Capital Structure Decisions: Old Issues New Insights from High-Tech SMEs

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Abstract:

Based on two sub-samples of SMEs: i) 135 high-tech SMEs; and ii) 330 non high-tech SMEs, using panel data models and the two-step estimation method, this study investigates if the capital structure decisions of high-tech SME and non high-tech SMEs are closer to what is predicted by Pecking Order Theory, or if they are closer to what is predicted by Trade-Off Theory. The results suggest that the capital structure decisions of high-tech SMEs are closer to what is predicted by Pecking Order Theory than to what is predicted by Trade-Off Theory. The empirical evidence suggests that the problems of information asymmetry, the low level of tangible assets and the technological and market uncertainty influence the capital structure decisions of high-tech SMEs.

Keywords: High-tech SMEs; Two-Step Estimation Method; Non High-Tech SMEs; Pecking Order Theory; Trade-Off Theory.

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1. Introduction

In the context of firms' capital structure decisions, following the important studies by Modigliani and Miller (1958, 1963), various studies seek to ascertain what the main determinants of firms' capital structure were. In this context, two theories are particularly important in explaining firms' capital structure: 1) Trade-Off Theory (Kraus and Litzenberger, 1973; Scott, 1977; Kim, 1978); and 2) Pecking Order Theory (Myers, 1984; Myers and Majluf, 1984). According to Trade-Off Theory, firms aim to reach an optimal level of debt, which means balancing the benefits and costs of debt. According to Pecking Order Theory, variations in debt do not have the aim of reaching an optimal level of debt, but they are the consequence of external financing needs, because when internal funds are insufficient, firms prefer to turn to debt rather than external equity.

SMEs are known to have difficulty in obtaining external finance, especially smaller and younger firms whose growth opportunities are associated with high risk. High-tech SMEs, in particular, have special characteristics, namely: high levels of intangible assets and high investment in R&D (Research and Development); lack of tangible assets that can be used as collaterals in the beginning of the life-cycle; products with nil or little record, increasing market uncertainty and technological uncertainty (Brierley, 2001; Smith, 2010). These characteristics of high-tech SMEs probably make these firms vulnerable to asymmetric information problems increasing their risk and probability of bankruptcy.

The problems of asymmetric information generate problems of moral hazard and adverse selection, which costs debtholders transfer to high-tech SMEs´ owners. The problems of asymmetric information combined with SMEs´ particular difficulty to achieve quotation in the stock market, and with the SME owners' reluctance to open up capital to external investors may have consequences for the capital structure decisions of high-tech SMEs, namely their likely preference for internal finance (Jou, 2001). Consequently, it is expected that capital structure decisions of high-tech SMEs are close to what is predicted by the Pecking Order Theory.

However, given that high-tech SMEs incur high costs to later expand capacity, when internal finance is exhausted, its growth opportunities value become lower (Jou, 2001). Furthermore, Jou (2001) concludes that high-tech SMEs´ choice of debt levels balances the costs against the benefits associated with debt, which suggests that these firms may follow the Trade-Off Theory in their capital structure decisions.

The study of the capital structure decisions of high-tech SMEs takes on particular importance, given that the access to and cost of finance are some of the most important factors that affect the ability of high-techs firms to survive and grow (Giudici and Paleari, 2000). Although various studies (Giudici and Paleari, 2000; Carpentier et al., 2007; Colombo and Grilli, 2007; Scellato and Ughetto, 2009; Brown et al., 2009; Smith, 2010) have focused upon the financing of high-tech SMEs, however the methodology used in those studies, namely logit, probit and tobit regressions do not allow to test directly the applicability of regression models related to Pecking Order and Trade-Off theories to the capital structure decisions of high-tech SME. This study seeks to fill the existing gap in the literature, by studying if the capital structure decisions of high-tech SME are closer to what is predicted by Pecking Order Theory, or if they are closer to what is predicted by Trade-Off Theory. Seeking to ascertain if the capital structure decisions of high-tech SMEs are particularly different from those of other SMEs, we also investigate if non high-tech SMEs follow the Pecking Order Theory or Trade-Off Theory in their capital structure decisions.

SMEs in high tech sectors promote dynamic efficiency, and are the major agents of technical change and job creation (Audretsch, 1995; Revest and Sápio, 2010), therefore high-tech SMEs are very important for economies in general, and for Portuguese economy in particular. In order to address the goals of this study, we consider two sub-samples of unquoted Portuguese SMEs in manufacturing industry: *i*) 330 non high-tech SMEs; and *ii*) 135 high-tech SMEs. Portuguese situation is suitable for reaching the objectives of this study, since 99.6% of all Portuguese firms are SMEs and very important for the process of economic growth and employment in the country (IAPMEI, 2008).

Portuguese SMEs´ sources of finance can be particularly restricted, as unlike the case of firms in other countries, such as the United States of America and the United Kingdom, Portuguese SMEs do not have access to the stock market and there is clearly little tradition of resorting to venture capital. This being so, when internal finance is insufficient, debt can be particularly important for Portuguese high-tech SMEs to fund the multiple growth opportunities available to these firms.

This study makes the following contributions to the literature on SMEs in general, and on high-tech SMEs and non high-tech SMEs in particular.

Firstly, the study is pioneering in the applicability of models, which allow us to test if the capital structure decisions of high-tech SME and non high-tech SMEs are closer to what is predicted by Pecking Order Theory or, if on the contrary, they are closer to what is predicted by Trade-Off Theory. The empirical evidence of the current study allows us to conclude that the capital structure decisions of high-tech SMEs are quite close to what is predicted by Pecking Order Theory, as this type of firm resorts above all to debt, in order to cover insufficiencies of internal finance. In the context of non high-tech SMEs, we conclude that the capital structure decisions of these SMEs are much closer to what is predicted by Trade-Off Theory than do those of high-tech SMEs. For non high-tech SMEs, we conclude that debt, being used to face insufficiencies of internal finance, is also used to reach a target debt ratio.

Secondly, in addition to the main contribution mentioned above, this study also makes an important methodological contribution to the literature on the capital structure decisions of high-tech and non high-tech SMEs. This study is pioneering in using the two-step estimation method proposed by Heckman (1979), in the context of the capital structure decisions of high-tech and non high-tech SMEs. Heshmati (2001), Welch (2007) and Frank and Goyal (2008) conclude that the results of the studies on capital structure decisions of SMEs may suffer from bias, as a matter of the firm´s survival. In order to address the problem of possible result bias, as a consequence of the survival issue, we use the two-step estimation method proposed by Heckman (1979).

The remainder of the paper is structured as follows: *i*) Section 2. Methodology and Research Hypotheses, presents the models to estimate, the variables used and corresponding measures, the estimation methods and the research hypotheses; *ii*) Section 3. Database and Descriptive Statistics, presents the methodology used, namely the database, the descriptive statistics of the variables used, and econometric methods used; *iii*) Section 4. Results, presents the empirical evidence obtained; *iv*) Section 5. Discussion of the Results goes on to discuss the empirical evidence obtained; and *v*) Section 6. Conclusions and Implications, presents the main conclusions and implications.

2. Methodology and Research Hypotheses

We now present the models used to test the applicability of Pecking Order and Trade-Off Theories to the capital structure decisions of high-tech SMEs and non high-tech SMEs. We then present the models to estimate together with the variables used and their corresponding measures. After, we present the estimation methodology used and finally the research hypotheses.

2.1. Pecking Order Theory

Relationship between Financial Deficit and Debt – POT Model I

Firstly, in order to test the Pecking Order Theory, we use the model proposed by Shyam-Sunder and Myers (1999). This model consists of testing a regression between financial deficit and debt variations.

Given that the current study focuses upon SMEs, which involves the selection of the firms on the basis of firm´s size, it may imply the exclusion of firms, which influences the research sample representativeness. Given that firms from a certain size have a higher probability of survival, then the analysis of capital structure decisions based only upon the surviving firms will become biased (Heshmati, 2001). To address the problem of possible result bias, as a consequence of the survival issue, we use the two-step estimation method proposed by Heckman (1979). In the first step, we estimate a probit regression, considering all firms, both surviving and non-surviving, and in the second step, we consider all explanatory variables corresponding to the regressions to estimate. Therefore, the regressions to estimate can be presented as follows:

$$\Pr(\delta_{i,t} = 1) = \tau_0 + \tau FD_{i,t} + D_S + d_t + z_{i,t}, \qquad (1)$$

where: $FD_{i,t}$ is the financial deficit, D_S represents the industry sector dummies[2], d_t represents the temporal dummies, and $z_{i,t}$ is the error term.

[2] As Blanco-Mazagatos et al. (2007), we consider six industry sectors: *i*) agriculture; *ii*) forestry and fisheries; *iii*) construction; *iv*) manufacturing; *v*) wholesale and retail trade; and *vi*) service industries. The classification is according to firms' primary activity, indicated by its single-digit SIC/NACE code.

