The dynamics of capital structure decisions*

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Abstract

In this paper we empirically test the tradeoff theory of capital structure against the pecking order theory using a unique dataset of micro, small, medium and large firms. We find some evidence in favour of the pecking order theory, given that there is a significant negative relationship between profitability and leverage. However we also observe that firms converge rapidly to their target debt ratios, thus providing evidence in favour of the trade-off theory. Given the speed of adjustment found in the results, we employ duration analysis to further analyse the dynamics of convergence to the target ratio. We conclude that firms which have to increase debt to reach their target take a longer time to do so than firms that have to decrease debt.

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Preliminary Version. Comments welcome!

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1 Introduction

In the corporate finance literature, there are two theories of capital structure that are relevant: the trade-off theory and the pecking order theory. The trade-off theory argues that firms choose the optimal level of debt by trading off the benefits of debt against its costs. The benefits of debt include tax deductibility of interest expenses and reduction of agency costs of equity derived from excess free cash flows. The costs of debt are mainly bankruptcy costs, either direct or indirect, and these may occur in a situation of excessive debt. According to this theory, there is an optimal level of debt which occurs when the marginal benefit equals the marginal cost of an additional unit of debt.

The pecking order theory is an alternative and more recent theory of capital structure. This theory argues that a pecking order in financing exists if there are information asymmetries in companies between the insiders, either shareholders or managers, and outsiders, mainly investors. In such case, the cost of issuing new securities is the most important issue and it goes beyond a discussion of benefits and costs of debt. The main prediction of this theory is that there is a hierarchy of financing sources. Hence, firms prefer to use retained earnings as their first financing source, followed by debt and, lastly, by equity. Equity is less interesting to firms, given that it entails larger information asymmetry costs, making its issuance more expensive relative to other funding sources.

The aim of this work is to look at decisions affecting the capital structure of firms. In other words, we discuss whether the leverage of firms follows more closely the predictions of the trade-off model and/or the pecking order model. The dataset covers the period from 1990 to 2007 and refers to detailed accounting data of micro, small, medium and large firms whereas most of the literature considers only large and publicly traded firms. In addition the database also includes other information such as the age of the firm and the number of employees.

We observe a significant negative relation between profitability and leverage, which supports the pecking order theory. However, we also observe that firms converge rapidly to their target leverage ratios, thus providing evidence in favour of the trade-off theory. We think these results may not be conflicting as they could refer to decisions made with different time-horizons in mind. Using duration analysis, we conclude that firms which have to increase debt to reach their target take a longer time to do so than firms that have to decrease debt.

This article is organized as follows. Section 2 overviews the trade-off and the pecking order theories and discusses their main predictions on leverage ratios. Section 3 briefly characterizes the dataset used. The next Section presents our empirical methodology and main results. Finally, Section 5 concludes the article.

2 How do firms choose their capital structure?

Since Modigliani and Miller's (1958) irrelevance proposition, firm's capital structure decisions have been intensely investigated. The irrelevance proposition states that under strict assumptions, among which is the absence of taxes, the structure of capital is irrelevant to the determination of a company's value. The assumption on taxes proved to be crucial for the irrelevance proposition. In fact, a few years later, Modigliani and Miller (1963) concluded that the introduction of corporate taxes and the possibility of deducting interest on debt from taxable profits would induce firms to be completely financed by debt. However, as this is not usually observed, several authors, including Modigliani and Miller themselves in Modigliani and Miller (1963), argued that bankruptcy costs, and other costs associated with debt could explain why firms were not totally financed by debt. This discussion on the benefits and costs of debt is central to the trade-off theory of capital structure. According to this theory, there are forces leading firms to less leverage, for instance bankruptcy costs, and forces leading to more leverage, among them the above mentioned tax benefits of debt and the agency costs of free cash flow. The combination of these forces results in the existence of a target leverage at which the value of firms is maximized. The main predictions of this theory on leverage ratios are related with the profitability of firms. In fact, profitability has a positive impact on leverage for three main reasons. First of all, as profitability increases bankruptcy costs decrease pushing firms to higher levels of debt. Second, as DeAngelo and Masulis (1980) argue, more profitable firms face higher expected tax rates than less or non-profitable firms. This asymmetric taxation of profits and losses drives more profitable firms to higher levels of debt as they would benefit more from the resulting tax benefits of debt. Third, more profitable firms tend to have more free cash flow, that is, more excess earnings over profitable investments. In the agency models of Jensen and Meckling (1976) and Jensen (1986), the interests of managers and shareholders are not aligned and managers tend to waste free cash flow in perquisites and/or bad investments. In such situations, the existence of debt payments helps to reduce agency costs of equity as these payments reduce excess cash in the firm. Besides profitability, there are other characteristics of firms that help to explain target leverages. According to theory, bankruptcy costs are expected to be lower for firms with more tangible assets as these could be used as collateral, in contrast to firms with more intangible assets. In addition, the existence of depreciation expenses helps to explain less leverage as these expenses result in tax benefits. Finally, in contrast with the above-mentioned agency models, firms with more investments would have less free cash flow for managers to allocate for their own benefit. Hence, for firms with more investments, debt is not as important as a way to monitor and constrain the actions of managers.

The pecking order theory was developed in Myers (1984), using the Myers and Majluf (1984) setting of asymmetric information. In their model, the insiders of the firm, typically the managers, are assumed to know more about the firms' prospects than outside investors. Being privy to confidential information, managers will issue risky securities only when they are overpriced (and will repurchase securities if they are underpriced). However, as investors anticipate this type of behaviour from the managers of the firm, they, the investors, will discount both new and the existing securities when new issues of risky securities are announced. As a result, managers may decide not to issue risky securities and possibly forego profitable investments because those issuances would be too expensive. To avoid distortions of investment decisions, the pecking order theory argues in favour of a hierarchy of financing. Firms are likely to finance their investments primarily with internal financing to prevent the firm from being exposed to the asymmetric information problem. If outside capital is needed, firms are likely to issue debt securities first, that is, those paying a predefined remuneration, which entails low risk. Only when the firm's debt capacity is reached should the firm consider equity as it is much riskier and investors would factor in a bigger discount. Some predictions of the pecking order are at odds with those of the trade-off theory. In the first place, there is no target leverage as each firm chooses its leverage ratio based on financing needs. Firms choose to use debt only when internal funds are not enough to cover their investment needs and not because there are benefits and costs from having debt. Secondly, profitable firms use less debt than less profitable ones. This effect derives from the fact that more profitable firms can finance a larger portion of their activity with internally generated funds. Finally, holding profitability constant, leverage is higher for firms with higher investments, as firms need to issue debt when investment exceeds internally generated earnings. In a more complex version of the theory, firms may be considering not only the present needs but also future needs of financing. In such cases, it is possible that firms with large expected investments would prefer to maintain some free debt capacity to avoid having to refuse profitable investments in the future or having to finance these good projects with new risky securities. In such cases, large expected investments help to explain less current leverage.[1]

Although the theories are in contradiction as far as the prediction of the impact of profitability on leverage ratios is concerned, they agree on the impact of volatility on leverage ratios. For the trade-off theory, the impact of volatility is negative as it increases bankruptcy costs. For the pecking order theory, firms with more volatile cash flows are also less likely to have debt in order to lower the possibility that they will have to issue new risky securities or forego future profitable investments when cash flows are low.

