Target leverage and speed of adjustment along the life cycle of the firm

Abstract

This paper analyzes differences of target leverage and speed of adjustment across three life cycle stages of the firm: introduction, growth and maturity. We find that profitability and tangibility are the most stable determinants, whereas growth opportunities, tangibles, and size show changing effects accross stages. The speed of adjustment increases as the firms evolve, although firms in introduction using operating debt are able to adjust the fastest. Firms changing stage adjust leverage at a lower speed and their target is more affected by profitability and growth opportunities, mainly when the change is from introduction to growth. Finally, we confirm the existence of long-term debt targets, evidencing that next-year target is a relevant factor to explain current debt when firms change from one stage to another.

Keywords: Capital structure; Target leverage; Firm's life cycle; Speed of adjustment; Transaction costs.

JEL: D91, D92, G32

1 INTRODUCTION

Since the seminal work of Fischer et al. (1989) proposed a model of dynamic capital structure choice taking into account the adjustment costs, target leverage has become an important concept for research on capital structure. In addition to the identification of the determinants of the target leverage, the model computes the speed of adjustment to the target. Depending on the cost of transactions relative to the changes toward the new capital structure, the speed of adjustment varies across companies and over time (Hovakimian et al., 2001). Recent papers have studied the target leverage as a function of firm-level or country-level variables, as well as in relation to firms´ legal and institutional environment. Our work adds a new factor to this growing literature: the firm's life cycle. We contribute the dynamic behavior of the target leverage along the life cycle stages of the firm as well as the differences in the speed of adjustment to the optimal capital structure when the firm changes from one stage to another. Furthermore, we show that a change of stage has an effect in the leverage target of the previous period.

Empirical literature suggests changing patterns of capital structure across the life stages (Teixeira and Santos, 2005) being the target leverage ratio time-varying (Myers, 1984; Elsas and Florysiak, 2011) in response to changing circumstances and conditions. Several authors (Hackbarth et al., 2006; Drobetz et al., 2007) show interesting relations between the speed of adjustment and well-known business cycle variables, indicating the impact of macroeconomic factors. However, there is no empirical evidence about the capital structure adjustment along the life cycle of the firm.

After using a classification model partially based on Dickinson (2011), that allows us to consider the comprehensive behavior of the firm in order to distinguish between firms in introduction, growth, or maturity, we investigate a panel data of quoted firms from the main European countries (Austria, Belgium, France, Germany, Italy, Netherlands, Spain, and UK) to analyze their target determinants and their speed of adjustment across the stages.

Our work makes several contributions. First, we show that the main factors of target leverage as well as the speed of adjustment vary along the stages of the life cycle. Our findings suggest that firms adjust to the target ratio faster during introduction or maturity than during growth. Second, we observe differential effects of some determinants and a lower speed of adjustment in firms that have changed of stage. We attribute this result to the increase of asymmetric information resulting in an intensification of transaction costs. Finally, we evidence that next-stage target leverage induce the level of current leverage, consistent with firms involved in the process of leverage adjustment previously (in advance) to carry out their planned investments.

The rest of the paper is organized as follows. Section 2 discusses the concepts of target leverage, adjustment speed, life cycle, and the relation between them, to derive the hypotheses tested. The following section describes the research design including the measure of life cycle, the factors of target leverage, the dynamic models of capital structure and the methodology used. Section 4 shows the sample and the descriptive statistics. Section 5 discusses the empirical results. Finally, section 6 concludes the paper.

2 THEORETICAL BACKGROUND AND HYPOTHESES

The optimal capital structure has been related to the trade-off theory (TOT) as it poses that a firm's target leverage is driven by competing forces which originate benefits and costs of debt, mainly the agency cost of financial distress and the tax-deductibility of debt finance (Myers, 1977). Under this dominant explanation, adjustment costs generate lags between the actual debt ratio and the optimal level, by slowing down the speed at which firms adjust deviations (Myers, 1984; Titman and Tsyplakov 2007). For example, if there are fixed transactions costs to issuing or retiring debt, a firm only rebalances when its debt ratio crosses an upper or lower hurdle (Fischer et al., 1989). Consistent with the trade-off reasoning, the following factors have been found crucial to determine the speed of adjustment (Elsas and Florysiak, 2011): high opportunity costs of deviating from a target, for example in firms with high financing deficits or in small firms; and high default risk.

However, for Shyam-Sunder and Myers (1999) the existence of a target debt ratio does not invalidate the pecking order theory (POT). Flannery and Rangan (2006) find that although more than half of the observed changes in debt ratios come from targeting behavior, pecking order and market timing considerations explain a part (less than 10% each). Under the POT managers do not attempt to maintain a particular target; instead, the leverage ratio is defined as the gap between operating cash flows and investment requirements over time (Barclay and Smith, 1999). In this line, Byoun's (2008) results suggest that most adjustments occur when firms have above-target debt with a financial surplus or when they have below-target debt with a financial deficit. Hovakimian and Li (2009) find asymmetric adjustment costs depending on whether the firm is above or below its target leverage. They find particularly low incremental costs when the firm pays off the excess debt with internal funds. Consistent with the pecking order reasoning, some factors appear as crucial to determine the speed of adjustment: the level of information asymmetry between insiders and outsiders (Lööf, 2004; Mahakud and Mukherjee, 2011; Ezeoha and Botha, 2012); a group of variables related to debt capacity, such as firm age, collateral value, or size (Heshmati, 2001; Lööf, 2004); Drobetz et al., 2007; Ezeoha and Botha, 2012); other variables indicating current or future additional investments, such as growth (Drobetz and Wanzenried, 2006; Drobetz et al., 2007) or growth opportunities (Heshmati, 2001; Ezeoha and Botha, 2012); and liquidity (Mahakud and Mukherjee, 2011).

We argue that the TOT and the POT change their prevalence along the introduction, growth, and maturity stages of firms' life cycle, giving rise to changing patterns of both debt targets and adjustment speeds. Costs and benefits of adjusting debt, adduced by the TOT, such as bankruptcy costs and tax shields, depend on firm-specific factors that evolve along life cycles as the firms do. Concerning the POT, factors behind the firms' financing needs, ability to produce cash flows, financing alternatives, debt capacity, and information asymmetries evolve along the life cycle as well.