After estimating the inverse Mill´s ratio[3], based on probit regressions, for high-tech SMEs and non high-tech SMEs, in the second step of estimation we consider the inverse Mill´s ratio as an explanatory variable.

According to Pecking Order Theory, debt variations occur exclusively as a function of firms' financing needs. In order to address the problem of possible result bias arising from the survival issue, we extend the model proposed by Shyam-Sunder and Myers (1999), considering, aside from financial deficit, the inverse Mill´s ratio as an explanatory variable in the regressions. Therefore, the regressions to estimate can be presented as follows:

$$\Delta D_{i,t} = \beta_0 + BFD_{i,t} + \gamma_\lambda \lambda_{i,t} + d_t + \varepsilon_{i,t} \qquad (2)$$

where $\Delta D_{i,t}$ is the difference between debt in the current period and debt in the previous period, $FD_{i,t}$ is the financial deficit, B is the parameter to measure the impact of financial deficit on debt variations, $\lambda_{i,t}$ is the inverse Mill's ratio, and $\varepsilon_{i,t}$ is the error, which is assumed to have normal distribution.

In order to estimate equation (2), we resort to OLS regressions for two fundamental reasons: *i*) the non-existence of the lagged dependent variable in the relationship forecast by equation (2) makes the use of dynamic estimators impossible; and *ii*) since the dependent variable is in first differences, non-observable individual effects (v_i) become irrelevant, and it is not possible to estimate the relationship forecast in the equation (2) with panel models considering random or fixed non-observable individual effects.

[3] The inverse Mill´s ratio is the ratio between cumulative density function and the density function. The designation of inverse Mill´s ratio is due to the fact that Mill´s ratio considers the inverse of Hazard ratio (also known as force of mortality). For a detailed description of calculation of the inverse Mill´s ratio, see Heckman (1979).

Given that heteroskedasticity is normally a phenomenon in empirical studies that use cross-section data, standard deviations of the parameters are estimated according to the White estimator. This estimator allows us to obtain standard deviations of estimated parameters consistent with the possible existence of heteroskedasticity.

Determinants of Debt – POT Model II

Following other studies (Aybar et al., 2004; Michaellas et al., 1999; López-Gracia and Sánchez-Andújar, 2007; López-Gracia and Sogorb-Mira, 2008), we test the Pecking Order Theory, on the basis of a second regression model, considering the determinants of debt according to what is predicted by Pecking Order Theory: *i*) cash flow; *ii*) age; and *iii*) interaction between cash flow and growth opportunities.

Firstly, as before, in the first step, we estimate probit regressions so as to estimate the inverse Mill´s ratio. The regressions to estimate can be presented as follows:

$$\begin{aligned} \Pr(\delta_{i,t}=1) = \tau_0 + \tau_1 CF_{i,t} + \tau_2 AGE_{i,t} + \tau_3 HGOLCF_{i,t} + \tau_4 LGOHCF_{i,t} + \\ + D_S + d_t + z_{i,t} \end{aligned} \quad (3)$$

in which: $CF_{i,t}$ corresponds to cash flow, given by the ratio of earnings after interest and taxes plus depreciation to total assets; $AGE_{i,t}$ is age, given by the natural logarithm of the number of years the firm that has been in existence; $HGOLCF_{i,t}$ are the growth opportunities of firms (i), at a given moment (t), corresponding to situations of high growth opportunities and low cash flow; $LGOHCF_{i,t}$ are the growth opportunities of firm (i), at a given moment (t), corresponding to situations of low growth opportunities and high cash flow.

To calculate $HGOLCF_{i,t}$, we consider initially a dummy variable that has: the value of 1 corresponding to firms that, at a given moment, have simultaneously growth opportunities above the median of growth opportunities of the total sample and cash flows under the median of cash flow of the total sample; and, the value of 0 in the remaining situations. To calculate $LGOHCF_{i,t}$ we consider, initially, a dummy variable with the value of: 1 when firms, at a given time, have simultaneously growth opportunities under the median of growth opportunities of the total sample and cash flows above the median of cash flows of the total sample; and, the value of 0 in the remaining situations. Finally, to calculate the variables $HGOLCF_{i,t}$ and $LGOHCF_{i,t}$, we multiply the previously calculated dummy variables by sales growth (considered as a measure of growth opportunities).

In the second step, to estimate the relationships predicted by Pecking Order Theory between determinants and debt, for high-tech SMEs and non high-tech SMEs, we use static panel models. The regressions to estimate can be presented as follows:

$$\begin{aligned} D_{i,t} &= \beta_0 + \beta_1 CF_{i,t} + \beta_2 AGE_{i,t} + \beta_3 HGOLCF_{i,t} + \beta_4 LGOHCF_{i,t} + \\ &+ \gamma_\lambda \lambda_{i,t} + u_i + D_S + d_t + \varepsilon_{i,t} \end{aligned} \quad (4)$$

in which: $D_{i,t}$ corresponds to debt, given by the ratio of total liabilities to total assets and u_i are firms' specific factors that are not directly observable from debt determinants.

As for estimation of the model concerning equation (4), we use static panel models, namely: *i*) an OLS regression; *ii*) a random effect model; and *iii*) a fixed effect model. To find the most appropriate way to carry out estimation of the relationship between debt and its determinants, we use the LM test and the Hausman test.

Research Hypothesis

According to Pecking Order Theory, variations in debt occur exclusively as a function of firms' financing needs, i.e., debt variations are a function of the financial deficit at a given time (Shyam-Sunder and Myers, 1999). In addition, according to Pecking Order Theory we can expect that: *i*) firms with greater cash flow resort less to debt (Myers, 1984; Myers and Majluf, 1984); *ii*) older firms resort less to debt (Diamond, 1989; Ang, 1991); *iii*) firms with high growth opportunities and low cash flow resort more to debt (Myers, 1984); and *iv*) firms with low growth opportunities and high cash flow resort less to debt (Myers, 1984).

Various studies (Hao and Jaffe, 1993; Giudici and Paleari, 2000; Carpenter and Petersen, 2002; Hall, 2002; Carpentier et al., 2007; Colombo and Grilli, 2007; Scellato and Ughetto, 2009) conclude that high-tech firms prefer to finance themselves through internal finance. The particular characteristics of high-tech firms may contribute to this result, namely: *i*) the relevance of intangible assets, such as intellectual capital and R&D expenditure, implying lower levels of collateral (Revest and Sapio, 2010); *ii*) the considerable need for growth in the beginning of the life cycle, and consequently increased operational risk, may contribute to a greater difficulty in obtaining debt for high-tech firms compared to non high-tech firms (Giudici and Paleari, 2000); and *iii*) the greater technological uncertainty and, consequently, greater uncertainty of market success associated with high-tech firms, compared to the case of non-high tech firms, contribute to lenders to consider the activities of the former to be high risk, and so hindering the access to debt for high-tech firms (Revest and Sapio, 2010; Smith, 2010).

The severe problems of asymmetric information, namely the problems of adverse selection and moral hazard may hinder investors to provide both equity and debt to this type of firm (Stiglitz and Weiss, 1981). When internal finance is clearly insufficient to fund firms' multiple investment opportunities, the adverse terms of the alternative sources of finance to retained earnings may be particularly important for the capital structure decisions of high-tech SMEs without access to the stock market, and with little tradition of using venture capital.

Based on the above arguments, we can expect that: i) the impact of financial deficit on debt variations in high-tech SMEs are of greater magnitude than that found in non high-tech SMEs; ii) high-tech SMEs resort less to debt as a function of cash flow, age, low growth opportunities and high cash flow than do non high-tech SMEs; and iii) high-tech SMEs resort more to debt, in situations of high growth opportunities and low cash flow than do non high-tech SMEs. Therefore, we formulate the following research hypothesis:

H1: In the capital structure decisions, high-tech SMEs adopt a financing behaviour closer to what is predicted by Pecking Order Theory than do non high-tech SMEs.

2.2. Trade-Off Theory

Adjustment of Actual Level of Debt towards Target Debt Ratio and Debt Determinants

We present the partial adjustment model that allows us to test the degree of adjustment of actual debt towards a target debt ratio, and the relationships between debt and determinants, according to Trade-Off Theory.

