Zeitschrift für Wirtschafts- u. Sozialwissenschaften (ZWS) 118 (1998), S. 163 - 184
Duncker & Humblot, Berlin

Do Small and Medium-Sized Enterprises Stabilize Employment?

Theoretical Considerations and Evidence from Germany*

By Ralf Fendel and Michael Frenkel

1. Introduction

It has often been presumed that the behavior of a firm in adjusting the number of employees along the business cycle depends on the size of the firm. Several authors argue that small and medium-sized enterprises (SME) are more hesitant than large enterprises in hiring additional employees in an upswing but also do not lay off workers as fast as large enterprises in a recession. This yields relatively less cyclical changes in employment of SMEs and implies that SMEs stabilize economy-wide employment. However, since this hypothesis refers to net changes in employment, it does not exclude that SMEs could still exhibit a higher total job turnover (i.e., the sum of job creation and job destruction). In fact, the latter observation has been supported by several studies (Davis and Haltiwanger [1992], Schmidt [1995]). By contrast, there has only been very limited theoretical support and empirical evidence for the hypothesis of a size-specific cyclical pattern of net employment changes.

Empirical evidence on the employment-stabilizing behavior of SMEs has so far been limited to relatively short time series and has focused on rather small segments of the economy. Gruhler [1979] analyzes the performance of German SMEs in the industrial sector for the period 1968 - 1975 and finds evidence for an employment-stabilizing role of SMEs. However, most of the evidence is derived only indirectly showing that regions with a relatively high share of SMEs experienced relatively small unemployment cycles. In addition, he fails to find statistically significant causalities. Rothwell and Zegveld [1982] report that Dutch SMEs remarkably contributed to employment stability during the period 1970 - 1975. Fotherwill and Gudgin [1979] study a limited number of regions in the U.K. and find that, during a period

---

Verantwortlicher Herausgeber / editor in charge: U. S.
* We are grateful to comments of an anonymous referee.

of severe industrial stagnation in the 1970s, smaller manufacturing firms have been more buoyant than their larger counterparts. Hughes [1993] argues for the UK that, during the 1980s, changes in the shares of small businesses in total employment mask an underlying stability in small-firm employment combined with major rationalization by large firms as manufacturing employment contracted in that period. For the US, Solomon [1986] states that the rise of the mass-production industry caused swings in the business cycles to become more violent. He argues that, due to the characteristics of smaller enterprises, they help to smooth out these swings. Common to all these studies is that the empirical evidence is limited to short time periods and to smaller regions, and that they lack explicit theoretical reasoning.

The purpose of this paper is to address the described shortcomings by presenting both a theoretical framework for the employment-stabilizing behavior of SMEs and a more comprehensive econometric analysis for Germany by looking at a longer time period and at both the entire industrial sector and specific industry segments. Germany appears to be a good case for studying the described hypothesis because many analysts emphasize that, particularly in Germany, SMEs (referred to as the "Mittelstand") constitute an important factor for economic developments.

The paper is structured as follows. Section 2 develops the theoretical framework for a size-specific behavior of firms in hiring and laying off workers. We argue that an important reason for the difference in the response of larger and smaller firms to business cycle fluctuations stems from the existence of transaction and adjustment costs associated with changes in employment. These costs can be expected to be size-dependent. Section 3 examines the empirical evidence on employment changes of firms of different sizes over the business cycle. In addition to studying the industrial sector of Germany as a whole we analyze some industry segments in which the share of SMEs is particularly high. Section 4 summarizes the results and presents the main conclusions.

2. The Model

In this section, we present a simple model which describes the optimal employment level of a representative firm at different stages of the business cycle. We assume that business cycle fluctuations stem from temporary changes in aggregate demand, which translate, at least partly, into price changes. We examine the optimal response of a firm in competitive markets to these price changes. There are two crucial features in our theoretical framework. First, we assume that firms incur transaction and adjustment costs when they change the number of their employees. In the case of an expansion, these costs are mainly associated with the hiring process and the building-up of firm-specific human capital through training.[1] In the case of a temporary output reduction, transaction and adjustment costs include compensation payments to laid-off workers and disadvantages of not being able to increase production in the future as fast as otherwise when demand picks up again. The producer has to weigh these costs against the advantages of a temporary employment variation. This consideration is relevant for cyclical output changes but not for structural changes. Since the latter are of a permanent nature, the producer is forced to make long-term decisions involving the termination of specific production activities or the initiation of new activities.

Second, we assume that output variations take a discrete form. This implies that there is a certain minimum quantity of output changes which we refer to as the lot size. For example, when market prices rise, a producer has to decide whether or not to expand production by at least this lot size. The lot size depends on technical characteristics of the production process and can be expected to be larger for larger firms.

We now formalize the optimal strategy of the firm. Assume a firm is in a situation of average economic activity along the business cycle when suddenly, due to higher economic activity, the price (p) rises in its output market. The producer now considers increasing his output in response to the price increase. To keep the analysis as simple as possible, we assume that variations in production require a change in the number of workers so that an increase in the number of hours per already employed worker is not possible.[2] In order to focus on short-term changes in output, we abstract from the effects of investment and assume that the firm does not operate at its capacity limit. Thus, variations in output can take place with a given physical capital stock. In addition, any output increase has to be equal to, or greater than, the quantity of one lot, which we denote by $\bar{x}$. We assume that firms expect the observed price increase to last for m periods. If m is relatively small, the price increase is expected to be fairly short-lived; if m is very large firms expect that the price change will last longer. We also assume that the firm can hire additional workers at the current wage rate and that the firm is small in its output market so that it cannot affect the price. The present value of profits associated with expanding output by one lot for m periods, which we denote by π_E (with the subscript denoting "expansion"), is

---

1 Firm-specific human capital includes the familiarity of the production process and the knowledge of the firm's product.

2 This assumption only affects the quantitative results but not the qualitative results of the analysis.

(1)
$$\pi_E = (p_0 - c_0)\bar{x} + \sum_{j=1}^{m} \frac{(p_j^e - c_j^e)\bar{x}_j}{(1+i)^j} - S_E \ ;$$

where c, i, and S denote variable costs, the interest rate, and total transaction and adjustment costs of hiring the required new employees, respectively. The subscripts of p, c, and x refer to time periods. The first term on the right hand side shows the difference between revenue and variable costs during the period, in which the price increase occurs and production can change for the first time. For this period, prices as well as costs represent actual rather than expected values. Variable costs, which, on the basis of our assumptions, comprise labor costs only, can be expected to rise with the number of lots produced. Variable costs in equation (1) thus reflect the cost situation for the marginal lot. The second term on the right-hand side of equation (1) represents the present value of profit contributions of future periods with the superscript "e" denoting expected values. The third term reflects total transaction and adjustment costs of increasing production by one lot. These costs have to be spent once additional workers are hired.

