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Outsourcing and Firm-level Performance

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Abstract

Using firm-level panel data from the German cost structure survey over the period 1992 to 2000, our empirical analysis shows that firms that increased material inputs relative to internal labor costs performed better in terms of gross operating surplus than other firms. However, firms that increased external services relative to internal labor costs, thus outsourcing service functions previously provided within the firm, performed worse. In sum, our findings support the view that firms tend to overestimate the benefits accruing from outsourcing of services previously provided internally.

JEL classification numbers: L22, L23, L60

Keywords: Outsourcing, Firm Performance, Business Service Sector.

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1 Introduction

Throughout the 1990s a remarkable increase of outsourcing activities by firms has been observed. It has been hypothesized that this increase results from the decline in transaction costs in connection with the intensified use of information technology (Abraham and Taylor, 1996; Groot, 2001). It has also been argued that part of the process of deindustralization is associated with outsourcing. Today, activities that used to be performed in-house (e.g. auditing, maintenance, repair, transportation, janitorial and legal services) are usually outsourced to firms in the business service sector. Consequently, outsourcing has contributed significantly to the growth of business-related services during the last decade (Fixler and Siegel, 1999). Moreover, manufacturing firms are outsourcing not only services but also internal production. One prominent example is the automotive industry, where some large car manufacturers only perform the final assemblage of major parts whose production is outsourced to external suppliers. Since this type of outsourcing quite often occurs at an international level, it is also closely entwined with the globalization process (Feenstra and Hanson, 1996).

This study is an empirical contribution to the literature on factors that determine firm performance. In particular, we test whether outsourcing is an important determinant for a firm's profitability. In addition, our paper also provides estimates on the relative importance of firm-, market- (i.e. industry-) and location-specific effects, as well as on the impact of organizational structure and human capital input on firm performance.

In general, outsourcing can be related to make-or-buy decisions on intermediate goods, to the hiring of temporary labor, and to the use of external services. The term outsourcing is used here to describe all the subcontracting relationships between firms, and the hiring of external workers. We presume that firms engage in outsourcing activities because they expect a positive impact on firm performance by saving resources in terms of both labor and capital. If for instance intermediate goods are not longer internally produced but purchased from an external supplier, this leads to a reduction of both labor costs and capital investments. In the absence of transaction costs, a firm will decide to outsource when the mar-

ket price for an outsourced activity is lower than internal marginal cost for that activity (Fixler and Siegel, 1999).

However, it is an unresolved empirical issue whether outsourcing actually has a positive influence on a firm's performance as is expected a priori. Some case studies have reported that firms tend to underestimate the transaction costs associated with outsourcing. For instance, it has been documented that some firm have again 'insourced' activities that were previously performed by external firms, because they were dissatisfied with the quality or because they have underestimated the amount of asset specific investments (Benson, 1999; Gornig and Ring, 2000; Young and Macneil, 2000). A few studies have analysed the impact of outsourcing on firm efficiency (for an overview see Heshmati, 2002). Although efficiency is certainly an important aspect of firm performance, it neglects the product market performance of firms. Taking this into account, our study is a novelty to the literature. For instance, even if efficiency of firms remains unchanged after outsourcing of internal production, higher quality of intermediate inputs might result in higher quality of final products and hence higher sales and higher margins. The lack of empirical studies on the link between outsourcing and firm performance might be also due to a limited availability of suitable micro data for analysing this subject.

Our study is based on a representative panel data set of about 43,000 German manufacturing firms from the German cost structure survey over the period 1992 to 2000. As an indicator for firm performance we use Gross Operating Surplus (GOS). We employ several measures for outsourcing activities of firms. We find that in particular outsourcing of internal production has a significant positive impact on firm performance in both the short and the long run, whereas outsourcing of services appears to have a negative impact in the short run but a positive impact in the long run. Besides this, our findings emphasize the importance of firm-specific characteristics for explaining differences in firm performance.

The remainder of this paper is organized as follows. Section 2 describes the empirical evidence and the hypotheses. Section 3 discusses the empirical approach. Section 4 presents the empirical results. Section 5 concludes.