2.1 Target leverage and life cycle

Considering the trade-off reasoning, the costs and benefits of debt financing are expected to change over the life cycle, thus allowing or forcing firms to modify their financing strategies. As firms grow and develop, they are usually more profitable and have more tangible assets acting as collateral, contributing these two factors to reduce bankruptcy costs. During growth firms hold cash to undertake their profitable investment projects deprived of raising outside funds at high transaction costs (Saddour, 2006). With a faster growth, firms should have a different level of fixed costs than more mature firms (Tomassen, 2004). During maturity the trust by shareholders and the market is greater, easing the transaction of these firms and decreasing their costs with regard to the growth stage. As for the benefits of debt, the possibility of using tax shields effectively varies depending on net income or profitability (Lööf, 2004). Therefore, in line with Frelinghaus et al. (2005), we can expect higher target leverage and higher levels of debt in larger and more mature firms. We derive our first hypothesis:

H.1a. As firms grow and mature, transaction costs of financing and bankruptcy costs decrease whereas they can use more tax shields effectively, increasing the target leverage.

As posed by the POT, the information asymmetries between insiders and outsiders tend to be higher during earlier stages of firms' life cycles whereas debt capacity is lower (Teixeira and Santos, 2005; Pfaffermayr et al. 2013). Start-up equity financing should become more probable than start-up debt financing in an information asymmetry setting/scenario, as Hirsch and Walz (2011) find for boom periods, when economies and industries grow rapidly. On the one hand, factors that increase as the firms evolve, such as age or size, indicate bigger debt capacity (due to know-how, notoriety, and collateral). In the same direction, growth and growth opportunities indicate more fund needs (higher investment requirements). On the other hand, better levels of liquidity and profitability during the growth and maturity stages mean more generation of cash flows and lower funds needed. We derive three additional hypotheses.

H.1b. With higher levels of asymmetric information, start-up firms rely more on equity than mature ones, resulting in lower target debt.
H.1c. As firms grow and mature, debt capacity and funding needs are higher, generating higher targets.
H.1d. As firms increase liquidity and profitability, lower needs of funds result in lower target debt.

Since transaction costs might vary seriously considering the change of stage, we argue that the optimal capital structure would be different for firms that change of life cycle stage than for those that remain in the same stage. For example, in a firm moving from introduction to growth, or from growth to maturity, information asymmetry rises. Consequently, information and negotiation costs (needed to draw up an appropriate contract) will be higher than for firms that remain in the same stage. Firms that do not change are perceived as more stable by the market. Therefore, both the POT and the TOT support our second hypothesis:

H.2. The target leverage is lower for firms that change of life stage than for the rest of firms.

Finally, from Jalilvand and Harris (1984) a number of works allude to long-run target capital structures, finding that the rate of annual convergence toward the target is lower than 40% for the typical firm (Flannery and Rangan, 2006; Huang and Ritter, 2009) or lower than 20% once the methodological bias has been avoided (Hovakimian and Li, 2009). Furthermore, Leary and Roberts (2005) attribute to some firms' shocks the lasting effects despite active rebalancing. In this line, we have considered the magnitude of investments when a big firm changes from one stage to another. For listed firms, the process to adjust the current capital structure to the future target may be longer than a period. This is consistent with a relevant fraction of major financing transactions associated with adjustments away from the target or adjustments beyond the target, even in cases where the speeds of adjustment are substantially higher (Hovakimian and Li, 2009). Given that the capital structure is the first decision a firm has to take before starting a new investment project, we hypothesize that during the period previous to a changing of life stage, the firm's leverage is not only explained by the contemporaneous target but by the target leverage of the next stage, leading to a new hypothesis not previously tested in this line of research.

H.3. When the firm changes from one stage to another, the target leverage of the next stage is an explanatory factor of the current capital structure.

2.2 Speed of adjustment and life cycle

Unlike the previous works, we study the speed of adjustment to target leverage in a dynamic way, by taking into consideration how the speed of adjustment changes by life cycle stages, and how the speed changes when firms evolve from one stage to another. Considering the trade-off reasoning, during introduction transaction costs are higher because of the limited possibilities of financing, as they have not projected a fully reliable and strong position in the market yet. During growth, additional needs of external financing (Saddour, 2006) and/or bargaining fight (Delmas and Marcus, 2004) may generate transaction costs. However, during maturity, firms can choose among alternative types of financing, what implies lower transaction costs, such as the cost of paying dividends to a wider number of shareholders or the cost of issuing bonds to a wider number of bondholders; furthermore, they frequently have less cash flow volatility which decreases the possible costs of distress increasing the expected speed of adjustment. Consistent with this reasoning, Hovakimian and Li (2009) identify firms in the highest maturity debt group as the ones with the highest speed of adjustment.

Both Hackbarth et al. (2006) and Drobetz et al. (2007) relate the speed to the economic cycle. Using common business cycle variables linked to the current or future state of the economy, they conclude that the adjustment is faster during booms than in recession periods, that is, with low interest rates and negligible risks of disruption in the global financial system. They attribute their results to the importance of these determinants of default risk. These arguments lead to our fourth hypothesis:

H.4a. As firms mature, fewer transaction costs of financing and fewer bankruptcy costs favor a higher speed of adjustment.

Concerning the POT, as growth starts leveling off, during maturity earnings and cash flows will continue to increase rapidly, reflecting past investments, but the investment in new projects will decline, decreasing the financing needs. Larger firms often have lower information asymmetry which would indicate a lower cost of financing and faster adjustment. Thus, better analyst coverage reduces information asymmetry upon announcement of debt or equity issues (Hovakimian and Li, 2009). Therefore, the pecking order reasoning provides us with factors pushing the speed of adjustment up.

H.4b. As firms mature, lower information asymmetry and financing needs reduce adjustment costs favoring a higher speed of adjustment.