For the same reasons mentioned above for the Pecking Order Theory – Model I, we use the two-step estimation method proposed by Heckman (1979). Initially, we estimate probit regressions considering the debt determinants predicted by Trade-Off Theory as explanatory variables. The regressions to estimate can be presented as follows:

$$\begin{aligned}\Pr(\delta_{i,t}=1) &= \tau_0+\tau_1 PROF_{i,t}+\tau_2 SIZE_{i,t}+\tau_3 TANG_{i,t}+\tau_4 GO_{i,t}+\\ &+\tau_5 NDTS_{i,t}+\tau_6 ETR_{i,t}+\tau_7 EVOL+D_S+d_t+z_{i,t},\end{aligned} \tag{5}$$

in which: profitability ($PROF_{i,t}$) is given by the ratio of earnings before interest and taxes to total assets; size ($SIZE_{i,t}$) is given by the natural logarithm of sales; asset tangibility ($TANG_{i,t}$) is given by the ratio of tangible assets to total assets; growth opportunities ($GO_{i,t}$) are given by the growth of total sales; non-debt tax shields ($NDTS_{i,t}$) are given by the ratio of depreciation to total assets; effective tax rate ($ETR_{i,t}$) is given by the ratio of actual income tax paid to net taxable income before taxes; and, level of risk ($EVOL_{i,t}$), given by the absolute value of the first difference of percentage change of earnings before interest, taxes, and depreciations.

In the second step, we estimate the adjustment of actual debt of high-tech SMEs and non high-tech SMEs towards the respective target debt ratios and the relationships predicted by Trade-Off Theory between determinants and debt. To do that, just as López-Gracia and Sánchez-Andujar (2007) and López-Gracia and Sogorb-Mira (2008), we resort to the partial adjustment model that is given by:

$$D_{i,t} - D_{i,t-1} = \alpha(D_{i,t}{*} - D_{i,t-1}), \tag{6}$$

in which: $D_{i,t-1}$ is the debt of firm *i* in the period *t-1*; $D_{i,t}{*}$ is the target debt ratio of firm *i* in period *t*, and α is the speed of adjustment of actual level of debt towards target debt ratio.

To estimate the above equation it is necessary to find the target debt ratio. In this study we consider, just as Miguel and Pindado (2001), López-Gracia and Sánchez-Andújar (2007) and López-Gracia and Sogorb-Mira (2008) that target debt ratio depends on firms' specific characteristics. Therefore, firms' target debt ratio is given by:

$$D_{i,t}^* = \sum_{K=1}^{n} \varphi_K Z_{k,i,t} + \gamma_\lambda \lambda_{i,t} + D_S + d_t + u_i + v_{i,t} \,, \qquad (7)$$

in which $Z_{K,i,t}$ is the determinant *k* of the book value of debt of firm *i* at time *t*, φ_K are the coefficients of each debt determinant, $\lambda_{i,t}$ is the Mill's ratio, and $v_{i,t}$ is the error term.

Substituting (7) in (6) and regrouping the terms, we have:

$$D_{i,t} = \lambda_0 D_{i,t-1} + \sum_{K=1}^{n} \beta_K Z_{k,i,t} + \rho_\lambda \lambda_{i,t} + \phi_S + \theta_t + \eta_i + \varepsilon_{i,t} \,, \qquad (8)$$

in which: $\lambda_0 = (1-\alpha)$, $\beta_K = \alpha\varphi_K$, $\rho_\lambda = \alpha\gamma_\lambda$, $\phi_S = \alpha D_S$, $\theta_t = \alpha d_t, \eta_i = \alpha u_i$ and $\varepsilon_{i,t} = \alpha v_{i,t}$.

To estimate equation (5) on the basis of traditional panel methods, considering fixed or random individual effects, we obtain biased and inconsistent estimates of the parameters, since in addition to the correlation between η_i and $D_{i,t-1}$, there is also correlation between $\varepsilon_{i,t}$ and $D_{i,t-1}$, which is to say, firms' non-observable individual effects and the error are correlated with the lagged debt. In addition, use of dynamic estimators, instead of traditional panel methods has the following extra advantages: *i*) greater control of endogeneity; *ii*) greater control of possible collinearity between explanatory variables; and *iii*) greater effectiveness in controlling effects caused by the absence of relevant explanatory variables for the results.

This study uses the Generalized Moments Method – GMM system (1998) estimator by Blundell and Bond (1998) to estimate the model of partial adjustment. Blundell and Bond (1998) conclude that when the dependent variable is persistent, the GMM system (1998) estimator is more robust than the Generalized Moments Method – GMM (1991) estimator[4]. Blundell and Bond (1998) extend the GMM (1991) estimator, considering a system of variables at level and in first differences. For the variables at level the instruments are presented in first differences, and for the variables in first differences the instruments are presented at level. Nevertheless, the GMM system (1998) estimator can only be considered valid if: *i*) the restrictions, a consequence of use of the instruments, are valid; and *ii*) there is no second-order autocorrelation.

To test the validity of the restrictions, we use the Hansen test. The null hypothesis indicates that the restrictions, imposed by using the instruments are valid. By rejecting the null hypothesis, we conclude that the restrictions are not valid, and so the results are not robust. We test for the existence of first and second-order autocorrelation. The null hypothesis is that there is no autocorrelation. Rejecting the null hypothesis of non-existence of second-order autocorrelation, we conclude that the results are not robust. For the results of the GMM system (1998) estimator to be considered robust, the restrictions imposed by use of the instruments have to be valid and there can be no second-order autocorrelation.

To test the robustness of the empirical evidence obtained we use the LSDVC (2005) estimator, proposed by Bruno (2005). The LSDVC (2005) estimator is appropriate in situations with a reduced number of observations. If the number of cross-sections is below 30, use of the LSDVC (2005) estimator is recommended to test the robustness of the results obtained with the GMM system (1998) estimator.

[4] In this study, we find persistence of debt for non high-tech SMEs and high-tech SMEs. The correlation coefficient of present debt and previous debt is 0.83525 for non high-tech SMEs and 0.7817 for high-tech SMEs. Therefore, it is clearly advisable to use the GMM system (1998) estimator, rather than the GMM (1991) estimator.

Research Hypothesis

According to Trade-Off Theory, firms adjust the actual level of debt towards target debt ratio (Taggart, 1977; Jalilvand and Harris, 1984). Lower transaction costs borne by firms in accessing debt will correspond to a greater adjustment of actual level of debt towards target debt ratio. Also according to Trade-Off Theory, we can expect that: *i*) more profitable firms resort more to debt (Kraus and Litzenberger, 1973; Scott, 1977; Kim, 1978); *ii*) larger firms resort more to debt (Rajan and Zingales, 1995); *iii*) firms with higher level of tangible assets resort more to debt (Myers, 1977); *iv*) firms with higher growth opportunities resort less to debt (Jensen and Meckling, 1976; Myers, 1977); *v*) firms with greater non-debt tax shields resort less to debt (DeAngelo and Masulis, 1980); *vi*) firms with higher effective tax rates resort more to debt (DeAngelo and Masulis, 1980); and *vii*) firms with higher risk resort less to debt (Mackie-Mason, 1990).

Due to high information asymmetry, high-tech SMEs may face particular difficulties in obtaining debt, compared to SMEs in general (Bank of England, 1996; Berger and Udell, 1998). The greater information asymmetry with the lenders, and consequently, the higher transaction costs, may contribute to high-tech SMEs to adjust the actual level of debt towards a target debt ratio as a merely secondary goal. Non high-tech SMEs due to lower information asymmetry and lower transaction costs, may effectively balance the bankruptcy costs with the tax shields associated with debt, making adjustments of actual level of debt towards the target debt ratio.

From what has been presented, we can expect that the financing decisions of non high-tech SMEs are closer to the assumptions of Trade-Off Theory than do those of the high-tech SMEs. We therefore expect that: *i*) non high-tech SMEs have a greater adjustment of actual level of debt towards target debt ratio than do high-tech SMEs; *ii*) non high-tech SMEs have higher level of debt as a function of higher levels of profitability, size, tangible assets, and effective tax rate than do high-tech SMEs; and *iii*) non high-tech SMEs have lower levels of debt as a function of higher levels of growth opportunities, non-debt tax shields, and risk than do high-tech SMEs. Based on the above, we formulate the following research hypothesis:

H2: In the capital structure decisions, non high-tech SMEs adopt a financing behaviour closer to what is predicted by Trade-Off Theory than do high-tech SMEs.

3. Database and Descriptive Statistics

3.1. Database

This study uses the SABI (Analysis System of Iberian Balance Sheets) database, supplied by Bureau van Dijk, for the period between 1999 and 2006. As the subject of study, we consider unquoted firms belonging to the manufacturing industry sector[5].