For simplicity, we use static price expectations for the subsequent m periods so that expected prices and costs are equal to the levels that can be observed in the period in which the firm makes the decision about the production expansion.[3] In order to simplify the notation, we omit the subscript for variables that are assumed to be constant over time. This yields

(2)
$$p_j^e = p_0 = p$$
$$c_j^e = c_0 = c \ .$$

We now consider different cases for the value of m. As one alternative, we assume $m = 0$, which means that the price increase is not expected to last for more than the current period, i.e., period 0. As the other extreme case, we assume that $m = \infty$, which reflects permanent price changes and, thus, structural changes in the output market of the firm caused by an altered demand structure. As the intermediate case reflecting the typical business cycle factor, m is assumed to be positive and finite. Using the simplifications (2) in equation (1), the present value of profits for the two extreme cases ($m = 0$ and $m = \infty$) and for the intermediate case ($0 < m < \infty$) is

[3] Although this assumption may seem to be restrictive, a more complicated expected price development would have no impact on the qualitative results of the analysis as long as some higher price level is expected for a certain period of time. Later we will discuss the effects of changes in expected cost levels. This reflects changes in expectations of the firm about future productivity levels caused by technological change.

$$
\begin{aligned}
&\pi_E = (p-c)\bar{x} - S_E && \text{for } m = 0 \\
(3) \qquad &\pi_E = (p-c)\bar{x}\sum_{j=0}^{m}(1+i)^{-j} - S_E && \text{for } 0 < \mathrm{m} < \infty \\
&\pi_E = (p-c)\bar{x}\frac{1+i}{i} - S_E && \text{for } m = \infty \,.
\end{aligned}
$$

Equation (3) shows that the importance of transaction and adjustment costs relative to net earnings associated with the expansion of production declines with an increase in m. Thus, they are particularly important when the change in output prices is only temporary. Transaction and adjustment costs S_E depend on the number of workers ($\overline{N}$) by which one lot changes employment and on transaction and adjustment costs per new employee (s_E). The latter are assumed to be a decreasing function of both the number of new employees and the size of the firm approximated by total output (x). Thus, total transaction and adjustment costs can be expressed as

$$(4) \qquad S_E = s_E(\overline{N}, x) \cdot \overline{N}; \qquad \frac{\partial s_E}{\partial \overline{N}} < 0, \frac{\partial s_E}{\partial x} < 0, \frac{\partial S_E}{\partial \overline{N}} > 0 \,.$$

It seems plausible to argue that training costs per worker decline with the number of new workers due to economies of scale in the search and in the training process. It also seems realistic to assume a negative relationship between the size of the enterprise and adjustment costs per (new) worker, which means that larger companies have an advantage of size. One could think of already existing training units in larger firms, which imply relatively low marginal costs of training compared to firms in which such units do not exist and other (for such events relatively unexperienced) workers have to perform these tasks. This advantage of larger firms could also reflect economies of scope since larger firms tend to centralize their training efforts for various production activities.

Expressing the size of a lot as

$$(5) \qquad \bar{x} = \overline{N} \cdot \mu$$

where μ denotes labor productivity, we can rewrite total transaction and adjustment costs in equation (4) as

$$(6) \qquad S_E = s_E(\bar{x}/\mu, x) \cdot \bar{x}/\mu \,.$$

Assuming that the entrepreneur's objective is to maximize profits, we can calculate a critical price above which it is optimal to expand production if output prices rise. This critical price (p^{high}) is associated with zero profits of an expansion of production ($\pi_E = 0$) and can be derived by combining equations (1) and (6). This threshold depends on the presumed length of the price increase:

$$
\begin{aligned}
&p^{high} = c + \frac{s_E(\bar{x}/\mu, x)}{\mu} && \text{for } m = 0 \\
(7) \qquad &p^{high} = c + \frac{s_E(\bar{x}/\mu, x)}{\mu} \cdot \sum_{j=0}^{m} (1+i)^{-j} && \text{for } 0 < \mathrm{m} < \infty \\
&p^{high} = c + \frac{s_E(\bar{x}/\mu, x) \cdot i}{\mu(1+i)} && \text{for } m = \infty \, .
\end{aligned}
$$

Whenever the actual price rises above the threshold level, the firm expands production and hires additional workers. In this case, the existence of transaction and adjustment costs drives a wedge between the critical price level and variable costs. Two interesting implications can be derived from these equations. First, the higher m is, i.e., the longer a firm expects the price increase to last, the less important are transaction and adjustment costs for the decision regarding the change in production because the wedge between the price and variable costs declines. This indicates that if the change is perceived as long-term, i.e., it is of structural nature, the transaction and adjustment costs are unlikely to affect the decision about the change in production. It also implies that transaction and adjustment costs hardly matter for structural changes in aggregate demand. Second, assuming that marginal costs, the interest rate, and labor productivity are the same for all firms, the critical price p^{high} is lower for larger firms because their transaction and adjustment costs per worker are lower. The greater the differences in $\bar{x}$ are and the greater the advantages resulting from size differences are (e.g., economies of scale and economies of scope in hiring and training), the greater is the difference in p^{high} between large firms and smaller firms.

We now turn to the production decision of a firm when economic activity declines and, as a consequence, the market price for the firm's output drops. This could, for example, be the case when the economy moves into a recession. If the firm reduces output there is a positive contribution to its profits resulting from not incurring losses for the marginal lot but, at the same time, the firm incurs transaction and adjustment costs associated with the production change. If the former effect dominates the latter, a decline in production increases overall profits. This suggests that production will be reduced if the price falls below a critical value (p_{low}). Transaction and adjustment costs of laying off workers mainly include compensation payments to workers and costs associated with the restructuring of production operations.

We denote the present value of profits stemming from a one-lot reduction in output by π_R (where the subscript denotes "reduction"). We basically apply the same assumptions as before, but limit the formal analysis to the two extreme values of m, since the results for positive and finite values of m represent intermediate cases. The present value of profits resulting from contracting output can then be expressed similarly to equation (2):

$$\text{(8)} \qquad \begin{aligned} \pi_R &= (c-p)\bar{x} - S_R && \text{for } m = 0 \\ \pi_R &= (c-p)\frac{1+i}{i}\bar{x} - S_R && \text{for m} = \infty \,. \end{aligned}$$

In the first case shown in equation (8), the savings resulting from the reduction in output in period 0 have to completely cover transaction and adjustment costs. In the second case, a positive profit contribution resulting from an output decline following the same price decline can be achieved more easily because it is the savings over many periods that have to cover the same amount of transaction and adjustment costs.

