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**Research highlights**

- We assess the impact of Organization Capital (OC) on the performance of European firms.
- OC is proxied by capitalizing Selling, General and Administrative expenses.
- OC output elasticity is high.
- OC omission strongly upwardly biases the estimates of R&D output elasticity.

# Organization capital and firm performance. Empirical evidence for European firms

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**Abstract**

The paper assesses the impact of Organization Capital (OC) on firm performance for a sample of European firms. OC is proxied by capitalizing Selling, General and Administrative expenses, an income statement item. Results are robust and show the strong effect of OC on firm performance.

*Keywords:* Intangibles, Knowledge-based resources, Organization capital, R&D capital stock, Translog production function.

*JEL Classification*: C210, D240, D290, L200.

## 1. Introduction

Theoretical and empirical studies emphasize the role of firms' *intangible* over *tangible resources* to achieve sustained competitive advantage (e.g. Hall, 1992). Among them, Organization Capital (OC) has recently gained momentum in business and managerial studies as a collective, firm-specific and idiosyncratic factor (e.g. Kaplan and Norton, 2004; Webster and Jensen, 2006).

OC is embedded in the organization and connected with firms' knowledge and capabilities. These features make it hard to analyze within standard economic theory, but, at the same time, they render it a keystone for sustainable competitive advantage. Like other knowledge-based resources, it is dynamic, imperfectly contractible, interrelated and organizational (Montresor, 2004). Furthermore, because of its rarity, non-substitutability, history dependency, causal ambiguity and complexity, it is heterogeneous and immobile (Barney, 1991).

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Because of its complex nature, it is hard to assess the real impact of OC on firm performance. Given the lack of good and prompt proxies, research in this area has been "uncoordinated and sporadic" (Black and Lynch, 2005), and has failed to reach conclusive results. The majority of the studies is survey-based and lacks shared definitions and methodology. Furthermore, researchers usually claim that the peculiar features of OC hamper the use of financial data: OC does not appear in firms' balance sheets and investments in it are treated as expenses; moreover, such "expenses" are hard to identify and track as they refer to different income statement items.

Two notable exceptions are Lev and Radhakrishnan (2005) and De and Dutta (2007). The former proxy OC using *Selling General and Administrative* (SGA) expenses, an item that includes several expenses that can generate OC: employee training costs, brand enhancement activities, payment to systems and strategy consultants and IT outlays. These authors estimate a Cobb-Douglas production function and compute OC as a residual, distinguishing a common OC from a firm specific one. They estimate the function from a large sample of US firms, differentiating among firms with and without R&D. Results show that all the explanatories have a positive effect on performance and firm-specific OC has the highest elasticity.

De and Dutta (2007) choose a sub-class of SGA: *administrative expenses*. In their specification, OC becomes a factor of production and is computed by capitalizing (a constant fraction of) these expenses with the perpetual inventory method, assuming a constant depreciation rate (as for the computation of R&D stocks). They estimate an extended Cobb-Douglas production function – including physical, brand, human and organization capital – on a sample of IT Indian firms. Results are quite robust across the different specifications and estimation methods, and show that OC has the highest output elasticity.

Drawing on these studies, we estimate the impact of OC on firm performance on a sample of European firms. To our knowledge, this is the first large study that analyzes the effect of OC, as proxied by an income statement item, conducted at the European level.

## 2. Empirical methodology

As in De and Dutta (2007), we model OC as a factor of production and proxy it by means of a capitalized income statement item.[1] Specifically, we apply the perpetual inventory method to a series of SGA annual expenses, assuming a capitalization rate of 20% and a depreciation rate of 10%.

The depreciation rate used for OC (10%) is smaller than the one used for the R&D stock (20%), because OC is more tacit, firm-specific, harder to imitate, and therefore less subject to depreciation.[2]

[1] The method used by Lev and Radhakrishnan (2005) suffers from serious flaws. On this point see Bresnahan (2005).

