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On the adjustment speed of SMEs to their optimal capital structure

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Abstract The aim of this paper is to analyse the speed of adjustment of small and medium-sized enterprises (SMEs) to the target leverage. By applying a system GMM technique to Spanish panel data collected during the period 1995–2005, we estimate a partial adjustment model in which both target leverage and speed of adjustment are simultaneously endogenized. We provide empirical evidence on the determinants of target leverage and the speed of adjustment. More specifically, the rate of financial flexibility, growth opportunities and size are positively related to the speed of adjustment, whereas the distance to the optimal ratio of debt shows a negative impact. Our findings demonstrate that, in terms of sample mean, a high percentage of Spanish SMEs adjust rationally to their target. Additionally, the SMEs analysed appeared to be over-levered and fairly motivated to adjust (annual adjustment speed: 26%).

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1 Introduction

Despite the extensive increase in the volume of literature on small and medium-sized enterprise (SME) capital structure, relevant questions remain to be unanswered regarding how such firms distribute their funds between equity and debt. Here, we focus on the presumable existence of target leverage for SMEs.

The existence of target leverage and how quickly companies revert to it represents a recurrent hobby-horse in capital structure research. An important sector of the literature stresses the idea of a trade-off between the costs and benefits of leverage which allows firms to achieve a target or optimum debt ratio by which they maximize their wealth. Significant research has been carried out on the determinants of capital structure using the observed debt–equity ratio as the optimum ratio (Rajan and Zingales 1995; Titman and Wessels 1988). This condition implies that there is no friction in capital markets and that firms do not incur transaction costs. In reality, however, the situation is quite different, and most of the recent research on this topic contends that firms partially adjust their actual debt–equity ratio to the optimum or target ratio depending on the significance of the transaction costs to be faced. The speed at which firms gradually converge will thus depend on adjustment costs. It is assumed that if firms deviate from the target again, they will attempt to revert back to it. Nevertheless, if transaction costs become prohibitive, they may outweigh the benefits of eliminating the gap between actual leverage and target leverage, thus leading the firm to remain *sticky*.

A crucial point of the research in the area is how to estimate target leverage, as it is unobservable in nature. Various strategies have been followed by researchers. One group has externally estimated target leverage as the average leverage ratio across a sample period (Jalilvand and Harris 1984; Shyam-Sunder and Myers 1999), while others have considered industry averages as target ratios (Lev 1969). More recently, a second group of researchers has applied a two-step strategy comprising (1) the running of an a prior regression to fit the target leverage, followed by (2) incorporation of the fitted value into the adjustment equation (Fama and French 2002; Hovakimian et al. 2001). In a more sophisticated style, a third group has endogenized the target leverage into a general adjustment equation which simultaneously allows for the magnitude of transaction costs to be estimated. Authors who have published papers using this approach include Drobetz and Fix (2005), Flannery and Rangan (2006), Miguel and Pindado (2001) and López-Gracia and Sogorb-Mira (2008), with the latter focusing on SMEs. Using international data, this methodology has also been applied by González and González (2008). One common feature of all these papers is that they do not resort to externally estimating a firm's target debt ratio. Instead, they propose a dynamic model of debt adjustment in which the unobservable debt target is substituted by a vector of variables (proxies) that capture typical firm characteristics, as described in the literature. Furthermore, all of these studies assume the adjustment-speed coefficient (inversely related to transaction costs) to be constant. Thus, using a sample of listed and large Spanish companies, Miguel and Pindado (2001) estimate an adjustment-speed coefficient of 0.79, which is higher than that reported by other authors in studies of U.S. firms [e.g. Flannery and Rangan 2006 (0.34); Jalilvand and Harris 1984 (0.69); Shyam-Sunder and Myers 1999 (0.59)]. Miguel and Pindado (2001) state that this higher coefficient is due to the lower proportion of public debt issued by Spanish firms, which consequently leads to lower transaction costs. Drobetz and Fix (2005) report similar results for a sample of Swiss listed companies, suggesting comparable reasons for the difference from their U.S. counterparts, although they advise caution when comparing results as they are sensitive to the exact definition of leverage.

Taken together, the body of literature now available on target leverage and the speed of adjustment towards the target represents a remarkable advance in research, but several questions remain unanswered. The one that this paper focuses on is that the adjustment-speed coefficient is not likely to be constant, as it has usually been considered. In contrast, the speed of adjustment varies from one firm to another depending on different factors, such as own distance to the target, restrictions in financial markets, size and a number of others. Once again, the problem will be how to introduce the speed of adjustment for each and every company into the adjustment model, as it is not observable in nature. We suggest that the solution is to endogenize this variable as well, although it will undoubtedly make the equation to be estimated more complex.

This strategy has been followed in three recently published papers, namely, those by Banerjee et al. (2004), Drobetz and Wanzenried (2006) and Lööf (2004). While panel data methodology and a similar econometric framework are applied in all three studies, only Drobetz and Wanzenried (2006) use an instrumental variable (IV) estimation technique—more specifically, the dynamic panel data estimator (differenced Generalized Method of Moments, GMM) suggested by Arellano and Bond (1991). We try to improve this procedure in this paper by applying an even more recent technique, namely, system GMM, which estimates equations in levels as well as in first-differences. These three studies also did not specifically consider SMEs, which are the focus of the present study.

SMEs differ greatly from large companies and display particular characteristics which make them a suitable group to analyse within the framework of this new field of research. This type of company tends to be more affected by restrictions in financial markets as they face serious information asymmetries and agency costs. Therefore, SMEs face a financial competitive disadvantage in comparison to larger enterprises. This disadvantage is only partially offset by special government programs targeting SMEs (e.g. in Spain, the Official Credit Institute or the Mutual Guarantee Scheme network facilitate low-interest loans). SMEs are also more volatile and, as such, more prone to bankruptcy. As they depend to a great extent on bank financing, they should find it more difficult to carry out their projects. SMEs are independent firms, usually owned and run by one manager or a few individuals (relatives); they are subject to fewer disclosure requirements than other types of enterprises, which make them more opaque and available information less reliable. As a consequence, transaction costs should be relevant when explanations are being sought on how these firms adjust to their target, and here we pay special attention to this. In summary, SMEs provide an interesting bench test to corroborate and extend previous results in the field.

The aim of this study reported here was to study the speed of adjustment to the target and the determinants of this speed using a sample of Spanish SMEs. As shown in Schmiemann (2008), the Spanish industrial panorama of SMEs differs significantly from that found in other countries in the European Union (EU) in that there is (1) a higher proportion of SMEs (99.9%), (2) a higher proportion of the number of persons employed (78.7%), (3) a larger contribution in Value Added (68.5%), (4) a greater density of SMEs (60 firms per 1,000 inhabitants) and (5) a lower productivity than the EU average, likely due to their smaller size in relative terms (97.5% of SMEs report sales below two million euro). Hence, Spain can be considered to be a representative country of a global world which is mainly made up of SMEs. The Spanish financial market can be roughly split into two levels: first, the Stock Exchange, where around 150 large non financial companies operate actively;[1] secondly, the banking system, which is the main source of credit for most of the SMEs in Spain (approximately three million firms). The capital structure of Spanish listed companies has frequently been analysed, but that of SMEs has not. Furthermore, growth in the Spanish economy clearly outpaced that of its European counterparts over the period 1995–2005, the time frame covered by our study, with SMEs being the main contributors. Thus, the singular characteristics of Spanish SMEs provide a different perspective on the adjustment process, particularly over the aforementioned period.

We contribute to the current research on this topic (1) by extending the type of companies being studied and (2) by applying a recent econometric methodology (system GMM estimator) which also enables us to simultaneously endogenize both non-observable target leverage and speed of adjustment. Moreover, this study contributes towards improving our knowledge of the Spanish market in relation to the speed of adjustment to optimal capital structure. Thus, Miguel and Pindado (2001) report a high speed of adjustment for Spanish listed companies, while López-Gracia and Sogorb-Mira (2008) assert that Spanish SMEs adjust very slowly and find the cost of an unbalanced position lower than the cost of adjusting. These results are explained by the different transaction costs companies face, but these studies do not provide the reasons for the gap. Our findings corroborate that Spanish SMEs do adjust slowly, and they show that the distance to the target negatively influences adjustment speed, whereas firm size, growth opportunities and financial flexibility act as incentives to approach the target and reduce transaction costs.

