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**Working Paper**

## Organisational capital: The power of an economic metaphor ; organisational capital in German establishments

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Institute of Labour Law and  
Industrial Relations in the European  
Community  
(IAAEG)

IAAEG Discussion Paper Series

**Organisational Capital: The Power of an  
Economic Metaphor:  
Organisational Capital in German Establishments**

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No. 2003/02

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# Abstract

The concept of organisational capital is multifaceted and often inadequately demarcated from related concepts like human or social capital. We define organisational capital as an agglomeration of technologies – business practices, processes and designs – that enable firms to gain a sustainable competitive advantage. Since organisational practices and their combinations are the primary components of organisational capital, it is inseparably linked to the organisation, which distinguishes it from other types of capital.

Organisational capital is predominantly non-tangible, non-fungible and idiosyncratic; therefore it is hard to measure. Measuring it by using additive indices of different practices or system variables presumes a concrete functional form for the link between organisational practices and the level of organisational capital, which is in reality unknown. Following an operationalisation of *Lev* and *Radhakrishnan* (2003) we approximate the level of specific organisational capital, using the data of the IAB-establishment-panel to control for several influencing variables. Unlike *Lev* and *Radhakrishnan*, we control for the effects of human and social capital and hence isolate the effects of organisational capital.

Keywords: organisation, organisational capital, corporate policy practices, production function, fixed effect, organisational practices

JEL-Classification:

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## 1. Organising Economic Activity: Organisational Capital

How is it possible that organisations with access to the same set of resources have substantially varying performances? For example, Walt Mart is outperforming most of its competitors despite the fact that they acquire their resources on the same factor markets. Similarly IKEA became the world leading furniture retailer, outperforming virtually every other company in the business, despite the fact that it had in the 1950s as a new entrant to the market no access to substantial resources. Or, Ajax Amsterdam managed for a long period to be one of the leading European soccer teams, although it had only access to relatively limited economic resources.

Traditional explanations for these performance differences range from differences in transaction costs (*Coase* 1937; *Williamson* 1975, 1985) or x-inefficiencies (*Comanor/Leibenstein* 1969; *Leibenstein* 1966, 1978) over more or less successful ways to solve incentive problems in teams (*Alchain/Demsetz* 1972) to the varying capability to discover and implement new (factor) combinations (*Schumpeter* 1934). Recent management research argues that differences in the endowment with idiosyncratic and hard to imitate internal resources are decisive; synergetic factor combinations being supposedly primordial for competitive advantages (*Peteraf* 1993; *Bresser/Millonig* 2003).

Returning to our examples, it is the supply chain organisation of Wal-Mart – the barcode of a sold product being read at the point of sale and directly transmitted to the suppliers who take care of the inventory management and product provision – that generates a substantial competitive advantage (*Lev/Radhakrishnan* 2003; an effective organisational reaction of the suppliers is analysed in *Abernathy et al.* 1995). Despite the thoroughly design of its supply chain one major source of IKEA's competitive advantage its stemming from its organisation of the other side: customer relationship. IKEA designed every aspect in this relationship to allow customers to compose their furniture as they wish and take it home instantly: exhaustive information is supplied by mailing a fast amount of the glossy catalogue and by putting comprehensive information tags on the furniture displayed in the show room in order to help the customers to make their decisions without extensive help from sales staff; every customer visiting the stores is equipped with tape measures, pens and notepaper; everything is packed in flat packages that can easily be transported by car for which huge parking spaces are provided; comprehensive instructions and the necessary tools are put into these packages to allow easy assembly; and barriers to entry for families are lowered by the provision of child care and restaurants. All

these practices help to reduce costs by economising on storage, assembly and delivery costs as well as reducing the need for sales people. But most importantly, IKEA succeeded in educating their customers in order to create a behaviour that allows them to design their living and makes them welcome the home assembly of their furniture. Without this transformation of the customer into a co-producer, who does not consume value but creates it, all other practices mentioned would yield only modest benefits, if any. This particular combination of practices leads to an organisation of economic activity, which generates as substantial competitive advantage for IKEA (*Normann, Ramirez* 1993, 1998). Looking at Ajax Amsterdam, the strict application of one playing system across all teams – youth, first and second teams – allows transferring the players between these as needed. Gaps due to injuries or transfers to another club are easily closed. The talent scouts have a strict guideline for recruiting young players and they only have to look at a small sub-sample of potential talents economising on their time.

One can view the ability to organise economic activity in an efficient way as an input factor like others, except for one qualification: While normal inputs are freely traded in the market and are accessible to all firms at the same price, the capability to organise may be linked to a particular firm constituting firm-specific idiosyncrasies and therefore be viewed as firm-specific capital, in short “organisational capital”.

Beyond metaphorical language, is it possible to determine the value of organizational capital? How is it formed and how can one invest in it? Which organisational practices constitute organisational capital? This paper touches on all these questions, but concentrates on the measurement issue.

We first give a brief overview over the literature on organisational capital and provide a definition, separating organisational from human and social capital. Then we take a closer look on the investment process and the impact of organizational capital and, in the main of the paper, we address the measurement problem analytically and empirically. The questions still open, are summarized at the end.

## 2. Organisational Capital and Related Concepts

The notion of organisational capital is not new in the literature, but its meaning is still multifarious. For example, according to Prescott and Visscher „[...] information is an asset to the firm, for it affects the production possibilities set and is produced jointly with output. We call this asset of the firm its organisation capital. [...]” (*Prescott/Visscher* 1980, p. 447). They emphasize that organisational capital is a form of human capital (*Prescott/Visscher* 1980, p. 459). Tomer similarly states “[...] organisational capital is clearly a type of human capital. [...]” (*Tomer* 1986, p. 243). Elsewhere, however, he remarks : “[...] Investment in organisational capital refers to changes which are vested in the organisation of the firm and which are substantially independent of the capabilities of its employees; such changes are expected to result in lasting increases in productivity. [...]” (*Tomer* 1981, p. 1 or 1987). Black and Lynch consider the practices “[...] workforce training, employee voice and work design [...]” (*Black/Lynch* 2002, p. 3) as the main factors generating organisational capital. In a macroeconomic context, Atkeson and Kehoe view organisational capital as determined by the real capital’s age and the knowledge of how to use it (*Atkeson/Kehoe* 2002). Other authors deal with organisational capital without bothering about a precise definition. For example *González* and *Johri* view productivity losses as a result of reduced organisational capital due to labour turnover without giving a definition of organisational capital (e.g.: *González/Johri* 2002). In a wider definition, *Sadowski* views the order that an organisation imposes on itself – its rules, conflict solution mechanisms and cooperation facilitating designs – as constituting organisational capital (*Sadowski* 2002, p. 334).

