Springer Proceedings in Mathematics & Statistics

A. Ismael F. Vaz
João Paulo Almeida
José Fernando Oliveira
Alberto Adrego Pinto *Editors*

Operational Research

IO2017, Valença, Portugal, June 28–30

Springer

Chapter 8
Efficiency and Capital Structure in Portuguese SMEs

António Fernandes, Clara Bento Vaz and Ana Paula Monte

Abstract This paper aims to analyse the bi-directional relationship between technical efficiency, as a measure of companies' performance, and capital structure, under the agency cost theory as well as the pecking order and trade-off theory, to explain the capital structure decisions. The technical efficiency was estimated by the DEA method and corrected by using a suitable bootstrap to obtain statistical inferences. To test the agency cost hypothesis, asymmetric information hypothesis, risk-efficiency hypothesis and franchise value hypothesis (under pecking order and trade off theories framework), two models were applied using some determinants of capital structure such as size, profitability, tangibility, liquidity as control and explanatory variables through a truncated regression with bootstrapping. From an initial sample of 1024 small and medium sized companies from the interior of Portugal, for the period 2006–2009, a subsample of 210 SMEs from secondary and tertiary sectors was selected. The results suggest that medium sized companies have higher average bias-corrected efficiency than small companies; that short-term leverage is

UNIAG—Research unit funded by the FCT - Portuguese Foundation for the Development of Science and Technology, Ministry of Science, Technology and Higher Education. Project No. UID/GES/4752/2016.
NECE—Research Unit in Business Sciences, Beira Interior University, Research unit funded by the FCT - Portuguese Foundation for the Development of Science and Technology, Ministry of Science, Technology and Higher Education. Project No. UID/GES/04630/2013.

A. Fernandes
Applied Management Research Unit (UNIAG), Polytechnic Institute of Bragança, Bragança, Portugal
e-mail: antoniof@ipb.pt

C. B. Vaz (✉)
Centre for Management and Industrial Engineering (CEGI/INESC TEC), Polytechnic Institute of Bragança, Bragança, Portugal
e-mail: clvaz@ipb.pt

A. P. Monte
Applied Management Research Unit (UNIAG) and NECE, Polytechnic Institute of Bragança, Bragança, Portugal
e-mail: apmonte@ipb.pt

A. I. F. Vaz et al. (eds.), *Operational Research*, Springer Proceedings in Mathematics & Statistics 223, https://doi.org/10.1007/978-3-319-71583-4_8

positively related to efficiency and that the companies in the sample follow pecking order theory.

Keywords Data envelopment analysis · Technical efficiency · Capital structure SME · Inland of Portugal

8.1 Introduction

The debate on capital structure of companies has been an issue discussed for long time and there is no consensus on it. Several theories have arisen since the seminal paper of Modigliani and Miller [39]. The most common has been the pecking order theory, hereinafter POT, [40, 42] and the tradeoff theory, hereinafter TOT [16, 38]. POT advocates that firms rank the different sources of capital by giving preference to self-financing, given that information asymmetry increases funding costs [24, 33, 42]. TOT argues that each company has an optimal capital structure that results from the balance between the use of debt (target debt ratio) and tax and other benefits against bankruptcy costs and other costs (such as agency costs) [12, 14, 30].

As Bie and Haan [12] point out, the choice of funding sources is driven by the costs of adverse selection resulting from the asymmetry of information between (more informed) managers and (less informed) investors. The POT is based on the information asymmetric hypothesis. According to this argument, insiders possess more private information about a firm's expectations on returns and potential investment growth, that is, the "true" value of the business [42, 68]. In this sense there is an adverse selection cost that force managers and owners of the companies to prefer to use internal funds, then debt and finally new equity to finance their investment opportunities as the higher risk is perceived and some constraints of external debt financing appear. Smaller and younger companies suffer more from this information asymmetry due to their natural information opacity, as La Rocca et al. [31] pointed out. Therefore, the availability of internally generated funds diminishes the need of external finance and hence it is expected lower debt ratios.

The agency cost hypothesis is another concurrent theory associated with TOT to explain the capital structure decisions. Agency conflicts between managers-ownership and debtors-creditors may explain the behavior and capital structure decisions. Jensen and Meckling [26] defend that low leverage ratios may motivate managers to act on behalf of shareholders' interests, reducing agency costs. High leverage ratios, inducing higher bankruptcy and distress costs, increase the agency costs, limiting the threshold leverage. Also Harris and Raviv [23] as park and jang [45] state that agency costs can be mitigated by use of leverage. The size of the companies can have a positive impact on this relationship, as is stated by several authors [3, 4, 34, 44, 47, 61].

Much literature has tried to validate these theories in different markets and sectors of activity as well as for companies of different sizes [1, 2, 6, 11, 17, 20, 27, 33, 37, 61, 64, 67]. Associated with each theory several determinants have been tested to

justify the capital structure and related decisions. Titman and Wessels [63], followed by others such as Frank and Goyal [19] and Guo and Suliman [21] studied factors such as liquidity, profitability, non-debt tax shields, tangibility, growth opportunities, uniqueness of products, among others. Other studies have analyzed, besides companies' characteristics, factors related to markets or macroeconomics characteristics like more market oriented economies or more banked economies [3, 8] or industry [32]. There are also reports of research that have been carried out on SMEs and non-listed or family-owned companies [11, 25, 27, 33, 36]. Some of these studies analyzed factors that influence the capital structure of SMEs, such as asset tangibility; profitability; growth opportunities and level of indebtedness [29]. The empirical results do not always coincide. Most of this research uses panel data analysis or cross-section analysis by ordinary least square (OLS) regressions or generalized method of moments (GMM) to explain the leverage against the above determinants. To measure financial leverage the ratio total debt to total asset is used and sometimes the short-term debt to total assets or long-term debt to total assets is analyzed.

There are some studies on Portuguese market [46, 51–55, 65, 66]. The majority of this research relies on determinants of capital structure or debt ratio using panel data analysis, cross section analysis and linear regressions. These methodologies are applied to SMEs, listed and unlisted companies. None of this research applies technical efficiency as explained or explanatory variables on leverage or capital structure.

