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# **THE FIRM SIZE EFFECT ON PERFORMANCE DUE TO INTANGIBLE RESOURCES**

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## **THE FIRM SIZE EFFECT ON PERFORMANCE DUE TO INTANGIBLE RESOURCES<sup>4</sup>**

The paper explores the effect of firm size on the relation between intangible resources and companies' performance (ROA). The authors identify six types of intangibles: human resources and management capabilities, innovation and internal process capabilities and customer loyalty and networking capabilities. The study provides econometric justification using a database of more than 1400 European public companies. The time period for the investigated data covers ten years from 2004 to 2013. A dummy regression analysis was applied for empirical testing. The findings revealed that the size of a company matters with regard to the employment of intangible resources and for a performance based on intangibles.

JEL Classification: O30, F 14, L 25, L60, L63

Keywords: intangibles, performance, SME, large companies, European companies, ROA, dummy regression.

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## Introduction

Companies' performance nowadays is driven by intangibles [Steward 1997; Haanes and Fjeldstad 2000; Lev 2001; Kamukama *et al.* 2011]. The role of intangibles as an enhancer of real assets is widely discussed in theoretical literature [Steward 1997; Carmeli 2004; Greco *et al.* 2013], as well is empirically tested (Widener 2006). The employment of resources and its transformation into companies' performance is determined through different factors [Syverson 2011; Molodchik *et al.* 2012]. One such factor that is widely recognized in the literature is the size of the company, which influences its strategies, processes, resource employment and consequently, performance. Large companies enjoy economies of scale and are able to distribute fixed costs over larger outputs [Wagner and Hansen, 2005; Spanos *et al.* 2001]. Compared to SMEs, they have sufficient financial resources to invest in intangible assets, but tend to create bureaucracy and are less flexible than SMEs [Cohen and Klepper 1996]. As noted by Terziovski (2010), SMEs appear to be more reactive, prone to having a "fire-fighting" mentality and informal strategies. Intangibles are significant for SMEs. However, for most SMEs, they are underdeveloped [Hutchinson and Quintas 2008]. Therefore, the factors that drive their performance are expected to be different. Consequently, performance management in the field of intangibles should also be designed around consideration of a company's size [Bahri *et al.* 2011].

The size effect has been discussed in-depth by investigating the innovation activities of firms in studies such as those conducted for example by Cohen and Klepper (1996), Wagner and Hansen (2005), and Coombs and Bierly (2006). Intangibles related to innovation capital are undoubtedly significant for company performance, but do not cover a wide variety of other intangible resources such as human capital, relational capital and process capital. In empirical studies devoted to the transformation of intangibles the company size of the firm is generally treated as a control variable [Molodchik *et al.* 2012]. Another cluster of papers have focused on distinct aspects of SMEs [F-Jardón and Martos 2009; Berends *et al.* 2013].

However, the literature does not reveal the differences through the employment of intangibles that are conditioned by the size of the firm. Moreover, the effect of intangibles on performance as conditioned by firm size was not studied in the surveyed literature.

Therefore, this paper aims to investigate the role of firm size through the employment of intangible resources and by their impact on firm performance. Knowledge of this impact can develop specific strategies for SMEs and large companies to improve their performance according to these intangibles, which can lead to produce a greater impact on it. This article provides an interdisciplinary research in areas of finance and intellectual capital management.

The results can be used to develop specific management tools for SMEs and large companies regarding the effective employment of intangible resources [Fernández-Olmos and Díez-Vial 2012].

The framework of the study is built on the input-output approach and analyses the transformation of strategic resources into company performance. Intangible resources are supposed to be the most important factors in this process. According to companies' performance, a return on assets is observed. The authors expect to find significant differences in the field of intangible resources conditioned by size. The authors applied a dummy regression analysis for testing the hypotheses put forward in the theoretical part of the paper.

The paper is organized as follows. In the next section, the theoretical foundation of differences for intangible-driven performance caused by the size effect is presented. Section 2 is devoted to the research design and measurement methodology of the present study. In section 3, the authors provide a statistical analysis of typical representatives of SMEs and large companies. Results of the regression analysis are presented in section 4. Finally, a conclusion and some limitations of the research are discussed in last section.