There are two more recent explanations of capital structure decisions, the market timing theory by Baker and Wurgler (2002) and the mechanical stock price explanation by Welch (2004). Baker

[1] For a more detailed discussion on the theory and empirical applications of capital structure decisions see Harris and Raviv (1991) and Fama and French (2002), among others.

and Wurgler (2002) argue that managers tend to "time the market" by issuing shares when the equity market is perceived as more favourable. This theory is in contrast with the pecking order hypothesis, as it assumes that managers are able to exploit information asymmetries to benefit current shareholders. On the other hand, as in the pecking order hypothesis, there is no reversion to a target capital ratio. To test their theory, Baker and Wurgler compare the market-to-book ratio with the capital that firms raise in the market. The Welch (2004) explanation of capital structure is based on share price fluctuations. According to this explanation, managers simply let market leverage ratios change because of share price fluctuations. However, given that most firms are not publicly traded, testing these theories with our data is not feasible and hence our analysis will focus on testing the first two above-mentioned theories.

Against this setting, we empirically test whether leverage decisions of firms follow the trade-off or the pecking order theory. Hence, we will study (i) how the level of leverage changes with firms' profitability and other firms' characteristics and (ii) if firms have an optimal target leverage to which they converge.

3 Data

This section provides a characterization of the Central Balance Sheet database held by Banco de Portugal. This database provides detailed accounting information on Portuguese firms,and is used mostly for economic and statistical purposes, covering more than 390 000 firms. In this work, only annual data will be used though quarterly data is also available for a smaller set of firms. Reporting was not compulsory before 2006. Despite that, the database covers around 60 per cent of total gross value added in the Portuguese economy up to 2005, with larger firms being covered more exhaustively than small and medium-sized ones. Even though this bias constitutes a shortcoming, the database is still is an extremely rich and unique dataset on non-financial corporations. From 2006 onwards the Central Balance Sheet database started to be filled in with information reported within the IES (Simplified Corporate Information). The IES is the result of a joint project by several entities (Ministry of Finance, Ministry of Justice, Statistics Portugal and Banco de Portugal). One advantage of the implementation of the IES is that it simplifies the reporting process of firms to different entities by concentrating all the reports in just one. In 2006 firms were asked to report information for the previous fiscal year and, as a result, the information in the Central Balance Sheet database from 2005 onwards refers to all companies operating in Portugal instead of just to a representative sample. The use of data from the Central Balance Sheet database enables differences in firm size, economic sector and age to be taken into account.

In Table 1 we present the debt structure of all the firms included in the database. We observe that bank loans are the main source of external finance for the companies included in the sample, accounting for more than 55 per cent of total debt. Trade credit accounts for slightly less than one fifth of firms' debt, though its importance has declined during the sample period. Debt securities represent a smaller amount of firms' debt (less than 10 per cent), even for the larger firms in the sample, thus illustrating the low importance of raising funding in debt markets for Portuguese firms.

In order to obtain non-spurious regression results we need to apply some filters to the data. First, we remove from the dataset observations with a negative value of assets and observations with a zero number of employees, in order to enhance the quality of data used for our analysis. We also remove observations for which there are less than two consecutive years of data and with no information on firm foundation date.[2] Moreover, to winsorize the dataset from spurious outlier observations, we delete observations below (and above) the 1st (99th) percentile for some relevant variables. We end up with a total number of more than 350 000 observations for the period from 1990 to 2007. These observations correspond to about 52 000 firms. On average, we observe firms for 9 years.

Table 1 also displays summary statistics for the leverage ratio, defined as bank loans and bonds as a percentage of total assets. When the whole sample is considered, the leverage ratio is, on average, 32 per cent, having remained relatively stable during the sample period. When only the reduced sample is considered, after applying the abovementioned filters, the leverage ratio decreases to around 22 per cent. Moreover, the median values for this sub-sample are much lower, standing at 4 per cent.

We created four classes of firms with different sizes considering simultaneously the value of sales and the number of employees (firm size definitions are presented in Table 2). Most of the firms in the sample are micro firms, having less than 10 employees and less than 2 million euros in turnover. As it would be expected, most of these firms do not use external finance, more specifically bonds and bank loans. The median leverage ratio for these firms is zero during the sample period. Small firms also represent a significant part of the sample. Their median leverage ratio stands at 8 per cent, referring almost exclusively to bank loans. Medium-sized firms are the most leveraged (their median leverage ratio is 14 per cent). Finally, large firms show a slightly lower median leverage ratio (12 per cent). Most bonds are issued by this last group of firms.

We also grouped firms according to their age. The average age of a firm in this dataset is 16 years. The percentile 10 of the variable age corresponds to 3 years, that is, 10 per cent of the

[2] These filters, most notably the foundation date, minimize the break in series from 2005 onwards, given that most of the firms included in the new information reporting system do not report their foundation date.

observations correspond to firms with less than 3 years. On the other hand, the percentile 90 corresponds to firms with 34 years. We defined four age classes according to the percentiles 25, 50 and 75 (see Table 3). We observe that leverage seems to be (non-linearly) increasing with firm age.

Finally, we also examine differences between economic sectors (Table 4), observing that the most leveraged sectors (taking into account median values) are real estate firms (18.7 per cent), followed by utilities (8.5), mining firms (7.4) and construction (5.4).

4 Leverage Regressions

The main objective of this paper is to evaluate which of the two most relevant capital structure theories better explains the capital structure decisions of Portuguese firms. On the one hand, according to the trade-off theory, firms balance the benefits of debt, such as tax benefits and lower agency costs of equity, with the costs of debt, such as bankruptcy costs. The optimal amount of leverage occurs when the marginal benefit of debt equals its marginal cost. As discussed in Section 2, this theory predicts that more profitable firms should have higher leverage ratios. On the other hand, the pecking order theory does not predict the existence of a target leverage ratio. Following this theory, firms would issue debt only if investment financing needs exceed their internally generated funds. Empirically, this should lead to results opposite from those predicted by the trade off theory. More profitable firms should be less indebted, as they do not need to finance as much of their activity with outside capital. Moreover, firms engaging in larger investment projects should have larger leverage ratios.