All these examples underline the increasing usage of the concept of organisational capital for the analysis of organisations. At the same time it becomes obvious that the metaphor’s meaning is still rather vague. The next section attempts to give a clear definition in order to measure organisational capital and to analyze its formation and its impact on the performance of firms.

### 2.1 Related capital concepts

In an economic perspective, real capital is a productive resource, which is the result of an investment, in other words, one has to forgo present benefits in order to generate earnings in later periods. In this point it differs from other factors that are continually used up and paid for (*Piazza-Georgi* 2002, p. 462). Real capital is tangible, productive and can be measured by

investment or acquisition costs minus depreciation (*Solow 1999; Arrow 2000*) as well as by replacement costs. In this form, real capital appears in the balance sheet of a company. Whatever its bookkeeping value is, the economic value of capital is given by its net present value.

The concept of ‘human capital’ has been established by Gary S. Becker. According to him, human capital consists of the skills and knowledge of an employee that increase her productivity (*Becker 1964*). Investment costs like course fees or instructor wages and particular apprenticeship costs of training have to be paid up-front and are hard to measure. For training-on-the-job costs occur due to mistakes or low production of trainees and due to reduced productive time of the instructors. Such opportunity costs can hardly be measured satisfying reasonable standards.

While human capital is a clear concept, ‘social capital’ is more ambiguous. It is used in many different ways (*Sobel 2002*). Leaving apart community related concepts (see *Putnam 2000; Sobel 2002*), we focus on an important interpretation of this term as stated by the sociologist Coleman. According to the latter, social capital is “[...] created when the relations among persons change in ways that facilitate action. [...]” (*Coleman 1988*, p. S100; cf. also Bourdieu (1986)). Social relations are the central element that generates social capital. Its value is measured by the (economic) benefits these relations embody for their owner. Such benefits consist of a person’s ability to tap other persons’ resources, to induce obligations and favours that can be called upon or information, which can be obtained using these social relations.

This type of social capital is inseparably linked to a person. Whenever a person is leaving the organisation, she takes substantial parts of the social capital as well as her human capital with her. But since social capital can be built up without investments, a basic capital characteristic is missing (*Arrow 2000, Glaeser/Laibson/Sacerdote 2000, 2002*). This is different for what we coin ‘organisational capital’.

## **2.2 Organisational capital**

There are – at least – two schools of understanding with respect to organisational capital. One considers organisational capital similar to human and social capital as interconnected with the individual (*Prescott/Visser 1980*); the other school regards organisational capital as embodied in and linked to the organisation rather than to the individual (*Tomer 1986; Lev/Radhakrishnan 2003*). The first view makes artificial distinctions between the three capital types necessary and is consequently of limited analytical value. Furthermore, we have already indicated our understanding



that organisational capital is primarily linked to the organisation itself and not to its members. Hence, we will follow the second school of thought throughout the paper.

„Organisation capital is thus an agglomeration of technologies – business practices, processes and designs, [...] – that enable some firms to consistently extract out of a given level of resources a higher level of product and [/or] at lower cost than other firms. [...]“ (*Lev/Radhakrishnan* 2003, p. 5). In other words: organisational capital is constituted by organisational practices, policies and specific combinations of these enabling an organisation to gain a sustainable competitive advantage for a considerable time period. For instance, Dell’s heavily Internet-based built-to-order distribution system is a complex set of organisational practices, which contribute substantially to the organisations success and hence constitute organisation capital (*Lev/Radhakrishnan* 2003). Such organisational capital is embodied in the organisation and inseparably linked to the organisation; it consists of organisational practices and their combinations. It is this inseparability, which distinguishes organisational capital from the other types of capital. Organisational capital cannot be exchanged without exchanging the whole organisation.

The formation of organisational capital through changes in existing practices or the implementation of new organisational practices generates costs – planning, adjustment, and launching costs – using internal and external resources (e.g. management consulting). These costs have to be paid upfront and compensated by future income, i.e., the formation of organisational capital is an investment. There are other investment costs, which stem from the practices themselves: for example, an explicit policy of job security is often stated in order to motivate employees to utilise their skills, knowledge and abilities to improve quality, to cut cost, and to increase productivity. However, these goals can only be achieved if the job security is perceived to be credible and reliable. Such credibility is generated by a history of retention from dismissals even during crises. The costs arising from an oversized workforce during such crises can be viewed as investments in organisational capital, which is generated by the job security practice. Similar costs arise from most other practices. In this perception organisational practices are rules, norms, policies and long-term behavioural patterns. This contrasts with spot or short-term decisions. The economic value of such an organisational capital stock is the net present value of the returns generated by the implemented organisational practices.

Thus, organising means putting order into social relations: by information, coordination, and motivation. What is, for instance, the value of reducing

“social uncertainty” in anonymous *collective* labour relations through predictability, rule based decision-making, and reliability? A substantial part of organisational capital is generated by the reduction of opportunistic behaviour and increased credibility of the organisation in its internal and external relationships. Such credibility and good reputation facilitates action through the reduction of employee, supplier and customer resistance to changes in these relationships. Hence, negotiation time and compensation payments are reduced, and productivity is increased. It is this “shadow of the future” that makes self-imposed rules worthwhile.

Nevertheless, self-binding rules can become disadvantageous if markets change and new and better exchange opportunities emerge, rewarding flexibility or “exchange value uncertainty” (*Lazzarini/Miller/Zenger 2002*). The organisation has therefore to account for the opportunity costs of self-imposed rules.

Which investments build up a stock of organisational capital? How is it depreciated? If the core of organisational capital is formed by rules, practices and ‘system trust’, then it surely cannot be generated by an advertising campaign. “Shadows of the past” are needed, a long-lasting experience of trustworthy interactions. In order to secure long-term benefits, the organisation has to forgo short-term chances for profit in order to demonstrate and signal reliability and produce predictability: ‘System trust’ means trust in job descriptions, rules, and procedures of an organisation void of any concrete person holding these jobs. ‘System trust’ does not result from personalised relationship networks, which in turn correspond to the social capital of the organisations’ members; system trust is trust in objects, not subjects (*Luhmann 2000*, p. 107).

In some cases a trustworthy reputation could be generated by one important decision, but trustworthiness is generally built upon many and varied experiences. Sending reliability signals only in a single and especially visible policy area will have a smaller impact than a coherent mix of signals in several policy areas and practices. Sending such reliability signals only at certain points in time – especially during good times – is of little value. In our opinion, the ‘secondary virtues’, generality and stability, make other market participants believe in an organisation’s reliability. Only through consistently ‘good’ behaviour can an organisation signal to its employees that it is a ‘good’ employer, thus allowing easy recruitment of employees and facilitating retaining them (*Schmidtke/Backes-Gellner 2002*). The same is true for the organisation’s relationship with customers and suppliers. While it takes a long time to build a stock of organisational capital through

reliable behaviour it can be easily and quickly lost. The formation and destruction of organisational capital are driven by different dynamics.

