rates are higher in the service sector than in manufacturing industries. This means that the relative importance of start-ups and incumbents in a region is confounded by the composition of industries in that region. This would result in a bias of overestimating the level of entrepreneurship in regions with a high composition of industries where start-ups play an important role, and underestimating the role of new business formation in regions with a high composition of industries where start-ups are relatively unimportant. To correct for the confounding effect of the regional composition of industries on the number of start-ups, a shift-share procedure was employed to obtain a sector-adjusted measure of start-up activity (see the Appendix of AUDRETSCH and FRITSCH, 2002, for details). This sector adjusted number of start-ups is defined as the number of new businesses in a region that could be expected if the composition of industries were identical across all regions. Thus, the measure adjusts the raw data by imposing the same composition of industries upon each region. Our analysis shows that this procedure leads to somewhat clearer results and higher levels of determination than do estimations using the non-adjusted start-up rate. However, the basic relationships are left unchanged.

We used panel estimation techniques that allowed us to account for unobserved region-specific factors. Application of the Huber-White method provides robust standard error estimates. To analyze the impact of new business formation on regional employment change, we included the yearly start-up rates at the beginning of the inspected employment change periods (current year) and for the ten preceding years. We found a rather strong correlation between start-up rates of subsequent years (see table A1 in the Appendix); all correlation coefficients for the relationship between start-up rates are statistically significant at the 1-percent level. In order to cope with this strong correlation, we applied Almon polynomial lags

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[9] See AUDRETSCH and FRITSCH (1994) for different approaches of calculating start-up rates.

for estimating the time lag structure of the effect of new firm formation on regional employment change (see GREENE, 2003, for a detailed description of this method). Besides start-ups, other variables for regional characteristics that may have been relevant for employment change, such as population density, did not prove to have any statistically significant effect and were therefore not included.[10] However, when we estimated our model for agglomerations, moderately congested areas and rural regions separately[11], we find differences in the magnitude of effects (see section 5).

5. The distribution of time lags

To shed light on the lag structure of the effect of new business formation on regional employment change, we first estimated a model that included the start-up rate at the beginning of the inspected period of employment change (current year) and all start-up rates of the preceding ten years. Because of a relatively high level of correlation between the start-up rates of subsequent years, we also analyzed the impact of each lagged start-up rate separately (table 1). When including all start-up rates in one model, we found the highest positive impact for new business formation of the current year and of the years t-6 and t-7, i.e. the start-up rates of six and seven years ago. Remarkably, the start-up rates of period t-3 and t-4 have a significantly negative impact on employment change. Thus, the results of the regression including all relevant start-up rates between t and t-10 indicate both a positive and a negative relationship between entrepreneurial activity and employment growth (figure 2). Such negative employment effects could result from exiting capacities and improved efficiency in the regional provision of goods and services due to market selection. However, when running separate regressions for each start-up rate, we found that there is always a significantly positive relationship between new business formation and regional employment change. The separate regressions with the single start-up rates show the strongest impact for the start-up rates of the years t-5 and t-6. The impact of start-ups on employment change first increases (between t and t+2) and then decreases with rising time lags from the period to

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[10] Population density can be regarded as a proxy variable for all kinds of regional characteristics such as availability of qualified labor, housing prices, local demand, and the level of regional knowledge spillovers.

[11] The definition of the type of region is taken from the FEDERAL OFFICE FOR BUILDING AND REGIONAL PLANNING (BUNDESAMT FÜR BAUWESEN UND RAUMORDNUNG) and is based upon the population density of the district as well as the total population of a core city.

which the dependent variable is related. Apparently, the impact of new business formation on regional employment change fades away with the years. In the regression that includes all lagged yearly start-up rates between t and t-10, the coefficients for the start-up rates of the most distant years (t-9 to t-10) are not statistically significant.