In this manner, the main research questions behind this study are (i) will there be an optimal capital structure depending on the efficiency and financial performance of SMEs? (ii) which factors determine the choice of the capital structure of SMEs? To answer these questions a sample of SMEs is used from the interior of Portugal and the technical efficiency is estimated using the DEA method and then two models to explain the bi-directional relationship of efficiency and leverage are used, following a similar research design to [34, 35] with a slightly difference: the bootstrap methods were used. The proposed approach allows more robust efficiency scores to be achieved by using suitable bootstrap methods [59, 60]. These efficiency scores are used to explain the bi-directional relationship of efficiency and leverage, enabling the determination of more robust conclusions, which has an advantage over deterministic approaches used in the literature [34, 35, 50]. In the Portuguese context, as far as we know, this paper is one of the first studies to associate the technical efficiency, as proxy for corporate performance, and leverage (proxy for decisions on companies' capital structure). This methodology may add new contributions to the controversy on leverage theory and SME behavior.

The remainder of the paper is as follows. Section 8.2 presents a concise literature review on performance, efficiency and capital structure. Then, Sect. 8.3 refers to the methodology adopted, describes the data and sample, the DEA method, the research hypothesis formulated on behalf of the previous literature review, the empirical models and definition of variables. Following that, Sect. 8.4 exhibits and discusses the results. It ends with identifiable conclusions, limitations and suggestions for further research.

8.2 Performance, Efficiency and Capital Structure

Most of the research on capital structure and performance relies on unidirectional relationship, independently of the theory used (TOT, POT, or others), measuring performance based on financial ratios such as return on assets (ROA) or return on equity (ROE) or similar [e.g. 13, 29, 33, 43, 46, 62]. However [10] proposed to use profit efficiency as firm performance instead of traditional ratios and looked for the bi-directional relationship between capital structure and performance under the efficiency-risk hypothesis and franchise value hypothesis using a sample of companies from the commercial banking sector. "*Profit efficiency evaluates how close a firm is to earning the profit that a best-practice firm would earn facing its same exogenous conditions. This has the benefit of controlling for firm-specific factors outside the control of management that are not part of agency costs*" [10, p. 1067]. This measure provides a good benchmark for how the firm is expected to perform if agency cost was minimized [10].

Under the efficiency-risk hypothesis, firms that are more efficient may choose higher leverage because higher efficiency reduces the expected costs of bankruptcy and financial distress. On the other hand, under the franchise-value hypothesis, more efficient firms may choose lower leverage to protect the economic rents derived from higher efficiency and the possibility of liquidation [10, 34, 35].

Margaritis and Psillaki [34, 35] used two cross-section models to explain the bi-directional relationship of capital structure, namely leverage and performance, more precisely technical efficiency. Margaritis and Psillaki [34] use the technical efficiency derived from the non-parametric input distance function [56] on a sample of New Zealand SMEs firms. Margaritis and Psillaki [35] measure the technical efficiency through the directional distance function on a sample of French firms from three different manufacturing industries. In model one they relate the technical efficiency obtained through the data envelopment analysis (DEA) model with leverage, measured by the debt ratio, and a group of control variables for firm and market characteristics such as size, tangibility, profitability, growth opportunities, among others.[1] This model intends to test the cost agency hypothesis. Model two relates the debt ratio (total debt to total assets) to the measure of the firm's technical efficiency and a number of factors that have been commonly used in other research to explain the capital structure or leverage. This model is intended to test the risk-efficiency hypothesis and franchise value hypothesis. The control variables used in model two were size, asset structure, profitability, risk and growth (variables related to firm characteristics) as well as market power (as industry characteristics).

[1] Other variables used by Margaritis and Psillaki [34] were risk, measured by the standard deviation of annual earnings before taxes and market power proxied by the concentration index (CI), that represents the market share of the largest four firms in the industry. Margaritis and Psillaki [35] used also the ownership structure. Other determinants used are effective tax paid, measured by the ratio of Tax Paid to Earnings Before Taxes [53] or Non-debt tax shield, measured by the ratio between depreciations and amortizations and total assets [50, 53].

Firm size (measured by the logarithm of the firm's sales) is expected to be positively related to leverage in accordance to TOT [34, 43, 48, 53, 63]. However, the firm's size may be also negatively correlated with leverage since "*size may act as a proxy for the information outside investors have, and that informational asymmetries are lower for large firms which implies that large firms should be in a better position to issue informationally sensitive securities such as equity rather than debt.*" [34, p. 1456]. Also Michaelas et al. [36] and Serrasqueiro et al. [53] pointed out that problems of asymmetric information and moral hazard will be greater for small firms, because of the lack of financial disclosure and their owner-managed nature. Therefore, lenders will be unwilling to lend long-term to small firms on favorable terms (higher long-term debt cost) and therefore, SMEs tend to issue short-term debt to overcome those problems. Consequently, small firms frequently have a higher level of short-term debt than larger firms [53]. Seelanatha [50] used a panel data analysis to estimate the radial technical efficiency scores of Chinese firms from different industries and then considered the impact of a firm's relative efficiency, market share and industry concentration on capital structure decisions.

Asset tangibility (measured by the ratio of fixed tangible assets to total assets) should be positively correlated to leverage, as tangible assets can be used as collateral and mitigate problems of information asymmetry [23, 34, 53]. However some empirical studies have found negative correlation with short-term debt ratios [61].

Profitability (pre-interest and pre-tax operating surplus divided by total assets) should be negatively correlated with leverage in accordance with POT [34, 53], because profitable firms will finance their investments with internal funds and move to external finance only when internal funding is insufficient. Still based on TOT and contracting cost theories we can predict a positive relation between profitability and leverage because the most profitable firms have greater debt capacity, and may take advantage of debt tax-shields [53].

Intangible assets such as future growth opportunities [34, 36, 43, 63] would have a negative correlation with debt since firms with expected growth opportunities would keep low leverage in order to avoid adverse selection and moral hazard costs associated with financing of new investments with new equity capital [34]. This behavior is aligned with TOT. Conversely, according to POT, firms with higher growth opportunities have more needs of funds and when the internal finance is exhausted, firms prefer debt to external equity to finance risky investments and therefore increase leverage. Some empirical studies on SME's capital structure have found positive correlation between growth opportunities and leverage [36]. Growth may be also measured by annual percentage change in earnings [34] or by asset growth as a total asset annual change in percentage [50, 53] or, as suggested by Margaritis and Psillaki [35], by sales growth.

Liquidity (as measured by current ratio: current assets to current liabilities) tends to be positively related to leverage according to TOT [53]. Firms with a lower level of liquidity will face more obstacles in obtaining debt and TOT predicts a positive relationship between liquidity and leverage. Conversely, POT predicts that there is a negative relationship because firms with a high level of liquidity have more internal funds and therefore tend to borrow less [8, 28].