For simplicity, we assume that S_R depends on the same factors as S_E.[4] This implies that transaction and adjustment costs per worker are a negative function of both firm size and the number of employees per lot, although the functional form of S_R can be different from S_E. Thus, large firms have relatively lower transaction and adjustment costs per employee than SMEs. The critical market price (p_{low}) below which the firm reduces output can be derived from equation (8) using a similar expression as in equation (6). This yields

$$\text{(9)} \qquad \begin{aligned} p_{low} &= c - \frac{s_R(\bar{x}/\mu, x)}{\mu} && \text{for } m = 0 \\ p_{low} &= c - \frac{s_R(\bar{x}/\mu, x) \cdot i}{\mu(1+i)} && \text{for } m = \infty \,. \end{aligned}$$

Here s_R denotes transaction and adjustment cost per layed-off worker. The critical price p_{low} is determined by how long the price decline is expected to last (i.e., the value of m), by the level of variable costs, and by the transaction and adjustment costs of employment changes. The producer is willing to accept a price below variable costs if the difference is smaller than the transaction and adjustment costs. The difference is larger for small values of m. If $m = 0$, only a relatively strong price decline would lead to an output reduction. In addition, the critical price p_{low} is lower for smaller firms because of higher transaction and adjustment costs per worker.

---

[4] Some authors argue that transaction and adjustment costs of job creation are higher than transaction and adjustment costs of job destruction (see, for example, Campbell and Fisher [1996] and Hamermesh and Pfann [1996]).

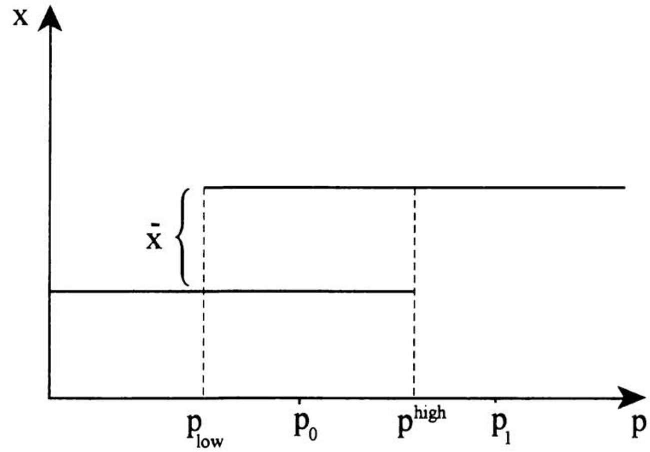

Figure 1: The Band of Inaction

Equations (7) and (9) imply that there is a gap between the critical price that triggers an increase in production and the price that leads to a reduction in output. This feature is well known in the literature on investment and is applied here to employment decisions of the firm.[5] Figure 1 shows the dynamics that can arise during the emergence of a business cycle. While the price is shown on the horizontal axis, the amount produced and, implicitly, the level of employment is indicated on the vertical axis. We first assume that beginning at a low price, p_0, the firm experiences an economic upswing and produces along the lower curve. If the price rises above p^{high} during a boom to, for example, p_1, the firm increases its production and incurs the transaction and adjustment costs. The supply function exhibits a discrete jump to a higher level of production. When in a later recession the price falls below p_{low} the firm reduces output and the supply function shows a discrete jump downwards. In general, during a boom the behavior of the firm is described by a rightward movement beginning on the lower branch, while a recession means a movement to the left beginning on a higher level of production.[6]

Any price fluctuation (business cycles) within the range between p_{low} and p^{high} does not cause the firm to change its output. We call this the "band of

5 Modern investment theory emphasizes that irreversible transaction and adjustment costs, uncertainty and the possibility of postponing the investment are major factors influencing the investment decision (Dixit and Pindyck [1994]).

6 The analysis also shows that, in between the two critical price levels, the level of production is not determined uniquely and depends on the historical situation.

inaction". Thus, relatively moderate price variations do not lead to employment changes. The width of the band is determined by the amount of transaction and adjustment costs and by the duration of the price change. The higher transaction and adjustment costs are and the more transitory (i.e., business-cycle related) price changes are perceived to be (in this case m can be expected to relatively small), the wider is the band of inaction. By contrast, the band is fairly small if m is relatively large, that is, if price changes are interpreted as reflecting structural changes in the demand structure. However, variations in variable costs, which can be interpreted as the outcome of technological change, influence the relative position of the band though not its size. Higher variable costs shift the band to the right and vice versa. In an extension of our basic analysis of cyclical price movements we later also consider the effects stemming from the process of technological change.

In order to show the effects of price changes on output and employment decisions of firms of different sizes over the business cycle, we compare two firms (see Fig. 2): firm A is assumed to be small and produces an output level x_A, and firm B is assumed to be large producing an output level x_B. The small firm faces higher transaction and adjustment costs per worker for the two reasons described above: it has a lower level of production and it has a lower lot size. Thus, assuming identical variable costs and labor productivity, the "band of inaction" of firm A is an envelope of B's "band of inaction".

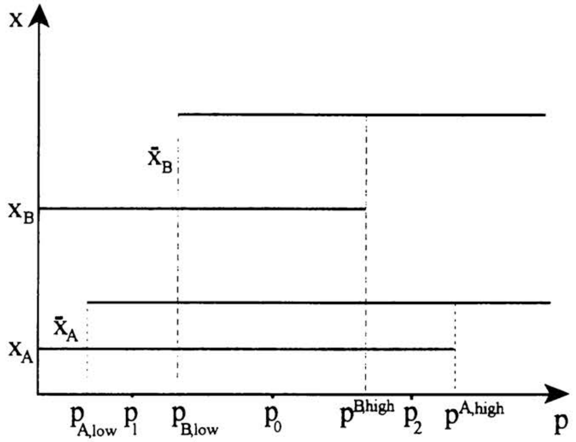

Figure 2: The Dynamics in Aggregate Employment with Firms of Different Size

The dynamics caused by price fluctuations are straightforward. Consider a price p_0 in the first period and assume that both firms are on the higher branch of their supply function. If, in the subsequent period, a recession occurs, the price declines below its initial level. If the fluctuation is relatively moderate, the new price level can be described by, say, p_1. While the large firm B reduces output and employment, the smaller firm A does not. If, during a subsequent boom, the price rises above $p^{B,high}$, say to p_2, firm B increases production again. Thus, the fluctuation in demand leads to a fluctuation in B's employment, while firm A does in fact stabilize aggregate employment. However, if the business cycle is very pronounced, prices can be expected to fluctuate more, too. For example, if the price level falls in a recession below the level of $p_{A,low}$, both firms reduce output and are forced to lay off workers. Now, B will increase employment sooner than A when economic activity and prices rise again. Hence, a relatively severe recession does not show the feature of an employment stabilization by A. These considerations imply that smaller firms can be expected to serve as an employment buffer if the recession is not too strong.

