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Effects of New Business Formation on Regional Development over Time

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FRITSCH M. and MUELLER P. (2004) Effects of new business formation on regional development over time, *Regional Studies* **38**, 961–975. In the analysis of the impact of new business formation on regional employment change, considerable time lags were identified. The structure and extent of these time lags were investigated by applying the Almon lag model and it was 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 created in the new entities. The peak of the positive impact of new businesses on regional development is reached about 8 years after entry.

Regional growth New businesses Entrepreneurship Time lags

FRITSCH M. et MUELLER P. (2004) Les effets temporels de la création d'entreprise sur l'aménagement du territoire, *Regional Studies* **38**, 961–975. Cette analyse des effets de la création d'entreprise sur l'aménagement du terriotire identifie d'importants décalages dans le temps. On examine la structure et la portée de ces décalages en appliquant le modèle Almon. Il s'avère que les nouvelles entreprises font preuves d'effets postifs et négatifs sur l'emploi régional. Les résultats portent à croire que les effets indirects de la création d'entreprise (l'éviction des concurrents, l'amélioration des conditions de l'offre, et une compétitivité accrue) sont d'une plus grande importance que ne l'est l'effet direct, c'est à dire les emplois créés dans les nouveaux établissements. L'effet positif des nouvelles entreprises sur l'aménagement du territoire touche à son maximum environ huit années après la création de celles-là.

Croissance régionale Nouvelles entreprises Esprit d'entreprise Laps de temps

FRITSCH M. und MUELLER P. (2004) Der Einfluss von Gründungsprozessen auf die Regionalentwicklung im Zeitablauf, *Regional Studies* **38**, 961–975. 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.

Regionalentwicklung Unternehmensgründungen Entrepreneurship Time lags

FRITSCH M. y MUELLER P. (2004) Los efectos de la formación de nuevas empresas en el desarrollo regional a lo largo del tiempo, *Regional Studies* **38**, 961–975. En el análisis del impacto de la formación de nuevas empresas sobre la variación en el empleo regional se identifican retardos temporales considerables. Nosostros investigamos la estructura y el grado de estos retardos mediante la aplicación del modelo de retardos de Almon y encontramos que las nuevas empresas pueden tener tanto un efecto positivo como negativo en el empleo regional. Los resultados indican que los efectos indirectos de la formación de nuevas empresas (desplazamiento de competidores, mejora de las condiciones de oferta y mejora de la competitividad) son de una magnitud mayor que el efecto directo, es decir, los empleos que se crean en las nuevas entidades. El impacto positivo de las nuevas empresas en el desarrollo regional alcanza su nivel más alto unos ocho años después de su entrada.

Crecimiento regional Nuevas empresas Empresarialidad Retardos temporales

JEL classifications: M13, O1, O18, R11

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INTRODUCTION

Does a high level of new business formation in a region stimulate economic development?[1] While most people believe this is the case, a clear and indisputable empirical proof for the 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 1983–85 could contribute to explaining employment change in 1993–98. 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 5 years earlier.

The present paper investigates the time lag of the effect of new business formation on regional growth for West Germany.[2] As a starting point, the second section reviews the possible direct and indirect effects of the set-up of new businesses on regional development. The third section then provides an overview of the empirical evidence attained thus far and the fourth section deals with data and measurement issues. Results concerning the time lag distribution of the effects that new firm formation has on regional employment are reported in the fifth section. Finally, the sixth section discusses implications of the findings for public policy and proposes some issues for further research.

POSSIBLE EFFECTS OF NEW BUSINESS FORMATION ON REGIONAL GROWTH

The relationship between new businesses and economic development is quite complex. Analysing 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. Fig. 1 overviews the different types of impacts that new firm formation can have on economic development.

