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**Article**

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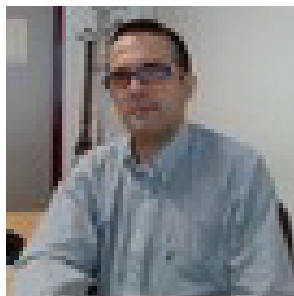
## THE QUADRATIC RELATIONSHIP BETWEEN INTANGIBLE ASSETS AND GROWTH IN PORTUGUESE SMES

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### Abstract

This article shows new empirical evidence concerning the growth determinants of SMEs. Specifically, we identify the existence of a quadratic relationship between the level of intangible assets of Portuguese SMEs and their growth. Based on the results obtained here, we conclude that intangible assets represents a catalyst for growth only when accounting for a significant proportion of total assets. A relatively weaker presence of intangibles might in fact inhibit growth.

**Keywords:** Growth; Intangible Assets; Portuguese SMEs

**JEL Classifications:** D21, G32, L25, L26

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### Introduction

Gibrat (1931) concludes that company growth is independent of previous size. Gibrat's conclusions became known in the literature as the *Law of Proportionate Effect* (LPE) or Gibrat's Law. According to Gibrat (1931), the size of companies is not a determinant of their being able to reach a particular rate of growth.

Sutton (1997) concludes that companies' rate of growth diminishes systematically with size, as a consequence of the fact of companies trying to reach the optimal scale of production that allows them to survive. The conclusions of Sutton (1997) show that validation, or not, of Gibrat's Law may depend on company size, the greater possibility for validation being in the context of small companies that may not yet have found their optimal scale of production.

In the context of small and medium-sized companies (SMEs), various studies have found rejection of Gibrat's Law, the empirical evidence of those studies showing that SME growth diminishes systematically as size increases (Heshmati, 2001; Becchetti and Trovato, 2002; Carpenter and Petersen, 2002; Yasuda, 2005; Calvo, 2006; Honjo and Harada, 2006; Oliveira and Fortunato, 2006; Moreno and Casillas, 2007; Sarno, 2008).

As well as testing the relationship between previous size and growth, empirical evidence about the determinants of SME growth has shown: (i) that growth diminishes as company age increases (Becchetti and Trovato, 2002; Yasuda, 2005; Calvo, 2006; Honjo and Harada, 2006; Moreno and Casillas, 2007); and (ii) internal finance is a relevant factor for the growth of SMEs (Carpenter and Petersen, 2002; Cabral and Mata, 2003, Honjo and Harada, 2006; Oliveira and Fortunato, 2006; Moreno and Casillas, 2007; Sarno, 2008).

Deloof (2003) and Rogers (2004) conclude that level of intangible assets can be considered a fundamental aspect for the survival and sustainable growth of SMEs, given the greater capacity to innovate and consequently greater possibility to diversify activities in companies with activities based on intangible assets. However, empirical studies have neglected the influence of intangible assets on SME growth.

This study fills that gap in the literature, testing the relationship between intangible assets and growth in SMEs. To this end, we consider a sample of 1383 Portuguese SMEs in the period 1999-2005.

Besides the relationship between intangible assets and growth, we also test: (i) Gibrat's Law, checking if growth is, or is not, independent of the previous size of companies; (ii) the relationship between age and growth; and (iii) the relationship between internal finance and growth.

After this introduction, the paper is structured as follows. The second section presents the database, the variables and the estimation methodology used. The third section presents the empirical results obtained, and finally the fourth section presents the conclusions.

## 1. Database, Variables and Methodology

### 1.1. Database

In this study we use the SABI (Sistema de Balanços Ibéricos- System Analysis of Iberian Balance Sheets) database supplied by Bureau van Dijk's, for the period between 1999 and 2005. We select small and medium-sized companies based on the recommendation of the European Union L124/36 (2003/361/CE). According to this recommendation, a company is considered small or medium-sized when it fulfils two of the following criteria: 1) fewer than 250 employees; 2) assets of less than 43 million euros; 3) volume of business of less than 50 million euros. Based on this criterion, we select 1383 SMEs with data for the period 1999 to 2005. All the companies of the research sample are privately owned companies. The total number of observations is 8298.