We also provide empirical evidence on the determinants of target leverage and the speed of adjustment. Our estimates provide strong evidence that our partial-adjustment capital structure model fits the data well. Furthermore, our model allows us to analyse the portion of times or periods in which firms adjust rationally (increasing or reducing leverage when under-levered or over-levered, respectively) according to their target. Our findings show that around 52% of observations adjust rationally, thus making targeting behaviour very obvious. Furthermore, in terms of sample mean, SMEs seem to adjust to target leverage at a speed of adjustment of (around) 26%.

The rest of the paper is organized as follows. Section 2 addresses the theoretical grounds of the research, develops a partial adjustment model in which target ratio and speed of adjustment are simultaneously endogenized and explains the methodology. Section 3 provides a discussion on the dependent

[1] Since 1986 Spain has a second capital market (currently called “Alternative Stock Market”) aimed at small enterprises, although it has never worked very well. We presume that the high information costs of going public and the threat of losing control are at the core of the decision to enter the stock market.

variable and the determinants of both optimal capital structure and speed of adjustment. Section 4 describes the sample selection process and presents a descriptive analysis of the data. Section 5 discusses the estimation method and presents the results. Special emphasis is placed on the analysis of the adjustment process along with the speed of adjustment of firms. Finally, Section 6 concludes and explains some of the limitations and implications of the study.

2 Dynamic adjustment to target leverage

Our model is set in a dynamic framework and aims to capture the financial behaviour of SMEs. We assume firms face transaction costs and partially adjust their current leverage to their optimal or target leverage. In a frictionless world, firms would always reach their target. In contrast, adjustment costs hinder full adjustment to the target, and firms compare the cost of an unbalanced (or suboptimal) position to the cost of adjusting. We expect most firms to progressively revert to their target, but small firms in particular will do it slowly as they typically face high fixed transaction costs.

We also assume that optimal capital structure varies across firms and over time as the factors determining target leverage will also change over time. This issue is crucial to being able to capture the essence of the dynamic nature of capital structure, which has traditionally been overlooked by researchers (Heshmati 2001). For similar reasons, we hypothesize that the rate of adjustment from one period to the next—referred to as adjustment speed—varies across firms and over time.

A standard partial adjustment model capturing the mentioned features can be summarized as follows (see Banerjee et al. 2004):

$$D_{it} - D_{it-1} = \mu_{it}(D^*_{it} - D_{it-1}) \tag{1}$$

where D_{it} and D_{it-1} respectively denote the observed debt ratio of firm i of the current (t) and previous ($t - 1$) periods, being defined as the quotient between total debt and total assets, D^*_{it} represents the target debt ratio and μ_{it} is the speed of adjustment or target-adjustment coefficient. Both D^*_{it} and μ_{it} are unknown and have to be substituted by their respective vectors of determinants, which will be developed in Sect. 3 below.

Each period, firms approach their target by a proportion μ of the existing gap between their actual debt ratio in the previous period and their objective level of debt at the end of the current period. Equation (1) represents dynamic behaviour whereby a given firm adjusts towards its target D^* in the presence of adjustment costs. Thus, when μ falls between 0 and 1, it follows that the firm will gradually bring its debt level in line with its target over time (Flannery and Rangan 2006). The adjustment coefficient μ works either for increasing or decreasing debt. Moreover, if $\mu > 1$, a firm over-adjusts and if $\mu < 0$, a firm deviates from the target over time. Accordingly, a typical expected rate for this coefficient should take a value between 0 and 1. Adjustment behaviour can be displayed as in Figs. 1, 2 and 3.

Now, rearranging Eq. (1) we arrive at the expression

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

Equation (2) says that the actual debt ratio of firm i is obtained as a weighted average from D_{it-1} and D^*_{it}, $1 - \mu_{it}$ and μ_{it} are the respective weights. If there are no transaction costs, it follows that μ will be equal to 1. In contrast, if transaction costs are extremely high, then μ will equal 0 and the debt ratio is sticky, that is, $D_{it} = D_{it-1}$. As a general rule, we expect firms to be far from the target in any period and firms' actual debt ratio to eventually converge to its optimal debt ratio. Equation (2) is intended to capture this process by allowing both target leverage D^*_{it} and the adjustment speed coefficient μ_{it} to be endogenized. The regression of Eq. (2) also makes it possible to avoid typical bias inherent to simply regressing observed leverage on determinants of optimal capital structure alone (see Heshmati 2001; Miguel and Pindado 2001). Let the optimal debt ratio D^*_{it} for firm i at time t be a linear function of the form

$$D^*_{it} = \beta_0 + \sum_{j=1}^{J} \beta_j X_{jit} \tag{3}$$

where X_{jit} is a vector of j firm and time variant characteristics (j being 1, 2, …, J) that have usually been considered in SME literature, β_0 is a constant term and β_j is a coefficient vector.

Let also the adjustment speed coefficient μ_{it} for firm i at time t be a linear function of the form

$$\mu_{it} = \alpha_0 + \sum_{k=1}^{K} \alpha_k Z_{kit} \quad (4)$$

where Z_{kit} is a vector of k firm and the time variant characteristics (k being 1, 2, …, K) related to adjustment costs and costs of deviating from the target, α_0 is a constant term and α_k is a coefficient vector.

Substituting Eqs. (3) and (4) into Eq. (2) and rearranging yields the following econometric model:

$$\begin{aligned} D_{it} &= (1-\mu_{it})D_{it-1} + \mu_{it}D^*_{it} + e_{it} \\ &= \left(1 - \alpha_0 - \sum_{k=1}^{K}\alpha_k Z_{kit}\right) D_{it-1} \\ &\quad + \left(\alpha_0 + \sum_{k=1}^{K}\alpha_k Z_{kit}\right)\left(\beta_0 + \sum_{j=1}^{J}\beta_j X_{jit}\right) + e_{it} \end{aligned} \quad (5)$$

where e_{it} is a statistical error term, independent and identically distributed with constant variance.

Multiplying Eq. (5) out, reorganizing the terms and taking into account that all regressions follow panel data methodology, econometric model (6) is yielded.

$$\begin{aligned} D_{it} &= \beta_0\alpha_0 + (1-\alpha_0)D_{it-1} + \alpha_0\sum_{j=1}^{J}\beta_j X_{jit} \\ &\quad + \beta_0\sum_{k=1}^{K}\alpha_k Z_{kit} - \sum_{k=1}^{K}\alpha_k Z_{kit} D_{it-1} \\ &\quad + \sum_{j=1}^{J}\sum_{k=1}^{K}\beta_j\alpha_k X_{jit} Z_{kit} + v_i + v_t + e_{it} \end{aligned} \quad (6)$$

where v_i is a firm-specific effect and v_t is a time-specific effect. While v_i controls the unobservable heterogeneity of the firms (different for everyone and constant over time), v_t is intended to capture possible macroeconomic effects (identical for all firms although variant over time). Hence, we do not intend to make the estimation unnecessarily complex by capturing macroeconomic effects from a global perspective instead of introducing particular macroeconomic variables. Thus, Eq. (6) will be the subject of our main empirical analysis.

When estimating Eq. (6) we first put the accent on α_k coefficients in order to analyse their actual effect on the speed of adjustment and the current debt ratio. Although α_k coefficients intervene in various terms of Eq. (6) we mainly focus on the interaction terms between speed adjustment determinants and lagged leverage, that is, $\sum_{k=1}^{K}\alpha_k Z_{kit} D_{it-1}$. Additionally, the coefficients in $\beta_0\sum_{k=1}^{K}\alpha_k Z_{kit}$ are also checked in order to guarantee that α_k estimates follow the same directions. This analysis represents one of the primary objectives of our research. Second, we will also emphasize the significance of β_j estimators in order to check the usual fulfilling of capital structure hypotheses. Third, we will also report on $1-\alpha_0$ significance, which is the coefficient associated to lagged leverage D_{it-1}. Eventually, the interaction $\alpha_k\beta_j$ appearing in $\sum_{j=1}^{J}\sum_{k=1}^{K}\beta_j\alpha_k X_{jit} Z_{kit}$ will also not be reported because it does not clearly contribute to explaining the debt ratio variation and it is not easy to interpret. Nevertheless, all of the terms on the right-hand side of Eq. (6), both v_i and v_t included, will be introduced in the regression as a whole.