Manufacturing firms are selected according to the NACE classification (Classification of Economic Activities in the European Union). High-tech and non high-tech firms are selected according to the OECD (2002) classification of economic activities. According to the OECD (2002), high-tech sub-sectors of manufacturing industry are: 24.4 Manufacture of pharmaceuticals 30. Manufacture of computers and office machinery, 32. Manufacture of electronics-communications, 33. Manufacture of

[5] It is worth highlighting at this stage that we restrict the sample of this study to manufacturing firms so as to guarantee greater homogeneity of the sample used. Indeed, given that our objective is to study the possibility of different relationships between determinants and growth in high-tech and non high-tech SMEs, with special emphasis to intensity of R&D expenditure, considering high-tech and non high-tech manufacturing and service firms in the same sample would lead to samples which were clearly not homogeneous, which could lead to biased results and incorrect interpretation. For example, service sub-sectors incorporating high technology and knowledge are considerably heterogeneous (Froehle et al., 2000; Edvardsson et al., 2005; Droege et al., 2009), which is shown by their designations: *i*) Knowledge-Intensive High-Technology Services; *ii*) Knowledge-Intensive Market Services; *iii*) Knowledge. Intensive Financial Services, and iv) Other Knowledge-Intensive Services. In order to analyze particularly the influence of R&D expenditure related to developing new products and new production processes on SME growth, guaranteeing simultaneously more homogeneous sub-samples of high-tech and non high-tech SMEs, we take only manufacturing SMEs as our subject of analysis.

scientific instruments and 35.3 Manufacture of aircraft and spacecraft. As non high-tech sub-sectors, we consider those of medium-high technology: 24-24.4 Manufacture of chemicals, 29. Manufacture of non-electrical machinery, 31. Manufacture of electrical machinery, 34. Manufacture motor vehicles 35-2+35.4+35.5 Other transport equipment. Additionally, regarding non high-tech sub-sectors, we consider those of medium-low technology: 23. Manufacture of refined products, 25. Manufacture of rubber and plastic products, 26. Manufacture of non-metallic mineral products, 27.4+27.53/54 Manufacture of non-ferrous metals, 28. Manufacture of fabricated metal products, 35.1 Manufacture of building and repairing of ships and boats, and 36.2 to 36.6 Miscellaneous manufacturing. Regarding non high-tech sub-sectors, we consider those of low technology: 15.+16. Manufacture of food, beverages and tobacco 17. to 19. Manufacture of textiles; 21.+22. Manufacture of paper, printing, and publishing 20.+36.1 Manufacture of furniture.

We select SMEs belonging to the manufacturing sector based on the European Union recommendation L124/36 (2003/361/CE). According to this recommendation, a firm is considered to be an SME when it fulfils two of the following criteria: *i*) fewer than 250 employees; *ii*) assets under 43 million Euros; and *iii*) annual turnover under 50 million Euros.

To address the problem of possible result bias, as a consequence of the matter of the survival of high-tech and non high-tech SMEs, and, also, in order to have a more representative sample of the Portuguese manufacturing SME situation, we consider four types of SMEs: *i*) SMEs in the sample for the entire period of analysis (1999-2006); *ii*) SMEs entering the market during the period of analysis (1999-2006); *iii*) SMEs leaving the market during the period of analysis (1999-2006); and *iv*) SMEs that cease to be so during the period of analysis.

However, given the use of dynamic panel estimators, there are restrictions in including SMEs that are in the sample for a very limited number of years. Indeed, according to Arellano and Bond (1991) firms must be present in the database for at least four consecutive years to be considered in the econometric analysis, and in the second-order autocorrelation tests that are essential to validate the robustness of results. This being so, in addition to the criteria mentioned above, we also eliminate from the analysis all high-tech SMEs and non high-tech SMEs that are not in the database for at least four consecutive years.

Therefore, the sub-samples of high-tech SMEs and non high-tech SMEs in manufacturing industry are made up as follows: *i*) 135 high-tech SMEs, of which 76 are in the sample for the entire period of analysis, 31 SMEs entering the market in the period of analysis, 15 SMEs leaving the market in the period of analysis, and 13 SMEs that become large firms in the period of analysis; and *ii*) 330 non high-tech SMEs, of which 211 are in the market for the entire period of analysis, 48 SMEs entering the market in the period of analysis, 52 SMEs leaving the market in the period of analysis, and 19 SMEs that become large firms in the period of analysis.

The summarized sample composition is presented in the following table.

(Insert Table 1 About Here)

3.2. Descriptive Statistics

Table 2 presents the descriptive statistics of the variables referring to high-tech SMEs and non high-tech SMEs[6].

(Insert Table 2 About Here)

[6] The median of the cash flow variable (CF) for high-tech SMEs is 0.0566, and 0.0784 for non high-tech SMEs. The median of the growth opportunities variable (GO) is 0.1498 for high-tech SMEs and 0.0533 for non high-tech SMEs. Calculation of the medians of the cash flow and growth opportunities variables served as the basis for calculation of the HGOLCF and LGOHCF variables, as presented in section 3. Methodology and Research Hypotheses.

The results of the descriptive statistics, and corresponding tests of mean differences, reveal that non high-tech SMEs have higher levels of cash flow than high-tech SMEs. We also find that on average high-tech SMEs are younger, have greater size, and have greater growth opportunities than non high-tech SMEs. These results suggest that high-tech SMEs, although younger than non high-tech SMEs, have higher rates of growth and are larger, as a possible consequence of the characteristics of their operating markets, namely the need to reach a larger size than do non high-tech SMEs. The greater growth may contribute to the average risk of high-tech SMEs being above that one of the non high-tech SMEs, according to the results presented in Table 2.

Finally, we find that average level of tangible assets is higher in non high-tech SMEs than in high-tech SMEs. This result is likely associated with the higher level of intangible assets, namely R&D expenditures of high-tech SMEs.

4. Results

4.1. Pecking Order Theory

Model I

Table 3 below presents the results of the survival analysis.

(Insert Table 3 About Here)

Financial deficit contributes to diminishing the probability of survival of high-tech SMEs, something which does not occur with non high-tech SMEs. This result suggests that financing restrictions affect particularly the survival of high-tech SMEs.

The following tables present the results of the tests of Pecking Order Theory, concerning model I presented above in section 2[7].

[7] Appendix A presents in Tables A1 and A2, for high-tech SMEs and non high-tech SMEs respectively, the correlation matrixes between the variables used in Model I – Pecking Order Theory. The coefficients

(Insert Table 4 About Here)

(Insert Table 5 About Here)

Financial deficit is an important variable in explaining the debt variations of high-tech SMEs and non high-tech SMEs. It is worth mentioning that the regression constants are statistically significant[8], whether taking high-tech SMEs or non high-tech SMEs as the subject of analysis.

The statistically significant relationship between the inverse Mill´s ratio and debt variations allow us to conclude that the inclusion of the inverse Mill´s ratio in the regressions was shown to be effective in controlling for possible bias of the estimated results.

The results of the Chow test show that the impact of financial deficit on variations of debt is of a greater magnitude in the case of high-tech SMEs than in that of non high-tech SMEs.

Model II

Table 6 presents the results of the survival analysis referring to the tests of Pecking Order Theory - model II.

(Insert Table 6 About Here)

Cash flow and age are important determinants to increase the likelihood of survival of high-tech SMEs and non high-tech SMEs, although these factors seem to be of greater relative importance for the survival of high-tech SMEs than for the probability

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between the independent variables are not statistically significant, which indicates that the problem of collinearity between independent variables is not relevant.

[8] Although in the case of high-tech SMEs the constant is only statistically significant at 5%.

of survival of non high-tech SMEs, given the greater magnitude of the estimated parameters[9].

The following tables present the results of the tests of Pecking Order Theory, referring to Model II[10].

(Insert Table 7 About Here)

(Insert Table 8 About Here)

The results of the LM test suggest the rejection of the null hypothesis of irrelevance of non-observable individual effects. Therefore, an OLS regression is not the most suitable method to estimate relationships between determinants and debt in high-tech SMEs and non high-tech SMEs. Also, the results of the Hausman test indicate the rejection of the null hypothesis of absence of correlation between non-observable individual effects and the explanatory variables, and, so neither a regression is, considering random non-observable individual effects, a suitable method to estimate the relationships between determinants and debt in high-tech SMEs and non high-tech SMEs. Therefore, the most correct way to estimate the relationships in the situation presented before is to consider fixed non-observable individual effects in the regressions.

For high-tech SMEs, we find that: *i*) higher cash flow, greater age, and situations of low growth opportunities and high cash flow contribute to reduce debt; and *ii*) situations

[9] We find that the estimated parameters referring to cash flow and age are statistically significant at 1% in the case of high-tech SMEs, with the estimated parameters only being statistically significant at 5% in the case of non high-tech SMEs. This evidence indicates the greater relevance of cash flow and age for the survival of high-tech SMEs than for the survival of non high-tech SMEs.

[10] Appendix A presents in Tables A3 and A4, for high-tech SMEs and non high-tech SMEs respectively, the correlation matrixes between the variables used in Model II – Pecking Order Theory. The coefficients between the independent variables are not very high, indicating that the problem of collinearity between independent variables will not be particularly relevant.

of high growth opportunities and low cash flow contribute to increased debt. As for non high-tech SMEs, higher cash flow contributes to reduced debt.

Since a statistically significant relationship is found between the inverse Mill´s ratio and debt, we can conclude that the inclusion of the inverse Mill´s ratio in the regressions was revealed to be effective, in solving possible bias in the estimated results.

