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Capital structure speed of adjustment heterogeneity across zero leverage and leveraged European firms

Flávio Morais [a,*], Zélia Serrasqueiro [b], Joaquim J.S. Ramalho [c]

[a] Department of Management and Economics & Center for Advanced Studies in Management and Economics of the UBI (CEFAGE-UBI) & Research Center in Business Sciences (NECE-UBI), University of Beira Interior (UBI), Estrada do Sineiro, Polo IV, 6200-209 Covilhã, Portugal

[b] Department of Management and Economics & Center for Advanced Studies in Management and Economics of the UBI (CEFAGE-UBI), University of Beira Interior (UBI), Estrada do Sineiro, Polo IV, 6200-209 Covilhã, Portugal

[c] Department of Economics & Business Research Unit (BRU-IUL), Instituto Universitário de Lisboa (ISCTE-IUL), Avenida das Forças, Armadas, 1649-026 Lisboa, Portugal

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ABSTRACT

This paper investigates whether leveraged and zero-leverage firms pursue or not a debt target level and, if so, how fast they adjust to that target. We also investigate how the influence of firms' debt policy on capital structure speed of adjustment (SOA) changes with different financial systems, macroeconomic conditions, financial constraints and financial flexibility levels. Using the dynamic panel fractional estimator and a sample of European listed firms for the 1995–2016 period, we find that both zero-leverage and leveraged firms actively adjust to a target debt ratio. We also find that, in general, leveraged firms display a significantly higher SOA than zero-leverage firms (27.6 % vs. 22.1 %), with only two exceptions: there are no significant differences when the analysis is restricted to financially constrained firms; and during the 2008 financial crisis zero-leverage firms adjusted significantly faster (46.8 %) than leveraged firms (25.6 %) and relative to non-crisis years (21.6 %).

1. Introduction

This paper focuses on two important topics on firms' capital structure, namely target capital structure speed of adjustment (hereafter SOA) and the so-called zero-leverage phenomenon (Saona et al., 2020; Yamada, 2019). Recognizing that debt brings tax shields (Modigliani and Miller, 1963) and simultaneously financial distress and bankruptcy costs (Kraus and Litzenberger, 1973), the static trade-off theory advocates that there exists an optimal capital structure that maximizes the firm's value. However, a dynamic version of the trade-off theory states that firm's financial structure can move away from its target. According to this theory, firms suffer costs of being off the target, known as deviation costs (e.g. financial distress and bankruptcy costs; loss of debt tax shields), which incentives firms to move closer to their targets. Nonetheless, this convergence is also a function of adjustment costs (e.g. transaction and debt agency costs) that prevent and hinder full adjustment toward the target (Fisher et al., 1989), which explains why firms may present large and persistent deviations from their target leverage and just partially adjust over time. Thus, these two classes of costs, deviation costs and adjustment costs, affect capital structure SOA: the more the former costs exceed the latter, the faster firms move to their target debt ratio.

* Corresponding author.
E-mail addresses: flavio.morais@ubi.pt (F. Morais), zelia@ubi.pt (Z. Serrasqueiro), jjsro@iscte-iul.pt (J.J.S. Ramalho).

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In empirical studies, a nonzero value estimated for the SOA is interpreted as evidence of the existence of a target leverage ratio, while a null SOA reveals that there is no target leverage and leverage changes are explained according to the financing deficit theory (Myers and Majluf, 1984).[1] Previous empirical evidence is almost unanimous in concluding that firms actively adjust to a target leverage (Drobetz et al., 2015; Fitzgerald and Ryan, 2019), with survey evidence presented by Graham and Harvey (2001) showing that more than 80 % of firms pursue a target capital structure. However, a growing number of firms report permanent average debt ratios below the estimated target levels (e.g. Graham, 2000), with a recent branch of the literature finding that there is a considerable number of firms with a "mysterious zero leverage" (Strebulaev and Yang, 2013) and that these firms effectively leave a substantial amount of "money on the table" (Graham, 2000; Strebulaev and Yang, 2013) by not levering up until their target. Therefore, debt-free firms are, on average, substantially under-leveraged (e.g. Dang, 2013).

Given the novelty of this phenomenon, little is known about the targeting behaviour of zero-leverage firms, namely whether they adjust or not to a target debt ratio and, if they do, how fast they do it. Indeed, neither the zero-leverage literature nor the SOA specific literature have investigated these research topics. On the one hand, the literature dealing with the zero-leverage phenomenon is mainly dedicated to study the reasons for firms adopting such extremely conservative policy in specific years. On the other hand, the literature about capital structure SOA has not considered the leverage target behaviour of zero-leverage firms. In fact, most studies in this area continue to consider zero-leverage firms as outliers, removing them from the analysis (e.g. Nguyen et al., 2020). However, contemporaneous literature shows that zero-leverage firms are an international and growing phenomenon (Bessler et al., 2013) and should not be interpreted as outliers or errors existent in databases.

This paper is the first to investigate the capital structure target and SOA behaviour of zero-leverage firms, focussing on the following research question: 1) *If zero-leverage firms pursue target leverage ratios, how quickly do they adjust back to their target?* To allow a deep analysis of their behaviour, we compare them with leveraged firms. Therefore, another research question that this paper tries to answer is the following: 2) *Is the SOA of zero-leverage firms significantly different from that exhibited by leveraged firms?* Finally, in line with the existing literature that investigates sources of heterogeneity on SOA (e.g. Drobetz et al., 2015), it is our purpose to answer the following research question: 3) *How the SOA of zero leverage and leveraged firms is influenced by the different financial constraints they may face and financial flexibility they may want to build up and by their country's financial system and macroeconomic context?* Indeed, previous research has considered country-specific factors (Bessler et al., 2013; Drobetz et al., 2015), macroeconomic factors (Dang, 2013; Halling et al., 2016) and firm-specific factors affecting the level of financial constraints and/or financial flexibility felt by firms (Devos et al., 2012; Fitzgerald and Ryan, 2019) as important determinants of both zero leverage and capital structure SOA.

To answer these questions and provide empirical evidence about the SOA of zero-leverage firms, and its comparison with leveraged firms, we use an unbalanced panel of 7046 listed firms from 14 European countries for the 1995–2016 period. The panel comprises both zero-leverage (firms that reported a null leverage ratio in at least one year of the period in analysis) and leveraged firms (remaining firms). Because Europe is the home of the largest banking system of the world, with non-financial firms being very dependent on bank loans as the primary source of external finance (European Investment Bank, 2015), but also includes countries with strong market-based financial systems, our panel is particularly suited to study the effect of the financial system on the SOA. Moreover, it also allows to study the effects of the 2008 financial crisis and subsequent sovereign debt crises that until recently prevented normal economic growth, availability of finance and recovery of investment levels in some European countries (European Investment Bank, 2015).

This work contributes to the literature in several ways. First, we advance the financial conservatism and capital structure SOA research by showing that debt-free firms actively adjust to a target level of debt, but in general at a significantly slower adjustment speed than leveraged firms. To explain this result, we argue that zero-leverage firms face lower deviation costs than leveraged firms, since they should possess a larger debt capacity, which allows them to hold the real option to lever up in the future and thus compensate the opportunity cost of not taking in the present full advantage of debt tax shields. This reasoning is supported by another important result that we obtain: when firms are divided into financially constrained and unconstrained firms, only in the latter case the SOA differences between zero-leverage and leveraged firms remain significant. Indeed, only when firms are debt-free by their own choice, and not due to market restrictions, can we argue that zero-leverage firms have a larger debt capacity. Second, we contribute to the literature focusing on the role played by the financial system on firm's financing decisions. We find that both zero-leverage and leveraged firms present a greater SOA in market-based financial systems, a result that seems to conform with the existing literature (Drobetz et al., 2015). However, reinforcing the importance of the SOA differences between the two groups of firms, our results show that zero-leverage firms from market-based countries adjust more slowly than leveraged firms from bank-based countries. Third, we contribute to the literature dedicated to the effect of the 2008 financial crisis on firm's capital structure. Particularly, in contrast to previous evidence claiming that firms adjust more slowly during recessions (Dang et al., 2014), our results reveal that zero-leverage firms increased significantly their SOA during the 2008 financial crisis, which even exceeded, and by a large margin, the SOA of leveraged firms. Again, this distinct behaviour of zero-leverage firms may be explained by their higher financial flexibility and greater debt capacity relative to leveraged firms, which gives them the possibility to adjust faster to a target leverage in bad times, when deviation costs become more important. Finally, we also contribute methodologically by using the dynamic panel fractional (DPF) estimator proposed by Elsas and Florysiak (2011, 2015) to estimate firms' SOA, which addresses the concerns of Chang and Dasgupta (2009) that SOA estimates obtained by the most commonly used dynamic panel estimators are potentially biased due to the overlooked bounded nature (between zero and one) of debt ratios.