## **1. Theoretical background**

### **1.1 Definition of intangibles**

Kristandl and Bontis (2007, pp. 1518) define intangibles as “strategic firm resources that enable an organization to create sustainable value, but are not available to a large number of firms (rarity). They lead to potential future benefits which cannot be taken by others (appropriability) and are not imitable by competitors or substitutable using other resources”.

Staying in the research context of the concept of intellectual capital a two-level decomposition of intellectual capital is used in this paper. Following Jacobsen *et al.* (2005) and Molodchik *et al.* (2014), human capital and structural and relational capital were divided into two subcomponents.

Human capital contains human resources capabilities and management capabilities [Molodchik *et al.* 2014]. Human capital refers to a set of characteristics that provide individuals with more skills, i.e., cognition, experience and knowledge. It is reflected through higher productivity, a higher propensity for entrepreneurial activity, greater levels of self-confidence and decreasing concerns over risk [Becker 1993]. According to several studies, it has the most importance for firm performance [St-Pierre and Audet 2011]; at the same time, however, human capital appears

to have the most risk attached, due to the fact that it is embedded within employees and can only be partly codified and transferred to structural capital.

Structural capital consists of innovation and internal process capabilities [Molodchik *et al.* 2014]. These types of intangible resources are captured by the firm and present knowledge that is embedded in the organization through organizational routines, practices, processes, new technology, patents, etc. [Wiedner 2006]. Structural resources are owned by the company and can be traded and transferred. Some authors [Wang and Chang 2005] have diversified structural capital into process and innovation capital. Process capital refers to companies' ability to codify knowledge, to formalize processes and activities and improve information flows [St.-Pierre and Audet 2011].

Relational capital includes customer loyalty and networking capabilities [Molodchik *et al.* 2014]. Similar to human capital, relational capital is not particularly codified; on the other hand, it is also not imitable. Recent studies [Arnott and Bridgewater 2002] have underlined the increasing importance of the virtual networking activities of the modern firm. Penetration through the Internet and leveraging external relationships through information technology has become one of the most innovative strategies for image-making [Matei 2004].

## **1.2 Large versus small and medium-sized companies**

By definition of the EU Commission (2003/361/EC), SMEs are firms that employ less than 250 persons and that have an annual turnover not exceeding EUR50 million, and/or an annual balance sheet total not exceeding EUR43 million. The differences between SMEs and large companies are essential for understanding the economic and business principles of these two types of companies. As noted by Welsh and White (1981) in their article "A small business is not a little big business", SMEs are constrained by "resource poverty" and follow other organizational practices compared to large companies. The limited resources of SMEs also affect their performance; thus, it is expected that SMEs generally have lower performance than large firms [Bennett and Smith 2002].

In the current economy, the use of knowledge and the employment of intangible resources are also applied in different ways by SMEs and large companies. This means that, significant to firm performance related to each type of intangible resource, human, structural and relational capital may be different [Cohen and Kaimenakis 2007]. This assumption led to the separate investigation of the link between intangibles and performance for SMEs and large companies. The literature review showed that studies concerning SMEs have predominantly been conducted

in the context of knowledge management. In this sense, there is a gap in the research devoted to comparative analysis of intangible-driven performance in SMEs and large companies. Moreover, the comparative analysis of separate components of intangible capital and their interrelationship also appears need further investigation.

Becker (1993) ascertained that human capital, defined as the expertise, experience, knowledge and skills of an individual, play a critical role for facilitating company performance. The results of a study by Haltiwanger *et al.* (1999) showed that firm size was significant for labour productivity. Large companies are endowed with a broad variety of tools that can attract highly qualified staff and motivate employees toward exemplary performances. SMEs are more dependent on human capital quality compared to large companies. At the same time, a study by Desouza and Awazu (2006) states that in SMEs, employees rarely leave the organization.