To appreciate the proximity of a firm's actual debt ratio to its target at a particular time, we define the optimality ratio $\theta_t = D^*_{it}/D_{it}$, which measures the degree of optimality of leverage that a firm has reached at time t (see Banerjee et al. 2004; Heshmati 2001). It takes a value of 1 if at time t the firm is at its optimal leverage. As target leverage D^* varies over time, a firm showing a value of 1 for this ratio at any point in time does not mean anything in terms of its future degree of optimality. Nevertheless, it does give a practical idea to managers of the actual situation of leverage policy and can help them to take steps accordingly. The ratio θ is frequently expected to be <1, which means that a firm is over-levered; on the contrary, a value of >1 means that the firm is under-levered with respect to its target. Behaviour will be rational if a firm reduces or raises its debt ratio, respectively, in the former or the latter situation.

As we intend to evaluate our basic dynamic model [Eq. (1)] we also define $\theta_{t-1} = D^*_{it}/D_{it-1}$, which is the optimality ratio where a firm's target $\left(D^*_{it}\right)$ is compared to its previous debt ratio (D_{it-1}). We proceed in this way in order to be coherent with Eq. (1). Thus, both θ_{t-1} and θ_t will be calculated, the latter being used just as a reference in the analysis.

3 Dependent and explanatory variables

3.1 Dependent variable

To the extent that data are available, both market and book values tend to be used to measure leverage as, for example, in Banerjee et al. (2004), Drobetz and Wanzenried (2006) and Flannery and Rangan (2006). In fact, a high correlation between the two has been found in some recent research (Banerjee et al. 2004). In this study, due to the lack of market values, we only calculate the book value of leverage measured as the ratio of the book value of total liabilities to total assets. We also include non-interest-bearing debt, as this typically represents an important source of financing for SMEs, affecting the adjustment speed to target leverage. Furthermore, managers of SMEs barely have any options to manage the capital structure of their firms other than book values, as this type of firms is not commonly listed on a capital market.

Thus, our leverage measure is a firm's book debt ratio (at time *t*),

$$D_{it} = \text{total liabilities}_{it}/\text{total assets}_{it}$$

3.2 Determinants of target leverage

In the following subsections we present the choice of firm-specific characteristics, X_j, that are thought to be relevant in determining optimal capital structure (see Rajan and Zingales 1995; Shyam-Sunder and Myers 1999; Titman and Wessels 1988).

3.2.1 Default risk

Default risk acts as a mechanism that offsets debt financing in order to safeguard firms from bankruptcy, thus preventing firms from using debt in excess. Default risk gives rise to either direct or indirect financial distress costs, and small firms are relatively more prone to suffering both of the latter. The volatility of operating income has a direct influence on these costs and, therefore, represents an accurate proxy of the probability of bankruptcy (Mackie-Mason 1990; Miguel and Pindado 2001). Hence, the higher the volatility of the operating income of firms, the greater their incentives to reduce the indebtedness (Wald 1999). We approach a firm's default risk, referred to here as *risk*, by using the ratio of the operating cash-flow standard deviation over the period starting in 1994 (with 1994 being the first year in which the data are available) up to the current year *t* to the mean of total assets over the same period. We expect this variable to negatively affect the optimal leverage ratio. Similarly, we capture the influence of this factor by using the proxy EBIT (earnings before interest and taxes) to interest costs.

3.2.2 Growth opportunities

As shown by Myers (1977), highly levered firms with significant expected growth face an underinvestment problem which leads them to forgo investment projects with a positive net present value. Therefore, by reducing debt, firms avoid the shareholder–bondholder agency conflict in which the benefits obtained by shareholders are transferred to bondholders if the investment project is carried out. It has also been suggested that as growth opportunities are intangible assets, and therefore difficult to assess, with a low residual value, the greater the growth opportunities of a firm, the more probability of bankruptcy; hence, the firm will tend to reduce debt (Titman and Wessels 1988). Nevertheless, from the point of view of asymmetric information costs, firms could increase leverage as a reaction to strong growth prospects once their internal resources have run out. Thus, debt is increased or decreased depending on whether or not investment requirements exceed the funds available internally (Shyam-Sunder and Myers 1999). Empirical research has documented both types of effects of this factor on leverage (see Michaelas et al. 1999). While most empirical studies have used market values of the firm versus book values, such as Tobin's q ratio, to measure growth opportunities, SME research has mainly adopted the percentage change in total sales or assets (Heshmati 2001; Scherr and Hulburt 2001). More specifically, we measure growth opportunities in terms of sales variation, which is proxied by the variable *growth*, defined as the average annual change from 1995 to the current year *t*. Under this definition we assume that the recent average increase in sales approximately depicts the expected increase in sales in the future.

3.2.3 Profitability

The existence of informational asymmetries makes firms choose internal resources as a first option as these are the cheapest funds (Myers 1984; Myers and Majluf 1984). This constraint implies that highly profitable companies will tend to finance investments with retained earnings instead of using external funds, either debt or equity. In addition, SMEs usually suffer financial restrictions in credit markets as they face typical problems of adverse selection and moral hazard, which lead them to mainly resort to internal resources, thus strengthening the aforementioned effect. Therefore, we can typically expect profitability to negatively affect leverage (see Fama and French 2002). Nevertheless, as has been documented from the point of view of the static trade-off theory, profitability would also have a positive relationship with capital structure for firms to take advantage of tax savings from debt interests. We measure this factor by the variable *profit*, which is defined as the ratio of operating income to total assets (e.g. Hovakimian et al. 2001; Wald 1999).

3.2.4 Non-debt tax shields

The presence of non-debt tax shields (NDTS), such as accelerated depreciation or investment tax credits, affects capital structure decisions, as discussed in the literature (e.g. DeAngelo and Masulis 1980). As firms increase their NDTS, they appear to be less interested in debt as it reduces taxable income (income–substitution effect). In other words, firms try to reduce their tax burden by using NDTS rather than debt, thus avoiding unnecessary distress costs (Dammon and Senbet 1988). NDTS can be particularly relevant in SMEs which take advantage of special treatment from the tax code. We expect leverage to be negatively affected by this variable. We measure this effect by using the proxy *shield*, which is defined as the ratio of depreciation and fixed assets.

3.2.5 Tangibility

Tangible assets significantly contribute to the solvency of firms, giving them a higher debt capacity. In the event of bankruptcy, tangible assets retain most of their value, whereas intangible assets suddenly disappear (Rajan and Zingales 1995; Titman and Wessels 1988). Despite this simple direct effect between tangibility and leverage, empirical research has often argued a contrary result (e.g. Grossman and Hart 1982). Thus, firms, such as many SMEs, boasting limited tangible (fixed) assets will bear high monitoring costs derived from the typical problems of informational asymmetries. In other words, lenders will pursue a more in-depth control of firms that lack collateral. Monitoring costs (and perquisites) can then be reduced if firms voluntarily raise debt. In summary, both effects on leverage, positive and negative, can be expected from tangibility. We measure this factor by using the proxy *tangib* which is defined as the ratio of fixed assets to total assets.

3.2.6 Uniqueness

Businesses focused on one sole product or activity face serious difficulties when, in the case of bankruptcy, assets need to be liquidated in order to reimburse lenders. The more unique the business, the more difficult it is to find a secondary market where assets can be sold (see Arping and Lornath 2006; Titman and Wessels 1988). This factor can be proxied by expenditure on research and development or advertising, but this information is not available in our database. Following Lööf (2004), we measure this factor (uniqueness) through the wage level, which is assumed to be a proxy for knowledge capital. Firms with relatively unique products tend to employ people with high levels of job-specific human capital and who are therefore well paid. Hence, we approach the variable *unique* as the quotient between employee costs and total sales. We expect leverage to be negatively affected by this variable.