[1] This last result is generally coincident with the arguments of the pecking order theory (Myers, 1984; Myers and Majluf, 1984) that firms do not have a target level, their financing decisions following a hierarchical sequence that allows to minimize financing costs.

The remainder of the paper is organised as follows. Section 2 briefly reviews the literature on SOA and establishes some research hypotheses. Section 3 describes the most commonly applied model to study SOA, discusses some methodological issues that renders the standard dynamic estimators unsuitable to this analysis and presents the estimator adopted in this study. Section 4 briefly describes the data. Section 5 presents and discusses the main results of the paper. Finally, Section 6 sets out some final considerations.

2. Literature review and empirical hypotheses

2.1. Empirical evidence on SOA

The extensive discussion about SOA to a target leverage ratio was driven by Fisher et al. (1989) finding that even small adjustment costs lead to wide swings in a firm's debt ratio over time. The authors used dynamic models in their analysis, which have since then acquired particular relevance in the investigation of whether firms adjust to a target debt ratio and the respective SOA. De Miguel and Pindado (2001), Ozkan (2001) and Gaud et al. (2005), for Europe, Flannery and Rangan (2006), Huang and Ritter (2009) and Lemmon et al. (2008), for the USA, and Antoniou et al. (2008), for G5 countries, are examples of the first studies using dynamic panel data models in this context, all of them confirming that firms actively adjust to a target, although at different rates. Recent examples of studies that, like ours, focussed on European listed firms, are Vallelado and Saona (2011) and Castro et al. (2016), both of which estimated their dynamic panel data models using GMM. The former authors examined the target long-term debt ratio, finding that country institutional environment plays a determinant role on long-term debt target behaviour, while the latter focussed on differences in target leverage and SOA across three firms' life cycle stages (introduction, growth and maturity), concluding that the SOA does not increase as the firms evolve over the life cycle, with firms in the introduction cycle adjusting the fastest.

Recognizing that financing decisions are unlikely to be homogenous across firms, time and countries, research about possible sources of heterogeneity in adjustment and deviation costs that ultimately impact on the SOA has been increasing. Most studies examine firm-level heterogeneity in SOA. Recently, Fitzgerald and Ryan (2019) found that smaller firms and low-dividend payers adjust faster than their counterparts, which suggests that financially constrained firms display a faster SOA than unconstrained ones. Using alternative proxies for financial constraints, also Dang et al. (2014), Drobetz et al. (2015) and Elsas and Florisiak (2011) reach the same conclusion. On the contrary, Öztekin and Flannery (2012), using dividend payments as proxy, find that unconstrained firms present higher SOA, while Faulkender et al. (2012), using firm size and dummies for being a dividend payer and having a bond rating as proxies, show that constrained firms may adjust more slowly or more quickly depending on whether they are above or below the target level. Following a different approach, Byoun (2008) considers the role played by financial flexibility on SOA, finding that firm's adjustments toward the target are conditioned by financing surplus and financing deficits. For example, firms with a financial surplus adjust more quickly when they have an above-target debt and more slowly when they have a below-target debt.

Firm's financing decisions are also determined by the country's specific characteristics, with another stream of the literature investigating whether differences in SOA can be explained by variations in countries' legal, institutional and financial environments (e.g. Antoniou et al., 2008; Vallelado and Saona, 2011). Öztekin and Flannery (2012), resorting to a sample of 37 countries, and Drobetz et al. (2015), using a sample of G7 countries, found that firms in countries with market-based financial systems, or with more developed financial systems, adjust faster due to lower transaction costs.

Other important strand of literature relates SOA to macroeconomic conditions. According to the model proposed by Hackbarth et al. (2006), macroeconomic conditions determine both the rhythm and the size of capital structure changes, being predicted that firms change their capital structure more often in expansionary than in recessionary periods, which has been empirically corroborated by several studies (Cook and Tang, 2010; Drobetz and Wanzenried, 2006). More recently, also Drobetz et al. (2015) and Halling et al. (2016) conclude that the SOA is lower during recessive than in boom periods, while Dang et al. (2014) estimate a slower SOA during the recent global financial crisis.

Despite extensive research, with many recent contributions increasing our knowledge about the target leverage behaviour of firms, SOA is still "perhaps the most important issue in capital structure research today" (Huang and Ritter, 2009, p. 239). This sentence remains pertinent, since, among other issues, currently little is known about the SOA of zero-leverage firms. Filling this gap is the main aim of this paper. Next, we formulate the research hypotheses to be tested in the empirical part of the paper.

2.2. Research hypotheses

2.2.1. Zero leverage and SOA

The literature about zero leverage has focused on the causes for such an extremely financially conservative policy (e.g. Bessler et al., 2013; Ghoul et al., 2018; Huang et al., 2017). Dang (2013) finds that zero leverage is the result of a persistent financial policy, with firms that in one year are debt-free having a 61 % chance of remaining in that situation in the following year (Strebulaev and Yang, 2013). DeAngelo and Roll (2015) observe that capital structure stability, although an infrequent phenomenon, occurs primarily at low-leverage levels. Dang (2013) shows that zero-leverage firms are under-leveraged most of the time, with an average 5.8 % points (pp) deviation from their target.[2] The author adds that zero-leverage firms lever up in the following years to reduce the deviation from

[2] Note that zero-debt firms are not under-leveraged by definition, since in most studies, including ours, it is enough for a firm to be classified as being zero-leverage to report a null leverage ratio in just one year throughout the period in analysis. Therefore, as any other firm, in some years zero-leverage firms may be over-leveraged and in other years under-leveraged.

the target leverage. In a similar vein, Devos et al. (2012) find that debt-free firms have a mean predicted leverage of 13.3 %.

Theoretically, a firm deviating from its target leverage faces deviation costs, varying the characteristics of such costs with the sign of the deviation (above or below the target). An over- leveraged firm faces higher bankruptcy and financial distress costs than it should according to the trade-off theory, while an under-leveraged firm does not take full advantage of debt tax shields. While in both cases firms have incentives to adjust to the target, a stronger incentive is verified when firms are highly leveraged. In particular, such firms have as ultimate cost the total loss of value of its shares, while the main cost of firms with low levels of debt is the opportunity cost of leaving money on the table (Mukherjee and Wang, 2013). Therefore, it is expected that the more leveraged the firm is, the greater is the managers' incentive to adjust back to the target, which implies a faster SOA for over-leveraged firms. Existing literature supports these arguments, with Byoun (2008), Faulkender et al. (2012) and Mukherjee and Wang (2013) providing evidence that the SOA is lower for under-leveraged firms.

Given that zero-leverage firms, when having a target leverage, are often under-leveraged (Dang, 2013), it is expected that on average these firms adjust at a slower speed than leveraged firms, which are more likely to be over-leveraged. Moreover, the deviation costs faced by zero-leverage firms might be balanced by a larger debt capacity allowing the firm to hold the real option to lever up in the future (Lotfaliei, 2018). In accordance with these arguments, in the empirical component of this paper, the following hypothesis will be tested:

H1. : Zero-leverage firms adjust slower than leveraged firms.

2.2.2. SOA and financial systems

The firm's financing decisions are also determined by the country's specific characteristics. On the one hand, the financial system prevailing in the country has impact on zero leverage. In particular, market-based financial systems, by providing a greater number of alternative financing sources to debt, increase the propensity for the presence of debt-free firms (Ghoul et al., 2018). On the other hand, the financial system may also influence the firm's SOA. For example, if institutional environment and financial market development makes it expensive to resort to external finance, it is expected that firms adjust more slowly given the higher adjustment costs suffered. Otherwise, if country characteristics impose higher deviation costs that outweigh adjustment costs, the benefits of being closer to the target are higher and it is expected that firms present higher adjustment speeds.