However, firms changing from one stage to another will suffer higher levels of information asymmetry between the firm managers and the financing market, generating higher transaction costs. Furthermore, for firms that change from introduction to growth, certain transaction costs such as those stemming from cash flow volatility, are expected to be higher than for firms that advance from growth to maturity. Consequently, the speed of adjustment should be slower in the last case. Hence, we pose two new hypotheses:

H.5a. Firms changing stage have higher adjustment costs and lower speed of adjustment.
H.5b. The speed of adjustment is faster for firms changing from growth to maturity than for firms changing from introduction to growth, due to differences in transaction costs.

3 RESEARCH DESIGN

3.1 Measure of life cycle

In order to consider different aspects of the business to assign firms into the proper stage of their life cycle, we have started from the model by Dickinson (2011). The author empirically shows that, consistent with theory, profitability and growth differ as the firm progress through life stages taking into consideration the signs of the operating, investing and financing cash flows. The combinations of these signs allow us to establish five possible stages of which we focus on the first three: introduction, growth and maturity[1], as presented in Table 1, considering only what concerns the operating and investing activities.

[1] Thus, we can compare our results with empirical studies on capital structure referred to these stages of the firm. In addition, we have to consider that shake-out is a difficult stage to delimitate, and companies move into decline directly from a lower stage.

Table 1. Life Cycle Stage Model

Cash Flow Type	Introduction	Growth	Mature
Operating	-	+	+
Investing	-	-	-

Given that our study concerns the evolution of firms' leverage across the life cycle, we have discarded that part of the Dickinson's model using financial cash flows. The operating and investing signs are exactly the same for the growth and maturity stages; therefore, we have introduced an alternative discriminant criterion, based on previous empirical literature, to assign firms to these specific stages. The first discriminant factor is growth because relatively young firms are fast-growing (Mueller, 1972) both in sales and assets (Miller and Friesen, 1984), considering for this study the growth of sales with respect to the previous year. The second discriminant measure is risk, found remarkably higher during the birth, growth and revival stages, in contrast with the more conservative maturity and decline stages (Miller and Friesen, 1984). In this study, we use the yearly standard deviation of monthly returns. Then, we consider the jointly effect of these variables. We calculate the decile of the risk and growth variables by year and country. Then, we create a new variable that takes the average value of the deciles in which these two factors are placed. Consequently, the firm is in the growth stage when the resulting value is equal or higher than 5; meanwhile it is in the maturity stage when the value is lower than 5.

3.2 Factors of target leverage

Following Welch (2011), we determine that non-financial liabilities should be considered debt. Hence, our proxy for leverage is the ratio of total liabilities to total assets (Welch, 2011).

Profitability is computed as the ratio of earnings before interest, taxes, depreciation, depletion, and amortization over total assets. For the trade-off theory, taxes, and bankruptcy costs drive more profitable firms towards greater leverage (H.1a). Alternatively, the pecking order theory suggests that higher profitability enables firms to use less debt (H.1d).

We measure growth opportunities as the market to book ratio, defined as market value of equity plus debt in current liabilities plus long-term debt plus preferred stocks, minus deferred taxes and investment tax credit over total assets. The trade-off theory predicts that firms with more growth opportunities have relative cost advantages in external growth funding (Drobetz et al., 2007; Elsas and Florysiak, 2011) and adjust faster (H.1a; H4a). The pecking order theory would expect more debt when firms have new opportunities, as further investments require additional funds (H.1c).

We proxy tangible assets by the percentage of property, plant, and equipment in total assets (PPE). Titman and Wessels (1988) indicate that firms with high proportions of tangible assets are likely to have rather low bankruptcy costs and, therefore, high target leverage ratios, as tangible assets can be collateralized (H.1a). The pecking order theory predicts a positive relation to leverage due to the low information asymmetry related to tangible assets as a reason of less costly debt issuances (H.1b).

We measure size as the logarithm of total assets. Size might be an inverse proxy for the probability of bankruptcy as larger firms tend to be more diversified (Gonzalez and Gonzalez, 2008). Hence, the trade-off theory predicts a positive relation between size and leverage (H.1a). On the other hand, size proxies for know-how, notoriety and collateral, working as an indication of debt capacity. Accordingly, the pecking order theory supports a positive relation between leverage and size.

3.3 Dynamic models of capital structure

We have used a target adjustment model in the line proposed by Miguel and Pindado (2001) which takes into account the role of transaction costs when firms change their debt level; and furthermore computes the target debt level as a function of the determining factors of capital structure. The model tests how quickly the debt level (D_{it-1}) moves toward the target (D_{it}^{*}) in one period.

$$\left(D_{it} - D_{it-1}\right) = \alpha\left(D_{it}^{*} - D_{it-1}\right) \tag{1}$$

The transaction costs impede firms to fully adjust their levels of indebtedness to the target level. Therefore, the coefficient α varies between 0 and 1, inversely related to adjustment costs. In the extremes, firms completely adjust their leverage to the optimal level (α = 1) when transaction costs are zero; on the contrary, transaction costs may be so high that no firm adjusts its debt level (α = 0), maintaining the previous debt level.

$$D_{it} = \alpha D_{it}^{*} + (1-\alpha)D_{it-1} \tag{2}$$

Following Gonzalez and Gonzalez (2008) and Rajan and Zingales (1995), profitability (*PROF*), growth opportunities (*GROWTH*), tangible assets (*PPE*) and size are included in the model as determinants of the target debt.

$$D_{it}^{*} = a_0 + a_1 PROF_{it} + a_2 GROWTH_{it} + a_3 PPE_{it} + a_4 Size_{it} + \mu_{it} \tag{3}$$

$$D_{it} = \alpha\left[a_0 + a_1 PROF_{it} + a_2 GROWTH_{it} + a_3 PPE_{it} + a_4 Size_{it} + \mu_{it}\right] + (1-\alpha)D_{it-1} \tag{4}$$

$$\begin{aligned} D_{it} = {} & \alpha a_0 + (1-\alpha)D_{it-1} + \alpha a_1 PROF_{it} + \alpha a_2 GROWTH_{it} + \alpha a_3 PPE_{it} + \\ & \alpha a_4 Size_{it} + \sum_{k=1}^{m} C_k + \sum_{t=2001}^{2012} Y_t + \gamma_i + \mu_{it} \end{aligned} \tag{5}$$

Where D_{it} is the leverage of firm *i* in year *t*, α_0 is the independent term and *a* are the coefficients of the variables taken as explanatory factors, C_k is the set of country dummy variables controlling for other aspects beyond those explicitly included in the equation, Y_t is a set of time dummy variables for each year capturing any unobserved firm time effect not included in the regression. γ_i is the firm effect, which is assumed to be constant for firm *i* over *t; and* μ_{it} is the error term. In our empirical analysis, we run several groups of regressions using diverse combinations of these variables.

