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Capital Structure Adjustment in SMEs: Limits of the Dynamic Trade-Off Model

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Abstract

Capital structure theory remains a central concern within corporate finance, despite more than six decades of sustained scholarly inquiry. The seminal contributions of Modigliani and Miller established the analytical foundations from which subsequent frameworks emerged, notably the static trade-off theory and its later evolution into dynamic adjustment models. Although competing theoretical perspectives have advanced the debate, their respective limitations have increasingly encouraged a more integrative understanding of firms' financing behaviour. This study critically examines the limitations of the dynamic trade-off model in explaining the financing decisions of Portuguese small and medium-sized enterprises (SMEs) during the period 2015–2024. The article contributes to the literature by proposing an original comparative methodological framework and introducing an empirical indicator designed to assess the divergence between the model's theoretical assumptions and observed financing practices. Using dynamic panel estimations based on the Generalized Method of Moments (GMM), the findings reveal that, although SMEs exhibit partial adjustment behaviour towards target leverage ratios, several core determinants predicted by the dynamic trade-off framework lose explanatory power when confronted with observed data. In particular, profitability displays patterns more consistent with pecking order behaviour, while variables traditionally associated with debt optimization and collateral effects become statistically weak or inconsistent. These results suggest that the financing behaviour of Portuguese SMEs cannot be fully explained by a single theoretical framework and is strongly shaped by institutional constraints, internal financing preferences, and contextual factors. The study therefore highlights both the continuing relevance and the empirical limitations of the dynamic trade-off model, while reinforcing the need for more pluralistic approaches to capital structure analysis. From a practical perspective, the findings indicate that SME financing decisions should not be interpreted solely through leverage optimization logic, carrying implications for managers, financial institutions, and policymakers involved in SME financing and fiscal policy design.



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1. Introduction

Capital structure remains a core and vigorously debated field within corporate finance and has sustained continuous scholarly scrutiny for more than six decades. Notwithstanding the considerable accumulation of research, extant theoretical frameworks still exhibit

substantive shortcomings in fully accounting for corporate financing behaviour, even if progressive refinements have brought theoretical propositions closer to observed practice. Seminal contributions by Modigliani and Miller (1958, 1963), together with the influential reflections of Myers (1984), explicitly acknowledged both conceptual and operational constraints embedded in their models. More recent studies (e.g., Serrasqueiro & Caetano, 2015; Khan et al., 2021; Rahman et al., 2024) continue to identify theoretical and empirical challenges, particularly in the analysis of small and medium-sized enterprises, where structural specificities often hinder the direct application of standard models.

Such limitations underscore the importance of a systematic reassessment of the extent to which capital structure theory is transferable to business practice. Contemporary scholarship broadly accepts that no single theoretical perspective offers a comprehensive explanation of firms' leverage choices. Accordingly, a number of authors have advanced the view that alternative frameworks should be interpreted as complementary rather than competing, and have even suggested the desirability of a more integrated theoretical architecture (e.g., Myers, 1984; Fama & French, 2012; Khan et al., 2021; Rahman et al., 2024). Following the broad consensus that traditional theories are not mutually exclusive (e.g., Harris & Raviv, 1991; Myers, 2001; Frank & Goyal, 2009), more recent contributions have further argued that behavioural dimensions also shape financing decisions, helping to mitigate the limitations of classical theories. In particular, managerial cognitive biases have been shown to exert significant influence, thereby widening the analytical lens through which capital structure choices are interpreted (e.g., Malmendier, 2018; Heaton, 2019; Tversky & Kahneman, 2020; DeAngelo, 2022; Carvalho et al., 2023). Earlier behavioural finance research had already laid important foundations in this respect (e.g., Thaler, 1993; Baker & Wurgler, 2013).

Trade off theory has undergone noteworthy conceptual refinement. Initially framed as a static equilibrium model centered on balancing the fiscal advantages of debt against expected bankruptcy costs, it has evolved into a dynamic formulation in which firms adjust leverage progressively towards a target ratio in the presence of adjustment costs, while retaining the equilibrium rationale.

This study contributes to the literature on SME capital structure in three ways. First, it proposes a comparative two-stage empirical strategy that distinguishes between a theoretically structured benchmark specification and an estimation based exclusively on observed data, allowing a clearer assessment of the external validity of the dynamic trade-off framework. Second, it provides updated evidence on Portuguese SMEs, a bank-dependent and financially constrained environment in which standard capital structure determinants may operate differently from those in large or listed firms. Third, it shows that leverage decisions reflect the coexistence of multiple financing logics, as partial adjustment dynamics consistent with the trade-off theory coexist with patterns more aligned with pecking order considerations. Overall, the study highlights the limitations of interpreting empirical support for capital structure theories without considering the influence of model specification itself. Nevertheless, the dynamic trade off framework continues to serve as an important theoretical reference in the analysis of corporate financing decisions, in line with prior evidence reported in the literature (e.g., Lemmon & Zender, 2010; Myers, 1984; Carvalho et al., 2023; Ju, 2024).

The remainder of the paper is structured as follows. Following this introduction, Section 2 reviews the relevant literature, and the Section 3 presents the data and methodology used in the empirical analysis. Sections four to six report and discuss the empirical results from the different approaches and, finally, the last section concludes by summarizing the key findings, discussing their implications, and outlining directions for future research.

2. Literature Review

Modern corporate finance is conventionally traced to the irrelevance proposition advanced by Modigliani and Miller (1958), who evidenced that, under conditions of perfect capital markets, capital structure does not influence firm value. In its original formulation, the model assumed the absence of corporate taxation and showed that firm value is invariant to the composition of financing, whether equity or debt. In a subsequent contribution, Modigliani and Miller (1963) relaxed this assumption by incorporating corporate taxes and establishing the tax deductibility of interest payments as a source of value through the debt tax shield. Miller (1977) later extended the framework by integrating both corporate and personal taxation on income derived from shares and bonds, seeking a more comprehensive specification. Despite these refinements, the model retained clear theoretical and practical shortcomings, not least because the implication of full debt financing was inconsistent with observed corporate behaviour. From an economic standpoint, maximum firm value is not attained through exclusive reliance on debt capital.