We begin by analysing the determinants of the leverage ratio. This analysis provides a direct test of the pecking order, but it does not make it possible to establish clear conclusions regarding the trade-off theory. In order to analyse the latter, we empirically test whether firms adjust their leverage ratios in order to converge to a target ratio.

4.1 Explaining the leverage ratios

Our empirical research strategy is to estimate a fixed effects panel data model such that:

$$\frac{D}{A}_{it} = f_i + \beta_1 + \beta_2 \frac{CF}{A}_{it} + \beta_3 X_{it} + \psi_t + \varepsilon_{it}.$$

Our dependent variable is $\frac{D}{A}_{it}$, the leverage ratio, defined as bonds and loans as a percentage of total assets. The main variable of interest to test this theory is $\frac{CF}{A}_{it}$, which is computed as net earnings before provisions and depreciation, scaled by firms' assets.[3] The coefficient β_2 will play a central role in testing the pecking order theory, given that only if it assumes negative (and significant) values there will be evidence in favour of this theory.

In order to accurately estimate β_2, we need to control for relevant firm characteristics which may also affect firms' leverage. The vector X_{it} refers to this set of control variables, which includes *Sales Growth*, $\frac{Tangible\ Assets}{Assets}$, *Assets*, *Group Dummy*, *Liquidity*, *R&D Dummy* and *Depreciation*. All these variables are firm-specific and time-varying. *Sales growth* is the year-on-year change of sales, which is included in the regressions to control for firm's growth. $\frac{Tangible\ Assets}{Assets}$, the share of tangible assets in total assets, controls for the asset structure of the firm, and also for the collateral potentially available for debt contracts. Firms whose assets are mostly comprised of intangibles may find it harder to obtain bank financing, thus displaying lower leverage ratios. In fact, as bankruptcy costs play a prominent role in the trade-off theory, asset tangibility is predicted to have a positive impact on leverage. We also consider a dummy variable which considers whether the firm belongs to a group, as this may yield important differences in terms of capital structure decisions, given the possibility of access to intra-group funding. If a firm records assets or liabilities within a group, then this variable takes the value one. In our regressions we also control for *Liquidity*, defined as short-term securities and cash as a percentage of short-term debt. Another potentially relevant explanatory variable is the *R&D Dummy*, which takes the value one whenever the firm records some R&D investment. This variable can be taken as a proxy for expected investment opportunities. In addition, together with the variable *Depreciation*, it also serves as a proxy for non-debt tax shields. In fact, expenditures on depreciations and provisions, which have important fiscal implications for firms, may also condition capital structure decisions. Thus, we also control for depreciations and provisions, measured as a percentage of total assets. Finally, given the apparent importance of firm size on leverage ratios, we use the logarithm of assets as a control variable as well. Moreover, in all regressions presented we control for time and firm fixed effects.

In Table 5 we present a brief statistical description of the variables considered in this analysis and in Table 6 we include a correlation matrix of the same variables.

Table 7 presents our first regression results. In the first column we present the results for a simple estimation, in which we consider as explanatory variable only the cash-flow ratio, which is our main variable of interest. We control, as in all other regressions, for time and firm fixed effects. We obtain a significant negative coefficient for cash-flow. These preliminary results seem

[3] Alternatively, it would be possible to use a profitability measure, such as net earnings over assets. The results obtained are similar to those resulting from the cash-flow ratio.

to be in favour of the pecking order theory: firms with more available funds will use less external funding than other companies.

However, this specification is clearly insufficient for more definite conclusions to be reached, given that several other firm characteristics are also likely to be important in explaining leverage ratios. Hence, in the second column of Table 7 we present another regression, in which we include the control variables specified above: *Sales Growth*, $\frac{Tangible\ Assets}{Assets}$, *Assets*, *Group Dummy*, *Liquidity*, *R&D Dummy* and *Depreciation*. The results obtained with this specification are consistent with those obtained with previous simple regression, as the coefficient associated with cash-flow is hardly affected by the change in specification, remaining negative and statistically very significant.

The coefficients obtained for the control variables are all statistically significant at 5 per cent (except for the *Group Dummy*). First, firms with stronger sales growth show lower leverage ratios, even though this effect is very small. If this variable is seen as a proxy for growth opportunities, this negative coefficient is consistent with the trade-off theory, as risk tends to be higher for these firms, pushing up bankruptcy costs. However, it is also consistent with the complex view of the pecking order theory, which argues that firms would rather maintain low-risk debt capacity to avoid foregoing future investments or having to finance them with new risky securities. Firms with more tangible assets (and hence with more collateral potentially available for credit) are also more indebted than other firms, as the trade-off theory predicts. Firm size seems to be extremely important in explaining leverage ratios, as larger firms show much higher leverage ratios than other firms, other firm characteristics being controlled for. This is consistent with the view that larger firms tend to be more diversified and, hence, less volatile, as discussed by Fama and French (2002). We also observe that firms belonging to a group depend less on debt, as would be expected, even though this effect is only statistically significant at a 10 percent level. Firms with stronger liquidity buffers are also less indebted. In contrast, we observe that firms engaging in R&D activities show higher leverage ratios than others. Finally, firms with more significant depreciations and provisions, as a percentage of their assets, also record higher leverage ratios. This effect does not comply with the predictions of the trade-off theory.

Nevertheless, the results for this second specification may be seriously affected by simultaneity issues. In fact, it is possible that there are some unobserved time-varying variables which simultaneously affect the leverage ratio and other firm-specific variables, thus leading to potentially serious endogeneity problems. In order to minimize this potential problem, we consider an alternative specification, in which all explanatory variables are lagged by one year, such that:

$$\frac{D}{A}_{it} = f_i + \beta_1 + \beta_2 \frac{CF}{A}_{it-1} + \beta_3 X_{it-1} + \psi_t + \varepsilon_{it} \qquad (1)$$

This specification is presented in the last column of Table 7. The estimated coefficient for cash-flow remains consistent with that previously observed: firms with more available funds are less indebted than other firms, controlling for other relevant firm characteristics, thus providing evidence in favour of the pecking order theory. As regards the other firm control variables, there are some differences worth noticing. In particular, *Sales Growth* and *Depreciation* are no longer statistically significant at a 5 per cent level. For all other control variables, the results are generally consistent with those observed in the previous specification.

Our results are broadly consistent with those obtained by Fama and French (2002). These authors estimate a model similar to (1) without considering firm-level fixed effects. We consider that the inclusion of firm level-fixed effects is crucial as they control for time invariant unobserved heterogeneity at the firm level. Their estimates produce negative coefficients on profitability, thus supporting the pecking order theory.