3.2.7 Size

Firm size is an important control variable that must be introduced. The larger the firm, the greater collateral guarantees and the more diversified it will be, thus offering less risk to lenders (Titman and Wessels 1988). Consequently, large companies can achieve a better reputation on financial markets and accomplish higher optimal debt capacity. Nevertheless, large companies also face lower costs derived from informational asymmetries and monitoring and as a result, they may have fewer incentives to boost leverage (Rajan and Zingales 1995). Lastly, if the fixed costs of external financing are important, small firms will have more difficulties gaining access to new borrowing. As Kurshev and Strebulaev (2007) contend, in the presence of non-trivial fixed costs, small firms would reject refinancing too often and would compensate from losing tax benefits by taking more leverage at each refinancing. It follows that a negative effect on leverage can be found either at the beginning of the cycle or within the cycle, but a positive effect can be found only when the firm is at the end of cycle. Thus, these authors suggest that in any cross-section, firms can display different stages of their refinancing process, making the prediction of the aggregate relationship a difficult task. We measure this factor by the variable *size*, which is defined as the logarithm of total sales.

3.3 Determinants of the speed of adjustment

No theoretical analysis on the determinants of the speed of adjustment has been developed in the literature on capital structure, much less in relation to SMEs. Nevertheless, the relevant issue to be discussed is which type of factors can contribute to reasonably explaining variations in the speed of adjustment. Empirical research has contributed to fill this gap by offering practical reasoning (see Banerjee et al. 2004; Drobetz and Wanzenried 2006; Kim et al. 2006). Not only can adjustment costs be important on their own, but also the distance to the target and the costs of being unbalanced have to be taken into account. Based on these grounds, we have selected four factors to be considered, two of which have already been defined above as determinants of optimal leverage (growth opportunities and size).

3.3.1 Distance between optimal debt and observed debt

SMEs face high costs of adjustment due to asymmetric information problems, such as adverse selection or moral hazard. As most of these costs can be considered to be fixed (e.g., legal fees or similar), firms have no incentives to adjust unless they are a long way off target. Thus, *prima facie*, it can be stated that SMEs will raise the speed of adjustment proportionally to their distance from the target. Moreover, SMEs compare the costs of being suboptimally situated (above or below the target) to the costs of adjusting and approaching the target. If the latter is highly burdensome, they probably will choose (1) to give up adjusting to the target or, alternatively, (2) to reduce the speed of adjustment. Therefore, both effects positive and negative of the distance to the target on the speed of adjustment are plausible. We measure the distance to the target by the proxy *distance*, which is defined as the absolute difference between optimal leverage ratio at time t D^*_{it} and observed leverage ratio the same year D_{it}, that is, $distance = \left|D^*_{it} - D_{it}\right|$, where D^*_{it} is fitted by a fixed-effects regression of the observed ratio D_{it} on the vector of determinants of capital structure. Our empirical research has also tested the variable *distance* as the difference between the optimal leverage ratio D^*_{it} and observed leverage ratio the previous year D_{it-1}.

3.3.2 Rate of financial flexibility

Small and medium-sized enterprises with a flexible financing structure have more opportunities to adjust their observed capital structure to the target. "Flexible" financing is understood here as the ability of firms to alter their debt composition without incurring prohibitive costs. Thus, liabilities in general (with non-interest-bearing) or short-term debt can be more easily restructured and negotiated with lenders than bonds, long-term debt or the like. However, SMEs with a high ratio of short-term to long-term debt are not necessarily flexible if they are not financially healthy. Thus, we measure the rate of financial flexibility, denoted *flexib*, by multiplying two dichotomous variables, namely, (1) the ratio of short-term debt to long-term debt, which equals 1 if it is above the mean, that is, a priori very flexible firms, and 0 otherwise, and (2) operating cash flow, which equals 1 if it is above the mean, that is, a priori financially healthy firms, and 0 otherwise. Thus, the variable *flexib* not only captures the proportion of short-term debt over long-term debt, but it also indicates the financial health of the company. We expect this variable to have a positive effect on adjustment speed.

3.3.3 Growth opportunities

Growing firms have obvious incentives to restructure their capital structure by raising new external capital, debt or equity, although typical asymmetric information problems prevent SMEs from reaching new equity when seeking new funds. Thus, SMEs will tend to increase debt once their internal resources—which have no information costs—have run out. Furthermore, to the extent that a significant portion of new financing costs are fixed, we can hypothesize that the more growth opportunities there are, the higher the increase in adjustment speed. Hence, our expected assumption is a positive relationship between growth opportunities and speed of adjustment.

3.3.4 Size

Size should also have an important influence on how fast SMEs adjust to their target. When large companies deviate from the target, they may be encouraged to restructure their capital structure to the extent that a significant part of the costs involved could be fixed costs, thus inducing scale economies. Hence, the larger the size, the smaller the cost of restructuring and, consequently, the higher the adjustment speed to be expected. In addition, it can be argued that larger firms can find more financial market opportunities and, obviously, more readily adjust. Hence, size and adjustment speed are expected to be positively related.

All of these variables (*distance*, *flexib*, *growth* and *size*) defined as determinants of speed of adjustment have been expressed as dichotomous variables to estimate Eq. (6), taking a value of 1 when they are above the mean and 0 if they are under the mean. Two reasons can be highlighted for operating this way. First, multicollinearity problems arising at model estimate [Eq.(6)] can be avoided; second, interpretation of coefficient estimates and the relationship between the speed of adjustment and its determinants can be improved.

Table 7 in the Appendix provides a detailed description of the dependent variable plus all of the variables incorporated as determinants of optimal capital structure and speed of adjustment.

4 Data

We construct our sample from all firms included in the SABI (Sistema de Análisis de Balances Ibéricos) database, managed by Grupo Informa D&B.

The firms in the sample meet the definition established by the European Commission for an SME (Recommendation 2003/361/EC, May 6th, 2003) which is as follows: (1) fewer than 250 employees; (2) less than €50 million invoiced or, alternatively, assets less than €43 million; (3) independent firm, that is, no more than 25% of total shares can belong to any other firm (or joint firms) unless they are also SMEs.

The period of analysis starts in 1995 and runs until 2005 (a time-span of 11 years in total). Firms showing extreme, missing or inconsistent figures in any of the variables were excluded from the sample. Those firms falling outside the interval $\pm$ 2 times the standard deviation were removed (see Anderson et al. 2001).[2] Due to the construction of the variables and the estimation method, the firms included in our sample are required to have complete data for at least seven consecutive years of the 11-year period of the panel. The final sample contains 947 firms with incomplete information for the 11-year period 1995–2005. This results in a data panel with 9114 observations. This sample is reasonably representative of Spanish SME firms as they cover all sectors, except finance and insurance due to their specific financial behaviour and specificity.

Table 1 (Sector A) shows the distribution of firms by number of consecutive years with complete information; Sector B shows the distribution of observations by year. The panel mostly comprises small firms, which represent 72% of the total sample (682 firms), followed by micro firms, with 27% (256 firms), and medium firms, with 1% (9 firms).[3] A larger proportion of micro firms have been excluded due to their accounting reports being of low quality. Overall, the included firms record an average of 9.6 years in which they provide financial information.

A summary of relevant statistics for the dependent and explanatory variables defined in Sect. 3 above is given in Table 2.

5 Estimation methodology and results

5.1 Estimation method

There are several ways to estimate our multivariate dynamic model represented by Eq. (6). The ordinary least squares (OLS) estimator will be inconsistent

[2] In order to avoid the "mask" effect produced by own extreme values, mean and standard deviation have been calculated without considering the lowest and highest ten values (Becker and Gather 1999).

[3] Small firms are defined as those having fewer than 50 employees and less than €10 million in sales or, alternatively, assets. Micro firms are those with fewer than ten employees and less than €5 million in sales or, alternatively, less than €2 million in assets.