Regarding the results of the Chow test, we find that for all determinants, the null hypothesis of equality of estimated parameters is rejected. The result of the Chow test of the parameters as a whole confirms those differences.

4.2. Trade-Off Theory

The following table presents the regressions referring to the survival analysis.

(Insert Table 9 About Here)

We find that profitability, size and growth opportunities are important determinants for the survival of high-tech SMEs, while risk is a restrictive factor for the survival of this type of firm. Regarding non high-tech SMEs, profitability, size, tangible assets, and non-debt tax shields are important determinants of survival, but the level of risk is a restrictive factor of the survival of non high-tech SMEs[11].

Tables 10 and 11, present the results of the tests of Trade-Off Theory[12].

(Insert Table 10 About Here)

(Insert Table 11 About Here)

[11] We find that the estimated parameters for profitability and size are statistically significant at 1% in the case of high-tech SMEs, estimated parameters being only statistically significant at 5% in the case of non high-tech SMEs. We can therefore expect profitability and size to be of greater relative importance for the survival of high-tech SMEs than for that of non high-tech SMEs.

[12] Appendix A presents in Tables A5 and A6, for high-tech SMEs and non high-tech SMEs, respectively, the correlation matrixes between the variables used in the model – Trade-Off Theory. The coefficients between the independent variables are not very high, which indicates the problem of collinearity between independent variables will not be particularly relevant.

Whether focusing on high-tech SMEs or non high-tech SMEs as the subject of analysis, the results of the Hansen test indicate that we cannot reject the null hypothesis of validity of the instruments used. Additionally, the results of the second-order autocorrelation tests indicate we cannot reject the null hypothesis of absence of autocorrelation. Based on the results of the Hansen and second-order autocorrelation tests, we can consider the results obtained with the GMM system (1998) estimator as valid, and consequently open to interpretation.

The results obtained through the LSDVC (2005) estimator are almost identical to those obtained with the GMM system (1998) estimator, which reinforces the robustness of the empirical evidence obtained in this study.

For high-tech SMEs we find that: *i*) they adjust the actual level of debt towards target debt ratio; *ii*) greater profitability means less recourse to debt; and *iii*) greater size and higher level of tangible assets mean greater level of debt. As for non high-tech SMEs we find that: *i*) they adjust the actual level of debt towards target debt ratio; *ii*) greater profitability, greater growth opportunities, greater non-debt tax shields, and greater risk mean lower level of debt; and *iii*) greater size and higher effective tax rates mean greater level of debt.

The inclusion of the inverse Mill´s ratio in the regressions seems to be effective in controlling for possible bias of estimated results, since there is a statistically significant relationship between the inverse Mill´s ratio and debt.

The results of the Chow test indicate the rejection of the null hypothesis of equality of estimated parameters, except for the effective tax rate determinant. The result of the Chow test of estimated parameters as a whole confirms that there are significant differences between the debt determinants of high-tech SMEs and non high-tech SMEs.

5. Discussion of the Results

The results show that the impact of financial deficit on debt variations is greater for high-tech SMEs (*B*=0.88171) than for non high-tech SMEs (*B*=0.43928). These results show that the recourse of debt is considerably more influenced by insufficient internal finance in the case of the high-tech SMEs than in the case of the non high-tech SMEs. The particular importance of internal finance for high-tech SME is also revealed by the fact that cash flow contributes significantly to the probability of survival of those SMEs.

It is also important to mention that, although non high-tech SMEs and high-tech SMEs turn less to debt as a function of higher cash flow, the magnitude of the reduction of debt is considerably higher in the case of high-tech SMEs than in the case of non high-tech SMEs. We also find that greater age of high-tech SMEs results in lower level of debt, but this does not occur in the case of non high-tech SMEs. These results are particularly important because they show that the effect of reputation, provided by greater age (Diamond, 1989), may not be sufficiently important for high-tech SMEs to increase their level of debt, possibly preferring internal finance over time.

The empirical evidence obtained in this study suggests that high-tech SMEs may face particular difficulties in accessing debt, compared to what occurs in the case of non high-tech SMEs. On the one hand, the greater use of debt as a consequence of situations of financial deficit, on the other hand the greater reduction of the level of debt as a consequence of higher cash flow, suggest that high-tech SMEs face greater problems of information asymmetry associated with the lack of tangible assets, greater technological and market risk than do non high-tech SMEs.

On the basis of the descriptive statistics of this study, we verify that the average of growth opportunities is greater for high-tech SMEs than for non high-tech SMEs. In addition, from the survival analysis, we find that the growth opportunities are an important determinant of survival in the case of high-tech SMEs, but they are not in the case of non high-tech SMEs. However, the results obtained in this study indicate that the obstacles of high-tech SMEs in obtaining external finance may prevent these firms to implement their multiple growth opportunities, when internal finance is exhausted.

The results of this study show that high-tech SMEs increase the level of debt, when they have high growth opportunities and low cash flow, reducing the level of debt in the opposite situation, i.e., when they have low growth opportunities and high cash flow. These results are not found for non high-tech SMEs. The changes of debt as a function of growth opportunities and cash flow in high-tech SMEs suggest that they are not basically motivated by the goal to reach a target debt ratio, but they depend rather on the capacity of internal finance to fund the growth opportunities.

The empirical evidence obtained in this study allows us to conclude that the financing behaviour of high-tech SMEs is closer to the assumptions of Pecking Order Theory, compared to what occurs in the case of non high-tech SMEs, and so we can accept the research hypothesis H1.

The results regarding internal finance as the fundamental source of Portuguese high-tech SMEs corroborates the empirical evidence obtained by various authors in the context of other countries (Hao and Jaffe, 1993; Carpenter and Petersen, 2002; and Hall, 2002 - United States of America; Giudici and Paleari. 2000; Colombo and Grilli, 2007, and Scellato and Ughetto, 2009 – Italy; and, Carpentier et al., 2007 – France). Contributing to explain this result, we may point out that high-tech firms: *i*) have low level of tangible assets, which may contribute to lenders hindering access to debt (Revest and Sapio, 2010); *ii*) need to grow, which may contribute to increased operational risk, implying particularly adverse terms of access to debt (Giudici and Paleari, 2000); and *iii*) have high uncertainty associated with technological innovations and, consequently, greater uncertainty of success in operating markets that may also contribute to lenders hinder the access to debt to those SMEs (Revest and Sapio, 2010; Smith, 2010).

Regarding the applicability of Trade-Off Theory to the capital structure decisions of high-tech and non high-tech SMEs, we find that the adjustment of actual level of debt towards target debt ratio is greater of magnitude in non high-tech SMEs, with a level of adjustment between $\alpha = 0.42679$ (using the LSDVC estimator) and $\alpha = 0.44189$ (using the GMM system estimator) than in high-tech SMEs that verify a level of adjustment between $\alpha = 0.10777$ (using the LSDVC estimator) and $\alpha = 0.12182$ (using the GMM system estimator).

The business risk associated with the activities of high-tech SMEs implies greater probability of bankruptcy, increasing transaction costs, which may contribute decisively to the lower adjustment of actual level of debt towards target debt ratio in high-tech SMEs, compared to the adjustment found in non high-tech SMEs. High-tech SMEs' access to debt on particularly disadvantageous terms may contribute to these firms only consider debt as a last resort, since the high interest rates can create difficulties in managing the financial resources, hampering the firm´s productivity and profitability. This may contribute decisively for the adjustments of actual level of debt towards the target debt ratio being a merely secondary goal for high-tech SMEs.

For non high-tech SMEs, due to the lower risk associated with their activities, and consequently lower transaction costs in obtaining debt, it is possible the recourse to debt, to cover not only the insufficiencies of internal finance, but also with the goal of making adjustments of actual level of debt towards the target debt ratio.

Contrary to what is expected according to Trade-Off Theory, the relationship between profitability and debt is negative in high-tech and non high-tech SMEs.

Nevertheless, we find that the reduction of debt, as a consequence of greater profitability, is of a greater magnitude in high-tech SMEs than in non high-tech SMEs. These results show that increased profitability means a proportionately greater reduction of debt in high-tech SMEs, probably as a consequence of the greater importance of the problems of information asymmetry that these firms face.

The relationship between debt and size is positive for high-tech and non high-tech SMEs, corroborating what is predicted by Trade-Off Theory. It is worth to mention that the magnitude of the estimated parameter measuring the relationship between size and debt is greater for high-tech SMEs than for non high-tech SMEs. Additionally, the relationship between tangible assets and debt is positive in high-tech SMEs, which is according to Trade-Off Theory, but that relationship is not statistically significant in non high-tech SMEs. Considering only the relationships between size and debt, and between tangible assets and debt, we would conclude that the capital structure decisions of high-tech SME are closer to what is predicted by Trade-Off Theory than do the capital structure decisions of non high-tech SME. However, these results may arise from the greater problems of information asymmetry that affect high-tech SME activity. Indeed, given the high risk associated with high-tech SME activities, and the importance of intangible assets in their asset composition, their greater size and higher levels of tangible assets may be particularly important for diminishing the problems of information asymmetry with debtholders, allowing those SMEs to have greater access to debt on more favourable terms. In the context of non high-tech SMEs, greater size and higher levels of tangible assets lose importance in obtaining debt, given that these firms have a lower level of risk and higher levels of tangible assets, and so the marginal effects of size and tangible assets are of less relative importance for greater access to debt for non high-tech SMEs.