The explicit formulation of trade off theory is generally attributed to Kraus and Litzenberger (1973), who introduced expected bankruptcy costs as a counterweight to the fiscal advantages of debt. In this setting, the optimal capital structure arises from balancing tax benefits against increasing costs of financial distress, thereby generating, for the first time, an optimal leverage ratio. Subsequent contributions, notably Jensen and Meckling (1976), Jensen (1986), and Altman (1993), advanced the theory by incorporating agency costs and default risk into the analytical framework. Conflicts of interest between managers and shareholders were shown to influence leverage decisions, with debt functioning as a disciplinary device. Nevertheless, the assumption that managers consistently seek to maximize firm value has been questioned by Myers (2003), who argued that such behavioural consistency is not always borne out in practice.

The dynamic trade off model represents a further conceptual step beyond the traditional static formulation. Rather than presuming instantaneous adjustment to an optimal leverage ratio, it posits that firms move progressively towards a target capital structure in the presence of adjustment costs. Myers (1984) systematized the distinction between the static trade off model, which assumes a fixed optimal debt level, and the dynamic version, in which gradual adjustment reflects transaction costs and market frictions. A foundational contribution to this dynamic perspective was made by Fischer et al. (1989), who developed a continuous time model incorporating adjustment costs and recurrent rebalancing. In this framework, firms alter leverage only when deviations from target levels become sufficiently large to justify issuance or repurchase costs, a logic later reinforced by Flannery and Rangan (2006). Empirical support for the dynamic adjustment process was provided by Leary and Roberts (2005), who estimated the speed at which firms converge towards target leverage ratios. These studies established the dynamic trade off model as a central reference point in contemporary capital structure research. Subsequent analyses, including Fischer et al. (1989) and Dang et al. (2014), conceptualized capital structure as a continuous and costly adjustment process, preserving the equilibrium logic between debt related costs and fiscal advantages (Harris & Raviv, 1991; Rajan & Zingales, 1995; Flannery & Rangan, 2006; Strebulaev, 2007; Leary & Roberts, 2005, 2014). Consideration of practical constraints and adjustment costs has remained central to this strand of research (Harris & Raviv, 1991; Chen & Zhao, 2007; Dang et al., 2014; DeAngelo, 2022).

From the early 2000s onwards, trade off theory was increasingly tested using partial adjustment models. Fama and French (2002) reported mixed evidence concerning the existence of target leverage. Flannery and Rangan (2006) documented economically significant adjustment speeds, while Lemmon et al. (2008) highlighted the persistence of capital structure ratios. Huang and Ritter (2009) further linked trade off considerations with market

timing effects. Collectively, this body of work suggests that firms seek a balance between fiscal advantages and the costs associated with excessive leverage in order to define a value maximizing capital structure (Frank & Goyal, 2009; Frank & Shen, 2016), recognizing that financing decisions entail tangible risks and costs (Korteweg, 2010). Adjustment is therefore gradual and conditional upon the net benefits of rebalancing (Fischer et al., 1989; Flannery & Rangan, 2006). Empirical evidence from Strebulaev (2007) and Chen and Zhao (2007) contend that adjustments are incomplete and shaped by market imperfections, transaction costs and information asymmetries. Leary and Roberts (2005, 2014) and Dang et al. (2018a, 2018b) estimate average annual adjustment speeds between 20 per cent and 40 per cent.

Parallel to these developments, alternative theories emerged. Myers and Majluf (1984) advanced the pecking order theory, later refined by Lemmon and Zender (2010), according to which firms follow a financing hierarchy, prioritizing retained earnings, then debt, and issuing equity only as a last resort due to information asymmetry. Modified versions of the pecking order relax the strict exclusion of equity issuance when market conditions are favorable.

In a different vein, Baker and Wurgler (2002), followed by Huang and Ritter (2009), formulated the equity market timing theory, arguing that firms issue equity during periods of overvaluation and rely more heavily on debt when market conditions are less advantageous. This financial market centered approach remains comparatively contentious (Leary & Roberts, 2005; Strebulaev & Whited, 2012), contributing to ongoing debate.

More recently, recognition of the limitations inherent in traditional frameworks has fostered support for a unified perspective. Myers (2001) and Fama and French (2005) advocated an integrated view of capital structure. Subsequent research emphasizes complementarity rather than exclusivity among theories (Leary & Roberts, 2014; Carvalho et al., 2023). Corporate behavioural finance has further enriched this debate. Thaler (1993) and Shefrin (2001), followed by Malmendier (2018), Heaton (2019), Tversky and Kahneman (2020), DeAngelo (2022), and Carvalho et al. (2023), evidenced that financing decisions are not purely rational but are influenced by cognitive biases and risk perception. Phenomena such as managerial overconfidence and corporate herd behaviour help explain deviations from traditional theory, particularly in episodes of capital structure rebalancing (Carvalho et al., 2024). Prominent scholars, including Fama and French (2012) and Myers (1984), argued that trade off, agency, pecking order, and market timing models should be considered jointly, a view reinforced by Khan et al. (2021) and Rahman et al. (2024).

Capital structure thus emerges from the interaction of fiscal, informational, institutional and behavioural factors, varying according to sector, size and stage of development. Each framework offers only a partial explanation, often complementing others in addressing the limitations of traditional models (Malmendier & Tate, 2005). These issues are particularly pronounced in the context of small and medium sized enterprises. Hall et al. (2004), Frank and Goyal (2009) and Serrasqueiro and Caetano (2015) showed that SMEs face tighter credit constraints, higher agency costs and greater reliance on bank financing. Evidence on debt reversibility suggests that financing decisions, especially among Portuguese SMEs, are shaped by dynamic and institutional factors that extend beyond a simple cost benefit calculus (Rogão & Serrasqueiro, 2023). In the Portuguese setting, Carvalho et al. (2023), examined leverage reversibility through the lenses of the dynamic trade off model, herd behaviour and reversibility without managerial intervention, concluding that although the dynamic trade off framework presents limitations, it remains a relevant explanatory reference for a substantial proportion of SME financing decisions.