Table 1 Sample distribution

Number of years	Firms
Sector A: distribution of firms by number of years with complete information	
7	107
8	86
9	237
10	143
11	374
Total	947
Years	**Observations**
Sector B: distribution of observations by year	
1995	374
1996	517
1997	754
1998	840
1999	947
2000	947
2001	947
2002	947
2003	947
2004	947
2005	947
Total	9114

Table 2 Descriptive statistics of variables

Variable	Mean	Standard deviation	Minimum	Maximum
D_{it}	0.7119	0.1458	0.1943	0.9923
risk	0.0332	0.0188	0	0.1214
growth	0.1337	0.1421	−0.4714	2.6010
profit	0.0572	0.0328	−0.0572	0.1796
shield	0.1286	0.0704	0	0.4036
tangib	0.2300	0.1342	0	0.6184
unique	0.1642	0.0910	0.0114	0.5014
size	6.3033	0.3079	5.3726	7.3408
distance	0.1096	0.0839	1.19 E^{-07}	0.5040
flexib	0.0706	0.2561	0	1

Note: All variables displayed in this table are defined in the Appendix (Table 7). Number of observations: 9114. Number of firms: 947

because the unobservable individual firm effect v_i is correlated with the lagged dependent variable D_{it-1} (Bond 2002; Hsiao 2003). Although it is possible to eliminate v_i by first-differencing, the OLS estimator is still inefficient as Δe_{it} and ΔD_{it-1} are correlated to each other as a consequence of the correlation between e_{it-1} and D_{it-1}. In addition, OLS estimator assumes that all of the explanatory variables are strictly exogenous, which may not be the case in leverage decisions (Demsetz and Villalonga 2001; Antoniou et al. 2006). On the other hand, the within-groups estimator eliminates v_i by transforming the original equation; however, it is also inconsistent as this transformation induces a non-negligible correlation between the transformed lagged dependent variable and the transformed error term (Baltagi 2005).

Consistent estimates can be obtained by using the two-stage least squares (2SLS) with instrumental variables procedure proposed by Anderson and Hsiao (1982), although this technique may not be asymptotically efficient. The generalized method of moments (GMM) developed by Hansen (1982) along with first-differenced GMM estimators developed by Holtz-Eakin et al. (1988) and Arellano and Bond (1991) provide a convenient framework for obtaining asymptotically efficient estimators in this context (Bond 2002; Ozkan 2001). Thus, the aforementioned GMM estimators can control for both individual heterogeneity and potential endogeneity problems.

Nevertheless, recent research shows that the differenced GMM estimator has a problem that is related to using weak instruments (Antoniou et al. 2006). Arellano and Bover (1995) and Blundell and Bond (1998) developed a system GMM technique that estimates equations in levels as well as in first-differences. The system GMM estimator uses instruments in first-differences for equations in levels and instruments in levels for equations in first-differences. Moreover, this estimator has a much smaller finite sample bias and is much more accurate when estimating autoregressive parameters using panels with a large number of cross-section units and a small number of time periods, as is the case with our data (Bond 2002). In addition, in this context, the two-step GMM estimator is frequently more efficient than the one-step estimator (Antoniou et al. 2006). Consequently, we will apply the two-step system GMM method to estimate Eq. (6) as it offers better estimation properties and allows us to overcome some of the typical underlying weaknesses associated with instrumental variable selection. All estimates are carried out using the statistical package Stata (StataCorp 2007).

5.2 Optimal debt ratio estimation

As stated in Subsect. 3.3, in order to calculate the variable $distance = \left|D^*_{it} - D_{it}\right|$, which is included in our main model, that is, Eq. (6), we first start by estimating D^*_{it} as it is non-observable in nature. We approach D^*_{it} through a non-dynamic or static fixed-effects model in which observed leverage D_{it} is regressed on the determinants of optimal capital structure. This econometric model can be represented as:

$$D_{it} = \beta_0 + \sum_{j=1}^{J} \beta_j X_{jit} + v_i + v_t + e_{it} \tag{7}$$

where X_{jit} is a vector of j firm and time-variant characteristics previously discussed in Subsect. 3.2, β_0 is a constant term and β_j is an associated coefficient vector. Equation (7) has also incorporated firm-specific or fixed effects (v_i) and time-specific effects (v_t).

Panel data from the selected sample of 947 SMEs are used to estimate Eq. (7), while at the same time the main determinants of capital structure are identified. Once the leverage target D^*_{it} has been fitted, the variable $distance = \left|D^*_{it} - D_{it}\right|$ can be calculated. Table 3 below shows the results from estimating model (Baltagi 2005).

Wald's test of joint significance of regressors clearly rejects the null hypothesis of all the parameters being equal to zero. Moreover, Hausman's test also rejects the null hypothesis of fixed-effect and random-effect estimators being equivalent, which can be interpreted in favour of using the former, that is, the fixed-effect estimator.

In terms of the particular estimates of regressors, empirical evidence indicates that all of them are significantly related to the debt ratio. The level of critical significance or p value for every coefficient indicates a high degree of confidence. Thus, growth opportunities (*growth*) and size (*size*) have a positive impact on leverage, whereas the remaining factors—default risk (*risk*), profitability (*profit*), non-debt tax shields (*shield*), tangibility (*tangib*) and uniqueness (*unique*)—have a negative influence. These results roughly corroborate previous empirical research on SME capital structure (see Berger and Udell 1998; Michaelas et al. 1999; Sogorb 2005). Overall, these results confirm the selected variables as appropriate determinants of capital structure and simultaneously permit the calculation of the variable *distance*, which has to be introduced into the dynamic model represented by Eq. (6).

Table 3 Fixed-effects estimates of optimal capital structure during the period 1995–2005 [Eq. (7)]

Number of observations: 9114; number of firms: 947	
Dependent variable: D_{it}	
Explanatory variable	Coefficient (p value)
constant	−0.2177 (0.000)
risk	−0.3566 (0.000)
growth	0.0580 (0.000)
profit	−0.5073 (0.000)
shield	−0.2068 (0.000)
tangib	−0.0802 (0.000)
unique	−0.1172 (0.000)
size	0.1718 (0.000)
R^2 within	0.2873
Wald test (F statistic)	162.57 (0.000)
Hausman test (χ^2)	277.77 (0.000)

Notes: Estimates are carried out through fixed-effect regressions using the robust intra-group estimator. The p value in parenthesis provides the level of critical significance. The model includes firm fixed effects and year dummies. Reported R^2 is "within" R^2 statistic. Wald's test statistic refers to the null hypothesis that all coefficients on the explanatory variables are equal to zero. Hausman's test refers to the null hypothesis of both fixed effects and random effects being equivalent. Dependent and explanatory variables are described in the Appendix (Table 7)

5.3 Dynamic model estimation

Our dynamic model represented by Eq. (6) is estimated by applying the system GMM estimator (two-step robust version). All of the explanatory variables of leverage and adjustment speed have been treated as endogenous. Specifically, these variables are considered predetermined.[4] Furthermore, as Arellano and Bond (1991) assert, the coefficient estimates are only consistent if there is no second-order serial

[4] The set of instruments includes all possible lag levels as instruments in the first-differenced equation (referred to $t-2$ year and the previous years for the lagged dependent variable and $t-1$ year and the previous years for all the explanatory variables of both leverage and adjustment speed). Additionally, we include the lagged first-differences (as to $t-1$ year) as instruments in the equation in levels.

correlation in the differenced residuals. As this hypothesis is violated, Eq. (6) is estimated by including the second lag of leverage (D_{it-2}) as an additional explanatory variable. This procedure usually allows the mentioned autocorrelation test to be fulfilled.

Table 4 displays the results and shows the associated coefficient estimates of the lagged leverage D_{it-1}, the explanatory variables of optimal capital structure X_{jit} and the adjustment speed—lagged leverage interaction terms $Z_{kit}D_{it-1}$. The remaining estimated coefficients of our dynamic model [Eq. (6)], as explained in Sect. 2, are just reported in the Appendix (Table 8).

The robustness of the estimation results has been analysed using different tests. First, Wald's test for the joint significance of target leverage and adjustment speed regressors (Wald-1) verifies the validity of the selected variables of the model (p value $= 0$). Wald's test for the joint significance of time dummies (Wald-2) also confirms their validity (p value $= 0.001$), suggesting that macroeconomic factors exert a relevant influence on leverage decisions. This empirical evidence supports the concept that the upward economic cycle and low interest rates significantly influenced the financial behaviour of SMEs throughout the period 1995–2005.