The size of the company also affects its structural capital, i.e., innovation and internal process capabilities. According to Desouza and Awazu (2006), SMEs maintain internal process capabilities, including knowledge sharing, creation and externalization primarily through the organization's members, without the intervention of the automated mechanisms usually found in large companies. At the same time, resource poverty, mentioned by Welsh and White (1981), constrains SMEs by implementing modern software like ERP, CRM and others that codify and protect knowledge. In this sense, SMEs that make an effort to launch such tools and to create structural capital will fare better against their competition. Investigating structural capital focused on the size effect, the cluster of papers devoted to innovation should be noted. Schumpeter (1942) hypothesized that large firms had an advantage over small ones, as their financial resources may allow them to be the most capable innovators. Since then, extensive research has been conducted to test Schumpeter's hypothesis. Results have been mixed [Wagner and Hansen 2005]. Most researchers suggest that large companies outperform SMEs in low-tech industries, but that there is no difference within high-tech industries [Berendes *et al.* 2013]. Wagner and Hansen (2005) found that small companies shared the field with larger companies by implementing a range of innovations (product, process and business innovation); on the other hand, they ascertained that large companies outrun small ones in terms of technological leadership (process innovation).

By analysing the literature, the authors conclude that SMEs, compared to large companies, develop their relational capital with greater ease, use the available knowledge from networking faster and as a whole, are more agile in creating partnerships [Cohen and Kaimenakis 2007].

Nevertheless, as was previously mentioned, the pressure of financial constraints influences the external activities of SMEs [Welsh and White 1981].

Summarizing theoretical and empirical evidence, the following hypothesis is put forward:

*H1: There are differences in terms of implementing intangibles conditioned by firm size.*

Previous literature has shown discrepancies in if intangible resources generate better performance in large companies [Bontis *et al.* 2000; Lings and Greenley 2011; Shih *et al.* 2010] or in SMEs [F-Jardón and Martos 2009; Gronum *et al.* 2012; Kamukama *et al.* 2011]. However, the differences between these two types of firms suggest that the effect in each case may be different. For example, more skilled human resources and management suggests that large companies' human capital should have more impact on performance compared to SMEs [Warech 2004]. However, managers of small companies typically have specific skills that facilitate the generation of innovations that lead them to better performance [Berends *et al.* 2013]. In this sense, it is possible that the impact in SMEs be greater.

Something similar happens with innovativeness and organizational processes. Large companies have better structured business processes and exhibit greater innovative capacity. Thus, these intangible resources should contribute to performance of large companies more successfully than to the performance of SMEs [Bennett and Smith 2002]. However, many SMEs' innovativeness possibly distinguish them from other companies that support improved performance [Gronum *et al.* 2012]. Therefore, the greater impact of SMEs' intellectual capital in comparison with large companies is possible.

Finally, the networks and relationships with customers are also more advanced in large companies and tend to have a higher quality and as such, a greater impact on performance can be expected. On the other hand, SMEs have greater proximity to customers, in many cases using this feature as a differential factor [Wong and Aspinwall 2004]. Consequently, it is possible that the impact of performance in SMEs can be higher. Following this discussion, the authors put forward the second hypothesis:

*H2: There are differences in the impact of intangibles on firm performance according to firm size.*

## 2. Research design and measurement approach

### 2.1 Research design

This study has two parts. The first is devoted to the first hypothesis analysing the differences by implementing intangibles conditioned by firm size. To ascertain the influence of firm size on intangibles, the authors performed a t-test with unequal variance for each variable, because different size affects the dispersion.

In the second part, the authors explored the effect of firm size on relationship between intangible resources and performance by dividing all enterprises in two categories: SMEs and large companies. Such division allows applying a dummy-variable regression approach. Following this approach, the authors entered a dichotomous factor into the regression equation by formulating a dummy regressor, coded “1” for large companies and “0” for SMEs. Instead of two separate regressions of performance on intangible resources for SMEs and large companies this study fit a combined model with the help of dummy-variable regression. This model facilitates a test of size-by-intangibles interaction. Moreover, a combined model permits for different intercepts and slopes within the two groups (SMEs and large companies) and produces the same fit to the data as separate regressions.

The following model accommodates size-by-intangibles interaction and the impact of intangibles on performance conditioned by firm size:

$$\mathbf{Performance}_{it} = \alpha + \beta \mathbf{IntR}_{it} + \gamma * \mathbf{size}_i + \delta * (\mathbf{IntR}_{it} * \mathbf{size}_i) + \varepsilon \quad (1)$$

where, IntR – vector of intangible resource indicators; size – dummy regressor for firm size (size=1 for large companies; size=0 for SMEs); IntR\*size – interaction regressor.