To consider the life cycle of the firm jointly with this dynamic model of capital structure, we test the model for the group of companies placed inside the introduction, growth, and mature stages. According to the classification criteria explained in section 3.1., we have used a dummy variable that equals one if the firm is in one stage and zero otherwise. Thus, we test if the different financing strategies of the firm across the stages affect the target and the speed of adjustment.

Concerning the second, third and fifth hypotheses, we study the firm´s change of stage and its impact on target leverage, as well as the speed of adjustment to the optimal capital structure. We run the regression with five different samples depending on the situation of the firms in two consecutive years: firms remaining in introduction, firms changing from introduction to growth, firms remaining in growth, firms changing from growth to maturity, and firms remaining in maturity.

To test the third hypothesis, we model current debt as a function of the next-year target instead of the contemporaneous target. The modified model is as follows:

$$D_{it} = \alpha \cdot D^{*}_{it+1} + (1-\alpha) D_{it-1} \tag{6}$$

$$D^{*}_{it+1} = a_0 + a_1 PROF_{it+1} + a_2 GROWTH_{it+1} + a_3 PPE_{it+1} + a_4 Size_{it+1} + \mu_{it} \tag{7}$$

$$D_{it} = \alpha\left[a_0 + a_1 PROF_{it+1} + a_2 GROWTH_{it+1} + a_3 PPE_{it+1} + a_4 Size_{it+1}\right] + (1-\alpha) D_{it-1} + \sum_{k=1}^{m} C_k + \sum_{t=2001}^{2012} Y_t + \gamma_i + \mu_{it} \tag{8}$$

We use the panel data methodology in order to eliminate the unobservable heterogeneity; specifically our models will be estimated by using the Generalized Method of Moments (GMM) to control for the potential endogeneity of the explanatory variables. As explained in the previous section, we use predetermined variables that have been carried out using a two-step Generalized Method of Moments, developed by Arellano and Bond (1991). There may be problems of endogeneity in the regressors as the variables used can be determined simultaneously with the debt ratio. In that case, we might solve this problem using all the lagged values of the explanatory variables that will be included in the instruments set. As a result, the use of panel data and GMM provide a more satisfactory basis for our purpose.

We use the *m* statistic, which tests for lack of second-order serial correlation in the two first-difference residuals, as this condition is required for the proper functioning of the estimator. Another test of specification used is the Hansen's statistic of over-identifying restrictions, which tests for the absence of correlation between the instruments and the error term. The use of panel data improves the efficiency of econometric estimates and is more flexible in the choice of variables to be used as instruments to control for endogeneity.

4 SAMPLE AND DESCRIPTIVE ANALYSIS

4.1 Sample

In our analysis, we have used firm balance-sheet and income-statement annual data from Worldscope database for 2001-2012. The panel data contain all firms from Austria, Belgium, France, Germany, Italy, Netherlands, Spain, and UK, with the required data for years: t−1, t, and t+1 (26,365 firm-year observations). For our second, third, and fifth hypotheses we work with five subsamples, firms that change from introduction to growth (1,391 firm-year observations), firms that move from growth to maturity (2,512 firm-year observations) and firms that maintains in the same stage (3,856 firm-year observations in introduction; 5,785 in growth; and 3,224 in maturity). We exclude financial firms (SIC codes 6000-6999) from the sample. Moreover, we winsorize variables with a higher standard deviation (profitability, market to book,) at the bottom and top 1% of their distributions and leverage with 5% of their distributions to avoid the influence of outliers.

4.2 Descriptive Statistics

Table 2 reports the descriptive statistics by life cycle stage. The total sample shows a mean leverage ratio of 52.9%; being higher for firms during growth and maturity than for introduction firms. In addition, firms that change of stage show a higher level of debt than those that remain in the same stage. The mean profitability of 2.62% hides strong differences between the negative mean for firms in introduction and 12% during growth and maturity (untabulated results). Profitability is higher for firms changing stage. Property, plant and equipment to total assets, and size show growing numbers across the stages, as expected. By contrast, growth opportunities show a sound decreasing pattern as the firms evolve.

Table 2. Descriptive statistics. General

Variable	Obs.	Mean	St.Dev.	Med.	Mean dif. (Growht minus Introduction)	Mean dif. (Maturity minus Growth)	Mean dif. (Stage Change minus No Stage Change)
Debt	26365	0.529	0.2353	0.5489	0.0765***	0.00169	0.0322***
Prof	25947	0.0262	0.2845	0.0918	0.318***	0.00114	0.0957***
Growth	10066	1.6418	2.172	0.9832	-1.361***	-0.162***	-0.671***
PPE	26283	0.2259	0.2165	0.159	0.0772***	0.0470***	0.00161
Size	26366	11.8084	2.411	11.6153	2.197***	0.622***	0.245***
Obs.	_	_	_	_	19516	18924	16769

Notes: Debt is book leverage (total liabilities / total assets); Prof is profitability (EBITDA / total assets); Growth is market to book (market value of equity + debt in current liabilities + long-term debt + preferred stocks - deferred taxes and investment tax credit to total assets); PPE is tangibility (property, plant and equipment / assets); and Size is the logarithm of total assets. Mean dif. indicates the difference of means test (t-test); *, ** and *** indicate significance at the 5%, 1% and 0.1% level, respectively.

In untabulated results, we analyze the correlation matrices, being profitability and size the most important factors for leverage. According to most of previous empirical evidence, debt ratios are negatively correlated with profitability and positively with size. The maximum value for the relation with profitability appears during growth. Remarkable differences can be appreciated along the life cycle of the firm.