Second, Sargan's test of overidentifying restrictions highlights that the instruments used in the dynamic model estimation are valid (p value $= 0.150$), thus confirming the need to treat the explanatory variables as endogenous. Lastly, serial correlation tests have confirmed the absence of second-order autocorrelation in first-differenced residuals (p value $= 0.370$).

In relation to the influence of individual explanatory variables on optimal capital structure, the estimated coefficients in our dynamic model remain essentially equal to those obtained by the fixed-effects model regression.[5] Only the size (*size*) is non-significant (p value $= 0.12$). Thus, system GMM estimation provides additional empirical evidence for hypotheses testing of capital structure choice.

Lagged leverage has a significant influence on the current choice of borrowing, as can be deduced from the estimation results of the dynamic model. The estimate of the coefficient is 0.5391 (p value $= 0$). Although the whole effect of lagged leverage on the debt ratio is diluted in Eq. (6), this result is consistent with that of our basic model summarized in Eq. (2),

Table 4 System GMM estimates of the dynamic model during the period 1995–2005 [Eq. (6)]

Number of observations: 7220; number of firms: 947	
Dependent variable: D_{it}	
Explanatory variable	Coefficient (p value)
constant	0.1815 (0.311)
D_{it-1}	0.5391 (0.000)
risk	−0.6010 (0.015)
growth	0.2702 (0.000)
profit	−0.4193 (0.000)
shield	−0.3381 (0.000)
tangib	−0.2166 (0.000)
unique	−0.1904 (0.001)
size	0.0403 (0.128)
D_{it-1} × *growth-speed*	−0.1365 (0.000)
D_{it-1} × *size-speed*	−0.2524 (0.000)
D_{it-1} × *distance-speed*	0.2810 (0.000)
D_{it-1} × *flexib-speed*	−0.0615 (0.032)
Tests of specification	Statistic (p value)
Wald-1	181.87 (0.000)
Wald-2	27.31 (0.001)
Correlation-1	−10.68 (0.000)
Correlation-2	0.90 (0.370)
Sargan	750.18 (0.150)

Notes: Estimates are obtained by applying the system GMM estimator (two-step robust version) to the whole Eq. (6) where the dependent variable D_{it} is the debt ratio at year t. Estimated coefficients (level of critical significance in parenthesis) are displayed only for first-lagged leverage, optimal capital structure determinants and interaction terms between adjustment speed and lagged leverage. Estimation includes a second-lagged leverage (D_{it-2}) regressor and time dummies (only reported in the Appendix, Table 8). All explanatory variables are treated as predetermined variables. Wald-1's test statistic refers to the null hypothesis that all coefficients on the explanatory variables of optimal capital structure and adjustment speed are jointly equal to zero. Wald-2's test statistic refers to the null hypothesis that all time dummies coefficients are jointly equal to zero. Correlation-1 and Correlation-2 test the null hypothesis of no first- and second-order autocorrelation in the residuals, respectively. The Sargan test applies to the null hypothesis that overidentifying restrictions are valid. Dependent and explanatory variables are described in the Appendix (Table 7)

[5] The factor default risk has also been proxied by the variable EBIT to interest costs, and the results remained the same (not reported).

in which current leverage was seen to be greatly affected by lagged leverage, assuming the presence of adjustment costs.[6] It is also consistent with previous research that has often documented its importance. For example, Banerjee et al. (2004) report that almost all of the increase in the explanatory value of their model is due to lagged leverage. Others, such as Flannery and Rangan (2006) and Miguel and Pindado (2001), have also highlighted the relevance of lagged leverage.

We now analyse the estimation results of our dynamic model relative to the adjustment speed to the target. As explained in Sect. 2, we focus our attention on α_k parameters, which represent the influence of the interaction terms of speed adjustment determinants and lagged leverage, that is, $Z_{kit}D_{it-1}$, on current debt ratio. Thus, we test the null hypothesis $\alpha_k = 0$, which means that the variable k has no influence on the adjustment speed in the case the null hypothesis is accepted. These interaction terms are affected by a negative sign in Eq. (6) and, consequently, must be taken into account to properly interpret their effects on adjustment speed.

Estimates in Table 4 reveal that all of the selected determinants have a notable influence on adjustment speed and, consequently, on capital structure. The estimated value of the parameter associated to the variable *distance* has a negative and statistically significant impact on adjustment speed (p value $= 0$), thus implying that SMEs adjust faster if their actual leverage is not far from the target, and vice versa. As discussed in Subsect. 3.3, adjustment costs can be highly burdensome for small businesses, and when they are far from their target such businesses may prefer to remain sticky or reduce their adjustment speed. Thus, it would appear that SMEs better manage small changes in debt ratio as they would not need to resort to issuing new equity or face high asymmetric information costs. These small changes could be made by means of a dividend strategy, a cash flow policy or something similar. Previous empirical evidence is mixed regarding the distance from the target. For example, Banerjee et al. (2004) and Lööf (2004) document a negative impact, whereas Drobetz and Wanzenried (2006) and Heshmati (2001) report a positive influence.[7]

As can be seen from Table 4, firm size and speed of adjustment are found to be positively related, as expected, with this relationship being statistically significant (p value $= 0$). Banerjee et al. (2004) also report a significant impact of firm size on speed of adjustment.

In terms of growth opportunities, SMEs show a positive and statistically significant impact of the variable *growth* on the speed of adjustment (p value $= 0$), as predicted. According to the hierarchical behaviour approach to capital structure, SMEs will seek new financing—mainly debt—once their internal resources have run out. As a significant percentage of new financing costs can be fixed, SMEs are prone to raising their speed of adjustment to the extent that they boast more growth prospects. Empirical evidence is also mixed at this point. Drobetz and Wanzenried (2006) and Kim et al. (2006) document a positive effect of this factor on adjustment speed, whereas Banerjee et al. (2004) and Heshmati (2001) report a negative impact.

The rate of flexibility also shows a positive and statistically significant impact on speed of adjustment (p value $= 0.032$). Apparently, as discussed in Subsect. 3.3, a flexible financing structure leads SMEs to reach their debt target faster, thus fulfilling our expectations. We have only found evidence of this factor in Kim et al. (2006), who also document a significant positive relationship.

We have also analysed the coefficients in Z_{kit}, and our estimates effectively follow the same pattern shown in the Appendix (Table 8).

5.4 Adjustment speed and rational financial behaviour

We now aim to evaluate our basic dynamic model [Eq. (1)]. A firm is said to behave rationally in year t if it reduces its gap towards the target from year $t-1$ to year t either by increasing debt when

[6] We have also estimated Eq. (6) by considering the speed of adjustment as a fixed variable; the results remain the same (lagged leverage coefficient $1-\mu$ equals 0.5837 and p value $= 0$). Full results are not reported.

[7] We have also tested our dynamic model [Eq. (6)] by taking the variable *distance* $= |D^*_{it} - D_{it-1}|$ into consideration; that is, the difference between optimal leverage and observed leverage in the previous year (results are reported in the Appendix, Table 9). Using this definition, this variable is seen to have a significant and positive impact on SME speed of adjustment, all the rest remaining broadly similar.