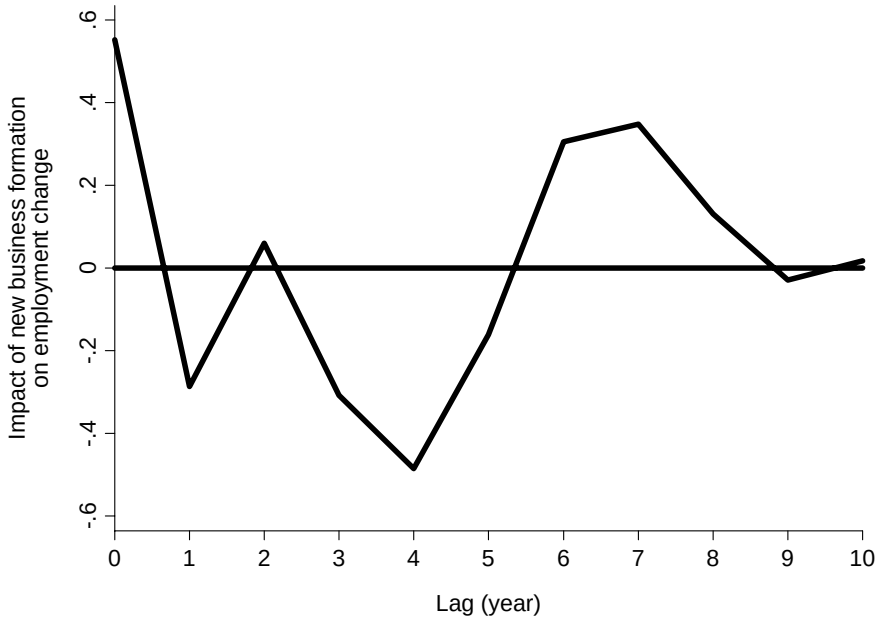

Figure 2: The structure of the impact of new business formation on regional employment growth based on a regression that accounts for entry rates over eleven years

Table 1: The impact of new business formation on regional employment change

	Two year regional employment change (percentage)											
Constant	-1.28** (3.13)	-0.47* (1.98)	-0.26 (1.10)	-0.72** (3.00)	-0.91** (3.83)	-1.01** (4.13)	-1.22** (4.88)	-1.67** (6.52)	-2.22** (8.12)	-2.62** (9.36)	-2.17** (7.25)	-1.06** (3.09)
Start-up rate current year t	0.55** (6.65)	0.25** (9.75)	-	-	-	-	-	-	-	-	-	-
Start-up rate year t-1	-0.29** (5.12)	-	0.23** (9.23)	-	-	-	-	-	-	-	-	-
Start-up rate year t-2	0.06 (0.78)	-	-	0.29** (11.04)	-	-	-	-	-	-	-	-
Start-up rate year t-3	-0.31** (4.07)	-	-	-	0.31** (11.57)	-	-	-	-	-	-	-
Start-up rate year t-4	-0.48** (6.60)	-	-	-	-	0.31** (11.27)	-	-	-	-	-	-
Start-up rate year t-5	-0.16* (2.28)	-	-	-	-	-	0.32** (11.50)	-	-	-	-	-
Start-up rate year t-6	0.31** (3.95)	-	-	-	-	-	-	0.32** (11.63)	-	-	-	-
Start-up rate year t-7	0.35** (4.73)	-	-	-	-	-	-	-	0.31** (10.57)	-	-	-
Start-up rate year t-8	0.13* (1.93)	-	-	-	-	-	-	-	-	0.29** (9.87)	-	-
Start-up rate year t-9	-0.03 (0.40)	-	-	-	-	-	-	-	-	-	0.24** (7.43)	-
Start-up rate year t-10	0.02 (0.26)	-	-	-	-	-	-	-	-	-	-	0.15** (4.08)
Spatial autocorrelation (residuals in adjacent regions)	0.48** (8.01)	0.79** (31.44)	0.80** (31.57)	0.81** (31.69)	0.81** (30.74)	0.81** (30.24)	0.81** (29.90)	0.80** (29.76)	0.72** (19.45)	0.64** (15.25)	0.66** (15.69)	0.63** (14.02)
R^2	0.16	0.41	0.41	0.44	0.44	0.44	0.45	0.43	0.30	0.21	0.22	0.18
F-value	32.41	543.19	536.87	546.29	514.40	508.30	506.74	529.50	278.70	175.35	154.08	105.92
Number of observations (No. of obs. per district)	2,608 (8)	5,868 (18)	5,542 (17)	5,216 (16)	4,890 (15)	4,564 (14)	4,238 (13)	3,912 (12)	3,586 (11)	3,260 (10)	2,934 (9)	2,608 (8)

*Notes: Robust Huber-White estimates; t-values in parentheses; **: statistically significant at the 1% level; *: statistically significant at the 5%-level.*