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 labelled as the *direct effect* of new capacities. Two types of *exits* can result from the entry of new capacities. First, there are new businesses that fail to be sufficiently competitive and thus have to leave the market after some time. Second, there is the crowding out of incumbents by

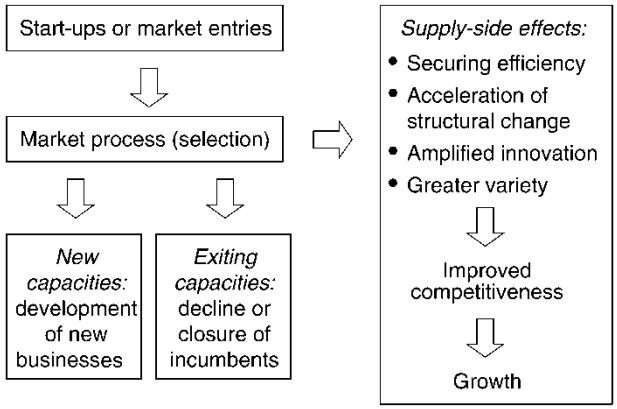

Fig. 1. *New business formation and the market process*

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:

- 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 *et al.*, 1988).
- 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.[3] This type of process has been put forward by SCHUMPETER's (1911/34, 1942) concept of 'creative destruction' and by MARSHALL's (1920) analogy of a forest in which the old trees must fall to give way to the new ones.
- 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 programme than they are in searching for new opportunities (GEROSKI, 1995, p. 431). Another explanation could be that to set up one's own business might appear to be the only or the most promising possibility to commercialize knowledge (AUDRETSCH, 1995).
- Innovative entry: may lead to a greater variety of products and problem solutions. If the product programmes 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 available beforehand. Increased variety due to new supplies may stimulate an intensified division of labour as well as follow-up innovation and in this way can generate significant impulses for economic development.

These supply-side effects of the new business formation process augment the regional knowledge stock and can 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 provide a given amount of output more efficiently than before and, insofar as labour productivity rises, this implies less employment. However, while such a labour-saving effect of increased efficiency may occur, it also concurrently results in improved competitiveness which may lead to rising output. Such a labour-saving effect can be regarded favourable from a growth perspective because 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 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 can 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 favours 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 (for a review of the evidence, see Caves, 1998). A high probability of failure could, however, have a negative effect if it was 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 that 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.

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 that combine the information on entry and exit 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, which is 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 subsectors, 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 (Baldwin, 1995; Disney *et al.*, 2003; Foster *et al.*, 2001; for a review, see 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 *et al.*, 2003).

Most 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 (for an overview, see Carree and Thurik, 2003, pp. 457–463). Ashcroft and Love (1996) detected evidence that entrepreneurship had a positive effect on employment change in Great Britain in the 1980s. Davidsson *et al.* (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.[4] 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 about 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 was positively shaped by new business formation from several of the earlier periods. According to their results, the magnitude of the effects over time took the form of an inverse 'U-shape' with a peak for the start-up activity from 5 years earlier. After 10 years, no effect of new firm formation on regional employment could be identified. Audretsch and Keilbach (2004) analysed 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 was quite pronounced. Because their analysis was only for 1 year, they could not examine the significance of a time lag in the relationship.

Audretsch *et al.* (2001) investigated the impact of changes in self-employment on unemployment for 23 Organisation for Economic Co-operation and Development (OECD) countries on a national level.[5] While they found some unemployment-reducing effects of increased self-employment, their analysis also showed 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 8 years show a stronger relationship between these indicators than do regressions for values calculated over 4 years. If calculations are based on 12 years, the impact of changes of self-employment on the unemployment rate becomes even more pronounced.

A number of studies analysing the effect of turbulence on regional productivity also found positive effects (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.

It is concluded 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.

DATA AND MEASUREMENT APPROACH

The present data on new business formation and regional development of employment is from the establishment file of the German Social Insurance Statistics (for a description, see FRITSCH and BRIXY, 2004). This database provides information about all establishments with at least one employee subject to obligatory social insurance. Currently, the information on West Germany is available yearly for a relatively long period of 20 years, from 1983 to 2002. Because the database records only businesses with at least one employee, start-ups consisting only of owners are not included. New businesses are excluded with more than 20 employees in the first or second 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. 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 the data to also be regarded as an indicator for regional entrepreneurship (FRITSCH and BRIXY, 2004; for analyses, see FRITSCH and GROTZ, 2002).