The results presented in the previous section suggest that the determinants of firm leverage may be considerably different depending on firms' size and age. In order to better explore these possible differences, we estimate the regression with all explanatory variables lagged by one year for different size and age cohorts. The results of these estimations are displayed in Table 8. First, we observe that the estimated coefficient for $\frac{CF}{A}_{it-1}$ remains negative and statistically significant regardless of firm size. Moreover, we observe that this coefficient becomes larger, in absolute value, as firm size increases, thus suggesting that large firms with more internal funds available use less external funding than comparable smaller firms. We obtain a similar result when we estimate the regressions by firm age: older firms have a similar behaviour to that of larger firms. These results continue to give support to the pecking order hypothesis.

In terms of the other control variables, the results are broadly consistent with those previously obtained. *Sales Growth*, *Group Dummy* and *Depreciation* are not significant and the remaining variables hold the same signals, when significant. Interestingly, *R&D Dummy* is only significant for the older firms.

For robustness purposes, we also estimate the regression for different sectors. In Table 8 we present the results for manufacturing firms, as these represent a large part of the sample used. The results are broadly consistent with those previously obtained and there is a slight improvement in the model's adjustment quality.

It is important to notice that more than 40 percent of the firms in the sample do not rely either on bank or market financing, thus having null leverage ratios. Given the possibility that this feature may affect the results of the estimations, we also present in Table 8 the regression estimated only for firms with positive leverage. Interestingly, there are some differences in the determinants of leverage ratios for this specific group of firms. Nevertheless, the results for our variable of interest, $\frac{CF}{A}_{it-1}$, remain unchanged. The main difference is that the liquidity ratio is no longer statistically significant, whereas *Depreciation* has now a positive significant impact on leverage. Considering that the decision on whether to seek external funding or not can be made before the choice of the leverage ratio, we also estimate a discrete choice regression to empirically analyse this preliminary decision to use external funds. In this regression, the dependent variable is a binary variable which takes the value one when the firm has positive leverage. The results are also shown in Table 8. Firms with positive leverage ratios have lower cash-flow ratios than firms with no external funding, other characteristics controlled for. All other firm characteristics considered yield results consistent with those previously obtained.

Finally, we also test an alternative definition of leverage, considering only long-term bonds and bank loans, as done by Flannery and Rangan (2006). Again, the results remain broadly consistent with those obtained in the other specifications.

4.2 Do firms have a target leverage ratio?

As discussed in Section 2, firms may have target leverage ratios to which they gradually converge over time. This is a central result of the trade-off theory. In order to test whether this conclusion is valid for the firms in our dataset, we estimate a two-step regression, in a spirit similar to that of Fama and French (2002). In the first step, we estimate a regression as defined in equation (1). However, given that the distribution of the leverage ratio has a clear discontinuity, with more than 40 percent of the firms having null leverage ratios, we estimate this regression only for the firms with positive leverage. The fitted values of this regression are our measure of the target leverage ratio. For firms without leverage, we consider that their target is zero.[4] In addition, for firms for which we obtain negative target ratios, we replace their targets by zero.

In the second-step regression, we use the fitted values of the first-step as a proxy for the target leverage (TL) in a partial adjustment model. In this model, changes in leverage ratios partially reflect the difference between firms' target leverage and the previous year's observed leverage ratio. We then estimate the following regression:

$$\Delta \frac{D}{A}_{it} = f_i + \beta_1 + \beta_2 adjust_{it} + \beta_3 \Delta \frac{CF}{A}_{it} + \beta_4 \Delta \frac{CF}{A}_{it-1} + \beta_5 \frac{Inv}{A}_{it} + \beta_6 \frac{Inv}{A}_{it-1} + \psi_t + \varepsilon_{it}$$

[4] We also estimated target leverage ratios for all the firms in the sample, and the results remain robust.

where,

$$adjust_{it} = \left[TL_{it} - \frac{D}{A}_{it-1} \right]$$

and the variable $\frac{Inv}{A}$ measures investment expenditures scaled by total assets. The estimation of this partial adjustment model allows us to test the trade-off theory given that, according to this theory, firms have target leverage ratios and move toward the target over time.[5] Hence, β_2, which measures the speed of adjustment should be positive. However, this parameter is expected to be null if the pecking order theory is valid. The investment and cash flow variables are included to control for any short-term movements in leverage away from the target. The results of this estimation are presented in the first column of Table 9. The adjustment variable has a coefficient of 0.61, which means that every year firms get 60 percent closer to their target leverage ratio. Hence, the results are clearly in favour of an adjustment toward the target, thus providing evidence in favour of the trade-off theory. As financing costs are higher for equity, the pecking order theory predicts that short-term variation in cash flow and investments should be absorbed by variations in debt, which is exactly what we observe. Our results are consistent with the ones in Fama and French (2002), Flannery and Rangan (2006), Antoniou *et al* (2008) and Huang and Ritter (2009) although the speed of adjustment found by these authors is much smaller than ours.

Given the discontinuity in the distribution of leverage ratios, we estimate the same regression only for the firms with positive leverage. Results are presented in the second column of Table 9. The results obtained are perfectly consistent with the ones for the full sample.

Furthermore, given that firm size may be associated with different adjustment capabilities, we run the second step regression for different firm size groups. Interestingly, we observe that there are indeed different adjustment speeds. In fact, smaller firms are able to adjust much faster to their target leverage ratio. The adjustment variable has a coefficient of 0.75 for micro firms and of only 0.33 for large firms.[6] This adjustment pattern may help to explain the differences between our results and those obtained by Fama and French (2002), given that their dataset covers only large firms.

Moreover, we also consider the possibility of differences between two adjustment paths. In fact, firms can either increase or decrease their leverage in order to achieve their target ratio. We observe that firms which have a negative adjustment (i.e., their target is below their current

[5] In the presence of a cointegration relationship, a different estimation approach should be followed. However, as the results presented in Table 10 use more than 35,000 firms, observed over 5 years, on average, the stationarity and cointegration tests for panel datasets cannot benefit from the necessary asymptotic properties. In this case, as the panel dataset has a small T and a large N, the existing panel data procedures are sufficient to consider very general temporal correlation patterns (see Hsiao, 2003).

[6] We conducted the same exercise but estimating target leverage ratios in separate regressions according to firm size. The results remain consistent.

leverage) are able to reach their target faster than firms that have to increase leverage. This result seems to suggest the existence of financial constraints in issuing new financial liabilities, as well as relatively high flexibility in decreasing leverage if firms' are affected by a negative shock on their equilibrium leverage ratio.