[2] We estimate the model also with other capitalization (10%) and depreciation (15%-20%)

We do not follow De and Dutta (2007) and use SGA expenses (as in Lev and Radhakrishnan, 2005) instead of administrative expenses based on the consideration that although the former is probably too general, the latter may be too restrictive. SGA expenses include general, administrative and selling expenses. Selling expenses refer mainly to distribution expenses and do not generate OC. However, general expenses are an heterogeneous class that includes different items and the criteria adopted to classify expenses as general or administrative are often arbitrary. Hence, besides reducing data availability, relying on administrative expenses could exclude important investments in OC.[3]

We start from a production function at the firm level with four inputs – physical capital ($K$), labor ($L$), R&D stock ($R$) and OC ($O$) – and adopt two functional specifications: i) Cobb-Douglas:

$$q_{it} = a_i + \beta_k k_{it} + \beta_l l_{it} + \beta_r r_{it} + \beta_o o_{it} \tag{1}$$

where production factors are in logs, $q_{it}$ is the log of the $i$th firm's annual sales at time $t$, and $a_i$ captures unobservable differences in production efficiency; ii) translog (e.g. Kim, 1992), a more flexible form that removes the assumptions of constant output elasticities and constant unit elasticity of substitution for inputs implied by the previous specification:

$$\begin{aligned} q_{it} = a_i + \beta_k k_{it} + \beta_l l_{it} + \beta_r r_{it} + \beta_o o_{it} + \gamma_k k_{it}^2 + \gamma_l l_{it}^2 + \gamma_r r_{it}^2 + \gamma_o o_{it}^2 + \\ + \gamma_{kl} k_{it} l_{it} + \gamma_{kr} k_{it} r_{it} + \gamma_{ko} k_{it} o_{it} + \gamma_{lr} l_{it} r_{it} + \gamma_{lo} l_{it} o_{it} + \gamma_{ro} r_{it} o_{it} \end{aligned} \tag{2}$$

Data are drawn from the *Compustat Global database* (see Appendix). The sample covers both large and medium firms. We divide it in two sub-samples – R&D firms and non-R&D firms – and estimate both the specifications in levels for 2006 (with industry and country dummies) and first differences (FD) 2005-2006 (to remove any firm-specific unobserved heterogeneity).

We also control for the strict exogeneity assumption of the model: all the different specifications are estimated using lagged values as instruments and the Hausman test never rejects the null hypothesis of no endogeneity.[4]

Since residuals are heteroskedastic (Cook-Weisberg test), we use robust standard errors.

rates. As in De and Dutta (2007), results are robust. Data available upon request.

[3]Some objections could be raised on the measure of OC developed from SGA expenses (Bresnahan, 2005). This measure implies that firms have higher OC levels when they have higher SGA expenses caused by inefficiencies. However, the same consideration could apply to the methodology used to measure innovation capital with R&D expenses. It could also be objected that this OC measure does not capture aspects not directly correlated with observed expenditures – for example managerial talent; it is, however, likely that even this unobserved variable requires monetary investment and, therefore, the effect of these aspects are negligible.

[4]In the models in levels, we use the lagged logs of physical capital, labor and R&D stock and the lagged SGA expenses as instruments. In the models in FD, physical capital and labor are assumed to be exogenous based on the level estimates. To verify the exogeneity assumption for OC, we estimate the model in FD using SGA expenses from 2000 to 2004 as instruments. Also in this case we do not reject the null at the 1% significance level.

Finally, to control for the influence of outliers, we also estimate the models with Huber and Tukey biweights.[5]

## 3. Estimation results

The magnitude of OC is considerable: OC (median in the R&D sample for 2006: 43.53 € millions) is always higher than R&D stock (19.74 € millions) and physical capital (30.08 € millions). Moreover, in both the samples OC has registered the highest increase in the period 2005-2006: median growth rate of 15% for R&D firms and 18% for non-R&D firms, against, respectively, 1% and 5% for physical capital and 4% for R&D stock.

Estimation results of output elasticities - reported in Table 1 - show that, in both samples and across all the different specifications, labor and OC have the highest elasticities.

In both models (levels and FD) and sub-samples, the translog function provides a better description of technology (Wald test of joint non significance of the log-quadratic and interaction terms: $p = 0.00$).[6] In this specification, the estimates in levels and FD result to be quite similar for all the variables. The point estimates of OC are 0.33-0.34 for R&D firms and 0.51-0.56 for non-R&D firms, much higher than the elasticities of physical capital, 0.16 and 0.06-0.09, respectively.

The output elasticity of OC is higher for non-R&D firms (though this difference is significant only in the model in levels). This result can be due to the fact that in non-R&D firms (that belong to sectors different from those of R&D firms) OC also takes up the role of R&D stock. Indeed, even though R&D stock does not appear to affect significantly output, it seems to influence the effect of OC on firm performance.