Other data used in the analysis are from publications of the Statistisches Bundesamt (German Federal Statistical Office). Analysis is restricted to West Germany for 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 with West Germany (cf. BRIXY and GROTZ, 2004; FRITSCH, 2004). Second, to determine the indirect effects of new business formation, one relies on a long period for West Germany for which data are not existent for East Germany.[6] The spatial units of analysis are the 326 West German *Kreise* (districts). 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 that allows for more sophisticated empirical analyses. A severe disadvantage could be that certain influences prove relevant for larger spatial units than districts, resulting in autocorrelation across regional borders. Indeed, the present authors have found quite a considerable degree of spatial autocorrelation that was explicitly accounted for in the analysis.

The indicator for regional development (%) is relative employment change in the private sector. To avoid disturbances by short-run fluctuations, change rate over 2 years is used 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 'labour 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.[7] An important adjustment was made to control for the fact that not only does the composition of industries differ considerably across regions, but also that the relative importance of start-ups and incumbent enterprises 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 (for details, see AUDRETSCH and FRITSCH, 2002, appendix). 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 was identical across all regions. Thus, the measure adjusts the raw data by imposing the same composition of industries upon each region. Analysis shows 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.

Panel estimation techniques were used that allowed one to account for unobserved region-specific factors. Application of the Huber–White method provided robust standard error estimates. To analyse the impact of new business formation on regional employment change, the yearly start-up rates at the beginning of the inspected employment change periods (current year) and for the 10 preceding years were included. A rather strong correlation was found between start-up rates of subsequent years (see the Appendix, Table A1); all correlation coefficients for the relationship between start-up rates were statistically significant at the 1% level. To cope with this strong correlation, Almon polynomial lags were applied to estimate the time lag structure of the effect of new firm formation on

regional employment change (for a detailed description of this method, see GREENE, 2003). Besides start-ups, other variables for regional characteristics that might have been relevant for employment change, such as population density, did not prove to have any statistically significant effect and were therefore not included.[8] However, when the model was estimated for agglomerations, moderately congested areas and rural regions separately,[9] differences in the magnitude of effects were found (see below).

DISTRIBUTION OF TIME LAGS

To shed light on the lag structure of the effect of new business formation on regional employment change, a model was first estimated 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 10 years. Because of a relatively high level of correlation between the start-up rates of subsequent years, the impact of each lagged start-up rate was also analysed separately (Table 1). When including all start-up rates in one model, the highest positive impact for new business formation of the current year and of the years $t-6$ and $t-7$ were found, i.e. the start-up rates of 6 and 7 years ago. Remarkably, the start-up rates of periods $t-3$ 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 (Fig. 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, it was found that there was 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 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 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 ($t-9$ and $t-10$) are not statistically significant.

Spatial autocorrelation was accounted for in two different ways (cf. ANSELIN, 1988; ANSELIN and FLORAX, 1995). First, an average of the residuals in the adjacent regions was included that could be an indication of unobserved influences that affect larger geographical entities than districts and that are not entirely reflected in the explanatory variables (cf. Table 1). Second, spillover effects when measured as an average of the employment change in the adjacent districts were employed to account for determinants of employment change not limited to the particular region. Both indicators of spatial autocorrelation resulted in the same lag structure, yet the magnitude of the positive effects was 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, the model with fixed effects regression was applied (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 was 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 not only in this specific year, but also in other years. Almon polynomials were applied to cope with this problem.[10] This method reduces the effects of multicollinearity in distributed lag settings by imposing a particular structure on the lag coefficients. It is assumed that the effect of changes in yearly start-up rates will be distributed over 11 years because regression analyses of lagged start-up rates suggested that the impact on employment change has more or less faded away after that period (Table 1).

A rather critical issue in applying the Almon lag procedure is determining which type of polynomial to assume. Table 2 has the results of the robust regressions when applying the Almon method with a polynomial lag of second, third, fourth and fifth order. Fig. 3 is a graphical exposition of the estimated lag structures that results from the different types of polynomials assumed. It was 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 $t-7$ are negative. The entries of the last 3 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 the observation from standard regressions (Table 1), namely that this impact, after having reached a maximum, is becoming increasingly smaller over the years until it has faded away.