If expectations about productivity changes accompany business cycle movements they may alter the dynamics of output and employment discussed above. Technological changes can be incorporated into our theoretical framework by taking into account changes in expected future levels of variable costs. In case a firm expects rising productivity levels, expected values of variable costs will fall. As explained before, this shifts the band of inaction shown in Figure 1 to the left but leaves the width of the band unchanged. If this occurs during a boom, this technology effect lowers the critical upper price level and, thus, leads to a faster employment response.

However, additional effects that are specific to the size of firms result only if size-specific technological changes occur. Should, for example, productivity changes favor small firms during a boom, this would shift their band in Figure 2 to the left. As a consequence, economic upswings cause earlier employment changes in small firms. Likewise, earlier employment changes in small firms also occur if expected productivity gains occurring at the same time as a recession are more pronounced in large firms. Thus, firm-specific productivity changes overlapping the effects of business cycles can create a larger variety of output and employment dynamics. However, *a priori* predictions about firm-specific technological changes do not seem to be possible.[7]

---

[7] Due to our focus on employment changes in existing production units, we concentrate here on process innovation and exclude product innovations and innovations that affect transaction and adjustment costs altering the width of the band of inaction. For a more detailed description of different forms of technical change and their sectoral patterns see Pavitt [1984]. Brouwer et al. [1993] examine the employment

Our analysis has an additional implication. Since employment fluctuations are likely to be less pronounced in SMEs, the risk of getting unemployed is smaller for jobs with smaller firms. This should be reflected in lower wages paid by SMEs compared to wages in large firms. If this holds, variable costs are not the same for all firm sizes as assumed above, but they are lower for larger firms. However, taking this into account in equations (6) and (8) would only reinforce the results of our analysis regarding the response of different firm sizes to price changes. For simplicity, differences in variable costs were therefore not included in the theoretical framework above.

3. Firm Size and Employment Changes: The Empirical Evidence

In this section we examine the empirical evidence of the influence of firm size on employment changes for the case of Germany. Traditionally, Germany has had a strong group of SMEs employing nearly half of the economy's labor force.[8] Since this group of enterprises, which is often referred to as the "Mittelstand", has a particularly strong root in German industry, the analysis concentrates on the whole industry as well as on single industry segments.

Ideally, an empirical analysis of the employment behavior of companies of different sizes should be based on longitudinal micro data on an establishment or enterprise level. This means that, for each size class, data on job creation and job destruction are included only for enterprises which remained in the same size class for the entire observation period. This would exclude data for entities which dropped out of the size class due to a class switch or because of a shut down. Futhermore, the data would also exclude entities which entered a size class during the period under investigation. However, such data are not publicy available for the entire German industry or for longer time periods in the regional segments for which data are available. Among the studies which, nevertheless, use longitudinal data is the analysis of Schmidt [1995]. Although this study uses gross data for employment changes, it does not distinguish between structural and cyclical employment effects.[9] For lack of data, it also has to focus on a regional segment

effects of different forms of technical change using differentiated R&D expenditure data. However, these studies do not address the issue of cyclical employment changes investigated in our paper.

8 However, a number of different criteria for the definition of SME's have been suggested in the literature. Their quantitative importance in terms of employment depends heavily on the criterion used.

9 Note that the use of longitudinal micro data for our investigation would also require some form of aggregation and consolidation since the focus of our study is on overall employment changes over the business cycle.

of German industry. In light of these data problems we choose a different approach. We use aggregated net employment data for enterprises in each size class. This does not permit us to distinguish between enterprises which, for the entire period we study, were in a specific size class and those enterprises which left or entered the size classes during that period. However, because of better availability of aggregate employment data, this approach allows us to study the entire industrial sector of Germany. Theoretically, the reliability of the results is not jeopardized as long as we can assume that the observed employment behavior is dominated by enterprises which were in different size classes during the entire period of investigation. This assumption does not seem to be unreasonable. Moreover, we will later examine whether our results are consistent with studies using longitudinal data and focusing on structural issues. The use of net rather than gross employment data is not critical since cyclical employment variations are reflected in changes in overall employment. By contrast, gross data contain cyclical changes and, in addition, structural changes between enterprises of the same size class.

A first empirical analysis examines Germany's industrial sector as a whole. We employ data on enterprises rather than on establishments because of the higher autonomy of enterprises compared to establishments and because the analysis focuses on what has traditionally been defined as the "Mittelstand". We also follow the conventional definition of firm sizes used in the literature: large firms are enterprises with more than 500 employees; SMEs have between 20 and 500 employees; firms with less than 20 employees (often referred to as micro-enterprises) are not taken into account. We use annual data for the period 1978 - 1992. In 1993, the structure of official statistics was changed so that a consistent time series could not be extended beyond 1992. The appendix contains a brief description of the characteristics and sources of the data used.

For the group of large firms as well as for the group of SMEs we regress an employment variable on business cycle variables. We also include a trend variable as well as other control variables to isolate structural effects on employment. Additional tests we performed suggested that an AR(1) process should partly be included in the specifications. Table 1 shows the results of six specifications we used in the regression analysis. Specification (1) examines percentage changes in employment of large firms (denoted by L) and of SMEs as a function of a constant (reflecting the trend) and of the difference between the growth rates of economy-wide real GNP and total factor productivity. This difference can be interpreted as reflecting the business cycle factor. The correction of growth rates for productivity changes is necessary for studying employment effects since an increase in productivity cannot be expected to lead to any employment change. The estimates for specification

(1) imply that a one percent change in the adjusted GNP growth rate leads to a change in employment in large firms by 1.74 percent and in SMEs by 1.32 percent. This suggests that large firms respond stronger to business cycle movements than SMEs, which is in line with our theoretical analysis.