2 Theoretical Considerations and Empirical Evidence

In theory, efficient firms will allocate their resources within the value chain to those activities that give them a comparative advantage (Shank and Govindarajan, 1992). Other activities that do not offer such advantages will be outsourced to external suppliers. When firms engage in outsourcing, they assess the productivity of their in-house service functions and decide to outsource if others can provide comparable services cheaper. Basically, when firms outsource activities and functions related to producing their products and services, they move towards a business strategy based on 'core competencies', a set of 'skills and knowledge' that helps maintain their competitive advantage in serving customers (Porter, 1985; Sharpe, 1997). Thus outsourcing is expected to imply cost savings relative to internal production or internal service functions. This will be the case if outside suppliers benefit from specialized knowledge and/or economies of scale (Heshmati, 2002).

However, recent work by Grossman and Helpman (2002) shows that the choice between continued internal production or an outsourcing decision means taking into consideration more than just production cost differences. According to transaction cost economics, outsourcing is desirable only when transaction costs incurring from asset specificity, incomplete contracting and search efforts are lower than the production cost advantage (Williamson, 1971). In addition, the attractiveness of outsourcing to a certain producer may well depend on how many firms can potentially provide the inputs it needs. As mentioned above, some case studies have also reported that benefits from outsourcing are quite often not derived immediately and that managers tend to overestimate the resulting benefits and underestimate the involved transaction costs (Benson, 1999; Gornig and Ring, 2000; Young and Macneil, 2000).

Furthermore, if firms improve efficiency by outsourcing it can be expected that other firms will do the same. Therefore, a competitive advantage that results from outsourcing activities can be expected to diminish in the long run since other firms are likely to adopt the same strategy as well.

Table 1 shows the means (medians) and the respective developments of two

performance variables for (all) West German firms over the period 1992 to 2000. Return on sales (ROS) decreased by about eight percent over the period whereas return per employee (RPE) increased by about 22 percent from 1992 to 2000. Looking at the three outsourcing indicators in Table 1, we see that the share of material inputs in gross production increased about five percent in this period, while labor costs as a share of gross production decreased about three percent. Moreover, a strong increase of about 27 percent in external contract work, i.e. farming out of internal production, and also a significant increase of about 14 percent in external services can be observed.

Table 2 contains the same descriptive information for the subsample large West German firms. In contrast to all firms, for large firms the median of ROS increased about 26 percent from 1992 to 2000 and RPE more than doubled. Thus, large firms have improved their performance significantly. On the other hand, labor costs as a share of gross production decreased by 18 percent, whereas material inputs increased by six percent and external contract work increased by about eight percent.

From this evidence we infer that among large firms in particular there has been a strong tendency toward reduction of internal labor costs and an increase in material inputs and external contract work throughout the 1990s. Simultaneously, we observe that the performance median has improved significantly. Consequently, we hypothezise that there is a link between outsourcing and a firm's performance. Outsourcing activities should lead to increased firm efficiency and/or to an increased competitive advantage, thereby increasing a firm's profits.

Our approach also controls for other factors that might exert an influence on firm performance. Many studies have reported the importance of firm-specific effects in explaining firm performance (Brenner, Bunke, Droge and Schwalbach, 2001). Hence, unobserved heterogeneity across firms, for example, in terms of firm-specific characteristics and managerial abilities, is likely to be important for explaining firm performance. Another strand of literature emphasizes the role of intangible assets, e.g. human capital or technological knowledge, for firms

(Kleinknecht and Mohnen, 2002; Webster, 1999). Firms with human-capital intensive production should perform better and have higher profits than firms with a low human-capital intensity. In addition, the industrial organization literature traditionally discusses the relevance of product market competition for firm performance (Martin, 1993). Accordingly, we can expect that product market effects are important for explaining firm performance. On the other hand, the empirical evidence on the relationship between market concentration rate and firm performance is ambiguous (Schmalensee, 1989, p. 976).

