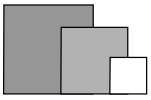
Research Report 0108

Startup activity and employment growth in regions



SCALES
SCientific AnaLysis of Entrepreneurship and SMEs

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Contents

Summary

A number of studies argue that in the last 25 years or so the innovative advantage has moved from large, established enterprises to small and new firms, because new technologies have reduced the importance of scale economies in many sectors. Also, an increasing degree of uncertainty in the world economy from the 1970s onwards has created more room for new-firm startups, trying to exploit new ideas. This bigger role in technological development for new-firm startups at the cost of large incumbent firms is sometimes indicated as the 'Schumpeterian regime switch'. An implication of this switch is that the contribution of new and small firms to economic growth increases. This hypothesis motivates the present report where we investigate whether the regime switch can be established empirically. We estimate a model in which employment growth is explained by startup activity and some controls, using a data set for 60 British regions in the period 1980-1998. Within this period we analyze different subperiods to investigate whether the impact of new-firm startups on growth has changed during the last two decades of the 20th century.

In our empirical work, we pay attention to the question which variable should be used to normalize regional startup rates, i.e., stock of businesses or regional workforce. We correct for different sector structures in different regions that may influence the perceived impact of startups on economic growth. Furthermore, we correct for reversed causality, i.e., the possibility that high correlations between startup activity and economic growth may reflect that regions performing well attract new businesses instead of new-firm startups contributing to regional growth.

We find evidence for a positive short-term effect of startup activity in the *late 1980s* and *early 1990s* on subsequent employment change, irrespective of macro-economic conditions, i.e., recession or boom periods. We do not find convincing evidence for a short-term effect of new businesses started in the *early 1980s*. But we do find a positive effect of these latter startups on employment change between 1991 and 1998, suggesting the existence of a long-term effect.

Our results for Great Britain show similarities to those found by Audretsch and Fritsch (2002) for German regions. They also find no effect of new-firm formation on employment growth in the 1980s but a significant positive effect in the 1990s. Furthermore, they also find evidence for a long-term effect of startup activity in the 1980s on growth in the 1990s. The bigger impact of new-firm startups on growth in the 1990s compared to the 1980s suggests that Great Britain and Germany might have moved from (more) 'managed' to (more) 'entrepreneurial' types of economies between the last two decades of the 20th century. This regime switch involving the increased positive employment impact of new-firm startups in Great Britain and Germany in the 1990s might induce policy makers in other countries as well to reconsider the role of new-firm startups in employment creation.

1 Introduction

An important question for policy makers at the regional level is the following: what is the engine of regional growth - large, established enterprises or new-firm startups? The answer to this question is crucial because it dictates the focus for the investment of regional economic development resources (Audretsch and Fritsch, 2002). For example, Schumpeter (1942) argues that the innovative advantage lies with large, incumbent enterprises (*creative accumulation* or Schumpeter Mark II regime). However, in his earlier work, Schumpeter (1912) argues that the innovative advantage lies with small, new enterprises (*creative destruction* or Schumpeter Mark I regime). The extent to which either of the two Schumpeterian technological regimes prevails in a certain period and industry varies. It may depend upon the nature of knowledge required to innovate, the opportunities of appropriability, the degree of scale (dis)economies, the institutional environment, the importance of absorptive capacity, demand variety, etc. (Carree, Van Stel, Thurik and Wennekers, 2002). Empirical studies on the link between entrepreneurship and economic growth can shed light on the question which Schumpeter regime prevails in a certain period and industry.

There are various strands in the empirical literature showing the effect of entrepreneurship on economic growth (Carree and Thurik, 2002). We will concentrate on three strands of empirical research. A *first* strand of research concentrates on the effect of (changes in) size-distribution in regions on subsequent economic growth. In case a region has a larger share of small firms when compared to another region this could indicate a higher level of entrepreneurial activity. Carree and Thurik (1998) show that the share of small firms in manufacturing industries in European countries in 1990 has had a positive effect on the industry output growth in the subsequent four years. Audretsch, Carree, Van Stel and Thurik (2002) find evidence for 17 European countries that the consequences for economic growth of not shifting the industry structure away from large business towards small business have been rather large.

A *second* strand concentrates on the effect of the number of self-employed (business owners) on subsequent growth. Carree, Van Stel, Thurik and Wennekers (2002) show that countries that deviate from the "equilibrium" business ownership rate for comparable levels of economic development suffer in terms of economic growth.

The present paper makes a contribution to a *third* strand of entrepreneurship and growth literature. This strand concentrates on the effect of market dynamics on economic growth. An obvious indicator for the extent of market dynamics in an economy is the amount of startup-activity. New-firm startups (entries) contribute to economic growth by increasing competition and introducing new innovative products. In the present study we use the number of new-firm startups (gross-entry) as indicator of market dynamics. Two other measures, net-entry and turbulence, are briefly discussed in Section 3.3.

Our analyses are inspired by Audretsch and Fritsch (2002) who use data on new-firm startups and employment change at the regional level for Germany, over the period 1983-1998. They investigate the impact of startups on growth in two ways. First, they classify regions in different types of 'growth regimes'. The regimes differ in the relative amount of startup activity and the level of economic growth, resulting in four quadrants ('growth regimes'). Differences between the 1980s and the 1990s are analyzed. Second, they apply regression analysis to establish the relationship between new-firm startups and (net) employment change.

In the present paper we follow the latter approach, i.e., we compute regressions in order to establish the impact of new-firm startups on employment change for Great Britain.[1] We make use of a unique data set for 60 British regions over the period 1980-1998. The 60 regions cover the whole of Great Britain. The length of our study period enables to investigate long-term effects of new-firm formation on economic growth. We pay special attention to three measurement issues. The *first* issue involves the question whether business stock or labour force should be used to normalize startup rates of different regions. The *second* issue involves a shift-share adjustment to take account of the fact that different sectoral structures may influence the perceived impact of startups on economic growth. The *third* issue involves the way in which the extent of market dynamics should be measured, i.e., whether gross-entry, net-entry, or turbulence should be used.

The organization of this paper is as follows. Section 2 discusses some theories about entrepreneurship and economic growth. Section 3 outlines the model to be estimated and discusses the above-mentioned measurement issues. Section 4 deals with the data and the construction of the various model variables. Section 5 presents and interprets the estimation results. It also discusses results from some related studies. The final section is used for discussion.

[1] The quadrant approach as proposed by Audretsch and Fritsch (2002) is replicated for Great Britain in Appendix 5 to this report.

2 Theory

Joseph Schumpeter's contribution to our understanding of the mechanisms of technological progress and economic development is widely recognized. In *The Theory of Economic Development* he emphasizes the role of the entrepreneur as prime cause of economic development. He describes how the innovating entrepreneur challenges incumbent firms by introducing new inventions that make current technologies and products obsolete. This process of *creative destruction* is the main characteristic of what has been called the Schumpeter Mark I regime (Schumpeterian entrepreneurship). In *Capitalism, Socialism and Democracy*, Schumpeter focuses on innovative activities by large and established firms. He describes how large firms outperform their smaller counterparts in the innovation and appropriation process through a strong positive feedback loop from innovation to increased R&D activities. This process of *creative accumulation* is the main characteristic of what has been called the Schumpeter Mark II regime.[1]

Because of the different implications for regional policies, an important question is which of the two Schumpeter regimes –creative destruction or creative accumulation- is dominant. Nelson and Winter (1982) argue that both regimes can occur but that the opportunities for a particular industry in a particular region depend on the specific knowledge conditions that prevail in that industry in that region. For example, are there principal–agent problems in evaluating the expected value of new ideas? If there are none, then there is little reason to start a new firm, and the innovative advantage might well lie with large incumbent enterprises. However, if there *are* such agency problems, then new-firm startups are more likely to occur and the innovative advantage might well lie with small and new firms.

Important developments like globalization, the ICT revolution and the increased role of knowledge in the production process have led to an increasing degree of uncertainty in the world economy from the 1970s onwards (Audretsch and Thurik, 2001). As a result of this uncertainty, agency problems as described above may indeed occur more often at present and hence, there may be more room for new-firm startups. These new firms can enhance growth by creating newness. In modern economies a great variety of young firms is involved in making innovative products. This is the case especially in niche markets (for example the biotechnology industries). The more firms are active in such markets, the greater the chance that an innovation takes place. Variety and selection play a role in this mechanism. Through these innovations new businesses can help increasing economic growth. The bigger role in technological development for small and new firms during the last 25 years or so is discussed in various studies. For instance, Piore and Sabel (1984) claim that an 'Industrial Divide' has taken place. Jensen (1993, p.835) considers it the period of the 'Third Industrial Revolution'. Audretsch and Thurik (2001) refer to a change from a 'managed' to an 'entrepreneurial' economy.

The studies mentioned above all point at an increased role of small and new firms in the process of innovation and economic growth. However, empirical support for a link between startup activity and economic growth is limited. In particular, empirical evidence using long-run data (for example spanning a 20 year period) is scarce. Making use of long-run data is important because of the time lags involved in the impact of startups on growth. To our knowledge, Audretsch and Fritsch (2002) are the only authors who make use of a long-run data set. Their research concerns Germany in the

[1] This paragraph is derived from Carree, Van Stel, Thurik and Wennekers (2002).

period 1983-1998. The present study investigates the contribution of new-firm startups to economic growth in Great Britain in the period 1980-1998.

In investigating the link between new-firm startups and economic growth we realize that only a small proportion of new and small firms can be considered innovative, perhaps making the number of startups a somewhat rough indicator for 'Schumpeterian entrepreneurship'. However, assuming the proportion of innovative entries in total entries constant across regions, the number of new-firm startups can be considered a useful indicator.

3 Model

In this section we present our regression model. Basically, we want to link startup activity in a certain period to economic growth (measured as employment change) in the subsequent period, at the level of British regions. We employ a number of control variables in order to avoid possible omitted variable bias. The explanatory variables with the expected sign of their effects are discussed below.

Startup rate. This is the main interest of the current study. The sign of the estimated parameter gives an indication which of the two Schumpeter regimes is prevalent in Great Britain in the period that we study. We have no expectation a priori.

Population density. As this variable is highly correlated with a number of factors like wage level, real estate prices, quality of communication infrastructure, diversity of the labour market, qualification of the workforce and the share of small businesses, the impact on growth of this variable is not a priori clear (Audretsch and Fritsch, 2002). Without claiming to understand all processes involved here, we include density in our model in order to avoid possible omitted variable bias.

Share of population having a job. Assuming that there is a strong positive correlation between total population and total labour force of a region, we interpret this variable as being the complement of the unemployment rate. The variable controls for reversed causality, i.e., the possibility that regions which perform well (as reflected by a high share of population having a job) attract new businesses.[1] If this variable is omitted from the equation, then this effect is (erroneously) captured by the startup activity variable.[2]

Lagged employment change. This variable has the same function as the employment share variable above. That is, it controls for reversed causality. However, in this case, (past) performance is measured in a dynamic fashion (i.e., lagged growth), instead of in a static fashion (i.e., unemployment).

Scotland/Wales dummy. Scotland and Wales seem to be structurally different from England, in the sense that the numbers of firm births are generally lower in these areas. This may be caused by a more negative attitude in Scotland and Wales towards entrepreneurship than elsewhere, creating an unfavourable 'culture' for starting a business (for Scotland, see Fraser of Allander Institute 2001). As the economies of Scotland and Wales, ceteris paribus, may have performed worse than the English economy in the period that we study, it may be necessary to control for these areas in the model. The expected sign of the dummy is negative.

[1] The argument here is that such prosperous regions are more attractive locational choices to start a new business than less prosperous regions because potential demand is higher.

[2] This can be seen as follows. Assume that the following three statistical relationships exist. *First*, startup activity influences subsequent employment change positively (the relationship we are interested in). *Second*, employment share influences subsequent startup activity positively (regions performing well attract new businesses). *Third*, employment share influences subsequent growth positively (business cycle effect, i.e., regions that perform well in a given period, keep performing well in the next period). Now, if we leave the employment share variable out of the model, the last-mentioned effect will (at least partly) be captured by the startup activity variable, thereby overestimating the impact of startup activity on employment change. This is due to the second (reversed causality) effect.