8.3 Methodology

8.3.1 Data and Sample

The database used in this research, from our point of view, is an added value as it contains 1024 companies from whom financial and non-financial data was collected through fiscal documents, known as Simplified Business Information model (Informação Empresarial Simplificada - IES[2]), for the period 2006 to 2009. For the sake of secrecy, the provided information omitted any data that could lead to the identification of the companies and a code was given to the companies in the database. There were only considered firms constituted in the legal form of companies. The basis for this decision was the fact that individual entrepreneurs have a specific IES model. Regarding the activity sector (industry), no restriction was established in the selection phase of the companies. This database is a convenient sample of a population of 60529 companies in 2009 distributed along the interior of mainland of Portugal. In this region were considered the following NUTS III: Douro, Alto Trás-os-Montes, Cova da Beira, Beira Interior Norte, Ave, Dão-Lafães, Beira Interior Sul, and Tâmega. Considering that, the main objective of this research is to analyze the efficient capital structure of companies in the interior region of Portugal, the research variables were defined from the respective accounting documents over the several years. As monetary values are not reported at the same moment in time, they were deflated with the following inflation rates: 2% for 2006, 3% for 2007 and 1% for 2008. See Fernandes [18] for further details about this database.

According to the assumptions of DEA, it is necessary to improve the homogeneity of the companies and remove some outliers from the database. The management schemes of Micro companies can be very different among them while the primary sector has a government support. Thus, to improve the homogeneity of the companies, we only consider the small and medium sized companies from secondary and tertiary sectors following Margaritis and Psillaki [34, 35]; Acaravci [2]. Regarding the outliers, it is essential to exclude from the sample the companies that have different features, such as the ones that are in technical bankruptcy or others that have a negative asset or an unusual other accounting score. In terms of DEA, it is important to mitigate the effect of some extreme observations as these outliers can severely affect the location of the DEA frontier. The extreme observations were removed according to the Andersen and Petersen [7] approach. Therefore, from the initial database of 1024 micro, small and medium sized companies from the interior of Portugal, for the period 2006–2009, a sample of 210 small and the medium sized

[2]IES is a new way for companies to deliver information on-line to public services, through an electronic form, by using a totally dematerialized procedure. This service allows to abiding, at once, the following legal obligations: Deposit of annual accounts in Business Register; Delivery of annual fiscal declaration to Ministry of Finance and Public Administration; Delivery of annual information to National Statistics Institute for statistical purposes; Delivery of information to Portuguese Central Bank. Additional information is available at http://www.ies.gov.pt/.

Table 8.1 Size of companies by sector of activity

Firm size		Activity sector		Total
		Secondary	Tertiary	
Medium	n	44	39	83
	% Size of the company	53.0%	47.0%	100.0%
	% Activity sector	13.3%	12.0%	12.6%
Small	n	287	287	574
	% Size of the company	50.0%	50.0%	100.0%
	% Activity sector	86.7%	88.0%	87.4%
Total	n	331	326	657
	% Size of the company	50.4%	49.6%	100.0%
	% Activity sector	100.0%	100.0%	100.0%

companies (SME) was collected from the secondary and tertiary sectors, involving 657 observations.

Table 8.1 summarizes the distribution of companies (n) in our sample by activity sector and size. The final sample comprising 87.4% of small companies and 12.6% of medium sized companies, involves a similar number of companies from both sectors (50.4 and 49.6% of the companies belong to secondary and tertiary sectors, respectively).

It can be observed from Table 8.2 that, on average, small enterprises have higher profitability (as measured by ROA) than medium sized ones. In terms of Standard Deviation (St. Dev.) it seems that there is not much difference between the two

Table 8.2 Descriptive statistics on profitability and growth, by firm size, for 2006–2009 period

Firm size		ROA[a]	NRT[b]	$\Delta(TNA)$[c]	$\Delta(Turnover)$[d]
Small	Mean	3.53%	−0.57%	6.13%	6.52%
	St.Dev.	9.84%	73.18%	26.09%	52.40%
	n	574	574	574	574
Medium	Mean	3.00%	−3.91%	9.51%	22.67%
	St.Dev.	8.02%	41.07%	51.81%	129.69%
	n	83	83	83	83
Total	Mean	3.46%	−1.00%	8.69%	6.58%
	St.Dev.	9.62%	69.93%	52.12%	26.69%
	n	657	657	657	657

[a]ROA: Return on Assets, measured by the ratio of Earnings Before Taxes (EBT) to TNA, that is a proxy for firm's profitability;
[b]NRT: Net Return on Turnover, measured by the ratio of EBT to firm's Turnover;
[c] $\Delta(TNA)$: is the annual change of TNA, measured by TNA of moment t minus TNA of previous moment $(TNA_t - TNA_{t-1})$;
[d] $\Delta(Turnover)$: is the annual change of Turnover, measured by $(Turnover_t - Turnover_{t-1})$

groups. Attending to the Net Return on Turnover (NRT), small enterprises have also higher profitability, although they present higher variability. In terms of growth (as measured by annual change of Total Net Assets (TNA) or Turnover), it is noted that medium sized enterprises showed higher growth rates than small firms but have higher variability (St. Dev. is higher for medium sized enterprises). This may be related to several factors, namely: more professional management, clearer separation between managers and holders of capital, greater supervision and internal control in the company.

8.3.2 DEA Methodology

The technical efficiency for each company is evaluated from the DEA model, introduced by Charnes et al. [15]. DEA is a non-parametric approach to assess the relative efficiency of a homogeneous set of Decision Making Units (DMUs) in producing multiple outputs from multiple inputs. DEA is used to assess the technical efficiency of the companies in minimizing the resources for a given level of achieved revenues. The technical efficiency reflects the economic perspective of each company in managing the resources for a given level of revenues. DEA allows the identification of the best practices DMUs (the benchmarks) and their linear combination defines the frontier technology that envelops all DMUs observed in the production possibility set (PPS). For the inefficient DMUs located inside the PPS, the magnitude of the inefficiency is derived by the distance to the frontier and a single summary measure of efficiency is estimated.