We accounted for spatial autocorrelation in two different ways (cf. ANSELIN, 1988; ANSELIN and FLORAX, 1995). First, we included an average of the residuals in the adjacent regions that could be an indication of unobserved influences that affect larger geographical entities than district and that are not entirely reflected in the explanatory variables (cf. table1). Second, we employed spillover effects measured as an average of the employment change in the adjacent districts to account for determinants of employment change which are not limited to the particular region. Both indicators of spatial autocorrelation resulted in the same lag-structure, yet the magnitude of the positive effects were stronger in the regressions that included the residuals of adjacent regions as a measure of spatial autocorrelation. Accounting for both control variables in one model led to implausible results due to multicollinearity. Serial autocorrelation was not a problem. As an alternative estimation method to the Huber-White method, we applied the model with fixed effects regression (cf. table A2). The differences in the results when using the robust standard error estimates are more or less gradual. The lag structure remains the same in the fixed-effects model, however the magnitude of the impact of new business formation on regional employment change came out to be slightly stronger.

The pronounced multicollinearity of the start-up rates makes the interpretation of the regression coefficients problematic. Due to the observed high correlation of start-up rates in subsequent years, the regression coefficient for a certain year may not necessarily reflect the impact of start-up activity in only this specific year but also in other years as well. We applied Almon polynomials to cope with this problem.[12] This method reduces the effects of multicollinearity in distributed lag settings by imposing a particular structure on the lag coefficients. We assume that the effect of changes in yearly start-up rates will be distributed over eleven years because our regression analyses of lagged start-up rates suggested that the impact on employment change has more or less faded away after that time period (table 1).

[12] See VAN STEL and STOREY (2003) for a similar approach.

Table 2: The impact of lagged start-up rates on regional employment change

	Two year regional employment change (percentage)			
	Almon method assuming a polynomial of			
	2nd order	3rd order	4th order	5th order
Constant	-1.21**	-1.19**	-1.21**	-1.20**
	(3.06)	(2.95)	(2.99)	(2.96)
Start-up rate current year	0.16	0.42	0.48	0.44
Start-up rate year t-1	0.06	-0.03	-0.09	-0.02
Start-up rate year t-2	-0.03	-0.25	-0.31	-0.30
Start-up rate year t-3	-0.08	-0.30	-0.31	-0.36
Start-up rate year t-4	-0.11	-0.22	-0.19	-0.23
Start-up rate year t-5	-0.12	-0.07	-0.02	-0.02
Start-up rate year t-6	-0.09	0.09	0.12	0.18
Start-up rate year t-7	-0.04	0.22	0.20	0.25
Start-up rate year t-8	0.03	0.26	0.20	0.18
Start-up rate year t-9	0.13	0.16	0.10	0.03
Start-up rate year t-10	0.25	-0.13	-0.06	-0.02
Spatial autocorrelation	0.60**	0.52**	0.51**	0.51**
(residuals in adjacent regions)	(13.01)	(9.68)	(9.56)	(9.45)
R^2	0.18	0.16	0.16	0.16
F value	53.13	53.21	45.55	39.01
Number of observations (No. of obs. per district)	2,608 (8)	2,608 (8)	2,608 (8)	2,608 (8)

*Notes: Robust Huber-White estimates; t-values in parentheses, ** statistically significant at the 1% level; * statistically significant at the 5% level.*

A rather critical issue in applying the Almon lag procedure is determining which type of polynomial to assume. Table 2 provides the results of the robust regressions when applying the Almon method with a polynomial lag of second-, third-, fourth-, and fifth-order. Figure 3 is a graphical exposition of the estimated lag structures that result from the different types of polynomials assumed. We found that a second-order polynomial results in a U-shape structure for the impact of new business formation on regional development. The results indicate that while the start-ups of the current period and of t-1 have a positive impact, the effects of new businesses' set-ups in years t-2 to t-7 is negative. The entries of the last three years (t-8 to t-10) have again an increasingly positive impact that is strongest for the last period (t-10). However, the rising strength of the effect of new businesses on regional development suggested by such a type of lag-structure is not consistent with our observation from standard

regressions (table 1), namely that this impact, after having reached a maximum, is becoming smaller and smaller over the years until it has faded away.