If new market conditions enforce organisational change – change of organisational practices and policies – in order to ensure the competitive capabilities of the organisations, then the costs of these changes depend not only on the speed of change but also on the quality and credibility of the justification of the changes (*Benz/Stutzer 2002*). An arbitrary execution of *management prerogatives* without justification will destroy system trust, and consequently destroy organisational capital. The accepted reasoning that the organisation is forced by market conditions to take certain actions and not behaving opportunistically should instead ensure low adjustment costs (*Sadowski 2002, Ch. 12; Lazzarini/Miller/Zenger 2002*). Rule-bound behaviour or the integration of relevant stakeholders into the decision making process is one way of accomplishing such legitimacy.

Organisations gain from organisational capital by facilitating the actions of the organisations' members and stakeholders, and by directing these actions towards the organisational goal through investment in organisational practices. Such an investment in organisational practices was termed „institutional capital“ by Hardin (*Hardin 1999, p. 178; Bresser/Millonig 2003*). Although organisational capital and social capital are analytically distinct concepts, in reality they are intermingled and connected. Some organisational practices constituting organisational capital can even be viewed as being geared at facilitating the creation of social capital. Still, social capital might reduce the costs of implementing new organisational practices, i.e. there are cost complementarities between social and organisational capital. It seems plausible that there are complementarities not only in costs, but also in returns. While the close and intertwined relationship is easy to grasp, severe measurement problems arise from these entanglements as well as from the intangible, non-fungible and tacit nature of organisational capital. Without effective controls for social capital one would always measure the influence of both types, a problem from which many studies suffer.

There is no market price for organisational capital, because it is not fungible. By definition, the only way to sell organisational capital is to sell the organisation (*Black/Lynch 2002, p. 2*). However, during merger and acquisition processes the organisational practices of the buying or bought organisation might have to be changed in order to achieve integration. Such a change then would destroy parts of the original organisational capital.

Organisational capital can also become obsolete by imitation and/or innovation of competitors (*Lev/Radhakrishnan 2003, p. 7*). The ‘resource based

view of the firm' identifies several barriers to imitation, such as time compression diseconomies, ambiguity of causality and hard to observe interaction effects, which work to secure an organisation-bound competitive advantage (*Dierickx/Cool 1989, Peteraf 1993, Siggelkow 2002*). In consequence the profit generating part of organisational capital is specific to the organisation. This idiosyncrasy of the organisational capital aggravates the measurement problem. Despite such severe measurement problems some studies have attempted to quantify the impact of aspects of organisational capital. Although most of them report a substantial impact of organisational practices on firm performance they also fall victim to the serious flaws to be discussed in section three in which we address these problems concretely in the next section.

### 3. Measurement Problems

As discussed above, we expect that organisational capital can explain why organisations with the same resource endowment differ in profitability. Therefore, it is of practical and theoretical interest to measure to what extent the profitability of organisations depends on their ability to organise processes and activities in a proper way. Additionally one would want to ask in which way the different practices contribute to the formation of organisational capital, however in this paper and the following sections we are focussing on the preceding questions: How can the value of organisational capital be measured? What is the size of the capital stock? What is its productive impact? Before attempting to answer these questions we have to stress some important obstacle to the measurement of the value of organisational capital.

For accounting purposes physical capital is measured by its purchase costs minus depreciation. This approach is not feasible for the measurement of organisational capital, because the acquisition costs are not sufficiently exact known. This is due to the fact, that without the possibility to trade organisational capital – it is infungible – there is no market price and consequently no price tag that can be attached to the organisational capital. Additionally, the costs generated through organizational capital formation are to large extent opportunity costs, indirect, hidden and tacit, similar to some costs of human capital formation mentioned in section two. What costs are generated by employee, customer or managerial resistance to organisational change? How much working time and labour costs are devoted to enact such a change? What was the cost of sorting out promising talents, because they did not fit in to Ajax's system? What business share did Dell forsake, because many consumers want to view merchandise before purchasing it? These questions are almost unanswerable and thus it is not possible to measure the organisational capital stock using the acquisition costs.

Alternatively one can try to measure the value of the organisational capital by its productive impact or its impact on the organisation's market value. (Lev/Radhakrishnan 2003; Black/Lynch 2002). Subtracting from the market value of an organisation the value of all other assets would isolate the productive contribution of organisational capital. Yet, this "goodwill" consists not only of the value of the organisational capital, but also includes the values of other unmeasured and immeasurable assets like human capital and social capital.

From the perspective of the organisation, there is an additional obstacle to measurement of the organisational capital stock. It seems impossible to de-

compose the organisation's performance at a particular point of time into the different contributions of the corresponding factors, like real capital, labour, human capital and social capital (*Lev/Radhakrishnan 2003*). Consequently the contribution of organisational capital cannot be determined.

Another method attempts to estimate the impact of organisational practices on production by means of (additive) indices of these practices. While researchers try to measure social capital of a community by the number of voluntary organisations, or the social capital of a manager by the size of her Rolodex (*Sobel 2002; Glaeser/Laibson/Sacerdote 2002*), some try to measure organisational capital by the number of organisational practices. Similar to the different attempts to measure social capital this approach not only neglects the fact that one practice (one address, one organisation) might have a bigger impact on the organisational (social) capital than others, but also ignores the possibility of interaction effects (*Sobel 2002; Glaeser/Laibson/Sacerdote 2002*). Using such weighted or unweighted indices impose a priori a particular functional form on the relationship between practices and the value of organisational, which, however, is not known. Consequently, results will be biased and flawed. Besides that, in most cases the data lacks information on some important practices anyway.

We therefore suggest measuring the value of the organisational capital through comparison – giving up the idea of bookkeeping standards – of the same organisation at different points of time, characterised by different organisational practices, or the comparison of different organisations, which are identical except for the applied organisational practices, at the same point of time. Differences in firm performance – market value, productivity and so on – can then be contributed to differences in the organisation of the firm, if the compared organisations are equal on all other parameters or if one is able to control for remaining differences. This indirect approach has important consequences: i) Instead of getting information about the absolute value of the organisational capital, one will only know the differences in the value caused by differing sets of practices. The information is relative by nature and can be viewed as interval scaled (without a natural zero point). ii) It is very improbable that two identical organisations varying only in some organisational practices should exist. Econometric methods should control for the intervening factors.