5 RESULTS

Table 3 compares results on the determinants of firms' leverage and the speed of adjustment across the three life cycle stages studied. In this table we observe that the traditional determinants of capital structure are significant drivers of the target leverage, but coefficients, signs, and significance change along the three stages. The main explanatory factors of target leverage from introduction to maturity are profitability and tangible assets. Growth opportunities and size are relevant determinants but not in every life stage. Our results are consistent with economic changes and corporate actions moving firms either away or towards their target (Titman and Tsyplakov, 2007); but besides, it is consistent with the leverage target varying in response to the evolution of market imperfections, such as taxes, financial distress costs (TOT), or asymmetric information (POT).

Profitability shows a negative contribution to the target leverage, confirming our hypothesis H.1d for the three stages, in line with the most frequently found result in previous literature. According to our results, the pecking order theory would support the behavior of leverage in respect to profitability along the three life stages considered, suggesting that higher profitability increases retained earnings, reducing the target debt.

High growth opportunities during introduction usually involve new projects (much better known by insiders), implicating higher information asymmetry. Thus, during earlier stages the access to new external financing is hampered and firms are forced to use retained earnings. The negative relation between growth opportunities and debt is also consistent with low current free cash flows, implying little need of debt to provide a tax shield or to control managerial spending. The prevalence of the pecking order over the trade-off theory supports our hypothesis H.1b. Growth opportunities show a positive significant relation with leverage during the growth stage, suggesting that the additional funds required by new investments are bigger than the retained earnings generated by profitable firms. During this stage, growth opportunities seem to indicate higher debt capacity and not so high asymmetric information, in the line of the pecking order, confirming our hypothesis H.1c. During maturity the coefficient for growth opportunities is not statistically significant at standard levels, similar to Gonzalez and Gonzalez's (2008) results. This is consistent with growth opportunities exerting opposite effects on leverage in this stage: bigger debt capacity and fund needs increase debt target whereas generation of more cash flows reduce debt target, partially confirming both hypotheses H.1c and H1d. Mixed evidence found for growth opportunities in previous works (Gonzalez and Gonzalez, 2008) would be explained by heterogeneous samples made up of firms in different stages of their life cycles, but also by the mentioned opposite forces in place during maturity.

As for tangible assets, we obtain a positive relation with leverage, indicating the effect of tangibles as collateral to reduce costs of distress and debt-related agency problems. Contrary to our hypothesis H.1a, during introduction our results suggest a stronger effect, which would reduce transaction costs and induce higher speed of adjustment. During growth and, specially, maturity the coefficient is lower, likely because mature firms have access to diverse sources of financing. For example, profitable firms are able to finance the increase of tangible assets with internal funds, as suggested by the correlation matrix.

Size shows a different relation with leverage through the life cycle. During introduction and growth, the coefficient is not significant at standard levels. The positive and significant coefficient during maturity is consistent with the traditional arguments of both the trade-off and the pecking order theories. Distress costs decrease, in line with our hypothesis H.1a, while debt capacity increases in larger and mature firms due to their know-how, notoriety and collateral, in accordance with our hypothesis H.1c. The access to diverse sources of funds give firms the option for cheaper sources of debt. In addition, transaction costs decrease due to the reduction of information asymmetry, confirming our hypothesis H.1b.

Table 3. By-Stage Determinants of Firm Leverage. GMM Procedure

VARIABLES	Introduction	Growth	Maturity
Intercept	0.104	0.226***	0.0906**
	[0.300]	[0.0834]	[0.0437]
Debt t-1	0.533***	0.776***	0.612***
	[0.0790]	[0.0502]	[0.0271]
Prof	-0.262***	-0.224***	-0.224***
	[0.0476]	[0.0364]	[0.0223]
Growth	-0.0181***	0.0185**	0.00274
	[0.00661]	[0.00900]	[0.00381]
PPE	0.364**	0.0973**	0.0819***
	[0.169]	[0.0455]	[0.0247]
Size	0.0128	-0.00830	0.00868***
	[0.0249]	[0.00542]	[0.00307]
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Observations	3,248	3,973	2,497
Firms	1,180	1,607	1,093
F test	39.83	46.35	53.74
Hansen test	45.46	85.57	270.2
Sig. Hansen	0.221	0.190	0.111
Sig. Wald	0	0	0
m2	0.05	0.89	-1
Sig. m2	0.96	0.376	0.317

Notes: Regressions are estimated using the Arellano and Bond (1991) two-step GMM difference estimator for panel data with lagged dependent variables. Debt t-1 is book leverage in the previous year (total liabilities / total assets); Prof is profitability (EBITDA/total assets); Growth is market to book (market value of equity + debt in current liabilities + long-term debt + preferred stocks - deferred taxes and investment tax credit to total assets); PPE is tangibility (property, plant and equipment/assets); and Size is the logarithm of total assets. Heteroskedasticity consistent asymptotic standard error is in brackets. ***, ** and * represent the significance at the 1%, 5% and 10% levels, respectively.

Concerning the speed of adjustment, the first column (introduction) shows a coefficient of 0.533 for $Debt_{t-1}$, which implies a value of 0.467 for α. As a result, the adjustment to the target leverage is the highest, suggesting a lower effect of transaction costs than during other stages. However, growth and maturity (second and third column) show higher coefficients (0.224 and 0.388, respectively) meaning α closer to zero and hence higher transaction costs. The coefficients suggest different levels of transaction costs in the three stages of the life cycle, remarkably higher during growth in comparison with introduction and maturity. Thus, our results support hypotheses 4a and 4b except for introduction. Results for growth and maturity are consistent both with the trade-off and the pecking order reasoning. Concerning the TOT, additional needs of external financing (Saddour, 2006) and/or bargaining fight (Delmas and Marcus, 2004) generate transaction costs during growth[2], whereas mature firms can choose among a wider variety of financing options, and suffer lower levels of default risk, what reduce their financing costs. As for the POT, lower information asymmetry and more stable cash flows in mature firms can contribute to increase the speed of adjustment.

