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Productivity Effects of Outsourcing – New evidence on the strategic importance of vertical integration decisions

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Abstract

Purpose – The paper presents an empirical investigation of firm level productivity effects of outsourcing against the background of a review of recent theoretical considerations about the topic.
Design/methodology/approach – The empirical research is based on a large representative data set from the German manufacturing industries containing detailed data of almost 500 establishments. It investigates productivity effects of outsourcing under control of other relevant factors influencing firm level productivity by means of a multivariate regression analysis.
Findings – In sharp contrast to common belief and prevailing management practices, outsourcing, i.e. the extent to which the vertical range of manufacturing is reduced, has a strong negative impact on a firm's labour productivity. Against the background of the theoretical considerations reviewed from the literature, this result can be explained such that mere cost efficiency comparisons are insufficient for appropriate decisions on vertical manufacturing range as the effects of opportunism, of disturbed competence formation and of limited innovative value creation processes may be overcompensating cost benefits.
Research limitations/implications – The investigation focuses on productivity effects of outsourcing as relevant long-term performance measure not regarding other firm level performance indicators. Although covering a significant range of industrial sectors in Germany, more empirical evidence is needed from other branches and regions. Moreover, performance effects of different types of outsourcing implementations (e.g. simple part supply versus outsourcing of whole businesses processes including design, production, and marketing) should be investigated as they might have different impacts.
Practical implications – The findings strongly recommend a revision of established decision-making schemes for vertical manufacturing range based on cost efficiency considerations. Decision-making should instead integrate the cost efficiency and transaction cost analysis with the competence and innovation capability formation perspectives. Procedural schemes for this integrated view are still to be developed, though.
Originality/value – The research considerably widens the empirical knowledge on productivity effects of outsourcing and has strong impact on management practice.

Keywords: Outsourcing, Vertical Manufacturing Range, Labour Productivity, Multivariate Regression Analysis

Paper type: Research paper

Introduction

Corporate restructuring activities have become a common management practice over the past two decades. In particular, outsourcing of manufacturing processes, regarded by management as not belonging to the "core business", has meanwhile

spread as a ubiquitous phenomenon in the manufacturing industries. Yet these popular management practices have so far found surprisingly little attention in the academic literature. There are, of course, a number of articles dealing with issues of making strategic restructuring and vertical integration decisions. Many of them develop conceptual models, though, based on anecdotal or case based evidence to support assertions in attempting to explain the rationale behind those decisions. They either focus on transaction cost economics or on competence formation issues or they eventually try to synthesise both perspectives in a unified model. Thus, “many intuitively appealing arguments have been offered both for and against outsourcing as a means of achieving sustainable competitive advantage” (Gilley and Rasheed, 2000: 763)

However, only very few studies empirically investigate the impact restructuring and in particular outsourcing have on a firm’s economic performance (Jiang et al., 2006: 1281). Moreover, those few that have empirically investigated performance effects of restructuring measures are based on a relatively small database with limited significance. This paper, in contrast, is based on a large representative survey of the German investment goods industries with detailed data from 492 establishments.

While the academic literature, although limited in number, draws a differentiated picture of restructuring activities considering quite diverse aspects to be considered in sourcing decisions, management practices such as outsourcing seem to be following a fad rather than being based on sound decision making schemes. Outsourcing decisions are typically legitimated by simple production cost comparisons not even taking transaction costs seriously into account let alone aspects of competence formation being affected by outsourcing decisions. In sharp contrast to these common management practices, the few empirical investigations that exist, including our own, produce a rather sceptical view on outsourcing by arguing that it is often overdone and thus impairs business performance due to insufficient decision making. Our data analysis reveals that outsourcing in the German manufacturing industries, contrary to common belief, strongly correlates negatively with labour productivity as it diminishes revenues or increases expenses.

The paper is organised as follows. The next chapter reviews the recent relevant literature on vertical integration and restructuring of firms, including outsourcing, in order to grasp relevant factors influencing restructuring decisions. We than outline our empirical database and the method of analysing the data. After presenting and discussing the main findings we conclude with recommendations for improved decision making procedures.

Literature Review

The question of how to structure and organise value creating processes is an important issue both in the organisational economics and strategic management literature. It asks when economic activities should be performed within a single vertically integrated firm, bought on the market or produced cooperatively through a network as a hybrid organisational arrangement. The answers to this question of structuring value creating processes may have a considerable effect on competitiveness and overall firm performance.

The respective literature embraces these sourcing or structuring issues under the headlines of vertical (dis)integration and outsourcing alike. Both concepts are used here synonymously although they may slightly differ in meaning. Looking at the necessary activities and processes to achieve a product or service – no matter whether these processes are directly creating value or only supportive in nature – vertical disintegration and outsourcing both denote the incident of removing a whole process and to purchase its result from a supplier. In this case, they both have the same meaning. Outsourcing may, however, also denote a vertical scope decision by which only parts of the process are supplied from outside while the process capacity to cover the rest remains in-house. In this latter case only, outsourcing differs in meaning from vertical disintegration. As our data do not allow for discriminating between these cases, we at least consider outsourcing as a strong indicator for vertical disintegration.

Research work dealing with these sourcing issues has mainly taken three different approaches so far to determine efficient boundaries of structural arrangements. One prominent perspective to explain vertical integration is transaction cost economics (Williamson, 1985, 1991). It has its focus on market failure and looks out for ways how the risks and costs of opportunistic behaviour can be reduced by integrating economic activities under unified governance. A second perspective is the resource-based view of the firm focusing on competitive advantages of specific internal capabilities as prevailing criteria for boundary decisions (Barney, 1991, 1996; Conner and Prahalad, 1996; Kogut and Zander, 1992; Zander and Kogut, 1995). Since both perspectives have their specific blind spots while concentrating on complementary issues, some researchers claim that benefits from additional explanatory power can be gained, if both perspectives are being integrated (Conner and Prahalad, 1996; Gulbrandsen and Haugland, 2000; Jacobides and Winter 2005).

Transaction cost economics

According to transaction cost economics, the question whether an economic activity should be vertically integrated or not depends on the specificity of the assets needed to perform this activity, the frequency of interaction between firm and supplier, the amount of uncertainty and the potential for opportunistic behaviour of the supplier (Williamson, 1985). The basic assumption is that organisations like individuals act with “bounded rationality” and that possible contingencies in transactions cannot be foreseen. That may make it costly to negotiate, monitor and enforce complete contracts for cooperation as a party’s opportunistic behaviour may take advantage from concealing information or misleading activities.