In summary, all major capital structure theories retain idiosyncratic limitations, thereby sustaining incentives for continued analytical refinement and methodological innovation (Myers & Majluf, 1984; Rajan & Zingales, 1995; DeAngelo, 2022; Brusov & Filatova, 2023;

Nguyen et al., 2023; Wang, 2025). The analytical framework advanced in this study is grounded in a critical and quantitative assessment of the limitations of the dynamic trade off model within the context of the capital structure of Portuguese small and medium sized enterprises.

SMEs constitute the backbone of the Portuguese economy, accounting for the overwhelming majority of firms and a substantial share of employment and value added. In this context, SME financing is structurally characterised by a high dependence on bank lending, reflecting the bank-based nature of the Portuguese financial system and the limited access of smaller firms to capital markets. Empirical evidence consistently shows that Portuguese SMEs rely primarily on internal funds and bank credit, with external equity playing a negligible role in their financing structure (Farinha & Félix, 2015; Serrasqueiro & Caetano, 2015). This reliance is further reinforced by post-crisis credit constraints and regulatory tightening in the banking sector, which have increased the importance of collateral and creditworthiness in lending decisions (OECD, 2024).

SME financing decisions in Portugal are also shaped by pronounced informational asymmetries and relationship-based banking. Due to limited disclosure and higher perceived risk, SMEs often face credit rationing and depend heavily on long-term relationships with financial institutions to secure funding (Antão & Bonfim, 2008; Farinha & Félix, 2015). In practice, financing choices tend to follow a hierarchical structure: firms first use retained earnings, then resort to bank debt, and only exceptionally access external equity. This behaviour is broadly consistent with pecking order dynamics, although empirical studies show that adjustment toward target leverage ratios, consistent with trade-off theory, also plays a relevant role (Serrasqueiro, 2011; Serrasqueiro & Caetano, 2015). Overall, the literature suggests that SME capital structure decisions in Portugal are not driven by a single theoretical mechanism, but rather by the interaction between financial constraints, banking relationships, and internal resource availability.

Our overarching research question that synthesizes this literature review is: “To what extent does the dynamic trade-off model explain the capital structure adjustment behaviour of Portuguese SMEs?”. Specifically, the central objective is to evaluate the extent to which the theoretical assumptions of the model correspond to observed financing practices, thereby enabling the formulation of the following alternative scenarios: (i) first, a substantial divergence may exist between theory and empirical reality. Under this scenario, firms do not adjust their capital structures in accordance with the specific assumptions underlying the dynamic trade off framework, implying significant inherent limitations in the model’s formulation and explanatory capacity; (ii) second, adjustment costs and financial constraints affecting Portuguese SMEs may not materially displace observed behaviour from the predictions of the dynamic trade off model. In this case, the distance between theory and practice would be limited, suggesting that the model’s constraints are not sufficiently pronounced to undermine its empirical relevance; (iii) third, firms may adjust their capital structures in full conformity with the assumptions of the dynamic trade off model. Such an outcome would indicate the absence of meaningful theoretical limitations in explaining corporate financing behaviour within the SME segment.

3. Data and Methodology

3.1. Methodology

The methodology adopted follows a structured three stage research design. In the first stage, the relevant variables are configured in accordance with the foundational assumptions of the dynamic trade-off framework. The initial dataset consists of accounting information extracted from the database, which was reorganized and transformed using the data preparation tool Power Query. The configuration of the variables was subsequently

implemented in Python 3.11.1. e. At this stage, we deliberately modified only the signs of the variable values, ensuring strict compliance with the theoretical restrictions implied by the dynamic trade-off model. This procedure was undertaken solely to establish a rigorous benchmark for comparison. A first multiple regressions is estimated using STATA 14.2 to obtain the corresponding parameter estimates. The resulting coefficients, both in sign and magnitude, conform by construction to the assumptions of the dynamic trade off framework, thereby serving as a predefined theoretical reference point. In the second stage, the same dataset is employed, but using the variables exactly as observed, without any adjustment or alignment with theoretical restrictions.

It should be noted that the first-stage specification was intentionally constructed in accordance with the theoretical assumptions of the dynamic trade-off model. The specification does not impose coefficient signs *ex ante* within the estimation procedure; rather, variables are operationalized according to the directional logic implied by the theoretical framework in order to construct a theoretically consistent benchmark. Its purpose is therefore not to provide an independent empirical validation of the model, but to allow comparison with the estimation based on observed data. Consequently, part of the observed consistency may reflect the model-based configuration of the variables, which limits the external validity of this specification.

A second multiple regression is estimated using the same econometric specification as in the first stage, thereby ensuring full comparability between the two models. Under this procedure, the estimated parameters derived from the effectively observed data are expected to approximate the predictions of the dynamic trade off theory only to the extent that such alignment is supported by actual corporate behaviour. In the third stage, we compare the results obtained in the previous two estimations, focusing on the signs and the magnitude of the estimated coefficients. This comparison enables both a theoretical and an empirical assessment of the explanatory capacity of the model relative to observed firm behaviour. More specifically, it allows a quantitative evaluation of the extent to which the dynamic trade off framework accounts for the capital structure formation of the small and medium sized enterprises included in the sample, and, consequently, the distance between theoretical prediction and empirical reality. Such an approach also creates scope for the consideration of alternative theoretical perspectives examined under a comparable quantitative design. Overall, this methodology provides a critical and numerically grounded assessment of the limits of the theory and of the degree to which the dynamic trade off model adequately reflects the financing decisions of Portuguese firms in practice.

To examine the underlying limitations of the theory, we employ a generic mathematical model, adapted in line with adjustment models commonly used in the literature by various authors (e.g., Ozkan, 2001; Flannery & Rangan, 2006; Byoun, 2008; D'Mello & Farhat, 2008; Faulkender et al., 2012; Devos et al., 2017; Aybar-Arias et al., 2012; Sardo & Serrasqueiro, 2021) to determine the most appropriate representation (proxy) of the optimal capital structure. For instance, following the approach of D'Mello and Farhat (2008) among others, we constrain leverage adjustments to the classical theoretical foundations of dynamic trade-off theory. For this reason, we also incorporate control variables related to firm-specific characteristics (e.g., Chen & Zhao, 2007; Chang & Dasgupta, 2009; Leary & Roberts, 2014; Brendea & Pop, 2019, among others).