Finance literature often evaluates how bank- and market-based financial systems influence firm's capital structure decisions (e.g. Antoniou et al., 2008). A market-based financial system is generally characterized as a well-functioning market with greater size and liquidity (Drobetz et al., 2015). Market-based financial systems are predominant in common law systems, which promote a better external investors' protection and a greater transparency and information sharing that lowers adverse selection problems (Djankov et al., 2007). Reciprocally, the small dimension and less development and liquidity of capital markets in bank-based financial systems result in higher adjustment costs, hindering the firm's access to those markets. Thus, issuing (or retiring) debt or equity is more difficult and costly in countries with bank-based financial systems. Therefore, lower adjustment costs are expected in market-based than in bank-based countries, resulting in a faster SOA in the former.

Another argument supporting a slower SOA in bank-based systems is that deviation costs are lower than in market-based systems. Particularly, the greater dependence on debt financing granted by banks in bank-based systems results in closer ties established between firms and banks, which reduces information asymmetries given that banks act as main monitoring entity (Leland and Pyle, 1977). Therefore, creditors are more willing to negotiate deviations from the target leverage instead of punishing the firm immediately as occurs often by investors in the market (Antoniou et al., 2008).

Öztekin and Flannery (2012) and more recently Drobetz et al. (2015) provide empirical evidence showing that firms in market-based financial systems present indeed a higher SOA. However, they did not discriminate between zero-leverage and leveraged firms. According to the arguments presented and previous empirical evidence, we expect that both types of firms adjust faster to their target leverage when located in countries with market-based financial systems. Therefore, the following research hypotheses are postulated:

H2a. Zero-leverage firms adjust more quickly (slowly) in market-based systems (bank-based systems).

H2b. Leveraged firms adjust more quickly (slowly) in market-based systems (bank-based systems).

2.2.3. SOA and macroeconomic conditions: the recent European crises

Economic cycles are important determinants of firm's default risk, which in turn affects the cost of raising capital (Cook and Tang, 2010). The balance sheet channel perspective argues that asset values fall in periods of uncertainty, which results in lower firm's net worth and collaterals and increases financial distress and bankruptcy costs. Additionally, the drop in consumer confidence that occurs in most financial and economic crises, such as the recent global crisis, promotes a fall in firms' investment, decreasing firms' need to raise debt (Kahle and Stulz, 2013). Hence, both collateral and debt are pro-cyclical (Kiyotaki and Moore, 1997). Also, from a supply side perspective, debt is considered to be pro-cyclical, since creditors may react to the losses returned by macroeconomic shocks promoting a contraction in credit availability or requiring higher interest rates and collaterals (Ivashina and Scharfstein, 2010). Supporting these arguments, Morais et al. (2020) show that firms displayed a higher propensity to have zero leverage during the recent crisis.

Macroeconomic conditions also affect the SOA toward target leverage. From a theoretical perspective, considering the greatest default risk and information asymmetries during adverse macroeconomic shocks, raising (or paying) external finance becomes more expensive, which will lead to an increase in firms' adjustment costs and slow down firms' SOA. Similarly, creditors' may decrease their loan activities and simultaneously increase interest rates and require more collaterals, which also contributes to increasing adjustment costs. Overall, these arguments suggest that the SOA is slower in adverse macroeconomic cycles. In line with these arguments, Hackbarth's et al. (2006) theoretical model shows that firms rebalance their leverage ratios more frequently in expansionary economic cycles than in periods of recession. Empirically, Drobetz and Wanzenried (2006), Cook and Tang (2010), Dang et al. (2014), Drobetz et al. (2015) and Halling et al. (2016) confirm the theoretical prediction of a lower SOA during economic recessions.

According to theoretical arguments and empirical findings, it is expected that during the recent financial crisis, all types of firms moved more slowly toward their target debt ratio. Therefore, the following hypotheses are formulated:

H3a. Zero-leverage firms adjusted more slowly during the recent financial crisis.

H3b. Leveraged firms adjusted more slowly during the recent financial crisis.

2.2.4. SOA and financial constraints

Some firms may face greater restrictions and tightening conditions in accessing external finance than others. A reason for this is the presence of adverse selection and moral hazard problems, which makes more difficult to obtain external finance for firms with little reputation (Stiglitz and Weiss, 1981), i.e., firms without a favourable past in the credit market. This is a traditional and generally accepted argument to justify the zero-leverage phenomenon. According to financing constraints arguments, rather than a financing decision, zero leverage emerges as an imposition raised by creditors (Bessler et al., 2013; Dang, 2013). Furthermore, the distinction between financially constrained and unconstrained firms may be also explored as a source for different adjustment and deviation costs, giving rise to different SOA across firms (Fitzgerald and Ryan, 2019).

Theoretically, it can be argued that financially constrained firms suffer higher adjustment costs, since issuing or retiring debt and/or equity become more expensive due to the higher interest rate demanded by creditors and/or investors, which ultimately should result in a slower SOA. However, it is also true that financially constrained firms face higher distress and bankruptcy costs, meaning higher deviation costs and a greater benefit to adjust faster toward the target. The empirical evidence is also mixed, with Dang et al. (2014), Drobetz et al. (2015), Elsas and Florisiak (2011) and Fitzgerald and Ryan (2019) finding that firms that are financially constrained, displaying higher bankruptcy and liquidation costs, exhibit a faster SOA, while Öztekin and Flannery (2012) find a faster adjustment speed for unconstrained firms.

Based on the most common conclusions of empirical studies, the following hypotheses are formulated:

H4a. Zero-leverage financial constrained firms adjust faster toward target leverage.

H4b. Leveraged financial constrained firms adjust faster toward target leverage.

2.2.5. SOA and financial flexibility[3]

Another well-established argument in the literature to explain zero-leverage policies is the financial flexibility theory (Dang, 2013; Huang et al., 2017; Morais et al., 2021). In contrast to the financing constraints approach, the financial flexibility hypothesis postulates that zero leverage emerges as a deliberately financing decision taken by the firm, instead of being an imposition raised by creditors (Morais et al., 2020). Thus, while the financing constraints perspective uses supply side arguments to explain zero leverage, the financial flexibility theory is based on the demand side. Financial flexibility may be understood as the firm's ability to take advantage of future investment opportunities or to answer opportunely to unexpected changes in its activity that may impact its cash flows (Ferrando et al., 2017; Marchica and Mura, 2010). Following Dang (2013), the financial flexibility theory states that even in the presence of market frictions, such as adverse selection (Myers, 1984) or transaction costs (Leary and Roberts, 2005), firms eschew debt and accumulate cash to save their borrowing capacity for future investment opportunities (Gamba and Triantis, 2008). Therefore, zero-leverage policies may be a consequence of a search for financial flexibility.

By having greater internal liquidity and debt capacity, financial flexible firms are expected to obtain more favourable conditions from creditors and/or investors to raise or retire debt and/or equity than non-financial flexible firms. Therefore, by facing lower adjustment costs, financial flexible firms could be expected to adjust faster toward the target. However, deviation costs are also expected to be lower for financial flexible firms, since these firms may use their greater internal liquidity to finance their day-to-day activities or to comply with their debt repayment plans without pressure from market actors. Moreover, the financial slack created by these firms is expected to decrease distress and bankruptcy costs and to give them the option to invest by levering up in the future. Considering that financial flexibility is characterized as a deliberately decision taken by financial managers that voluntarily increase liquidity and limit credit lines (Bancel and Mittoo, 2004; Brounen et al., 2006), we expect financial flexible firms to move more slowly toward their debt ratio. Therefore, the following hypotheses are established:

H5a. Zero-leverage financial flexible firms adjust more slowly toward target leverage.

H5b. Leveraged financial flexible firms adjust more slowly toward target leverage.

[3] We thank an anonymous referee for suggesting the inclusion of this analysis.

3. SOA – The Model

We start this section by presenting the dynamic partial adjustment model considered throughout the paper. Next, we discuss the inability of the most commonly applied estimators in the SOA literature to deal with the fractional nature of leverage ratios. Finally, we describe the Elsas and Florisiak's (2011; 2015) doubly-censored Tobit - or DPF - estimator that we use in our analysis.