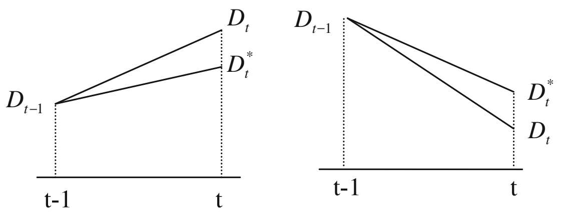

Fig. 1 $\mu > 1$ over-adjustment (increasing or decreasing debt). μ Adjustment speed, D_t, debt ratio at current period, D_{t-1} debt ratio at previous period

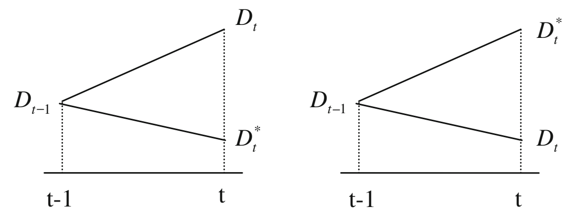

Fig. 2 $\mu < 0$ irrational adjustment

$D^*_{it} - D_{it-1} > 0$ (under-levered) or, alternatively, by reducing debt if $D^*_{it} - D_{it-1} < 0$ (over-levered). D^*_{it} is the optimal leverage at year t, and D_{it-1} is the observed leverage at year $t{-}1$. Firms that behave rationally show a speed of adjustment μ of between 0 and 1. The remaining firms will display a coefficient $\mu > 1$ (over-adjustment; Fig. 1) or $\mu < 0$ (irrational adjustment; Fig. 2). We expect the dynamic model [Eq. (1)] to be able to capture rational behaviour in most of the firms in our sample. Various routes can be followed to estimate D^* and μ. Our approach consists of firstly obtaining D^* from our estimated dynamic model [Eq. (6)], as it represents our main developed model in this study, before subsequently deducting μ from Eq. (1). Nevertheless, in order to strengthen the results we will also estimate D^* using the static model (Baltagi 2005), which was also used to approach the variable *distance*. Table 5 reports the main statistics of the adjustment speed μ and the quotient of optimality $\theta_{t-1} = D^*_{it}/D_{it-1}$ and, as a reference, $\theta_t = D^*_{it}/D_{it}$. Additionally, Table 5 reports a breakdown of firms that have (only) rationally adjusted by increasing or reducing leverage (rational behaviour; Fig. 3).

As can be seen from Table 5, the proportion of observations adjusting rationally stands at 51.99%.[8] Thus, SMEs support the capacity of Eq. (1) to capture rational financial behaviour. Overall, the firms behaving rationally seem to be relatively over-levered (optimality ratio mean: 0.9175). The breakdown shows that the SMEs that have reduced leverage (over-levered firms) strongly overcome firms that have increased leverage (under-levered firms): 74.42 versus 25.58%, respectively. It also suggests that SMEs got themselves overly into debt due to the influence of the upward economic period analysed and low interest rates. One typical and expected reaction on behalf of SMEs to avoid bankruptcy was probably to reduce leverage by borrowing less or by issuing new capital. Thus, based on this debt-cutting strategy, we presume that SMEs were highly motivated to adjust as the

Table 5 Rational adjustment to target leverage during the period 1995–2005

Statistics	μ	θ_{t-1}	θ_t
$0 < \mu < 1$	Observed = 4246 (51.99%)		
Mean	0.2628	0.9175	0.9180
Standard deviation	0.2375	0.2896	0.2308
Median	0.1868	0.8472	0.8890
Minimum	0.0000	0.3397	0.3536
Maximum	0.9977	3.3023	2.5546
$D_t > D_{t-1}$ (under-levered)	Observed = 1086 (25.58%)		
Mean	0.3313	1.3064	1.2082
Standard deviation	0.2566	0.2940	0.2343
Median	0.2759	1.2187	1.1310
Minimum	0.0010	1.0018	1.0001
Maximum	0.9977	3.3023	2.5546
$D_t < D_{t-1}$ (over-levered)	Observed = 3160 (74.42%)		
Mean	0.2393	0.7838	0.8182
Standard deviation	0.2258	0.1144	0.1176
Median	0.1654	0.7975	0.8332
Minimum	0.0000	0.3397	0.3536
Maximum	0.9926	0.9970	0.9999

Notes: μ is the adjustment speed, θ_t is the optimality ratio D^*_{it}/D_{it} and θ_{t-1} is D^*_{it}/D_{it-1}. The interval $0 < \mu < 1$ corresponds to firms that behave rationally. $D_t > D_{t-1}$ and $D_t < D_{t-1}$ include firms that (rationally) adjust by increasing and reducing debt, respectively. Coefficients μ and θ are obtained by first estimating D^* from model (6). Furthermore, 8.62% of observations, over-adjust ($\mu > 1$), whereas 39.39% adjust irrationally ($\mu < 0$). The percentage 51.99% is the result of dividing 4246 (observations adjusting rationally) by 8167 (the total number of observations where μ can be obtained, that is, 9114 − 947)

[8] This percentage is the result of dividing 4246 (observations adjusting rationally) by 8167 (the total number of observations where μ can be obtained; that is, 9114 − 947).

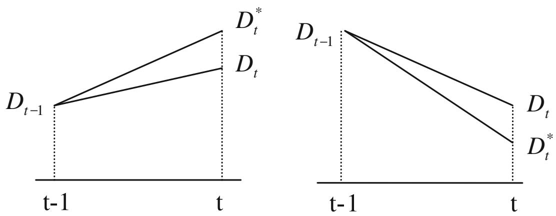

Fig. 3 $0 < \mu < 1$ rational behaviour

benefits (mainly solvency and capacity to borrow in the future) of reaching the target clearly outweighed adjustment costs.

As shown in Table 5, the speed of adjustment of SMEs is around 26%. This means that a firm will take around 2 years to cover half of the gap to the target, assuming it is stable. As stated above, we have also tested other routes to calculate the speed of adjustment, such as, for example, estimating first D^* from the static model (Baltagi 2005), with similar results: the adjustment speed turned out to be 0.2891. This result seems relatively low, although previous empirical research on SMEs has documented similar values (see Heshmati 2001; López-Gracia and Sogorb-Mira 2008).

Lastly, an additional analysis has been carried out in order to explore the adjustment process over the period 1995–2005 and strengthen results. We have calculated the adjustment speed of SMEs along with the optimality ratio year by year throughout the sample period. Table 6 presents the mean values by year of observation (along with the global mean as a reference). It also shows that SMEs adjusting rationally maintain a similar level of adjustment speed over the entire period, thus confirming previous findings. Once again, over-levered SMEs turned out to be the largest group throughout the period of analysis. Therefore, when we look at the adjustment speed and optimality ratio on a yearly basis, the results are very similar.

6 Summary and conclusions

This paper provides empirical evidence on the speed of adjustment to the optimal capital structure of Spanish SMEs. Panel data covering the 11-year

Table 6 Yearly average of rational adjustment to target leverage

	%	μ	θ_{t-1}	θ_t
Sector A: $0 < \mu < 1$				
1996	55.08	0.2469	0.8740	0.8823
1997	51.26	0.2580	0.9111	0.9074
1998	54.51	0.2423	0.9083	0.9042
1999	53.57	0.2577	0.8917	0.8982
2000	53.22	0.2529	0.9034	0.9058
2001	55.33	0.2702	0.8914	0.8984
2002	52.06	0.2647	0.9217	0.9206
2003	51.43	0.2775	0.9232	0.9264
2004	48.15	0.2811	0.9555	0.9550
2005	47.52	0.2632	0.9719	0.9596
Mean	51.99	0.2628	0.9175	0.9180
Sector B: $D_t > D_{t-1}$ (under-levered)				
1996	23.19	0.3226	1.2728	1.1880
1997	28.30	0.3338	1.2915	1.1877
1998	26.52	0.3399	1.2803	1.1816
1999	22.44	0.3452	1.2711	1.1856
2000	23.41	0.3256	1.3022	1.2012
2001	21.76	0.3542	1.2874	1.1903
2002	23.73	0.3348	1.3644	1.2496
2003	23.41	0.3355	1.3437	1.2375
2004	29.52	0.2955	1.3214	1.2301
2005	34.22	0.3307	1.2985	1.2041
Mean	25.58	0.3313	1.3064	1.2082
Sector C: $D_t < D_{t-1}$ (over-levered)				
1996	76.33	0.2239	0.7528	0.7894
1997	71.70	0.2281	0.7610	0.7967
1998	73.48	0.2070	0.7740	0.8041
1999	77.56	0.2323	0.7819	0.8151
2000	76.59	0.2306	0.7815	0.8155
2001	78.24	0.2468	0.7812	0.8173
2002	76.27	0.2429	0.7840	0.8183
2003	76.59	0.2598	0.7947	0.8313
2004	70.18	0.2750	0.8000	0.8381
2005	65.78	0.2282	0.8020	0.8324
Mean	74.42	0.2393	0.7838	0.8182

Notes: μ is the adjustment speed, θ_t is the optimality ratio D^*_{it}/D_{it} and θ_{t-1} is D^*_{it}/D_{it-1}. The interval $0 < \mu < 1$ corresponds to firms that behave rationally. $D_t > D_{t-1}$ and $D_t < D_{t-1}$ includes firms that adjust by increasing and reducing debt, respectively. Coefficients μ and θ are obtained by first estimating D^* from model (6). % is the proportion of times that firms adjust rationally in every year and group period 1995–2005 have been used to estimate a partial-adjustment capital structure model in which both target debt ratio and adjustment speed are simultaneously endogenized. Thus, the model allows us to evaluate not only the determinants of optimal capital structure, but also the determinants of the speed of adjustment, which is now allowed to vary across firms and over time. Model estimates have been carried out using a system GMM regression technique, which presumably improves the treatment of endogeneity problems and enables us to incorporate firm-fixed effects and time-specific effects, which respectively capture individual heterogeneity and macroeconomic effects.