Asset specificity is involved, if specific durable investments such as machinery and tools or knowledge and skills are required to support transactions and realise least cost performance. The transaction cost perspective assumes that the more expensive such specific investments are, the higher the uncertainty, the greater the frequency of interaction and the higher the potential for opportunistic behaviour, the higher the transaction costs will be and the more likely the supply activities will be vertically integrated, since they can then be effectively controlled and efficiently accomplished through unified governance. Among these variables, asset specificity, i.e. durable investments that are undertaken in support of particular transactions, appears to be most critical and vertical integration is supposed to be the most efficient governance mode for high asset specificity in transactions (Williamson, 1985).

Reversely, if in case of low asset specificity and low uncertainty of the transactions the supplier is able to expand its activities to higher volumes by supplying many customers, each of them can draw advantages form these economies of scale. It is then less costly to outsource the supply activities (Argyres, 1996).

Competence formation

While the transaction cost perspective identifies different governance modes for organising transactions, the capability or competence perspective is rooted in evolutionary economics (Nelson and Winter, 1982; Kogut and Zander, 1992, 1996) and relies on basic assumptions of the resource-based view of the firm (Penrose, 1995; Wernerfelt, 1984; Prahalad and Hamel, 1990).

In the resource-based view of the firm (Penrose, 1995; Wernerfelt, 1984; Barney, 1991, 1996; Hall, 1992; Grant, 1991; Teece et al., 1997), strategic management pays specific attention to the genesis and development of the organisation's internal resources and capabilities as source of sustainable competitive advantages. Resources in this context can be thought of as any prerequisite for action serving as means to effectively change reality, in particular intangible assets such as organisational knowledge or competences to innovate and to flexibly react to market demands and customer requirements. The resource-based view focuses not only on the resources themselves, however, but rather on the specific ways the organisation puts them to effective use: "Resources include all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve efficiency and effectiveness“ (Barney, 1991: 101).

History matters in this perspective: As the use of resources and the development of capabilities are highly interwoven with the evolution of organisational processes and routines, resource and capability formation are strongly path-dependent: „ When firm-specific assets are assembled in integrated clusters spanning individuals and groups so that they enable distinctive activities to be performed, these activities constitute organisational routines and processes“ (Teece et al., 2002: 338f). According to Kogut and Zander (1992), firms exist because they can develop organisational schemes and principles that markets cannot produce. Such organisational schemes and principles include “shared coding schemes”, “values”, “a shared language” and “mechanisms by which to codify technologies into a language accessible to a wider circle of individuals”. Hence, what firms “do better than markets is the sharing of and the transfer of knowledge of individuals and groups within an organization” (Kogut and Zander, 1992: 383).

Complementary to transaction cost analysis, according to which costs for preparing and performing market transactions are reduced as organisations constrain the action scope of its members, the resource-based view focuses on the unique and barely imitable competences an organisation may develop to increase effectiveness and efficiency of its resources by using them in a specific way. High performance organisations thus not only reduce the transaction costs for the resources they need, but they also exploit their potential more effectively by the specific way they make use of these resources. "Capabilities involve complex patterns of coordination between people and people and other resources. Perfecting such coordination requires learning through repetition“ (Grant, 1991: 122).

The constitution of the resource-based view of the firm has over the decades shifted its focus from more or less general resources and their firm-specific combination and use towards the generation and use of intangible assets such as capabilities and competences and, more recently, towards knowledge processing (Nonaka, 1994; Grant, 1996). The evolution of organisational routines and issues of organisational learning related to the acquisition of resources have thus gained more emphasis (Prahalad and Hamel, 1990; Kogut and Zander, 1992; Teece et al., 1997).

Synthesising the perspectives

Transaction cost economics look at different governance modes for transactions (e.g. hierarchies, markets, networks). They may cause different costs depending on the uncertainty, the frequency of the particular transaction and on the amount of durable transaction-specific investments required. A firm's hierarchy is likely to be the preferred choice in case of higher uncertainty, higher frequency of transactions and higher degree of asset specificity.

The resource-based or competence perspective, in contrast, regards the firm as a unique bundle of resources. While putting these resources to effective use, firms internally develop, according to this view, some co-specialised intangible assets such as shared interpretation schemes, organisational routines for making sense of the artefacts in use, a shared language and values. Firms exist because they organise their coordinated acting, communication and learning, in particular the sharing and transfer of knowledge, in a specific way that enables them to superior performance as compared to competitors (Kogut and Zander, 1992). Due to the tacit dimension of these specific competences, i.e. to the fact that they are hard to be explicitly codified and difficult to communicate and teach, they can be hardly imitated by others and they require high efforts to be appropriated. Firms, therefore, are likely to develop and grow on the grounds of already existing competences being enlarged rather than acquiring substantially different competences for new activities. Thus, a firm will fail on vertical integration, if a new activity does not fit its existing competence base.

As both perspectives have their specific weaknesses and blind spots, it seems reasonable to integrate them for a comprehensive explanation of whether a boundary decision leads to economic benefits or not. The two perspectives complement each other as they draw attention to different aspects of a firm's action constraints, in particular transaction efforts and competence limitations of doing quite different things. While the governance perspective ignores the mechanisms through which opportunistic behaviour can be influenced and pays no attention to the conditions under which a firm's resource base can develop, the competence perspective neglects contractual problems. As the weaknesses of one of these perspectives seem to be strengths in the other and vice versa, it is reasonable to bring them together (Afuah, 2001; Conner and Prahalad, 1996; Gulbrandsen and Haugland, 2000).

Most of recent empirical work on vertical manufacturing range has been carried out to shed more light on the relationship and interaction of the two perspectives. Conner and Prahalad (1996) were among the first to provide a link between the aspect of efficient generation and exploitation of knowledge and skills and the governance perspective of transaction cost economics. They argue that even in the absence of opportunism, transaction costs will still remain due to the fact that knowledge is often

tacit or uncoded, bound to individual skills or embedded in organisational routines and therefore difficult to transfer or to acquire.

Based on these considerations, Afuah (2001) investigated the effects vertical integration has on the ability to cope with competence-destroying technological change. Using the case of adopting RISC (reduced instruction set computer) technology, he found that efficient boundaries of a firm are dynamic, and that, in the face of competence-destroying technological change, those firms perform best that have not been vertically integrated into the older technology but are being vertically integrated into the new one instead.