Consider a set of n DMUs $j\,(j = 1, \ldots, n)$, each consuming m resources (inputs) x_{ij} $(x_{1j}, \ldots, x_{mj})$ to produce s results (outputs) y_{rj} $(y_{1j}, \ldots, y_{sj})$. As the scale size affects the productivity of a company, it is necessary to estimate the pure technical efficiency (hereafter technical efficiency) in reference to the variable returns to scale (VRS) observed frontier [9]. Thus, for an input minimizing perspective the relative efficiency of the assessed DMU_o can be estimated using the linear programming model (8.1):

$$\begin{aligned} \min \Big\{ \hat{\theta}_{j_o} | \hat{\theta}\, x_{ij_o} &\geq \sum_{j=1}^{n} \lambda_j\, x_{ij}, \quad i = 1, \ldots, m \\ y_{rj_o} &\leq \sum_{j=1}^{n} \lambda_j\, y_{rj}, \quad r = 1, \ldots, s \\ \sum_{j=1}^{n} \lambda_j &= 1 \\ \lambda_j &\geq 0; \quad \forall_{j,i,r} \Big\} \end{aligned} \tag{8.1}$$

The optimum solution of model (8.1), $\hat{\theta}^*_{j_o}$, corresponds to the minimum factor by which the inputs levels can be reduced giving the current level of revenues, corresponding to the relative efficiency of the assessed DMU_o. DEA enables us to identify the efficient DMUs, which the efficiency measure is equal to 1, being the benchmarks. The remaining DMUs are the inefficient units which the efficiency measure is lower than 1, indicating the existence of inefficiencies in managing the resources for a given level of revenues.

To correct the DEA efficiency estimates for bias, the bootstrapping method is used, according to Simar and Wilson [59], which is suitable for use with DEA efficiency estimates, ranging from 0 to 1. Simar and Wilson [59] proposed the smoothed bootstrap method suitable to DEA to estimate the original densities of the non-parametric efficiency scores using kernel smoothing methods combined with a reflection method [58] by mimicking the data generating process (DGP). This procedure was implemented using the statistical software R including the FEAR library, developed by Wilson [69]. Thus, for each DMU there is derived the bias and the bias-corrected efficiency, $\hat{\hat{\theta}}$ as defined in (8.2). These scores are used to assess the company's performance and to analyze the bi-directional relationship.

$$\hat{\hat{\theta}} = \hat{\theta}^*_o - Bias \tag{8.2}$$

To explore the determinants that can be associated with good efficiency levels of the companies, we use the bootstrap-truncated regression formulated according to the double bootstrap method (algorithm #2) proposed by Simar and Wilson [60], in which efficiency scores are bootstrapped in the first stage, as explained before, and then the second step is performed based on the bootstrap truncated regression. This approach is used to investigate the determinant variables on efficiency levels of the companies. Considering the company $j\,(j = 1, \ldots, n)$ in the time period t $(t = 1, \ldots, m)$, the impact of the regressors, defined by variables z_{jt}, on efficiency score θ_{jt}, is assessed by the model (8.3):

$$\theta_{jt} = \beta_o + z_{jt}\beta + \varepsilon_{jt} \tag{8.3}$$

where β_o is the intercept, β corresponds to the vector of regression coefficients to be estimated and ε_{jt} is the error term with a $N(0, \sigma^2_\varepsilon)$ distribution with a truncation at $(1 - \beta_o - Z_{jt}\beta)$. Note that θ_{jt} corresponds to the efficiency of company j, in year t, estimated by using model (8.1) and corrected by bootstrapping as defined in (8.2).

8.3.3 Hypothesis, Empirical Models and Variables

Having in mind that the goal of this study is to investigate the bi-directional relationship of companies' performance in terms of efficiency and the leverage (or capital structure decision), taking into account the two main theories, TOT and POT as well

as the agency theory, the research hypotheses to be tested based on previous literature review are as following:

H_1 (agency cost hypothesis): Performance is improved as higher leverage is expected to lower agency costs and reduce inefficiency. That is, efficiency is positively related to leverage.

H_2 (efficiency risk hypothesis): Firms that are more efficient choose higher leverage ratios because higher efficiency is expected to lower the costs of bankruptcy and financial distress. That is, the leverage is positively related to efficiency.

H_{2a} (franchise-value hypothesis): Firms that are more efficient tend to hold extra equity capital and therefore, all else being equal, choose lower leverage ratios to protect their future income or franchise value. Thus, the leverage is negatively related to efficiency.

Two equations cross-sections models will be used in order to test the proposed hypotheses mentioned above. The research hypothesis H_1 is explored through the truncation regression model for the firm performance model given by equation model (8.4):

$$\hat{\hat{\theta}}_{jt} = \beta_o + Leverage_{jt}\beta_1 + z_{1jt}\beta_2 + \varepsilon_{jt} \tag{8.4}$$

where $\hat{\hat{\theta}}_{jt}$ is the bias-corrected efficiency determined from bootstrapping [59]. The leverage is the short-term debt ratio. The z_{1jt} control variables include the size, the debt cost, the asset structure, the coverage of non-current assets, the ROA and the current ratio.

The research hypotheses H_2 and H_{2a} are investigated through the OLS regression model for the firm leverage given by equation model (8.5):

$$Leverage_{jt} = \alpha_o + \hat{\hat{\theta}}_{jt}\alpha_1 + z_{2jt}\alpha_2 + \upsilon_{jt} \tag{8.5}$$

The z_{2jt} is a vector of control variables that include the bias-corrected efficiency, the size, the debt cost, the asset structure, the coverage of non-current assets, the ROA and the current ratio. The υ_{jt} is a stochastic error term. The statistical inference of OLS regression is performed by bootstrapping, using 2000 replicates.

The control variables used in both models (8.4) and (8.5) are the following:

- Firm size (Size): this variable is measured by ln(sales). If the effect of this variable is positive, it may indicate that large companies use better technology, are more diversified and better managed. A negative effect can be observed in situations where there will be loss of control resulting from inefficient hierarchical structures [5].
- Debt cost (%): this variable corresponds to the cost of external financing sources of capital. This was obtained by dividing the interest expenses by total liabilities. The company is supposed to replace debt by equity, or equity by debt, until the firm's value is maximized [41].

- Short-term (debt ratio) (%): indicates the weight of current liabilities in total assets. The size of the company may influence its financing sources. Small firms, compared to large firms, bear higher costs of issuing long-term debt [63]. The authors consider that small firms may be more leveraged than large firms and may prefer to take short-term loans (through bank loans) instead of issuing long-term debt due to lower fixed costs associated with this alternative.
- Asset structure (%): indicates the proportion of non-current assets that are found in total assets. This is a proxy for tangibility. The existence of asymmetric information and agency costs may induce creditors to require collateralised guarantees [5, 22, 49]. If the company has high investments in land, equipment and other tangible assets, it will usually face lower financing costs compared to a company that is mainly based on intangible assets [5].
- Coverage of non-current asset (%): corresponds to permanent capital (equity + non-current liabilities) to non-current assets. If the value is greater than 1, it is concluded that the company is following the rule of minimum financial equilibrium. Hackbarth [22] considers that the debt-to-firm value ratio captures the degree of leverage. "*The ex ante value of equity prior to the leverage decision differs from the ex post value of equity, i.e., at the time when the debt is already in place. In particular, the ex post value of equity is the value of the perpetual entitlement to the firm's cash flows net of its promised debt service. The ex ante value of equity equals total firm value at* $t = 0$; *i.e., the sum of the ex post value of equity and the issuance value of debt*" [22, p. 397].
- Current Ratio: this ratio is obtained by the quotient of current assets to current liabilities. The indicator is directly related to the working capital being responsible for the changes in the company's debt as a result of deviations from the budget [57].
- ROA (%): corresponds to the ratio of earnings before tax to total net assets. This is one of the profitability ratios commonly used.