### 1.2. Variables

The dependent variable used in this study is the growth of Portuguese SMEs. As independent variables, that is, as determinants of SME growth, we consider: (i) size in the previous period; (ii) level of intangible assets in the previous period; (iii) age in the previous period; and (iv) cash flow in the previous period, as a measure of internal finance. The variables and their corresponding measurements appear in the following table.

**Variables and Measurement**

Table 1

Variable	Measurement
Growth ( $GROW_{i,t}$ )	Difference between logarithm of Total Assets in current period and logarithm of Total Assets in previous period
Size ( $SIZE_{i,t}$ )	Logarithm of Total Assets
Intangible Assets ( $INT_{i,t}$ )	Ratio Between Intangible Assets and Total Assets
Age ( $AGE_{i,t}$ )	Logarithm of Number of years of Firm's Life
Cash Flow ( $CF_{i,t}$ )	Ratio between Earnings after tax plus depreciations and Total Assets

**1.3. Methodology**

The classic test of Gibrat’s Law consists of testing the relationship between growth in the current period and size in the previous period. The relationship to test can be presented as follows:

$$SIZE_{i,t} - SIZE_{i,t-1} = \beta_0 + (\beta_1 - 1)SIZE_{i,t-1} + d_t + e_{i,t}, \tag{1}$$

in which:  $SIZE_{i,t}$  is the size of company  $i$ , in the current period;  $SIZE_{i,t-1}$  is the size of company  $i$ , in the previous period;  $d_t$  represents annual dummy variables measuring the impact of possible macroeconomic changes on growth; and  $e_{i,t}$  is the error term.

Company growth is equal to:

$$GROWTH_{i,t} = SIZE_{i,t} - SIZE_{i,t-1}. \tag{2}$$

Substituting (2) in (1), gives:

$$GROWTH_{i,t} = \beta_0 + (\beta_1 - 1)SIZE_{i,t-1} + d_t + e_{i,t}. \tag{3}$$

The null hypothesis to be tested is the following  $H_0 : \beta_1 - 1 = 0$ , against the alternative hypothesis  $H_1 : \beta_1 - 1 \neq 0$ . By not rejecting the null hypothesis, i.e.  $\beta_1 - 1 \approx 0$ , we will validate Gibrat’s Law and therefore consider that growth in the current period is independent of size in the previous period.

Afterwards we test the influence of the lagged variables of: (i) intangible assets; (ii) age; and (iii) internal finance, on Portuguese SME growth, and so we have:

$$GROW_{i,t} = \beta_0 + (\beta_1 - 1)SIZE_{i,t-1} + \beta_K X_{k,i,t-1} + d_t + e_{i,t}, \tag{4}$$

in which:  $X_K$  is the  $k$  determinant of growth. Determinants of growth, besides size to company  $i$  in the previous period ( $SIZE_{i,t-1}$ ), are: (i) intangible assets to company  $i$  in the previous period ( $INT_{i,t-1}$ ); (ii) age to company  $i$  in the previous period ( $AGE_{i,t-1}$ ); and (iii) cash flow to company  $i$  in the previous period ( $CF_{i,t-1}$ ).

Methodologically, to estimate the relationships between determinants and Portuguese SME growth, we use OLS regressions, considering parameter estimates consistent with the possible existence of heteroschedasticity.

## 2. Results

### 2.1. Descriptive Statistics

The following table presents the descriptive statistics of the variables used in this study.

**Descriptive Statistics**

Table 2

Variable	Observations	Mean	Standard Deviations	Minimum	Maximum
$GROW_{i,t}$	8298	0.03170	0.22593	-2.12392	2.75202
$SIZE_{i,t}$	8298	15.0651	1.25179	10.5525	17.6963
$INT_{i,t}$	8298	0.01130	0.04471	0	0.78492
$AGE_{i,t}$	8298	2.92316	0.65392	0.69314	5.08140
$CF_{i,t}$	8298	0.07159	0.09289	-2.20686	0.64779

We can see that the variables: (i) growth; (ii) level of intangible assets; and (iii) cash flow; present considerable volatility, since standard deviations of the variables are above the respective means.

The low level of intangible assets in Portuguese SMEs is of note, something which may limit the strategy of innovation and diversification of product and activities in Portuguese SMEs.

### 2.2. Regressions

Table 3 below presents the results of the estimated regressions. Initially, we present the results referring to the classic test of Gibrat's Law. Afterwards, we also consider level of intangible assets as a determinant of Portuguese SME growth, considering the possibility of a linear or quadratic relationship between level of intangible assets and growth. Finally, we consider age and cash flow as possible determinants of Portuguese SME growth.