For high-tech SMEs, growth opportunities and risk are not determinants of debt. In the case of non high-tech SMEs, a higher level of growth opportunities and a higher level of risk mean lower level of debt, suggesting that non high-tech SMEs reduce the level of debt so as not to increase the probability of bankruptcy, and consequently, reducing their future growth opportunities. These results are according to the financing behaviour predicted by Trade-Off Theory.

Additionally, we find that the non debt tax shields and effective tax rate have no effect on the level of debt of high-tech SMEs. However, non high-tech SMEs reduce the level of debt in situations of greater non debt tax shields, increasing the level of debt in situations of higher effective tax rates. On the one hand, in situations of higher effective tax rates, non high-tech SMEs prefer to turn to more debt, and the trade-off between the marginal benefits and the marginal costs of debt seems to correspond to a higher level of debt. On the other hand, in situations of greater non-debt tax shields, non high-tech SMEs prefer to reduce debt, seeking to reduce the probability of bankruptcy, and the trade-off between the marginal benefits and the marginal costs of debt seems to correspond to a lower level of debt. This empirical evidence indicates that non high-tech SMEs consider a trade-off between the marginal benefits and the marginal costs of debt, in their capital structure decisions, as a function of the effective tax rate and non-debt tax shields.

Except for the relationships between size and debt and tangible assets and debt, the empirical evidence obtained allows us to conclude that the capital structure decisions of non high-tech SMEs are closer to Trade-Off Theory than do the capital structure decisions of high-tech SMEs. Therefore, we can accept the research hypothesis H2.

6. Conclusions and Implications

The current study is motivated by the importance of capital structure decisions of high-tech SMEs, given that the access to and cost of finance are some of the most important factors that affect the ability of high-techs firms to survive and grow. Therefore, this study seeks to fill the existing gap in the literature, by studying if capital structure decisions of high-tech SME are closer to the financing behaviour predicted by Pecking Order Theory, or alternatively to that predicted by Trade-Off Theory. Seeking to achieve the study's goals we consider two sub-samples of Portuguese SMEs: *i*) 135 high-tech SMEs; and *ii*) 330 non high-tech SMEs.

This paper makes two important contributions to the literature on capital structure decisions in general, and to the literature on capital structure decisions of high-tech SMEs and non high-tech SMEs in particular. Firstly, the paper is pioneering in direct use of the Pecking Order Theory and Trade-Off Theory models to capital structure decisions of high-tech SMEs and non high-tech SMEs. Secondly, it is pioneering in applying the two-step estimation method in the context of capital structure decisions of high-tech and non high-tech SMEs, allowing efficient estimation of the results, without the possible result bias arising from the survival issue.

The problems of asymmetric information, combined with SMEs' particular difficulty to achieve quotation in the stock market and their reluctance to open up capital to external investors, have repercussions for capital structure decisions of high-tech SMEs. The empirical evidence obtained in this study indicates that the capital structure decisions of high-tech SMEs are clearly different from those of non high-tech SMEs: *i*) capital structure decisions of high-tech SMEs are closer to the assumptions of Pecking Order Theory than do non high-tech SMEs; and *ii*) capital structure decisions of non high-tech SME are closer to the forecasts of Trade-Off Theory than do non high-tech

SMEs. More specifically, we find that: *i*) the impact of financial deficit on debt variations is of a considerably greater magnitude in high-tech SMEs than in non high-tech SMEs; and *ii*) the adjustment of actual level of debt towards target debt ratio is of a considerably greater magnitude in non high-tech SMEs than in high-tech SMEs.

The results of the current study indicate that high-tech SMEs need to acquire greater size, probably due to the need to reach a scale of efficiency that allows them to survive in the markets where they operate. Furthermore, high-tech SMEs with high growth opportunities and low levels of cash flow, in the presence of financial deficit, increase the level of debt. However, when high-tech SMEs are older, more profitable, and have low growth opportunities and high cash flow, they reduce the level of debt. The level of tangible assets and size are positively related to debt, which suggests that high-tech SMEs face problems of asymmetric information. These problems increase the costs of debt, which contributes to explain the lower level of adjustment of actual level of debt towards the target debt ratio of high-tech SMEs, compared to non high-tech SMEs. In general, the results suggest that high-tech SMEs follow the financing behavior predicted by the Pecking Order Theory.

For non high-tech SMEs, the non-debt tax shields and risk are negatively related to the level of debt, and the effective tax rate is positively related to the level of debt. Additionally, for non high-tech SME, growth opportunities are related negatively to debt, suggesting that as growth opportunities imply an increase of debt costs, they lose value for those SMEs. However, non high-tech SMES verify higher adjustments of actual level of debt towards the target debt ratio, suggesting less transaction costs for non high-tech SMEs than for high-tech SMEs. In general, the results suggest that capital structure decisions of non high-tech SME are close to what is predicted by Trade-off Theory. Therefore, non high-tech SMEs consider more effectively the possibility to reach a target debt ratio, therefore not turning to debt only in situations of insufficient internal finance.

Currently, high-tech SMEs have an important role in stimulating employment and economic growth, therefore they are especially important for developed economies in general, and for Portuguese economy in particular. In Portugal, SMEs do not fulfil the requirements to achieve quotation in the stock market, and they have little tradition of recourse to venture capital. Therefore, when internal finance is insufficient, given the considerable difficulty in obtaining debt, high-tech SMEs may face difficulty in financing their multiple growth opportunities, so jeopardizing their growth process and survival. Measures of economic policy in general, and of industrial policy in particular, should be directed specifically towards financial support for high-tech SMEs, creating special lines of credit. As high-tech SMEs can be important agents in stimulating employment and economic growth, the financial support is necessary so that profitable high-tech SMEs with capacity for innovation do not see threatened their survival and implementation of growth opportunities.

In future research, we suggest to study the importance of sources of finance of R&D expenditures for high-tech SMEs' survival and performance.

Appendix A: Correlations Matrix

Table A1: Correlation Matrix – High-Tech SMEs – Pecking Order Theory Model I

	$\Delta D_{i,t}$	$FD_{i,t}$	$\lambda_{i,t}$
$\Delta D_{i,t}$	1		
$FD_{i,t}$	0.76***	1	
$\lambda_{i,t}$	-0.34***	0.02	1

Notes: 1. *** statistical significant at the 1% level.

Table A2: Correlation Matrix – Non High-Tech SMEs – Pecking Order Theory Model I

	$\Delta D_{i,t}$	$FD_{i,t}$	$\lambda_{i,t}$
$\Delta D_{i,t}$	1		
$FD_{i,t}$	0.43***	1	
$\lambda_{i,t}$	-0.26***	0.01	1

Notes: 1. ** statistical significant at the 1% level. 2. ** statistical significant at the 5% level.

Table A3: Correlation Matrix – High-Tech SMEs – Pecking Order Theory Model II

	$D_{i,t}$	$CF_{i,t}$	$AGE_{i,t}$	$HGOLCF_{i,t}$	$LGOHCF_{i,t}$	$\lambda_{i,t}$
$D_{i,t}$	1					
$CF_{i,t}$	-0.30***	1				
$AGE_{i,t}$	0.04*	0.29***	1			
$HGOLCF_{i,t}$	0.02	-0.19***	-0.07**	1		
$LGOHCF_{i,t}$	-0.03	0.28***	0.11***	-0.30***	1	
$\lambda_{i,t}$	-0.22***	0.03	0.04*	0.01	-0.02	1

Notes: 1. *** statistical significant at the 1% level. 2.** statistical significant at the 5% level.
3. *statistical significant at the 10% level.

Table A4: Correlation Matrix – Non High-Tech SMEs – Pecking Order Theory Model II

	$D_{i,t}$	$CF_{i,t}$	$AGE_{i,t}$	$HGOLCF_{i,t}$	$LGOHCF_{i,t}$	$\lambda_{i,t}$
$D_{i,t}$	1					
$CF_{i,t}$	-0.24***	1				
$AGE_{i,t}$	0.03	0.07**	1			
$HGOLCF_{i,t}$	-0.01	-0.04*	-0.17***	1		
$LGOHCF_{i,t}$	0.11***	-0.07**	0.10***	-0.22***	1	
$\lambda_{i,t}$	-0.24**	-0.04*	-0.01	-0.02	0.01	1

Notes: 1. *** statistical significant at the 1% level. 2.** statistical significant at the 5% level.
3. *statistical significant at the 10% level.