8.4 Results

Firstly, the DEA model (8.1) is used to estimate the technical efficiency of Portuguese small and medium sized companies from secondary and tertiary sectors regarding the 2006 and 2009 period. Secondly, we estimate the DEA efficiency of SMEs corrected for the bias [59]. These scores are used to analyze the bi-directional relationship for SMEs from secondary and tertiary sectors, following similar research as Margaritis and Psillaki [34, 35].

8.4.1 Efficiency

In this stage, the DEA model (8.1) is used to estimate the technical efficiency for each company in minimizing the current resources required to achieve the observed total revenues. In terms of inputs we identify all the necessary resources to achieve the total revenues. The distance from each company to the efficient production technology is the result of inefficiencies regarding contracting costs, different principle agent objectives, managerial slack or oversight [34, 50]. Thus, the efficient frontier will identify the best practice companies in managing the resources for a given level of revenues. Taking into account this perspective, the DEA model is constructed using a single output (total revenues) and three inputs (capital, operational costs and labor) technology. The total revenues correspond to the total sales and provided services for each company. The capital is measured by the company's total net assets. The operational costs include the cost of goods sold, other operating expenses and the depreciation expenses, excluding staff costs. The labor input is measured by the total number of full-time equivalent employees and working proprietors. The data concerning the inputs and output are summarized in Table 8.3.

Table 8.3 Summary statistics of 210 small and medium sized companies between 2006 and 2009

Variable	Mean	St.Dev.	Min	Max
Capital	2086938	3216828	33828	24500000
Operational costs	1994528	3882617	15382	37800000
Labor	25.61	28.20	9.00	216.00
Total revenues	2788849	4920226	6390	38800000
Debt cost	0.03	0.03	0.00	0.31
Asset structure	0.85	0.61	0.02	4.25
Coverage of non-current assets	0.89	1.33	0.00	20.75
ROA	0.03	0.10	−1.21	0.33
Debt ratio	0.56	0.21	0.04	1.00
Current ratio	0.09	3.04	−33.52	13.12

The technical efficiency of a company in a given year is estimated by comparison to the best practices observed during the period analysed, ranging from 2006 to 2009. These efficiency estimates provide insights into potential improvements by taking into account statistical inference derived through the bootstrapping framework. The correction of the DEA efficiency estimates for bias has been performed by using 2000 bootstrap samples. Table 8.4 summarizes results for the technical efficiency, bias-corrected efficiency, standard error and bias.

Bias-corrected efficiencies reveal that magnitude of the corrected efficiencies are slightly lower than the original efficiencies, although this variation is very small. The bias-corrected efficiency estimates are preferred to the original efficiencies, since they

Table 8.4 Results of original and bootstrapped average efficiency estimates

Year	2006	2007	2008	2009
Original eff. Score $\hat{\theta}$	0.69	0.67	0.69	0.66
Bias-corrected eff. $\hat{\hat{\theta}}$	0.67	0.65	0.68	0.65
Bias	0.019	0.018	0.016	0.014
St.Dev.	0.019	0.018	0.016	0.016

Table 8.5 Average bias-corrected efficiency of companies by sector and size

		Size		
		Small	Medium	Mean by sector
Sector	Secondary	0.70 (287)	0.35 (44)	0.65 (331)
	Tertiary	0.71 (287)	0.37 (39)	0.67 (326)
Mean by size		0.70 (574)	0.36 (83)	

represent a more precise estimate of the true efficiency. Globally, the average bias-corrected efficiency varies between 0.67 (in 2006) and 0.65 (in 2009), indicating that each company should reduce their current operational costs, capital and labor by 33% (in 2006) and 35% (in 2009), on average, achieving the current level of revenues. A slight decrease in 2009 was observed, which could be explained by the financial crisis which erupted in 2008. These scores are used to analyze the bi-directional relationship.

Comparing small and medium sized companies from secondary and tertiary sectors (see the number of involved units in brackets), in Table 8.5, the medium sized companies have the lowest average technical efficiency (0.36), while the small companies have the highest score (0.70). Note that the average technical efficiency is similar in both sectors.

In the next sections, the bias-corrected efficiency of companies are used to explore the bi-directional relationship following the similar research as Margaritis and Psillaki [34, 35].

8.4.2 Efficiency Determinants Model

After the identification of the most efficient DMUs, it is intended to analyse the control variables (summarized in Table 8.3) that most contribute to this efficiency using the Eq. (8.4), testing the agency cost hypothesis (H_1). Table 8.6 summarizes the results from the panel data truncated model in terms of coefficients, standard errors and p-values. The total number of observations was 657. The truncated regression

Table 8.6 Truncated regression analysis results

Variable	Coefficient	Bootstrap Std. Err.	p-value
Debt ratio	0.2915	0.1117	0.009[a]
Size	−0.1794	0.0249	0.000[a]
Debt cost	0.1095	0.7054	0.877
Asset structure	−0.1361	0.0409	0.001[a]
Current ratio	0.016	0.0082	0.051[c]
Coverage of non-current assets	−0.0387	0.0217	0.075[c]
ROA	0.7711	0.2433	0.002[a]
Intercept	3.3004	0.3878	0.000[a]

[a]Indicates significance at the 1% level
[b]Indicates significance at the 5% level
[c]Indicates significance at the 10% level

model is statistically significant ($Wald - Chi^2$ test with p-value <0.001), with a pseudo-R^2 equal to 0.25.

The efficiency has a positive and statistically significant relation with short-term debt ratio (leverage). Although we used the short-term leverage, it does not reject the hypothesis H_1, that is the higher the short-term debt, the higher the company's efficiency. This can be explained by higher short-term credit facilities when compared to long-term credit for SME [63]. The firm size has a negative and statistically significant coefficient ($\beta_{Size} = -0.1794$, p-value <0.001), which means that the smaller the company, the higher its efficiency. This result is reinforced by the analysis of the asset structure effect, the current ratio and the coverage of non-current assets. A negative and statistically significant relation of tangibility (asset structure) with efficiency is observed. Although the literature indicates a positive impact of tangibility on efficiency, this is not observed in this sample. A possible reason for this is the need of SMEs to give credit and hold inventories above adequate level. In short, companies in this sample became more efficient with the increase of current assets as well as current liabilities. This observation is strengthened by the result of the coverage of the non-current assets effect on efficiency, which is negative.