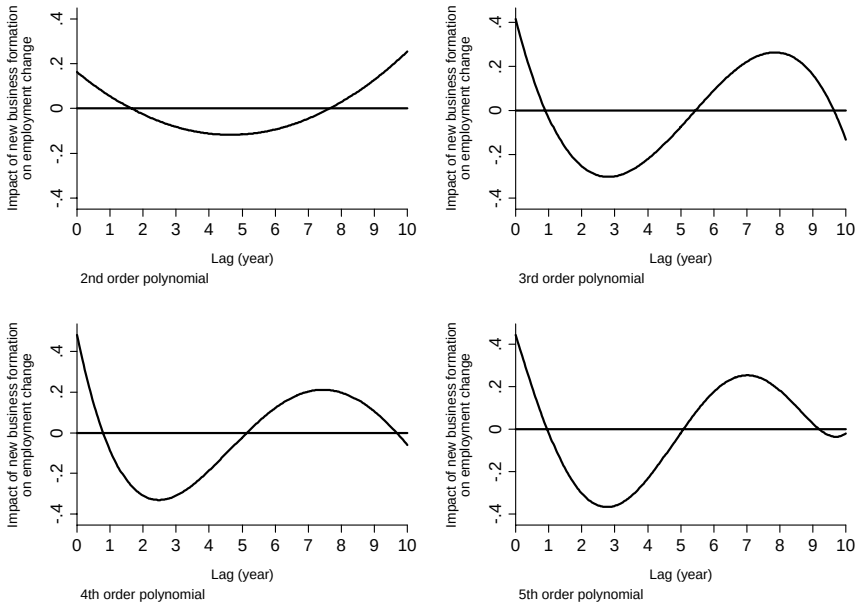

Figure 3: The lag structure of the impact of new business formation on regional employment growth

Assuming a third-order polynomial leads to a quite different type of lag structure that can also be found for a fourth- and a fifth-order polynomial[13]. This pattern suggests that new business formation of the current year has a positive impact on employment change. For the years t-1 to t-5 the effect is negative with a minimum in t-3. For the entries in the years t-6 to t-9 we find a positive relationship with a maximum between year t-7 and t-8. The magnitude of the effect then decreases and is somewhat negative in the last year included (t-10). The relatively high F-value for the estimates applying a third-order polynomial indicates that this assumption fits the data rather well. However, the F-value for estimates based on a second-order polynomial falls in about the same range, indicating that this type of polynomial can also be regarded a reasonably good approximation.

[13] The model with the fifth-order polynomial has a comparatively low level of statistical significance.

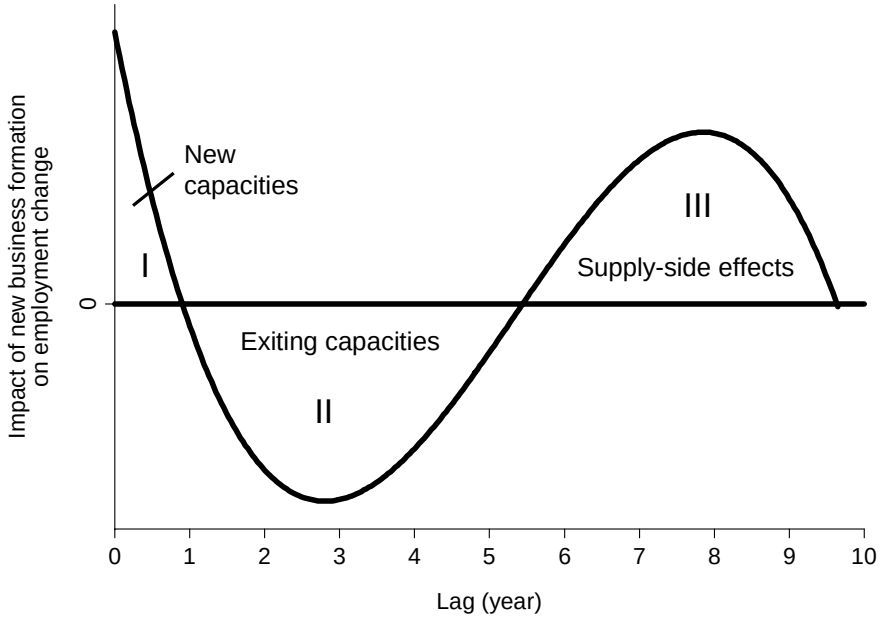

Figure 4: Direct and indirect effects of new business formation on employment change over time