Assuming a third-order polynomial leads to a quite different type of lag structure that can also be found for fourth- and fifth-order polynomials.[11] This pattern

Table 1. *Impact of new business formation on regional employment change*

	Two-year regional employment change (%)											
Constant	−1.28**	−0.47*	−0.26	−0.72**	−0.91**	−1.01**	−1.22**	−1.67**	−2.22**	−2.62**	−2.17**	−1.06**
	(3.13)	(1.98)	(1.10)	(3.00)	(3.83)	(4.13)	(4.88)	(6.52)	(8.12)	(9.36)	(7.25)	(3.09)
Start-up rate, current year t	0.55**	0.25**	—	—	—	—	—	—	—	—	—	—
	(6.65)	(9.75)										
Start-up rate, year $t-1$	−0.29**	—	0.23**	—	—	—	—	—	—	—	—	—
	(5.12)		(9.23)									
Start-up rate, year $t-2$	0.06	—	—	0.29**	—	—	—	—	—	—	—	—
	(0.78)			(11.04)								
Start-up rate, year $t-3$	−0.31**	—	—	—	0.31**	—	—	—	—	—	—	—
	(4.07)				(11.57)							
Start-up rate, year $t-4$	—0.48**	—	—	—	—	0.31**	—	—	—	—	—	
	(6.60)					(11.27)						
Start-up rate, year $t-5$	−0.16*	—	—	—	—	—	0.32**	—	—	—	—	—
	(2.28)						(11.50)					
Start-up rate, year $t-6$	0.31**	—	—	—	—	—	—	0.32**	—	—	—	—
	(3.95)							(11.63)				
Start-up rate, year $t-7$	0.35**	—	—	—	—	—	—	—	0.31**	—	—	—
	(4.73)								(10.57)			
Start-up rate, year $t-8$	0.13*	—	—	—	—	—	—	—	—	0.29**	—	—
	(1.93)									(9.87)		
Start-up rate, year $t-9$	−0.03	—	—	—	—	—	—	—	—	—	0.24**	—
	(0.40)										(7.43)	
Start-up rate, year $t-10$	0.02	—	—	—	—	—	—	—	—	—	—	0.15**
	(0.26)											(4.08)
Spatial autocorrelation	0.48**	0.79**	0.80**	0.81**	0.81**	0.81**	0.81**	0.80**	0.72**	0.64**	0.66**	0.63**
(residuals in adjacent regions)	(8.01)	(31.44)	(31.57)	(31.69)	(30.74)	(30.24)	(29.90)	(29.76)	(19.45)	(15.25)	(15.69)	(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	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 (number of observations per district)	2608 (8)	5868 (18)	5542 (17)	5216 (16)	4890 (15)	4564 (14)	4238 (13)	3912 (12)	3586 (11)	3260 (10)	2934 (9)	2608 (8)

Notes: Robust Huber–White estimates; t-values are in parentheses.
Statistically significant at: **1 and *5% levels.

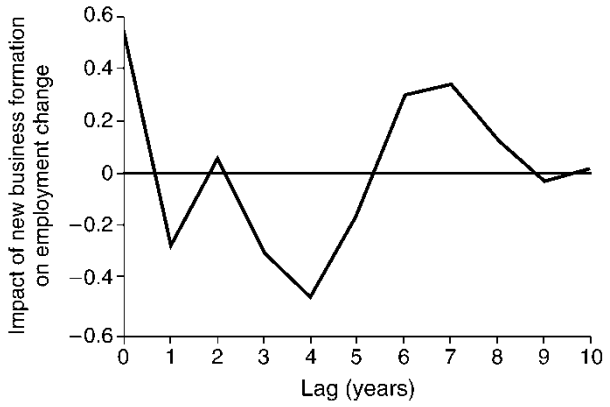

Fig. 2. Structure of the impact of new business formation on regional employment growth based on a regression that accounts for entry rates over 11 years

suggests that new business formation of the current year has a positive impact on employment change. For years $t-1$ to $t-5$, the effect is negative with a minimum in $t-3$. For the entries in years $t-6$ to $t-9$, a positive relationship is found with a maximum between $t-7$ 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.