In Table 4, we compare the target leverage determinants between the firms that change and those that remain in the same life stage. Moreover, we distinguish the change from introduction to growth and from growth to maturity.

Table 4. Determinants of Firm Leverage According to the Stage Change. GMM Procedure.

VARIABLES	Int-no change	Change Int-Growth	Growth-no change	Change Growth-Mat	Mat-no change
Intercept	1.214***	0.0669	0.174***	0.0468**	0.0339
	[0.0686]	[0.0839]	[0.0299]	[0.0233]	[0.0240]
Debt t-1	0.219***	0.895***	0.685***	0.715***	0.655***
	[0.0160]	[0.0381]	[0.0137]	[0.0124]	[0.0144]
Prof	-0.0910***	-0.284***	-0.195***	-0.248***	-0.270***
	[0.00896]	[0.0390]	[0.0130]	[0.0153]	[0.0119]
Growth	-0.00692***	0.0324***	-0.00530***	-0.00761***	0.0133***
	[0.000965]	[0.00621]	[0.000930]	[0.00250]	[0.00226]
PPE	0.394***	0.0614	0.0726***	0.0316*	-0.0413***
	[0.0288]	[0.0700]	[0.0150]	[0.0165]	[0.0113]
Size	-0.0700***	-0.0106*	0.00166	0.00916***	0.0129***
	[0.00529]	[0.00561]	[0.00195]	[0.00150]	[0.00151]
Country dummies	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes

[2] In untabulated results we observe the importance of the measure of liquidity along the life cycle through the descriptive statistics. The highest value appears during introduction, decreasing in growth and then increased for mature firms. According to the previous literature, there is positive relation between the coefficient of liquidity and the speed of adjustment, as it is shown by the results.

Observations	2,097	526	1,946	823	1,099
Firms	765	453	983	644	555
F test	95.03	81.87	249.7	1212	200.2
Hansen test	307.1	44.20	319.0	237.3	283.1
Sig. Hansen	0.119	0.739	0.252	0.870	0.189
Sig. Wald	0	0	0	0	0
m2	-0.55	0.98	-0.13	0.76	-1.23
Sig. m2	0.585	0.326	0.9	0.445	0.219

Notes: Regressions are estimated using the Arellano and Bond (1991) two-step GMM difference estimator for panel data with lagged dependent variables. Debt t-1 is book leverage in the previous year (total liabilities / total assets); Prof is profitability (EBITDA/total assets); Growth is market to book (market value of equity + debt in current liabilities + long-term debt + preferred stocks - deferred taxes and investment tax credit to total assets); PPE is tangibility (property, plant and equipment/assets); and Size is the logarithm of total assets. Heteroskedasticity consistent asymptotic standard error is in brackets. ***, ** and * represent the significance at the 1%, 5% and 10% levels, respectively.

For firms changing of stage, profitability seems to play a more relevant role as a negative determinant of target debt, supporting our second hypothesis. If we analyze size, we can observe a significant evolution through the stages. During the earlier stages (introduction and transaction from introduction to growth), the relation is negative supporting the pecking order theory since the adverse selection problems considerably decrease in large firms (H.1b). Then, the relation changes, it is no significant during growth up to turning positive, and shows the highest coefficient during maturity (H.1c). The TOT considers size as a sign of the firms' strength for lenders, in parallel with assets as collateral.

The lowest speed takes place when firms change from introduction to growth (α=0.105) followed by those changing from growth to maturity. These results support our hypotheses H.5a and H5.b and are consistent with higher information asymmetries increasing transaction costs for firms in transitions, being even higher costs when the transition is from introduction to growth.

Besides, the change of life cycle stage involves new strategies, for which new financing may be necessary, implying different and more difficult ways to access to the market, resulting in higher transaction costs. A change of stage always brings about riskier strategies and decisions, with which the stakeholders may not agree, producing a conflict of interest that noticeably increase the transaction costs. Moreover, asymmetric information can affect all dealings done by the firm, hindering their accomplishment or increasing their cost. For example, administrative, enforcement, or fiscal procedures may be delayed by several conflicts.

The coefficient in the second column suggests that the strategies or transactions made by a firm evolving from introduction to growth cause distrust from the market, leading to higher costs in accessing to additional financing. Consistent with Hovakimian and Li (2009), firms adjusting to paid off the excess of debt show lower adjustment costs. The presence of both types of firms in this group, those who reduce debt and those who increase it, explains the small difference in adjustment costs in respect to firms that remains in maturity.

Then, we perform a third group of regressions to test if the target leverage of the next stage acts as a key factor to explain the current leverage when firms have changed of life stage. Table 5 shows how some drivers of the next-year debt target are acting in a completely different way than the same drivers of the current target to explain current debt. This is the case of profitability, market to book and size for firms that change from introduction to growth, meanwhile profitability and property, plant and equipment are different for the next change.

Table 5. Influence of the Next Target Leverage on Firm Leverage. GMM Procedure.

VARIABLES	**Change Int-Growth t+1**	**Change Growth-Mat t+1**
Intercept	-0.276***	0.107***
	[0.0853]	[0.0325]
Debt t-1	0.870***	0.713***
	[0.0187]	[0.0149]
Prof	0.483***	0.132***
	[0.0509]	[0.0192]
Growth	-0.0498***	-0.0320***
	[0.00940]	[0.00309]
PPE	-0.0883	-0.0956***
	[0.0698]	[0.0158]
Size	0.0168**	0.00529**
	[0.00739]	[0.00234]
Country dummies	Yes	Yes
Time dummies	Yes	Yes
Observations	457	760
Number of Firms	395	615
F test	3497	198.3
Hansen test	24.92	237.6
Sig. Hansen	0.771	0.101
Sig. Wald	0	0
m2	0.45	-0.18
Sig. m2	0.656	0.861

Notes: Regressions are estimated using the Arellano and Bond (1991) two-step GMM difference estimator for panel data with lagged dependent variables. Debt t-1 is book leverage in the previous year (total liabilities / total assets); Prof t+1 is profitability in the following stage (EBITDA/total assets); Growth t+1 is market to book in the following stage (market value of equity + debt in current liabilities + long-term debt + preferred stocks - deferred taxes and investment tax credit to total assets); PPE t+1 is tangibility in the following stage (property, plant and equipment/assets); and Size t+1 is the logarithm of total assets in the following stage. Heteroskedasticity consistent asymptotic standard error is in brackets. ***, ** and * represent the significance at the 1%, 5% and 10% levels, respectively.

