Organizational capital and firm performance. Empirical evidence for European firms
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Abstract  
The paper assesses the impact of Organizational Capital (OC) on firm performance for a sample of European firms. OC is proxied by capitalizing an income statement item (SGA expenses). A rationale for this methodology is provided. Results are robust and show the strong effect of OC on firm performance.

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

JEL Classification: C210, D240, D290, L200

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1. Introduction

Theoretical and empirical studies emphasize the role of firms’ intangibles over tangibles for a sustained competitive advantage (e.g. Hall, 1992). Among them, Organizational 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 firm’s knowledge and capabilities. These features make it hard to analyze within standard economic theory, but, at the same time, they render it a good basis for a sustainable competitive advantage. Like other knowledge-based resources, it is dynamic, imperfectly contractible, interrelated and organisational (Montresor, 2004). Furthermore, because of its rarity, non substitutability, history dependency, causal ambiguity and complexity, it is heterogeneous and immobile (Barney, 1991).

Because of its complex nature, it is hard to assess the real impact of OC on firms’ performance. Given the lack of good and prompt proxies for it, research in this area has been “uncoordinated and sporadic” (Black and Lynch, 2005), with no conclusive results. Indeed, the majority of the studies is survey-based, with no shared definitions and methodology, while researchers usually claim that the peculiar features of OC hamper the use of financial data: OC does not appear in firm’s balance sheets and investments in it are treated as expenses; moreover, such “expenses” are hard to identify and track since they refer to different income statement items.

Two notable exceptions are Lev and Radhakrishnan (2005) and De and Dutta (2007).

Lev and Radhakrishnan (2005) proxy OC using Selling General and Administrative (SGA) expenses, an item that turns out to include many of the expenses that can generate OC, namely: employee training costs, brand enhancement activities, payment to systems and strategy consultants, IT outlays. These authors estimate a Cobb-Douglas production function and work out 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 instead a sub-class of SGA: administrative expenses. In their specification, OC becomes a factor of production and is worked out by capitalizing (a constant fraction of) these expenses with the perpetual inventory method, assuming a constant depreciation rate (like done for R&D stocks). They estimate an extended Cobb-Douglas production function – including physical, brand, human and organizational capital – from a sample of IT Indian firms. Results are quite robust across the different specifications and estimation methods, showing that OC has the highest output elasticity.

Drawing on these studies, we estimate the impact of OC on firms’ performance from a sample of European firms. At the best of our knowledge, this is the first large study on the effect of OC on firms’ performance for Europe.
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. In particular, we apply the perpetual inventory method to the series of SGA annual expenses, assuming a capitalization rate of 20% and a depreciation rate of 10%.

We assume a depreciation rate for OC (10%), smaller than the one used for the R&D stock (20%), because OC is more tacit, firm-specific and thus harder to imitate, and this makes it less subject to depreciation.

We decided not to follow De and Dutta (2007) and use SGA expenses (like Lev and Radhakrishnan, 2005) instead of administrative expenses: although the former is probably too general, the latter may be too restrictive. Indeed, SGA includes general, administrative and selling expenses. Selling expenses refer mainly to distribution and do not generate OC. However, general expenses are a heterogeneous class with different items and the criteria to classify expenses under general or administrative are often arbitrary. Hence, aside from reducing data availability, relying on administrative expenses can exclude important investments.

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

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

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:

$$q_{it} = a_i + \beta_k k_{it} + \beta_l l_{it} + \beta_r r_{it} + \beta_o o_{it} + \gamma_{kr} k_{it}^2 + \gamma_{lr} l_{it}^2 + \gamma_{oo} o_{it}^2 +$$

$$+ \gamma_{kk} k_{it} l_{it} + \gamma_{kk} k_{it} r_{it} + \gamma_{kl} k_{it} o_{it} + \gamma_{lr} l_{it} r_{it} + \gamma_{or} o_{it} r_{it} + \gamma_{rr} r_{it} o_{it}$$

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 sectoral and country dummies) and first differences (FD) 2005-2006 (to remove any firm-specific unobserved heterogeneity).

We control also for the strict exogeneity assumption in the model: all the different specifications are estimated using lagged values as instruments and the

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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%) rates. As in De and Dutta (2007), results are robust. Data available at request.
Hausman test never rejects the null hypothesis of no endogeneity.\(^3\)

Since residuals turn out to be heteroskedastic (Cook-Weisberg test), we use robust standard errors.