The pattern found for the lag distribution of the impact of new business formation on regional employment suggests a certain time sequence of the different effects detailed above. First, an interpretation of the results of the model with the third-order polynomial will be given and then this reading will be applied to the pattern 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 created in the newly founded businesses at the time of inception. This direct employment effect is given by area I in Fig. 4. It is known 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 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. It may therefore be assumed that the negative impact of the start-ups in years $t-1$ to $t-5$ (Fig. 4, area II) 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 (Fig. 4, area III). After about 9 or 10 years, the impact of new businesses on regional employment has faded away. The authors have no plausible explanation for the slightly negative value 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 found when

Table 2. Impact of lagged start-up rates on regional employment change

	Two-year regional employment change (%)			
	Almon method assuming a polynomial of:			
	Second order	Third order	Fourth order	Fifth order
Constant	−1.21** (3.06)	−1.19** (2.95)	−1.21** (2.99)	−1.20** (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 (residuals in adjacent regions)	0.60** (13.01)	0.52** (9.68)	0.51** (9.56)	0.51** (9.45)
R^2	0.18	0.16	0.16	0.16
F	53.13	53.21	45.55	39.01
Number of observations (number of observations per district)	2608 (8)	2608 (8)	2608 (8)	2608 (8)

Notes: Robust Huber–White estimates; t-values are in parentheses.
Statistically significant at: **1 and *5% levels.