In contrast with the results using the current target debt, the next-year profitability factor is positively related to debt in all cases, supporting the trade-off theory. Consistent with Ross (1977), considering the new perspectives offered by the changes of stage, higher levels of debt can be used by managers to signal an optimistic future for the firm. In addition, more profitable firms can hold up a higher leverage ratio.

Concerning our third hypothesis, coefficients indicate a less stable target debt during the growth stage and a more stable target debt during maturity. One year later, growth firms will show a quite different target debt, therefore, the firm contracting its debt with a long-term perspective will show a slightly higher adjustment to the current target. Our results support the findings by Hovakimian and Li (2009) as firms changing from introduction to growth would be making adjustments closer to the next-year target than to the current target. Firms changing from growth to maturity will show more stable target debt. Therefore, their speed of adjustment is similar using either the current target or the next-year target. It confirms that the debt target is a strategic decision that addresses the debt policy during several years.

6 Robustness Analysis

We have checked the robustness of our results by replicating estimations 1) with a different measure of leverage; and 2) using an alternative classification procedure for distinguishing life cycle stages.

Using debt as the dependent variable, results are very similar to those obtained with total liabilities. Light differences point to lower speed of adjustment during introduction; tangibility and size acting as stronger inductors of debt during growth and maturity; and higher intercepts. The lower speed during introduction is consistent with the expected reduction of transaction costs as the firms grow and mature, supported by the TOT and the POT. Considering that traditional theories pay little attention to operating debt, differences suggest an open research question concerning the use of different sources of funds along the firms' life cycle. The stronger effect of tangibility and size as determinants of target debt is consistent with the role of tangible assets as collateral in obtaining mainly debt. The better specification of the models confirm that the factors are inducing not only debt but all available sources of external funds, in line with the Welch's (2011) reasoning.

Taking the whole Dickinson's (2011) model as discriminant criterion, to distinguish between life cycle stages, all coefficients obtained to measure the speed of adjustment follow the same patterns. We confirm that using financial cash-flows to distinguish growth from maturity has a significant effect over the coefficients of some variables, mainly size followed by tangibility. For instance, the size effect during growth (maturity) tend to be determined by the positive (negative) sign of net financial cash flow posed by the Dickinson's model.

7 Conclusion

We conclude that the target leverage and the speed of adjustment to the optimal capital structure vary across the life cycle stages of the firms in a study using a panel database of non-financial firms in eight European countries during the period 2001-2012.

To distinguish life cycle stages, we start from the Dickinson's (2011) innovative methodology, based on the signs of operating, investing and financing cash-flows, but we substitute the financing cash-flow part by an alternative criterion based on a combination of growth and risk factors to separate growth than mature firms. This way, the current and target leverage across stages is not conditioned by the classification criterion.

Taking total liabilities as proxy for leverage, our results show a low-high-low pattern for the speed of adjustment across the life cycle stages. During introduction and maturity, the speed of adjustment is higher, meaning considerable lower transaction costs. During growth, quoted firms usually enter in other business or increase their investments in order to reach a higher growth, increasing the asymmetric information, and hindering the access to capital markets. Our results find remarkable differences of speed during introduction depending on the leverage measure. Debt is much slower to adjust during introduction than operating debt. Hence, a firm using a higher proportion of operating debt during introduction can adjust to target faster than growth firms.

Analyzing the determinants of target leverage by stage, we conclude that profitability and tangibility are the main drivers from introduction to maturity, whereas growth opportunities and size are relevant determinants but not in every stage. Profitability keeps a negative relation along the life of firm, supporting its role as source of retained earnings posed by the POT. Tangible assets have a positive contribution, in line with its effect as collateral posed by the POT. The growth opportunities variable shows a negative relation during introduction, in line with higher information asymmetry hampering new external funding (POT). The positive relation during growth suggests that the retained earnings produced by profitable firms are insufficient to cover the additional fund needs. The no-significant coefficient found for mature firms suggest opposite effects derived from this factor: bigger debt capacity and fund needs contrast with increased cash flow generation. The size factor is significant during maturity, supported by both the TOT and the POT reasoning.

A lower speed of adjustment is observed in firms that change of life stage in respect to those remaining in the same stage, consistent with higher asymmetric information and transaction costs associated to strategy changes. Concerning the target leverage, profitability and growth opportunities show a stronger effect for firms changing from introduction to growth. We conclude that new strategies cause frictions on the market affecting costs and capital structure. In addition, our results show only slightly higher costs for firms changing from growth to maturity than for firms remaining in maturity. This result is consistent with a mixed group of firms concerning adjustments of debt: those reducing debt and those increasing it, considering the asymmetric costs of both types of adjustment (Hovakimian and Li, 2009).

Finally, our results confirm that firms changing from one life stage to another use long-term targets. Furthermore, during the change from introduction to growth the adjustment is slightly faster to next-year target than to the current target. In this case, factors proxying for debt target suffer relevant changes from year to year, and debt changes are likely to adjust to needs expected two or three years ahead. By contrast, firms changing from growth to maturity would expect more stable financial needs.

Therefore, the adjustment speed is similar when either the current target or the next-year target is taken.

We contribute to the line of research on optimal capital structure twofold. Firstly, we show that the capital structure determinants as well as the speed of adjustment to target levels depend on the stage of the firm, as the capital structure theories play different roles along the life cycle stages of firms. Furthermore, we evidence differences for firms changing from one stage to another, both in targets and speed of adjustment. Secondly, we contribute to the target leverage literature by adding a new explanatory factor: the next-year target debt. Our results confirm that the next-year target is also a relevant factor to explain the current debt, being the adjustment behavior of the firms different by stages.

REFERENCES

Arellano, M., and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277 – 297.