Different studies use different variables to operationalise the organisational performance and hence measure the value of organisational capital or its impact in different ways. Depending on preferences and data availability, these measures range from gross sales and added value over the growth rates to downtime of production lines and the capital market value of a

firm. At first glance, the value of a firm as assessed by the capital market, seems to be the best choice. Assuming that the capital market is functioning reasonably well, changes in organisational practices should change the market value, representing the value of the change in practices, or to term it differently, the increase in organisational capital (*Lev/Radhakrishnan 2003; Brynjolfsson/Hitt/Yang 2001*). The information efficiency of capital markets, however, is doubtful and in most economies only a small minority of companies is listed on the stock exchange. If the reasons for the decision to go public or not are intermingled with the formation and implications of organisational capital, then a selection problem arises. We attempt to avoid this selection problem using the added value as dependent variable.

Despite the obstacles discussed so far, there have been more or less successful attempts to measure the productive impact of organisational practices, which can be regarded as attempt to measure organisational capital. For example, Ichniowski et al. tried to measure the impact of HRM-systems on the uptime of steel finishing lines. This can be reinterpreted as an attempt to measure the impact of the HRM part of organisational capital on organisational performance. They found that certain HRM-systems increase uptime to such an extent that the generated value amounts to 10 Mio. US-Dollars per steel finishing line when it is accumulated over ten years (*Ichniowski/Shaw/Prennushi 1997*). Applying a very similar approach to a German data set – the IAB-establishment panel – Ludewig also found a substantial impact of HRM-systems on organisational performance for German firms (*Ludewig 2001*). Nevertheless, these studies suffer from the obstacles just discussed. In the following section we propose an approach that seems to us to a much smaller extent susceptible to these flaws.

## 4. Measuring Organisational Capital of German Establishments

The problem of the small number of listed firms and the resulting selectivity is especially severe in Germany. We therefore use as a performance measure, the added value of a firm, which is available in a large-scale data set, the so-called IAB-establishment-panel.

### 4.1 Empirical Design

#### 4.1.1 A Production Function Approach to the Determination of the Relevance of Organisational Capital

In order to analyse the productive effect of organisational capital, we resort on a production function approach using the following simple function as starting point:

$$Q = f(\Omega, K, L) \quad (1)$$

$Q$  is the quantity of produced output measured by added value,  $\Omega$  is the organisational capital stock,  $K$  is the size of the real capital stock and  $L$  gives the volume of used labour. Cobb-Douglas-styled production functions are especially suitable for the derivation of an estimation model:

$$Q = \Omega K^{\beta_2} L^{\beta_3} \quad (2)$$

It is easily seen that we use the unaccounted output as a proxy for the productive impact of organisational capital. That is,  $\Omega$  is not the value of the organisational capital stock itself but a measure of its impact on output. We believe that this is not just a ‘measure of ignorance’, because we are able to control for the important intervening variables and to isolate the effects of organisational capital.<sup>1</sup> As it is the idiosyncratic element of the organisational capital, which secures a sustainable competitive advantage, we divide  $\Omega$  in a general component ( $\Omega_G$ ) due to organisational capital available to every firm, like practices that can easily be imitated, as well as the institutional and legal environment, and a firm specific part ( $\Omega_S$ ). Doing so, we follow an operationalisation introduced by *Lev and Radhakrishnan (2003)*:

$$Q = \Omega_G \Omega_S K^{\beta_2} L^{\beta_3} \quad (3)$$

---

<sup>1</sup> *Atkeson and Kehoe (2002)* take a similar approach for macro data on the U.S. manufacturing sector, while we are using micro data. They found, that 4% of the total output of the U.S. manufacturing sector is caused by organisational capital, and that its value is about 2/3 of real capital’s value.



Taking the natural logarithm and accounting for J intervening variables  $x_j$  as well as for a stochastic error term  $\varepsilon$  gives us a linearised semi-logarithmic function:

$$\ln Q_i = \ln \Omega_G + \ln \Omega_{S,i} + \beta_2 \ln K_i + \beta_3 \ln L_i + \sum_{j=1}^J \alpha_j x_{j,i} + \varepsilon_i \quad (4)$$

The index  $i=1, \dots, N$  denotes the different units of analysis. While in the conventional regression approach the influence of the common organisational capital on output would be equal to the constant element ( $\ln \Omega_G = \beta_0$ ),

$$\ln Q_i = \beta_0 + \ln \Omega_{S,i} + \beta_2 \ln K_i + \beta_3 \ln L_i + \sum_{j=1}^J \alpha_j x_{j,i} + \varepsilon_i, \quad (5)$$

there is still the open question how to estimate the influence of the firm specific organisational capital.

We discussed in chapter three several approaches and dismissed them as insufficient. Instead we attempt to use an operationalisation introduced by *Lev and Radhakrishnan (2003)* that allowed them to measure the impact of organisational capital on the organisations' performance with U.S. data. We apply their model specification to a German data set. Using the IAB-establishment panel allows us to isolate the effects of organisational capital while controlling for human and social capital. This control for the other capital types, which was not applied by *Lev and Radhakrishnan (2003)*, is in our view rather crucial. Without it one gets a single estimate for the combined effects of organisational capital, human capital and social capital, we instead are able to measure the isolated effects of organisational capital.

We use the panel character of the data to identify the impact of organisational capital. Panel data is characterised by observations for the same unit of analysis at different points of time. The time structure allows to control for so called "unobservable heterogeneity". This term is used for characteristics of the unit of analysis that influence the value of the dependent variable, but which are not observed. Unobserved heterogeneity can cause a severe bias of the estimates, which has led to the development of several compensatory econometric techniques, among them the so called "fixed-effect estimators" (*Greene 1997*). The effects of the establishment specific organisational capital can be identified using a specific type of the fixed effects effect estimator, the so-called dummy variable least square (DVLS) estimator. All panel models controlling for unobserved heterogeneity assume that these effects are constant over time. Utilising its time structure, a panel allows filtering out these time invariant effects. To incorporate the time structure, we have to add to our last expression the time index

$t=1, \dots, T$  indicating the points of time at which the specific observations were made:

$$\ln Q_{i,t} = \beta_0 + \ln \Omega_{S,i,t} + \beta_2 \ln K_{i,t} + \beta_3 \ln L_{i,t} + \sum_{j=1}^J \alpha_j x_{j,i,t} + \varepsilon_{i,t} \quad (6)$$

One can estimate the effects on output of the time-invariant firm specific effects by putting dummies for every unit of analysis in the expression, which take the value one for the focal unit at every point of time and which are otherwise zero.