3.1. Capital structure adjustments – dynamic partial adjustment model

In accordance with the dynamic trade-off theory, target leverage may be time-varying and firms can deviate from their target. While firms have incentives to adjust toward the target, the existence of adjustment costs may prevent full adjustments. Therefore, dynamic partial adjustment models have been used to estimate SOA, which assume that a firm has a unique target leverage ratio in a given time period and actively adjusts its leverage ratio in each time period. These assumptions can be econometrically expressed as:

$$LEV_{i,t} - LEV_{i,t-1} = \lambda\left(LEV^*_{i,t} - LEV_{i,t-1}\right) + \omega_{i,t} \quad (1)$$

where $LEV_{i,t}$ represents the leverage ratio in the current time period and $LEV_{i,t} - LEV_{i,t-1}$ is the change in the actual leverage ratio from period t-1 to period t. This change depends on the SOA, λ, and on the distance between the (time-varying) target leverage $LEV^*_{i,t}$ and the lagged leverage ratio. $\omega_{i,t}$ is the error term. If $\lambda = 0$, then the SOA is 0, which means that there is no adjustment toward a target leverage (there are only random movements of leverage). On the other hand, $\lambda = 1$ implies an immediate adjustment and a full correction of the deviation.

Firm's target leverage ratio is unobservable and recent studies model it as a function of a vector of the observable firm characteristics $X_{i,t}$ (Drobetz et al., 2015):

$$LEV^*_{i,t} = \theta X_{i,t} + \varphi_i + \varphi_t + \upsilon_{i,t} \quad (2)$$

where θ is the coefficient vector (including a constant term), φ_i and φ_t are respectively a firm and a time fixed effect and $\upsilon_{i,t}$ is a generic error term. Replacing $LEV^*_{i,t}$ in (1) by this target definition, we have:

$$LEV_{i,t} = (1-\lambda)LEV_{i,t-1} + \beta X_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \quad (3)$$

which represents the general equation of a dynamic partial adjustment model, where 1 minus the coefficient of the lagged dependent variable is interpreted as the average SOA exhibited by firms.

3.2. Methodological issues

Estimating SOA represents a real econometric puzzle. There is no consensus in the literature on which estimation method should be used and very different estimates of the SOA have been obtained when applying different methods, even for the same dataset (Drobetz et al., 2015; Elsas and Florysiak, 2015). One example concerns the USA case, where we may find in the literature studies with SOA estimates of (not significantly different from) 0 % (Welch, 2004), 7–18 % (Fama and French, 2002; Kayhan and Titman, 2007), about 25 % (Lemmon et al., 2008; Huang and Ritter, 2009) and above 30 % (Flannery and Rangan, 2006) per year.

Most of the techniques commonly applied to estimate the SOA have recently been criticized because they fail to account for particular characteristics of corporate financial data and leverage ratios, providing estimates that are severely biased (Dang et al., 2015; Drobetz et al., 2015; Elsas and Florysiak, 2015; Flannery and Hankins, 2013). The bias arises from not dealing in an appropriate way with: (i) the unbalanced nature of the available panel data; (ii) the inclusion of the lagged dependent variable as a regressor; (iii) the presence of unobserved heterogeneity; and (iv) the fractional nature of the dependent variable, which is bounded between zero and one. For example, pooled OLS estimators ignore issues (ii)-(iv); standard fixed-effects panel data estimators ignore the fractional nature of leverage ratios and the correlation between the lagged dependent variable and the regression error term; and even more advancing techniques such as dynamic IV (Anderson and Hsiao, 1981) and GMM difference (Arellano and Bond, 1991) and system estimators (Blundell and Bond, 1998), the LD estimator of Hahn et al. (2007) and the bias-corrected LSDVC estimator of Kiviet (1995) adapted for unbalanced panel data (Bruno, 2005) do not account for the fractional nature of debt ratios (Loudermilk, 2007). A consequence is that most standard estimators are subject to the problem of "mechanical mean reversion" (Chang and Dasgupta, 2009), providing a positive SOA estimate even when debt ratio changes are due to random factors. Therefore, they have low power to reject the null hypothesis of no capital structure adjustment. Finally, standard estimators have non-monotonic bias curves, producing the same estimates for the SOA in cases where the underlying true SOA is different (Elsas and Florysiak, 2015).

To avoid all these problems, Elsas and Florysiak (2011, 2015) extend the model of Loudermilk (2007) and propose a doubly-censored (bounded between zero and one) Tobit estimator for unbalanced panel data with a lagged dependent variable, accounting both for the presence of fractional dependent variables and for unobserved heterogeneity. As demonstrated by simulation by Elsas and Florysiak (2015), the so-called DPF estimator detects "mechanical mean reversion" and provides unique estimates of SOA for different true underlying SOA, being thus ideal for investigating their heterogeneity. Using empirical data, Drobetz et al. (2015) and Elsas and Florysiak (2015) confirm the biased estimates provided by commonly used estimators and show that the DPF estimator is either unbiased or the least-biased estimator available for dealing with unbalanced panel data with fractional dependent variables and unobserved heterogeneity.

3.3. The DPF estimator

According to Elsas and Florysiak (2015), by using a latent variable specification, the DPF estimator is able to deal with the fractional nature of leverage ratios. The unobserved latent variable $LEV_{i,t}$ is assumed to evolve according to the dynamic model expressed in (3):

$$LEV^{\#}_{i,t} = (1-\lambda)LEV_{i,t-1} + \beta X_{i,t} + \eta_i + \eta_t + \varepsilon_{i,t} \tag{4}$$

Correspondingly, the observed doubly censored dependent variable $LEV_{i,t}$ assume values between two possible extreme outcomes and is expressed as follows:

$$LEV_{i,t} = \left\{ \begin{array}{c} 0, \quad if \quad LEV^{\#}_{i,t} \leq 0 \\ LEV^{\#}_{i,t}, \quad if \& 0 < LEV^{\#}_{i,t} < 1 \\ 1, \quad if \quad LEV^{\#}_{i,t} \geq 1 \end{array} \right\} \tag{5}$$

A possible economic interpretation for the unobserved latent variable is firm's debt capacity (Elsas and Florysiak, 2015). While authors argue that debt capacity may go outside the unit range, the observed debt ratio is bounded between zero and one.

The DPF estimator requires the specification of the conditional distribution of the firm fixed effects η_i. It is assumed that η_i depends on the mean of the firm specific variables, $E(X_i)$, and on the leverage ratio in the initial period, $LEV_{i,0}$:

$$\eta_i = \alpha_0 + \alpha_1 LEV_{i,0} + \alpha_2 E(X_i) + a_i \tag{6}$$

with error term $a_i \sim N(0, \sigma_a^2)$. The distribution of the fixed effects η_i, adopted by Elsas and Florysiak (2015), allows a correlation structure between the regressors of the model and the fixed effect. Estimation of the model described by Eqs. (4)–(6) is performed using the maximum likelihood method.

There are only a few recent empirical studies using the DPF estimator in SOA analyses, such as Elsas and Florysiak (2011, 2015) for a sample of US listed firms, Drobetz et al. (2015) for G7 listed firms and Fitzgerald and Ryan (2019) for UK listed firms. Considering our goal of studying the SOA of zero-leverage firms (firms with corner observations at 0), applying the DPF estimator on a partial adjustment model makes even more sense.

4. Data

4.1. Dataset selection and variables

The data set was taken from the DataStream database provided by Thomson Reuters. Accounting, financial and market data was collected for listed firms from 14 Western European countries (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the UK) for the period between 1995 and 2016. Using such a large European sample, including various countries with different financial systems, represents an opportunity to analyse the influence of such systems on SOA. Moreover, the period of analysis (1995–2016) allows us to examine the impact of the recent European financial and sovereign debt crises on the capital structure dynamics.

Utilities and financial firms (industry code 7000–7999 and 8000–8999 of FTSE/Dow Jones Industry Classification Benchmark-ICB) were excluded from our analysis, because they face different regulations and hence their capital structure decisions may be driven by special factors. Firms without an industry code were also excluded. Firm-year observations with obvious errors for sales, assets or equity (e.g. non-positive sales, assets or equity) or missing data in any model variable were also discarded. Finally, only firms with a minimum of three years of consecutive data were included in the sample. For all firms, we allowed entry and exit from the sample, in an attempt to mitigate potential survivor bias. After applying these filtering and cleaning criteria, we ended up with a sample of 7046 listed firms, corresponding to an unbalanced panel data with 74,384 firm-year observations.

Table 1 provides a definition of the variables considered in our empirical analysis, namely the dependent variable, the control variables and the categorical variables used to divide the sample in groups that allows us to study SOA heterogeneity and thus test our research questions. We choose book leverage ratio as dependent variable, since, as argued by Huang and Ritter (2009), firms' market leverage ratios are affected by equity market shocks. The lack of control of firms on such shocks may, potentially, lead to spurious inferences on the SOA, resulting in an overestimate of their value (Huang and Ritter, 2009).