Table A5: Correlation Matrix – High-Tech SMEs – Trade-Off Theory Model

	$D_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$TANG_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$	$ETR_{i,t}$	$EVOL_{i,t}$	$\lambda_{i,t}$
$D_{i,t}$	1								
$PROF_{i,t}$	-0.39***	1							
$SIZE_{i,t}$	0.12***	0.24***	1						
$TANG_{i,t}$	0.17***	0.02	-0.02	1					
$GO_{i,t}$	-0.01	0.08**	0.10***	0.01	1				
$NDTS_{i,t}$	0.04*	-0.04*	0.01	0.20***	-0.02	1			
$ETR_{i,t}$	-0.02	0.01	-0.02	0.04*	0.02	-0.05*	1		
$EVOL_{i,t}$	0.08**	-0.18***	-0.16***	0.02	0.21***	0.02	-0.01	1	
$\lambda_{i,t}$	-0.17***	-0.04*	0.02	0.08**	-0.01	0.07**	0.02	-0.06**	1

Notes: 1. *** statistical significant at the 1% level. 2.** statistical significant at the 5% level.
3. *statistical significant at the 10% level.

Table A6: Correlation Matrix – Non High-Tech SMEs – Trade-Off Theory Model

	$D_{i,t}$	$PROF_{i,t}$	$SIZE_{i,t}$	$TANG_{i,t}$	$GO_{i,t}$	$NDTS_{i,t}$	$ETR_{i,t}$	$EVOL_{i,t}$	$\lambda_{i,t}$
$D_{i,t}$	1								
$PROF_{i,t}$	-0.23***	1							
$SIZE_{i,t}$	0.07**	0.15***	1						
$TANG_{i,t}$	0.12***	-0.10***	0.25***	1					
$GO_{i,t}$	-0.15***	-0.02	-0.20***	-0.11***	1				
$NDTS_{i,t}$	-0.01	0.04*	0.12***	0.26***	-0.08**	1			
$ETR_{i,t}$	0.04*	-0.01	0.02	-0.02	0.01	0.01	1		
$EVOL_{i,t}$	-0.06**	-0.06**	-0.13***	-0.14***	0.12***	-0.02	0.04*	1	
$\lambda_{i,t}$	-0.15***	0.01	-0.02	-0.11***	-0.01	0.08**	-0.07**	0.02	1

Notes: 1. *** statistical significant at the 1% level. 2.** statistical significant at the 5% level.
3. *statistical significant at the 10% level.

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Table 1: Sample Description

	High-Tech SMEs Nace Classifications: 24.4; 30; 32; 33; 35.3		Non High-Tech SMEs Nace Classifications: 15+16; 17 through 19; 21+22; 20+36.1; 23; 24-24.4; 25; 26; 27.1 through 27.3+27.51/52; 27.4+27.53/54; 28; 29; 31; 34; 35.1; 35.2+35.4+35.5: 36.2 through 36.6	
	Number of Firms	Observations	Number of Firms	Observations
Incumbent firms in all period 1999 – 2006	76	532	211	1477
Firms entering in the period 1999 –2006	31	164	48	247
Firms exiting in the period 1999-2006	15	77	52	266
Firms that become large in the period 1999-2006	13	68	19	258
Total Number of SMEs	135		330	
Total Number of Observations		841		2248

Table 2: Descriptive Statistics

	High-Tech SMEs					Non High-Tech SMEs					Mean Difference Mann Whitney Z-Statistics
Variable	N	Mean	S.D.	Min.	Max	N	Mean	S.D.	Min	Max	
$\Delta D_{i,t}$	841	176644	976152	-1.97E+0.7	2.08E+0.7	2248	187812	1002341	-2.10E+0.7	1.08E+0.7	-0.78 (0.6144)
$FD_{i,t}$	841	-355671	1388712	-2.30E+0.7	1.78E+0.7	2248	-117381	834251	-7989192	996661	-6.11*** (0.0000)
$D_{i,t}$	841	0.61434	0.19055	0.02566	0.99564	2248	0.66943	0.2190	0.01738	0.99112	-0.68 (0.6908)
$CF_{i,t}$	841	0.05172	0.08432	-0.22738	1.4834	2248	0.06579	0.09056	-0.3473	1.3453	-2.021** (0.0403)
$AGE_{i,t}$	841	2.81822	0.71222	0	4.04737	2248	2.90294	0.72627	0	4.50393	-3.04*** (0.0000)
$HGOLCF_{i,t}$	841	0.1109	0.3091	0.0504	14.674	2248	0.03829	0.21526	0.1422	5.9312	-6.27*** (0.0000)
$LGOHCF_{i,t}$	841	0.04162	0.1011	-0.9672	0.0981	2248	-0.0434	0.1072	-1.8982	0.0498	-5.091** (0.0000)
$PROF_{i,t}$	841	0.04392	0.1050	-2.0349	1.2937	2248	0.04876	0.1124	-1.4781	0.5733	-1.45 (0.2782)
$SIZE_{i,t}$	841	8.7234	1.11673	4.1837	10.7084	2248	8.3918	1.06473	4.12374	10.7163	-2.01** (0.0409)
$TANG_{i,t}$	841	0.25771	0.20012	0	0.9934	2248	0.3435	0.2255	0.03421	0.9783	-2.345** (0.0197)
$GO_{i,t}$	841	0.07482	0.26373	-1.0234	8.0893	2248	0.05644	0.2274	-1.0783	6.7637	-2.98*** (0.0000)
$NTDS_{i,t}$	841	0.04783	0.0577	0	0.4771	2248	0.0546	0.06012	0	0.4895	-1.55* (0.0781)
$ETR_{i,t}$	841	0.4087	1.5663	-12.781	36.11	2248	0.4273	1.6088	-14.097	32.849	-0.55 (0.6552)
$EVOL_{i,t}$	841	1.9193	2.8514	0.0007	18.003	2248	1.4536	2.7610	0.0006	18.443	-2.371* (0.0182)

1. P - values in parentheses. 2. *** statistical significant at the 1% level. 3. ** statistical significant at the 5% level. 4. * statistical significant at the 10% level.

Table 3: Survival Analysis–Pecking Order Theory Model I

Dependent Variable: $Pr(\delta_{i,t}=1)$		
Independent Variables	High-Tech SMEs	Non High-Tech SMEs
$FD_{i,t}$	-0.000003***	0.000009
	(0.000001)	(0.0000016)
CONS	0.00483***	0.06247***
	(0.00012)	(0.00182)
Pseudo R^2	0.14839	0.04351
Log Likelihood	-95.83	-87.90
Firms	135	330
Observations	841	2248

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. ***statistical significance at the 1% level. 4. The estimates include sector *dummy* variables, but not show. 5. The estimates include time *dummy* variables, but are not shown.

Table 4: Impact of Financial Deficit on Debt Variations-Pecking Order Theory Model I

	High-Tech SMEs	Non High-Tech SMEs
	Dependent Variables	Dependent Variables
Independent variables	$\Delta D_{i,t}$	$\Delta D_{i,t}$
$FD_{i,t}$	0.88171***	0.43929***
	(0.07612)	(0.06473)
$\lambda_{i,t}$	-68.81***	-61.78***
	(11.45)	(10.96)
CONS	68194**	176712***
	(33113)	(34191)
F(N(0,1))	117.89***	98.71***
R^2	0.6443	0.4223
Firms	120	278
Observations	661	1782

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. *** statistical significance at the 1% level. 4. ** statistical significance at the 5% level. 5. The estimates include sector *dummy* variables, but not show. 6. The estimates include time *dummy* variables, but are not shown.

Table 5: Impact of Financial Deficit on Debt Variations - Chow Test – Pecking Order Theory Model I

	Dependent Variable: $\Delta D_{i,t}$
Independent variables	
$(FD_{i,t})\rho_{HT}-\rho_{NHT}=0$	74.49***
F(1,2443)	(0.0000)

Notes: 1. Probabilities for F statistics in parenthesis. 2. *** statistical significance at the 1% level.

Table 6: Survival Analysis – Pecking Order Theory Model II

	Dependent Variable: $Pr(\delta_{i,t}=1)$	
Independent Variables	High-Tech SMEs	Non High-Tech SMEs
$CF_{i,t}$	0.56789***	0.14731**
	(0.07009)	(0.07212)
$AGE_{i,t}$	0.17890***	0.09764**
	(0.05332)	(0.04633)
$HGOLCF_{i,t}$	0.02091	-0.01718
	(0.05544)	(0.06009)
$LGOHCF_{i,t}$	-0.01194	0.01615
	(0.03223)	(0.02451)
CONS	0.006718	0.00401
	(0.01021)	(0.01561)
Pseudo R^2	0.1291	0.1412
Log Likelihood	-112.34	-116.98
Firms	135	330
Observations	841	2248

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. *** statistical significance at the 1% level. 4. ** statistical significance at the 5% level. 5. The estimates include sector *dummy* variables, but not show. 6. The estimates include time *dummy* variables, but are not shown.