Even though we have not used all the same variables in this model as Margaritis and Psillaki [34, 35], we also validate the agency cost hypothesis. We also found similar results on size and tangibility.

8.4.3 Leverage Determinants Models

Table 8.7 summarizes the results from the OLS regression model (8.5), which intends to test the efficiency as a determinant of (short-term) leverage, including other variables commonly presented as capital structure determinants according to POT or TOT. The total number of observations was 657. The OLS regression model is statis-

Table 8.7 OLS regression analysis results

Variable	Coefficient	Bootstrap Std. Err.	p-value
Bias-corrected efficiency	0.0881	0.0366	0.019[b]
Debt cost	−0.8454	0.2475	0.001[a]
Asset structure	−0.0948	0.0258	0.000[a]
Coverage of non-current assets	−0.0521	0.0272	0.057[c]
ROA	−0.458	0.111	0.000[a]
Current ratio	−0.0008	0.0048	0.864
Size	−0.0284	0.0066	0.000[a]
Intercept	1.0691	0.1123	0.000[a]

[a]Indicates significance at the 1% level
[b]Indicates significance at the 5% level
[c]Indicates significance at the 10% level

tically significant ($Wald - Chi^2$ test with p-value <0.001), with a pseudo-R^2 equal to 0.23.

The obtained results are in line with those presented in model one. It is observed that there is a positive and statistically significant effect of efficiency on short-term leverage. This validates H_2 (efficiency risk hypothesis) and rejects the franchise-value hypothesis (H_{2a}). The lower the firm size, the higher is the short-term debt. Note that the variable asset structure (proxy for tangible assets) is negative and statistically significant. This result is reinforced by coverage of non-current assets (also negative) results. This shows that companies follow the rule of minimum financial equilibrium according to POT theory. Analysing the profitability, the ROA is negative and statistically significant related to short-term debt.

8.5 Conclusions and Suggestions for Further Research

This paper reviews some aspects of the empirical literature on capital structure. Although our results are not conclusive, they serve to document empirical regularities that are consistent with existing theory. Some authors, such as Titman and Wessels [63] tried to test several models, including all the hypotheses jointly in the empirical tests. Shyam-Sunder and Myers [57] considered theories as conflicting hypotheses and examined their relative explanatory power. Based on a database of 1024 companies, for the period during the years 2006–2009, a sample of 210 companies was selected. Through the DEA method, we find companies that present an efficient capital structure. Then, we attempt to explain the variables that influence the efficiency of the capital structure of the company, as well as to explain how short-term debt is influenced by efficiency as well as by other variables.

The methodology proposed enables us to estimate more robust technical efficiency scores than Margaritis and Psillaki [34, 35] by using bootstrap methods [59, 60]

suitable for the DEA method. These efficiency scores are used to explain the bi-directional relationship of efficiency and leverage, enabling us to determine more robust conclusions.

The main empirical results obtained in this study can be summarized as follows:

- From the efficiency analysis along the time horizon in this research, we observed a slight reduction in the companies' efficiency in 2009. This behavior may be related to the economic and financial crisis that started in 2008.
- The efficiency of companies rises with the increase of short-term accounts (current assets and current liabilities). Given the size of the companies in question, they are able to finance themselves at lower cost using short-term external capital, since they do not have the confidence and guarantees that the banking sector requires to finance them with long-term capital [5].
- More efficient firms choose higher leverage ratio because higher efficiency is expected to lower the costs of bankruptcy and financial distress. That is, the leverage is positively related to efficiency (H_{2a}) following the POT theory, and the efficiency hypothesis.
- The fact that variable size is negative indicates that firms have lost control resulting from an inefficient hierarchical structure in the management of the company.
- Short-term debt ratio was negatively related to company size, probably reflecting the relatively high transaction costs that small firms face when issuing long-term financial instruments. This evidence also supports some of the implications of Titman and Wessels [63].

In general, the companies under study favor the short-term rather than the long-term. Given its size, as well as its environment, current assets present values above those that would be considered normal values. Clients require more credit, just as there is a need for inventories to be higher to avoid the risk of stock out as a result of the long distances traveled. The non-current asset, which would be expected to make the companies more efficient, on the contrary, presents a negative signal. One possible explanation may be that the management of these types of companies is not a professional management, and that is wasting resources. These facts lead to an increase in current ratio (liquidity) as well as an increase in short-term liabilities.

One possible limitation of this research is the time horizon of data. As in this research we focus only on the short-term leverage it would be interesting to test the bi-directional efficiency effect on capital structure using total leverage (total debt ratio) and the long-term leverage (long-term debt ratio). Another suggestion is to test if there is a significant difference if the efficiency is estimated by NACE (Statistical Classification of Economic Activities in the European Community). An important concern that arises is related to estimation methods. Considering a bi-directional relationship, this means that efficiency and leverage are endogenous variables, and thus, other estimation methods can be explored in future developments, as suggested by an anonymous reviewer.