As suggested by the influential study of Frank and Goyal (2009), we modelled firms' target ratio as a function of reliable important determinants of leverage, namely: firm size, growth opportunities, asset tangibility, profitability, non-debt tax-shields and annual industry median leverage. Following previous capital structure research (DeAngelo and Masulis, 1980; Drobetz et al., 2015; Frank and Goyal, 2009; Rajan and Zingales, 1995; Titman and Wessels, 1988), we expect leverage to be inversely related to profitability, market-to-book ratio and non-debt tax shields, but positively associated with firm size, asset tangibility and the industry median of leverage.

Regarding categorical variables, first we consider the *Zero leverage* variable to analyse differences on SOA between zero-leverage and leveraged firms. To make this analysis possible, we divide our sample in two groups, one composed by zero-leverage firms and the

Table 1
Definition of the variables.

Variable	Definition*
Dependent variable	
Leverage	Ratio of long- and short-term debt (03251 and 03051 or 03255) to total book assets (02999)
Control variables	
Size	Logarithm of total book assets (02999)
Growth opportunities	Market-to-book ratio (the market value of equity (08001) plus the book value of debt (03255), divided by total assets (02999))
Tangibility	Ratio of fixed assets (02501) to book assets (02999)
Profitability	Ratio of earnings before interests, taxes, and depreciation (EBITDA) (18198) to book assets (02999)
Non-debt tax shields	Ratio of depreciation and amortizations (01151) to book assets (02999)
Industry leverage	Industry median book leverage in a given year for DataStream industry classification, the FTSE/Dow Jones Industry Classification Benchmark-ICB (ICBIC)
Categorical variables	
Zero leverage	A firm is classified as being Zero leverage if has at least a zero-book leverage ratio in one year **, otherwise the firm is considered a Leveraged firm
Financial system	A country is classified as having a Market system if it has a market-based financial system (a higher level of stock market development relative to banking sector development), otherwise is considered as having a Bank system (source:Demirgüç-Kunt and Levine, 2004)***
Crisis	A firm-year observation is classified as Crisis for the years of financial and sovereign debt crises in Europe (the period of crisis goes from 2008 to 2009, 2011 or 2012, depending on the country being considered), otherwise is considered a non-crisis period (source:Laeven and Valencia, 2018)****
SA-index	Equals 1 if the firm's Size-Age index is in the fourth or fifth quintile (higher indexes) and 0 if it is in quintile 1 or 2 (lower indexes). The Size-Age index is constructed as $(-0.737 * \text{Size}) + (0.043 * \text{Size}^2) - (0.040 * \text{Age})$, where Age is the difference between the year of the observation and the first date that the firm appears in the DataStream database with trading available data and Size is as defined previously (Hadlock and Pierce, 2010).
Cash ratio	Equals 1 if the firm's cash holdings (cash and short-term investments to total book assets) are in the fourth or fifth quintile (higher cash ratios) and 0 if it is in quintile 1 or 2 (lower cash ratios).

Note: * The corresponding *DataStream* field or code is in parentheses. ** To check the robustness of the results, later zero-leverage firms will be redefined as firms reporting zero debt in at least 3 consecutive years. *** According to Demirgüç-Kunt and Levine (2004), Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Portugal and Spain belong to bank-based financial systems, while Denmark, the Netherlands, Sweden and the UK belong to market-based financial systems. **** The longest crisis period is considered only for the following countries: Austria, Belgium, Greece, Ireland, Portugal and Spain. For UK the crisis period is 2008–2011 and for the remaining countries only the 2008–2009 period is considered as a crisis period. See Laeven and Valencia (2018).

other by leveraged firms. Following most of the literature (e.g. Strebulaev and Yang, 2013), a firm is included in the group of zero-leverage firms if it has a debt ratio equal to zero in at least one year, otherwise the firm is placed in the group of leveraged firms.

Second, to study the effects of the financial system on the SOA we use the *Financial system* variable. Contrary to Öztekin and Flannery (2012) and Drobetz et al. (2015) that adopted a set of country-level indexes or scores to study SOA between different financial systems, we follow Demirgüç-Kunt and Levine (2004) and use an indicator which allows the partition of our sample into countries with a market-based financial system (a more developed capital market) and countries with a bank-based financial system (a more developed banking sector).[4]

Third, to examine the effects of macroeconomic conditions on SOA, we use the *Crisis* variable. Similar to Dang et al. (2014), we are particularly interested in estimating the effects of the recent global financial crisis on the SOA, but additionally we consider its extension to a sovereign debt crisis in 2010 in several European countries (Laeven and Valencia, 2018). Therefore, we define the crisis period by using the recent classification developed by Laeven and Valencia (2018) about banking, currency and sovereign debt crises, which recognizes that the 2008 global financial crisis affected European countries in different ways, being longer in some countries than in others.

Fourth, to examine the effects of different levels of financial constraints on SOA, we follow recent studies (e.g. Dang et al., 2014) and use the so-called Size-Age index of Hadlock and Pierce (2010) to divide the groups of zero-leverage and leveraged firms into sub-groups of financially constrained and unconstrained firms. As shown by Hadlock and Pierce (2010), the Size-Age index is a more appropriate measure to classify financially constrained and unconstrained firms than other common composite measures such as the WW- (Whited and Wu, 2006) and KZ-indexes (Kaplan and Zingales, 1997). To create the categorical variable *SA-index*, we use a similar procedure to those of Bessler et al. (2013). Hence, first we calculate quintiles of the cross-sectional distribution in each year and assign all firm-year observations to one of those quintiles. In a second step, we compute the (rounded) average quintile of a firm over time and assign all its observations to this average quintile. This procedure leads to five groups of firms. A higher (lower) value for the index suggests that greater (smaller) financial constraints are faced by firms, thus firms on quintile 4 and 5 (1 and 2) are classified as financially constrained (unconstrained) firms. In order to avoid misclassification, all firms in quintile 3 are excluded from the analysis.

Finally, we also used a categorical variable to divide the sample in groups of firms with higher or lower financial flexibility. In contrast to the previous case, where alternative indexes measuring financial constraints are available in the literature, there is no well-

[4] As noted by Drobetz et al. (2015), their main findings related with cross-country heterogeneity on SOA are congruent with a classification into countries with bank-based or market-based financial systems.

defined measure of financial flexibility. In fact, previous studies often assess financial flexibility by resorting to measures related to internal liquidity and future growth opportunities (Arslan-Ayaydin et al., 2014; Morais et al., 2021). Following Morais et al. (2021), we use a natural and simple measure of internal liquidity, firms' cash holdings, the most liquid asset detained by firms, to divide the groups of zero-leverage and leveraged firms into sub-groups of financially flexible and non-flexible firms. We use a similar procedure to that followed for financial constraints to create the categorical variable *Cash ratio*. A higher (lower) level of cash holdings suggests greater (smaller) financial flexibility, thus firms on quintiles 4 and 5 (1 and 2) are classified as financially flexible (non-flexible) firms. Firms in quintile 3 are dropped from the analysis.

4.2. Sample characterisation and descriptive analysis

Table 2 presents the distribution of observations and firms by country and leveraged-based groups.

More than 60 % of observations come from the UK, France and Germany. We observe that about 26 % of firms (1853 out of 7046) are assigned to the zero-leverage group, indicating that these firms present zero-leverage levels in at least one year. A high proportion of zero-leverage firms have also been reported by Dang (2013), which found that almost 35 % of his sample of UK listed firms were debt-free. Table 2 also shows that zero-leverage firms are present in all European countries in our sample, which confirms the international nature of the phenomenon. However, the zero-leverage phenomenon seems to be more prevalent in market-based countries, where 1261 out of 3574 firms (35.3 %) are assigned to the zero-leverage group against only 17.1 % (592 out of 3472) in bank-based countries. The results show that more than 68 % of zero-leverage firms are found in market-based countries.

Table 3 reports descriptive statistics for the variables that will be used in the model. On average, firms present a book leverage ratio of approximately 20 %, a level close to that reported by recent European studies. However, mean debt levels vary considerably between zero-leverage and leveraged firms. Particularly, firms classified as being zero-leverage have on average debt ratios of around 8.7 %, which are significantly smaller than those presented by leveraged firms (almost 25 %).[5]

Table 4 presents the average debt ratio of zero-leverage and leveraged firms for the sub-samples constructed using the categorical variables *Financial system*, *Crisis*, *SA-index* and *Cash ratio* defined in Table 1. To verify whether there are significant differences on mean debt ratios, within and between groups, a two-sample t-test is used.