3.1 Business stock approach versus labour market approach

An important issue in research involving startup activity at the regional level is how startup rates are measured. The numerator is some indicator for the absolute level of startup activity in a region like the number of VAT registrations. But which variable should be used as denominator? The denominator should both control for the different absolute sizes of the regions concerned, and represent the source from which startups or firm formations are most likely to come (Ashcroft, Love and Malloy, 1991). Two variables which are often used as denominator are the stock of existing firms and the size of the regional workforce. We call these two choices for denominators the business stock approach and the labour market approach, respectively. The business stock approach assumes that new firms somehow arise from existing ones, whereas the labour market approach assumes that new firms arise from (potential) workers.[1] The distinction is not only important from a theoretical point of view but also from an empirical point of view. For example, for a given number of startups, regions which are equally large in terms of workforce but which are different in terms of average firm size, will have the same startup rate according to the labour market approach but different startup rates according to the business stock approach.[2] The choice of approach may thus influence research outcomes. Audretsch and Fritsch (1994) show that, for a sample of regional markets in West Germany, the statistical relationship between unemployment and startup activity crucially depends on the method used to measure startup rates, i.e., using the business stock approach or the labour market approach.[3] To see whether results differ between the two methods for our model as well, we apply both methods.

3.2 Shift-share adjustment

Besides the question which denominator should be used in measuring startup rates, we pay attention to another important empirical question. This involves the question whether or not a correction should be made for the fact that different regions have different sectoral structures and hence, different potentials to have high numbers of startups. For example, startup rates are higher in service industries than in manufacturing industries (Audretsch and Fritsch, 2002). So, regions with a high share of services in the local economy are more likely to have higher startup rates for the region as a whole than regions with a low service share. But this does not necessarily mean that these regions are also more 'entrepreneurial', in the sense that startup rates are higher for each sector of the local economy (or most sectors of the local economy). Therefore, to correct for different sectoral structures, we apply a shift-share procedure, as described by Ashcroft, Love and Malloy (1991), to arrive at a measure of sector adjusted startup activity. This sector adjusted number of startups is defined as the number of new firms in a region that can be expected to be observed if the composition of industries was identical across all regions. Thus, the measure adjusts the raw data by imposing the same composition of industries on each region (Audretsch and Fritsch, 2002). In Appendix 3 we give a numerical example illustrating the shift-share procedure. In this paper, we will present results both using unadjusted startup rates and using sector adjusted startup rates.

[1] In Ashcroft and Love (1996), total population is used as denominator. However, the implicit assumption is that new firms may arise from children or elderly persons as well. This seems less plausible.

[2] In Appendix 4 we present a numerical example illustrating the (differences between the) two approaches.

[3] In Audretsch and Fritsch (1994) the business stock approach is called the ecological approach.

3.3 Gross-entry, net-entry or turbulence

An obvious indicator for the extent of market dynamics in an economy is the amount of startup-activity. New-firm startups (entries) contribute to economic growth by increasing competition and introducing new innovative products. Also the number of exits form an important aspect of market dynamics, as high numbers of exits might reflect a process of intensive competition, i.e., incumbent firms being displaced by new firms entering the market. Because of these two separate aspects of market dynamics (entry and exit), three indicators of market dynamics are often used in empirical work relating the extent of market dynamics to the level of economic growth. These indicators are turbulence (entry plus exit), net-entry (entry minus exit) and gross-entry. In the present paper we use gross-entry. By doing so we avoid an important pitfall inherent in using combinations of entry and exit. This pitfall involves that employment impacts of births and deaths are fundamentally different. The biggest difference in the employment impact of births and deaths is obvious from the *direct* effect. The direct employment effect of births is positive whereas the direct effect of deaths is negative. The different employment impacts of births and deaths make combined indicators like net-entry or turbulence less appropriate, as various authors report. As regards net-entry, Ashcroft and Love (1996) state that "a given change in the stock of firms may have a different impact on employment according to the composition of the stock change. The net employment impact of births and deaths is likely to differ so it is inappropriate to constrain their individual effect to be the same, which is the consequence of defining firm births in net terms" (Ashcroft and Love 1996, p. 491). In a study for West-Germany, Fritsch (1996) considers all three market-dynamics indicators. As regards turbulence he states that, due to the often observed high correlations between entries and exits (reflecting processes of displacement and replacement), "the turbulence indicator primarily represents the impact of entries on economic development" (Fritsch 1996, p. 247).
In the present study we use gross-entry as indicator of market dynamics.

4 Variables and data

We use data at the spatial aggregation level of NUTS3 regions in Great Britain. This involves the county level in England and Wales, and the local authority region level in Scotland. In this partitioning, Great Britain is split up in 60 regions. Next, in our data set the regional data are disaggregated at the level of 6 sectors. This enables us to correct for different sector structures in different regions, i.e., to apply the shift-share procedure described in Section 3.2. Due to different regional and sectoral classifications in the crude data files we had to perform some linking operations in order to make data comparable for the whole period 1980-1998. These linking operations and the exact classification schemes employed in our data set are described in detail in Appendix 1. Furthermore, there were some missing data which we had to deal with. This is described in Appendix 2. In our analyses we exclude the agricultural sector from our data, as this sector is fundamentally different from the rest of the economy. The exact variable definitions and their sources are given below. The unit of observation is the region.

(Lagged) Employment change. This is the relative change in regional employment, excluding agriculture, expressed in percentages. Data on employment are taken from the Census of Employment and the Annual Employment Survey and are supplied by Nomis. Employment figures include both full-time and part-time employees, and exclude self-employed workers and unpaid family workers. Employment is measured in September of each year.

Sector adjusted startup rate. This is the sectoral startup rate, weighted by stock of businesses per sector (business stock approach) or employment per sector (labour market approach) *for Great Britain as a whole*. By using this kind of weighting schemes the same sector structure is imposed upon each region. Note that we use regional employment instead of the regional workforce as denominator for the labour market approach. This is due to data limitations (in particular, we do not dispose of regional unemployment data). Startups in the agricultural sector are excluded. Startups and stock of businesses are measured as VAT registrations and stock of VAT registered enterprises, respectively, and are supplied by Small Business Service. In former days these VAT registration data used to be supplied by the Department of Employment. The consistency and general availability of this data source make it the most generally useful source of data on firm formation for the UK as a whole (Ashcroft, Love and Malloy, 1991). Startup rates are expressed as the number of startups per hundred existing firms (business stock approach) or per thousand workers (labour market approach).

Startup rate. The sectoral startup rate, weighted by the appropriate denominator (stock of businesses or employment) *for the region under consideration*. Again, agricultural startups are excluded.

Population density. Data on both population and area of the regions are obtained from the Office for National Statistics.[1] The variable is expressed in thousands inhabitants per squared kilometre.

Share of population having a job. This variable is equal to employment divided by total population, where definitions and sources of employment and population are as described above.[2] The variable is expressed as a fraction (i.e., a number between zero and one). Because this variable is used as an indicator of regional prosperity, agricultural workers are also included.

Scotland/Wales dummy. This dummy variable has value 1 for Scottish or Welsh regions and value 0 otherwise.

[1] Due to data limitations, population in 1988 is an interpolation between 1981 and 1998.

[2] Employment in 1988 is an interpolation between 1987 and 1989.

Suggested variables by factor demand theory

Having described the explanatory variables, one might wonder whether *all* relevant variables have been included in our employment change model. In particular, factor demand theory suggests two more variables: wage level and output level. Due to data limitations we were not able to test for the significance of these variables. However, Ashcroft and Love (1996) did dispose of wage and output data. Similarly to the present study, they estimate a model in which employment change at the British county level is explained by startup activity and various control variables, albeit that they employ a different lag structure and consider only the period 1981-1989. Ashcroft and Love (1996) found insignificant parameter estimates for wage level and output level. The insignificant effect of wage level might be explained by the fact that for many industries, collective bargains are concluded at the national level, causing regional variations in wage levels to be small. Based on the findings of Ashcroft and Love (1996), we conclude that the exclusion of these two variables from our model does not lead to omitted variable bias.

5 Estimation results

We estimate the model using OLS. Each regression is estimated cross-sectionally, i.e., using 60 observations (one for each region). Because of missing (employment) data, the region Orkney/Shetland/Western Isles had to be dropped. So we end up with a sample of 59 observations. To identify short-term and long-term effects, the model is estimated for a number of subperiods. First, we consider startups in the period 1980-83 and determine the effect on subsequent employment change in the period 1984-1991. Second, we investigate the impact of startups in the period 1987-90 on employment change in the period 1991-1998. In this way we obtain an indication as to whether the short-term effect of startup activity has changed between the 1980s and the 1990s. Finally, we examine the effect of startups in the early 1980s on growth in the 1990s to see whether long-term effects exist. Each time, both the business stock approach and the labour market approach, and both the unadjusted and the sector adjusted startup rate are applied.
All model specifications in Tables 1, 2 and 3 easily pass the Jarque-Bera test on normality of the disturbances and the Lagrange Multiplier test on heteroscedasticity (test statistics are not reported). This enables a straightforward interpretation of the results.

5.1 Startups and growth in the 1980s: no short-term effect

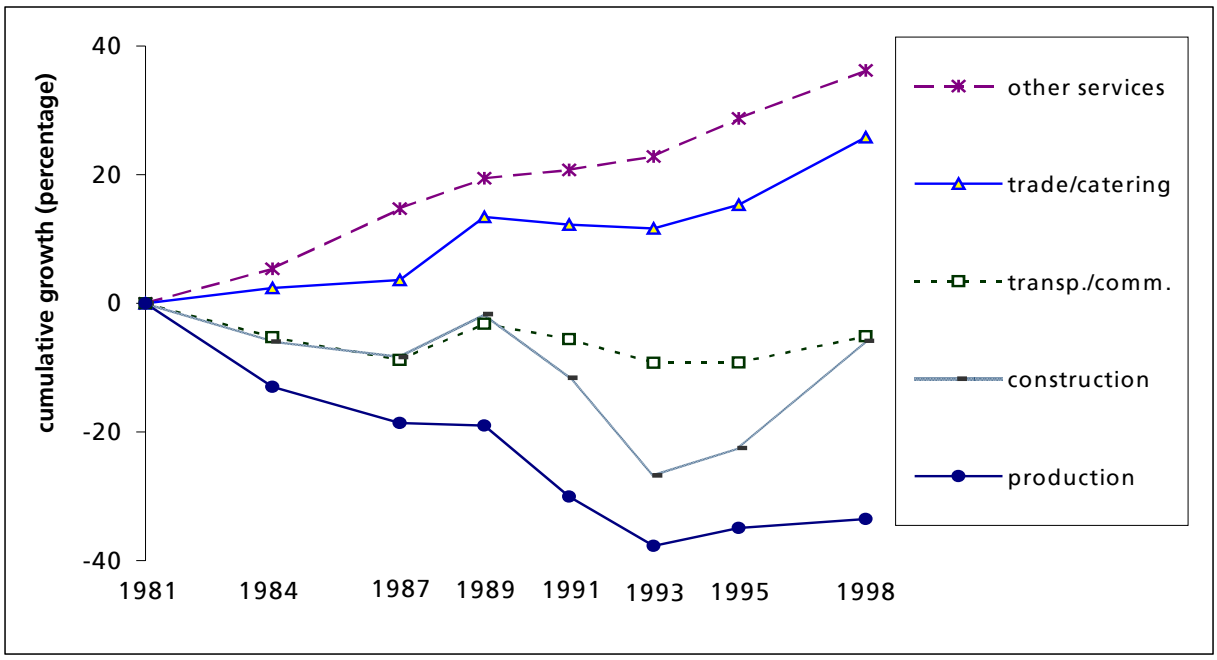
Estimation results for the 1980s (short-term equation) are in Table 1. The control variables share of population having a job (in 1981) and the Scotland/Wales dummy turned out to be non-significant and hence, were excluded from the final model specifications.[1] Looking at the estimated parameters for the startup variables, we see that the sign is positive in all four cases. The estimate is significant only for the unadjusted startup rate at the labour market approach (t-value 2.60). But the fact that the estimate for the sector adjusted startup rate is non-significant (t-value 1.56) suggests that this is mainly a sectoral effect (viz., a services effect). Regions with higher shares of services generally have more startups, because of the smaller scale of production of firms in the service industries. Because service industries grew very fast in the 1980s compared to other sectors (see Figure 1 for employment growth per sector over the period 1981-1998), these higher growth rates are ascribed to the higher startup rates in the estimation procedure. Once we control for sector structure, we see that the size and significance of the estimated parameter is much lower. We conclude that there has been no significant impact of startup activity on employment change in the 1980s.