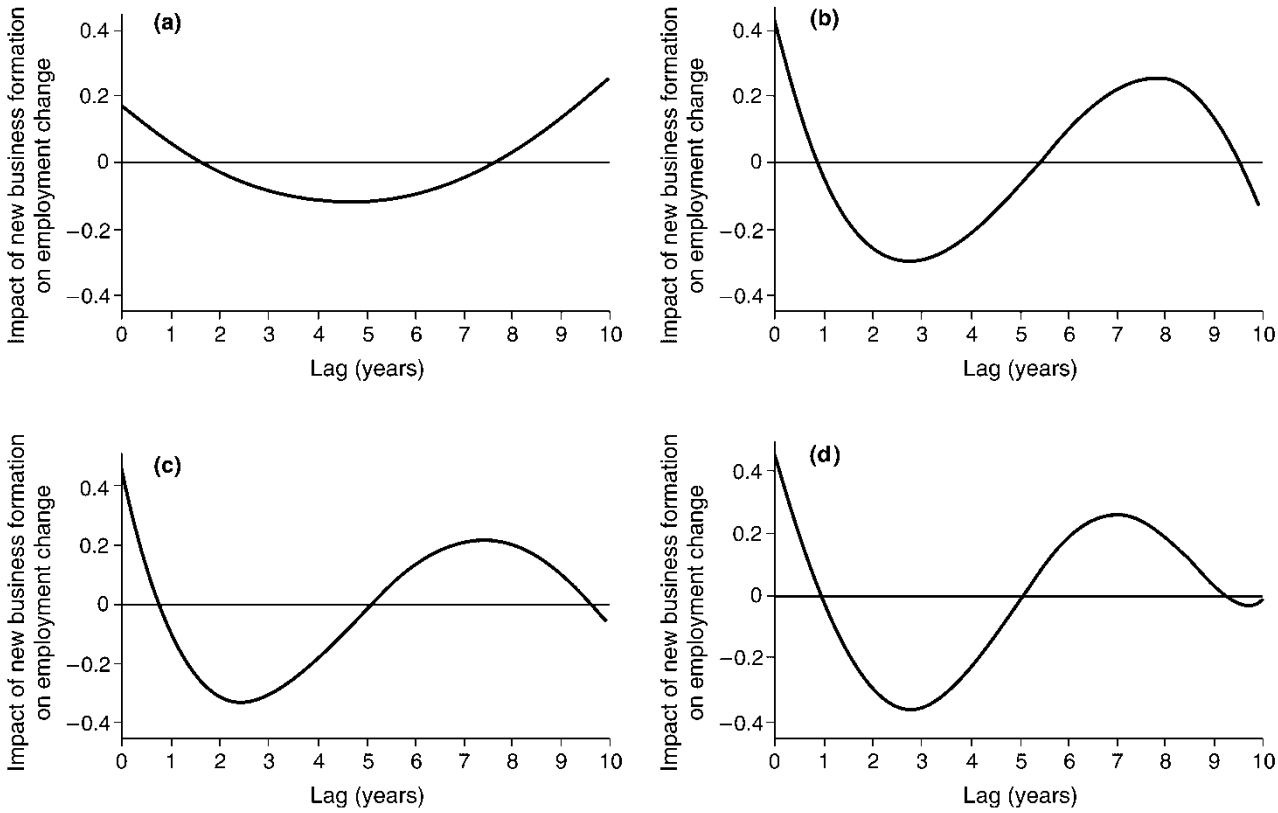

Fig. 3. *Lag structure of the impact of new business formation on regional employment growth: (a) second-order polynomial, (b) third-order polynomial, (c) fourth-order polynomial and (d) fifth-order polynomial*

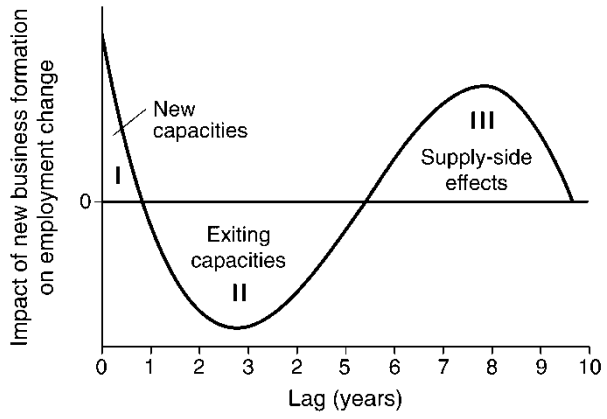

Fig. 4. *Direct and indirect effects of new business formation on employment change over time*

assuming a second-order polynomial is quite similar, particularly regarding the direct effect of new business employment and the crowding out effects. In addition, 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 increasingly stronger without decreasing again in the more backdated years. As mentioned, this latter pattern appears highly implausible 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 by definition can only possess one inflection point.

If the 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 Fig. 3 that represents the indirect supply-side effect is always larger than that of the initial employment effect. This is particularly clear if the supply-side effects are compared with the net effect of new capacities and exiting capacities given by area I minus area II in Fig. 4. Because one cannot account for those parts of the supply-side effects that occur in other regions, this type of impact is probably underestimated herein. However, if the true supply-side effects are considerably larger than what has been estimated, it can be concluded that this effect is the most important result of new business formation for economic development. In addition, the crowding out effect is also likely to be underestimated because the decreasing output of incumbents might also occur in other regions or cross industry boundaries.

Estimates of variations of the model and for subsamples arrived at some interesting results. For example, the impact of entrepreneurial activity on employment change for longer time lags was analysed. Testing for

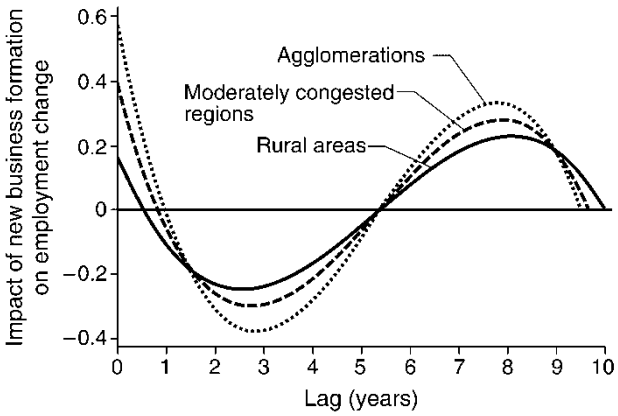

Fig. 5. *Effects of new business formation on employment change in different types of region*

12-year lags showed plausible estimates only for a third-order polynomial. Results of models that assumed a 14-year 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 years $t-7$ to $t-9$ had the strongest positive impact on employment change.[12]