An alternative empirical strategy to test whether firms converge toward a target leverage ratio consists in using a one-step procedure as in Flannery and Rangan (2006). These authors compare different methodologies and argue that adding the lagged dependent variable on the right hand side of the equation is crucial and that a simple cross-sectional regression appears to omit this important variable. In addition, unlike Fama and French (2002), they do not estimate the model in two stages. Instead of using the model in (1) to generate a leverage target proxy and then use this proxy in a partial adjustment model, they estimate the partial adjustment model in just one step. They believe the two-stage estimation helps explaining the low speed of adjustment found in other works. We proceed to this estimation by rewriting the equations used in the first step, such that:

$$\frac{D}{A}_{it} = f_i + \beta_1 + \beta_2 \frac{D}{A}_{it-1} + \beta_3 \frac{D}{A}_{it-2} + \beta_4 \frac{CF}{A}_{it-1} + \beta_5 X_{it-1} + \psi_t + \varepsilon_{it}$$

where X_{it-1} consists of the set of control variables used in the previous subsection. In order to estimate this regression, we use a fixed effects dynamic panel data model, with the Arellano-Bond (1991) estimator, using difference equations. The results are presented in Table 10. There is a clear persistence of leverage ratios over time, confirming the hypothesis that firms converge to an endogenously defined target leverage ratio. The coefficients for the control variables are consistent with those obtained before.

However, to accurately test the two main theories proposed in the literature, we need to add another variable to the regressions. This additional variable, which we call financial deficit, measures the funding needs of firms for investment and is defined as the sum of the change in working capital and of investment, less the cash-flow generated by the firm (all scaled by firms' assets) as in Frank and Goyal (2003). Firms with a larger financial deficit will likely need to rely more on external funding. In column 2 we present the results for this estimation. The results obtained continue to suggest a strong adjustment toward target leverage ratios. The financial deficit is not statistically significant, contrary to the results obtained by Flannery and Rangan (2006), who observe a positive and significant coefficient.

4.3 The speed of adjustment

The results obtained in the previous subsection suggest that firms converge rapidly to their target leverage ratio. The speed of adjustment is specially high for the smallest firms in the sample which can help to explain the differences between our results and those usually found in the literature, as most available databases include mainly large and publicly traded firms. To further explore these results, we employ duration analysis, evaluating the time until a firm is close to its target leverage.[7] The following results are still work in progress and should be regarded as preliminary.

In Figure 1 we present the hazard function,[8] observing that the probability of reaching the target is strongly increasing over the first years. In Figures 2 and 3 we depict the Kaplan-Meier survival estimate[9] for the two possible adjustment paths (positive and negative, respectively). We observe that the adjustment is much faster when firms have to make a negative adjustment, i.e., when their target leverage ratio is below their current leverage.

This econometric framework allows us to estimate semiparametric Cox regressions[10] in order to evaluate which firm characteristics are relevant to explain differences in the time firms take to reach their target ratio. We find that firms which belong to a group or that have higher liquidity ratios take, on average, a longer time to converge to their optimal debt ratio (Table 11). In turn, larger firms, as well as those with more tangible assets and with some R&D expenses are able to reach their targets sooner. As discussed previously, the rebalancing pattern of firms with positive or negative adjustments may be very different, even though this issue has not been much discussed in the literature. By running separate regressions for these two different cases, we observe that the determinants do not differ significantly with the exception of the cash flow ratio. In fact, whereas firms that have to increase debt to reach their target take a longer time to do so if they have more available cash flow, given that they face a less severe pressure to obtain external funds. In contrast, firms which aim to reduce debt, are able to do so faster if they are able to internally generate more cash flow, as expected.

[7] As a baseline definition we consider that the firm is close to the target when the observed leverage ratio is within the interval [90%,110%] of the initial estimated target. For robustness purposes we also considered the broader interval [80%, 120%]. Our approach differs from the one by Leary and Roberts (2005) who also employ duration analysis to assess how do firms rebalance their leverage to stay within an optimal range.

[8] The hazard function is defined as the probability of a firm leaving default in the time interval $[t, t + dt)$, conditional on being in default: $h(t) = \lim \frac{\Pr(t \leq T < t+dt | T \geq t)}{dt}, dt \to 0$.

[9] The survivor estimate is defined as the probability of remaining in default until t: $S(t) = \Pr(T \geq t) = 1 - F(t)$.

[10] The Cox proportional hazard model may be defined as: $h(t, X(t), Z(t)) = \kappa(X(t), Z(t))h_0(t)$, where $\kappa(.)$ is a non-negative function of $X(t)$ and $Z(t)$, and $h_0(t)$ is defined as the baseline hazard, which is common to all firms (individual hazard functions differ from each other proportionally, as a function of $\kappa(X(t), Z(t))$. This is a partly non-parametric approach, given that we can estimate unknown parameters of $\kappa(.)$ without specifying the form of the baseline hazard.

5 Concluding remarks

In this paper we propose to empirically test the two most prominent theories of capital structure, the pecking order and the trade-off theories. In order to do so, we explore the information contained in the Portuguese Central Balance Sheet. We observe that banks are the most important source of long-term debt for Portuguese non-financial corporations, as access to market funding is to some extent limited to larger firms.

In this paper, we followed two distinct empirical strategies. First, we estimated a simple panel data regression, with time and firm fixed effects, using as dependent variable firms' leverage ratio. By using the cash-flow as an explanatory variable, we are able to test some of the predictions of the pecking order theory. According to this theory, firms with more available internal funds should have less external funding. The results obtained with these estimations are broadly consistent with these predictions. However, this simple regression does not allow us to test the trade-off model.

Second, in order to be able to also test the predictions of the trade-off theory, we follow a complementary route. We estimate models of partial adjustment, to verify to what extent firms adjust their debt to a target leverage ratio. We observe that this adjustment exists and, when compared with other empirical studies, seems to be very strong. Hence, these results are supportive of the trade-off theory.

The results obtained with these two different strategies are not necessarily contradictory, as they may reflect decisions made in different time horizons.

Given the speed of adjustment found in the results, we employ duration analysis to further analyse the dynamics of convergence to the target ratio. Our results suggest that larger firms are able to reach their targets faster. Moreover, we also conclude that firms which have to increase debt to reach their target take a longer time to do so than firms that have to decrease debt. These results are preliminary and deserve further analysis.