[1] The parameter estimates of the remaining variables are not affected by this exclusion.

Table 1: Determinants of regional employment change in the period 1984-1991 (%), short-term equation (t-values in parentheses)

	Business stock approach		Labour market approach	
	Adjusted	Un-adjusted	Adjusted	Un-adjusted
Constant	8.50 (1.12)	8.28 (1.16)	3.65 (1.09)	1.10 (0.363)
Average sector adjusted startup rate, 1980-1983	0.017 (0.029)		0.647 (1.56)	
Average startup rate, 1980-1983		0.033 (0.061)		0.951 (2.60)
Population density 1981	-4.03 (-4.10)	-4.05 (-4.11)	-3.81 (-4.27)	-3.52 (-4.02)
Adjusted R^2	0.236	0.236	0.268	0.318

Figure 1: Cumulative employment growth per sector for Great Britain, 1981-1998



Source: EIM based on Nomis.

5.2 Startups and growth in the 1990s: positive effect

Estimation results for the 1990s (short-term equation) are in Table 2. Lagged employment change (measured over the period 1984-91) turned out to be non-significant, and was excluded.[1] We see that the estimated parameters for the startup variables are all highly significant, with t-values ranging from 2.24 to 6.06.[2] So, apparently regions with higher startup rates at the end of the 1980s were rewarded with higher growth rates in the 1990s. This is striking given the non-significance of 1980-83 startups on employment change in the period 1984-91 (see Table 1). What is even more striking is that these latter startups *do* seem to have a positive impact on employment change in the period 1991-98, at least for the labour market approach. See Table 3.[3] So, while there is no short-term effect of 1980-83 startups (no effect on growth 1984-91), there does seem to be a long-term effect (positive effect on growth 1991-98). Apparently, these new businesses start to contribute to employment change only after a number of years. This might be explained as follows. In the early years of their existence, survival is essential for these new firms, without the necessity to create new jobs yet. Once they have survived for a number of years and have gained a permanent place in the market, they can expand and hire new employees. The lagged employment impact is consistent with Audretsch, Carree and Thurik (2001). In their study of the impact of changes in self-employment on subsequent unemployment change for 23 OECD countries in the period

[1] For the 1980s estimations from Table 1, we could not test for the significance of lagged employment change measured over a seven-year period as we do not dispose of employment data for years earlier than 1981. However we *did* test for including the variable employment change 1981-84. This variable did not become significant in the estimations (absolute t-value < 1.2). However, when the variable was included for the labour market approach, t-values of the sector adjusted startup rate and the unadjusted startup rate became 1.09 and 2.30, respectively, making the impact of the shift-share adjustment for this model specification even more marked.

[2] Note that for the 1990s regressions in Tables 2 and 3 the employment share variable is significantly positive. So, regions performing well at the start of the study period keep performing well (business cycle effect). To test our hypothesis that omitting employment share from the equation would result in overestimating the impact of startup activity on employment growth, we computed the regressions leaving employment share out of the model. It turned out that for the *labour market approach*, the coefficient of sector adjusted startup rate was hardly affected, as the correlation between startup rate and employment share was very low. However, for the *business stock approach*, omitting employment share resulted in coefficients (t-values) for the sector adjusted startup rate of 1.64 (2.52) for startups in the period 1987-90 and 1.50 (2.14) for 1980-83 startups. So, coefficients as well as t-values become higher when employment share is omitted. Indeed, the correlations between employment share 1988 and sector adjusted startup rate were +0.27 (startups 1987-90) and +0.39 (startups 1980-83). We conclude that for the business stock approach, omitting employment share from the equation results in overestimating the impact of startup activity on employment growth. By including employment share, our regression results do not suffer from such reversed causality problems.

[3] Because of high observed intertemporal correlations (>0.8) we do not report results for equations which include 1980-83 and 1987-90 startup rates simultaneously. Such regressions suffer from multicollinearity. In particular, it is difficult to estimate individual response coefficients accurately and regular t-tests on the significance of individual parameter estimates are unreliable (Stewart 1991, pp. 180-181). Therefore, we choose to estimate separate regressions, each time with one startup variable included, see Tables 2 and 3. A disadvantage of this approach is that, because of the strong intertemporal correlation between startup rates, the estimated startup rate coefficient will pick up some of the effect of startup activity from other periods. Therefore we should be cautious in comparing coefficients of long-term and short-term equations. However, we consider the sign and significance of the estimated parameters reliable. A more sophisticated way of establishing the individual impacts of startup rate variables from different periods is based on distributed lag literature. By including startup rates of different periods in one regression, but imposing restrictions on the individual parameters, an accurate approximation of the shape of the lag response can be obtained. The Almon method suggests a specific set of parameter restrictions (i.e., a specific way of reparameterization). See Stewart (1991, pp. 181-182).

1974-1998, they find a time lag of at least eight years, reflecting that "the employment impact of entrepreneurship is not instantaneous but rather requires a number of years for the firm to grow" (Audretsch, Carree and Thurik 2001, p. 7).

Table 2: Determinants of regional employment change in the period 1991-1998 (%), short-term equation (t-values in parentheses)

	Business stock approach		Labour market approach	
	Adjusted	Un-adjusted	Adjusted	Un-adjusted
Constant	-32.8	-31.6	-32.1	-32.2
	(-2.59)	(-3.38)	(-4.50)	(-4.57)
Average sector adjusted startup rate, 1987-1990	1.42		1.66	
	(2.24)		(5.92)	
Average startup rate, 1987-1990		1.70		1.53
		(3.51)		(6.06)
Population density 1988	-3.48	-3.32	-1.63	-1.67
	(-3.22)	(-3.26)	(-1.77)	(-1.84)
Share of population having a job, 1988	49.9	33.9	61.0	65.7
	(2.44)	(1.68)	(3.70)	(4.00)
Dummy Scotland/Wales	-6.28	-5.41	-3.76	-4.34
	(-2.87)	(-2.69)	(-2.16)	(-2.59)
Adjusted R^2	0.385	0.453	0.592	0.600

Table 3: Determinants of regional employment change in the period 1991-1998 (%), long-term equation (t-values in parentheses)

	Business stock approach		Labour market approach	
	Adjusted	Un-adjusted	Adjusted	Un-adjusted
Constant	-21.8	-23.7	-29.0	-30.9
	(-2.03)	(-2.36)	(-3.83)	(-4.08)
Average sector adjusted startup rate, 1980-1983	1.11		2.27	
	(1.58)		(4.89)	
Average startup rate, 1980-1983		1.41		2.07
		(2.07)		(5.15)
Population density 1988	-3.74	-3.83	-2.00	-1.89
	(-3.28)	(-3.43)	(-2.05)	(-1.97)
Share of population having a job, 1988	48.2	42.7	57.0	65.9
	(2.25)	(1.99)	(3.23)	(3.78)
Dummy Scotland/Wales	-7.67	-7.18	-4.14	-4.68
	(-3.75)	(-3.52)	(-2.20)	(-2.62)
Adjusted R^2	0.357	0.377	0.534	0.549

Recession births versus boom births

But if new firm births create jobs only after a number of years, how can we explain then that firm births in the period 1987-90 do have a short-term effect on employment change, as the results from Table 2 suggest? A possible explanation is that the 1980-83 startups may be a different type of startups than the 1987-90 startups. While the years 1980-83 can be characterized as a period of recession, the years 1987-90 can be characterized as a 'boom' period. See again Figure 1. During recession years different types of persons may start new firms than during boom years. One might think of unemployed persons who are forced into enterprise during a period of recession. These startups may be less likely to generate jobs.[1] On the other hand, during a period of economic prosperity, it may be more 'entrepreneurial' types of persons who start a business. With 'entrepreneurial' we mean people who pursue economic opportunities and wittingly choose to operate a business instead of working as a wage-earner. This type of startups may be more likely to generate jobs. In short, while recession births may be the result of 'push'-factors being at work (possibly creating not so many jobs), boom births may be more 'pull-factor' in nature (possibly creating more jobs).[2]

[1] Storey (1991) provides an overview of studies concerned with the role of unemployment in new-firm formation.

[2] Wennekers and Thurik (1999) distinguish between 'Schumpeterian entrepreneurs' and 'managerial business owners'.

Of course, the above explanation for the different short-term impacts of the 1980-83 and 1987-90 firm births is speculative. To provide some further intuition, we also look at the impact on growth of firm births in the second UK recession period of the last twenty years, that of the beginning of the 1990s. Using the same control variables as those reported in Tables 2 and 3, we estimate a regression in which employment change in the period 1993-98 is explained by the average (sector adjusted) startup rate over the period 1990-93. The results are similar to those reported in Table 2: we find a significant positive impact.[1] This does not support the hypothesis of different types of persons starting new businesses during recession or boom years.

Rather, (new) firms in the 1990s seem to contribute more to employment change than in the (early) 1980s. According to our exercises, businesses started during the period 1987-93 contribute significantly to subsequent employment change, irrespective of whether or not the businesses were started during recession or boom years. Furthermore, regions with higher startup activity in the early 1980s are rewarded with higher growth rates in the period 1991-98, suggesting that in the 1990s a high number of firms *in general* (i.e., not necessarily a high number of startups) is conducive to economic growth of a region. Also considering that we find no short-term effect for the 1980s, Great Britain might have moved from an economy where knowledge conditions were more favourable to large incumbent enterprises (Schumpeter II), to an economy where the innovative advantage lies with small, new-firm startups (Schumpeter I). In the terminology of Audretsch and Thurik (2001), Great Britain might have moved from a (more) 'managed' to a (more) 'entrepreneurial' economy between the last two decades of the 20th century.

Special position of Scotland and Wales

We also tested the hypothesis of Scotland and Wales having a structurally different economy from England. We included a dummy that is 1 for Scottish or Welsh regions, and 0 otherwise. From the three tables we see that the Scotland/Wales dummy is non-significant (and therefore, not included) in the model explaining regional employment change in the period 1984-91, while the dummy is significantly negative for the period 1991-98.[2] This implies that in the 1984-91 period, the economies of Scotland and Wales were not very different from the English economy, while in the 1991-98 period they were. Perhaps, in the terminology of Audretsch and Thurik (2001), while England might have moved from a more 'managed' to a more 'entrepreneurial' economy, with new-firm startups contributing significantly to employment change, Scotland and Wales might have persisted in the more 'managed' type of economy, thereby not reaping the benefits from the 'entrepreneurial' type of economy. As mentioned earlier, this might be caused by a more negative attitude towards entrepreneurship, causing startup rates to be low. Interestingly, since October 1993, there has been an active public policy in Scotland with the objective to increase business startups, and in particular business startups that create jobs. This initiative is called the Business Birth Rate Strategy (BBRS) and was launched by Scottish Enterprise. In a recent review of the policy, some empirical support is presented for a positive effect of the BBRS on the number of VAT registrations per head of adult population in Scotland relative to the UK (Fraser of Allander Institute 2001). Although the periods studied in the current paper do not entirely coincide with the period during which the BBRS

[1] For the labour market approach, parameter estimates of the sector adjusted and the 'normal' startup rate variables (t-values) are 1.98 (6.19) and 1.90 (6.25), respectively.

[2] We also tried dummies for Scotland and/or Wales separately. It turned out that the adjusted R^2 was higher when the combined dummy was included. The inclusion of dummies for Scotland and/or Wales coincides with correcting for spatial autocorrelation, as dummies for the other Standard Regions of Great Britain were not significant for any model specification.

is active (from 1994 onwards), the negative value for the Scotland/Wales dummy does not indicate that the BBRS also contributed positively to job creation yet.