In order to compare the two sets of explanations for boundary decisions, Argyres (1996) analyses qualitative data on make-or-buy decisions made by a large firm. By simultaneously considering possible roles of transaction cost variables and those associated with firm capabilities he found support for the proposition that firms outsource when suppliers possess superior capabilities, except when higher costs are accepted in the short run while capabilities are being developed in-house. Moreover, relative firm capabilities seem to matter most when there is very little or very significant overlap between knowledge bases related to activity performance, in particular when this knowledge is tacit and team-based.

Based on empirical data from the Norwegian hydroelectric power generation industry, Gulbrandsen and Haugland (2000) found that both closeness to core competence and asset specificity are positively related to vertical integration, while a high degree of tacit knowledge required for performing a new activity makes it less likely that the firm will integrate it as it is expensive to acquire. The results are in support of both the governance and competence perspectives. Combining the perspectives provides a better understanding of vertical integration as compared to relying on only one of them. The need for reducing opportunistic potential together with internal capabilities and competences are both, separately as well as combined, important factors determining efficient organisation of economic activities.

Probably the most sophisticated conceptual frame integrating the two perspectives has recently been presented by Jacobides and Winter (2005) arguing that transaction costs and capabilities are fundamentally intertwined in the determination of vertical manufacturing range. Illustrated by two contrasting cases, they analyse the dynamics of capability and transaction cost co-evolution: Capability differences turn out to be a necessary condition for vertical specialisation, while transaction cost reductions lead to specialisation only, if capabilities are heterogeneous along the value chain. According to their model, the dynamics of capability and transaction cost co-evolution is further driven by four evolutionary mechanisms that shape vertical scope over time. First, the selection process, itself produced by capability differences, dynamically shapes vertical scope; second, transaction costs are endogenously changed by firms that try to reshape the transactional environment to increase their profit and market share; third, changes in vertical scope affect the nature of the capability development process, i.e., the way in which firms improve their operations over time; and finally, the changes in the capability development process reshape the capability pool in the industry, changing the roster of qualified participants (Jacobides and Winter, 2005).

Vertical manufacturing range and performance

The literature reviewed so far examines the problem of understanding the factors determining vertical scope. With the governance perspective based on transaction cost economics and the competence perspective rooted in evolutionary economics and the resource-based view on capability formation, two powerful conceptual models have been developed that, combined into an integrated approach, can to a high degree explain a firm's boundary decisions. Corresponding empirical evidence has been used to clarify the co-evolution of the two factor bundles and the effects they have on vertical scope.

There are, however, very few empirical investigations that focus on the relationship between vertical manufacturing scope and economic performance. In recent years outsourcing, i.e. the disintegration of vertical scope, has become a widely spread management practice the rationale of which appears rather questionable in the light of the governance and competence perspectives. The literature summarises a number of advantages and disadvantages of outsourcing, while empirical data are still rare (Gilley and Rasheed, 2000; Lei and Hitt, 1995; Bengtsson and Haartman, 2005, Beaumont and Sohal, 2004).

Among the propagated advantages of outsourcing, cost reductions due to diminished manufacturing costs, reduced investment and less fixed capital costs, are the most prominent as they improve short-run financial performance. Furthermore, as in-house production may increase managerial attention and organisational commitment to the development of core competences – seen as the "collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple teams of technologies" (Prahalad and Hamel, 1990: 85). Outsourcing non-core activities thus contributes to improving business performance. Not least outsourcing may enhance a firm's flexibility with respect to both changes in demand (capacity) and technological change (capability) by switching to suppliers handling new technologies best and thus exploiting the best available sources at a time (Gilley and Rasheed, 2000; Berggren and Bengtsson, 2004; Leiblein et al., 2002).

Despite these many potential benefits of outsourcing, the reliance on outside suppliers may lead to a loss of overall market performance. One of the most serious threats resulting from reliance on outsourcing is, in accordance with the competence perspective, that it can erode the firm's potential for organisational learning and development of new technologies, particularly those skills necessary for developing new businesses and core competences (Lei and Hitt, 1995). The firm is then likely to lose touch with changes that offer new opportunities for product and process innovations. In addition, suppliers may gain enhance their manufacturing knowledge and skills eventually enabling them to begin marketing products on their own (Prahalad and Hamel, 1990). Moreover the cost savings associated with outsourcing may be overestimated as transaction costs can be significant and outsourcing requires a shift in overhead allocation that degrades financial performance. This factor, together with short-run cost improvements, tends to initiate a spiral of reinforced outsourcing decisions (Gilley and Rasheed, 2000).

Although there was a steady rise in outsourcing (Kinkel and Lay, 2003) and outsourcing has become a "fashionable management technique" (Beaumont and Sohal, 2004: 698), only few empirical studies on the effects outsourcing has on business performance have been conducted so far (Jiang and Qureshi, 2006). One

recent one finds, based on a sample of 51 publicly traded and thus very large firms, that outsourcing can improve a firm's cost-efficiency. On the other hand it finds that outsourcing activities and the firms' productivity and profitability are not positively correlated. The authors conclude that outsourcing can reduce direct operating costs as well as the commitment to fixed costs and thus cost-efficiency, while productivity and profitability rely very much on tangible assets closely related to core activities (Jiang et al., 2006). Investment in these activities like e.g. research and development (R&D) cannot be simply reduced without risking negative long-run implications. Moreover, profitability is a relative measure which might be influenced negatively if the cost improvements in outsourcing are diminished under a strong price pressure of customers or competitors (McCarthy, 2002).

Another of the few existing studies differentiates between two types of outsourcing: peripheral and core outsourcing. Based on a survey of roughly 100 independent firms with more than 50 employees from different manufacturing industries, the results indicate that, whereas outsourcing has no significant direct effect on firm performance, both firm strategy and environmental dynamics moderate this relationship. For cost leaders, outsourcing positively correlates with firm performance, in particular peripheral outsourcing has a positive effect on financial performance (measured by return on assets), while core outsourcing has a positive effect on innovation capacity (indicated by frequency, R&D expenses and growth) as they can opt for the “best of breed”. For innovative differentiators, on the other hand, in particular innovation performance increases with the degree of peripheral outsourcing by focusing their efforts on specific innovation enhancing activities. However, the benefits of peripheral outsourcing to firm performance decline in a dynamic environment (Gilley and Rasheed, 2000).