Our methodological approach was developed through an analysis of the various specifications adopted by authors whose methodological reasoning is conceptually closest to our own. Consequently, these studies serve as important methodological and epistemological reference points in the development of our empirical framework. In particular, the work of Shyam-Sunder and Myers (1999), constituted a major methodological reference. In their

study, the authors construct empirical models directly grounded in the assumptions of competing theories, demonstrate that certain empirical tests may favor one theory depending on the specification employed, and apply alternative specifications of the same model to assess whether the evidence supporting a given theory is robust or instead driven by the modelling framework itself. Similarly, [Esghaier \(2024\)](#), compares alternative model specifications, including both symmetric and asymmetric versions of the dynamic trade-off theory. This comparative methodological logic also informed the development of our empirical strategy. Accordingly, the methodology adopted in the present study builds upon insights from the existing literature while pursuing a distinct analytical approach. Although inspired by the methodological reasoning and specification strategies proposed in prior studies, the framework developed here applies these ideas in a different manner and for a different purpose.

In the econometric estimation of this study, the Generalized Method of Moments (GMM) estimator with robust standard errors was employed, given the potential limitations of traditional estimators in observational data. The use of GMM is justified by the possible endogeneity between some explanatory variables and the error term, which may arise from reverse causality, omitted variables, measurement errors, and from the inclusion of the lagged dependent variable. In such contexts, estimators such as OLS or fixed-effects models may produce biased and inconsistent estimates. The GMM approach addresses this issue through the use of instrumental variables and moment conditions that ensure the consistency of parameter estimates even when regressors are correlated with the error term, as established by [Hansen \(1982\)](#) and widely applied in dynamic panel models by [Arellano and Bond \(1991\)](#) and [Blundell and Bond \(1998\)](#). In addition, the use of heteroskedasticity-robust standard errors accounts for the possible presence of heteroskedasticity, ensuring valid statistical inference without imposing the restrictive assumption of constant variance ([White, 1980](#); [Wooldridge, 2010](#)). Model adequacy is assessed using tests specific to the GMM framework, particularly the over-identification tests of instrumental validity, such as the [Sargan \(1958\)](#) and [Hansen \(1982\)](#) tests. Furthermore, the Arellano–Bond serial correlation tests, AR(1) and AR(2), were also conducted. In dynamic panel models estimated using GMM, first-order serial correlation [AR(1)] is expected due to the transformation of the model, whereas the absence of second-order serial correlation [AR(2)] is required to ensure the validity of the moment conditions and the consistency of the GMM estimators ([Arellano & Bond, 1991](#)).

Firms adjust their leverage levels so that their current annual leverage ratio aligns closely with the targeted debt ratio. This leads to an adjustment mechanism given by the following model:

$$D_{ijt} - D_{ijt-1} = \beta_{ijt} (D_{ijt}^* - D_{ijt-1}) \quad (1)$$

where D_{ijt} represents the current leverage ratio; D_{ijt}^* is the target (optimal) leverage ratio of the firm i , sector j and at time t (e.g., [Leary & Roberts, 2014](#)), as determined by the proposed model according to the considered perspectives, both endogenously and exogenously. $(D_{ijt}^* - D_{ijt-1})$ can be interpreted as the distance between the target leverage and the current leverage, with only a portion of the gap towards the target leverage being realized, which is equal to $(D_{ijt} - D_{ijt-1})$. This difference constitutes the response of leverage changes to the deviation between the target leverage and the current (annual) leverage. Where: D_{ijt} represents the leverage of firm i in sector j at year t ; (D_{ijt-1}) represents the leverage in the previous period; β_{ijt} is the parameter indicating the speed of adjustment of leverage changes $(D_{ijt} - D_{ijt-1})$ to the gap between the target leverage level and the observed leverage $|(D_{ijt}^* - D_{ijt-1})|$. If firms do not adjust towards the target leverage, the value of β_{ijt} will be equal to, or very close to, zero; therefore, if the current leverage equals the leverage of the previous period ($D_{ijt} = D_{ijt-1}$). If there is full adjustment towards the target

leverage, the parameter β_{ijt} will take a value equal to, or very close to “1” indicating that the current leverage subsequently equals the target leverage ($D_{ijt} = D^*_{ijt}$). The coefficient β_{ijt} will, therefore, take a value between 0 and 1, representing the level of response of a firm’s leverage changes to the gap between its target leverage and the observed leverage for each year. The adjustment is partial due to bankruptcy (or debt) costs and adjustment costs, as well as other factors inherent to the adjustment process in general, such as the level of required bank collateral. The base regression model used for the first two methodological stages is represented as follows:

$$\Delta D_{ijt} = \alpha_{AJ} + \Delta D_{ijt-2} + (1 - \beta_{1AJ})ADJUST_{ijt} + \beta_{2AJ}DC_{ijt-1} + \beta_{3AJ}TS_{ijt-1} + \sum_{n=1}^n \beta_{iAJ}\Delta X_{ijt-1} + \varepsilon_{ijt-1} \quad (2)$$

where, ΔD_{ijt} (the dependent variable) represents the level of change in current leverage (denoted by the acronym V_ENDIV) in response to the gap between the target and observed leverage ($D^*_{ijt} - D_{ijt-1}$), forming the variable denoted by the acronym ADJUST (independent variable); ΔD_{ijt-2} (2st) is the two steps lagged variable representing the dynamics of the debt adjustment; DC is the variable representing the cost of debt; TS is the variable representing the level of tax savings; X_{ijt-1} represents the vector of control variables used: DIM_1; PROFIT_1; TANGIB_1; NDTs_1; EFTAX_1. These variables are defined in the next section.