Therefore, the model for SMEs becomes:

$$\mathbf{Performance}_{it} = \alpha + \beta \mathbf{IntR}_{it} + \gamma * (0) + \delta * (\mathbf{IntR}_{it} * 0) + \varepsilon = \alpha + \beta * \mathbf{IntR}_{it} + \varepsilon \quad (2)$$

and for large companies:

$$\begin{aligned} \mathbf{Performance}_{it} &= \alpha + \beta \mathbf{IntR}_{it} + \gamma * (1) + \delta * (\mathbf{IntR}_{it} * 1) + \varepsilon \\ &= (\alpha + \gamma) + (\beta + \delta) \mathbf{IntR}_{it} + \varepsilon \end{aligned} \quad (3)$$



where,

$\beta$  – effect of SMEs,  $\delta$  – differential effect,  $(\beta + \delta)$  – effect of large companies.

It should be noticed that the differential effect reflects size-by-intangible interaction. Therefore, the significance of this coefficient in the regression will confirm the first hypothesis about the presence of differences by employment of intangible resources conditioned by size.

## 2.2 Measurement approach

Despite many efforts directed at elaborating the measurement system for intangible resources in general or intellectual capital [Bontis 2001] in particular different approaches in this field remain. This study applied the quantitative and qualitative indicators proposed by Molodchik *et al.* (2014) for the empirical exploration of intangible-driven performance considering the size effect. Firm performance in this paper is measured with return on assets (ROA) a commonly-used indicator. Table 1 presents the indicators for intangible resources, the source of information and references to previous studies.

**Table 1.** Indicators of intangible resources

Intangible resources	Indicators (variables)	Description and source of information	Previous studies
<b>Human resources capabilities</b>	Return on cost of employees	EBIT/Cost of employees. Company's annual report section "financial data" and "common information"	Sveiby (1997); Rompho and Siengthai (2012)
<b>Management resources capabilities</b>	High qualification of board of directors	If more than one third of directors have a postgraduate level of qualification and more than five years' experience – 1 point; in any other cases – 0. Company's annual report section "common information"	Ugboro and Obeng, (2000) and Tseng and Goo (2005) Molodchik <i>et al.</i> (2012)
<b>Innovation capabilities</b>	Intangible Assets/ Book value	Company's annual report section "financial data"	Sveiby (1997); Coombs and Bierly (2006)
<b>Internal process capabilities</b>	Knowledge management system implementation	Company's web site. If company has information about KM system implementation – 1 point; otherwise – 0 points.	Roos <i>et al.</i> (2005)
<b>Networking capabilities</b>	Participation in professional associations	Company's web site. If company participates in professional association – 1 point; otherwise – 0 points.	Hakansson and Snekota (1995); Romero and Molina (2010)
<b>Customer loyalty</b>	High citation in search engines	Search for company's name and its score on the website: <a href="http://www.prchecker.info/check_page_rank.php">www.prchecker.info/check_page_rank.php</a>	Arnott and Bridgewater (2002); Matei (2004)

Source: slightly modified from Molodchik *et al.* (2014)

A set of indicators based on publicly available data was used to measure intangibles. Such approach, by using only accessible data, allows researchers to enhance model reliability and to increase the sample size [Sydler *et al.* 2014]. However, the phenomenon of each type of intangibles can be hardly captured by only one indicator which is accessible in open sources. This fact is considered to be a restriction of applied measurement approach and should be noticed interpreting the results.

### **3. Sample and data analysis**

The dataset in this study was collected from a combination of detailed longitudinal databases, namely Bureau Van Dijk (Amadeus) and Bloomberg. The collected dataset covers ten years (2004-2013) and consists of financial and non-financial indicators underlying the variables that reflect several of the quantitative and qualitative characteristics of intangible resources. The database contained information about more than 1400 companies located in five European countries. The entire GDP of these countries covered more than 70% of the European GDP. As such, it represented the European market according to individual country criterion. It also accurately represented these countries in relation to the industry structure of the European economy. The Statistical Classification of Economic Activities in the European Community (NACE) was applied and the following sectors were included in the database: professional, scientific and technical activities (26%), manufacturing (19%), finance and insurance activities (17%), information and communication (10%) and other industries (28%). The representative rate of SMEs and large enterprises in the database was 28% and 72%, respectively. This corresponds with the rate of public SMEs and large companies in the whole population of public companies in Europe.