The pattern we found for the lag distribution of the impact of new business formation on regional employment suggests a certain time sequence of the different effects that were detailed in section 2. We first give an interpretation of the results of the model with the third-order polynomial and then apply this reading to the pattern that we obtained for the model with the second-order polynomial. The positive employment impact for start-ups in the current year can be understood as the additional jobs that are created in the newly founded businesses at the time of inception. This direct employment effect is given by area I in figure 4. We know from other analyses that employment in entry cohorts tends to be stagnant or declining from the second or the third year onward (BOERI and CRAMER, 1992; BRIXY and GROTZ, 2004; FRITSCH and WEYH, 2004). Therefore, new business formation in the years t-1, t-2 and in earlier years should not lead to any significant direct employment effect. As soon as a new business is set up it is subject to market selection and will perhaps gain market shares from incumbent suppliers. We may therefore assume that the negative impact of the start-ups in the years t-1 to t-5 (area II in figure 4) results from exiting capacities, i.e. new businesses that fail to be competitive and from the crowding-out of incumbents. The positive impact of new business formation for the years on employment t-6 to t-10 is probably due to a dominance of indirect supply-side effects, i.e. increased competitiveness of the regional suppliers resulting from market selection (area III in figure 4). After about nine or ten years

the impact of new businesses on regional employment has faded away. We have no plausible explanation for the slightly negative value that we found for new firm formation in period t-10 and presume that it represents a kind of approximation error of the Almon lag procedure.

The interpretation of the lag structure that we found when assuming a second-order polynomial is quite similar, particularly regarding the direct effect of new business employment and the crowding-out effects. Also, the amount of time it takes for the supply-side effects to dominate is in about the same range. What is different, however, is that these supply-side effects then become stronger and stronger without decreasing again in the more backdated years. As previously mentioned, this latter pattern appears highly implausible to us in light of the results of standard regressions shown in table 1. Presumably, this kind of pattern is caused by the very nature of a second-order polynomial, which can by definition possess only one inflection point.

If our interpretation of the lag structure is correct, both patterns imply that the employment gain due to indirect supply-side effects of new business formation is much larger than the initial employment created in the newly founded businesses, i.e. the direct employment effect. One indication for this conjecture is that, according to the estimated coefficients, the area in figure 3 that represents the indirect supply-side effect is always larger than the area of the initial employment effect. This becomes particularly clear if the supply-side effects are compared to the net effect of new capacities and exiting capacities that is given by area I minus the area II in figure 4. Because we cannot account for those parts of the supply-side effects that occur in other regions, this type of impact is probably underestimated here. But if the true supply-side effects are considerably larger than what we have estimated, we can conclude that this effect is the most important result of new business formation for economic development. In addition, the crowding-out effect is likely to be underestimated as well because the decreasing output of incumbents might also occur in other regions or cross industry boundaries.

Estimates of variations of the model and for sub-samples arrived at some interesting results. We analyzed, for example, the impact of entrepreneurial activity on employment change for longer time lags. Testing for 12-year time lags showed plausible estimates only for a third-order polynomial. Results of models that assumed a 14-year time lag were not very robust and partly implausible, which may be an effect of the relatively low number of observations that remain if such a long time lag is used. A common result of those alternative

versions that led to plausible lag structures was that start-up activity in the current year and of the years t-7 to t-9 had the strongest positive impact on employment change.[14]

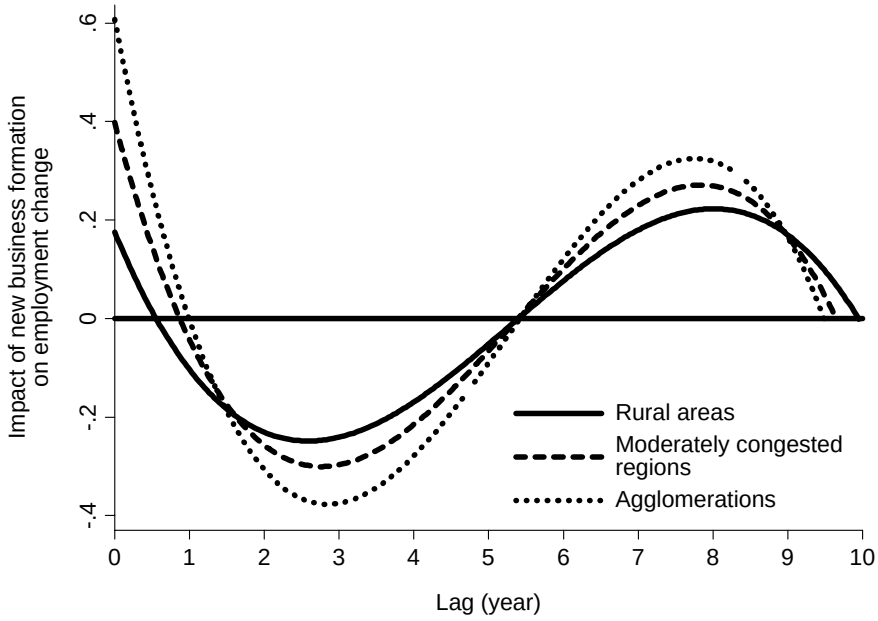

Figure 5: Effects of new business formation on employment change in different types of region