Regarding the relationship between firm size and performance, there should be a trade-off between economies of scale on the one hand and increasing inefficiency on the other. Since outsourcing often implies the shift of internal production activities from large to external medium scale producers, e.g. in the automobile industry, it can be hypothesized that there is an optimal firm size for any given production activity and that the relation between size and performance in terms of efficiency is non-linear. Accordingly, firms which are smaller than optimal and firms which are larger than optimal should perform worse than optimally sized firms.

Firms that produce with a high capital intensity can be expected to have higher (gross) profits because they have to re-earn their capital investments. Even more important, they also have to finance their current and future capital investments out of gross profits. Finally, firm profits should be positively related to the number of owners working in the firm because these owners' income is taken out of profits.

3 Empirical Approach

3.1 Specification

Gross Operating Surplus (GOS) of firm i in period t is defined as

$$GOS_{it} = S_{it} - C_{it},$$

where S_{it} denotes gross production and C_{it} denotes production costs. We assume that GOS_{it} is a function of the cost structure of production (i.e. intensity of out-

sourcing), of the human capital input, the organization of the firm and market-, regional as well as unobserved firm-specific characteristics. Thus, we have

$$GOS = f(\text{production process, outsourcing, organizational structure, product market, location, unobserved firm-specific characteristics, unobserved time effects}) + \text{error}. \quad (1)$$

Return on capital would be a suitable indicator for describing firm performance. However, since capital stock data is not available we employ two different relative measures of firm performance in the empirical analysis. The first is as GOS_{it}/L_{it}, which can be labelled as *return per employee (RPE)*. It is worth pointing out that this measure possesses similarities to measures of labour productivity, since GOS_{it}/L_{it} is derived from gross value added at factor costs (i.e. before depreciation) minus wages and salaries. However, while labor productivity is a purely input/output related measure, RPE also captures the market outcome of the output.

The second measure of firm performance is GOS_{it}/S_{it}, which we label as *return on sales (ROS).* If average costs are taken as a proxy for marginal costs, then this measure may reflect the markup $(p - c\prime)/p$, which is used in the Industrial Organization literature as a measure of a firm's market power. For this reason, we interpret this measure as an indicator of a firm's product market performance.

3.2 Variable Definition

Table 3 gives the names and provides definitions of the variables we use in the regression equation.[1] Firms' GOS at factor costs before depreciation have been derived from

$$GOS = \text{gross production-total intermediate consumption-wages \& salaries},$$

[1] For further details on the definition of variables, we refer the reader to the original series "Kostenstrukturerhebung", annual publication of the Federal German Statistical Office.

where

total intermediate consumption=material+energy+traded goods

+external contract work+external repair services

+rents & leasing+other costs.

We measure firms' outsourcing activities using three variables. All of these variables are expressed relative to internal labor costs in order to reflect substitution between internal labor and outsourcing costs. The first outsourcing variable is material inputs. This variable reflects the make-or-buy decisions of firms. If firms decide to outsource internal production to external suppliers, we can expect to observe an increase in material inputs relative to internal labor costs.[2] The second outsourcing variable is external contract work, which mainly consists of farming out internal production. Accordingly, this measure reflects subcontracting between firms, where firms transfer their intermediate products to other firms for further processing. The third variable for outsourcing is based on the category other costs not related to production, which is used as a collective item in the cost structure survey. As such, it includes many externally provided services e.g. transportation, consultancy, external advertising agency costs, external audit services, cleansing, janitorial services, etc. However, a caveat applies here because this also includes a few categories of costs, e.g. bank fees, which are not related to outsourcing of internal services.

We stress that it is important to capture differences in the production process across firms in the analysis. Accordingly, we use four variables to describe the production process of a firm. All of these variables are divided by the corresponding employment figures.