5.3 Size of the effects

We will now look at the size of the effect. Because labour market approach estimations produce a better statistical fit than business stock approach estimations (see the next paragraph), we only consider results according to the labour market approach here. For example, looking at Table 2, we see that the estimated parameter of the (sector adjusted) startup rate is 1.66. The interpretation of this number will be illustrated below by means of a computational example. The dependent variable equals $100\left(Empl_{1998} - Empl_{1991}\right)/Empl_{1991}$, where Empl stands for employment.[1] The independent variable equals $1000\sum_{i=1987}^{1990} NFF \Big/ \left(4\,Empl_{1987}\right)$, where NFF stands for new-firm formation. Due to data limitations we use four times 1987-employment, instead of the sum of employment over the years 1987-1990.[2] Now, if we assume for simplicity that employment in 1987 equals employment in 1991, the impact of one new-firm startup on absolute employment change is (1.66 × (1000/4)) / 100 = 4.2. So, ceteris paribus one new firm started in the period 1987-90 on average created 4.2 net new jobs between 1991 and 1998.[3] Similarly, each new firm started in the period 1980-83 is associated with 5.7 net new jobs in the same period 1991-98, suggesting that the long-term effect of the early 1980s startups might be even larger than the short-term effect of the late 1980s startups. Furthermore, the impact of one new-firm startup in the period 1980-83 on net employment change between 1984 and 1991 is 1.6 jobs. The latter result is based on a non-significant parameter estimate though.

Labour market approach outperforms business stock approach

We will now look at the results with a special focus on the debate which measure of startup activity is most appropriate, startups divided by stock of businesses (business stock approach) or startups divided by the regional workforce (labour market approach). The distinction turns out to be important, as t-values of the estimated parameters of the startup rate variables are quite different between the business stock approach and the labour market approach, especially for the 1984-91 period. A comparison of adjusted R^2 values in the various tables reveals that, without exception, these are clearly higher for the labour market approach than for the business stock approach. Apparently, regional workforce is a more appropriate choice of denominator in measuring startup

[1] Actually, we used a log-difference to measure relative change, but for ease of presentation we use the alternative notation here.

[2] Likewise, we use four times 1981-employment to compute the average startup rate 1980-83 and four times 1991-employment (SIC80 classification) to compute the average startup rate 1990-93. For reasons of consistency we did the same for the denominator in the business stock approach, although we have no missing data for the stock of VAT registered enterprises; see Table A1 in Appendix 1.

[3] A word of caution is required here. The average effect of a new-firm startup partly depends on the length of the period over which the startup rate is averaged. In the example, the period covers the four years of 1987 through to 1990. However, one might expect that if the average over, say, 1987-1989 was used, the coefficient of the startup rate would not be different from 1.66. But in the formula of the effect, 1987 employment in the denominator is multiplied by 3 instead of 4, resulting in an average effect per startup that is 4/3 times bigger. This is not desirable as the length of the startup rate period is arbitrary. Therefore, the outcomes of this type of computations must be viewed as rough indications of the size of the effect.

rates than the stock of businesses. So, according to our estimations, assuming that new firms spring from people is more realistic than assuming that new firms spring from existing firms. We think this is plausible. After all, each new firm is started by a person.

Shift-share adjustment matters

As described earlier we also look at whether or not sector structure is important in determining model outcomes. Therefore estimation results with and without the shift-share adjustment applied are included in the various tables. As we saw earlier, the application of the shift-share procedure to the startup rate leads to different outcomes for the 1980s estimates according to the labour market approach (Table 1). The significant impact of the unadjusted startup rate turns out to be mainly a sectoral effect and is not so much caused by regional variations in startup activity, as becomes clear from the non-significance of the parameter once the sector adjustment is made. Looking at Tables 2 and 3, we see that for the equations explaining growth in the period 1991-98, the differences between the coefficients and t-values of the sector adjusted and the 'normal' startup rate variables are generally smaller, especially for the labour market approach. However, given the results of Table 1, we conclude that one can not be sure beforehand whether or not the shift-share adjustment will have a big impact on estimation results. The best research procedure is to compute regressions both using unadjusted and sector adjusted startup rates.

5.4 Results from other studies

Our results for the 1980s are contradictory with earlier research for the British counties by Ashcroft and Love (1996). They find support for a strong positive effect of new firms started in the period 1980-88 on net employment change in the period 1981-89. They employ a model in which both employment change and new-firm formation are explained simultaneously, allowing for interdependencies between these two variables. However, the lag structure employed in their model might not be in accordance with reality, possibly accounting for their results. In particular, new-firm formation and net employment change are measured contemporaneously, whereas our exercises suggest that the effect of new-firm startups in the 1980s is a long-term effect rather than a short-term effect (let alone a contemporaneous effect).

Our findings for Great Britain display similaraties to those found by Audretsch and Fritsch (2002) for German regions. They find, using the labour market approach, no effect of regional startup activity in the period 1983-85 on employment change in the period 1983-89, while they do find a significant positive effect of 1993-95 startups on 1993-98 employment change. They also find a positive effect of 1983-85 startups on 1993-98 employment change. So, for Germany too, there seems to be a short-term effect of new firms started in the 1990s, while an effect of startups from the (mid) 1980s is perceptible only after a number of years.

In EIM (1994, pp. 41-47), a principal component type of analysis is conducted, using data for Dutch COROP regions in the period 1987-1990.[1] No relation is found between employment growth and firm dynamics. It is important to realize that this principal component is determined mainly by new-firm startups. However, given the results for Germany and Great Britain where the impact of start-up activity on employment growth seems to have increased in the 1990s compared to the 1980s, it might be worthwhile to reconsider the role of new-firm startups in employment creation in the Netherlands in recent years.

[1] The COROP classification is the regional classification for the Netherlands at the NUTS3 spatial aggregation level.

6 Discussion

In the present paper we investigate the impact of new-firm startups on employment change for British regions in the period 1980-1998. We find evidence for a positive short-term effect of startup activity in the late 1980s and early 1990s on subsequent employment change, irrespective of macro-economic conditions (i.e., recession or boom periods). We do not find a short-term effect for new businesses started in the early 1980s. But we do find a positive effect of these latter start-ups on employment change between 1991 and 1998, suggesting the existence of a long-term effect.

Furthermore, we find evidence for the hypothesis that economies of Scotland and Wales are structurally different from that of England, in the sense that, ceteris paribus, employment change in the 1990s has been generally lower for these areas. Our results also suggest that the size of the regional workforce is a more appropriate variable to normalize startup rates than the stock of businesses, and that correcting startup rates for different sector structures matters for the estimation results.

According to our exercises, (new) businesses contribute more to economic growth in the 1990s than in the 1980s, suggesting that Great Britain might have moved from a (more) 'managed' to a (more) 'entrepreneurial' economy between the last two decades of the 20th century (Audretsch and Thurik, 2001). However, the evidence based on our analysis on recession and boom births is still somewhat indirect. We can draw no definite conclusions on why firm births in the early 1980s do not contribute to short-term growth while firm births in the late 1980s and the early 1990s do. In particular, we do not have enough information on the different *types* of startups, i.e., which types of startups create jobs and which don't? Although for the period 1987-93 we find no different effects for recession and boom births, this does not mean that there *are* no different types of startups. Perhaps the distribution of these different types is not as different between recession and boom periods as one would expect. This would explain the similarity of the results of the 1987-90 and 1990-93 periods. On the other hand, although both are recession periods, this distribution might have been different between the 1980-83 and the 1990-93 periods, possibly explaining the different results for these periods. In short, we need more information on which factors influence the number of firm births, and in particular, which factors influence the number of *job creating* firm births. Therefore, future research should concentrate on estimating (simultaneous) models, where regional variations in the number of new-firm startups are explained on the one hand, and the impact of (different types of) new-firm startups on economic growth is explained on the other hand. Many additional variables are needed to pursue such research.

Furthermore, we should realize that the increasing employment impact of startup activity over time is valid for our period of analysis 1980-1998. We can not simply extrapolate this increasing impact to future periods, as an unlimited expansion of new and small firms will result in large numbers of marginal entrepreneurs, causing the average scale of operations to remain below optimum. These marginal entrepreneurs absorb capital and human energy that could have been allocated more productively elsewhere (Carree, Van Stel, Thurik and Wennekers, 2002).

Finally, we need to gain more insight in the exact lag structure of the employment impact of new-firm startups. Reparameterization methods like the Almon method might be useful here.

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Appendix 1: Data sources

The variables that are used in this report are all constructed from a database which contains four basic variables: startups, closures, number of enterprises, and employment. This database was constructed by EIM. These four variables are available at the sectoral (1-digit) and regional (British NUTS3) aggregation level for the period 1980-99. By and large, each of these four variables is available on a yearly basis according to uniform regional and sectoral classifications, for the whole period 1980-99. Achieving this uniformity is not straightforward, since the crude data were delivered according to different regional and sectoral classifications. In this appendix the exact regional and sectoral aggregation levels, at which the four variables are available in the EIM-data set, are presented. Also, the linking operations that were performed on the crude data, are described in detail. Furthermore, the data sources and some characteristics of the variables are described. Among other things, this includes some definitional problems concerning the comparability over time of the startup and closure data.

Basic data

In Tables A1a and A1b, we give an overview of the different classifications (regional and sectoral), according to which the four variables are available in the basic data files. Also, the exact years for which the variables are available (for employment there are some missing years), are tabulated.

Table A1a: Available years and classification schemes in basic data files: startups, closures and number of enterprises [a]

Period	Available years	Regional classification	Sectoral classification
1980-1993	All	pre-LGR [b]	VTC [c]
1994-1999	All	post-LGR	SIC92

[a] The figures of these variables are supplied by Small Business Service.

[b] LGR = local government reorganisation 1995-98.

[c] VTC = VAT Trade Classification. This is effectively SIC68.

Table A1b: Available years and classification schemes in basic data files: employment [a]

Period	Available years	Regional classification	Sectoral classification
1980-1991	1981; '84; '87; '89; '91	pre-LGR [b]	SIC80
1991-1999	1991; '93; '95-'98	pre-LGR	SIC92

[a] The figures of this variable are supplied by Nomis.

[b] LGR = local government reorganisation 1995-98.

Startups, closures and number of enterprises: source and description

The figures on startups, closures, and number of enterprises are supplied by Small Business Service (SBS). This organisation publishes yearly figures on VAT registrations, VAT deregistrations, and the stock of VAT registered enterprises, based on data from the Inter-Departmental Business Register (IDBR; this register is administered by the Office for National Statistics). See SBS (2000). The VAT-registrations and VAT-deregistrations represent the number of enterprises registering and de-registering for VAT each year. Because there is a turnover threshold for VAT (£52,000 in 2000, for example), the very smallest one person businesses are excluded from the figures. The stock of VAT registered enterprises represents the number of enterprises registered for VAT at the start of the year.

Limitations of VAT data

There are a number of limitations concerning the comparability over time of these VAT data. The most important one is the fact that the above mentioned VAT registration threshold changes over time. By and large, the threshold changes have been roughly inflationary. However, in 1991 and 1993 there were large increases in the threshold. This implies that the 1980-91, 1992-93 and 1994-99 data are not on the same footing. As in the current research, only cross-sectional analyses are performed, we do not suffer from these intertemporal incomparabilities. For a detailed outline on (other) limitations of the VAT data, see Keeble, Potter and Storey (1990, Chapter 4).

Employment: source and description

The figures on employment are taken from the Census of Employment (until 1993) and the Annual Employment Survey (from 1995 onwards) and are supplied by Nomis. The employment figures only relate to employees. Self-employed workers and unpaid family workers are thus excluded from the data. This implies a disadvantage of this data source. For instance, employees who decide to start their own company are not counted any more because their employment status changes to self-employed. This is not desired, since in both cases the person has a job, and should be included in an employment count. The employment figures include both full-time and part-time employees, and relate to the situation in September of each year.

Regional aggregation level and classification schemes

The regional aggregation level employed in our data set is the British NUTS3 level. This involves the county level in England and Wales, and the local authority region level in Scotland. We thus have data at the level of the 64 regions which are listed in Table 2 of Ashcroft, Love and Malloy (1991, p. 397). In the period 1995-98, a local government reorganisation took place in Great-Britain. The five tier NUTS level classification was reviewed, and the so-called unitary authorities (UAs) were introduced. In the old classification, Great Britain was divided into a number of counties (England and Wales) and local authority regions (Scotland). In the new classification England is divided into a number of counties *and* a number of UAs, while Wales and Scotland have moved toward a classification entirely in UAs. Due to boundary changes, most new regions are not comparable with the old regions. As can be seen from Table A1a, the data on startups, closures and number of enterprises for the years 1994-99 were delivered according to the new regional classification. We convert the new regions into old regions so that the variables are comparable over time for the whole period 1980-99. For the English regions, this is not a problem, since the data in the basic file are given in terms of both the new and the old regions ('former counties'). But for Wales and Scotland no variables for the period 1994-99 are given in terms of the old classification. Therefore, a linking operation has to be performed. For Scotland, this is a straightforward operation, since all 'old' local

authority regions are the aggregate of one or more 'new' UAs, leaving no overlapping areas. For Wales, unfortunately, there *are* overlapping areas. We must combine some Welsh 'old' counties, so that no overlapping 'new' UAs remain. See Table A2.