Estimating our model separately for high-density agglomerations, moderately congested regions, and rural areas showed some variation according to population density (figure 5). We found the highest magnitude of effects for the agglomerations followed by the moderately congested regions and the rural areas, for which the effects are relatively weakly pronounced. This result can be explained by the relatively intense competition in areas with a high density of economic activity. If this interpretation is correct, the high density areas should be characterized by a relatively high level of competitiveness due to high entry rates and rigorous market selection. Our interpretation is supported by an analysis of FRITSCH and FALCK (2002), who found a positive relationship between the level of new business formation and

[14] We also calculated relative employment change, the dependent variable in our analysis, for time periods of only one year as well as over three, four and five years. The results showed that the magnitude of the effects is the highest the shorter the time period chosen for calculating the employment change. But these differences decrease with the length of the time period taken for measuring employment change so that the results of models for employment change calculated over a three year period and a four year period are quite similar. The lag structure of the different models is rather akin.

population density. Moreover, FRITSCH, BRIXY and FALCK (2004) could show that survival rates of start-up cohorts are significantly lower in regions that are characterized by high entry rates. Quite obviously, entry leads to intensified competition and selection. As in our basic model (table 2), the start-ups of the year t-8 exhibit the strongest positive impact on employment for all three types of regions.[15] Estimating the models for start-ups and employment change in the manufacturing and the service sectors separately shows a much larger effect of new capacities (area I in figure 4) for manufacturing, which is probably due to the higher average size of entries in this sector. This contradicts GEROSKI'S (1995) conjecture that entry is relatively unimportant for the performance of manufacturing industries. Negative employment effects due to exiting capacities occur earlier in the service sector than in manufacturing; in some of the models they already appear in the year after start-up. This result corresponds to the relatively high hazard rates that can be observed for new service-sector businesses during the first years of their existence (cf. FRITSCH and WEYH, 2004; FRITSCH, BRIXY and FALCK, 2004). We find the supply-side effects in manufacturing slightly less pronounced than in services. This is compatible with the observation that markets for output of manufacturing establishments tend to be geographically larger than in the case of services, so that supply-side effects are less concentrated within the start-up region.[16]

In order to restrict the analysis to the long-term effects, we included only start-up rates of the years t-4 to t-10 into our regressions and applied a second-order polynomial. This corresponds to the model used in the analysis of VAN STEL and STOREY (2004). Interestingly, this results in an inverse U-form lag-structure that is quite similar to what has been found by VAN STEL and STOREY. In our analysis, however, the highest positive impact of new businesses on employment is again found for the start-ups of the years t-7 and t-8[17] This is in contrast to the estimates of VAN STEL and STOREY (2004), where the start-up rate of year t-5

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15 Running the model for regions with relatively high and with relatively low start-up rates separately did not show more pronounced effects in the region with a high level of new business formation. Obviously, it is the density and not the regional level of entry that makes the difference. The distribution of agglomerations, moderately congested regions and rural areas was not evidently different between the regions with high and low start-up rates.

16 We also tested for the effects of entries in either manufacturing or services on employment change in the private economy as a whole. Our result showed quite similar long-term effects of new business formation and suggests that its impact is not limited to the respective sector or industry.

17 Including start-up-rates for more recent years than t-4 does not lead to an inverse-U lag structure but the U-form that is reported in table 2 and figure 3.

has the strongest effect. In order to capture spillover effects we also tested for the impact of new business formation activity in adjacent regions by including the start-up rates in these regions as independent variables.[18] The result revealed there to be a tremendous effect of start-ups in adjacent regions on a region's employment.

6. Final discussion

We have investigated the lag structure of the effect of new business formation on regional employment change. Our results and interpretations clearly suggest that an analysis of the employment effects of new businesses that mainly focuses on the development of the entrants is inadequate. According to our analysis, the indirect supply-side effects of entries are far more important than the amount of jobs that are directly created in the new businesses. As we have argued, it is not necessary that the new entities survive and exhibit strong growth in order for these supply-side effects to occur. The critical point here is that improvements are made, whether on the side of the newcomers or on the side of the incumbents. Therefore, even those start-ups that fail to survive competition may make an important contribution. It is the contestability of markets that counts.