Finally, to control for the influence of outliers, we estimate the models also with Huber and Tukey biweights.\(^4\)

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) and physical capital (30.08). 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 are reported in Table 1. They show that, for both the samples and across all the different specifications, labour and OC have the highest elasticities.

In both the models (levels and FD) and for both the samples, the translog function provides a better description of technology (Wald test of joint non significance of the log-quadratic and interaction terms: \(p = 0.00\)).\(^5\) In this specification, the estimates in levels and FD are pretty similar for all the variables. The point estimates for OC are 0.33-0.34 in R&D firms and 0.51-0.56 in non-R&D firms, much higher than the elasticities of physical capital, respectively, 0.16 and 0.06-0.09.

The output elasticity of OC is higher in 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 (belonging to sectors different from those of R&D firms) OC takes up also 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.

In fact, R&D output elasticity is positive but rather low (0.03-0.06) and never significant. This can be partly due to the double counting problem (Mairesse and Sassenou, 1991) and it could be exacerbated in this study by the inclusion

\(^3\)For the models in levels, we use the lagged logs of physical capital, labour and R&D stock and the lagged SGA expenses as instruments. In the model in FD, physical capital and labour are assumed to be exogenous based on the level estimates. To verify the exogeneity assumption for OC, we estimate the model in FD by using SGA expenses from 2000 to 2004 as instruments. Also in this case we do not reject the null at the 1\% significance level.

\(^4\)In both sub-samples all the distributions (levels and rates of growth) are positively skewed with slim tails, due to the presence of “giants” such as Siemens, Volkswagen, Royal Dutch (R&D sample) or Carrefour, Tesco and Sainsbury (non-R&D sample).

\(^5\)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 error) are calculated at the sample median. They do not significantly differ when calculated at the mean.
of OC among inputs, producing a downward bias for R&D estimates.\textsuperscript{6}

Nonetheless, the exclusion of OC among the explanatory variables, as in the majority of the studies that analyze the effect of R&D on firm performance, can lead to 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 OC is excluded from the explanatory variables and the R&D average elasticity turns out to be about 0.07, rather similar to what found by similar studies (e.g. Aiello and Cardamone, 2005).\textsuperscript{7}

4. Conclusions

This paper aims at assessing the impact of Organizational 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 this performance: its output elasticity turns out to be positive and highly significant in all the estimates. This elasticity is even higher than that of physical capital and R&D stock, providing strong evidence for its crucial role in production.

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

Acknowledgements

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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).\textsuperscript{8}

\textsuperscript{6}SGA expenses sometimes include customer or government sponsored R&D expenses. In this case, the model provides downward (upward) biased estimates for R&D stock (OC).

\textsuperscript{7}A hint of the mispecification is also in the significant differences between the estimates of the model in levels and FD for physical capital and R&D.

\textsuperscript{8}Data on employment occasionally taken from Amadeus.
Table 1: Output elasticities estimation results – Levels (year 2006) and First Differences (years 2005-2006)

<table>
<thead>
<tr>
<th></th>
<th>R&amp;D firms</th>
<th>Non-R&amp;D firms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cobb-Douglas (without OC)</td>
<td>Cobb-Douglas</td>
</tr>
<tr>
<td></td>
<td>Levels</td>
<td>FD</td>
</tr>
<tr>
<td>$K$</td>
<td>0.21***</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>(0.03)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>$L$</td>
<td>0.73***</td>
<td>0.78***</td>
</tr>
<tr>
<td></td>
<td>(0.05)</td>
<td>(0.05)</td>
</tr>
<tr>
<td>$R$</td>
<td>0.06***</td>
<td>0.12***</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.04)</td>
</tr>
<tr>
<td>$O$</td>
<td>0.30***</td>
<td>0.39***</td>
</tr>
<tr>
<td></td>
<td>(0.06)</td>
<td>(0.10)</td>
</tr>
<tr>
<td>Obs.</td>
<td>410</td>
<td>375</td>
</tr>
</tbody>
</table>

$^a$Elasticities evaluated at the sample median.
Significance levels: * 10%; ** 5%; *** 1%. Robust standard errors in parentheses.
Firms with missing data for PPE, employees, or revenues were excluded. The final sample counts 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.

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