Table A2: Aggregation scheme for Welsh counties

Label	pre-LGR based counties [a]
North/Mid Wales	Gwynedd Clwyd Powys
Dyfed	Dyfed
West Glamorgan	West Glamorgan
South/East Wales	Mid Glamorgan South Glamorgan Gwent

[a] LGR = local government reorganisation 1995-98.

From Table A2 we see that in two cases, three counties had to be taken together to avoid overlap, and that in two other cases the regions remain unchanged. The number of Welsh regions thus reduces from eight to four. As a result, the total number of regions in our data set reduces from 64 to 60. These 60 regions comprise 46 English counties, 4 Welsh regions (see Table A2), and 10 Scottish local authority regions. In the latter group of regions, the Orkney, Shetland and Western Isles are combined into one region. The 60 regions cover the whole of Great Britain.

Sectoral aggregation level and classification schemes

At the regional level described above, the four variables are all available at the sectoral 1-digit level. However, from Tables A1a and A1b, we see that three different sectoral classifications circulate: SIC68, SIC80, and SIC92. These classifications are all different, see Table A3.

Table A3: Three Standard Industrial Classifications: 1-digit level labels [a]

SIC68	SIC80	SIC92
agriculture, forestry and fishing	**0** agriculture, forestry and fishing	**AB** agriculture; forestry and fishing
production	**1** energy/water supply industries	**CE** mining and quarrying; electricity, gas and water supply
construction	**2** extraction/manufacture: minerals/metals	**D** manufacturing
motor trades	**3** metal goods/vehicle industries, etc	**F** construction
wholesale	**4** other manufacturing industries	**G** wholesale, retail and repairs
retail	**5** construction	**H** hotels and restaurants
catering	**6** distribution, hotels/catering; repairs	**I** transport, storage and communication
transport and communication	**7** transport/communication	**J** financial intermediation
finance and professional services	**8** banking, finance, insurance, leasing, etc	**K** real estate, renting and business activities
business and other personal services	**9** other services	**LO** public administration; other community, social and personal services
		MN education; health and social work

[a] In this table, similarities in covered parts of the economy across columns are coincidental.

We can make the following linking diagrams between the three classifications. See Tables A4a and A4b. *By and large*, there are no overlapping sectors in these diagrams.

Table A4a: Relation SIC68-SIC92 classifications

SIC68-sectors	SIC92-sectors (codes)
agriculture, forestry and fishing	AB
production	CDE
construction	F
trade [a]	G
catering	H
transport and communication	I
other services [b]	JKLMNO

[a] This is an aggregate of three SIC68 sectors: motor trades; wholesale; retail.

[b] This is an aggregate of two SIC68 sectors: finance and professional services; business and other personal services.

Table A4b: Relation SIC68-SIC80 classifications

SIC68-sectors	SIC80-sectors (codes)
agriculture, forestry and fishing	0
production	1, 2, 3, 4
construction	5
trade and catering [a]	6
transport and communication	7
other services	8, 9

[a] This is an aggregate of the two sectors of the same name from Table A4a.

The six-sector classification in the left column of Table A4b is the classification that is employed in the EIM-dataset. All variables from the basic data files have been aggregated towards this six-sector level according to the linking diagrams in the above tables. In this way we have a data set with uniform sectors for the whole period 1980-99.
As we saw earlier, the variables have also been made available at a uniform spatial (regional) classification. In summary, the EIM-data set for Great Britain contains the four variables startups, closures, number of enterprises and employment. Apart from some missing years for employment, these variables are available on a yearly basis for the whole period 1980-99, at relatively disaggregated sectoral and spatial aggregation levels (6 sectors, 60 regions), and according to uniform sectoral and regional classifications.

On the next page we give a listing of the 60 regions of Great Britain in our data set. Regions 1 up to 46 are in England, regions 47 up to 50 are in Wales, and regions 51 up to 60 are in Scotland.

LIST OF BRITISH REGIONS

1	Cleveland	31	Berkshire
2	Durham	32	Buckinghamshire
3	Northumberland	33	East Sussex
4	Tyne and Wear	34	Hampshire
5	Cheshire	35	Kent
6	Lancashire	36	Oxfordshire
7	Cumbria	37	Surrey
8	Greater Manchester	38	West Sussex
9	Merseyside	39	Isle of Wight
10	Humberside	40	Avon
11	North Yorkshire	41	Devon
12	South Yorkshire	42	Dorset
13	West Yorkshire	43	Wiltshire
14	Derbyshire	44	Cornwall and Isles of Scilly
15	Leicestershire	45	Gloucestershire
16	Nottinghamshire	46	Somerset
17	Lincolnshire	47	North/Mid Wales *
18	Northamptonshire	48	Dyfed
19	Hereford and Worcester	49	West Glamorgan
20	Shropshire	50	South-East Wales *
21	Staffordshire	51	Central
22	Warwickshire	52	Dumfries and Galloway
23	West Midlands	53	Fife
24	Bedfordshire	54	Grampian
25	Cambridgeshire	55	Highland
26	Essex	56	Lothian
27	Hertfordshire	57	Strathclyde
28	Norfolk	58	Tayside
29	Suffolk	59	Borders
30	Greater London	60	Orkney/Shetland/Western Isles

* See Table A2 for underlying regions.

Appendix 2: Dealing with missing data

In the data set described in Appendix 1 there are some missing data for employment (apart from the years missing between 1980 and 1999; see Table A1b). For reasons of confidentiality, we do not dispose of the employment figures of certain sectors in certain regions for certain years. In this appendix we describe how we compute regional employment growth in those cases. Furthermore, we describe how we compute startup rates in case of missing employment data for some sectors (labour market approach).

Regional employment growth

For some regions, there are missing data for one or two subsectors within the production sector: sectors 1 and/or 2 of the SIC80 classification, and sectors C and/or E of the SIC92 classification (see Table A3). Now, if for a certain region information about SIC80 subsectors 1 and/or 2 is not available, we use the growth rate of the remaining sectors in the region for which information *is* available (we exclude agriculture, forestry and fishing). Analogously, if information about SIC92 subsectors C and/or E is not available then we also use the growth rate of the remaining sectors. The implicit assumption of this procedure is that the growth rate of the missing sectors equals the growth rate of the nonmissing sectors. Since our growth figure for a region is always based on the bulk of the regional economy -we dispose of data for at least sectors 3 until 9 (SIC80) or sectors D, and F until N (SIC92)- this assumption is plausible. Only for the region Orkney/Shetland/Western Isles there are also missing data for some of these last-mentioned sectors and therefore we drop the observations for this region.

Startup rates in the labour market approach

As we saw earlier, in the labour market approach the absolute number of startups is divided by employment. The startup rate for a region is obtained by weighing sectoral startup rates with the appropriate weighting scheme (Great Britain or the region concerned, for the adjusted or unadjusted startup rate, respectively). However, as mentioned above, for certain regions there are missing employment data for one or two subsectors within the production sector. In these cases we have to make an approximation for total employment in the production sector to get a startup rate for this sector. We do this by assuming that the ratio employment(1+2+3+4)/employment(3+4) (in case SIC80 sectors 1 and 2 are missing) stays constant over time.[1] Note that this approximation is also necessary for getting a right weighting scheme to compute the unadjusted startup rate of a region.

[1] We apply the ratio of 1981, for which year there are no missing data.

Appendix 3: Illustration shift-share procedure

In this appendix we illustrate the shift-share procedure by means of a numerical example. Basically, the shift-share procedure imposes the same sector structure on each region. The sector structure is measured in terms of employment (labour market approach) or in terms of number of businesses (business stock approach). As an illustration, we show the calculation of the average startup rate 1980-83 (labour market approach) for the region Derbyshire using two methods: unadjusted and adjusted for the sector structure of the region. Derbyshire is chosen because of the relatively large difference between the two methods for this region.

Table A5: Illustration shift-share procedure; the case of Derbyshire, 1980-83

sector	average startup rate 1980-83, per sector*	employment share 1981, Derbyshire	employment share 1981, Great Britain
production	1.519	0.470	0.323
construction	23.294	0.049	0.052
trade & catering	24.478	0.145	0.196
transport & communication	7.559	0.054	0.067
other services	3.848	0.282	0.363
average (unadjusted) startup rate 1980-83, Derbyshire		6.890	
average sector adjusted startup rate 1980-83, Derbyshire			8.392

* Number of VAT registrations per 1000 workers.

In the second column of Table A5 the startup rate (averaged over the years 1980-83) is reported for each sector of economy (except for agriculture which sector is excluded from the current study). The startup rate of a region is a weighted average of the sectoral startup rates. The difference between the unadjusted startup rate and the sector adjusted startup rate of a region is the weighting scheme applied to the sectoral startup rates. For the unadjusted startup rate, the employment shares of the sectors of the region under consideration (in this case Derbyshire) are taken as weights. This results in a value of 6.890. For the sector adjusted startup rate of Derbyshire, we take the sectoral employment shares of Great Britain as a whole as weights. This results in a value of 8.392.

The difference between the sector adjusted and the unadjusted startup rate as a percentage of the unadjusted startup rate is equal to 21.8%, which is quite large. A closer inspection of Table A5 learns that the differences between the employment shares of Derbyshire and Great Britain as a whole, of especially the sectors production and trade&catering account for the large difference between the unadjusted and the sector adjusted startup rates. The relatively large share of production in Derbyshire (a sector with a low startup rate) and the relatively small share of trade&catering (a sector with a high startup rate) account for the lower value for the unadjusted startup rate.[1] We

[1] The relatively low startup rate for production according to the labour market approach is directly related to the large average firm size in this sector. In the business stock approach the relative startup rate for production, compared to other sectors, is much higher. See also Appendix 4.

prefer the sector adjusted startup rate, because the lower (unadjusted) value would merely be due to the particular sector structure of Derbyshire. We argue that, given the sector structure of Derbyshire, the higher (sector adjusted) value is a more appropriate measure of the relative amount of startup activity in this region.

The differences between the sector adjusted and the unadjusted startup rates range from –20.9% to 21.8% for the labour market approach (covering the periods 1980-83 and 1987-90), and from –7.4% to 9.3% for the business stock approach. Given these differences it is not surprising that the choice between using the unadjusted or the adjusted startup rate also affects results of regression analyses. See Tables 1, 2, and 3.

Appendix 4: Illustration business stock approach versus labour market approach

In this appendix we illustrate the difference between the business stock approach and the labour market approach by means of a numerical example. In the business stock approach startup rates are normalized using the stock of businesses while in the labour market approach employment is used as normalization variable. As an illustration, we show the calculation of the average sector adjusted startup rate 1980-83 for the region Cleveland using the two methods. The startup rate of Great Britain as a whole is used as a benchmark value. Cleveland is chosen because of the relatively large difference between the two methods for this region.

From Tables A6a and A6b we can see that for the business stock approach Cleveland has *above average* startup activity (16.3 versus 14.0 for Great Britain as a whole) while for the labour market approach Cleveland has *below average* startup activity (5.4 versus 7.5 for Great Britain). This is consistent with the separate sectoral startup rates. For the business stock approach we see that the Cleveland startup rates are higher than the Great Britain startup rates for four out of the five sectors. For the labour market approach however, Cleveland startup rates are lower than Great Britain startup rates for all five sectors.

These differences can be explained looking at the average firm size of Cleveland. The last columns of the two tables show that he average firm size in Cleveland is considerably higher than the average firm size in Great Britain, for all sectors of economy. So, *given a certain level of employment*, Cleveland has relatively few businesses (and hence a relatively low value for the denominator of the startup rate in the business stock approach). As a result Cleveland has a relatively high startup rate according to the business stock approach and a relatively low startup rate according to the labour market approach. Therefore it is no surprise that Cleveland is classified as an entrepreneurial regime in the business stock approach, and as a routinized regime in the labour market approach (Cleveland has above average employment growth in the 1980s). See Appendices 5 and 6.