The first variable we use is rents and leasing. It is used as a measure for the *external* user costs of capital services. The second variable we employ is capital labour intensity. This captures the *internal* user cost of capital services. In the literature, the internal user cost of capital services is commonly measured by a

[2] As an alternative indicator it would be possible define material input relative to user costs of capital services because firms will also save capital costs if material inputs are produced by external suppliers.

composite indicator using the depreciation rate, the price for investment goods and the interest rate (Jorgenson, 1963). Since we are interested in the relative user cost of capital services across firms, the most important firm-specific component of the internal user cost of capital services is depreciation. We use tax depreciation per person engaged, which we label as capital intensity. Tax depreciation rates are presumably higher than economic depreciation rates. However, since this is valid for all firms, we expect that the structure of tax depreciation across firms is correlated with the unobservable economic depreciation. The third variable is energy consumption. Note that this measure is also used for capturing varying degrees of capacity utilization of production over time. The fourth variable is the wage level, which is total wages and salaries plus the employer's contribution to social insurances divided by the number of persons employed. The wage level is interpreted as a measure of the human capital intensity of production.

We employ several variables to control for the organizational characteristics of a firm. One measure is firm size, which is the number of persons engaged. The second variable is an indicator for the legal form of business organization. It distinguishes between corporate and non-corporate firms. We also include a variable indicating whether a firm belongs to skilled trades or manufacturing. Finally, the number of owners engaged in the firm is also included.

Regarding product market effects on firm performance, we use three different indicators. First, an indicator variable at the four-digit level for the industry in which a firm operates is included. Note that due to a change of industry classification in 1995 we have estimated the industry assignment of each individual firm before 1995 using a transition matrix. The industry assignment of a firm is almost time-invariant, so that the statistical mode of reported industry assignment is used for each firm. Furthermore, concentrations on product markets are measured with the Herfindahl index. Note that only domestic concentration is captured by this measure. Furthermore, we use the market share of a firm in total industry turnover as a proxy for the market power.

We also test whether firm performance is related to locational effects. For this reason, indicators for nine types of regions are included in the equation. This

indicator describes the degree of agglomeration of regions. Table 4 describes the structure of our unbalanced panel data set. Firms with only one observation are included in the between-firm analysis but are excluded in the within-firm analysis.

4 Estimation Results

Our estimation strategy consists of two parts. First, we perform a between-firm analysis where all observations are averaged for each firm. This approach enables us to estimate the relative importance of time-invariant variables, e.g. market, locational and organizational effects. In addition, we interpret the coefficients from this between-firm analysis as estimates of the long run parameters. Second, we perform a within-firm analysis where firm-specific effects are included in order to capture unobserved heterogeneity across firms. Here, all time-invariant and nearly time-invariant variables, e.g. industry, legal form and number of owners, are excluded. We interpret the coefficients from the within-firm estimation as estimates of the short run effects. The estimation method both for the between-firm approach and the within-firm approach is Analysis of Covariance (ANCOVA).

As a result of the large number of observations, almost all included effects turn out to be significant even at a 1 percent level. Therefore, two rules of thumb are used to distinguish the more important and robust variables from less important and less robust ones.[3] First, a variable is considered to be important if its partial R^2, i.e. the partial contribution of this variable to explaining the overall R^2, is larger than 0.005 in the between-firm analysis and 0.001 in the within-firm analysis. Note, that the partial R^2 is the change in total R^2 if the variable is removed from the model given all other variables. It is worth pointing out, however, that a relative low partial R^2 – in particular if the corresponding $F-$statistic is significant – does not imply that a variable is not important for the analysis. Such a variable might be important because if it is correlated with other variables, then estimates of the other effects will be biased if the variable is excluded. A low par-

[3] This includes both continuous and qualitative variables, which are also labelled as class variables or effects.

tial R^2 is interpreted in this context as evidence that the variable contributes little to explaining firm performance *independently of the other variables given.*

The second assessment criteria is whether, for continuous variables, an estimated effect is robust both in terms of sign and significance when rank transformations of all continuous variables are performed and the ANCOVA estimation is repeated (Conover and Iman, 1982). If both the sign and significance remain after rank transformation, an effect is considered to be *robust*. Note that regressions based on rank transformed variables do not measure linear but monotone relationships (Iman and Conover, 1979). Also, regressions based on rank transformed variables are less sensitive to influential outliers.