R&D output elasticity is positive but rather low (0.03-0.06) and never significant. This can be partly due to a double counting problem (Mairesse and Sassenou, 1991) and it could be exacerbated in this study by the inclusion of OC among the inputs, producing a downward bias for R&D estimates.[7]

Nonetheless, the exclusion of OC from the explanatories, as in the majority of the studies that analyze the effect of R&D on firm performance, could cause an omitted variable problem and produce strongly upward biased results. This is shown by the estimates reported in the first two columns of Table 1, where

[5]In both sub-samples all the distributions (levels and growth rates) are positively skewed with slim tails, due to the presence of "giants" such as Siemens, Volkswagen, Royal Dutch (R&D sample) and Carrefour, Tesco and Sainsbury (non-R&D sample).

[6]Table 1 reports elasticities of a simplified translog function, including only significant interaction and quadratic effects iteratively selected through the Wald test. The elasticities (and the relevant standard errors) are calculated at the sample median. They do not significantly differ when calculated at the sample mean.

[7]SGA expenses sometimes include customer or government sponsored R&D expenses. In this case, the model could provide downward (upward) biased estimates for R&D stock (OC).

OC is excluded from the explanatories and the R&D average elasticity results to be about 0.07, as found by similar studies (e.g. Aiello and Cardamone, 2005).[8]

## 4. Conclusions

This paper aims at assessing the impact of Organization Capital (OC) on performance for European firms. Results show that OC, a collective, firm-specific and idiosyncratic factor, is one of the main determinants of firm performance: its output elasticity is positive and highly significant in all the estimates. This elasticity is even higher than those of physical capital and R&D stock, providing strong evidence of its crucial role in production.

Given the robust, quite stable and reasonable nature of the estimates obtained, the inclusion of OC among production factors appears to be justified, not only at the theoretical but also at the empirical level. Moreover, it effectively points to a possible bias in the estimates of specifications that do not include OC among the explanatory variables.

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## Appendix A. Data appendix

Data are drawn from the *Compustat Global database*. European firms reporting SGA expenses are 1,309.

Data for each firm in the sample include: industry (4-digits SIC codes); country; yearly revenues (2005-2006); yearly SGA expenses (2000-2006); yearly property, plant and equipment (PPE) (2005-2006); yearly intangible assets (2005-2006); yearly R&D expenses (R&D) (2000-2006); and yearly number of employees (2005-2006).[9]

Firms with missing data for PPE, employees, or revenues have been excluded. The final sample consists of 828 firms: 418 with R&D stock and 410 without R&D.

The most represented countries are UK, Germany, France, Netherlands and Denmark (almost 90% of the sample). The distribution by sector is smooth.

[8]A hint of the misspecification is also in the significant differences between the estimates of the model in levels and FD for physical capital and R&D.

[9]Data on employment are occasionally taken from *Amadeus*.

Table 1: Output elasticities estimation results – Levels (year 2006) and First Differences (years 2005-2006)

| | R&D firms | | | | | | Non-R&D firms | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cobb-Douglas (without OC) | | Cobb-Douglas | | Translog[a] | | Cobb-Douglas | | Translog[a] | |
| | Levels | FD | Levels | FD | Levels | FD | Levels | FD | Levels | FD |
| $K$ | 0.21*** | 0.04 | 0.16*** | 0.03 | 0.16*** | 0.16* | 0.10*** | 0.09** | 0.06*** | 0.09** |
| | (0.03) | (0.04) | (0.03) | (0.04) | (0.03) | (0.09) | (0.03) | (0.04) | (0.02) | (0.04) |
| $L$ | 0.73*** | 0.78*** | 0.56*** | 0.66*** | 0.54*** | 0.50*** | 0.37*** | 0.30*** | 0.46*** | 0.38*** |
| | (0.05) | (0.05) | (0.06) | (0.06) | (0.05) | (0.12) | (0.05) | (0.08) | (0.04) | (0.07) |
| $R$ | 0.06*** | 0.12*** | 0.02 | 0.05 | 0.03 | 0.06 | | | | |
| | (0.02) | (0.04) | (0.02) | (0.04) | (0.02) | (0.04) | | | | |
| $O$ | | | 0.30*** | 0.39*** | 0.33*** | 0.34** | 0.47*** | 0.64*** | 0.51*** | 0.56*** |
| | | | (0.06) | (0.10) | (0.04) | (0.15) | (0.04) | (0.10) | (0.04) | (0.09) |
| Obs. | 410 | 375 | 410 | 375 | 410 | 375 | 418 | 418 | 418 | 418 |

[a]Elasticities evaluated at the sample median.
Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors in parentheses.

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