Statistical analysis indicated evidence of the differences between large companies and SMEs, thereby confirming previous assumptions. Table 2 presents descriptive statistics for independent and dependent variables. For almost all variables according to t-test, the size of the company was significant. By analysing the data it was observed that on average, large companies had higher performance and employed more intangible resources compared to SMEs. Only one type of intangible resources such as innovation capabilities measured by share of intangible assets in total assets appeared to be equally employed by SMEs and LEs. The lower knowledge management system implementation, participation in professional associations and the level of citation in search engines of SMEs can be explained by restricted financial resources.

**Table 2.** Descriptive statistics of dependent and independent variables  
(Number of observations: SMEs- 3732, large companies – 10439)

Variables	Mean (Std.Dev.)		t-test Difference	Min		Max	
	SME	Large		SME	Large	SME	Large
ROA	-0.103 (0.56)	0.067 (0.09)	- 0.170***	-9.550	-1.221	3.018	0.60
Intangibles:							
EBIT/cost of employees	-0.408 (4.52)	0.738 (4.62)	-1.146***	-96.968	-80.044	88.882	98.510
High qualifications of board of directors	28.9% (0.45)	35.8% (0.47)	-0.068***	0	0	1	1
Intangible Assets/Book value	0.189 (0.22)	0.183 (0.187)	0.005	0	0	0.993	0.995
Knowledge management system implementation	13.5% (0.34)	30.3% (0.45)	-0.167***	0	0	1	1
Participation in professional associations	25.3% (0.43)	39,2% (0.48)	-0.138***	0	0	1	1
High level of citation in search engines	20.2% (0.40)	49.2% (0.45)	-0.289***	0	0	1	1

Significance level \*\*\* -  $p < 0.01$

## 4. Results

Analysis of the size effect on intangible-driven performance was performed using the dummy variable regression presented before. When considering the dataset control, variables such as the 2008-2009 economic crisis, industry and country belonging were included. After running the regression, the value of VIF (variance inflation factor) for the quantification of the severity of multicollinearity was estimated. The maximum value of VIF was equal to 9.1 for the variable “Knowledge Management System Implementation”. VIF mean was equal to 4.12. These values were below the cut-off value of VIF (equal to 10) proposed by Kutner *et al.* (2004). Table 3 presents the results of the regression analysis. The estimated model was significant and has an explanatory power of 17%.

**Table 3.** Results of dummy-variable regression (ROA – dependent variable)

Independent variables	Effect on	Coeff., sign.	Robust std. err.
Constant	SMEs	-0.151***	0.024
Size	Difference	0.213***	0.024
	Large Companies	0.062***	
EBIT/cost of employees	SMEs	0.033***	0.009
	Difference	-0.029***	0.009
	Large Companies	0.004***	
High qualification level of board of directors	SMEs	-0.037*	0.023
	Difference	0.046*	0.024
	Large Companies	0.009*	
Intangible Assets/Book Value	SMEs	0.131**	0.052
	Difference	-0.146***	0.053
	Large Companies	-0.015**	
Knowledge management system implementation	SMEs	0.122***	0.017
	Difference	-0.119***	0.018
	Large Companies	0.003***	
Participation in professional associations	SMEs	-0.047**	0.021
	Difference	0.048**	0.022
	Large Companies	0.001**	
High citation level in search engines	SMEs	0.023	0.018
	Difference	-0.006	0.019
	Large Companies	0.017	
Number of observations		10538	
R-squared		0.169	
F(25, 10512)		34.30***	

Significance level \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

First, the results show that the size of the company was significant for performance. Large enterprises generally had a higher positive constant (0.062) than SMEs as an indicator of positive performance, with zero intangibles. In contrast, SMEs had a negative (-0.151) value for performance without intangibles, indicating the superiority of the performance of large firms. This result is in line with the study of Bennett and Smith (2002). Secondly, from the six investigated intangible resources, the effect on performance of five was significant. It is also worth notice that the differential effect for five intangible resources was significant. This can be interpreted as a confirmation of H1 concerning the differences in the employment of intangible resources conditioned by size. Thirdly, the influence of intangibles on performance was different for SMEs and large companies. For two types of intangibles (human resources capabilities and internal processes capabilities) the impact for performance of SMEs and large companies is positive but the SMEs gain more from these types of resources than large companies. For three types of intangibles (management, innovation and networking capabilities) the direction of impact was different for SMEs and large companies. This supports the second hypothesis.