$$\ln Q_{i,t} = \beta_0 + \beta_{FE,i} D_{i,t} + \ln \Omega_{S,i,t} + \beta_2 \ln K_{i,t} + \beta_3 \ln L_{i,t} + \sum_{j=1}^J \alpha_j x_{j,i,t} + \varepsilon_{i,t} \quad (7)$$

The extensive use of dummy variables, one for each unit of analysis except one (vector  $D_{i,t}$  contains  $N-1$  different dummy variables), is what the dummy variable least square estimator gave its name (*Greene* 1997, pp. 615 ff.). The coefficients  $\beta_{FE,i}$  measure the fixed effects of the different establishments, which includes all idiosyncratic and firm specific effects that are constant over time and are not measured with other variables. If it is possible to control for all other relevant variables and if the organisational capital stock is rather constant over time, what seems plausible to us, then the  $\beta_{FE,i}$  measure the influence of the idiosyncratic part of the organisational capital on output. We get the following equation:

$$\ln Q = \beta_0 + \beta_{1,i} D_{i,t} + \beta_2 \ln K_{i,t} + \beta_3 \ln L_{i,t} + \sum_{j=1}^J \alpha_j x_{j,i,t} + \varepsilon_{i,t} \quad (8)$$

$\beta_{1,i}$  give the influence of the organisational capital on the dependent variable. Or, to term it differently, the firm specific part of the organisational capital  $\Omega_{S,i}$  of the  $i$ -th establishment leads to a variation of the logarithmised performance variable of  $\beta_{1,i}$  ( $\Delta \ln Q_i = \beta_{1,i}$ ). The similarity to the macroeconomic growth accounting approach pioneered by Solow and Griliches is obvious (*Griliches* 1957; *Solow* 1957; *Jorgenson, Griliches* 1967). Their constant ‘ $a$ ’, corresponding to our  $\Omega$  in function (2), is viewed as the growth rate or the total factor productivity, while our  $\beta_{1,i}$  measures the differences in total factor productivity due to organisational capital across establishments.

Although this production function approach imposes a structure on the relation between the diverse inputs and the output it does not force a particular relationship onto the link between the different practices and organisational capital. Indeed, the productive impact of organisational capital is measured indirect as a residual without resorting on any practice. Hence, our model

specification is not as restrictive as approaches utilising system variables or indices as proxies for organisational capital.

One shortcoming of the IAB-establishment-panel is that the actual stock of real capital is not available. We use as a proxy for capital the ongoing investment, because it reflects to a substantial part the replacement of depreciated capital, which is proportional to the capital stock. The labour input is measured by the volume of labour, determined by multiplying the number of employees with the weekly working time (for part-time workers only one half of the weekly working time is taken). Both the capital variable and the volume of labour are highly correlated with firm size and with each other. We attempt to avoid multicollinearity by dividing the capital stock by the number of employees. Hence, capital per employee is used for the estimation instead of capital (*Caves/Barton* 1990; *Bellmann/Büchel* 2001).

In the theoretical chapters, we devoted much space to the distinction of organisational capital from social and human capital. All three types of capital should increase the output. Consequently we have to control for the two latter types in order to isolate the influence of the organisational capital. Estimating the effects of organisational capital without these controls will confound the different effects of the three capital types. Such fixed effects as in *Lev and Radhakrishnan* (2003) give the combined effect of social, human and organisational capital; our estimates should therefore be more accurate.

Social capital is embodied in the employees' relationships. Should an employee leave the organisation then the social capital embodied in her relationships with her colleagues is destroyed. Firms employing a high social capital stock will try to retain employees and their corresponding social capital; they will refrain from dismissals and try to discourage resignations. Additionally, social capital is accumulated via repeated social interactions and prolonged social relationships. Therefore the employees' social capital that can be used by the organisations increases with tenure. Hence, firms with high social capital will have a low personnel turnover rate and vice versa. We use the rate of fluctuation or labour turnover as proxy for social capital.

Human capital is, as stated above, another relevant influencing factor, which would add substantial noise to our estimation. Consequently we have to control for it. We do so using the ratio of skilled employees (i.e. completed vocational training) as a control variable.

In order to control for the market situation and environmental factors we use an extensive set of control variables, among them are industry dum-

mies, which also control for industry specific organisational capital, the export ratio and a works council dummy. Additionally, we control for effects that are of the same magnitude over all units, but vary over time, by putting year dummies into the equation. These effects, which are fixed to the specific points of time, have to be distinguished from the unit fixed effects discussed further above. For a list of all variables and their operationalisation see the appendix. These modifications give the following function:

$$\ln Q_{i,t} = \beta_0 + \beta_{1,i} D_{i,t} + \beta_2 \ln \left( \frac{K_{i,t}}{E_{i,t}} \right) + \beta_3 \ln L_{i,t} + \sum_{j=1}^J \alpha_j x_{j,i,t} + \varepsilon_{i,t} \quad (9)$$

This expression is easily estimated by a semi-logarithmic regression.

#### 4.1.2 The Value of the Organisational Capital

Estimating these equations gives us only the fixed effect as a proxy for the variation in  $\ln Q$  induced by different levels of organisational capital ( $\Delta \ln Q_i(\Omega_{S,i}) = \beta_{1,i}$ ) and not the value or the level of organisational capital itself. Assigning an economic value to these variations in the logarithmised added value necessitates some calculations. We derive the change in added value induced by the organisational capital through the subtraction of the estimated values of the dependent variable under exclusion of the fixed effect from the estimated value of the dependent variable with the full model:

$$\Delta Q_{i,t}(\Omega_{S,i}) = e^{\beta_0^*} e^{\beta_{1,i,t}^*} \left( \frac{K_{i,t}}{E_{i,t}} \right)^{\beta_{2,i,t}^*} L_{i,t}^{\beta_{3,i,t}^*} e^{\sum \alpha_j^* x_{j,i,t}} e^{\varepsilon_{i,t}} - e^{\beta_0^*} \left( \frac{K_{i,t}}{E_{i,t}} \right)^{\beta_{2,i,t}^*} L_{i,t}^{\beta_{3,i,t}^*} e^{\sum \alpha_j^* x_{j,i,t}} e^{\varepsilon_{i,t}} \quad (10)$$

This calculation gives the value for one period, but the economic value of capital stock is its discounted cash flow over several periods. Hence, in a second step we have to calculate the present value of the productive impact just derived. A discounting rate is easily found. We use the interest paid on ‘Bundesschatzbriefe’ (federal treasury bill) averaged over the investigation period, which gives us  $d=0.05134$ . However, the correct number of discounting periods is not so easily found. In order to get an idea of size and importance of organisational capital, we try to approximate the value of the specific organisational capital stock by giving estimates for a lower and upper limit as well as for an intermediate value.