A survey of a representative sample of Swedish engineering firms produced similar results. There is no significant correlation between the extent of outsourcing manufacturing activities and plant operating performance (in terms of productivity, quality and lead time) or innovation capability (as indicated by the extent of changes, time-to-market and introduction time). After all, firms that outsourced the most display lower return on assets. Furthermore, improvements of plant performance are explained to a significantly higher extent by a firm’s technological and organisational efforts than by outsourcing: Firms that invested in developing technological and organisational capabilities show a significantly higher business performance and introduce more innovative products than those who do not. Outsourcing should therefore not be regarded as a substitute for developing further internal manufacturing competence (Bengtsson and Haartman, 2005).

A most recent empirical investigation of a large number of product introductions in the global microcomputer industry comes up with a differentiated picture. In contrast to most prior research, it focuses on the simultaneous pursuit of vertical integration and strategic outsourcing rather than investigating both in isolation. The basic proposition is that firms pursuing an attentively balanced strategy of simultaneously pursuing vertical integration and strategic outsourcing when organising for innovation (called “taper integration”) enriches a firm’s product portfolio and product success, and in turn contributes to competitive advantage and overall firm performance. Data analysis provides strong support for the notion that carefully balancing vertical integration and strategic outsourcing helps firms to achieve superior performance in terms of revenues. The findings again refer to the relevance of a synthesised

perspective of considering costs and competences in vertical scope decisions alike. Balancing internal and external sourcing particularly strengthens a firm's absorptive capacity to learn and internalise new external knowledge and thus helps to develop advantage-creating competences. Overuse of external sources may lead to opportunism and excessive transaction costs, however (Rothaermel et al., 2006).

In sum, overall assessment of previous investigations of vertical scope decision making, in particular outsourcing, reveals that they are mostly conceptual in nature, eventually supported by case-based empirical evidence. Their main focus is on clarifying the rationale behind vertical scope decisions (e.g. Leiblein et al., 2003), while the impact these decisions have on overall firm performance are more or less ignored. The very few studies that explicitly investigate the performance effects (Gilley and Rasheed, 2000; Bengtsson and Haartman, 2005; Jiang et al., 2006; Rothaermel et al., 2006) are based on rather limited samples, though. This seriously draws into question common managerial practices based on the questionable assumption that outsourcing will positively influence business performance. In this situation, it appears necessary to further clarify this relationship on a much broader empirical data basis.

Facing this paradoxical situation that, on one hand, there is widespread management practice of outsourcing and that on the other hand there are only very few empirical studies of the performance effects, drawing the economic benefits into question, we see an urgent need to test the rationale of these outsourcing practices. As performance measure we chose labour productivity as it is the most commonly used measure for the productivity of a firm or nation (OECD, 2002). Labour productivity thus serves in many studies as the pivotal indicator for the international competitiveness of companies, sectors or countries. However, the total factor productivity (TFP) of a company will also be influenced by other inputs like e.g. productivity of material, land and particularly capital. Statistically, an increase in labour productivity normally has to be interpreted as a result of a more active work force as well as of the substitution of labour through capital by additional investment in equipment and machinery. In consequence, labour productivity is usually rising while capital productivity is stagnating or even declining as a result of modernisation and optimisation strategies and measures. Thus, labour productivity seems to be a good indicator integrating the various effects of sourcing decisions on the firms' mid and long term economic competitiveness. Taking the common management practices of outsourcing and the underlying assumption of its economic benefits seriously, we assume as our basic hypothesis:

H 1: Labour productivity increases when vertical scope of manufacturing is reduced (i.e. more manufacturing activities are outsourced).

Labour productivity is a very highly aggregated indicator for a company's success. Therefore, it does not only depend on a company's vertical scope but also on a whole number of other structural and process variables of the surveyed companies. Thus we included, besides sector dummies, several further variables into our regression model, based on the following assumptions:

We expect a negative impact of the percentage of personnel costs at turnover on labour productivity, as in high wage countries such as Germany, especially companies which are able to effectively reduce the quota of personnel costs without

risking to lose their innovation capabilities are particularly productive (e.g. Heshmati, 2003; Kossbiel, 2000). We therefore assume:

H 2a: Labour productivity is negatively correlated with the percentage of personnel costs at turnover.

We expect a higher labour productivity of companies located in the former Western German federal states, as longstanding research on the so called "productivity gap in Eastern Germany" (e.g. Czarnitzki, 2003; Klodt, 2000; Ragnitz, 1999) clearly shows that companies located in the former Eastern German federal states reach only about 65 to 80 per cent of the productivity level of their Western German counterparts. Thus, we assume:

H 2b: Labour productivity is positively correlated with company location in the former Western German federal states.

We expect a positive correlation of the firms' export quota with labour productivity, as exporting companies are no longer able to operate in their protected national niches but rather have to face global competition on foreign markets, forcing them to exploit further efficiency and productivity potentials (e.g. Bernard, 2004; Sourafel et al., 2004; Wagner, 2002). We therefore assume:

H 2c: Labour productivity is positively correlated with the firms' export quota.

We also expect a positive correlation of the firms' import quota with labour productivity, as we measure labour productivity in price terms as "valued added (total turnover minus total inputs of purchased parts, materials, operations and services) per employee", and a higher import quota might enable a company to source at least commodities to a lower price level from low-wage countries (e.g. Barba Navaretti and Venables, 2004; Olsen, 2006). Thus, we assume:

H 2d: Labour productivity is positively correlated with the firms' import quota.

We expect a higher labour productivity of companies producing large batch sizes than companies producing small and medium batch sizes, as so called "economies of scale" are easier to realise under the frame conditions of large batch size production, enabling productivity growth through rationalising repetitive tasks (e.g. Klette, 1999). This is also the main argument for a positive relation between labour productivity and the size of the firm: Large companies are able to realize greater economies of scale within their boundaries than small firms, given their reduced and sometimes sub-critical mass in certain production and auxiliary functions (e.g. Klette, 1999; Söderbom and Teal, 2001). We therefore assume:

H 2e: Labour productivity is positively correlated with large batch size production.

H 2f: Labour productivity is positively correlated with firm size.

We expect a positive correlation of the complexity of the manufactured products with labour productivity, as we measure labour productivity in price terms (valued added (total turnover minus total inputs) per employee) and in high wage countries such as Germany, particularly complex and knowledge-intensive products can be produced in an internationally competitive way and sold with a sufficient price margin (e.g. Legler and Gehrke, 2006). Thus, we assume:

H 2g: Labour productivity is positively correlated with product complexity.

We expect a positive impact of the degree of capacity utilisation on a firm's labour productivity, as it is a suitable indicator to measure the order situation of a company,

which directly influences labour productivity, e.g. if labour or equipment capacities are under- or over-utilised due to unexpected market developments (e.g. Lay et al., 1998). Thus, we assume:

H 2h: Labour productivity is positively correlated with the firm's degree of capacity utilisation.