Of course, the choice of normalization variable can also affect estimation results in regression analyses explaining regional growth by startup activity. A region can have a relatively high or low value of the explanatory variable, depending on the approach used. In fact, as we showed in Section 5, results did indeed differ considerably, and we have seen that the labour market approach provided the best statistical fit.

Table A6a: Some characteristics on startup activity and employment for **Great-Britain**, 1980-83 [1]

	1. stock of businesses 1981, x 100	**2.** employ-ment 1981, x 1000	**3.** average no. of start-ups, 1980-83	sector share stock of businesses	startup rate business stock ap-proach (= 3/1)	sector share employ-ment	startup rate labour market approach (= 3/2)	average firm size (= 2/1)
prod.	1208	6747	15970	0.109	13.2	0.323	2.4	55.9
constr.	1844	1087	24814	0.166	13.5	0.052	22.8	5.9
tr./cat.	5403	4093	73543	0.485	13.6	0.196	18.0	7.6
tr./comm.	566	1397	7469	0.051	13.2	0.067	5.3	24.7
other ser.	2113	7591	34476	0.190	16.3	0.363	4.5	35.9
total	11134	20914	156271	1.000		1.000		
average startup rate 1980-83, Great Britain, business stock approach (benchmark value)					**14.0**			
average startup rate 1980-83, Great Britain, labour market approach (benchmark value)							**7.5**	

[1] excluding Orkney, Shetland, Western Isles

Table A6b: Some characteristics on startup activity and employment for **Cleveland**, 1980-83

	1. stock of businesses 1981, x 100	**2.** employ-ment 1981, x 1000	**3.** average no. of start-ups, 1980-83	*GB* sector share stock of businesses	startup rate business stock ap-proach (= 3/1)	*GB* sector share employ-ment	startup rate labour market approach (= 3/2)	average firm size (= 2/1)
prod.	4.75	79.7	81	0.109	17.1	0.323	1.0	167.7
constr.	12.15	13.9	201	0.166	16.6	0.052	14.5	11.4
tr./cat.	36.05	37.9	533	0.485	14.8	0.196	14.1	10.5
tr./comm.	3.70	12.0	48	0.051	12.8	0.067	4.0	32.4
other ser.	10.75	62.7	223	0.190	20.7	0.363	3.6	58.3
total	67.40	206.1	1085	1.000		1.000		
average sector adjusted startup rate 1980-83, Cleveland, business stock approach					**16.3**			
average sector adjusted startup rate 1980-83, Cleveland, labour market approach							**5.4**	

Appendix 5: Growth regimes in Great Britain

Audretsch and Fritsch (2002) analyse the relationship between startup activity and employment growth at the regional level for Germany, using the concept of growth regimes. In this appendix we replicate this type of analysis for Great Britain.

1. THEORY OF GROWTH REGIMES

The theory of growth regimes is derived from the theory of technological regimes (see for example Nelson and Winter 1982). Different technological regimes distinguish between distinct knowledge conditions underlying an industry.

Audretsch and Fritsch (2002) distinguish between four different types of 'growth regimes'. The regimes differ in the relative amount of startup activity and the level of economic growth (in this report measured as employment growth), resulting in four quadrants or growth regimes. The first regime type is called the *entrepreneurial regime* and is characterized by relatively high startup rates and relatively high employment growth. The entrepreneurial regime is assumed to be favorable to innovative entry. The second regime type is called the *routinized regime* and is characterized by low startup rates but high employment growth. This regime type is assumed to be favorable to innovative activity by established firms. The difference between these two regime types may be explained by distinct knowledge conditions. If information outside of the routines practiced by the incumbent firms is a relatively important input in generating innovative activity, newly established firms will tend to have the innovative advantage over the incumbent firms. By contrast, when information based on nontransferable experience in the market is an important input in generating innovative activity, then incumbent firms will tend to have the innovative advantage over new firms (Audretsch and Fritsch, 2002).

The third growth regime is the *revolving door regime*. This regime type is characterized by high startup rates but low employment growth. In this regime type entries are assumed to be non-innovative, supplying about the same products by using about the same technology as the incumbent firms. If these entries are succesful, they tend to crowd out local competitors instead of creating additional employment (Audretsch and Fritsch, 2002). Thus high entry rates and high exit rates occur simultaneously. That is why the name 'revolving door' is given to this regime type.

The last growth regime that is considered is the *downsizing regime*. This regime type is characterized by low startup activity and low employment growth. The low growth levels are assumed to be the result of downsizing and plant closures of incumbent enterprises. The relatively low level of startup activity is insufficient to provide enough new jobs to substitute the losses in the incumbent firms (Audretsch and Fritsch, 2002). In Table A7 the four regime types are summarized.

Table A7: Characteristics of growth regimes

Growth regime	Startup rate	Employment growth
Entrepreneurial	High	High
Routinized	Low	High
Revolving Door	High	Low
Downsizing	Low	Low

2. DESCRIPTIVE STATISTICS FOR DIFFERENT REGIME TYPES

As we did in the main report, we analyze two periods in this appendix. The first period considers (adjusted) startup rates in the years 1980-83 and subsequent employment growth in the years 1984-91 while the second period considers startups in the years 1987-90 and growth in the years 1991-98. These periods are called the 1980s and the 1990s, respectively. All 59 British regions in our sample are classified in one of the four regime types, depending on whether they belong to the upper/lower 50% of the sample observations on the two dimensions adjusted startup rate and employment growth. As a test of robustness we also look at the upper/lower 40% and 30%. In the tables below we give some descriptive statistics for the different regime types. We do this for both the the business stock approach and the labour market approach and for both the 1980s and the 1990s.

Business stock approach

Table A8a: Characteristics of regional growth regimes in the 1980s - business stock approach *

Regional Characteristics	Growth Regime 1980s			
	Entrepreneurial	Revolving Door	Routinized	Downsizing
average startup rate 1980-83 +	14.47 (15.23 / 15.87)	14.30 (14.47/ 14.61)	12.91 (12.57 / 12.20)	12.87 (12.88 / 12.05)
average closure rate 1980-83 +	11.42 (11.42 / 11.21)	12.02 (12.12 / 13.10)	10.43 (10.33 / 10.15)	11.07 (11.74 / 10.77)
average net-entry rate 1980-83 +	3.25 (3.40 / 4.30)	1.97 (1.97 / 1.84)	1.99 (1.93 / 1.93)	1.58 (1.58 / 1.53)
employment change 1984-91 (%)	10.25 (10.65 / 11.10)	2.40 (1.15 / -1.40)	11.7 (13.2 / 12.8)	2.30 (-1.20 / 0.15)
population density 1981 ++	365 (399 / 352)	539 (803 / 2139)	115 (101 / 87)	241 (258 / 159)
no. of regions	12 (8 / 4)	18 (12 / 7)	18 (12 / 8)	11 (7 / 4)

* Median values. + Rate per 100 existing businesses. ++ Inhabitants per km^2. First value in parentheses: value for regions that are among the upper/lower 40% with regard to the criteria startup rate and employment growth. Second value in parentheses: value for regions that are among the upper/lower 30%.

According to Table A8a, a high startup rate is not sufficient for high employment growth. Thirty regions have high startup rates (entrepreneurial and revolving door regimes), but only twelve of these have high employment growth (entrepreneurial regimes). So it seems that high startup rates are not associated with high growth. Likewise, low startup rates are not associated with low growth (there are more routinized regions than downsizing regions). These results are consistent with the non-significance of the variable startup rate in the employment change regression for the 1980s, see Table 1.

Looking at Table A8a, we can make some further observations. Although both the entrepreneurial and the revolving door regimes have high startup rates (by definition), we see that the regions with an entrepreneurial regime type have higher net-entry rates. We see the same phenomenon at the regions with a routinized and downsizing regime type. The routinized regions have higher net-entry rates than the downsizing regions. So, given a certain level of the startup rate (high or low), higher net-entry rates are associated with higher employment growth. This is no surprise as high net-entry rates are an indicator for good conditions for survival of new-firm startups. Finally, we observe that regions with higher startup rates have higher population densities.

Table A8b: Characteristics of regional growth regimes in the 1990s - business stock approach *

Regional Characteristics	Growth Regime 1990s			
	Entrepreneurial	Revolving Door	Routinized	Downsizing
average startup rate 1987-90 +	19.36 (19.53 / 19.53)	17.54 (17.54 / 18.20)	16.66 (16.41 / 16.18)	16.39 (15.71 / 14.43)
average closure rate 1987-90 +	13.20 (13.39 / 13.39)	13.73 (13.34 / 13.59)	11.98 (11.79 / 11.98)	12.29 (11.85 / 11.44)
average net-entry rate 1987-90 +	6.00 (6.46 / 6.66)	4.05 (4.59 / 4.62)	4.45 (4.42 / 4.50)	3.08 (3.07 / 3.07)
employment change 1991-98 (%)	14.29 (15.50 / 15.54)	1.51 (0.67 / -1.15)	12.27 (13.06 / 13.84)	1.22 (-0.43 / -1.67)
population density 1988 ++	352 (352 / 327)	428 (364 / 633)	131 (142 / 169)	155 (65 / 55)
no. of regions	19 (13 / 9)	11 (8 / 2)	11 (6 / 3)	18 (12 / 8)

* Median values. + Rate per 100 existing businesses. ++ Inhabitants per km^2. First value in parentheses: value for regions that are among the upper/lower 40% with regard to the criteria startup rate and employment growth. Second value in parentheses: value for regions that are among the upper/lower 30%.

Compared to the 1980s, Table A8b shows a reversed pattern for the 1990s. Now, nineteen out of the thirty regions with a relatively high startup rate, experience high employment growth. Likewise, for the 1990s there are more downsizing than routinized regimes (18 versus 11). So, in the 1990s high startup rates seem to be associated with high employment growth and vice versa. This is consistent with the significant positive sign of the variable startup rate in the employment change regression for the 1990s, see Table 2.

As was the case for the 1980s, we see again that higher net-entry rates are associated with higher employment growth. Finally, we see that regions with higher startup rates have higher population densities.

Labour market approach

Table A9a: Characteristics of regional growth regimes in the 1980s - labour market approach *

Regional Characteristics	Growth Regime 1980s			
	Entrepreneurial	Revolving Door	Routinized	Downsizing
average startup rate 1980-83 +	9.34 (9.46 / 9.86)	8.04 (8.81 / 9.37)	7.00 (6.56 / 6.52)	5.66 (5.36 / 5.15)
average closure rate 1980-83 +	7.71 (7.44 / 7.44)	6.48 (7.02 / 8.81)	5.65 (5.43 / 5.43)	5.22 (4.77 / 4.59)
average net-entry rate 1980-83 +	1.73 (1.92 / 1.92)	1.63 (1.50 / 1.19)	1.38 (0.82 / 1.44)	0.66 (0.61 / 0.58)
employment change 1984-91 (%)	11.10 (11.70 / 12.30)	4.60 (4.20 / 1.30)	9.70 (11.00 / 15.3)	1.95 (-0.80 / 0.15)
population density 1981 ++	162 (162 / 158)	376 (374 / 354)	151 (151 / 55)	446 (359 / 255)
no. of regions	17 (13 / 7)	13 (6 / 2)	13 (9 / 3)	16 (10 / 8)

* Median values. + Rate per 1000 workers ++ Inhabitants per km^2. First value in parentheses: value for regions that are among the upper/lower 40% with regard to the criteria startup rate and employment growth. Second value in parentheses: value for regions that are among the upper/lower 30%.

Table A9a makes it clear that a high startup rate is not sufficient for high growth as we saw earlier. But compared to Table A8a, there is now more support for a positive contribution of startup rate to employment growth. Seventeen out of the 30 regions with high startup rates have high employment growth. Likewise, 16 out of the 29 regions with low startup rates have low employment growth. So, 33 out of the 59 observations are consistent with the hypothesis of startup rate contributing positively to employment growth (the entrepreneurial and the downsizing regions). For the business stock approach, only 23 regions were entrepreneurial or downsizing in the 1980s. This is consistent with the higher t-value for the sector adjusted startup rate in the regression for the labour market approach compared to the business stock approach, see Table 1. The effect is still not significant though (t-value 1.56).