We assume for the lower estimate that the stock of organisational capital will last only one period. That is, capital formation takes place at the beginning of the period and earnings are generated only during this particular period. After the end of the period the organisational capital is completely

depreciated and replaced. Under such conditions the value of the organisational capital stock corresponds to the value of the discounted earnings of one period:  $\underline{\omega}(\Omega_{s,i}) = \Delta Q(\Omega_{s,i})$ . This represents a highly volatile environment with permanently changing conditions, which would force the organisation to adapt frequently to new situations. A reverse scenario is given when one assumes that the environment is absolutely stable and nothing leads to a depreciation of organisational capital. In such a world the earnings from organisational capital are generated indefinitely. The value generated by such continuous earnings is given by the perpetuity formula:

$\bar{\omega}(\Omega_{s,i}) = \frac{\Delta Q(\Omega_{s,i})}{d}$ . This is the upper bound of the estimation interval. The value of earnings generated during an intermediate time span can be calculated using the conventional discounting formula:  $\omega(\Omega_{s,i}) = \sum_{t=1}^T \frac{\Delta Q(\Omega_{s,i})}{(1+d_t)^t}$ .

We estimate the value of this expression setting  $T=5$ .

These calculations will give us the upper and lower limits of the economic value of the organisational capital of the different establishments as well as an intermediate estimate. These values can be interpreted as being similar to the resale value of real capital. They give the maximum price that a potential investor should be prepared to pay for the organisational capital of a firm. Yet, organisational capital is inseparably linked with the organisation and can be sold only with the organisation. Consequently, this resale value of organisational capital is hypothetical and incorporated into the market value of the firm if it were sold. Before we discuss the results of the estimations we will introduce the data set.

## 4.2 The Data Set: The IAB-establishment-panel

As already mentioned, the IAB-establishment-panel will be used as data source. In West Germany the first wave was conducted in 1993 and in East Germany in 1996. Since then, a new wave was carried out each year. The response rates for repeatedly (newly) interviewed establishments are about 85 % (75 %). The sample is drawn from all German establishments with one or more employee(s) subject to compulsory social security contributions according to the principles of optimum stratification of random samples. The stratification criteria are the industry and the firm size. Larger firms have a higher selection probability. The panel covers about 4 500 establishments in the West and 5 000 in the East. Newly drawn establishments compensate losses due to panel mortality. For a more complete description of the IAB-Establishment panel see *Bellmann (1997)* or *Kölling (2000)*.

The IAB-establishment-panel has some advantages over other data sets. The sample is large, covering all industries, and it is representative for the whole German economy. Additionally, it has much higher response rate than most other surveys due to the fact that the IAB had the backing of the Federal Employment Office and the National Employer Association. Hence it can be expected that a possible non-response bias is much less severe in the IAB data than in the other samples. This is especially important for our analysis, because for the estimation of the fixed effects several waves must be used. In this case we use information from the waves of the years 1994 to 2001.

While we are using information from this time span we are not using all waves for the estimation procedure, because we need information from precedent as well from subsequent waves in order to complete the information of a particular wave. Because of this we cannot estimate the fixed effects for the first and the last year. In order to get a sufficiently long panel we have to use the information from 1994 to 2001, which allows us to use the waves 1995 to 2000 for estimating. This excludes East Germany from the analysis because it was not integrated into the panel until 1996 (including East Germany would restrict the estimation to the waves 1997-2000, which seems to be a too short period). With severe and systematic panel mortality such a long panel would be a highly biased sample. Nevertheless, *Hartmann and Kohaut (2000)* are able to show that the unit non-response is not selective and that a selection bias is rather improbable.

However, not all cases of the sample will be used for the analysis. First, we assume that a well-planned and thoroughly designed organisational policy can only be expected in firms of a certain size (see for a similar argumentation: *Hoque 1999*). Hence only establishments with 50 or more employees will be analysed. Second, we try to measure the value of organisational capital by the value of its impact on production. The latter is given by output multiplied with market price. Hence, only for-profit organisations (firms) are likely to implement such systems; non-profit organisations and state agencies are eliminated from the data set. This is also necessary because firm performance will be measured in terms of profit or value added. Similarly, substantial subsidies are paid to establishments in the agricultural sector and mining industry. Hence, they are more like non-market than market organisations and should also be excluded.

### **4.3 First Results and Discussion**

We put the OLS-estimates in the appendix, because they are basically of limited interest due to the fact that around five hundred fixed effects giving

the productive impact of the organisational capital cannot be displayed due to limited space. The overall fit of the estimation is reasonably good as the adjusted  $R^2=0.95$  and the F-test indicate. The constant term suggests that the common organisational capital has a substantial and statistically significant impact on firm output. A summary of the effects of the specific organisational capital is given in table 1.

Table 1: Estimates for the value of the firm specific organisational capital in EURO

	Mean	Std. Dev.	Min	Max
Influence on added value	1 037 900	4 637 191	-709 066	45 811 753
Lower limit	987 216	4 410 743	-674 440	43 574 631
Upper limit	20 247 158	89 987 370	-13 804 880	894 760 800
Intermediate estimate	4 484 029	19 940 383	-3 058 547	197 869 960

This table includes also the upper and lower limit of our estimates for the economic value, in order to get a grasp of its economic importance. The intermediate approximation of the overall value of the organisational capital ranges from -3 058 547 to 197 869 960 Euro indicating that the different propensities to invest in organisational capital lead to substantial differences in organisational performance.<sup>2</sup> Even if the firm is only able to earn the benefits of the organisational capital during one year, then the difference in added value that is due to the organisational capital amounts to around 44. mio. Euros. Hence, organisational capital makes a difference to the organisations competitive position, which gives a first answer to the basic question of the relevance of organisational capital: The value generated through firm specific organisational capital is potentially rather high. Its importance for the success of firms and to the welfare of the society should not be underestimated.

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<sup>2</sup> As mentioned before, one should view these results as a range and not focus on the absolute values, because it is interval scaled and has no natural zero point. This is logical due to its relative nature but also caused by the estimation through dummies. In order to avoid perfect multicollinearity one has to omit one dummy. This dummy defines the reference establishment; its coefficient is zero and all other coefficients are relative to this reference establishment. However, this dummy is chosen arbitrarily, because there is no a priori knowledge about the levels of organisational capital of the different establishments.

Thus firms should analyse their ways to organize themselves and their activities and ask themselves whether there are ways to improve the organisational performance through the change of organisational practices or not. However, it is only possible to give advice and recommendations how to organise, if the link between particular practices and the size of the value of organisational capital is known. Consequently, further research should concentrate on this relationship.