The table 3 shows that among human resources both of indicators are significant. The high productivity of employees led to high performance for both SMEs and large companies. But the strength of this relationship appeared to be different. SMEs benefit more than large companies from human resources capabilities. At the same time the impact of management capabilities on performance provided opposite results. The high qualification level of the board of directors (if more than one third of directors had a postgraduate level of qualification and more than five years' experience) was negatively associated with the performance of SMEs (- 0.037), while having a positive influence on the performance of large companies (0.009). For both SMEs and large companies, resources, innovation and internal process capabilities were significant for performance. The share of intangible assets had a small positive influence for SMEs and was negative for LEs. From the implementation of knowledge management systems, SMEs gained more than LEs. If SMEs had a knowledge management system, its performance increased by 12.2%; for large enterprises, the presence of a knowledge management system increased performance only by 0.3%. Participation in professional associations as indicator of networking capabilities decreases the performance of SMEs and slightly positively influences performance of large companies. A high level of citation on the Internet appeared to be insignificant in terms of performance for both SMEs and large companies.

## Conclusions

Two groups of enterprises, SMEs and large companies, were studied by focusing on intangible resources. The paper reveals significant differences in the employment of intangible resources according to firm size. Due to the size effect, larger companies are able to use greater amounts of intangible resources and apply a higher variety of knowledge and intellectual capital management tools. The authors provided empirical evidence that on average, large enterprises are able to outpace SMEs by developing organizational capabilities based on intangible resources. These findings are consistent with the study of Hutchinson and Quintas (2008), which also highlights that intangibles are underdeveloped in SMEs. In this sense, SMEs can gain potential benefits through the intensification of intangible resources employment. Managers of SMEs can gain a first mover advantage by developing human resources capabilities [Berends *et al.* 2013], innovation and internal process capabilities [Gronum *et al.* 2012], as well as customer loyalty [Wong and Aspinwall 2004].

The second hypothesis discussed in this paper considered differences in intangible driven performance as a result of firm size. The authors have discovered such differences and conclude that intangible resources are more important for SMEs. It appears that intangible resources identified in this study through assessable data became compulsory or core resources for large companies. Zack (1999) determines core knowledge as resources that are “commonly shared by all members of an industry, and offers no competitive value”. Core knowledge is that minimum scope and level of knowledge required just to “play the game”. In that sense the investigated types of intangible resources for SMEs can be treated as advanced knowledge that enables firm to create competitive advantage. The authors underline three types of intangible resources that should be developed by SMEs: human resource capabilities, innovation, internal process capabilities. These resources can enhance SMEs’ performance and deliver to them more benefits than for large companies. Such empirical evidence contributes to the field of performance management where firm size is concerned.

An unexpected result was found in terms of the high qualification level of the board of directors. Having experienced and more educated top-level managers led to an increase in performance for large companies and a decrease in the financial results of SMEs. One of the possible explanations for this can be attributed to the high expenditures needed for a highly qualified board of directors in SMEs, which is not covered by revenue.

For innovation capabilities the opposite results were discovered. For SMEs, the share of intangible assets in total assets had a positive and significant influence. Meanwhile, large companies suffered from having on average almost the same (see table 2) share of intangible assets in total assets. It should be noted that the influence of innovative activities on companies' performance has been studied by many authors, but the results of these studies are mixed. The findings of the current paper supports a study conducted by Coombs and Bierly (2006), which also highlighted that the metric "share of intangible assets in total assets" is weak for measuring innovative activities. This final fact can potentially be employed as an improvement measure for future research.

One of the restrictions regarding the results obtained in this study concerns the type of observed SMEs and large companies, which representative only public companies. The choice for selecting these companies simplified the data collection, but may have caused some biases. This should be taken into consideration by implementing results into practice.

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