Finally, we have trimmed the distributions of the two dependent variables with large tails at the lower and upper 1 percent quantiles in order to remove influential observations from the analysis.

Table 5 contains the partial R^2s and Table 6 the estimated elasticities at mean data points for the continuous variables for the between-firm analysis. The total R^2 for the respective dependent variables RPE and ROS are 0.35 and 0.21 respectively, which is a satisfactory fit for a cross-sectional estimation. For RPE, we find that year, industry, capital intensity, wage level and material inputs are important explanatory variables. For ROS, we find that YEAR, EAST/WEST dummy interacted with YEAR, capital intensity and wage level are important. Industry effects are important as well, in particular for ROS. We also find that wage level has a positive effect on RPE, and thus has a positive impact on firm efficiency, but a negative impact on ROS. Since ROS proxies the markup of a firm, any increase in input prices will lower the markup and thus the profit margin. Material inputs relative to labour costs have a positive impact on RPE. Accordingly, firms can improve their efficiency by outsourcing internal production to external suppliers. Year effects are particularly important for ROS. Note that in the between-firm analysis, the effect YEAR is defined as the average (rounded) observation year for a firm.

Although the associated partial R^2s are lower than 0.005, we find that a firm's market share has a positive effect both on RPE and ROS. Another conclusion to

be drawn from the between-firm analysis is that size is not a particularly important explanatory variable of firm performance. It is worth noting, however, that in general small firms tend to perform better in terms of both RPE and ROS than large firms. The negative coefficient for SIZE$*$SIZE implies a u-shaped relationship between size and firm performance.

Table 7 displays the results from the within-firm estimation and Table 8 contains the estimated elasticities for continuous variables at the mean data points. As mentioned above, we stress that the within-firm estimation gives the short run effects of variables, whereas the between-firm estimation reflects the long run impact of variables. Time-invariant variables, e.g. industry and location, and also nearly time-invariant variables, e.g. size, are not included in the within-firm analysis. However, as a measure of business cycles at the industry level, the growth of industry-wide turnover is additionally included.

We find that particularly firm-specific effects, which are interpreted as unobserved firm-specific characteristics, e.g. product knowledge and/or managerial abilities, are very important for explaining firm performance. Almost half of the variation in performance across firms can be explained by firm-specific characteristics, and this is even stronger for ROS than for RPE. These results also imply that firm performance appears to be quite persistent over time, since firm-specific and time-invariant influences could not otherwise matter for firm performance. Furthermore, we find that material inputs have a positive impact on RPE, while external services have a negative impact on ROS. The coefficient for external contract work is positive and significant for RPE, but turns out not to be robust.

Similar to the between-firm estimation, wage level has a positive impact on RPE, but a negative impact on ROS. This implies that on the one hand, firms with human-capital intensive production are more efficient than other firms, but that an increase in the price of labour leads to a reduction of the firm's mark-up and profit margin. Interestingly, the elasticity of efficiency (RPE) with respect to the wage level is smaller in the short run than in the long run. In contrast, the elasticity of RPE with respect to material inputs is larger in the short run than in the long run. Thus, positive effects from this type of outsourcing appear to

diminish in the long run.

As expected, capital intensity is a very important explanatory variable for firm performance. Business cycles effects from the aggregate economy which would be captured by the set of year dummies appear to have rather small effects both for RPE and ROS. In this context we find that energy consumption is positively related to performance in the within-firm analysis, and thus it captures the effects of business cycles and different degrees of capacity utilization. We also find that, albeit with a low partial R^2, growth of industry-wide turnover has a positive impact on firm performance.

Finally, location effects are significant but not very important for explaining firm performance. Firms in agglomerated regions have a higher expected performance than firms in rural areas. Also, the EAST/WEST location effect turns out to be significant. However, interaction with year dummies shows that the difference in performance almost disappears over the period 1992 to 2000.