3.2. Data

The dataset employed in this study comprises a panel sample of 2428 small and medium sized enterprises (SMEs) operating within the Portuguese industrial sector, classified according to the two-digit codes of NACE Rev. 3, primary division, covering the period from 2015 to 2024. The data were extracted from the SABI database.

Table 1 presents the sector codes, their corresponding description, the number of firms per sector, sectoral frequencies within the sample, and the mean values for both turnover and the average number of employees. The sample is not fully balanced, as certain firms exhibit missing data for some years within the observation period. Nevertheless, the proportion of missing observations is extremely small, approximately 0.012 per cent of the total dataset, indicating overall high data quality. Consequently, the estimates are unlikely to be biased, even though the firms display considerable heterogeneity in terms of size, sectoral characteristics, and operational structure.

Table 1. Sample.

NACE Rev. 3 (Two-Digit Codes)	Sector (Description)	Number of Firms per Sector	Frequency (%)	Average Turnover (€)	Average Number of Employees
10	Food industry	271	11.16	6,573,844	34
11	Beverage industry	50	2.06	5,238,280	37
13	Manufacture of textiles	150	6.18	2,847,585	36
14	Manufacture of wearing apparel	276	11.37	1,658,581	33
15	Manufacture of leather and related products	175	7.21	2,561,906	43
16	Manufacture of wood and cork products, except furniture	135	5.56	2,185,828	22
17	Manufacture of pulp, paper and paperboard	28	1.15	10,165,908	51
18	Printing and reproduction of recorded media	69	2.84	1,629,882	24
19	Manufacture of coke and refined petroleum products	1	0.04	1,044,587	10

Table 1. Cont.

NACE Rev. 3 (Two-Digit Codes)	Sector (Description)	Number of Firms per Sector	Frequency (%)	Average Turnover (€)	Average Number of Employees
20	Manufacture of chemicals	50	2.06	9,538,691	33
21	Manufacture of pharmaceutical products	7	0.29	11,924,897	90
22	Manufacture of rubber and plastic products	87	3.58	3,900,370	33
23	Manufacture of other non-metallic mineral products	145	5.97	2,868,152	34
24	Basic metals	19	0.78	6,465,609	45
25	Manufacture of fabricated metal products, except machinery	465	19.15	2,099,621	29
26	Manufacture of computer, electronic and optical equipment	16	0.66	4,076,788	35
27	Manufacture of electrical equipment	40	1.65	3,186,830	34
28	Manufacture of machinery and equipment	91	3.75	3,026,348	34
29	Manufacture of motor vehicles, trailers and semi-trailers	31	1.28	6,943,039	77
30	Manufacture of other transport equipment	11	0.45	7,191,906	80
31	Manufacture of furniture	167	6.88	1,961,277	27
32	Other manufacturing	50	2.06	4,063,995	39
33	Repair and installation of machinery and equipment	94	3.87	743,924	26
Averages	—	106	4.35	4,430,341	39

Notes: The search strategy applied to the SABI database includes the following items: Country: Portugal; SME: Small and medium-sized enterprises (according to the User guide to the SME Definition (2020) based on Commission Recommendation 2003/361/EC, published in the Official Journal of the European Union L 124, p. 36 of 20 May 2003). Includes the Number of employees: min = 10, max = 250. Companies include Total Assets up to €50,000,000 and Turnover up to €43,000,000.

The raw data consist of the individual line items drawn from firms' balance sheets and income statements. These accounting figures are subsequently converted into ratio-based variables, which serve as the explanatory factors used to examine capital structure decisions.

The definition and operationalization of all variables are presented in the following table (Table 2).

Table 2. Definition of variables.

Category	Variable	Symbol	Measurement/Definition
Dependent Variable	Change in Total Leverage	V_ENDIV	Difference between the total leverage ratio at the beginning of the period and the total leverage ratio at the end of the period. Total leverage is measured as Total Liabilities divided by (Total Liabilities + Equity), where Equity = Total Assets – Total Liabilities (*)
Adjustment Model Variables	Adjustment	ADJUST	Ratio of the difference between target total leverage in the current period and initial leverage in the same period. Target leverage is estimated endogenously using firm-specific characteristics (**)
	Tax Shield	TS	(Tax Shield) Tax benefit of debt (***)
	Default Cost	DC	Debt Cost: incorporating expected bankruptcy costs and adjustment costs. (****)

Table 2. Cont.

Category	Variable	Symbol	Measurement/Definition
Control Variables	Firm Size	DIM_1	Natural logarithm of total assets
	Return on Assets	PROFIT_1	Earnings before tax divided by total assets
	Asset Tangibility	TANGIB_1	Tangible assets divided by total assets
	Non-debt Tax Shields	NDTS_1	Depreciation and amortization divided by total assets
	Effective Tax Rate	EFTAX_1	Income tax paid divided by earnings before tax

Notes: (*) Total leverage is defined as the ratio of total debt to total assets in year t . It is calculated as Total Liabilities divided by the sum of Total Liabilities and Equity, where Equity corresponds to Total Assets minus Total Liabilities. This measurement is consistent with [Rajan and Zingales \(1995\)](#) and [Booth et al. \(2001\)](#). (**) Target leverage is estimated for each firm and for each year using a predictive regression model. The target level is determined endogenously from firm-specific characteristics identified in the literature as key determinants of capital structure decisions: asset tangibility (TANG), firm size (DIM), non-debt tax shields (NDTS), profitability (POFIT) and the effective tax rate (EFTAX). This dynamic specification follows [Ozkan \(2001\)](#), [Flannery and Rangan \(2006\)](#), [Byoun \(2008\)](#), [Faulkender et al. \(2012\)](#), [Devos et al. \(2017\)](#) and [Aybar-Arias et al. \(2012\)](#). (***) Tax shield (TS) is computed as: $TS = T_t \times r_{d,t} \times (D_t)$; where T_t denotes the effective corporate tax rate, $r_{d,t}$ represents the cost of debt (interest expense divided by total debt) and D_t corresponds to total leverage. (****) Cost of debt or expected financial distress cost (DC) is specified as: $DC_t = P_D \cdot C_f + k(D_t - D_{t-1})^2$ where P_D denotes the probability of default, C_f represents financial distress costs, k is the marginal cost of debt and the quadratic term captures adjustment costs. This specification is consistent with [Leland \(1994\)](#), [Leland and Toft \(1996\)](#) and [Hennessy and Whited \(2005, 2007\)](#).