The results reveal that the group of leveraged firms present systematically higher debt ratios than zero-leverage firms, being the difference always statistically significant, irrespective of the financial system, the period and the levels of financial constraints and flexibility being considered. More interesting, within each group the mean debt ratio significantly differs across the different realities considered. In particular, both zero-leverage and leveraged firms have, on average, a significantly higher debt ratio: (i) in bank-based systems than in market systems; (ii) in crisis periods than in non-crisis years; (iii) when they are classified as being financially unconstrained (small SA-index); (iv) when they are classified as financially non-flexible (small Cash ratio). Overall, debt ratios significantly differ across zero-leverage and leveraged firms, varying also significantly in different sub-samples, which reinforces our expectations that the SOA of zero-leverage and leveraged firms may vary across different financial systems, macroeconomic conditions and levels of financial constraints and flexibility.

Table 5 presents Pearson's paired correlation coefficients for the explanatory variables. The correlations between the explanatory variables does not seem to be particularly high, always presenting coefficients below 0.4, which, conjugated with the low values of the variance inflation factor (always below 1.5), suggests that multicollinearity is not a problem.

5. Empirical results

5.1. Leverage policy as a source of SOA heterogeneity

Table 6 presents the DPF estimates for the dynamic partial adjustment model (3). To examine SOA heterogeneity, we consider three different sets of observations in the estimation of Eq. (3): the full sample; the group of zero-leverage firms; and the group of leveraged firms. For each independent variable, we report the estimated coefficient and the respective standard error and an indicator of its statistical significance. We also report the difference in SOA between sub-samples and apply a simple two-tailed z-test to assess if the difference is statistically significant.[6]

The Wald test for the joint significance of the explanatory variables in each model confirm their ability to explain the leverage behaviour of sample firms. Also individually all variables are statistically significant, except *Growth Opportunities* and *Non-debt tax shields* for the specific case of zero-leverage firms. As expected, size, tangibility and the median industry leverage exhibit a positive effect on leverage, while profitability presents a negative effect on firms' leverage (e.g. Frank and Goyal, 2009). While the first results are consistent with the trade-off theory, the negative effect of profitability on leverage is consistent with the predictions of the pecking order theory, since more profitable firms generate more internal funds. The positive effect of growth opportunities for leveraged firms is also consistent with the arguments of the pecking order theory claiming that firms with more future investment opportunities should

[5] Using a simple t-test for mean differences between the two groups of firms, we find that this difference is statistically significant (t-statistic for no differences in the mean: 125.88; p-value: 0.0000).

[6] The z test applied throughout the paper to test the difference between SOA of different groups is not the ideal test to use, but, given the complexity of our econometric model, it is the best available option in the sense that it provides a good approximation to the true result. See inter alia Clogg et al. (1995), Paternoster et al. (1998) and Fitzgerald and Ryan (2019).

Table 2
Sample characterisation by country and leverage policy.

	All firms			Zero-leverage firms		Leveraged firms	
Country	N. obs.	%	N. firms	N. obs.	N. firms	N. obs.	N. firms
Bank-based countries							
Austria	1343	1.81	118	255	22	1088	96
Belgium	1801	2.42	154	208	17	1593	137
Finland	2318	3.12	170	297	20	2021	150
France	11,481	15.43	1058	801	76	10,680	982
Germany	10,895	14.65	959	3522	298	7373	661
Greece	4249	5.71	334	1121	84	3128	250
Ireland	976	1.31	93	266	25	710	68
Italy	3544	4.76	311	339	27	3205	284
Portugal	1016	1.37	91	91	8	925	83
Spain	2138	2.87	184	138	15	2000	169
Subtotal	39,761	53.45	3472	7038	592	32,723	2880
Market-based countries							
Denmark	2409	3.24	198	433	36	1976	162
Netherlands	2739	3.68	248	695	59	2044	189
Sweden	6109	8.21	614	2737	274	3372	340
UK	23,366	31.41	2514	9122	892	14,244	1622
Subtotal	34,623	46.54	3574	12,987	1261	21,636	2313
Total	74,384	100	7046	20,025	1853	54,359	5193

Note: This table presents the distribution of firms across the 14 countries considered in the sample. The first 3 columns report the number of observations (N. obs.), the percentage of observations (% obs.) and the number of firms (N. firms), by country, for all firms. The next 4 columns present the number of observations (N. obs.) and the number of firms (N. firms) for firms classified as zero leverage and for firms classified as leveraged.

Table 3
Descriptive statistics.

	Full sample			Zero-leverage firms			Leveraged firms		
Variable	N	mean	sd	N	mean	sd	N	mean	sd
Leverage	74,384	0.2033	0.1692	20,025	0.0865	0.1334	54,359	0.2464	0.1605
Size	74,384	11.8461	2.1442	20,025	10.5724	1.6767	54,359	12.3154	2.1067
Growth Opportunities	74,384	1.3796	1.6162	20,025	1.8488	2.2603	54,359	1.2067	1.2575
Tangibility	74,384	0.2568	0.2233	20,025	0.1856	0.2119	54,359	0.2831	0.2216
Profitability	74,384	0.0740	0.2066	20,025	0.0222	0.3017	54,359	0.0931	0.1533
Non-debt tax shields	74,384	0.0496	0.0459	20,025	0.0490	0.0556	54,359	0.0498	0.0418
Industry leverage	74,384	0.1831	0.0546	20,025	0.1658	0.0625	54,359	0.1894	0.0499

Table 4
Mean debt ratio of zero-leverage and leveraged firms.

	Leveraged firms	Zero-leverage firms	*T-test for mean differences Between groups*
Financial system			
Market system	0.2328	0.0796	96.14***
Bank system	0.2554	0.0992	73.69***
T-test for mean differences Within groups	-16.12***	-9.93***	
Macroeconomic conditions			
Non-crisis period	0.2423	0.0854	114.60***
Crisis period	0.2723	0.0919	53.42***
T-test for mean differences Within groups	-15.03***	-2.60***	
Financial constraints			
Small SA-index	0.2663	0.1031	78.45***
High SA-index	0.2201	0.0841	55.42***
T-test for mean differences Within groups	30.04***	7.11***	
Financial flexibility			
Small Cash ratio	0.2906	0.1521	48.93***
High Cash ratio	0.1706	0.0525	72.63***
T-test for mean differences Within groups	71.91***	43.41***	

Note: This table compares the mean debt ratio between and within our groups of zero-leverage and leveraged firms across different financial systems, macroeconomic conditions and levels of financial constraints and flexibility. T-tests are presented for differences in means between and within groups.

*** indicates statistical significance at 1 %.

Table 5
Pearson correlation matrix and Variance Inflation Factor (VIF).

Variables	Size	Growth Opportunities	Tangibility	Profitability	Non-debt tax shields	Industry leverage	VIF
Size	1.0000						1.16
Growth Opportunities	-0.1694**	1.0000					1.06
Tangibility	0.2009**	-0.1214**	1.0000				1.15
Profitability	0.2652**	-0.0634**	0.1315**	1.0000			1.09
Non-debt tax shields	-0.0924**	0.0034	0.1329**	-0.0590**	1.0000		1.04
Industry leverage	0.1985**	-0.1731**	0.2747**	0.1154**	-0.0449**	1.0000	1.13

Note: The table shows the Pearson correlation coefficients between the variables of the study, and the coefficients associated with the VIF.
** significance at 1 %.

Table 6
SOA estimates for full sample and across sub-samples of leverage policy.