5 Conclusions

The early 1990s have witnessed a remarkable increase in outsourcing activities. The starting hypothesis of this study was that firms pursue an outsourcing strategy in order to improve their performance. From the perspective of the firm, the rationale for outsourcing is to save internal resources either in terms of labor costs or capital investments or both. Outsourcing activities have many facets, e.g. cleaning, janitorial, transportation services or intermediate production. Our study provides estimates of the importance of three different types of outsourcing activities. The first type is increasing intermediate material inputs relative to internal labor costs, which reflects the make-or-buy decision of firms. The second type is farming out production, which subsumes subcontracting between firms. The third type is external services, e.g. consultancy or auditing.

The general result is that in the long run, all three types of outsourcing activities have a positive impact on return per employee (RPE), which we interpret as a measure of firm efficiency. Conversely, this does not necessarily imply higher profit margins for firms either in the short run or in the long run. On the one hand,

firms that have increased their material inputs relative to labor costs performed better than firms that did not. On the other hand, firms which have farmed out internal production or used external services are more efficient but have lower profit margins as a result of outsourcing. These findings suggest that firms have overengaged in these two latter types of outsourcing, and thus on average these types of outsourcing are above the optimal level.

In sum, our analysis supports the view that firms tend to overestimate the benefits accruing from outsourcing of external services and/or underestimate the associated transaction costs. A prerequisite for successful outsourcing activities is that markets for intermediate inputs really function. Our results suggest that this is the case for material inputs, but not for external services. One reason could be that it is easier for firms to monitor quality of intermediate products than to monitor the quality of services. As noted by Williamson (1971), if market do not function, then vertical integration will used by firms as a substitute for markets organization. Also, firms might not fully anticipate the search costs of finding a suitable partner that can provide the service functions required.

We have also analyzed other factors that determine firm performance. For instance, we find that the wage level, which we interpret as human capital intensity of production, has a positive impact on efficiency particularly in the long run, but has a negative impact on the markup of a firm. This is not unexpected, since the markup corresponds to the difference between output and input prices, such that any increase in input prices will lower the markup.

Another central conclusion of our study is that unobserved firm-specific characteristics, which presumably comprise technological knowledge, marketing or managerial abilities, are very important factors for explaining firm performance. These firm-specific factors turn out to be much more important than industry and location effects together. This finding also suggests that firm performance is quite persistent. Finally, firm size is not a particularly relevant variable for explaining differences in performance. The estimates suggest, however, that small firms tend to perform better than large firms.

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Appendix

Tab. 1: Selected Indicators for Performance and Production, Mean (Median) Values of all West German Firms

	Performance		Outsourcing			Production		
Year	Return on Sales[1] [%]	Return per employee [DM/Employee]	Material inputs[1] [%]	External contract work[1] [%]	External services[1] [%]	Capital intensity[2] [DM/Employee]	Wage level [DM/Employee]	Internal labor costs[1] [%]
1992	0.084 (0.081)	20966 (14535)	0.338 (0.330)	0.025 (0.000)	0.079 (0.066)	13396 (10064)	59088 (59118)	0.330 (0.314)
				Mean 1992=100				
1992	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1993	85.7	90.8	98.2	98.2	103.9	108.8	104.6	103.9
1994	91.3	100.7	98.4	106.9	103.9	112.2	108.5	101.3
1995	91.7	104.9	102.2	116.9	110.6	114.9	115.6	99.1
1996	86.0	99.3	101.5	121.1	111.6	117.2	118.9	100.4
1997	95.3	111.5	101.0	123.3	111.9	115.9	118.4	98.6
1998	97.3	118.7	101.7	134.6	112.4	119.1	121.9	96.8
1999	94.5	118.2	102.4	120.7	114.3	122.6	126.0	99.1
2000	92.4	121.9	104.8	127.2	114.1	124.8	128.9	97.2

Notes: Median is given in parentheses. [1]As share of gross production. [2] Depreciation per employee.