4. Results—First Methodological Stage

4.1. Descriptive Statistics

Table 3 presents the descriptive statistics of the variables of interest, namely the number of observations, the mean, and the standard deviation.

Table 3. Descriptive Statistics of the Variables.

Variable	Number of Obs.	Mean	Standard Deviation	Minimum	Maximum
V_ENDIV(2st)	24,280	−0.0053	0.1682	−2.7850	2.8180
DC_1	24,280	−0.0380	0.2072	−0.7897	0.7773
TS_1	24,280	−0.0000	0.0047	−0.2621	0.1705
ADJUST_1	24,280	−0.0082	0.1804	−3.5141	2.8532
DIM_1	24,280	0.0037	0.1255	−3.0242	2.9357
PROFIT_1	24,280	−0.0083	0.1577	−2.6690	2.7809
TANGIB_1	24,280	−0.0015	0.0872	−0.9430	0.9889
NDTS_1	24,280	0.0023	0.0543	−1.9359	2.3662
EFTAX_1	24,280	−0.0030	0.2893	−3.9891	3.9255

Note: Results were obtained using STATA software 14.2. (2st) 2 steps lagged variable. For the variables' definition see Table 2.

The means close to zero observed for most variables suggest the absence of systematic biases and confirm the appropriateness of the configuration applied to the series.

Regarding the cost of debt and debt tax savings, the negative mean of the former and the value close to zero of the latter, coupled with substantial dispersion, indicate that financing conditions and the tax benefits of debt vary significantly across firms. These results reflect differences in the risk perceived by creditors, access to bank credit, and the effective capacity to utilize the debt tax shield, which are central aspects in the context of the Portuguese financial system and are consistent with the predictions of trade-off theory.

The variable for the change in leverage shows a slightly negative mean alongside a wide range, highlighting the heterogeneity in leverage adjustments. Taken together with the mean value of the adjustment variable, these findings suggest that firms gradually modify their leverage towards a target level, with a prevailing tendency, on average, for persistent debt reduction, indicating a typical situation of over-leverage among firms. This evidence aligns with the predictions of dynamic trade-off theory ([Ozkan, 2001](#); [Flannery &](#)

Rangan, 2006; Byoun, 2008; D’Mello & Farhat, 2008; Faulkender et al., 2012; Devos et al., 2017; Aybar-Arias et al., 2012; Sardo & Serrasqueiro, 2021).

The control explanatory variables, Size, Profitability, and Tangibility, exhibit greater dispersion, reflecting structural differences in access to financing and in the costs associated with financial distress (Chen & Zhao, 2007; Chang & Dasgupta, 2009; Leary & Roberts, 2014; Brendea & Pop, 2019).

4.2. Estimates

Table 4 presents the correlation levels between the variables, in relation to the parameter estimates of the model.

Table 4. Correlation Matrix of the Variables.

Variable	V_ENDIV	DC_1	TS_1	ADJUST_1	DIM_1	PROFIT_1	TANGIB_1	NDTS_1	EFTAX_1
V_ENDIV(2st)	1								
DC_1	0.4784 ***	1							
TS_1	0.1314 *	0.1223	1						
ADJUST_1	0.4472 ***	0.3522 ***	0.0546 *	1					
DIM_1	0.5250 ***	0.5776 ***	0.1038 *	0.3691 ***	1				
PROFIT_1	0.5653 ***	0.4602 ***	0.0811 *	0.3495 ***	0.4719 ***	1			
TANGIB_1	0.4004 ***	0.6072 ***	0.0957 *	0.2973 ***	0.5843 ***	0.3657 ***	1		
NDTS_1	−0.1875 ***	−0.2834 ***	−0.0351	−0.1375 ***	−0.2117 ***	−0.1763 ***	−0.2420 ***	1	
EFTAX_1	0.1940 *	0.4317 ***	0.1234 *	0.1655 ***	0.2489 ***	0.2292 ***	0.2539 ***	−0.1213	1

Note: Results were obtained using STATA software. * $p < 0.10$; *** $p < 0.01$. Table 4 reports the Pearson correlation matrix for the variables used in the empirical analysis. For the variables’ definition see Table 2. (2st) 2 steps lagged variable.

Overall, larger and more profitable firms tend to exhibit higher leverage, greater debt coverage, more tangible assets, and stronger adjustment dynamics, whereas firms with higher non-debt tax shields generally display lower leverage, smaller size, lower profitability, and fewer tangible assets. Most correlations are moderate, while tax-related variables, namely tax shields and effective tax rates, show weaker associations with the remaining firm characteristics, suggesting multicollinearity is not a concern (Gujarati & Porter, 2010). This conclusion is reinforced by the VIF values, which range between 1 and 2, with a mean VIF of 1.435, well below the typical thresholds of 5 or 10 (Gujarati, 2000; Wooldridge, 2010; Greene, 2012). The GMM regression results reported in Table 5 provide empirical support for the dynamic trade-off theory of capital structure (Kraus & Litzenberger, 1973; DeAngelo & Masulis, 1980; Frank & Goyal, 2009; Strebulaev, 2007; Ju, 2024). The findings suggest that firms gradually adjust leverage over time by balancing the tax advantages of debt against the expected costs of financial distress, with adjustment dynamics playing a central role in financing decisions.