Independent variables	Full sample	Leveraged firms	Zero-leverage firms
$Leverage_{t-1}$	0.7270 ***	0.7239 ***	0.7795 ***
	(0.0037)	(0.0044)	(0.0089)
Size	0.0285 ***	0.0239 ***	0.0364 ***
	(0.0007)	(0.0008)	(0.0016)
Growth opportunities	0.0006 *	0.0026 ***	-0.0005
	(0.0003)	(0.0004)	(0.0006)
Tangibility	0.1290 ***	0.0988 ***	0.2021 ***
	(0.0041)	(0.0045)	(0.0094)
Profitability	-0.1021 ***	-0.1585 ***	-0.0646 ***
	(0.0023)	(0.0032)	(0.0041)
Non-debt tax shields	0.0208 **	0.0400 ***	0.0158
	(0.0104)	(0.0132)	(0.0196)
Industry leverage	0.1471 ***	0.1063 ***	0.1944 ***
	(0.0225)	(0.0244)	(0.0558)
% SOA	27.30 ***	27.61 ***	22.05 ***
SOA difference (pp)		5.56 ***	
Observations	66,716	48,810	17,906
Year Dummies	Yes	Yes	Yes
Wald test for joint significance	82,059.83 ***	60,642.48 ***	12,139.75 ***

Note: Table 6 presents the estimates of SOA from the partial adjustment model in (3) using the DPF estimator for the full sample and the sub-samples of zero-leverage and leveraged firms. For each independent variable we report the regression coefficients and standard errors (in brackets).
* ** ,* *,* indicates statistical significance at 1 %, 5 % and 10 % respectively.

accumulate more debt over time. The unexpected sign for the coefficient of non-debt tax shields for leveraged firms is sometimes observable in the literature (e.g. Fitzgerald and Ryan, 2019) and may be explained by the proxy used, which relies on depreciation and amortizations of fixed assets, making difficult to isolate the effects of non-debt tax shields and fixed assets.

In all models the coefficient of the lagged book leverage ratio ($1 - \lambda$) is significantly different from one, which implies that the estimated SOA (λ) is significantly different from zero and hence firms exhibit leverage targeting behaviour, irrespective of their leverage policy. Considering our full sample, on average, firms adjust to their target leverage at an annual rate of $1 - 0.727 \approx 27.3\%$, which implies that firms take approximately 2 years to close half the gap between actual and target capital structure.[7] Similar estimates of SOA have been obtained by Drobetz et al. (2015) and Öztekin and Flannery (2012), with the former authors reporting a SOA of approximately 25 %.

For the group of zero-leverage firms, the estimated SOA is approximately 22.1 %, while the group of leveraged firms presents a SOA of about 27.6 %, being the difference of 5.5pp statistically significant. This suggests that the group of zero-leverage firms needs almost 3 years to close half the gap between observed and target leverage, while leveraged firms just need about 2 years. The finding that zero-leverage firms adjust significantly slower than leveraged ones are supported by the arguments that a zero-leverage firm faces lower deviation costs than leveraged firms, since they arguably possess a larger debt capacity, which allows them to hold the real option to lever up in the future and thus compensate the opportunity cost of not taking in the present full advantage of debt tax shields (Lotfaliei, 2018). Moreover, in line with previous empirical evidence of Dang (2013) that zero-leverage firms are on average under-leveraged, our results confirm that such firms have less incentives to adjust back to the target, since their ultimate cost of being off the target is only the loss of debt tax benefits. On the basis of the results obtained, hypothesis H1 is corroborated. However, in the next section we show that there is a particular case where this hypothesis does not hold.

[7] The half-life of leverage adjustment is calculated as $ln(0.5)/ln(1-\lambda)$, where $\lambda \approx 0.273$.

5.2. Sources of SOA heterogeneity within and between zero-leverage and leveraged firms

After finding significant differences between zero-leverage and leveraged firms in their target leverage behaviour, in this section we study more deeply the possible sources of heterogeneity between and within both groups of firms. In particular, we investigate, on the one hand, whether those differences remain significant for specific sub-samples of zero-leverage and leveraged firms (between-group differences) and, on the other hand, how the factors appearing in hypotheses 2–5 affect the target debt behaviour of each group of firms (within-group differences). Therefore, Table 7 presents the estimated SOA for zero-leverage and leveraged firms for the sub-samples defined by the categorical variables *Financial system*, *Crisis*, *SA-index* and *Cash ratio* defined in Table 1. To save space, the regression coefficients of the 16 models that we needed to estimate to obtain the SOA estimates are not reported, but they are similar, in terms of sign and significance, to those presented in Table 6.

We start by analysing cross-country differences on SOA, focusing on the role played by the financial system prevailing in the country. Table 7 shows that firms adjust significantly faster in market- than in bank-based financial systems, irrespective of being a zero-leverage or a leveraged firm. Zero-leverage firms adjust to the target leverage at an estimated speed of approximately 23.7 % in market-based systems and around 20.0 % in bank-based systems, while leveraged firms present a SOA of about 31.5 % in the former system and of around 25.5 % in the latter. These results are supported by the arguments that lower (higher) adjustment costs and higher (lower) deviation costs occur in market-based (bank-based) financial systems, leading to higher (lower) adjustment benefits. Specifically, the greater liquidity and development of capital markets in market-based systems imply lower adjustment costs, allowing an easier access to external finance. On the other hand, the closer ties established between firms and banks in bank-based systems implies that creditors are more willing to negotiate deviations from the target leverage, lowering the deviation costs faced by firms and the need to quickly adjust to their target (Antoniou et al., 2008; Leland and Pyle, 1977). Thus, these results corroborate hypotheses H2a and H2b and are in accordance with previous empirical evidence (Drobetz et al., 2015; Öztekin and Flannery, 2012) that firms located in market-based financial systems exhibit a greater SOA than firms in bank-based systems.

Regarding the differences between zero-leverage and leveraged firms, once again we observe that zero-leverage firms present a slower SOA than leveraged firms, in both market- and bank-based financial systems. The difference between zero-leverage and leveraged firms of more than 7pp in market-based systems and 5pp in bank-based systems are both statistically significant. Moreover, it is worth to emphasize that even zero-leverage firms from market-based systems adjust slower than leveraged firms from bank-based countries. As a consequence, our findings show that previous existing evidence that firms from market-based systems adjust faster than firms from bank-based systems (Drobetz et al., 2015; Öztekin and Flannery, 2012) may not be completely true, since extremely financial conservative firms, even if located in market-based systems, adjust slower than leveraged firms located in bank-based systems. Therefore, previous empirical evidence should be interpreted with caution and a deeper analysis of the firm's debt policy is needed to correctly evaluate heterogeneity in SOA in different financial systems.

Regarding the effect of different macroeconomic conditions on SOA, Table 7 shows a substantial different behaviour between zero-leverage and leveraged firms. In particular, while leveraged firms did not change significantly their average adjustment rate towards a target leverage ratio during the recent crisis, zero-leverage firms adjusted significantly faster during this period. For the group of leveraged firms, the SOA ranges between 25.6 % during the crisis period and around 26.9 % in the non-crisis years. A very different pattern is observed for zero-leverage firms, which exhibit a SOA of almost 47 % during the crisis period and of approximately 21.6 % in non-crisis years. This implies that these firms just needed approximately 1 year to close half the gap between actual and target leverage ratios during the crisis period, but required 3 years outside that period. Therefore, both hypotheses H3a and H3b are rejected. Furthermore, because we find that zero-leverage firms adjusted faster than their leveraged counterparts during the 2008 financial crisis, our previous evidence about the validity of hypothesis H1 does not seem to hold during crisis periods.

The arguments that firms rebalance their capital structure at a slower speed during crisis periods due to greater adjustment costs (Ivashina and Scharfstein, 2010) is hence not supported for both leveraged and zero-leverage firms. Since one of the reasons for firms to adopt zero-leverage policies is to build up financial flexibility and keep their borrowing capacity (Bessler et al., 2013) to have a better financial position to face future unexpected events, these firms hold the real option to lever up in periods of uncertainty (Lotfaliei, 2018). Therefore, zero-leverage firms, by facing smaller adjustment costs, can adjust their capital structure at more favourable conditions in crisis periods than their leveraged counterparts, which explains why the former group adjusted faster during the crisis period than the latter. On the other hand, because deviation costs tend to increase substantially during adverse macroeconomic shocks, higher deviation costs may explain the greater SOA exhibited by zero-leverage firms during the crisis years in comparison to other periods. In contrast, in the crisis period, leveraged firms suffer from both higher deviation costs and higher adjustment costs, which seem to compensate each other and hence their SOA does not change significantly. Overall, our findings reveal that previous empirical evidence that firms adjust more slowly in periods of recession (Dang et al., 2014; Drobetz et al., 2015; Halling et al., 2016) should be interpreted with caution, since firms with extremely conservative leverage policies, which are often excluded from empirical studies, may adjust faster in periods of adverse macroeconomic shocks.