Table A9b: Characteristics of regional growth regimes in the 1990s - labour market approach *

Regional Characteristics	Growth Regime 1990s			
	Entrepreneurial	Revolving Door	Routinized	Downsizing
average startup rate 1987-90 +	13.06 (13.49 / 13.53)	12.69 (13.44 / 15.16)	9.88 (9.28 / x)	8.30 (8.27 / 8.17)
average closure rate 1987-90 +	9.15 (9.57 / 9.60)	8.98 (9.24 / 11.36)	7.31 (6.95 / x)	6.72 (6.72 / 6.62)
average net-entry rate 1987-90 +	4.10 (4.19 / 4.23)	3.80 (3.91 / 3.80)	3.07 (2.33 / x)	1.73 (1.71 / 1.65)
employment change 1991-98 (%)	14.29 (15.54 / 15.67)	4.90 (2.27 / -1.87)	9.30 (10.15 / x)	0.51 (-0.27 / -0.97)
population density 1988 ++	239 (239 / 239)	320 (364 / 59)	382 (60 / x)	309 (249 / 212)
no. of regions	23 (17 / 12)	7 (4 / 1)	7 (1 / 0)	22 (18 / 14)

* Median values. + Rate per 1000 workers. ++ Inhabitants per km^2. First value in parentheses: value for regions that are among the upper/lower 40% with regard to the criteria startup rate and employment growth. Second value in parentheses: value for regions that are among the upper/lower 30%.

From Table A9b we see that for the 1990s, there are now 23 entrepreneurial regimes and 22 downsizing regimes, according to the labour market approach. So 45 out of the 59 regions are consistent with a positive contribution of startup rate to employment growth. It is no surprise then that in Table 2, we find a very strong positive statistical relationship between (sector adjusted) startup rate and employment growth: t-value 5.92.
In Appendix 6 all regions in our data set are classified into one of the four different growth regimes.

3. TRANSITIONS BETWEEN REGIME TYPES

From Tables A8 and A9 we have seen that there are quite some differences in the distribution of the regions over the different regime types between the 1980s and the 1990s. For example, in the business stock approach, there were 12 entrepreneurial regions in the 1980s while there were 19 entrepreneurial regions in the 1990s. So apparently there are regions which move from one regime type to another one between the two decades. In Table A10 and A11 these movements are described by means of transition matrices.

Business stock approach

Table A10: Transition matrix - business stock approach *

No. of cases Row percentage		Growth Regime in the 1990s				Row Total
		Entrepreneurial	Revolving Door	Routinized	Downsizing	
Growth Regime in the 1980s	Entrepre-neurial	9 (4 / 3) 75.0 (66.7 / 100)	2 (2 / 0) 16.7 (33.3 / 0)	1 (0 / 0) 8.3 (0 / 0)	0 (0 / 0) 0 (0 / 0)	12 (6 / 3) 100 (100 / 100) 20.3 (24.0 / 33.3)
	Revolving Door	5 (3 / 1) 27.8 (50.0 / 100)	6 (1 / 0) 33.3 (16.7 / 0)	3 (1 / 0) 16.7 (16.7 / 0)	4 (1 / 0) 22.2 (16.7 / 0)	18 (6 / 1) 100 (100 / 100) 30.5 (24.0 / 11.1)
	Routinized	3 (1 / 0) 16.7 (14.3 / 0)	2 (1 / 0) 11.1 (14.3 / 0)	6 (2 / 1) 33.3 (28.6 / 33.3)	7 (3 / 2) 38.9 (42.9 / 66.7)	18 (7 / 3) 100 (100 / 100) 30.5 (28.0 / 33.3)
	Downsizing	2 (1 / 0) 18.2 (16.7 / 0)	1 (1 / 1) 9.1 (16.7 / 50.0)	1 (1 / 0) 9.1 (16.7 / 0)	7 (3 / 1) 63.6 (50.0 / 50.0)	11 (6 / 2) 100 (100 / 100) 18.6 (24.0 / 22.2)
Column Total		19 (9 / 4) 32.2 (36.0 / 44.4)	11 (5 / 1) 18.6 (20.0 / 11.1)	11 (4 / 1) 18.6 (16.0 / 11.1)	18 (7 / 3) 30.5 (28.0 / 33.3)	59 (25 / 9) 100 (100 / 100)

* First figure in parentheses: value for regions that were among the upper/lower 40% in the 1980s AND 1990s with regard to the criteria applied for classification. Second value in parentheses: value for regions that were in the upper/lower 30% in the 1980s AND 1990s.

From Table A10, it follows that 31 out of the 59 regions have changed into another regime type (the sum of the off-diagonal cells). Nine out of twelve regions characterized by an entrepreneurial regime in the 1980s (75%) were also characterized by an entrepreneurial regime in the 1990s. Furthermore, over 60 percent of the regions with a downsizing regime in the 1980s remained downsizing in the 1990s. So the entrepreneurial and the downsizing regime seem to be some kind of steady states. Regions characterized by a revolving door regime tend to remain in the revolving door regime *or* shift to the entrepreneurial regime (5 out of 18). Finally, regions with a routinized regime seem to stay in a routinized regime or change into a downsizing regime in the 1990s (7 out of 18, or 38.9%).

From these movements between the two decades we can extract the following pattern. Regions with high startup rates in the 1980s have high employment growth in the 1990s (entrepreneurial regions remaining entrepreneurial or revolving door regions moving into entrepreneurial regions), while regions with low startup rates in the 1980s have low employment growth in the 1990s (downsizing regions remaining downsizing or routinized regions moving into downsizing regions). This pattern suggests the existence of a long-run effect of startup activity on employment growth. In Table 3 there is indeed some empirical support in the regression explaining employment change in the 1990s by (sector adjusted) startup rate in the 1980s: the estimated parameter is positive. The effect is not significant though.

Labour market approach

Table A11: Transition matrix - labour market approach *

No. of cases Row percentage		Growth Regime in the 1990s				Row Total
		Entrepreneurial	Revolving Door	Routinized	Downsizing	
Growth Regime in the 1980s	Entrepreneurial	13 (8 / 4) 76.5 (88.9 / 100)	4 (1 / 0) 23.5 (11.1 / 0)	0 (0 / 0) 0 (0 / 0)	0 (0 / 0) 0 (0 / 0)	17 (9 / 4) 100 (100 / 100) 28.8 (32.1 / 36.4)
	Revolving Door	8 (4 / 0) 61.5 (100 / x)	2 (0 / 0) 15.4 (0 / x)	2 (0 / 0) 15.4 (0 / x)	1 (0 / 0) 7.7 (0 / x)	13 (4 / 0) 100 (100 / x) 22.0 (14.3 / 0)
	Routinized	2 (0 / 0) 15.4 (0 / 0)	0 (0 / 0) 0 (0 / x)	4 (0 / 0) 30.8 (0 / 0)	7 (6 / 1) 53.8 (100 / 100)	13 (6 / 1) 100 (100 / 100) 22.0 (21.4 / 9.1)
	Downsizing	0 (0 / 0) 0 (0 / 0)	1 (0 / 0) 6.3 (0 / 0)	1 (1 / 0) 6.3 (11.1 / 0)	14 (8 / 6) 87.5 (88.9 / 100)	16 (9 / 6) 100 (100 / 100) 27.1 (32.1 / 54.5)
Column Total		23 (12 / 4) 39.0 (42.9 / 36.4)	7 (1 / 0) 11.9 (3.6 / 0)	7 (1 / 0) 11.9 (3.6 / 0)	22 (14 / 7) 37.3 (50.0 / 63.6)	59 (28 / 11) 100 (100 / 100)

* First figure in parentheses: value for regions that were among the upper/lower 40% in the 1980s AND 1990s with regard to the criteria applied for classification. Second value in parentheses: value for regions that were in the upper/lower 30% in the 1980s AND 1990s.

The patterns that we observed for the business stock transition matrix are even stronger for the labour market approach, see Table A11. Now 76.5% of the entrepreneurial regions and 87.5% of the downsizing regions in the 1980s stay in the same growth regime in the 1990s. Furthermore, 61.5% of the revolving door regions in the 1980s become entrepreneurial in the 1990s. Of the more extreme cases with values belonging to the upper/lower 40 percent in both decades it is even the case that all revolving door regions in the 1980s became entrepreneurial in the 1990s (four regions). Finally, 53.8% of the routinized regions in the 1980s became downsizing in the 1990s.

Again, the above observations suggest that the entrepreneurial and the downsizing regimes represent a sort of equilibrium or steady state situation, while the revolving door and routinized regimes appear to be more transitional in character. The transitions that take place for the two last-mentioned growth regimes seem to represent movements down a one-way path leading to an entrepreneurial or a downsizing regime type only. If these hypotheses are correct and only the entrepreneurial and downsizing regimes seem to behave as stable combinations of startup activity and employment change, this would imply a positive long-run relationship between new-firm formation and regional growth. Indeed, according to Table 3, for the labour market approach there is a strong positive effect of new firms started in the beginning of the 1980s on employment change in the period 1991-1998, with t-value 4.89.

Concluding remark

Both the business stock approach and the labour market approach result in the same notion that the entrepreneurial and downsizing regimes function as equilibrium states while the revolving door and routinized regimes are more transitional states toward the entrepreneurial and downsizing regimes, respectively. The values that support this hypothesis are more apparent in the labour market approach than in the business stock approach. Overall, startups seem to be of great importance especially in the long run: high startup activity may lead to low growth in the short run (revolving door) but results in high growth in the long run (transition of revolving door to entrepreneurial), whereas low startup activity may lead to high growth in the short run (routinized) but results in low growth in the long run (transition of routinized to downsizing).

Appendix 6: Classification of British regions into regime types in the 1980s and the 1990s

In this appendix we present the classification of the British regions into the different types of growth regimes, based on the analysis of Appendix 5. We give the classifications for both the business stock approach and the labour market approach, and for both the 1980s and the 1990s (decades are defined in Appendix 5). We also give a table with the 'common denominator' for both approaches. Table A14 thus presents only those regions that are classified in one of the four growth regimes for *both the business stock approach and the labour market approach*.

Table A12: Classification in Growth Regimes according to the **Business Stock Approach**

1980s		1990s	
Entrepreneurial (above average startup rate and above average employment growth)			
Cleveland *	West Sussex	Cheshire	East Sussex *
Cheshire **	Avon *	Leicestershire	Hampshire **
Northamptonshire **		Northamptonshire **	Oxfordshire *
Hereford and Worcester		Warwickshire	Surrey
Cambridgeshire *		Cambridgeshire **	West Sussex **
Berkshire **		Essex *	Avon
Buckinghamshire **		Hertfordshire **	Devon
Hampshire		Greater London *	Dorset **
Kent *		Berkshire **	Wiltshire **
Oxfordshire		Buckinghamshire **	
Revolving Door (above average startup rate and below average employment growth)			
Durham	West Midlands **	Cleveland **	South-East Wales
Tyne and Wear **	Bedfordshire **	Durham *	Central *
Greater Manchester *	Essex *	Tyne and Wear	
Merseyside **	Hertfordshire **	Merseyside	
South Yorkshire	Greater London **	Humberside *	
West Yorkshire *	Surrey	South Yorkshire *	
Derbyshire	Gloucestershire	Bedfordshire *	
Leicestershire **	West Glamorgan	Kent *	
Staffordshire*	South-East Wales *	Isle of Wight **	

see next page

Growth Regimes according to the **Business Stock Approach** – continued

1980s		1990s	
Routinized (below average startup rate and above average employment growth)			
Lancashire	Wiltshire *	Northumberland *	Gloucestershire **
Humberside *	Cornwall & Isles of Scilly**	North Yorkshire	Somerset
North Yorkshire **	Somerset	West Yorkshire	
Lincolnshire **	North/Mid Wales **	Lincolnshire **	
Shropshire *	Central	Hereford & Worcester **	
Norfolk **	Dumfries and Galloway *	Shropshire *	
Suffolk	Grampian **	Staffordshire *	
Devon **	Highland	Suffolk	
Dorset	Borders **	Cornwall and Isles of Scilly	
Downsizing (below average startup rate and below average employment growth)			
Northumberland **	Strathclyde *	Lancashire *	West Glamorgan *
Cumbria	Tayside **	Cumbria **	Dumfries and Galloway **
Nottinghamshire *		Greater Manchester	Fife *
Warwickshire		Derbyshire	Grampian **
East Sussex *		Nottinghamshire	Highland **
Isle of Wight **		West Midlands *	Lothian
Dyfed		Norfolk	Strathclyde **
Fife **		North/Mid Wales	Tayside **
Lothian		Dyfed **	Borders **

The median values of the indicators (sector adjusted startup rate and employment growth) are used for classification. * The region is also among the upper/lower 40% with regard to both criteria. ** The region is also among the upper/lower 30% with regard to both criteria.