In order to use an industry-specific variable for the fluctuations in economic activity, specification (2) uses real value-added growth of the industry as the explanatory variable rather than an economy-wide measure of production as in equation (1). Not surprisingly, the coefficients are now smaller.[10] Again, the main result for our analysis is that the estimates suggest a stronger employment response of large firms to business cycle fluctuations than is the case for SMEs, although the difference is not as pronounced as in specification (1).

In order to strengthen our results, we include additional control variables in specifications (3) through (5). Whereas in specifications (1) and (2) structural effects on employment are captured by a single constant, we now examine whether our results still hold after including structural variables that may also have an impact on employment. We chose the growth of unit labor costs and the growth of R&D expenditure in German industry. Specifications (3) and (4) show that the coefficients of GNP growth as well as of value-added growth remain significantly higher for large enterprises. However, the coefficients of the two control variables, the growth of R&D expenditure and the growth of export orders, have the wrong sign or are not significant. Thus, neither R&D growth nor the dependence on export markets is the reason for the observed size-specific employment behavior. This supports our business cycle argument and rejects the competing hypotheses used here. Of the control variables, only the labor cost variable for SMEs turns out to be significant and of the expected sign, which can be interpreted as an indication in favor of the often cited argument according to which especially small and medium-sized enterprises are affected by high labor costs. Nevertheless, even this specification yields a considerably higher employment response of large enterprises, which is in line with our theoretical analysis.

---

10 If the production function is assumed to be Cobb-Douglas with labor-augmenting technical progress, the rate of change in employment is given by $w_L = \frac{1}{\alpha}(w_Y - w_A - (1-\alpha)w_K)$, where w denotes a rate of change, α is the coefficient of labor in the production function, and L, Y, A and K are labor, output, technical progress and capital stock, respectively. If we interpret the term $1/\alpha$ as our OLS coefficient we would expect values of about 3. But since we do not include the rate of change in capital stock, the term in parantheses can be expected to be higher than in reality. Thus our coefficients are downward biased.

In addition, we use two alternative proxies for output growth-adjusted productivity, namely economy-wide GDP growth and industry-specific value-added growth. Since the industry can be expected to be more capital intensive and growth rates of capital stock are above economy-wide average, the coefficients in specification (2) are more biased downwards than in (1).

Table 1: **Regression Results for Employment Changes in German Industry (1978 - 1992)**

Specification	Explained variable [a]	Const.	GNP growth minus productivity growth	Value-added growth minus productivity growth	Labor cost growth	Growth of R&D expenditure	Growth of export orders	Employ ment (-1)	AR(1)	R^2	D.W.
(1)	Rel. change in employment L	-3.78	1.74						0.79	0.63	1.54
		(-0.86)	(3.26)						(1.99)		
	Rel. change in employment SME	-1.06	1.32						0.38	0.70	1.84
		(-1.55)	(2.72)						(0.90)		
(2)	Rel. change in employment L	-0.04		0.70						0.53	1.90
		(-0.09)		(3.88)							
	Rel. change in employment SME	0.34		0.58						0.71	1.85
		(-1.13)		(5.67)							
(3)	Rel. change in employment L	-3.87	2.19		-0.21	0.14			0.79	0.76	1.41
		(-1.25)	(4.59)		(-1.06)	(1.19)			(2.19)		
	Rel. change in employment SME	0.41	1.47		-0.38	-0.07			-0.40	0.86	1.78
		(0.68)	(8.61)		(-4.61)	(-1.16)			(-1.29)		
(4)	Rel. change in employment L	0.72		0.83	0.05	-0.11			-0.17	0.55	2.03
		(0.52)		(3.46)	(0.21)	(-0.72)			(-0.46)		
	Rel. change in employment SME	1.86		0.59	-0.25	-0.11			-0.45	0.87	2.29
		(3.52)		(9.28)	(-3.36)	(-1.99)			(-1.79)		
(5)	Rel. change in employment L	-2.65	2.02		-0.33		-0.01		0.78	0.71	1.62
		(-0.73)	(4.11)		(-1.46)		(-0.10)		(2.11)		
	Rel. change in employment SME	-0.25	1.54		-0.36		0.005		-0.26	0.85	1.81
		(-0.52)	(7.96)		(-3.61)		(0.14)		(- 0.77)		
(6)[b]	Employment L	1887404	87559					0.59		0.94	1.99
		(4.85)	(7.63)					(7.01)			
	Employment SME	534954	43178					0.79		0.96	1.84
		(2.76)	(6.28)					(11.77)			

t-statistics in parantheses.
[a] *L* denotes large enterprises and SME small and medium-sized enterprises.
[b] trend-adjusted
Source of data: Federal Statistical Office of Germany, Report of the Council of Economic Experts, Federal Minstry of Economic Affairs and own calculations.

If SMEs react less strongly to business cycle fluctuations than larger enterprises it can be expected that their employment levels are to a larger degree determined by past employment levels. To examine this implication, specification (6) regresses trend-adjusted employment levels on GNP growth net of productivity growth and past employment levels. The results show that past employment has indeed a stronger effect on current employment in SMEs than in large firms.

We also apply regression analyses to selected industry segments in order to examine whether our findings for the whole industry are confirmed for individual industry segments. More disaggregated analyses have the advantage of a better control for structural aspects. We choose specification (3) of Table 1 as a reference regression because among the specifications in Table 1 this regression has a particularly good fit. In Table 2, we report our results for the four main sectors of German industry. It turns out that three sectors show a stronger employment response of large enterprises and, in addition, the differences in the coefficients are more pronounced than on the aggre-

Table 2

Regression Results for Employment Changes in German Industry Sectors (1978 - 1992)

Sector of production	Enterprise-size	Const.	GNP growth minus productivity growth	Labor cost growth	Growth of R&D expenditure	AR(1)	R^2	D.W.
Capital goods	SME	0.99 (0.82)	**1.49** (4.76)	– 0.37 (– 2.51)	– 0.03 (– 0.23)	– 0.04 (– 0.10)	0.76	2.08
	Large	– 3.81 (– 1.27)	**2.33** (3.57)	– 0.15 (– 0.54)	0.20 (1.21)	0.74 (2.25)	0.66	1.48
Consumer durables	SME	– 1.68 (– 2.03)	**1.69** (6.82)	– 0.39 (– 3.54)	0.03 (0.34)	– 0.02 (– 0.15)	0.85	2.62
	Large	– 2.91 (– 2.29)	**3.42** (8.77)	– 0.91 (– 5.06)	0.16 (1.46)	– 0.24 (– 0.61)	0.88	1.65
Other consumer goods[a)]	SME	2.17 (1.53)	**0.69** (2.33)	– 0.24 (– 1.56)	– 0.22 (1.87)	0.15 (1.64)	0.85	2.38
	Large	3.21 (0.62)	**3.44** (2.94)	– 0.99 (– 1.39)	– 0.22 (– 0.67)	0.04 (0.07)	0.77	2.44
Intermediate goods	SME	– 0.54 (– 0.41)	**1.46** (3.42)	– 0.27 (– 1.44)	– 0.03 (– 0.27)	0.08 (0.22)	0.65	2.11
	Large	– 2.70 (– 2.60)	**1.01** (3.00)	– 0.15 (– 1.01)	0.08 (0.97)	0.28 (0.74)	0.58	1.78

t-statistics in parantheses.

a) Due to data availability problems, the period 1984 - 1989 is excluded.