Our findings show that SMEs were aware of and strived to achieve target debt ratios over the period 1995–2005. Furthermore, our results also display a partial adjustment model that fits the data well and—in line with previous research—target debt ratios are determined by standardly accepted firm characteristics. We also find robust evidence of the determinants of adjustment speed. Specifically, SMEs seem to adjust faster when they are relatively near their target, as they would not need to resort to issuing new equity or incur significant asymmetric information costs. Moreover, firm size, growth opportunities and rate of financial flexibility are positively related to speed of adjustment, as expected.

In relation to the adjustment process, SMEs support the capacity of our model to capture rational financial behaviour. We find that around 52% of observations adjust rationally; that is, firms increase leverage when under-levered, and vice versa. In terms of SMEs adjusting rationally, most are over-levered and therefore reduce leverage (around 74% of observations). SMEs record a speed of adjustment of roughly 26% (sample average), which in turn means that they need a couple of years to close half the leverage gap. Furthermore, the empirical evidence shows that the adjustment speed to the target leverage approximately persists at the same level throughout the period analysed. Finally, our results suggest that SMEs were motivated to adjust to and reach their target throughout the period as the benefits (mainly solvency and capacity to borrow in the future) outweighed adjustments costs.

This research is focused on SMEs, so the comparison of results to previous literature calls for some caution. In particular, we intend to replicate the studies of Banerjee et al. (2004), Drobetz and Wanzenried (2006) and Lööf (2004), three important papers in the field, but all three studies focus on large companies. They analyse the speed of adjustment to optimal capital structure as time-variant and firm-variant, as we do, although the literature on capital structure incorporates this variable as a constant. Thus, comparisons to other papers have to be carried out with caution as well. Moreover, the Spanish economy grew strongly throughout the period 1995–2005, thus particularly influencing estimation results. Lastly, some variables in the study have been measured using scarce financial information as SMEs do not provide market values or other relevant items, such as Research + Development expenditure.

This study opens up a new field for SME researchers, focusing on the speed of adjustment to the target from a different perspective. This study could also help policy-makers learn how important size, growth opportunities and some other specific factors are to adjust SME capital structure to their target. Transaction costs have turned out to significantly affect optimal capital structure. Hence, SMEs should ensure that the management of transaction costs is efficient as it may make it easier for them to achieve their target and, therefore, the opportunity to take advantage of being financially competitive.

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Appendix

See Tables 7, 8, 9.

Table 7 Description of variables

Denomination	Term	Description
Dependent variable		
Debt ratio at *t*	D_t	Ratio of the book value of total liabilities to total assets at year *t*
Explanatory variables of target leverage		
Debt ratio at $t-1$	D_{t-1}	Ratio of the book value of total liabilities to total assets at year $t-1$
Default risk	*risk*	Ratio of the operating cash-flow standard deviation over the period starting in 1994 until the current year *t* to the mean of total assets over the same period
Growth opportunities	*growth*	Average of annual change rates of sales since 1995 to the current year *t*
Profitability	*profit*	Ratio of operating income to total assets
Non-debt tax shields	*shield*	Ratio of depreciation to fixed assets
Tangibility	*tangib*	Ratio of fixed assets to total assets
Uniqueness	*unique*	Ratio of cost of employees to total sales
Size	*size*	Logarithm of total sales
Explanatory variables of adjustment speed		
Growth opportunities	*growth-speed*	Discrete variable taking a value of 1 (or 0) if the average of annual change rates of sales since 1995 to the current year *t* is above (below) the mean of the whole sample
Size	*size-speed*	Discrete value taking a value of 1 (or 0) if the logarithm of total sales is above (below) the mean of the whole sample
Distance between optimal debt and observed debt	*distance-speed*	Discrete value taking a value of 1 (or 0) if $\left\|D_t^* - D_t\right\|$ is above (below) the mean of the whole sample
Rate of financial flexibility	*flexib-speed*	The result of multiplying two dichotomous variables: (1) the ratio short-term debt to long-term debt, which equals 1 if it is above the mean and 0 otherwise; (2) the operating cash flow, which equals 1 if it is above the mean and 0 otherwise

Table 8 System GMM estimates of dynamic model [full results of Eq. (6)]

Number of observations: 7220; number of firms: 947	
Dependent variable: D_{it}	
Explanatory variable	Coefficient (p value)
constant	0.1815 (0.311)
D_{it-1}	0.5391 (0.000)
D_{it-2}	0.0673 (0.000)
Target leverage	
risk	−0.6010 (0.015)
growth	0.2702 (0.000)
profit	−0.4193 (0.000)
shield	−0.3381 (0.000)
tangib	−0.2166 (0.000)
unique	−0.1904 (0.001)
size	0.0403 (0.128)
Adjustment speed	
growth-speed	0.3548 (0.007)
size-speed	0.4554 (0.013)
distance-speed	−0.4488 (0.000)
flexib-speed	0.4516 (0.153)
Interactions terms	
D_{it-1} × *growth-speed*	−0.1365 (0.000)
D_{it-1} × *size-speed*	−0.2524 (0.000)
D_{it-1} × *distance-speed*	0.2810 (0.000)
D_{it-1} × *flexib-speed*	−0.0615 (0.032)
Time dummies	
year 1998	−0.0040 (0.150)
year 1999	−0.0042 (0.176)
year 2000	−0.0084 (0.017)
year 2001	−0.0130 (0.001)
year 2002	−0.0139 (0.001)
year 2003	−0.0178 (0.000)
year 2004	−0.0201 (0.000)
year 2005	−0.0183 (0.000)
Tests of specification	Statistic (p value)
Wald-1	181.87 (0.000)
Wald-2	27.31 (0.001)
Correlation-1	−10.68 (0.000)
Correlation-2	0.90 (0.370)
Sargan	750.18 (0.150)

Note: This table is an extension of Table 4. Results include all estimates shown in Table 3 plus the remaining coefficient estimates of Eq. (6) except the interaction-terms $\alpha_k\beta_j$, which are not reported as discussed in Sect. 2

Table 9 System GMM estimates of dynamic model (Eq. 6 with *distance* $= \left|D^*_{it} - D_{it-1}\right|$)

Number of observations: 7220; number of firms: 947	
Dependent variable: D_{it}	
Explanatory variable	Coefficient (p value)
constant	−0.4311 (0.033)
D_{it-1}	0.9873 (0.000)
risk	−0.51532 (0.060)
growth	0.3434 (0.000)
profit	−0.5321 (0.000)
shield	−0.2597 (0.000)
tangib	−0.2023 (0.000)
unique	0.0201 (0.754)
size	0.0761 (0.010)
D_{it-1} × *growth-speed*	−0.1908 (0.000)
D_{it-1} × *size-speed*	−0.2980 (0.000)
D_{it-1} × *distance-speed*	−0.2477 (0.000)
D_{it-1} × *flexib-speed*	−0.0253 (0.361)
Tests of specification	Statistic (p value)
Wald-1	120.19 (0.000)
Wald-2	34.01 (0.000)
Correlation-1	−11.44 (0.000)
Correlation-2	1.11 (0.267)
Sargan	729.10 (0.240)

Note: Estimation results shown in this table are a replica of those displayed in Table 4 for Eq. (6) although now defining *distance* $= \left|D^*_{it} - D_{it-1}\right|$

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