Tab. 2: Selected Indicators for Performance and Production, Mean (Median) Values of Large West German Firms with more than 1000 Employees

	Performance				Outsourcing						Production					
Year	Return on sales[1] [%]		Return per employee [DM/Employee]		Material inputs[1][%]		External contract work[1] [%]		External services[1] [%]		Capital intensity[2] [DM/Employee]		Wage level [DM/Employee]		Internal labor costs[1] [%]	
1992	0.060	0.062	16551	14630	0.340	0.330	0.026	0.008	0.097	0.084	15627	12614	74520	72804	0.323	0.026
	Mean 1992=100															
1992	100.0		100.0		100.0		100.0		100.0		100.0		100.0		100.0	
1993	70.4		79.1		98.5		92.6		106.0		110.9		105.2		101.8	
1994	99.0		118.5		99.1		100.4		103.8		115.6		109.2		96.4	
1995	98.0		124.1		103.4		105.0		104.8		117.3		114.5		92.7	
1996	96.1		129.7		104.5		99.4		106.9		121.8		118.1		91.6	
1997	116.1		166.1		104.6		104.7		107.7		126.7		120.9		87.3	
1998	121.5		191.8		104.6		113.9		108.3		132.7		124.8		84.1	
1999	120.9		182.9		102.9		109.4		107.6		137.6		128.1		88.4	
2000	126.1		222.8		106.3		108.3		107.5		144.1		131.0		82.0	

Notes: Median is given in parentheses. [1]As share of gross production. [2] Depreciation per employee.

Tab. 3: Names and Definitions of Variables

Name	**Definition**
Dependent variables:	
Return	gross operating surplus
per employee (RPE)	/ number of employed persons[1]
on sales (ROS)	/ gross production
Costs and production indicators:	
CAPITAL INTENSITY	depreciation / number of employed persons[1]
RENTS & LEASING	rents & leasing expenses
	/ number of employed persons[1]
ENERGY CONSUMPTION	energy costs / number of employed persons[1]
WAGE LEVEL	wages & salaries / number of employed persons
Outsourcing indicators:	
MATERIAL INPUTS	material inputs / labor costs
EXTERNAL CONTRACT WORK	external contract work / labor costs
EXTERNAL SERVICES	external service costs / labor costs
Market indicators:	
MARKET SHARE	turnover of firm / industry turnover
CONCENTRATION	Herfindahl index
INDUSTRY	industry indicator 4-digit level
Organizational factors:	
SIZE	number of employed persons
LEGAL FORM OF BUSINESS	non-corporate or corporate company
NUMBER OF OWNERS	number of owners working in the firm
CRAFT / MANUFACTURING	dummy variable
Locational effects:	
TYPE OF REGION	nine different types of regions

[1] including owners working in the firm

Tab. 4: Structure of the Unbalanced Panel

Obs. Periods	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	Total
No. of Firms										
All firms	4848	14505	5517	6367	5269	1426	2473	318	2287	43010
East	2955	12225	4096	5603	4395	1180	2001	267	2108	34830
West	1893	2280	1421	764	874	246	472	51	179	8180

Tab. 5: Partial R-Squares from Between-firms estimations

		Dependent Variable:			
		Return per employee (RPE)		**Return on sales (ROS)**	
	DF	Part. R^2	Notes	Part. R^2	Notes
Cost and Production	4				
CAPITAL INTENSITY	1	**.0656**	**+,s,r**	**.0335**	**+,s,r**
RENTS & LEASING	1	.0000		.0015	-,s,r
WAGE LEVEL	1	**.0072**	+,s	**.0065**	-,s,r
ENERGY CONSUMPTION	1	.0001		.0033	-,s,r
Outsourcing					
MATERIAL INPUTS	1	**.0090**	**+,s,r**	.0009	-,s,r
EXTERNAL CONTRACT WORK	1	.0004	+,s	.0000	
EXTERNAL SERVICES	1	.0020	+,s	.0017	-,s,r
Product Market					
MARKET SHARE	1	.0006	+,s,r	.0003	+,s,r
CONCENTRATION	1	.0001		.0001	
INDUSTRY	263	**.0338**	**s**	**.0414**	**s**
Organization					
SIZE	1	.0016	-,s,r	.0006	-,s,r
SIZE*SIZE	1	.0010	+,s	.0004	+,s
LEGAL FORM OF BUSINESS	2	.0004	s	.0006	s
NUMBER OF OWNERS	9	.0014	s	.0034	s
CRAFT/MANUFACTURING	2	.0001		.0008	s
Location Effects:					
REGION TYPE	8	.0022	s	.0018	s
FEDERAL STATE	15	.0004	s	.0009	s
EAST/WEST	1	.0002	s	.0011	s
EAST/WEST*YEAR	8	.0013	s	**.0103**	s
YEAR	8	.0073		**.0305**	s
Obs.		42615		42411	
Total R^2		.3487		.2059	