Our results imply that the evolution of indirect supply-side effects of new business formation takes some time. Employment gains are rather modest in the year in which the new businesses are founded, and it is rather likely that these initial employment gains are in subsequent years more than compensated for by exiting capacities due to crowding-out effects and failing newcomers. Therefore, the net-employment effect of the entry processes over the first six or seven years may well be negative. New businesses do lead to more employment – but in the longer run. The magnitude of the different effects of start-ups on regional employment may vary according to the characteristics of the entrants and their competitors in the respective industry and region. Because highly innovative entry constitutes a greater challenge to the incumbents than non-innovative entry, we may expect larger supply-side effects for this type of entry. It is quite likely that this relationship is shaped by the type of technological regime that dominates in the respective industry and region (AUDRETSCH, 1995,

[18] New business formation activity in adjacent regions is calculated for each district by taking the average number of sector-adjusted start-ups in adjacent regions and dividing them by the average number of employees in adjacent regions. We applied Almon polynomial lags to these start-up rates of adjacent regions as well.

39-64; WINTER, 1984). In an entrepreneurial regime it should be easier for newcomers to seriously challenge the incumbents than under the conditions of a routinized regime.

Obviously, the quality of market selection is of crucial importance for the emergence of the supply-side effects of new business formation that are likely to result in improved competitiveness and employment growth. Public policy should therefore safeguard the quality of this selection process and avoid everything that could disturb the 'survival of the fittest' scenario. This means, for example, that failure of newcomers and market exits should be understood as necessary elements of market selection and that policy should abstain from subsidizing firms in order to prevent them from leaving the market. Moreover, stimulating and supporting entries should not result in unfair competition that jeopardizes the reliability of market selection. Such unfair competition may, for example, occur if entries are crowding out incumbents merely because they enjoy policy support. Instruments for the promotion of start-ups should be designed in a way that avoids such distorting effects.

Further research should try to achieve an in-depth understanding of the different effects of entry on market processes within different types of industries. Case studies could show to what extent our argument concerning the different effects and the respective time frame is deemed accurate. Another important question that is of particular interest for policy concerns the magnitude of the indirect supply-side effects. What determines the size of these effects and their regional incidences? Which market conditions and what kind of selection processes are conducive to the supply-side improvements that are induced by entry? What could policy do in order to improve these effects? And how should policies for stimulating start-ups be designed so that they do not impair the quality of market selection?

A further important step of analysis could be to employ other indicators for regional performance than simply employment change. If our interpretation of the empirical results attained is correct, we would expect that the supply-side effects should lead to rising total factor productivity. However, measuring total factor productivity requires estimating a regional production function with several input categories and such information is not readily available available. Further research should also try to shed more light on the sources of the considerable spatial autocorrelation that we found in our analysis.

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Appendix

Table A1: Correlation matrix of sector-adjusted start-up rates for subsequent time periods

	Start-up rate										
	Year t	Year t-1	Year t-2	Year t-3	Year t-4	Year t-5	Year t-6	Year t-7	Year t-8	Year t-9	Year t-10
Year t	1.0000										
Year t-1	0.8966	1.0000									
Year t-2	0.8373	0.8946	1.0000								
Year t-3	0.8262	0.8397	0.9030	1.0000							
Year t-4	0.8490	0.8524	0.8724	0.9053	1.0000						
Year t-5	0.8355	0.8461	0.8502	0.8722	0.9306	1.0000					
Year t-6	0.8250	0.8315	0.8424	0.8586	0.9184	0.9327	1.0000				
Year t-7	0.8327	0.8202	0.8260	0.8521	0.9076	0.9209	0.9329	1.0000			
Year t-8	0.8358	0.8277	0.8148	0.8336	0.9027	0.9092	0.9200	0.9322	1.0000		
Year t-9	0.8255	0.8318	0.8226	0.8232	0.8878	0.9048	0.9085	0.9193	0.9309	1.0000	
Year t-10	0.7945	0.8197	0.8260	0.8347	0.8881	0.8904	0.9038	0.9072	0.9181	0.9296	1.0000

Notes: All coefficients are statistically significant at the 1% level.