Source of data: Federal Statistical Office of Germany, Report of the Council of Economic Experts, Federal Ministry of Economic Affairs and own calculations.

Table 3

Regression Results for Employment Changes in Selected German Industry Segments (1978 - 1992)

Sector of production (SYPRO-No.)[1]	Enter-prise-size	Const.	GNP growth minus produc-tivity growth	Labor cost growth	Growth of R&D expendi-ture	AR(1)	R^2	D.W.
(25) stone mining	SME	– 1.55	**1.88**	– 0.37	0.11	– 0.52	0.83	2.44
		(– 1.41)	(7.11)	(– 2.39)	(0.99)	(– 1.17)		
	Large	– 6.86	**1.21**	– 0.29	0.49	– 0.14	0.43	1.97
		(– 2.27)	(1.56)	(– 0.72)	(1.72)	(– 0.27)		
(27) iron producing industry	SME	– 3.38	**0.78**	– 0.47	0.28	– 0.41	0.64	2.98
		(– 2.38)	(2.00)	(– 2.28)	(1.90)	(– 1.28)		
	Large	– 8.57	**1.53**	0.23	0.35	– 0.29	0.85	2.41
		(– 8.43)	(5.48)	(1.66)	(3.26)	(– 1.29)		
(28) metal producing industry	SME	– 2.33	**1.64**	– 0.37	0.04	– 0.60	0.53	2.70
		(– 0.68)	(1.53)	(– 0.74)	(0.15)	(– 1.37)		
	Large	– 5.80	**1.58**	0.38	0.18	0.50	0.43	2.06
		(– 0.88)	(1.43)	(0.47)	(0.40)	(0.72)		
(29) foundry	SME	– 1.13	**2.04**	– 0.80	0.13	– 0.26	0.62	1.98
		(– 0.53)	(3.45)	(– 2.77)	(0.62)	(– 0.70)		
	Large	– 10.4	**3.32**	0.07	0.72	– 0.43	0.81	1.96
		(– 5.82)	(6.69)	(0.29)	(3.90)	(– 1.56)		
(31) steel and light-metal construction and rail vehicles	SME	0.98	**1.78**	0.14	– 0.19	– 0.19	0.66	1.85
		(0.55)	(3.66)	(0.62)	(– 1.12)	(– 0.49)		
	Large	– 1.24	**2.23**	1.24	– 0.79	– 0.25	0.66	1.93
		(– 0.28)	(1.84)	(2.13)	(– 1.73)	(– 0.79)		
(32) machine building	SME	– 2.68	**1.67**	0.11	0.35	0.58	0.69	2.06
		(1.57)	(3.22)	(0.42)	(2.50)	(2.62)		
	Large	– 3.15	**2.08**	– 0.17	0.18	– 0.02	0.35	1.96
		(– 0.89)	(2.10)	(– 0.37)	(0.54)	(– 0.06)		
(33) cars	SME	– 0.59	**1.76**	– 0.43	0.02	– 0.29	0.47	1.91
		(– 0.28)	(3.01)	(– 1.51)	(0.13)	(– 0.83)		
	Large	– 1.83	**1.17**	– 0.09	0.32	– 0.21	0.58	2.08
		(– 1.52)	(3.47)	(– 0.58)	(2.75)	(– 0.59)		
(36) electrical engineering and household appliances	SME	3.62	**1.19**	– 0.48	– 0.10	– 0.33	0.52	2.13
		(2.30)	(2.69)	(– 2.27)	(– 0.64)	(– 0.91)		
	Large	– 5.15	**2.22**	0.14	0.47	0.77	0.78	0.87
		(– 1.87)	(3.46)	(0.54)	(3.08)	(4.42)		
(37) micro mechanics and optics	SME	– 2.44	**1.88**	– 0.07	0.08	– 0.13	0.76	2.13
		(– 1.92)	(5.36)	(– 0.42)	(0.67)	(– 0.37)		
	Large	– 14.6	**4.90**	0.85	0.97	0.02	0.50	2.24
		(– 2.00)	(2.46)	(0.93)	(1.38)	(0.09)		
(38) iron, sheet-metal and metal products	SME	2.50	**1.38**	– 0.53	– 0.24	0.06	0.90	1.96
		(2.90)	(5.70)	(– 4.79)	(– 3.03)	(0.16)		
	Large	5.09	**3.09**	– 1.58	– 0.26	– 0.38	0.84	2.33
		(2.53)	(5.61)	(– 5.86)	(– 1.27)	(– 1.15)		

Sector of production (SYPRO-No.)[a]	Enterprise-size	Const.	GNP growth minus productivity growth	Labor cost growth	Growth of R&D expenditure	AR(1)	R^2	D.W.
(40) chemical industry	SME	3.27	**0.50**	– 0.19	– 0.33	– 0.27	0.63	1.83
		(2.44)	(1.44)	(– 1.13)	(– 2.34)	(– 0.88)	0.33	1.87
	Large	– 0.97	**0.43**	– 0.19	0.12	0.20		
		(– 0.71)	(1.09)	(– 1.11)	(0.95)	(0.58)		
(53) wood processing	SME	– 4.21	**2.52**	0.08	0.03	– 0.28	0.73	2.41
		(– 1.50)	(3.58)	(0.24	(0.12)	(– 0.55)	0.44	2.67
	Large	5.84	**4.21**	– 1.40	– 0.95	– 0.45		
		(0.47)	(1.32)	(– 0.79)	(– 0.81)	(– 1.04)		
(55) paper industry	SME	1.66	**0.51**	– 1.03	– 0.03	– 0.53	0.56	2.29
		(0.77)	(0.84)	(– 3.35)	(– 0.14)	(– 1.85)	0.37	1.66
	Large	– 2.79	**1.29**	0.48	0.12	0.04		
		(– 0.91)	(1.53)	(1.21)	(0.43)	(0.09)		
(59) rubber processing	SME	0.03	**0.86**	– 0.84	0.06	– –	0.61	2.08
		(0.01)	(1.39)	(– 3.31	(0.24)		0.40	1.81
	Large	– 3.19	**1.39**	– 0.16	0.28			
		(– 1.28)	(2.25)	(– 0.64)	(1.04)			

t-statistics in parantheses
[a] Based on the SYPRO classification ("Systematik der Wirtschaftszweige, Fassung für die Statistik im Produzierenden Gewerbe") of the Federal Statistical Office of Germany.
Source of data: Federal Statistical Office of Germany, Report of the Council of Economic Experts, Federal Ministry of Economic Affairs and own calculations.