Table A13: Classification in Growth Regimes according to the **Labour Market Approach**

1980s		1990s	
Entrepreneurial			
Lancashire	Devon *	Leicestershire	Buckinghamshire **
Lincolnshire	Dorset **	Lincolnshire **	East Sussex *
Northamptonshire **	Cornwall & Isles of Scilly**	Northamptonshire **	Hampshire
Hereford and Worcester *	Somerset	Hereford and Worcester**	Surrey **
Shropshire **	North/Mid Wales **	Shropshire *	West Sussex **
Cambridgeshire *		Warwickshire *	Devon
Norfolk *		Cambridgeshire *	Dorset **
Suffolk **		Essex *	Wiltshire
Berkshire *		Hertfordshire **	Cornwall & Isles of Scilly**
Buckinghamshire **		Suffolk	Gloucestershire **
Kent *		Greater London	Somerset **
West Sussex		Berkshire **	
Revolving Door			
West Yorkshire	Hertfordshire	Lancashire	
Derbyshire	Greater London	Bedfordshire *	
Leicestershire **	East Sussex **	Norfolk	
Staffordshire *	Surrey *	Kent *	
Warwickshire *	Gloucestershire	Isle of Wight *	
Bedfordshire	Dyfed	North/Mid Wales	
Essex *		Dyfed **	
Routinized			
Cleveland *	Wiltshire **	Northumberland *	
Cheshire *	Central *	Cheshire	
Humberside *	Dumfries and Galloway *	North Yorkshire	
North Yorkshire	Grampian **	West Yorkshire	
Hampshire	Highland	Staffordshire	
Oxfordshire	Borders **	Oxfordshire	
Avon *		Avon	

see next page

Growth Regimes according to the **Labour Market Approach** - continued

Downsizing			
Durham **	South-East Wales	Cleveland **	West Glamorgan **
Northumberland **	Fife **	Durham **	South-East Wales
Tyne and Wear **	Lothian	Tyne and Wear **	Central **
Cumbria	Strathclyde **	Cumbria **	Dumfries and Galloway **
Greater Manchester	Tayside **	Greater Manchester *	Fife *
Merseyside **		Merseyside **	Grampian **
South Yorkshire **		Humberside *	Highland **
Nottinghamshire *		South Yorkshire **	Lothian
West Midlands *		Derbyshire	Strathclyde **
Isle of Wight		Nottinghamshire	Tayside **
West Glamorgan		West Midlands **	Borders *

The median values of the indicators (sector adjusted startup rate and employment growth) are used for classification. * The region is also among the upper/lower 40% with regard to both criteria. ** The region is also among the upper/lower 30% with regard to both criteria.

Table A14: Classification in Growth Regimes according to *both* business stock approach *and* labour market approach

1980s		1990s	
Entrepreneurial			
Northamptonshire **		Leicestershire	Buckinghamshire **
Hereford and Worcester		Northamptonshire **	East Sussex *
Cambridgeshire *		Warwickshire	Hampshire
Berkshire *		Cambridgeshire *	Surrey
Buckinghamshire **		Essex *	West Sussex **
Kent *		Hertfordshire **	Devon
West Sussex		Greater London	Dorset **
		Berkshire **	Wiltshire
Revolving Door			
West Yorkshire	Essex *	Bedfordshire *	
Derbyshire	Hertfordshire	Kent *	
Leicestershire **	Greater London	Isle of Wight *	
Staffordshire *	Surrey		
Bedfordshire	Gloucestershire		
Routinized			
Humberside *	Dumfries and Galloway *	Northumberland *	
North Yorkshire	Grampian **	North Yorkshire	
Wiltshire *	Highland	West Yorkshire	
Central	Borders **	Staffordshire	
Downsizing			
Northumberland **	Tayside **	Cumbria **	Fife *
Cumbria		Greater Manchester	Grampian **
Nottinghamshire *		Derbyshire	Highland **
Isle of Wight		Nottinghamshire	Lothian
Fife **		West Midlands *	Strathclyde **
Lothian		West Glamorgan *	Tayside **
Strathclyde *		Dumfries and Galloway **	Borders *

The median values of the indicators (sector adjusted startup rate and employment growth) are used for classification. * The region is also among the upper/lower 40% with regard to both criteria, *for both approaches*. ** The region is also among the upper/lower 30% with regard to both criteria, *for both approaches*.

Appendix 7: List of Research Reports

Order no.	Title
H9301	The intertemporal stability of the concentration-margins relationship in Dutch and U.S. manufacturing; Yvonne Prince and Roy Thurik
H9302	Persistence of profits and competitiveness in Dutch manufacturing; Aad Kleijweg
H9303	Small-store presence in Japan; Martin A. Carree, Jeroen C.A. Potjes and A. Roy Thurik
intern	Multi-factorial risk analysis and the sensitivity concept; Erik M. Vermeulen, Jaap Spronk and Nico van der Wijst
H9304	Do small firms' price-cost margins follow those of large firms? First empirical results; Yvonne Prince and Roy Thurik
H9305	Export success of SMEs: an empirical study; Cinzia Mancini and Yvonne Prince
H9306	Het aandeel van het midden- en kleinbedrijf in de Nederlandse industrie; Kees Bakker en Roy Thurik
H9307	Multi-factorial risk analysis applied to firm evaluation; Erik M. Vermeulen, Jaap Spronk and Nico van der Wijst
H9308	Visualizing interfirm comparison; Erik M. Vermeulen, Jaap Spronk and Nico van der Wijst
H9309	Industry dynamics and small-firm development in the European printing industry (Case Studies of Britain, the Netherlands and Denmark); Michael Kitson, Yvonne Prince and Mette Mönsted
H9401	Employment during the business cycle: evidence from Dutch manufacturing; Marcel H.C. Lever and Wilbert H.M. van der Hoeven
H9402	De Nederlandse industrie in internationaal perspectief: arbeidsproduktiviteit, lonen en concurrentiepositie; Aad Kleijweg en Sjaak Vollebregt
H9403	A micro-econometric analysis of interrelated factor demand; René Huigen, Aad Kleijweg, George van Leeuwen and Kees Zeelenberg
H9404	Between economies of scale and entrepreneurship; Roy Thurik
H9405	L'évolution structurelle du commerce de gros français; Luuk Klomp et Eugène Rebers
intern	Basisinkomen: een inventarisatie van argumenten; Bob van Dijk
H9406	Interfirm performance evaluation under uncertainty, a multi-dimensional frame-work; Jaap Spronk and Erik M. Vermeulen
H9407	Indicatoren voor de dynamiek van de Nederlandse economie: een sectorale analyse; Garmt Dijksterhuis, Hendrik-Jan Heeres en Aad Kleijweg
H9408	Entry and exit in Dutch manufacturing industries; Aad Kleijweg and Marcel Lever
intern	Labour productivity in Europe: differences in firm-size, countries and industries; Garmt Dijksterhuis

H9409	Verslag van de derde mondiale workshop Small Business Economics; Tinbergen Instituut, Rotterdam, 26-27 augustus 1994; M.A. Carree en M.H.C. Lever
H9410	Internal and external forces in sectoral wage formation: evidence from the Netherlands; Johan J. Graafland and Marcel H.C. Lever
H9411	Selectie van leveranciers: een kwestie van produkt, profijt en partnerschap?; F. Pleijster
intern	Grafische weergave van tabellen; Garmt Dijksterhuis
H9501	Over de toepassing van de financieringstheorie in het midden- en kleinbedrijf; Erik M. Vermeulen
H9502	Insider power, market power, firm size and wages: evidence from Dutch manufacturing industries; Marcel H.C. Lever and Jolanda M. van Werkhooven
H9503	Export performance of SMEs; Yvonne M. Prince
H9504	Strategic Niches and Profitability: A First Report; David B. Audretsch, Yvonne M. Prince and A. Roy Thurik
H9505	Meer over winkelopenstellingstijden; H.J. Gianotten en H.J. Heeres
intern	Interstratos; een onderzoek naar de mogelijkheden van de Interstratos-dataset; Jan de Kok
H9506	Union coverage and sectoral wages: evidence from the Netherlands; Marcel H.C. Lever and Wessel A. Marquering
H9507	Ontwikkeling van de grootteklassenverdeling in de Nederlandse Industrie; Sjaak Vollebregt
H9508	Firm size and employment determination in Dutch manufacturing industries; Marcel H.C. Lever
H9509	Entrepreneurship: visies en benaderingen; Bob van Dijk en Roy Thurik
H9510	De toegevoegde waarde van de detailhandel; enkele verklarende theorieën tegen de achtergrond van ontwikkelingen in distributiekolom, technologie en externe omgeving; J.T. Nienhuis en H.J. Gianotten
H9511	Haalbaarheidsonderzoek MANAGEMENT-model; onderzoek naar de mogelijk-heden voor een simulatiemodel van het bedrijfsleven, gebaseerd op gedetailleerde branche- en bedrijfsgegevens; Aad Kleijweg, Sander Wennekers, Ton Kwaak en Nico van der Wijst
H9512	Chippen in binnen- en buitenland; De elektronische portemonnee in kaart gebracht; een verkenning van toepassingen, mogelijkheden en consequenties van de chipcard als elektronische portemonnee in binnen- en buitenland; drs. J. Roorda en drs. W.J.P. Vogelesang
H9601	Omzetprognoses voor de detailhandel; Pieter Fris, Aad Kleijweg en Jan de Kok
H9602	Flexibiliteit in de Nederlandse Industrie; N.J. Reincke
H9603	The Decision between Internal and External R&D; David B. Audretsch, Albert J. Menkveld and A. Roy Thurik
H9604	Job creation by size class: measurement and empirical investigation; Aad Kleijweg and Henry Nieuwenhuijsen
H9605	Het effect van een beursnotering; drs. K.R. Jonkheer
H9606	Een Micro-werkgelegenheidsmodel voor de Detailhandel; drs. P. Fris
H9607	Demand for and wages of high- and low-skilled labour in the Netherlands; M.H.C. Lever and A.S.R. van der Linden
H9701	Arbeidsomstandigheden en bedrijfsgrootte. Een verkenning met de LISREL-methode; drs. L.H.M. Bosch en drs. J.M.P. de Kok

H9702 The impact of competition on prices and wages in Dutch manufacturing industries; Marcel H.C. Lever

H9703 FAMOS, een financieringsmodel naar grootteklassen; drs. W.H.J. Verhoeven

H9704 Banencreatie door MKB en GB; Pieter Fris, Henry Nieuwenhuijsen en Sjaak Vollebregt

H9705 Naar een bedrijfstypenmodel van het Nederlandse bedrijfsleven; drs. W.H.M. van der Hoeven, drs. J.M.P. de Kok en drs. A. Kwaak

H9801 The Knowledge Society, Entrepreneurship and Unemployment; David B. Audretsch and A. Roy Thurik

H9802 Firm Failure and Industrial Dynamics in the Netherlands; David B. Audretsch, Patrick Houweling and A. Roy Thurik

H9803 The determinants of employment in Europe, the USA and Japan; André van Stel

H9804 PRISMA'98: Policy Research Instrument for Size-aspects in Macro-economic Analysis; Ton Kwaak

H9805 Banencreatie bij het Klein-, Midden- en Grootbedrijf; Henry Nieuwenhuijsen, Ben van der Eijken en Ron van Dijk

H9806 Milieumodel; drs. K.L. Bangma

H9807 Barriers for hiring personnel; Jacques Niehof

H9808 Methodiek kosten en baten Arbowetgeving; drs. K.M.P. Brouwers, dr. B.I. van der Burg, drs. A.F.M. Nijsen en ir. H.C. Visee

H9809 Business Ownership and Economic Growth; An Empirical Investigation; Martin Carree, André van Stel, Roy Thurik and Sander Wennekers

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