## 5. Conclusion

First we distinguished organisational capital from several other important types of capital, especially social and human capital. Then we utilised a fixed effect estimator to identify the influence of the general and the specific components of organisational capital on output for German establishments using the IAB-establishment panel as a data set. Doing so, we applied a broad set of control variables. This set included proxies for social capital and human capital, thus our study estimates the effect of organisational capital while controlling for the effects of other non-physical capital types. This distinguishes it from previous studies. In a third step we calculated an approximation interval for the economic value of organisational capital.

Our results indicate that organisational capital has a substantial impact on output. While this impact can be as great as almost 45 mio. Euros it is still not accounting for the common organisational capital, which is provided by the regulatory, institutional and legal environment. The high constant of the regression indicates that this influence of the common part of the organisational capital is substantial, too. Our findings on the impact of the firm-specific component of organisational capital suggest that it is worthwhile to think about the investment in such specific organisational capital.

While we were able to derive concrete values – although only on an interval scale – for the value of organisational capital of the different establishments, the linkage or functional form assigning the corresponding value of the organisational capital to the different practices and their combination are still missing. Additional empirical research is necessary.

## Literature

- Abernathy, Frederick H.; John T. Dunlop; Janice H. Hammond; David Weil (1995): "The Information-Integrated Channel: A Study of the U.S. Apparel Industry in Transition." In: Baily, Martin Neil; Reiss, Peter C.; Winston, Clifford (eds.): *Brookings Papers on Economic Activity. Microeconomics*. Washington D. C.: Brookings Institution. pp. 175-246.
- Alchian, Armen A, Harold Demsetz (1972): "Production, Information Costs and Economic Organization." In: *American Economic Review*, Vol. 62, No. 5, pp. 777-795.
- Arrow, Kenneth J. (2000): "Observations on Social Capital." In: DasGupta, Partha; Ismail Serageldin (eds.): *Social Capital: A Multifaceted Perspective*, Washington DC: The World Bank, pp. 3-5.
- Atkeson, Andrew; Patrick J. Kehoe (2002): *Measuring Organisational Capital*. NBER Working Paper 8722, Cambridge, MA: NBER.
- Becker, Gary S. (1964): *Human capital. A theoretical and empirical analysis, with special reference to education*. New York: Columbia University Press.
- Bellmann, Lutz (1997): "Das Betriebspanel des IAB." In: Hujer, Reinhard; Ulrich Rendtel; Gert Wagner (eds.): *Wirtschafts- und Sozialwissenschaftliche Panel-Studien. Sonderheft des Allgemeinen Statistischen Archivs*, No. 30.
- Bellmann, Lutz; Felix Büchel (2001): "Betrieblich finanzierte Weiterbildung und Unternehmenserfolg. Eine Analyse für West- und Ostdeutschland unter besonderer Berücksichtigung von Selektionseffekten." In: Backes-Gellner, Uschi; Petra Moog (eds.): *Bildungssystem und betriebliche Beschäftigungsstrategien. Beiträge der Jubiläumstagung '25 Jahre Bildungsökonomischer Ausschuß'*. Schriften des Vereins für Socialpolitik, Vol. 279, Duncker und Humblot: Berlin, pp. 75-92.
- Benz, Matthias; Alois Stutzer (2002): *Do Workers Enjoy Procedural Utility?* Unpublished manuscript, pp. 1-25.
- Black, Sandra E.; Lisa M. Lynch (2002, unpublished working paper): *Measuring Organizational Capital in the New Economy*. Forthcoming in 2003, in: Corrado, Carol; John Haltiwanger; Dan Sichel (eds.): *Measuring Capital in the New Economy*. Chicago: Chicago Press.
- Bourdieu, Pierre (1986): "Forms of Capital." In: Richardson, John G. (ed.): *Handbook of Theory and Research for the Sociology of Education*. Greenwood Press: Westport, pp. 241-260.
- Bresser, Rudi K.; Klemens Millonig (2003): "Institutional Capital: Competitive Advantage in Light of New Institutionalism in Organization Theory." In: Schmalenbach's *Business Review*, Vol. 55, No. 3, pp. 220-241.
- Brynjolfsson, Erik; Lorin M. Hitt; Shinkyu Yang (2001): *Intangible Assets: How the Interaction of Computers and Organizational Structure Affects Stock Market Valuations*. Discussion Paper.

- Caves Richard E.; David R. Barton (1990): *Efficiency in U.S. Manufacturing Industries*. Cambridge and London: MIT Press.
- Coase, Ronald H. (1937) "The Nature of the Firm." In: *Economica*, Vol. 4, pp. 386-405.
- Coleman, James S. (1988): "Social Capital in the creation of human capital." In: *American Journal of Sociology*, Vol. 94, pp. S94-S120.
- Comanor, William S.; Harvey Leibenstein (1969): "Allocative Efficiency, X-Efficiency and the Measurement of Welfare Loss." *Economica*, August, Vol. 36, pp. 304-309.
- Dierickx, Ingemar; Karel Cool (1989): "Asset Stock Accumulation and the Sustainability of Competitive Advantage." In: *Management Science*, Vol. 35, No. 12, pp. 1504-1511.
- Glaeser, Edward L.; David Laibson; Bruce Sacerdote (2000): *The Economic Approach to Social Capital*. NBER Working Paper 7728.
- Glaeser, Edward L.; David Laibson; Bruce Sacerdote (2002): "An Economic Approach to Social Capital." In: *The Economic Journal*, Vol. 112 (November), pp. F437-F458.
- González, Francisco M.; Alok Johri (2002): *Asymmetric Labor Adjustment, Organizational Capital and Aggregate Job Flows*. Unpublished manuscript, pp. 1-42.
- Grilliches, Zvi (1957): "Hybrid Conr: An Exploration in the Economics of Technological Change." In: *Econometrica*, Col. 25, No. 4, pp. 501-522.
- Greene, William H. (1997): *Econometric Analysis*. 3<sup>rd</sup> edition. Prentice Hall: Upper Saddle River.
- Hardin, Russel (1999): "Social Capital." In: Alt, James E.; Margaret Levi; Elinor Ostrom (eds.): *Competition and Cooperation: Conversations with Nobelists about Economics and Political science*. New York.
- Hartmann, Josef; Susanne Kohaut (2000): "Analysen zu Ausfällen (Unit-Nonresponse) im IAB-Betreibspanel." In: *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*. Vol. 33, No. 4, pp. 609-618.
- Hoque, Kim (1999): "Human Resource Management and Performance in the UK Hotel Industry." In: *British Journal of Industrial Relations*, Vol. 37, No. 3, pp. 419-443.
- Ichniowski, Casey; Kathryn Shaw; Giovanna Prennushi (1997): "The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines." In: *American Economic Review*, Vol. 87, No. 3, pp. 291-313.
- Jorgenson, Dale W.; Zvi Griliches (1967): „The Expansion of Productivity Change.“ In: *Review of Economic Studies*, Vol. 34, pp. 249-283.
- Kölling, Arnd (2000): "The IAB-Establishment Panel." In: *Schmollers Jahrbuch*, Vol. 120, No. 2, pp. 291-300.
- Lazzarini, Sergio G.; Gary J. Miller; Todd R. Zenger (2002): *Moving out of Committed Relationships*. Unpublished manuscript, pp. 1-42.