gated industry level. The fact that there are considerable differences in the estimated constants and coefficients of control variables among the different sectors suggests that structural effects are sector-specific. This view is also strongly supported by the analysis of Pavitt [1984]. Only the intermediate goods sector exhibits a stronger employment response of SMEs, which is not in line with our theoretical analysis. However, as reported in the appendix, this sector has the smallest share of SMEs among the four sectors.

We now extend the analysis further by applying specification (3) of Table 1 also to various industry segments on a 2-digit-level of the SYPRO classification. Due to data availability, our analysis is limited to 14 segments. Table 3 reports that in 10 out of 14 segments we find strong support for the hypothesis of a stabilizing behavior of SMEs. The coefficients of GNP growth are significantly higher for large enterprises than for SMEs. In four segments, we are not able to find empirical support for our hypothesis. However, in two out of these four segments (metal industry and chemical industry) the differences in the coefficients are marginal and, in addition, the estimates are not significant on usual levels. Furthermore, we again observe considerable large differences in the estimates of the constants and the coefficients of control variables.

In sum, we find strong empirical support for our theoretical argument of an employment-stabilizing role of SMEs over the business cycle. The support can be derived both on an aggregated and on a disaggregated level in German industry. It is important to note that our findings do not contradict the results of studies that focus on gross employment changes. For example, Brouwer et al. [1993], using data on 859 Dutch manufacturing firms, find that smaller firms have, ceteris paribus, substantially higher growth rates of employment than their larger counterparts. However, their study focuses on structural effects on employment and it does not include cyclical movements since it is limited to the fairly short period 1983 - 1988. Davis and Haltiwanger [1992], using longitudinal data, find that, on average, gross employment changes (i.e., the sum of job creation and job destruction) are higher among smaller enterprises than among larger enterprises. At the same time, they emphasize that SMEs, unlike larger enterprises, do not exhibit systematic variations of gross employment over the business cycle. This implies that net changes are also relatively stable over the business cycle, which, in turn, is consistent with our result according to which SMEs stabilize employment during output fluctuations.[11]

Combining the result of lower net employment fluctuations among SMEs with the finding of higher job creation and job destruction rates suggests that structural changes among SMEs are faster than among larger enterprises. An explanation for this observation can be that SMEs are more flexible in changing their business activities in response to market changes.

As pointed out in section 2, the analysis also implies that SME jobs are safer with respect to business cycle movements than those in large firms. The latter implication gives rise to the question whether wages in the two groups are different, reflecting the differences in the workers' risk of becoming unemployed. A closer look at average salaries in German industry indeed reveals significant differences between large enterprises and SMEs. The ratio of average SME salaries to the average salaries in large firms was about 0.83 in 1978 and declined to 0.78 in 1992. This observation also holds for individual industry sectors.[12] Although it is difficult to compare wages of different firms because the job content may be different, the time series

---

[11] Note that our analysis does not explicitly capture employment effects of new firm start-ups. However, Audretsch and Acs [1994] examine the effects of business cycle stages on new firm start-ups. On the one hand, their results emphasize that during an expansion the start-up activities tend to be higher. On the other hand, they also find that unemployment is conducive to new firm start-ups. As incumbent enterprises reduce employment, the resulting unemployment triggers an increase in the start-ups of new firms. Since most of the latter can be expected to be smaller firms, this structural effect supports our view of a stabilizing role of SMEs on the job market.

[12] However, these ratios vary among different industry sectors. Especially in the consumer durables sector the ratio is higher compared to other sectors.

clearly indicate that average SME wages are lower than wages paid by large firms. This wage differential is also well documented for the US. Brown, Hamilton and Medoff [1990] show that workers in large enterprises earn over 30 percent more than their counterparts in small enterprises. The authors refer to this as "the size-wage premium". Data for Germany show that this wage difference has increased over the past two decades. Our analysis suggests that this is, at least partly, due to the differences in workers' risk of becoming unemployed. There is a large micro-based literature on the topic of wage differentials. These differentials are mainly explained by differences in the degree of workers' qualification, differing working conditions, asymmetric information and efficiency wage considerations. For a survey and empirical tests for Germany see Schmidt [1995]. Brown and Medoff [1989] consider several explanations for a positive relationship between employer size and wages in the US. Among these are: large employers hire higher-quality workers, and make more use of high wages to forestall unionization; furthermore, they have more ability to pay high wages, and they face smaller pools of applicants relative to vacancies. Our argument, which states that differences in wages are caused by differing risks of getting unemployed and that a rise in the economy-wide unemployment-risk widens the wage differential, should be understood as an additional explanation reinforcing the above-mentioned theories.[13]

4. Summary and Conclusions

The paper examines the often-expressed hypothesis that business cycles lead to smaller employment fluctuations in small and medium-sized firms compared to large firms. We first develop a simple model that explains the described differences. A crucial element that can cause a different employment response is the existence of transaction and adjustment costs associated with employment changes. Such costs can be assumed to be smaller for large firms, mainly due to economies of scale and economies of scope. However, the analysis shows that transaction and adjustment costs are of little relevance for permanent, i.e., structural, changes in the output market of a firm. The empirical analysis focuses on German's industry because it is often used as an example for a relatively strong group of SMEs. We also ex-

[13] Since the ratios of average SME salaries to average salaries in large firms show significant changes over time, we checked whether these changes reflect changes in the overall risk of becoming unemployed. Our argument states that the ratios should fall, i.e., the wage gaps widen, if the unemployment risk rises. A simple correlation analysis we performed yields strong negative correlation around values of – 0.70 in all industry sectors. However, in order to fundamentally support this wage effect, a more comprehensive econometric analysis with differentiated wage data and additional control variables would be needed. We leave this for future research.

amine single industry segments and control for structural effects. The empirical findings strongly support the view of a smaller employment response of SMEs to changes in economic activity.