To analyse the SOA for firms with different levels of financial constraints, zero-leverage and leveraged firms are divided into financially constrained and unconstrained firms, according with the categorical variables *SA-index*.[8] Table 7 shows that financially constrained firms (firms with higher *SA-index*, quintiles 4 and 5 of the composite measure) present a higher SOA toward the target than unconstrained firms, irrespective of being zero-leverage or not. However, unlike most of the empirical studies that found a significant

[8] The total number of observations is not equal to those reported previously for leveraged and zero-leveraged firms, because firms on quintile 3 of the categorical variable *SA-index* were dropped to avoid misclassification.

Table 7
SOA heterogeneity across different sub-samples of zero-leverage and leveraged firms.

	Leveraged firms		Zero-leverage firms		*Between difference (pp)*
	N	%SOA	N	%SOA	
Financial system					
Market system	19,213	31.48 ***	11,577	23.73 ***	7.75 ***
Bank system	29,597	25.47 ***	6329	20.05 ***	5.42 ***
Within difference		6.01 ***		3.68 * *	
Macroeconomic conditions					
Non-crisis period	41,655	26.94 ***	14,695	21.55 ***	5.39 ***
Crisis period	7155	25.64 ***	3211	46.78 ***	-21.14 ***
Within difference		1.30		-25.23 ***	
Financial constraints					
Small SA-index	23,157	26.45 ***	10,718	21.04 ***	5.41 ***
High SA-index	16,063	27.84 ***	2895	24.65 ***	3.19
Within difference		-1.39		-3.61	
Financial flexibility					
Small Cash ratio	16,883	26.94 ***	6804	22.09 ***	4.85 ***
High Cash ratio	16,305	26.31 ***	5669	19.89 ***	6.42 ***
Within difference		0.63		2.20	

Note: Table 7 presents estimates of SOA from the partial adjustment model in (3) using the DPF-estimator for sub-samples of zero-leverage and leveraged firms across different financial systems, macroeconomic conditions and levels of financial constraints and flexibility. We present the % of SOA obtained for each model and the difference within and between leveraged and zero-leverage firms. To assess whether the differences are statistically significant we apply a simple two-tailed z-test.
* ** ,* *,* indicates statistical significance at 1 %, 5 % and 10 % respectively.

difference between the SOA of constrained and unconstrained firms (Dang et al., 2014; Drobetz et al., 2015; Fitzgerald and Ryan, 2019), the SOA differences that we obtained are not statistically significant. Therefore, our findings imply the rejection of hypotheses H4a and H4b.

Regarding the differences between zero-leverage and leveraged firms, we find that the former group only present a significant slower SOA than leveraged firms for the case of unconstrained firms. If both types of firms face high financial constraints, then their SOA is similar. This reinforces the idea that the average SOA of zero-leverage firms is lower due to their greater financial flexibility and debt capacity, since this explanation implicitly assumes that firms are debt-free by their own choice.

Finally, to compare the SOA for firms with different levels of financial flexibility, zero-leverage and leveraged firms are divided into financially flexible firms (higher cash ratios) and non-flexible firms (lower cash ratios) according with their cash ratios .[9] Table 7 shows that irrespective of a firm being classified as zero-leverage or leveraged, financially flexible firms present a lower SOA toward the target. However, the SOA differences across financially flexible and non-flexible groups for both leveraged and zero-leverage firms are not statistically significant. Based on these findings, we reject hypotheses H5a and H5b.

Regarding the differences between zero-leverage and leveraged firms, Table 7 shows that the former group adjusts significantly slower than leveraged firms for both the cases of financially flexible firms and non-flexible firms. Table 7 also highlights that even zero-leverage firms classified as financially non-flexible present a slower SOA than leveraged firms classified as financially flexible. This result confirms that zero-leverage firms present lower adjustment rates toward the target due to their unused debt capacity (Ferrando et al., 2017; Marchica and Mura, 2010), which allows these firms to benefit from lower deviation costs by holding the real option to lever up when good growth opportunities arrive or macroeconomic shocks turn the costs of being off the target more aggressive (Lotfaliei, 2018).

The statistically significance of the SOA estimated in all models confirms that European firms exhibit leverage targeting behaviour, irrespective of the leverage policy adopted by the firms, the financial system that prevails in the country, the economic cycle and the different levels of financial constraints and flexibility felt by firms. Similar results were obtained when zero-leverage firms were redefined as firms reporting zero debt in at least 3 consecutive years.[10] These findings support the relevance of the dynamic trade-off theory to explain European firms' capital structure decisions.

6. Conclusion

This paper analyses two classic and puzzling subjects on corporate finance that have been on the daily agenda of the scientific community. In particular, we investigate sources of heterogeneity in SOA towards a target debt ratio for zero-leverage firms and compare it with that of traditionally leveraged firms. To perform this research, we used a sample of 7046 European listed firms over the period between 1995 and 2016, where more than 26 % of the firms are classified as zero-leverage firms. On average, the group of zero-

[9] Similar to the analysis developed for financing constraints the total number of observations observed for the financial flexibility analysis is not equal to those reported previously for leveraged and zero-leveraged firms, because firms on quintile 3 of the categorical variable *Cash ratio* were dropped to avoid misclassification.
[10] Results available upon request.

leverage firms presents a book debt ratio of around 8.7 %, which is significantly lower than that exhibited by the group of leveraged firms (24.6 %). Additionally, the zero-leverage phenomenon is more prevalent in market- than bank-based financial systems, with the proportion of debt-free firms in the former system being twice larger.

Using dynamic partial adjustment models and the unbiased DPF-estimator suggested by Elsas and Florysiak (2015), we find that European firms exhibit leverage targeting behaviour by adjusting toward their target at an annual rate of approximately 27.3 %. More importantly, we show that the firm's financial policy is an important source of SOA heterogeneity. In particular, zero-leverage firms present an annual SOA of 22.1 %, which is a significantly slower adjustment speed than the 27.6 % exhibited by leveraged firms. While the former firms need almost 3 years to close half the gap between observed and target leverage, leveraged firms just need about 2 years.

We also found that the influence of the debt policy adopted by the firm on SOA heterogeneity changes with different financial systems, macroeconomic conditions and financial constraints and flexibility levels. Our results thus show that adjustment speeds estimated without considering heterogeneity in firms' financing policies and institutional context may draw inaccurate conclusions about adjustment behaviour. One example is the effect of the financial system on firms' SOA. We show that both zero-leverage and leveraged firms present a greater SOA in market-based financial systems, extending the work of Drobetz et al. (2015). We also found, however, that the average zero-leverage firm from market-based systems adjust slower than the average leveraged firm from bank-based systems.

Another example of the importance of taking into account firms' debt policies when estimating their SOA towards target debt ratios is given by the finding that financially constrained and unconstrained firms, on the one hand, and financially flexible and non-flexible firms, on the other hand, display similar adjustment rates when the analysis is performed separately for zero-leverage and leveraged firms. Moreover, zero-leverage firms do not adjust at a slower pace than leveraged firms for the case of financially constrained firms, which shows that the key point in this analysis is whether zero leverage is a choice of the firm or an imposition of the market. Indeed, only in the former case zero-leverage firms are likely to have a greater financial slack and debt capacity than leveraged firms and the option to lever up in the future, which motivates them to have a lower SOA in the present.

A further important result of the paper is that zero-leverage firms adjusted faster during the 2008 financial crisis, relative to both other time periods and leveraged firms. This unexpected result may be explained, on the one hand, by a substantial increase in deviation costs during the crisis period and, hence, in the benefits of adjusting toward the target; and, on the other hand, by the smaller adjustment costs faced by zero-leverage firms relative to leveraged firms during the crisis, since the financial slack build by zero-leverage firms enables them to lever up in a better financial position when facing unexpected events. Our findings thus complement and contrast the recent literature that shows that firms adjust more slowly during bad times, namely the recent financial crisis (Dang et al., 2014).

Beyond theoretical contributions, the paper has also some practical implications. For financial managers, we show that firms adopting financial conservative policies adjust more slowly to a desirable target debt ratio, which may indicate a lower adjustment benefit to these firms. Further, financial conservatism allows a greater SOA during recessions, indicating that policies that preserve firms' debt capacity allows to quickly adjust to target debt ratios when deviation costs turn to be more aggressive. Together, these results convey signals that conservative debt policies may better prepare firms for periods of crisis, since they are able to obtain more favourable conditions from creditors than leveraged firms.

CRediT authorship contribution statement

Flávio Morais: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Funding acquisition **Zélia Serrasqueiro:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing **Joaquim Ramalho:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – review & editing.

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