Notes: Sign before partial R^2indicates direction of effect s=signficant at 1% r=rank-transformation robust. Partial R^2>= 0.01 are printed bold.

Tab. 6: Elasticities for Selected Variables From Between-firms Estimations

		Dependent Variable: **Return per Employee (RPE)**	
(Selected Variables)	DF	Elasticity[1]	t-value
Cost and Production			
CAPITAL INTENSITY	1	.3810	65.27
RENTS & LEASING	1	-.0022	-0.55
WAGE LEVEL	1	.5193	21.56
ENERGY CONSUMPTION	1	-.0093	-2.23
Outsourcing			
MATERIAL INPUTS	1	.1130	24.21
EXTERNAL CONTRACT WORK	1	.0108	5.40
EXTERNAL SERVICES	1	.0681	11.46
Product Market			
MARKET SHARE	1	.0124	6.49
CONCENTRATION	1	.0283	1.99
SIZE	1	-.0171	-10.10
SIZE*SIZE	1	.0012	8.17
Obs.		42615	
Total R^2		.3487	

[1] At the mean data point.

Tab. 7: Partial R-Squares From Within-firms Estimations

		Dependent Variable:			
		Return per Employee (RPE)		**Return on Sales (ROS)**	
	DF	Part. R^2	Notes	Part. R^2	Notes
Firm-specific Effects	37961	**.4957**	**s**		
	37932			**.6085**	**s**
Cost and Production					
CAPITAL INTENSITY	1	**.0066**	**+,s,r**	**.0032**	**+,s,r**
RENTS & LEASING	1	.0009	**-,s,r**	**.0012**	**-,s,r**
WAGE LEVEL	1	.0004	+,s,r	**.0012**	**-,s,r**
ENERGY CONSUMPTION	1	.0004	+,s,r	.0000	
Outsourcing					
MATERIAL INPUTS	1	**.0024**	**+,s,r**	.0001	+,s
EXTERNAL CONTRACT WORK	1	.0001	+,s	.0000	
EXTERNAL SERVICES	1	.0007	-,s,r	**.0019**	**-,s,r**
Product Market					
MARKET SHARE	1	.0003	+,s,r	.0003	+,s,r
CONCENTRATION	1	.0000	-,s,r	.0001	-,s,r
GROWTH OF INDUSTRY SALES	1	.0002	+,s,r	.0002	+,s,r
YEAR	8	.0005	s	.0005	s
Obs.		143539		143714	
Total R^2		.7346		.6674	

Sign before partial R^2indicates direction of effect. s=signficant at 1%
r=rank transformation robust, partial R^2>= 0.001 are printed bold.

Tab. 8: Elasticities for Selected Variables From Within-firms Estimations

		Dependent Variable: **Return per Employee (RPE)**	
(Selected Variables)	DF	Elasticity[1]	t-value
Cost and Production			
CAPITAL INTENSITY	1	.2715	51.34
RENTS & LEASING	1	-.0747	-19.00
WAGE LEVEL	1	.2881	12.44
ENERGY CONSUMPTION	1	.0240	9.25
Outsourcing			
MATERIAL INPUTS	1	.1704	31.15
EXTERNAL CONTRACT WORK	1	.0101	5.77
EXTERNAL SERVICES	1	-.0960	-16.45
Product Market			
MARKET SHARE	1	.0229	11.50
CONCENTRATION	1	-.0203	-4.17
GROWTH OF INDUSTRY SALES	1	.0049	8.10
Obs.		143539	
Total R^2		.7346	

[1] At the mean data point.