Table A2: The impact of new business formation on regional employment change

	Two year regional employment change (percentage)											
Constant	-17,26** (7,32)	-1,44** (4,47)	0,77* (2,19)	-1,44** (3,06)	-0,83 (1,66)	-0,28 (0,52)	-0,47 (0,81)	-0,72 (1,19)	-1,27 (1,95)	+2,70** (3,91)	-2,73** (3,73)	-0,86 (1,05)
Start-up rate current year t	0,82** (13,09)	0,38** (10,01)	-	-	-	-	-	-	-	-	-	-
Start-up rate year t-1	-0,21** (3,06)	-	0,12** (2,92)	-	-	-	-	-	-	-	-	-
Start-up rate year t-2	0,44** (4,00)	-	-	0,39** (6,79)	-	-	-	-	-	-	-	-
Start-up rate year t-3	-0,05 (0,51)	-	-	-	0,30** (4,97)	-	-	-	-	-	-	-
Start-up rate year t-4	-0,30** (2,91)	-	-	-	-	0,22** (3,41)	-	-	-	-	-	-
Start-up rate year t-5	0,01 (0,10)	-	-	-	-	-	0,23** (3,25)	-	-	-	-	-
Start-up rate year t-6	0,52** (5,17)	-	-	-	-	-	-	0,21** (2,85)	-	-	-	-
Start-up rate year t-7	0,55** (5,56)	-	-	-	-	-	-	-	0,20* (2,49)	-	-	-
Start-up rate year t-8	0,19 (1,88)	-	-	-	-	-	-	-	-	0,30** (3,63)	-	-
Start-up rate year t-9	0,01 (0,07)	-	-	-	-	-	-	-	-	-	0,31** (3,49)	-
Start-up rate year t-10	0,11 (1,04)	-	-	-	-	-	-	-	-	-	-	0,13 (1,27)
Spatial autocorrelation (residuals in adjacent regions)	0,44** (12,67)	0,80** (63,90)	0,81** (61,81)	0,82** (63,37)	0,82** (61,36)	0,82** (59,61)	0,82** (57,80)	0,82** (53,48)	0,73** (37,36)	0,64** (25,74)	0,67** (26,45)	0,64** (22,75)
R^2	0,04	0,38	0,38	0,41	0,42	0,42	0,42	0,40	0,27	0,19	0,19	0,15
F-value	43,63	2059,30	1918,94)	2011,35	1890,32	1779,41	1672,70	1432,02	703,36	345,96	358,91	258,89
Number of observations (No. of obs. per district)	2,608 (8)	5,868 (18)	5,542 (17)	5,216 (16)	4,890 (15)	4,564 (14)	4,238 (13)	3,912 (12)	3,586 (11)	3,260 (10)	2,934 (9)	2,608 (8)

*Notes: Estimates with fixed effects; t-values in parentheses; **: statistically significant at the 1% level; *: statistically significant at the 5%-level.*

Table A3: The impact of lagged start-up rates on regional employment change

	Two year regional employment change (percentage)			
	Almon method assuming a polynomial of			
	2nd order	3rd order	4th order	5th order
Constant	-17.18**	-14.99**	-15.37**	-15.26**
	(7.54)	(6.45)	(6.59)	(6.53)
Start-up rate current year	0.37	0.59	0.69	0.66
Start-up rate year t-1	0.28	0.16	0.09	0.14
Start-up rate year t-2	0.21	-0.04	-0.12	-0.12
Start-up rate year t-3	0.15	-0.09	-0.09	-0.14
Start-up rate year t-4	0.12	-0.02	0.04	0.00
Start-up rate year t-5	0.10	0.11	0.19	0.20
Start-up rate year t-6	0.10	0.25	0.30	0.34
Start-up rate year t-7	0.11	0.35	0.33	0.37
Start-up rate year t-8	0.15	0.36	0.27	0.26
Start-up rate year t-9	0.20	0.23	0.14	0.08
Start-up rate year t-10	0.28	-0.10	0.01	0.04
Spatial autocorrelation	0.61**	0.52**	0.51**	0.51**
(residuals in adjacent regions)	(22.01)	(16.20)	(16.04)	(15.85)
R^2	0.05	0.05	0.05	0.05
F value	146.63	101.46	84.82	72.39
Number of observations (No. of obs. per district)	2,608 (8)	2,608 (8)	2,608 (8)	2,608 (8)

*Notes: Estimates with fixed effects; t-values in parentheses, ** statistically significant at the 1% level; * statistically significant at the 5% level.*