Barclay, M.J., and Smith, C.W. (1999). The capital structure puzzle: another look at the evidence. *Journal of Applied Corporate Finance* 12(1), 8-20.

Byoun, S. (2008). How and when do firms adjust their capital structures toward targets? *Journal of Finance*, 63(6), 3069-3096.

Delmas, M., and Marcus, A. (2004). Firms' choice of regulatory instruments to reduce pollution: a transaction cost approach. *Business and Politics*, 6(3), 1-20.

Dickinson, V. (2011). Cash flow patterns as a proxy for firm life cycle. *The Accounting Review*, 86(6), 1969-1994. Available at SSRN: http://ssrn.com/abstract=755804.

Drobetz, W., Pensa, P., and Wanzenried, G. (2007). Firm characteristics, economic conditions and capital structure adjustments? *Working Paper*. University of Hamburg, Hamburg, Germany.

Drobetz, W., and Wanzenried, G. (2006). What determines the speed of adjustment to the target capital structure? *Applied Financial Economics*, 16(13), 941-958.

Elsas, R., and Florysiak, D. (2011). Heterogeneity in the speed of adjustment toward target leverage. *International Review of Finance*, 11(2), 181-211.

Ezeoha, A., and Botha, F. (2012). Firm age, collateral value, and access to debt financing in an emerging economy: evidence from South Africa. *South African Journal of Economic and Management Sciences*, 15(1), 55-71.

Fischer, E.O., Heinkel, R., and Zechner, J. (1989). Dynamic capital structure choice: theory and tests. *Journal of Finance*, 44(1), 19-40.

Flannery, M.J., and Rangan, K.P. (2006). Partial adjustment toward target capital structures, *Journal of Financial Economics*, 79(3), 469-506.

Frelinghaus, A., Mostert, B., and Firer, C. (2005). Capital structure and the firm's life stage. *South African Journal of Business Management*, 36(4), 9-18.

Gonzalez, V.M., and Gonzalez, F. (2008). Influence of bank concentration and institutions on capital structure: New international evidence. *Journal of Corporate Finance*, 14(4), 363-375.

Hackbarth, D., Miao, J., and Morellec, E. (2006). Capital structure, credit risk, and macroeconomic conditions, *Journal of Financial Economics*, 82(3), 519-550.
Heshmati, A. (2001). The dynamics of capital structure: evidence from Swedish micro and small firms, *Research in Banking and Finance*, 2, 199–241.

Hirsch, J., and Walz, U. (2011). Financing decisions along a firm's life-cycle: Debt as a commitment device, *European Financial Management*, 17(5), 898-927.

Hovakimian, A., Opler, T., and Titman, S. (2001). The debt-equity choice. *Journal of Financial and Quantitative Analysis*, 36, 1-24.

Hovakimian, A., and Li, G. (2009). Do firms have unique target debt ratios to which they adjust? *Working paper*, Baruch College, April. Available at SSRN: http://ssrn.com/abstract=1138316 or http://dx.doi.org/10.2139/ssrn.1138316.

Huang, R., and Ritter, J.R. (2009). Testing theories of capital structure and estimating the speed of adjustment. *Journal of Financial and Quantitative Analysis*, 44(2), 237-271.

Jalilvand, A. and Harris, R. S. (1984). Corporate Behavior in Adjusting to Capital Structure and Dividend Targets: An Econometric Study. *Journal of Finance*, 39(1), 127-45.

Leary, M.T., and Roberts, M. (2005). Do firms rebalance their capital structures? *Journal of Finance*, 60(6), 2575-2619.

Lööf, H. (2004). Dynamic optimal capital structure and technical change. *Structural Change and Economic Dynamics*, 15(4), 449-468.
Mahakud, J., and Mukherjee, S. (2011). Determinants of adjustment speed to target capital structure: evidence from Indian manufacturing firms. *International Conference on Economics and Finance Research*, IPEDR (4), 67-71.

Miguel, A., and Pindado, J. (2001). Determinants of capital structure: new evidence from Spanish panel data. *Journal of Corporate Finance*, 7(1), 77–99.

Miller, D., and Friesen, P.H. (1984). A longitudinal study of the corporate life cycle. *Management Science*, 30(10), 1161-1183.

Mueller, D. (1972). A life cycle theory of the firm. *Journal of Industrial Economics*, 20(3), 199-219.

Myers, S. (1977). Determinants of corporate borrowing, *Journal of Financial Economics* 5, 147-175.

Myers, S.C. (1984). The capital structure puzzle. *Journal of Finance*, 39(3): 575-592.

Pfaffermayr, M., Stöckl, M. and Winner, H. (2013). Capital Structure, Corporate Taxation and Firm Age. *Fiscal Studies,* 34(1): 109-135.

Rajan, R.G., and Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *Journal of Finance*, 50(5), 1421-1460.

Ross, S. (1977). The determination of financial structure: the incentive signaling approach, *Bell Journal of Economics*, 8(1), 23-40.

Saddour, K. (2006). The determinants and the value of cash holdings: evidence from French firms, *Working Paper 2006-6*, CEREG, pp. 1-33, available at: www.dauphine.fr/cereg/cahiers_rech/cereg200606. pdf (accessed June 3, 2012).

Shyam-Sunder, L., and Myers, S.C. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51(2), 219-244.

Teixeira, G., and Santos, M.J. (2005). Do firms have financing preferences along their life cycle? *Working Paper*, Available at SSRN: http://ssrn.com/abstract=676869 or http://dx.doi.org/10.2139/ssrn.676869.

Titman, S. and Tsyplakov, S. (2007). A dynamic model of optimal capital structure. *The Review of Financial Studies*, 11 (3), 401-451.

Titman, S., and Wessels, R. (1988). The Determinants of Capital Structure Choice. *Journal of Finance*, 43(1), 1-21.

Tomassen, S. (2004). The effects of transaction costs on the performance of foreign direct investments: An empirical investigation. *Ph.D. thesis, Norwegian School of Management* BI, Oslo.

Welch, I. (2011). Two common problems in capital structure research: The financial-debt-to-asset ratio and issuing activity versus leverage changes, *International Review of Finance*, 11(1), 1-17.