We expect a positive impact of strategic decentralisation measures at the companies' organisational level on labour productivity, as such measures are targeted at improving the capabilities of the firm to adapt more flexibly to dynamically changing market conditions, thereby realising positive productivity effects, also in times of dynamic environmental conditions (e.g. Latniak et al., 2002; Lay et al., 1998; Zwick, 2003). We therefore assume:

H 2i: Labour productivity is positively correlated with a company's use of strategic decentralisation measures.

We expect a positive impact of job enrichment measures at the job floor level on labour productivity, as these measures are focused at improving the capabilities of workers to upgrade in parallel the quality, flexibility and productivity of production processes (e.g. Goldmann et al., 1995; Hammer and Champy, 1994; Womack et al., 1990). As such strategies are most promising if the company employs adequately qualified workers, we assume a negative correlation between the percentage of unskilled and semiskilled workers at the total workforce and labour productivity. We therefore assume:

H 2k: Labour productivity is positively correlated with a company's use of job enrichment measures.

H 2l: Labour productivity is negatively correlated with the percentage of unskilled and semiskilled workers at the total workforce.

We assume that companies with a higher R&D intensity might show a higher labour productivity, as a clear focus on R&D and innovation might enable manufacturing companies to escape the low cost race and enhance the possibility to achieve sufficient prices and thus a superior productivity (e.g. Clark and Grilliches 1982). A similar argument holds true for firms with a competitive strategy focusing clearly on innovation or quality leadership. Thus, we phrase:

H 2m: Labour productivity is positively correlated with a company's R&D intensity.

H 2n: Labour productivity is positively correlated with a company's strategic focus on innovation or quality leadership.

These hypotheses are being tested in the following.

Methodology and Data

The following analysis is based on the German dataset of the European Manufacturing Survey (EMS) 2003. The survey was organised and coordinated by the Fraunhofer Institute for Systems and Innovation Research (ISI) and conducted at the end of 2003 in nine European countries. The European Research Partners are ARC Systems Research in Austria, Universities of Zagreb and Split in Croatia, BETA Université Louis Pasteur Strasbourg in France, Fraunhofer ISI in Germany, Fondazione Rosselli in Italy, University of Maribor in Slovenia, Lucerne School of Business in Switzerland, Cranfield University School of Management in the UK and Sabanci University Istanbul in Turkey. In total 2249 firms answered questions

concerning manufacturing strategies, the application of advanced production technologies and organisational concepts in production, personnel deployment and qualification. In addition, data on performance indicators such as productivity, flexibility, quality and returns was collected. The questions were developed jointly by the partners and pre-tested in different companies of all countries. The survey is conducted every three years with slightly changing questions. In 2006 partners from Greece (Technological Education Institution of West Macedonia), the Netherlands (Nijmegen School of Management) and Spain (University of Girona) joined the consortium. In the next round 2009, Denmark, Finland, Sweden, and China will be additionally participating.

The German dataset 2003 covers also data on outsourcing activities and performance indicators of the period 2002 to 2003. The final dataset includes 492 answering firms of the German rubber, plastics, metal and electronics industry which completed all variables that have been integrated in our multivariate regression model (c.f. Table 2). The responding companies represent a cross section of the main manufacturing industries in Germany. Producers of machinery (NACE 29: 30 percent) and finished metal products (NACE 28: 27 percent) are most frequent in the dataset, followed by producers of electrical engineering (NACE 30-32: 15 percent) and precision instruments (NACE 33: 13 percent). Small and medium sized enterprises (SMEs) with less than 250 employees cover almost 80 percent of the responding companies. Table 1 illustrates the distribution of the observations according to industrial sectors and firm size.

Take in Table 1

For testing the above stated hypothesis we have first calculated a bivariate correlation of labour productivity and scope of vertical integration. We measure labour productivity in price terms on the firm level as "valued added (total turnover minus total inputs) per employee"[1]. The "outsourcing quota" is measured as the ratio of total inputs[2] to total turnover, the scope of vertical integration as the inverse (100 % minus outsourcing quota). Additionally, a linear trend line and a fourth-order polynome for visualising the correlation have been inserted in the scatterplot (Figure 1). The linear trend line shows that, contrarily to the formulated hypothesis, labour productivity seems to rise with increasing vertical scope. The fourth-order polynome graph also shows that an increasing labour productivity can be observed with higher vertical scope, whereas a converted U-shaped correlation is rather not to be found. Furthermore, the polynome shows that in a medium range of around approximately 40 to 70 per cent of vertical scope, labour productivity scarcely does increase with increasing scope of vertical integration. However, below and above these boundaries the ascent is incrementally increasing. On the sole basis of the bivariate correlation we might conclude that for manufacturing companies of the rubber, plastics, metal and electronics industry, a lowering of the vertical scope below 40 per cent will lead to a marked decrease in productivity, and a rise of vertical integration above 70 per cent will result in additional internal productivity potentials.

Take in Figure 1

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1 We calculate this measure based on questions on "total annual turnover (in million €)", "total annual inputs (purchased parts, materials, operations, services, in million €)" and "number of employees".
2 Question on "total annual inputs (purchased parts, materials, operations, services, in million €)".

For testing the productivity effects of a company's vertical scope of manufacturing, we use a multivariate regression model into which, besides the outsourcing quota, we included six sector dummies and several further independent variables which are assumed to explain differences in the firms' productivity (see hypotheses H 2a to H 2n). The firm's labour productivity measured as value added (total turnover minus inputs) per employee serves again as the dependent variable, this time logarithmitised.

Findings

The calculated multivariate regression model is, on the whole, statistically significant and shows a corrected R^2 of 0.468 (Table 2). This model can therefore explain almost 47 per cent of the variance in the companies' productivity, which is a very good result given the multiplicity of the variables and frame conditions which potentially may influence labour productivity. Due to missings in the multiplicity of the considered variables, the originally 1157 companies of the metal and electronics industry have been reduced to 492 cases featuring all the considered variables.