Table 7: Determinants of Debt – Pecking Order Theory Model II

	Dependent Variable: $D_{i,t}$					
	High-Tech SMEs			Non High-Tech SMEs		
Independent Variables	OLS Regression	Random Effects	Fixed Effects	OLS Regression	Random Effects	Fixed Effects
$CF_{i,t}$	-0.39019***	-0.49192***	-0.79182**	-0.36162***	-0.44019***	-0.47812***
	(0.11991)	(0.12421)	(0.17751)	(0.11911)	(0.12731)	(0.10192)
$AGE_{i,t}$	0.01010	0.01616	-0.06712***	0.01819	0.03211*	-0.02012
	(0.03178)	(0.02744)	(0.01821)	(0.02988)	(0.17023)	(0.04516)
$HGOLCF_{i,t}$	0.02112	0.03209**	0.06617***	-0.00819	0.01819	0.02244
	(0.03446)	(0.01589)	(0.01113)	(0.02556)	(0.03001)	(0.03559)
$LGOHCF_{i,t}$	-0.0144	-0.01273*	-0.04531***	0.02182***	0.02351*	-0.01811
	(0.02564)	(0.06112)	(0.01443)	(0.00671)	(0.01199)	(0.02998)
$\lambda_{i,t}$	-12.918***	-10.777**	-16.982**	-10.732**	-11.4536**	-18.671**
	(3.4536)	(2.4145)	(2.9185)	(2.6645)	(2.1997)	(4.0012)

CONS	0.01661*	0.01819	0.02321	0.06172**	0.11981***	0.09281***
	(0.00812)	(0.03426)	(0.03892)	(0.02014)	(0.03155)	(0.02547)
F(N(0.1))	105.34***		125.78***	106.65***		114.46***
Wald (χ^2)		184.44***			176.78***	
LM (χ^2)		151.10***			154.67**	
Hausman (N(0.1))		46.01***			50.07***	
R^2	0.4617	0.5081	0.6642	0.5617	0.5289	0.5873
Firms	120	120	120	278	278	278
Observations	661	661	661	1782	1782	1782

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. *** statistical significance at the 1% level. 4. ** statistical significance at the 5% level. 5. * statistical significance at the 10% level. 6. The estimates include sector *dummy* variables, but not show. 7. The estimates include time *dummy* variables, but are not shown.

Table 8: Pecking Order Theory Model II – Chow Test

	Dependent Variable: $D_{i,t}$
Independent variables	
$(CF_{i,t})\tau_{1HT}-\tau_{1NHT}=0$	15.67***
F(1,2443)	(0.0000)
$(AGE_{i,t})\tau_{2HT}-\tau_{2NHT}=0$	20.45***
F(1,2443)	(0.0000)
$(HGOLCF_{i,t})\ \tau_{3HT}-\tau_{3NHT}=0$	22.34***
F(1,2443)	(0.0000)
$(LGOHCF_{i,t})\ \tau_{4HT}-\tau_{4NHT}=0$	17.89***
F(1,2433)	(0.0000)
Global Difference	26.61***
F(4,2433)	(0.0000)

Notes: 1. Probabilities for F statistics in parenthesis. 2. *** statistical significance at the 1% level.

Table 9: Survival Analysis - Trade-Off Theory Model

	Dependent Variable: $Pr(\delta_{i,t}=1)$	
Independent Variables	High-Tech SMEs	Non High-Tech SMEs
$PROF_{i,t}$	0.59817***	0.17342**
	(0.08981)	(0.08601)
$SIZE_{i,t}$	0.16718***	0.05819**
	(0.04019)	(0.02813)
$TANG_{i,t}$	0.05123	0.16829***
	(0.07817)	(0.05718)
$GO_{i,t}$	0.12523***	0.04637
	(0.04101)	(0.07818)
$NDTS_{i,t}$	0.00391	0.06172***
	(0.01671)	(0.01918)
$ETR_{i,t}$	-0.00928	-0.01828
	(0.02438)	(0.05610)
$EVOL_{i,t}$	-0.05415***	-0.02792**
	(0.01558)	(0.01332)
CONS	0.01225	0.01019
	(0.02990)	(0.03526)
Pseudo R^2	0.2918	0.2681
Log Likelihood	-100.81	-146.92
Firms	135	330
Observations	841	2248

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. *** statistical significance at the 1% level. 4. ** statistical significance at the 5% level. 5. The estimates include sector *dummy* variables, but are not shown. 6. The estimates include time *dummy* variables, but are not shown.

Table 10: Trade-Off Theory Model

	High-Tech SMEs		Non High-Tech SMEs	
	Dependent Variable: $D_{i,t}$		Dependent Variable: $D_{i,t}$	
Independent Variables	GMM System (1998)	LSDVC (2005)	GMM System (1998)	LSDVC (2005)
$D_{i,t-1}$	0.87818***	0.89223***	0.55811***	0.57321***
	(0.09811)	(0.10924)	(0.05612)	(0.06173)
$PROF_{i,t}$	-0.90192***	-0.86171***	-0.43521***	-0.38291***
	(0.07182)	(0.06777)	(0.05141)	(0.04536)
$SIZE_{i,t}$	0.07181***	0.06881***	0.03516**	0.03716***

	(0.01828)	(0.01611)	(0.01722)	(0.01308)
$TANG_{i,t}$	0.35261***	0.38191***	0.08178	0.05161
	(0.10092)	(0.11779)	(0.14152)	(0.12332)
$GO_{i,t}$	0.01324	0.01998	-0.07181***	-0.06335***
	(0.03429)	(0.03777)	(0.02224)	(0.01881)
$NDTS_{i,t}$	0.05151	0.03444	-0.26171***	-0.20191**
	(0.09189)	(0.08877)	(0.00817)	(0.09811)
$ETR_{i,t}$	0.00971	0.01223	0.04831***	0.05727***
	(0.02873)	(0.03488)	(0.01012)	(0.01443)
$EVOL_{i,t}$	0.00455	-0.00342	-0.01453***	-0.01339***
	(0.01761)	(0.02091)	(0.00347)	(0.00401)
$\lambda_{i,t}$	-23.089	-26.778**	-18.871	-21.942**
	(4.0067)	(4.9676)	(3.9101)	(4.4251)
CONS	0.04771**		0.01918	
	(0.2334)		(0.03432)	
F(N(0,1))	62.12***		75.90***	
Hansen (N(0,1))	39.76		43.90	
m_1 (N(0,1))	-6.19***		-5.67***	
m_2 (N(0,1))	0.28		0.31	
Firms	120	120	278	278
Observations	661	661	1782	1782

Notes: 1. CONS is the constant of the regressions. 2. Standard deviations in parenthesis. 3. *** statistical significance at the 1% level.4. ** statistical significance at the 5% level. 5. The estimates include sector *dummy* variables, but are not shown. 6. The estimates include time *dummy* variables, but are not shown.

Table 11: Trade-Off Theory Model – Chow Test

	Dependent Variable: $D_{i,t}$	
Independent variables	GMM system (1998)	LSDVC (2005)
$(D_{i,t-1})\alpha_{HT}-\alpha_{NHT}=0$	37.65***	36.88***
F(1,2443)	(0.0000)	(0.0000)
$(PROF_{i,t-1})_N\ \beta_{1HT}-\beta_{1NHT}=0$	23.89***	24.31***
F(1,2443)	(0.0000)	(0.0000)
$(SIZE_{i,t})\beta_{2HT}-\beta_{2NHT}=0$	21.78***	19.33***
F(1,2443)	(0.0000)	(0.0000)
$(TANG_{i,t})\ \beta_{3HT}-\beta_{3NHT}=0$	21.17***	23.15***
F(1,2443)	(0.0000)	(0.0000)
$(GO_{i,t})\beta_{4HT}-\beta_{4NHT}=0$	28.90***	28.13***
F(1,2443)	(0.0000)	(0.0000)
$(NDTS_{i,t})\beta_{5HT}-\beta_{5NHT}=0$	21.49***	19.97***
F(1,2443)	(0.0000)	(0.0000)
$(ETR_{i,t})\beta_{6HT}-\beta_{6NHT}=0$	18.70***	20.98***
F(1,2443)	(0.0000)	(0.0000)
$(EVOL_{i,t})\beta_{7HT}-\beta_{7NHT}=0$	17.36***	15.01***
F(1,2443)	(0.0000)	(0.0000)
Global Difference	36.56***	34.98***
F(8,2443)	(0.0000)	(0.0000)

Notes: 1. Probabilities for F statistics in parenthesis. 2. *** statistical significance at the 1% level.