Estimating the present model separately for high-density agglomerations, moderately congested regions and rural areas showed some variation according to population density (Fig. 5). 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, were found. 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. The present interpretation is supported by the analysis of Fritsch and Falck (2002), who found a positive relationship between the level of new business formation and population density. Moreover, Fritsch *et al.* (2004) also showed that survival rates of start-up cohorts are significantly lower in regions characterized by high entry rates. Quite obviously, entry leads to intensified competition and selection. As in the basic model (Table 2), the start-ups of year $t-8$ exhibit the strongest positive affect employment for all three types of regions.[13] 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 (Fig. 4, area I) 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 *et al.*, 2004). The present authors 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.[14]

To restrict the analysis to the long-term effects, only start-up rates of years $t-4$ to $t-10$ were included in regressions and a second-order polynomial was applied. This corresponds to the model used in the analysis of Van Stel and Storey (2004). Interestingly, this results in an inverse U-shape lag structure that is quite similar to what was found by Van Stel and Storey. In the present analysis, however, the highest positive impact of new businesses on employment is again found for the start-ups of years $t-7$ and $t-8$.[15] This is in contrast to the estimates of Van Stel and Storey (2004), where the start-up rate of year $t-5$ has the strongest effect. To capture spillover effects, the impact of new business formation activity in adjacent regions was tested by including the start-up rates in these regions as independent variables.[16] The result revealed there to be a tremendous effect of start-ups in adjacent regions on a region's employment.

FINAL DISCUSSION

This paper has investigated the lag structure of the effect of new business formation on regional employment change. The 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 the present analysis, the indirect supply-side effects of entries are far more important than the amount of jobs directly created in the new businesses. As 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 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 might make an important contribution. It is the contestability of markets that counts.

The 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 in subsequent years are 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 6 or 7 years might 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 can 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, one might 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, pp. 39–64; WINTER, 1984). In an entrepreneurial regime, it should be easier for newcomers seriously to 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 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 the failure of newcomers and market exits should be understood as necessary elements of market selection and that policy should abstain from subsidizing firms 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 might, 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 the present argument concerning the different effects and the respective period 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 induced by entry? What could policy do to improve these effects? 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 the present interpretation of the empirical results attained is correct, it would be expected 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. Further research should also try to shed more light on the sources of the considerable spatial autocorrelation that were found in the present analysis.

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NOTES

1. For an analysis at the regional level, there are important differences between new firms and new establishments. One difference relates to the location of entrepreneurship. While both the set-up of new firms and the set-up of subsidiary establishments involve some entrepreneurship, it will be mainly sited at the firm's headquarters. The erection of a new branch plant in a region might, therefore, not be regarded there as an indication for entrepreneurship. Moreover, the location decision for a subsidiary could be influenced by factors rather different from those that determine the location of a new firm's headquarters. Restricting empirical analysis to the firm level by including only new headquarters could largely make 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 might have for regional development. The paper uses the term 'new business' as the overall category for both new firm headquarters and new subsidiaries. The present empirical data include these two categories of new entities.
2. As compared with the data analysed by AUDRETSCH and FRITSCH (2002), the present paper has a longer time series of data available and analysis for smaller spatial units (districts instead of planning regions) is performed.
3. 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; PFIRRMANN and WALTER, 2002).
4. 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 might indicate the share of recently established firms.
5. Unemployment might 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 the age of the work force, development of labour force participation rates and mobility between regions or countries.
6. The Berlin region was excluded due to changes in the definition of that region during the inspected period.
7. For different approaches of calculating start-up rates, see AUDRETSCH and FRITSCH (1994).
8. Population density can be regarded as a proxy variable

for all kinds of regional characteristics such as the availability of qualified labour, housing prices, local demand and the level of regional knowledge spillovers.