In the calculated model the percentage of personnel costs at turnover[3] with a beta value of minus 0.47 has the strongest impact on the companies' productivity. Hypothesis H 2a is therefore supported. Surprisingly, the variable on the outsourcing quota takes second rank with a beta value of minus 0.38; i.e. contrarily to the formulated hypothesis this variable shows a negative sign. This means that the more a company has reduced its vertical scope by means of outsourcing, the lower its medium labour productivity is. The degree of outsourcing in a company is therefore negatively correlated with its ability to produce productively and generate value added. Hypothesis H 1 is thus not supported. Rank three in explaining productivity takes a dummy variable with a beta value of 0.25, differentiating whether a company is located in the Western or Eastern federal states of Germany (H 2b is supported). The export quota with a positive beta value of 0.21 ranks fourth (H 2c is supported). Rank five to eight, with almost identical positive beta values between 0.06 and 0.08 are taken by series size of production (H 2e is supported), in cases where series sizes are higher than 1000 pieces per month, product complexity, in cases in which complex multipart products or machinery are manufactured (H 2g is supported), the degree of capacity utilisation in production (H 2h is supported), as well as the company specific potential to which the respective company has put into practice the customer- or product-line-oriented organisation of central departments, measured on a scale of 0 to 100 per cent (H 2i is supported). Hypotheses H 2d, H 2f, H 2k, H 2l, H 2m and H 2n are not supported, but contrarily to H 1 they do not show a significant correlation with an opposite sign than assumed.

On the whole, in terms of sign and intensity of impact, the productivity effects demonstrated with this model are quite comprehensible and correspond to other empirical findings on this topic. The sole exception is represented by the crucial variable outsourcing quota which contrarily to the formulated hypothesis H 1 is not positive, but highly significant and strongly negatively correlated with the labour productivity in the surveyed companies.

Take in Table 2

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3 We asked for the "percentage of personnel costs at turnover (in %)".

Discussion

The significant and strongly negative impact of the percentage of personnel costs at turnover on labour productivity is no surprise and is in line with existing empirical findings (e.g. Heshmati, 2003; Kossbiel, 2000) and our expectations (H 2a). In Germany and other high wage countries strategies to strengthen or to innovate processes through substituting labour by capital or through intelligent organisational and working time concepts, are particularly productive. Strictly speaking, this analysis would also have to take into consideration whether this variable has not only a negative impact on labour productivity, but maybe also a positive impact on capital productivity of production. However, this is a fundamental problem of productivity research, which due to lack of sufficient indicators traditionally focuses on labour productivity rather than on the total factor productivity of the system. Nevertheless, for the variable percentage of personnel costs at turnover we can conclude that its negative explanatory contribution for labour productivity at company level was to be expected and is plausible.

The positive explanatory contribution of the dummy variable, measuring whether a company is located in the former Western German federal states or not, was assumed, too (H 2b). Our results clearly show that Western German companies do significantly outrank Eastern German companies in terms of productivity and thus support once again the hypothesis of the so called "productivity gap in Eastern Germany" (e.g. Czarnitzki, 2003; Klodt, 2000; Ragnitz, 1999).

As other empirical studies have already demonstrated, our model, too, shows that the export quota of the surveyed companies, i.e. the percentage of turnover generated on foreign markets, is positively correlated to labour productivity (e.g. Bernard, 2004; Sourafel et al., 2004; Wagner, 2002). Exporting companies have to build up capabilities to achieve the specific, locally expected quality and innovation level on foreign markets and, simultaneously, internationally competitive prices thereby realising adequate productivity potentials at their production sites. Thus, the direction and the intensity of the interrelation between export intensity and labour productivity at company level are consistent with our expectations (H 2c). However, our assumption of a significantly positive impact of a higher import quote on labour productivity (H 2d) is not supported, but shows the expected sign. It seems to be more difficult than expected to realize measurable cost advantages by simply sourcing some parts and materials from foreign countries, as markets become more and more global and prices more and more comparable.

The finding that producers of large batch sizes have a (slightly) higher labour productivity than companies producing small and medium sized series have, confirms our assumptions (H 2e). The former possess more opportunities to achieve intra-firm productivity growth through "economies of scale" (e.g. Klette,1999; Söderbom and Teal, 2001). However, our assumption of a positive relation between labour productivity and firm size was not supported (H 2f). It seems that in our model the variable batch size comprises more explanation power of internal economies of scale than firm size does. Another finding indicates that this interrelation cannot be analysed independently of the complexity of the manufactured products. Complex products and services are knowledge-intensive and require innovative and flexible capabilities of highly qualified and skilled workers, so that they can be produced in

high-wage countries in an internationally competitive way (e.g. Legler and Gehrke, 2006). Accordingly, manufacturers of complex multipart products display a (slightly) higher medium labour productivity than manufacturers of simple products do, which is also in line with our expectations (H 2g).

The variable degree of capacity utilisation measures to which degree, in percentages, the company has managed to optimally utilise its production capacities. This indicator, suited to measure cyclical fluctuations and variations in the sales markets of the surveyed companies, is, as it was expected (H 2h), slightly positively correlated with labour productivity at firm level. Understandably, labour productivity is higher in those companies that manage to utilise their production capacities to a higher degree.

The positive impact of a more extensive use of a customer- or product-line-oriented organisation (subdivision) of central departments (e.g. design, controlling, etc.) on labour productivity, which is one important strategic element of decentralisation activities of manufacturing companies, confirms our expectations (H 2i) and other empirical findings (e.g. Latniak et al., 2002; Lay et al., 1998; Zwick, 2003). On the other hand, our results for job enrichment measures at the level of work organisation considered in our model, for instance the integration of planning or quality control tasks into the job role of directly productive workers, read quite differently. Our assumption of a positive correlation with productivity was not supported (H 2k), but shows the expected sign. It seems that these measures are specifically focused at enabling workers, by means of adequate integration and qualification measures, to improve process quality and flexibility without thereby risking decreases in production productivity (Latniak et al., 2002). Companies seem to be at least successful in avoiding negative productivity effects of task integration measures while focussing on the enhancement of different performance indicators.

Similar findings apply for the percentage of unskilled and semiskilled workers at the total workforce. The sign is negative, impact on labour productivity, however, is not statistically significant (H 2k not supported). Neither a mere focussing on highly qualified and well trained skilled workers to improve the innovative capabilities of the firm, nor attempting to utilise cost advantages by employing unskilled and semiskilled workers in simple, repetitive manufacturing and assembly tasks seems to prove successful per se if these strategies are not coherent to the frame conditions and strategic orientations of the respective company (e.g. Hill, 1993).