Within this theoretical framework, the key model variables—cost of debt, tax shield, and debt adjustment—display effects broadly consistent with the predictions of the dynamic trade-off. The cost of debt is positively associated with leverage adjustments, suggesting that firms respond to financing costs by recalibrating their capital structure. Economically, this reflects the idea that higher borrowing costs can incentivize firms to reassess their debt levels, balancing the tax benefits of debt against its increasing marginal cost. This pattern aligns with Myers (2001) and more recent evidence highlighting the sensitivity of leverage decisions to changes in capital market conditions (Tian et al., 2024). Similarly, the tax shield exhibits a positive relationship with leverage, indicating that firms with greater fiscal advantages from debt financing tend to rely more on external borrowing. From an economic perspective, this supports the standard trade-off mechanism: as the value of interest tax deductions increase, debt becomes more attractive relative to equity financing. This finding is consistent with the traditional framework of Kraus and Litzenberger (1973)

and DeAngelo and Masulis (1980), as well as more recent empirical applications in both developed and emerging markets (e.g., Taherinia et al., 2024).

Particular attention is given to the debt adjustment variable, which captures the speed at which firms move toward their target capital structure. The positive coefficient suggests that firms adjust their leverage gradually rather than instantaneously, consistent with partial adjustment behaviour. Economically, this reflects the presence of adjustment costs, market frictions, and firm-specific constraints that prevent immediate convergence to an optimal leverage level. This result reinforces the core predictions of dynamic trade-off models, where firms continuously revise their capital structure in response to shocks and evolving market conditions (Fischer et al., 1989; Flannery & Rangan, 2006; Dang et al., 2018a; Ju, 2024).

Table 5. Estimation Results from the Perspective of the Dynamic Trade-Off Model.

Variable	Coef.	Std. Err.	t	p-Value
V_ENDIV(2st)	0.3491	(0.2901)	1.20	0.229
DC_1	0.0962 ***	(0.0184)	5.24	0.000
TS_1	2.1519 **	(0.6807)	3.16	0.002
ADJUST_1	0.1508	(0.0796)	1.89	0.058
DIM_1	0.3579 ***	(0.0589)	6.08	0.000
PROFIT_1	0.4122 ***	(0.0546)	7.55	0.000
TANGIB_1	0.0997 *	(0.0501)	1.99	0.047
NDTS_1	−0.0667 *	(0.0271)	−2.46	0.014
EFTAX_1	−0.0227 ***	(0.0063)	−3.62	0.000
constant	0.0038	(0.0029)	1.31	0.192
Test	Value	p-value		
AR (1) z-value	−1.93 *	0.053		
AR (2) z-value	0.67	0.503		
Hansen J chi2	17.42	0.137		

Note: Results were obtained using STATA software. Estimates—GMM with robust standard errors. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. For the variables' definition see Table 2. (2st) 2 steps lagged variable: corresponds to the one-period lag of the already lagged dependent variable, included in the model to capture the persistence of leverage over time, in accordance with the assumptions of the dynamic trade-off theory (Fama & French, 2002; Flannery & Rangan, 2006).

The remaining control variables behave in line with established capital structure theory. Firm profitability and size are positively related to leverage, suggesting that more profitable and larger firms are better positioned to sustain higher debt levels. This can be interpreted through lower bankruptcy risks, stronger bargaining power with lenders, and improved access to credit markets. These patterns are consistent with Titman and Wessels (1988) and subsequent empirical work on leverage determinants (Dang et al., 2018a; Ju, 2024). Asset tangibility also shows a positive association with leverage, indicating that firms with a higher share of tangible assets tend to rely more on debt financing. This reflects the role of collateral in reducing creditor risk and lowering borrowing constraints. Conversely, short-term debt intensity and non-debt tax shields are negatively associated with leverage, suggesting that alternative sources of tax benefits and higher perceived risk reduce the incentive to rely on additional debt. These findings are consistent with the marginal bankruptcy cost perspective and prior theoretical contributions (Myers, 2001; Graham & Leary, 2011). The lagged leverage term indicates persistence in capital structure over time, although its effect is economically moderate, suggesting that while past financing decisions matter, firms retain meaningful flexibility in adjusting their debt levels.

Diagnostic tests support the reliability of the estimation strategy. First-order serial correlation appears as expected in first-differenced models, while there is no evidence second-order autocorrelation, supporting the validity of GMM estimations (Arellano & Bond, 1991). In addition, the overidentification tests do not indicate instrument invalidity, suggesting that the chosen instruments are appropriate and that the model is well specified (Hansen, 1982; Roodman, 2009a).

To mitigate instrument proliferation, the GMM-style instruments were collapsed following the recommendations of Roodman (2009a). In addition, the lag structure was restricted to lags 2–9 in order to maintain a parsimonious instrument matrix and preserve the reliability of the Hansen overidentification test. Moreover, the instrument matrix was restricted to lags 2–9, ensuring a parsimonious specification and maintaining the number of instruments below the number of groups. The dynamic panel model was estimated using the System GMM estimator. The sample comprises 2428 firms observed over the period 2014–2023, resulting in a balanced panel of 24,280 firm-year observations. A total of 17 instruments were employed in the estimation procedure, which remains well below the number of groups, thereby mitigating concerns related to instrument proliferation. Furthermore, the Hansen test does not reject the null hypothesis of instrument validity, supporting the overall adequacy of the instrument set.

Overall, the evidence from the main structural variables and control factors is consistent with the dynamic trade-off view of capital structure. Firms appear to adjust their debt levels over time in a gradual manner, balancing the tax advantages of debt against bankruptcy and adjustment costs. This supports the relevance of dynamic capital structure theory in explaining financing behaviour among Portuguese SMEs.

It is important to note that these results are based on a baseline specification in which variables are constructed to reflect the expected theoretical relationships of the dynamic trade-off framework. As such, they serve as a benchmark for comparison. The following stage of the analysis presents estimates using the observed variable configurations, allowing for a direct assessment of robustness and sensitivity of the results.