**Results of Estimation Growth Determinants**

Table 3

Dependent Variable: $GROW_{i,t}$					
Independent Variables	I	II	III	IV	V
$SIZE_{i,t-1}$	-	-	-	-	-
	0.03173*** (0.00460)	0.03174*** (0.00459)	0.03131*** (0.00458)	0.02639*** (0.00472)	0.02603*** (0.00472)
$INT_{i,t-1}$		0.00656 (0.08764)	- 0.42340*** (0.16181)	0.02202 (0.08462)	-0.34216** (0.15969)
$INT^2_{i,t-1}$			1.11611*** (0.41800)		0.94456** (0.40945)
$AGE_{i,t-1}$				- 0.03670*** (0.00538)	- 0.03662*** (0.00538)
$CF_{i,t-1}$				0.28576*** (0.07179)	0.28077*** (0.07133)
$CONS$	0.53901*** (0.07150)	0.53903*** (0.07148)	0.53518*** (0.07144)	0.55055*** (0.07135)	0.54729*** (0.07133)
$R^2$	0.0431	0.0431	0.0440	0.0534	0.0541
$Wald$	254.84***	255.14***	259.38***	303.35***	307.55***
$Observations$	6915	6915	6915	6915	6915

Notes: 1. \*\*\* significant at 1%; \*\* significant at 5%; \* significant at 10%. 2. Year – dummies are included, but not shown. 3. Corrected heteroschedasticity OLS according to White’s estimator.

From the results obtained, we can conclude that: (i) we reject Gibrat’s Law, since we find that Portuguese SME growth diminishes with increased size, that is,  $\beta_1 - 1 \neq 0$ ; (ii) considering a linear function of intangible assets, the relationship between intangible assets and Portuguese SME growth is not statistically significant; (iii) the relationship between level of intangible assets and Portuguese SME growth is statistically significant when we consider a quadratic function of intangible assets; (iv) greater age of Portuguese SMEs means less growth; and (v) internal finance, measured by cash flow, contributes positively to Portuguese SME growth.

Concerning the empirical evidence about the existence of a quadratic relationship between the level of intangible assets in Portuguese SMEs and their growth, we find that the coefficient measuring the relationship between  $INT_{i,t-1}$  and  $GROW_{i,t}$  is negative, whereas the coefficient measuring the relationship between  $INT^2_{i,t-1}$

and  $GROW_{i,t}$  is positive. The results show that the relationship between intangible assets and growth in Portuguese SMEs is negative for low levels of intangible assets, but positive for higher levels of intangible assets.

### Conclusion

Using a sample of 1383 Portuguese SMEs for the period 1999-2005, this article shows new empirical evidence regarding the determinants of SME growth. Specifically, we identify a quadratic relationship between level of intangible assets in Portuguese SMEs and their growth.

Based on the results obtained, we conclude that level of intangible assets is only a catalysing factor of Portuguese SME growth for high levels of intangible assets, being a restrictive factor for low levels of intangible assets.

The empirical evidence obtained only allows us to corroborate partially the conclusions of Deloof (2003) and Rogers (2004), since the greater possibility of innovation and diversification of company activities, as a consequence of a higher level of intangible assets, is only a catalysing factor of Portuguese SME growth for high levels of intangible assets.

In Portugal, SMEs represent around 99.6% of the Portuguese business sector, and are responsible for around 75.2% of the total number of jobs and 56.4% of business volume (IAPMEI, 2008).

In cases of insufficient internal finance, the considerable difficulties SMEs generally face in accessing external finance may decisively restrict their possibilities for growth. In this context, given that intangible assets are only a catalysing factor of Portuguese SME growth for high levels of intangible assets, we suggest that policy-makers create financial incentives for those Portuguese SMEs showing organizational culture directed towards entrepreneurship and innovation.

The empirical evidence concerning the relationships between the remaining determinants considered in this study and Portuguese SME growth is in agreement with empirical studies in general about determinants of growth in the context of SMEs: (i) we find a negative and statistically significant relationship between size and growth in Portuguese SMEs, rejecting Gibrat's Law; (ii) the growth of Portuguese SMEs diminishes as age increases; and (iii) internal finance is a catalysing factor of Portuguese SME growth.



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