Appendix

Structure of Employment and Value-Added in German

Industry sector	Employment share in total industry in 1990 in %	Share of SMEs in employment (1990, in %)	Share of SMEs in value-added (1990, in %)
Capital goods	55.7	35.4	32.1
Intermediate goods (incl. mining)	18.8	28.8	24.1
Durable consumer goods	18.4	66.6	64.3
Other consumer goods	7.1	59.5	39.6

Data Sources and Remarks

Series	Source	Remarks
Total employment per size class	Federal Statistical Office, Germany, "Fachserie 4, Reihen 4.3.1, 4.3.2, 4.3.3"	Includes owners and excludes homeworkers
Real value-added per size class	Federal Statistical Office, Germany, "Fachserie 4, Reihen 4.3.1, 4.3.2, 4.3.3"	GNP deflator was used to calculate real values
Real GNP growth	Annual Report of the Council of Economic Experts, 1996	
Productivity growth in German industry	Annual Report of the Council of Economic Experts, 1996	No sector specific data available
Overall employment	Annual Report of the Council of Economic Experts, 1996	
Unit labor cost in German industry	Annual Report of the Council of Economic Experts, 1996	
R&D expenditure per size class	Federal Ministry of Economic Affairs, "Unternehmensgrößenstatistik", 1992/93 and 1997/98	No sector specific data available
Export orders	Annual Report of the Council of Economic Experts, 1996	The sector-specific index for "durable consumer goods" was also applied for "other consumer goods"

References

Audretsch, D. B. / Z. J. *Acs* (1994), Entrepreneurial Activity, Innovation, and Macroeconomic Fluctuations, in: Shionoya, Y. and M. Perlman (Eds.), Innovation in Technology, Industries, and Institutions, Ann Arbor.

Brouwer, E. / A. *Kleinknecht* / J. O. N. *Reijnen* (1993), Employment growth and innovation at the firm level, an empirical study, in: Evolutionary Economics, Vol. 3, pp. 153 - 159.

Brown, C. / J. *Medoff* (1989), The Employer Size-Wage Effect, in: Journal of Political Economy, Vol. 97, pp. 1027 - 1059.

Brown, C. / J. *Hamilton* / J. *Medoff* (1990), Employees Large and Small, Harvard University Press, Cambridge, Mass.

Campbell, J. R. / J. D. M. *Fisher* (1996), Aggregate Employment Fluctuations with Microeconomic Asymmetries, NBER Working Paper No. 5767.

Davis, S. J. / J. *Haltiwanger* (1992), Gross Job Creation, Gross Job Destruction, and Employment Reallocation, in: Quarterly Journal of Economics, Vol. 107, pp. 819 - 863.

Dixit, A. K. / *Pindyck,* R. (1994), Investment under Uncertainty, Princeton University Press, Princeton.

Fotherwill, S. / G. *Gudgin* (1979), The Job Generation Process in Britain, Center for Environmental Studies, London, Research Series 32.

Gruhler, W. (1979), Unternehmensgröße und Beschäftigung in der Industrie, Beiträge zur Wirtschafts- und Sozialpolitik No. 63, Institut der deutschen Wirtschaft, Köln 1979.

Hamermesh, D. S. / G. A. *Pfann* (1996), Turnover and the Dynamics in Labour Demand, in: Econometrica, Vol. 63, pp. 359 - 367.

Hughes, A. (1993), Industrial Concentration and Small Firms in the United Kingdom: The 1980s in Historical Perspective, in: Acs, Z.J. and D.B. Audretsch, (Eds.), Small firms and entrepreneurship: an East-West perspectice, pp. 15 - 37, Cambridge.

Pavitt, K. (1984), Sectoral Patterns of technical change: Towards a Taxonomy and a theory, in: Research Policy,Vol. 13, pp. 343 - 373.

Rothwell, R. / W. *Zegveld* (1982), Innovation and the Small and Medium Sized Firm, Hingham, Massachusetts.

Schmidt, E. M. (1995), Betriebsgröße, Beschäftigtenentwicklung und Entlohnung. Eine ökonometrische Analyse für die Bundesrepublik Deutschland, Campus, Frankfurt, New York.

Solomon, S. (1986), Small Business USA – The Role of Small Companies in Sparking America's Economic Transformation, New York.

Zusammenfassung

Die vorliegende Arbeit untersucht die Hypothese, nach der die Anpassung der Beschäftigtenzahl von Unternehmen während eines Konjunkturzyklus von der Unter-

nehmensgröße abhängt. Verschiedene Autoren argumentieren, daß mittelständische Unternehmen sowohl bei der Einstellung zusätzlicher Beschäftigter im Konjunkturaufschwung als auch bei der Entlassung von Arbeitskräften in rezessiven Phasen zögerlicher reagieren als Großunternehmen. Dies impliziert, daß mittelständische Unternehmen eine stabilisierende Wirkung auf die gesamtwirtschaftliche Beschäftigungsentwicklung während eines Konjunkturzyklus haben. Allerings sind theoretische Erklärungsansätze und empirische Überprüfungen dieser Hypothese bisher sehr rar. Diese Arbeit liefert einen theoretischen Erklärungsansatz für unternehmensgrößenspezifisches Beschäftigungsverhalten, in dessen Mittelpunkt Transaktions- und Anpassungskosten als wesentliche Ursache für dieses Verhalten modelliert werden. Zudem werden empirische Resultate für den industriellen Sektor in Deutschland präsentiert, welche die Hypothese einer weniger stark ausgeprägten Beschäftigungsvariation mittelständischer Unternehmen als Reaktion auf Veränderungen der gesamtwirtschaftlichen Aktivität bestätigen.

Abstract

This paper investigates the hypothesis according to which the behavior of firms in adjusting the number of employees along the business cycle depends on the firm size. Several authors argue that small and medium-sized enterprises are more hesitant than large enterprises in hiring additional employees in an upswing and laying off workers in a recession. This implies that small and medium-sized enterprises stabilize economy-wide employment over the business cycle. However, while several authors presume such behavior, formal analytical work as well as empirical evidence has been very limited. This paper presents a theoretical framework for the size-specific behavior of firms in hiring and laying off workers and argues that transaction and adjustment costs are important reasons for the size-specific behavior. We also present empirical evidence for the industrial sector in Germany, which confirms the view of a less pronounced employment response of small and medium-sized enterprises to changes in economic activity.

JEL-Klassifikation: D 21; E 25; E 32