References

1. J. Abor. Determinants of the capital structure of Ghanaian firms, 176. African Economic Research Consortium, Nairobi, 2008
2. S.K. Acaravci, The determinants of capital structure evidence from the Turkish manufacturing sector. Int. J. Econ. Financ. **5**-Capital-Structure, 158–171 (2015), http://www.scopus.com/inward/record.url?eid=2-s2.0-84923040625&partnerID=tZOtx3y1
3. M.A. Acedo-Ramirez, F.J. Ruiz-Cabestre, Determinants of capital structure: United Kingdom versus Continental European countries. J. Int. Financ. Manag. Account. **25**(3), 237–270 (2014)
4. M.A. Acedo-Ramírez, J.C. Ayala-Calvo, J.E. Rodríguez-Osés, Capital structure of small companies in the Spanish footwear sector: relevant factors. SERIEs **2**(2), 155–173 (2012)
5. T. Akhtar, A. Zahir, M.A. Tareq, F. Rabbi, Capital structure and firm efficiency: a case of Pakistan. Indian J. Financ. **10**(2), 50–66 (2016)
6. P. Alves, E.B. Couto, P.M. Francisco, Board of directors' composition and capital structure. Res. Int. Bus. Financ. **35**, 1–32 (2015). https://doi.org/10.1016/j.ribaf.2015.03.005
7. P. Andersen, N.C. Petersen, A procedure for ranking efficient units in data envelopment analysis. Manag. Sci. **39**(10), 1261–1264 (1993)
8. A. Antoniou, Y. Guney, K. Paudyal, M.J. Alderson, B.L. Betker, T.W. Anderson, J.L. Zimmerman, The determinants of capital structure: capital market-oriented versus bank-oriented institutions. J. Financ. Quant. Anal. **43**(1), 59 (2008). https://doi.org/10.1017/S0022109000002751
9. R.D. Banker, A. Charnes, W.W. Cooper, Some models for estimating technical and scale inefficiencies in data envelopment analysis. Manag. Sci. **30**(9), 1078–1092 (1984)
10. A.N. Berger, E.B. Di Patti, Capital structure and firm performance: a new approach to testing agency theory and an application to the banking industry. J. Bank. Financ. **30**(4), 1065–1102 (2006). https://doi.org/10.1016/j.jbankfin.2005.05.015
11. C. Bhaird, B. Lucey, Determinants of capital structure in irish SMEs. Small Bus. Econ. **35**(3), 357–375 (2010). https://doi.org/10.1007/s11187-008-9162-6
12. T.D.E. Bie, L.D.E. Haan, Market timing and capital structure: evidence for Dutch firms. De Economist **155**(2), 183–206 (2007)
13. L. Booth, V. Aivazian, A. Demirguc-kunt, A. Demirgüç-Kunt, V. Maksimovic, Capital structures in developing countries. J. Financ. **56**(1), 87–130 (2001). https://doi.org/10.1111/0022-1082.00320
14. E.C. Charalambakis, D. Psychoyios, What do we know about capital structure? revisiting the impact of debt ratios on some firm specific factors. Appl. Financ. Econ. **22**, 1727–1742 (2012)
15. A. Charnes, W.W. Cooper, E. Rhodes, Measuring the efficiency of decision making units. Eur. J. Oper. Res. **2**(6), 429–444 (1978)
16. H. DeAngelo, R.W. Masulis, Optimal capital structure under corporate and personal taxation. J. Financ. Econ. **8**(1), 3–29 (1980). https://doi.org/10.1016/0304-405X(80)90019-7
17. M. Dong, I. Loncarski, Jt Horst, C. Veld, What drives security issuance decisions: market timing, pecking order, or both? Financ. Manag. **41**(3), 637–663 (2012). https://doi.org/10.1111/j.1755-053X.2012.01213.x
18. A.B. Fernandes, A Importância dos Benefícios Fiscais para as Empresas do Interior de Portugal. Ph.D. in Management, Universidade da Beira Interior, 2013
19. M.Z. Frank, V.K. Goyal, Capital structure decisions: which factors are reliably important? Financ. Manag. **38**(1), 1–37 (2009)
20. J.R. Graham, C.R. Harvey, The theory and practice of corporate finance: evidence from the field. J. Financ. Econ. **60**(2–3), 187–243 (2001). https://doi.org/10.1016/S0304-405X(01)00044-7
21. E. Guo, O. Suliman, Corporate operating characteristics and capital structure: causality testing in heterogeneous panel data. Appl. Financ. Econ. **20**(March), 1901–1922 (2010)
22. D. Hackbarth, Determinants of corporate borrowing: a behavioral perspective. J. Corp. Financ. **15**(4), 389–411 (2009). https://doi.org/10.1016/j.jcorpfin.2009.02.001
23. M. Harris, A. Raviv, The theory of capital structure. J. Financ. **46**(1), 297–355 (1991), http://search.ebscohost.com/login.aspx?direct=true&db=bth&AN=4653270&site=ehost-live&scope=site

24. J. Helwege, N. Liang, Is there a pecking order? evidence from a panel of IPO firms. J. Financ. Econ. **40**(3), 429–458 (1996). https://doi.org/10.1016/0304-405X(95)00851-5
25. S.Z. Islam, S. Khandaker, Firm leverage decisions: does industry matter? N. Am. J. Econ. Financ. **31**, 94–107 (2015). https://doi.org/10.1016/j.najef.2014.10.005
26. M.C. Jensen, W.H. Meckling, Theory of the firm: managerial behavior, agency costs and ownership structure. J. Financ. Econ. **3**(4), 305–360 (1976). https://doi.org/10.1016/0304-405X(76)90026-X
27. K. Jõeveer, Firm, country and macroeconomic determinants of capital structure: evidence from transition economies. J. Comp. Econ. **41** (2013). https://doi.org/10.1016/j.jce.2012.05.001
28. A.D. Jong, R. Kabir, T.T. Nguyen, Capital structure around the world: the roles of firm- and country-specific determinants. J. Bank. Financ. **32**(9), 1954–1969 (2008)
29. M. Kebewar, S.M.N.A. Shah, The effect of debt on corporate profitability: evidence from French service sector. Bruss. Econ. Rev. **56**(1), 43–60 (2013)
30. A. Kraus, R.H. Litzenberger, A state-preference model of optimal financial leverage. J. Financ. **28**(4), 911–922 (1973). https://doi.org/10.1111/j.1540-6261.1973.tb01415.x
31. M. La Rocca, T. La Rocca, A. Cariola, Capital structure decisions during a firm's life cycle. Small Bus. Econ. **37**(1), 107–130 (2011). https://doi.org/10.1007/s11187-009-9229-z
32. M.T. Leary, M.R. Roberts, Do peer firms affect corporate financial policy? J. Financ. **69**(1), 139–178 (2014)
33. J. López-Gracia, F. Sogorb-Mira, Testing trade-off and pecking order theories financing SMEs. Small Bus. Econ. **31**, 117–136 (2008). https://doi.org/10.1007/s11187-007-9088-4
34. D. Margaritis, M. Psillaki, Capital structure and firm efficiency. OP-J. Bus. Financ. Account. **34**(9), 1447–1469 (2007). https://doi.org/10.1111/j.1468-5957.2007.02056.x
35. D. Margaritis, M. Psillaki, Capital structure, equity ownership and firm performance. J. Bank. Financ. **34**(3), 621–632 (2010). https://doi.org/10.1016/j.jbankfin.2009.08.023
36. N. Michaelas, F. Chittenden, P. Poutziouris, Financial policy and capital structure choice in UK SMEs: empirical evidence from company panel data. J. Bus. Econ. **12**(1992), 113–130 (1999). https://doi.org/10.1023/A:1008010724051
37. A.D. Miguel, J. Pindado, Determinants of capital structure: new evidence from Spanish panel data. J. Corp. Financ. **7**(1), 77–99 (2001). https://doi.org/10.1016/S0929-1199(00)00020-1
38. M.H. Miller, Debt and taxes. J. Financ. **32**(2), 261–275 (1977). https://doi.org/10.1111/j.1540-6261.1977.tb03267.x
39. F. Modigliani, M.H. Miller, The cost of capital, corporation finance and the theory of investment. Am. Econ. Rev. **XLVIII**(3) (1958)
40. S.C. Myers, Determinants of corporate borrowing. J. Financ. Econ. **5**(2), 147–175 (1977). https://doi.org/10.1016/0304-405X(77)90015-0
41. S.C. Myers, The capital structure puzzle. J. Financ. **39**(3), 574–592 (1984). https://doi.org/10.1111/j.1755-053X.2010.01090.x
42. S.C. Myers, N.S. Majluf, Corporate financing and investment decisions when firms have information that investors do not have. J. Financ. Econ. **13**(2), 187–221 (1984). https://doi.org/10.1016/0304-405X(84)90023-0
43. A. Ozkan, Determinants of capital structure and adjustment to long run target: evidence from UK company panel data. J. Bus. Financ. Account. **28**(1–2), 175–198 (2001). https://doi.org/10.1111/1468-5957.00370
44. Ö. Öztekin, Capital structure decisions around the world: which factors are reliably important? J. Financ. Quant. Anal. **50**(3), 301–323 (2015). https://doi.org/10.1017/S0022109014000660
45. K. Park, S. Jang, Capital structure, free cash flow, diversification and firm performance: a holistic analysis. Int. J. Hosp. Manag. **33**, 51–63 (2013). https://doi.org/10.1016/j.ijhm.2013.01.007
46. P. Proença, R.M.S. Laureano, L.M.S. Laureano, Determinants of capital structure and the 2008 financial crisis: evidence from Portuguese SMEs. Science **150**, 182–191 (2014)
47. M. Psillaki, N. Daskalakis, Are the determinants of capital structure country or firm specific. Small Bus. Econ. **33**(3), 319–333 (2009). https://doi.org/10.1007/s11187-008-9103-4