9. The definition of the type of region is taken from the Bundesamt für Bauwesen und Raumordnung (Federal Office for Building and Regional Planning, 2002) and is based upon the population density of the district and the total population of a core city.
10. For a similar approach, see Van Stel and Storey (2003).
11. The model with the fifth-order polynomial has a comparatively low level of statistical significance.
12. Relative employment change, the dependent variable in our analysis, was also calculated for only 1 year, as well as over 3, 4 and 5 years. Results showed that the magnitude of the effects is the highest the shorter the period chosen for calculating the employment change. However, these differences decrease with the period taken for measuring employment change, so that the results of models for employment change calculated over 3 and 4 years are quite similar. The lag structure of the different models is rather akin.
13. Running the model for regions with both relatively high and 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.
14. The effects of entries in either manufacturing or services on employment change in the private economy as a whole were also tested. The result showed quite similar long-term effects of new business formation and suggests its impact is not limited to the respective sector or industry.
15. Including start-up rates for more recent years than $t-4$ does not lead to an inverse-'U' lag structure but to the 'U' form reported in Table 2 and Fig. 3.
16. 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. Almon polynomial lags were also applied to these start-up rates of adjacent regions.

APPENDIX

Table A1. *Correlation matrix of sector-adjusted start-up rates for subsequent 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

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

Table A2. *Impact of new business formation on regional employment change*

	Two-year regional employment change (%)											
Constant	−17.26**	−1.44**	0.77*	−1.44**	−0.83	−0.28	−0.47	−0.72	−1.27	−2.70**	−2.73**	−0.86
	(7.32)	(4.47)	(2.19)	(3.06)	(1.66)	(0.52)	(0.81)	(1.19)	(1.95)	(3.91)	(3.73)	(1.05)
Start-up rate, current year *t*	0.82**	0.38**	–	–	–	—	—	—	—	—	—	—
	(13.09)	(10.01)										
Start-up rate, year *t*−1	−0.21**	—	0.12**	—	—	—	—	—	—	—	—	—
	(3.06)		(2.92)									
Start-up rate, year *t*−2	0.44**	—	—	0.39**	—	—	—	—	—	—	—	—
	(4.00)			(6.79)								
Start-up rate, year *t*−3	−0.05	—	—	—	0.30**	—	—	—	—	—	—	—
	(0.51)				(4.97)							
Start-up rate, year *t*−4	−0.30**	—	—	—	—	0.22**	—	—	—	—	—	—
	(2.91)					(3.41)						
Start-up rate, year *t*−5	0.01	—	—	—	—	—	0.23**	—	—	—	—	—
	(0.10)						(3.25)					
Start-up rate, year *t*−6	0.52**	—	—	—	—	—	—	0.21**	—	—	—	—
	(5.17)							(2.85)				
Start-up rate, year *t*−7	0.55**	—	—	—	—	—	—	—	0.20*	—	—	—
	(5.56)								(2.49)			
Start-up rate, year *t*−8	0.19	—	—	—	—	—	—	—	—	0.30**	—	—
	(1.88)									(3.63)		
Start-up rate, year *t*−9	0.01	—	—	—	—	—	—	—	—	—	0.31**	—
	(0.07)										(3.49)	
Start-up rate, year *t*−10	0.11	—	—	—	—	—	—	—	—	—	—	0.13
	(1.04)											(1.27)
Spatial autocorrelation	0.44**	0.80**	0.81**	0.82**	0.82**	0.82**	0.82**	0.82**	0.73**	0.64**	0.67**	0.64**
(residuals in adjacent regions)	(12.67)	(63.90)	(61.81)	(63.37)	(61.36)	(59.61)	(57.80)	(53.48)	(37.36)	(25.74)	(26.45)	(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	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 (number of observations per district)	2608 (8)	5868 (18)	5542 (17)	5216 (16)	4890 (15)	4564 (14)	4238 (13)	3912 (12)	3586 (11)	3260 (10)	2934 (9)	2608 (8)

Notes: Estimates with fixed effects; *t*-values are in parentheses.
Statistically significant at: **1 and *5% levels.

Table A3. *Impact of lagged start-up rates on regional employment change*

	Two-year regional employment change (%)			
	Almon method assuming a polynomial of:			
	Second order	Third order	Fourth order	Fifth order
Constant	−17.18** (7.54)	−14.99** (6.45)	−15.37** (6.59)	−15.26** (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 (residuals in adjacent regions)	0.61** (22.01)	0.52** (16.20)	0.51** (16.04)	0.51** (15.85)
R^2	0.05	0.05	0.05	0.05
F	146.63	101.46	84.82	72.39
Number of observations (number of observations per district)	2608 (8)	2608 (8)	2608 (8)	2608 (8)

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

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