- Leibenstein, Harvey (1966): "Allocative Efficiency vs. "X-Efficiency"." *American Economic Review*, June , Vol. 56, No. 3, pp. 392-415.
- Leibenstein, Harvey (1978): "On the Basic Proposition of X-Efficiency Theory." *American Economic Review*, May , Vol. 68, No. 2, pp. 328-332.
- Lev, Baruch; Suresh Radhakrishnan (2003): *The Measurement of Firm-Specific Organisation Capital*. NBER Working Paper No. 9581, NBER.
- Ludewig, Oliver (2001): "Personalpolitische Systeme in Deutschland." In: Kossbiel, Hugo (ed.): *Modellgestützte Personalentscheidungen 5*. München, Mering: Hampp, pp. 9-26.
- Luhmann, Niklas (2000): *Vertrauen. Ein Mechanismus der Reduktion sozialer Komplexität*. 4<sup>th</sup> edition, Stuttgart: Lucius & Lucius.
- Normann, Richard; Rafael Ramirez (1998): "Designing Interactive Strategy. From Value Chain to Value Constellation" Chichster, et al.: Wiley & Sons.
- Normann, Richard; Rafael Ramirez (1993): "From value chain to value constellation: designing interactive strategy", *Harvard Business Review*, july-august 1993, vol. 71, n° 4, pp. 65-77.
- Peteraf, Magaret A. (1993): "The Cornerstone of Competitive Advantage: A Resource-Based View." In: *Strategic Management Journal*, Vol. 14, No. 3, pp. 179-191.
- Piazza-Georgi, Barbara (2002): "The role of human and social capital in growth: extending our understanding." In: *Cambridge Journal of Economics*, No. 26, pp. 461-479.
- Prescott, Edward C.; Michael Visscher (1980): "Organization Capital." In: *Journal of Political Economy*, Vol. 88, No. 3, pp. 446-461.
- Putnam, Robert D. (2000): "Bowling Alone. The Collapse and Revival of American Community." New York: Simon & Schuster.
- Sadowski, Dieter (2002): *Personalökonomie und Arbeitspolitik*. Schäffer Pöschel.
- Schmidtke, Corinna; Uschi Backes-Gellner (2002): "Betriebliche Strategien gegen Fachkräftemangel." In: Bellmann, Lutz; Arnd Kölling (eds.): *Beiträge zur Arbeitsmarkt- und Berufsforschung (BeitrAB)*. Betrieblicher Wandel und Fachkräftebedarf. No. 257, pp. 101-127.
- Schumpeter, Joseph A. (1934): *The Theory of Economic Development*. Oxford, UK: Oxford University Press.
- Siggelkow, Nicolaj (2002): "Misperceiving Interactions among Complements and Substitutes: Organizational Consequences." In: *Management Science*, Vol. 48, pp. 900-916.
- Sobel, Joel (2002): "Can We Trust Social Capital?" In: *Journal of Economic Literature*. Vol. 40, March, pp. 139-154.
- Solow, Robert M. (1999): "Notes on Social Capital and Economic Performance." In: Dasgupta, Partha; Ismail Serageldin (eds.): *Social Capital: A Multifaceted Perspective*. Washington, D.C.: World Bank.

- Solow, Robert M. (1957): "Technical Change and the Aggregate Production Function." In: *Review of Economics and Statistics*, Vol. 39, No. 3, pp. 312-320.
- Tomer, John F. (1981): "Organizational Change, Organizational Capital and Economic Growth." In: *The Eastern Economic Journal*, No. 7, January, pp. 1-14.
- Tomer, John F. (1986): "Productivity and Organizational Behavior: Where Human Capital Fails." In: Gilad, Benjamin; Stoney Kaish (eds.): *Handbook of Behavioral Economics*, Vol. A. Greenwich (Connecticut), London: JAI Press Inc., pp. 233-235.
- Tomer, John F. (1987): *Organisational Capital. The Path to Higher Productivity and Well-being*. New York, Westport, London: Praeger.
- Williamson, Oliver E. (1975): *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.
- Williamson, Oliver E. (1985): *The Economic Institutions of Capitalism*. New York: Free Press.

## Appendix

### Appendix A: The variables

Variable	Operationalisation
<b>Dependent variables</b>	
Log of added value	Gross sales minus supplies and bought services
<b>Independent variable</b>	
Physical capital	Investment of the previous period
Labour	Volume of work: (Number of employees-0.5*Number of part-time employees)*weekly working ours
Works council	Dummy that is one if a works council exists and otherwise zero
Labour turnover	(Number of quits+Number of dismissals)/number of employees
Further training	Dummy that is one if the establishment finances employee further training and otherwise zero
Qualification ratio	Number of skilled employees/number of employees
Technology	A dummy that is one if the technology is regarded as new or better and otherwise zero
Collective agreement	A dummy that is one if the establishment is following a collective agreement and otherwise zero
Exports	Exports as ration of total sales
Industry dummies	15 industry dummies
Year dummies	4 year dummies

## Appendix B: The Regression

Number of obs = 1473

F(512, 960) = 52.01

Prob > F = 0.0000

R-squared = 0.9652

Adj R-squared = 0.9466

Root MSE = 0.34602

Log value added	Coef.	Std. Err.	t	P> t
Log of Physical capital	0.366	0.072	5.05	0.000
Log of work volume	0.006	0.024	0.26	0.797
Works council	0.052	0.108	0.48	0.633
Labour turnover	-0.278	0.256	-1.08	0.278
Qualification ratio	0.001	0.001	0.93	0.354
Further training	0.032	0.057	0.56	0.576
Technology	0.026	0.036	0.71	0.479
Collective agreement	-0.012	0.064	-0.19	0.852
Exports	-0.004	0.001	-3.12	0.002
Dummies for the establishment fixed effects	Yes			
Dummies for the time fixed effects	Yes			
Industry dummies	Yes			
constant	11.961	0.757	15.80	0.000