48. R.G. Rajan, L. Zingales, What do we know about capital structure? some evidence from international data. J. Financ. **50**(5), 1421–1460 (1995)
49. J.H. Scott, Bankruptcy, secured debt, and optimal capital structure: comment. J. Financ. **32**(1), 1–19 (1977). https://doi.org/10.1111/j.1540-6261.1979.tb02085.x
50. S.L. Seelanatha, The determinants of capital structure: evidence from China. Econ. Manag. Financ. Mark. **5**(4), 106–126 (2010)
51. Z. Serrasqueiro, A. Caetano, Trade-off theory versus pecking order theory: capital structure decisions in a peripheral region of Portugal. J. Bus. Econ. Manag. **16**(2), 445–466 (2014). https://doi.org/10.3846/16111699.2012.744344
52. Z. Serrasqueiro, P.M. Nunes, J. Leitão, M.J.R. Armada, Are there non-linearities between SME growth and its determinants? a quantile approach. Ind. Corp. Chang. **19**(4), 1071–1108 (2010). https://doi.org/10.1093/icc/dtp053
53. Z. Serrasqueiro, F. Matias, L. Salsa, Determinants of capital structure: new evidence from Portuguese small firms. Dos Algarves Multidiscip. E-J. **28**, 13–28 (2016). http://www.dosalgarves.com/rev/N28/2rev28.pdf
54. Z.S. Serrasqueiro, P.J.M. Nunes, Performance and size: empirical evidence fand rom Portuguese SMEs. Small Bus. Econ. **31**, 195–217 (2008). https://doi.org/10.1007/s11187-007-9092-8
55. Z.S. Serrasqueiro, M.R. Armada, P.M. Nunes, Pecking order theory versus trade-off theory: are service SMEs'capital structure decisions different? Serv. Bus. **5**(4), 381–409 (2011). https://doi.org/10.1007/s11628-011-0119-5
56. R.W. Shephard, *Theory of Cost and Production Functions* (Princeton University Press, Princeton, 1970)
57. L. Shyam-Sunder, S.C. Myers, Testing static tradeoff against pecking order models of capital structure. J. Financ. Econ. **51**, 219–244 (1999). https://doi.org/10.1016/S0304-405X(98)00051-8
58. B.W. Silverman, *Density Estimation for Statistics and Data Analysis* (Chapman and Hall, London, 1986)
59. L. Simar, P.W. Wilson, Sensitivity analysis of efficiency scores: how to bootstrap in nonparametric frontier models. Manag. Sci. **44**(1), 49–61 (1998)
60. L. Simar, P.W. Wilson, Estimation and inference in two-stage, semi-parametric models of production processes. J. Econ. **136**, 31–64 (2007)
61. F. Sogorb-Mira, How SME uniqueness affects capital structure: evidence from a 1994–1998 Spanish data panel. Small Bus. Econ. **25**(5), 447–457 (2005). https://doi.org/10.1007/s11187-004-6486-8
62. R. Stulz, Managerial discretion and optimal financing policies. J. Financ. Econ. **26**(1), 3–27 (1990). https://doi.org/10.1016/0304-405X(90)90011-N
63. S. Titman, R. Wessels, The determinants of capital structure choice. J. Financ. **43**(1), 1–19 (1988). https://doi.org/10.1111/j.1540-6261.1988.tb02585.x
64. D. Vasiliou, N. Daskalakis, Institutional characteristics and capital structure: a cross-national comparison. Global Financ. J. **19**(3), 286–306 (2009). https://doi.org/10.1016/j.gfj.2008.09.002
65. E. Vieira, Determinantes da estrutura de capital das empresas portuguesas cotadas. Revista Portuguesa E Brasileira de Gestão, pp. 38–51 (2013)
66. E.S. Vieira, A.J. Novo, A estrutura de capital das PME: Evidência no mercado português. Estudos Do ISCA **2**(2), 1–19 (2010). https://doi.org/10.1234/ei.v0i2.578
67. S.C. Vogt, The role of internal financial sources in firm financing and investment decisions. Rev. Financ. Econ. **4**(1), 1–24 (1994). https://doi.org/10.1016/1058-3300(94)90002-7
68. R. Watson, N. Wilson, Small and medium size enterprise financing: a note on some of the empirical implications of a pecking order. J. Bus. Financ. Account. **3**, 1–23 (2002). https://doi.org/10.1111/1468-5957.00443
69. P.W. Wilson, Fear: a software package for frontier efficiency analysis with R. Socio-Econ. Plan. Sci. **42**(December), 247–254 (2008)