No statistically significant correlation between the R&D intensity of the surveyed companies and their labour productivity were to be found (H 2m). Because of severe problems in modelling the time-lag and spillover effects, this result is not surprising, as the results of earlier studies range from no positive productivity effects of R&D (e.g. Grilliches, 1979) to small and mediated effects on the sector level (e.g. Griffith et al., 2004) to clear positive impacts on the firm level (e.g. Clark and Grilliches, 1982). Also one could have concluded that a clear competitive strategy focusing strictly on innovation leadership might have positive impacts on the firm's productivity (H 2n). According to our results, which show no significant correlation, not the choice of strategy itself, e.g. innovation, quality or cost leadership is the decisive factor, but rather the way the chosen strategy is consistently and coherently implemented at company level.

Finally, the rather clear finding according to which companies with a high outsourcing quota display a markedly lower labour productivity than companies with a higher vertical scope of manufacturing do, needs some interpretation – none the least as this finding contradicts our research hypothesis. In case of companies with a higher outsourcing quota, the strategic risks of competence and capability drains and increased transaction costs seem to overcompensate the anticipated direct cost and efficiency potentials of outsourcing initiatives in the medium and long term. Besides other explanatory factors this might be due to the fact that cost and efficiency considerations dominate most outsourcing decisions at company level, whereas strategic positioning and (core) competence considerations play a rather minor role (Kinkel and Lay, 2003).

This very clear finding on the negative impact of a high degree of outsourcing on labour productivity at company level might lead us to the conclusion that strategic competence and capability considerations as well as questions of the real transaction costs for coordinating the newly established cross-company value chains are not sufficiently taken into account when it comes to deciding for or against outsourcing measures. In the future, the companies' ability to steer the complete value chain in terms of optimal utilisation of competences and knowledge will gain increasing importance (Dreher et al., 2005). The companies' ability to innovatively position themselves in the "industrial system" by utilising and newly combining dynamic capabilities in the face of rapidly changing market and customer requirements will become ever more important. Thus, it is imperative to either retain the corresponding knowledge pools and capabilities in-house, or at least secure connectivity to external knowledge in crucial areas and to strategically cultivate the matching networks. In this sense, outsourcing decisions have to be based more strongly than in the past on strategic and competence based long term considerations rather than short term attempts to increase efficiency. New portfolio approaches enabling a "visualisation" of competences and capabilities available in-house or in dynamic networks might constitute an important prerequisite for the evaluation of the future impact of outsourcing strategies on the innovation ability and market success of the firm in the long term.

Conclusions

The fact that the hypothesis of beneficial performance effects of outsourcing has so strongly been rejected by our empirical data analysis based on a large representative sample from the German manufacturing industries calls for a revision of widespread management practices. As our analysis suggests, outsourcing has obviously been pushed much too far in general. Too many outsourcing projects are rather detrimental to business performance as measured by productivity; otherwise the strong negative correlation between outsourcing and labour productivity could not have been observed.

Mere cost comparisons as mostly practised in outsourcing decisions (Kinkel and Lay, 2003), even if they take not only production costs but also transaction costs into account (which often is practically difficult), turn out to be insufficient. Even if decision-making on vertical manufacturing integration is confined to cost considerations, benefits from eventually reduced production costs might easily be overcompensated by increased transaction costs when taking into account their full range. Moreover, cost considerations alone, no matter how comprehensive they are,

completely ignore the strong effects outsourcing decisions may have on competence development as the other big factor influencing business performance. As empirical evidence suggests, it might often be the case that productivity gains from integrated processes realising strong competence development effects outweigh cost advantages from outsourcing. These findings have considerable impact on both management practices and future research directions.

With respect to Operations Management practice, appropriate determination of vertical manufacturing scope proves to be – according to the scientific findings presented here – complex decisions with far reaching consequences. The findings suggest that it is not sufficient to take into account single factors like future cost structures or competence development as such. Rather, it appears necessary to combine the view on production cost comparisons with the governance perspective making full account of transaction costs caused by different governance modes and the competence perspective regarding their impact on the development of competitive capabilities. This requires careful evaluations rather than simple cost calculations to help management making better sourcing decisions.

Against this background, from an Operations Management practice and research point of view a critical "revisiting" of the economic “repertoire” of methods and approaches used for supporting outsourcing decisions is needed. In particular, there is a need for evaluation methods that can integrate important qualitative factors (soft factors) such as future innovation ability or strategic investments in restructuring business. Some integrated approaches to categorise the key benefits and risks of outsourcing activities have recently been developed (e.g. Harland et al., 2005), but they still lack to provide guidelines how the long-term effects of outsourcing activities on crucial competitiveness factors at the firm level can be practically assessed. Also monetary decision instruments often used and well liked in company practice, such as investment calculations, capital value calculations or cost structure comparisons are explicitly to be supplemented and upgraded with the respective qualitative dimensions. Finally, it is imperative to trace in a comprehensible way the potential effects of changes in vertical scope on the future competence structure and innovation ability in a dynamic perspective, thus supporting, with the help of adequate simulation approaches and sensitivity analyses, a creative "playing about" with the possible long term consequences, thereby sensitising decision makers at company level more for these strategic aspects.

Limitations and further research

Before drawing some lines for further research depending on our findings, the limitations of our study have to be clearly stated. First of all our results rely on a sample of about 500 German manufacturing firms. Thus it could be possible that in some other European countries no negative effects of outsourcing on labour productivity could be measured, e.g. due to a higher flexibility of the labour market or to a different degree of outsourcing the companies have realised in the past. Secondly, our results are restricted to outsourcing in manufacturing industries. As in these industries the biggest amounts of outsourcing activities might be related to materials and not services, the results could be more positive for service outsourcing as transaction costs might be lower compared to the overall value of the operation. Thirdly, our research is limited to investigate the effects of outsourcing on labour productivity. It might be possible that the capital productivity of a firm increases to a

larger extent than its labour productivity decreases, so that the total factor productivity (TFP) would also increase. If so, the respective firm must be able reduce its costs for fixed capital more flexibly than its labour costs connected to the outsourced processes, and the "leverage effect" of the improved capital productivity needs to be higher than that of the decreased labour productivity. Both arguments might particularly be relevant for capital intensive industries like the chemical industry which was not part of our sector coverage, whereas in our sample more labour intensive sectors like mechanical engineering or manufacturing of metal parts are dominating.

With respect to further research in Operations Management, the findings have so far demonstrated that the conceptual modelling and comprehension of sourcing decisions is quite well elaborated, in particular in the advanced forms of integrating the governance with the competence perspective. On the other hand, empirical investigations of the effects sourcing decisions have on firm performance in more industries and countries as well as wider areas of outsourcing, e.g. headquarters or central services based on representative data are still lacking. Such an enlarged empirical knowledge can help, in combination with the conceptual understanding, to develop, elaborate, and test holistic decision making schemes for improved and scientifically proven evaluation of sourcing alternatives.