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Tables and Figures

Table 1 – Debt decomposition and leverage of the corporate sector – Central Balance Sheet sample

	Debt composition of the total sample (% of total debt)				Leverage [(Loans + Bonds)/Assets]		
	Loans (1)	Debt securities	Trade credit (2)	Other debt	Total Sample (3)	Average values for the reduced sample (4)	Median values for the reduced sample
1990	50.7	6.5	22.5	19.5	32.1	25.7	1.8
1991	49.8	5.8	22.4	21.3	30.6	25.4	1.7
1992	50.4	5.6	21.4	22.1	30.8	25.6	1.7
1993	56.3	5.1	18.0	20.1	30.4	26.4	0.6
1994	48.5	7.8	18.6	24.6	26.6	19.1	0.4
1995	49.3	8.0	22.9	19.3	27.1	18.9	0.3
1996	49.4	6.7	24.6	18.7	29.5	20.8	1.3
1997	50.1	8.0	23.4	18.0	29.5	21.4	2.2
1998	49.2	9.1	23.8	17.3	27.3	20.0	3.5
1999	51.6	11.8	19.6	16.5	29.8	21.6	4.6
2000	59.9	6.8	18.0	14.7	29.8	19.1	7.3
2001	62.1	5.7	17.4	14.0	32.0	20.1	7.0
2002	62.3	6.1	17.0	14.0	32.3	21.0	7.2
2003	60.9	6.5	16.9	15.1	31.7	21.4	7.4
2004	61.2	8.2	16.3	13.6	32.3	21.5	6.9
2005	57.1	5.9	18.5	17.5	32.1	21.4	6.8
2006	56.5	7.8	17.7	17.4	33.8	23.3	5.3
2007	57.1	7.9	17.0	17.2	34.2	23.1	5.1
Total	56.9	7.3	18.4	16.7	31.9	21.5	4.0
Number of observ	1 331 253	1 331 253	1 331 253	1 331 253	1 331 253	350 212	350 212
Number of firms	391 327	391 327	391 327	391 327	391 327	52 825	52 825
Median number of years a firm is	3	3	3	3	3	9	9

Source: Central Balance Sheet database.

Notes: weighted averages except for the last column which reports median values. (1) It includes loans granted by other firms in the same financial group and Accounts Payable to suppliers of fixed assets. (2) It considers only Accounts Payables. (3) It includes loans granted by other firms in the same financial group and Accounts Payables to suppliers of fixed assets. (4) Reduced sample after the application of filters.

Table 2 – Characterization of data by firm size

	Number of employees (E)	Annual Sales (S) in million euros	Number of observations	Number of firms	Leverage (median)
Micro	$E \leq 10$	$S \leq 2$	171,953	38,185	0.0
Small	$10 < E \leq 50$	$2 < S \leq 10$	118,688	26,828	8.1
Medium	$50 < E \leq 250$	$10 < S \leq 50$	47,088	9,409	14.0
Large	$E > 250$	$S > 50$	12,479	2,063	12.1

Note: the sum of the column with the number of firms is higher than 50 000 as firms changed from one class size to another.

Table 3 – Characterization of data by firm age

Age class	Firm age in number of years (Y)	Number of observations	Leverage (median)
1	Y ≤ 7	77,363	0.0
2	$7 < Y \leq 13$	86,194	3.8
3	$13 < Y \leq 22$	94,029	6.0
4	$Y > 22$	92,622	5.8

Table 4 – Leverage by sector

	Number of observations	Leverage	
		mean	median
Agric	11,174	14.4	5.2
Commerc	82,102	12.4	5.0
Constr	48,999	14.9	5.4
Education	1,393	13.4	4.4
Fish	1,099	14.2	4.9
Health	1,867	12.2	2.5
Indust	142,155	11.9	5.1
Mining	3,697	13.2	7.4
Other	2,679	10.9	1.2
Other_serv	10,183	11.4	1.6
Real_est	3,716	25.3	18.7
Tourism	7,580	12.3	0.0
Transp	28,793	7.0	-
Utilities	1,269	19.3	8.5

Table 5 – Summary statistics

	N	mean	sd	min	p5	p25	p50	p75	p95	max
Leverage	346 706	12.3	16.7	0.0	0.0	0.0	4.0	20.3	47.8	81.5
CF_A	343 204	6.8	12.9	-71.4	-13.1	2.1	6.5	12.7	26.7	52.7
Inv_A	343 204	5.9	9.7	-11.2	0.0	0.0	1.8	7.4	27.1	59.3
Sales growth	269 933	8.0	43.1	-100.0	-46.5	-10.0	3.5	18.8	73.4	364.3
Tang_assets	350 208	26.8	23.7	0.0	0.3	6.8	20.6	41.6	74.9	128.6
ln_Assets	350 208	13.2	2.0	1.6	10.1	11.8	13.1	14.5	16.7	23.4
D_group	350 208	0.2	0.4	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Liquidity	340 507	56.1	160.4	0.0	0.3	3.0	11.0	37.6	244.8	1941.8
D_RD	350 208	0.2	0.4	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Dep_prov_A	346 706	6.3	6.0	0.0	0.1	2.0	4.7	8.9	18.5	35.4

Notes: CF_A is net earnings before provisions and depreciation as a % of assets. Inv_A stands for investment as a % of assets and Tang_assets is the share of tangible assets in total assets. D_group is a dummy variable which takes the value one when the firm is consolidated in a group. Liq is a measure of liquidity, defined as short term securities and cash as a % of short term debt. D_RD is a dummy variable which takes the value one whenever the firm has invested in R&D. Dep_prov_A is depreciations and provisions for the year as a % of total assets.

Table 6 – Correlation matrix

	Leverage	CF_A	Inv_A	Sales growth	Tang_assets	Ln_assets	D_group	Liquidity	D_RD	Dep_prov_A
Leverage	1									
CF_A	-0.1348*	1								
Inv_A	-0.0149*	0.2033*	1							
Sales growth	-0.0173*	0.1807*	0.1386*	1						
Tang_assets	0.0450*	0.1513*	0.3977*	0.0416*	1					
Ln_assets	0.3195*	-0.0026	-0.0315*	0.0026	0.0246*	1				
D_group	0.1233*	-0.0231*	-0.0406*	-0.0183*	0.0138*	0.4801*	1			
Liquidity	-0.1523*	0.0909*	-0.0498*	-0.0234*	-0.0652*	-0.1480*	-0.0609*	1		
D_RD	0.1399*	0.0071*	0.0475*	-0.0022	0.1082*	0.3640*	0.2451*	-0.0618*	1	
Dep_prov_A	-0.0355*	0.2881*	0.0779*	0.0064*	0.1243*	-0.1047*	-0.0271*	0.0002	-0.0089*	1

Notes: * indicates that the correlation is significant at the 5% level. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Inv_A stands for investment as a % of assets and Tang_assets is the share of tangible assets in total assets. D_group is a dummy variable which takes the value one when the firm is consolidated in a group. Liq is a measure of liquidity, defined as short term securities and cash as a % of short term debt. D_RD is a dummy variable which takes the value one whenever the firm has invested in R&D. Dep_prov_A is depreciations and provisions for the year as a % of total assets.

Table 7 – Regressions

Dependent variable: leverage

	All firms		Lagged variables
CF_A	-0.12	-0.15	-0.09
	-51.70	*-46.89*	*-25.67*
Sales growth	-	-0.004	-0.0005
	-	*-6.22*	*-0.61*
Tangible assets	-	0.03	0.03
	-	*11.07*	*10.83*
Log assets	-	4.46	3.39
	-	*56.86*	*35.38*
D_group	-	-0.23	-0.08
	-	*-1.88*	*-0.62*
Liquidity	-	-0.003	-0.002
	-	*-17.62*	*-7.28*
D_RD	-	0.43	0.41
	-	*4.49*	*3.89*
Dep_prov_A	-	0.03	0.00
	-	*3.74*	*-0.44*
Constant	10.10	-47.77	-32.91
	55.12	*-44.27*	*-26.29*
Number of observations	340,103	255,122	189,067
Number of firms	52,451	50,467	36,067
R-sq: within	0.030	0.062	0.035
between	0.021	0.135	0.123
overall	0.027	0.117	0.106

Notes: t-ratios in italics. Time and firm fixed-effects and robust standard errors are considered. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Tang_assets is the share of tangible assets in total assets. D_group is a dummy variable which takes the value one when the firm is consolidated in a group. Liq is a measure of liquidity, defined as short term securities and cash as a % of short term debt. D_RD is a dummy variable which takes the value one whenever the firm has invested in R&D. Dep_prov_A is depreciations and provisions for the year as a % of total assets.

Table 8 – Robustness regressions

Dependent variable: leverage

	By firm size:				By firm age:				Robustness:			
	Micro firms	Small firms	Medium firms	Large firms	1st quartile	2nd quartile	3rd quartile	4th quartile	Manufacturing firms	Firms with positive leverage	Dependent variable: dummy leverage	Dependent variable: long term leverage
CF_A	-0.04	-0.12	-0.21	-0.29	-0.03	-0.04	-0.08	-0.12	-0.11	-0.16	-0.010	-0.06
	-9.43	*-16.43*	*-16.21*	*-11.28*	*-2.96*	*-6.55*	*-10.46*	*-16.72*	*-21.18*	*-24.40*	*-21.20*	*-6.16*
Sales growth	0.000	-0.003	-0.004	0.003	0.000	-0.001	-0.003	-0.001	0.000	0.000	0.000	-0.001
	0.25	*-1.78*	*-1.74*	*0.69*	*0.26*	*-0.45*	*-1.52*	*-0.59*	*0.30*	*0.26*	*1.39*	*-1.19*
Tangible assets	0.01	0.05	0.04	0.07	-0.01	0.04	0.03	0.03	0.04	0.02	0.01	0.04
	2.95	*7.88*	*4.75*	*3.96*	*-1.14*	*5.31*	*3.91*	*4.79*	*9.03*	*4.82*	*19.42*	*10.09*
Log assets	2.73	3.74	4.63	4.62	1.75	2.47	2.93	4.18	3.78	3.02	0.53	1.53
	17.62	*20.89*	*16.85*	*9.50*	*4.76*	*10.33*	*12.45*	*21.23*	*26.97*	*20.04*	*77.88*	*8.41*
D_group	-0.82	-0.15	-0.10	-0.18	-0.34	-0.52	0.44	0.08	-0.09	-0.10	-0.14	0.16
	-2.14	*-0.66*	*-0.46*	*-0.44*	*-0.49*	*-1.59*	*1.66*	*0.41*	*-0.45*	*-0.62*	*-6.67*	*1.24*
Liquidity	-0.001	-0.004	-0.01	-0.01	-0.002	0.001	-0.001	-0.003	-0.003	-0.001	-0.001	0.000
	-2.68	*-6.58*	*-8.11*	*-5.58*	*-1.69*	*2.06*	*-2.52*	*-8.24*	*-7.49*	*-1.16*	*-31.20*	*0.83*
D_RD	0.22	0.37	0.41	0.67	-0.16	-0.19	0.17	0.86	0.46	0.23	0.15	0.29
	0.80	*2.19*	*2.25*	*1.99*	*-0.31*	*-0.78*	*0.84*	*5.09*	*3.37*	*1.77*	*8.22*	*2.88*
Dep_prov_A	0.04	-0.01	-0.04	0.00	0.03	0.00	0.03	-0.03	-0.03	0.04	-0.01	-0.02
	3.37	*-0.61*	*-1.49*	*0.02*	*0.85*	*-0.23*	*1.79*	*-1.81*	*-2.27*	*2.52*	*-5.21*	*-1.09*
Constant	-24.17	-38.10	-54.65	-57.88	-11.33	-22.46	-26.92	-45.95	-38.01	-20.81	-6.55	-17.06
	-13.21	*-16.13*	*-12.58*	*-7.03*	*-2.57*	*-7.44*	*-8.76*	*-16.17*	*-20.86*	*-10.19*	*-72.37*	*-7.05*
Number of observations	77,877	70,037	31,839	9,314	25,953	51,606	54,426	57,082	87,053	117,954	190,557	190,557
Number of firms	19,928	15,468	6,195	1,563	12,846	16,572	13,881	10,278	14,514	26,166	36,258	36,258
R-sq within	0.021	0.047	0.064	0.075	0.012	0.019	0.023	0.040	0.043	0.032	-	0.010
between	0.115	0.122	0.090	0.069	0.081	0.108	0.121	0.153	0.157	0.026	-	0.069
overall	0.098	0.107	0.086	0.080	0.071	0.093	0.107	0.121	0.136	0.029	-	0.047

Notes: t-ratios in italics. Time and firm fixed-effects and robust standard errors are considered. All explanatory variables are lagged by 1 year. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Tang_assets is the share of tangible assets in total assets. D_group is a dummy variable which takes the value one when the firm is consolidated in a group. Liq is a measure of liquidity, defined as short term securities and cash as a % of short term debt. D_RD is a dummy variable which takes the value one whenever the firm has invested in R&D. Dep_prov_A is depreciations and provisions for the year as a % of total assets. The dummy leverage takes the value one when firms have positive leverage. Long term leverage considers long term loans and bonds as a percentage of total assets.

Table 9 – Target leverage ratio – two step regressions

Dependent variable: change in leverage

	Two-step regressions							
	Full sample	**Firms with positive leverage**	Micro firms	Small firms	Medium firms	Large firms	Positive adjustment	**Negative adjustment**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
Adjustment	0.61	0.62	0.75	0.61	0.49	0.33	0.48	0.71
	152.21	*127.31*	*100.11*	*97.01*	*62.44*	*26.34*	*92.29*	*72.82*
$D.CF\_A_t$	-0.084	-0.178	-0.049	-0.112	-0.189	-0.225	-0.053	-0.181
	-34.24	*-35.86*	*-16.22*	*-22.55*	*-20.64*	*-11.99*	*-25.09*	*-21.35*
$D.CF\_A_{t-1}$	-0.024	-0.048	-0.007	-0.028	-0.066	-0.087	-0.019	-0.049
	-10.89	*-10.34*	*-2.64*	*-6.19*	*-7.92*	*-5.22*	*-9.91*	*-6.30*
Inv_A_t	0.037	0.055	0.034	0.029	0.053	0.083	0.063	-0.038
	11.90	*10.81*	*7.67*	*5.49*	*5.92*	*3.80*	*19.68*	*-4.29*
Inv_A_{t-1}	0.023	0.033	0.015	0.025	0.048	0.070	0.022	0.055
	8.44	*7.62*	*3.91*	*5.54*	*6.28*	*3.88*	*7.93*	*7.35*
Constant	-0.92	-0.62	0.34	-1.04	-1.25	-3.55	-2.45	5.11
	-6.31	*-3.21*	*1.27*	*-4.65*	*-6.76*	*-7.82*	*-16.90*	*13.49*
Number of observations	183,783	113,669	75,246	68,268	31,135	9,134	127,966	55,817
Number of firms	35,427	25,502	19,341	15,199	6,121	1,554	30,277	19,811

Notes: t-ratios in italics. Time and firm fixed-effects and robust standard errors are considered. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Inv_A stands for investment as a % of assets.