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Tables and figures

Table 1: Survey observations according to industrial sectors and firm size

	Database	
Industrial sector (NACE)	n	Percent
Manufacture of rubber and plastic products (25)	50	10.2 %
Manufacture of fabricated metal products (28)	133	27.0 %
Manufacture of machinery and equipment (29)	145	29.5 %
Manufacture of office machinery and computers (30)	6	1.2 %
Manufacture of electrical machinery and apparatus (31)	42	8.5 %
Manufacture of radio, television and communication equipment & apparatus (32)	28	5.7 %
Manufacture of medical, precision and optical instruments (33)	62	12.6 %
Manufacture of motor vehicles, trailers and semi-trailers (34)	15	3.0 %
Manufacture of other transport equipment (35)	11	2.2 %
Total	492	100.0 %
	Database	
Company size	n	Percent
up to 49	166	33.8 %
50-99	118	24.0 %
100-199	89	18.1 %
200-299	35	7.1 %
300-499	40	8.1 %
500-999	21	4.3 %
1000 and more	23	4.7 %
Total	492	100.0 %

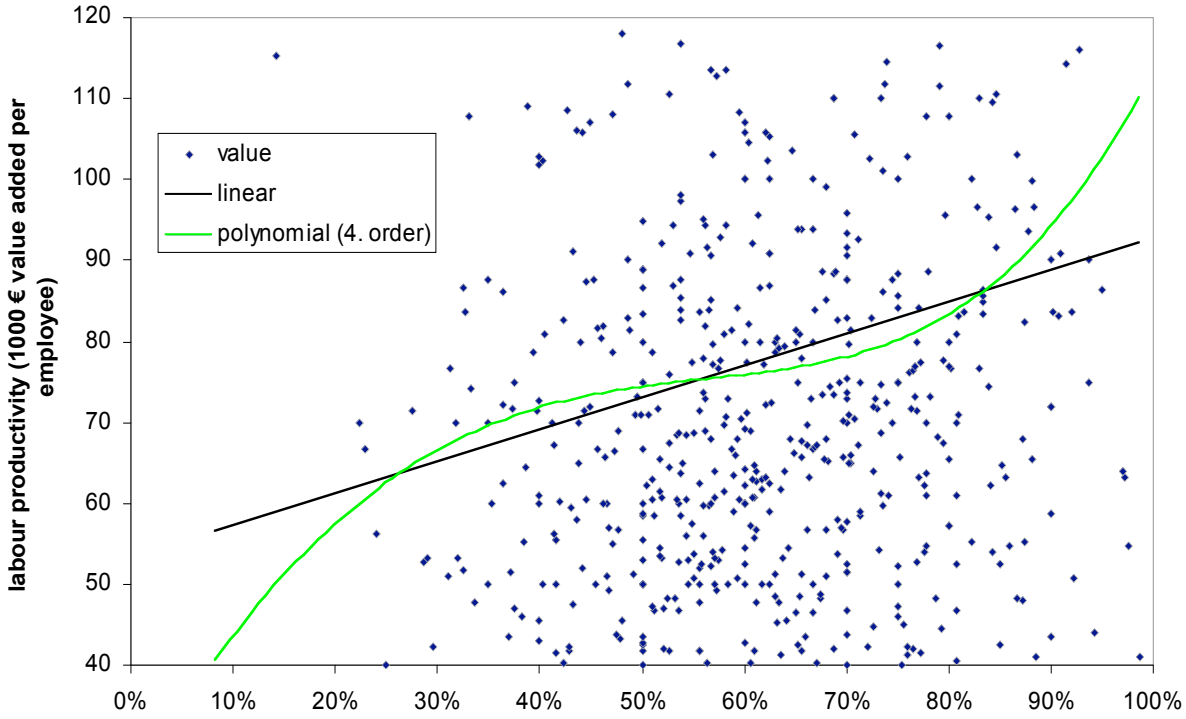

Figure 1: Bivariate analysis: Labour productivity and vertical integration

Table 2: Regression model

Summarised model

R-square	Corrected R-square	df	F	Significance
0.490	0.467	491	21.518	0.000***

Dependent variable: log labour productivity

Coefficients	**B**	**Beta**	**T**	**Significance**
(Constant)	4.679		26.289	0.000***
Western German federal states („bundeslaender“)	0.311	0.250	6.914	0.000***
log Employees	0.019	0.044	1.112	0.267
Main competitive factor: Quality leadership	-0.006	-0.015	-0.434	0.664
Main competitive factor: Innovation leadership	-0.014	-0.050	-1.396	0.163
Customer- or product-line-oriented organisation (subdivision) of central departments (e.g. design, controlling, etc.): extent of used potential	0.001	0.064	1.743	0.082*
Task integration (planning, controlling or quality control tasks into the job role of directly productive workers): extent of used potential	0.000	0.013	0.357	0.721
Percentage of unskilled and semi-skilled workers at the total workforce	-0.001	-0.047	-1.157	0.248
Batch size: single or small batch production	0.034	0.034	0.761	0.447
Batch size: Large batch production	0.089	0.077	1.850	0.065*
Product complexity: complex	0.070	0.069	1.685	0.093*
Outsourcing quota	-1.223	-0.379	-10.117	0.000***
Percentage of personnel costs at turnover	-0.020	-0.470	-11.971	0.000***
Percentage of R&D expenses at turnover	-0.001	-0.015	-0.401	0.688
Degree of capacity utilisation	0.003	0.070	2.003	0.046**
Import quota	0.001	0.059	1.559	0.120
Export quota	0.004	0.213	5.141	0.000***
Manufacture of fabricated metal products (NACE 28)	0.005	0.005	0.086	0.931
Manufacture of machinery and equipment (NACE 29)	-0.022	-0.020	-0.323	0.747
Manufacture of electrical machinery & apparatus (NACE 31)	-0.059	-0.033	-0.736	0.462
Office machinery, computers, radio, television and communication equipment & apparatus (NACE 30 & 32)	0.001	0.003	0.062	0.951
Manufacture of medical, precision and optical instruments (NACE 33)	-0.039	-0.026	-0.502	0.616
Manufacture of motor vehicles, trailers and semi-trailers and transport equipment (NACE 34 & 35)	0.098	0.044	1.065	0.287

Dependent variable: log labour productivity

Significance levels: *** = 1 per cent; ** = 5 per cent; * = 10 per cent