Table 10 – Target leverage ratio – Arellano-Bond estimator

	Dependent variable: leverage	
	Target one step (GMM estimator)	
	(1)	(2)
Leverage $_{t-1}$	0.61	0.53
	8.53	*7.36*
Leverage $_{t-2}$	0.05	0.10
	1.43	*2.61*
CF_A $_{t-1}$	0.106	0.013
	1.99	*0.17*
Financial deficit $_{t-1}$	-	-0.02
	-	*-0.32*
Sales growth $_{t-1}$	0.00	-0.01
	0.02	*-0.58*
Tangible assets $_{t-1}$	0.07	0.06
	3.10	*2.80*
Log assets $_{t-1}$	-1.64	-2.38
	-1.10	*-1.59*
D_group $_{t-1}$	0.20	0.11
	1.04	*0.62*
Liquidity $_{t-1}$	0.00	0.00
	1.98	*1.14*
D_RD $_{t-1}$	1.42	1.47
	1.51	*1.55*
Dep_prov_A $_{t-1}$	-0.33	-0.29
	-3.68	*-3.40*
Number of observations	147,491	143,491
Number of firms	28,207	27,834
Number of instruments	222	236
Sargan-test (chi-square)	0.36	0.13
Arellano-Bond test		
order 1	0.00	0.00
order 2	0.99	0.27

Notes: t-ratios in italics. Time and firm fixed-effects and robust standard errors are considered. The estimations are obtained using difference equations as in Arellano and Bond (1991). The GMM-type instruments for these equations are the third lags of CF_A, financial deficit, sales growth, Tang_assets, Log_assets, D_RD and Dep_prov. Liq, D_group and the year dummies are standard instruments. For leverage, all lags from the third lag back are taken into account. Financial deficit is the difference between investment and cash-flow over assets. Other variables as defined in Table 10.

Table 11 – Cox proportional hazard regressions

	Dependent variable: time to target		
	Full sample	Positive adjustment	**Negative adjustment**
	(1)	**(2)**	**(3)**
CF_A_t	1.001	0.994	1.018
	0.86	*-4.37*	*7.90*
Sales growth $_{t-1}$	1.000	1.000	1.001
	1.48	*-0.21*	*1.64*
Tangible assets $_t$	1.003	1.002	1.003
	5.46	*3.10*	*3.58*
Log assets $_t$	1.141	1.175	1.072
	17.68	*16.75*	*5.57*
D_group_t	0.848	0.759	1.023
	-4.91	*-6.10*	*0.46*
Liquidity $_t$	0.993	0.991	0.997
	-20.85	*-18.23*	*-7.17*
D_RD_t	1.147	1.162	1.093
	4.54	*3.75*	*1.96*
$Dep\_prov\_A_t$	1.001	1.005	0.993
	0.20	*1.28*	*-1.57*
Log pseudo likelihood	-66410	-36683	-24463
Number of observations	225982	177381	48601
Number of failures	50694	50042	21593
Number of subjects	7096	4087	3009
Time at risk	225982	177381	48601

Notes: z-scores in italics. The dependent variable is the time a firm takes to reach its target leverage ratio, considering that a firm is close to the target when the observed leverage ratio is within the interval [90%,110%] of the initial estimated target. An estimated coefficient lower than 1 should be interpreted as contributing a longer time until the firm reaches its target. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Inv_A stands for investment as a % of assets. Leverage is defined as bonds and loans over total assets. CF_A is net earnings before provisions and depreciation as a % of assets. Tang_assets is the share of tangible assets in total assets. D_group is a dummy variable which takes the value one when the firm is consolidated in a group. Liq is a measure of liquidity, defined as short term securities and cash as a % of short term debt. D_RD is a dummy variable which takes the value one whenever the firm has invested in R&D. Dep_prov_A is depreciations and provisions for the year as a % of total assets.

Figure 1 – Hazard function

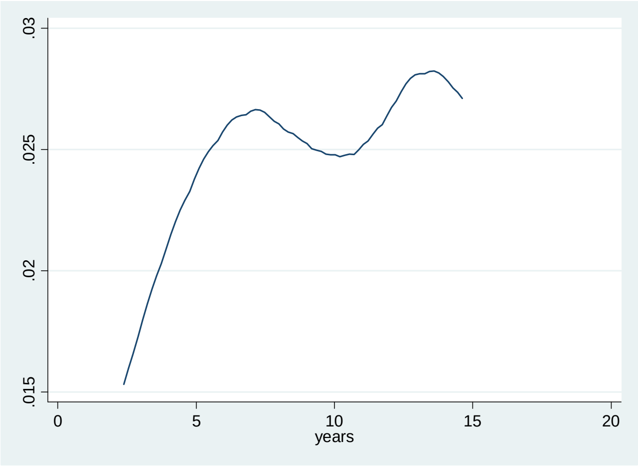

Figure 2 – Survivor function with positive adjustment

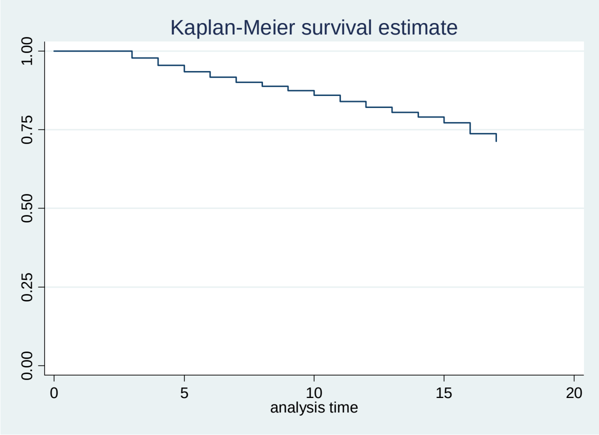

Figure 3 – Survivor function with negative adjustment