5. Results—Second Methodological Stage

5.1. Descriptive Statistics

The descriptive statistics presented in Table 6 offer a first characterization of the distribution and variability of the variables included in the empirical model, based on a panel of 24,280 observations. The variable, $V_ENDIV(2st)$, has a mean that is very close to zero (-0.0053) and displays moderate dispersion, indicating that, on average, changes in firms' leverage are relatively small, although there is meaningful heterogeneity across firms and over time. This pattern is consistent with the gradual leverage adjustment process predicted by dynamic trade-off theory (e.g., Fischer et al., 1989; Flannery & Rangan, 2006). The remaining explanatory variables also follow patterns that align with established theoretical predictions in capital structure literature. Both the cost of debt and the tax shield exhibit relatively stable mean values, reflecting the persistent fiscal and financial incentives shaping firms' reliance on debt, as emphasized in the trade-off framework (e.g., Kraus & Litzenberger, 1973; DeAngelo & Masulis, 1980). By contrast, the adjustment variable shows substantially greater dispersion, suggesting significant cross-firm heterogeneity in the speed of leverage adjustment. This result is consistent with dynamic capital structure models that allow for variation in adjustment speeds across firms (Flannery & Rangan, 2006).

Regarding the control variables, profitability and firm size show moderate variation, indicating meaningful differences in firms' performance and scale. This is relevant under the pecking order theory, which suggests that more profitable firms prefer internal financing (Myers & Majluf, 1984), and the trade-off theory, which links larger firms to lower bankruptcy risk and therefore greater debt capacity (Rajan & Zingales, 1995). The effective tax rate and the non-debt tax shields also vary considerably, reflecting differences in tax environments and firm-specific tax strategies, both of which are important determinants of capital structure in the literature (Graham, 1999). Asset tangibility shows moderate dispersion, suggesting variation in collateral availability across firms. Higher tangibility typically reduces agency problems and improves access to external financing by

strengthening creditors' security (e.g., Jensen & Meckling, 1976; Titman & Wessels, 1988). Overall, the data indicate substantial cross-sectional heterogeneity, which is essential for examining financing decisions the dynamic trade-off, pecking order, agency, and market timing frameworks.

Table 6. Descriptive Statistics of the Variables.

Variable	Number of Obs.	Mean	Standard Deviation	Minimum	Maximum
V_ENDIV(2st)	24,280	−0.0053	0.1682	−2.7850	2.8180
DC_1	24,280	0.2105	0.0083	0.2100	0.7897
TS_1	24,280	−0.0001	0.0047	−0.2621	0.1455
ADJUST_1	24,280	−0.0082	0.1805	−3.5141	2.8538
DIM_1	24,280	0.0346	0.1207	−1.4307	3.0242
PROFIT_1	24,280	0.0002	0.1579	−2.7809	2.6690
TANGIB_1	24,280	0.0029	0.0872	−0.8740	0.9890
NDTS_1	24,280	0.0004	0.0543	−2.3662	1.9359
EFTAX_1	24,280	−0.0026	0.2893	−3.9891	3.5512

Note: Results were obtained using STATA software. For the variables' definition see Table 2. (2st) 2 steps lagged variable.

5.2. Estimates

Table 7 presents the correlation matrix among the variables under study, providing essential insight into potential multicollinearity within the subsequent econometric model. Notably, all pairwise correlations between independent variables remain below 0.50 in absolute value, indicating a lack of severe multicollinearity that might compromise the reliability of parameter estimates. Additionally, the Variance Inflation Factor (VIF) for all variables in the model are below the commonly accepted threshold of 5, indicating that multicollinearity is not a concern. The mean VIF is 1.438, confirming the absence of significant collinearity among the explanatory variables.

Table 7. Correlation Matrix of the Variables.

Variable	V_ENDIV	DC_1	TS_1	ADJUST_1	DIM_1	PROFIT_1	TANGIB_1	NDTS_1	EFTAX_1
V_ENDIV(2st)	1.0000								
DC_1	0.0320 *	1.0000							
TS_1	0.0904 *	−0.0090	1.0000						
ADJUST_1	0.4472 *	0.0036	0.0239 *	1.0000					
DIM_1	−0.0178 *	0.0166 *	0.0223 *	0.0630 *	1.0000				
PROFIT_1	−0.3718 *	−0.0479 *	−0.0011	−0.3003 *	0.2095 *	1.0000			
TANGIB_1	0.0630 *	0.0197 *	0.0188 *	0.0694 *	0.0093	−0.1350 *	1.0000		
NDTS_1	0.0158 *	0.0059	−0.0034	0.0110 *	−0.0741 *	−0.0334 *	0.0529 *	1.0000	
EFTAX_1	−0.0348 *	0.0082	0.0443 *	−0.0347 *	0.0081	0.0553 *	−0.0259 *	0.0018	1.0000

Note: Results were obtained using STATA software. * $p < 0.10$. Table 7 reports the Pearson correlation matrix for the variables used in the empirical analysis. For the variables' definition see Table 2. (2st) 2 steps lagged variable.

Beyond confirming statistical robustness, the matrix reveals patterns consistent with major capital structure theories. The positive association between leverage and adjustment dynamics supports the Dynamic Trade-Off Theory (Titman & Wessels, 1988), while the negative relationship between profitability and leverage is consistent with the Pecking Order Theory (e.g., Myers & Majluf, 1984). In addition, the positive correlation between asset tangibility and leverage aligns with Agency Theory (e.g., Jensen & Meckling, 1976). Fiscal and market timing variables exhibit weaker associations, suggesting a more limited explanatory role (e.g., Baker & Wurgler, 2002).

Table 8 reports the regression results for the determinants of capital structure in industrial SMEs. The empirical model is estimated using the Generalised Method of Moments (GMM) with robust standard errors, an approach widely used in corporate finance because it addresses unobserved heterogeneity, autocorrelation, and potential

endogeneity simultaneously. GMM estimators are particularly appropriate in the presence of lagged dependent variables and endogenous regressors (Arellano & Bond, 1991; Blundell & Bond, 1998; Roodman, 2009b). When the specification and instrument set are properly defined, the GMM framework itself mitigates endogeneity concerns, making additional endogeneity tests generally unnecessary (e.g., Agostino et al., 2024; Boumlik et al., 2025).

Table 8. Results of the estimates from the perspective of the observed data.

Variable	Coef.	Std. Err.	t	p-Value
V_ENDIV(2st)	0.1491	0.2785	0.54	0.592
DC_1	−0.5702	0.7557	−0.75	0.451
TS_1	2.5816 ***	0.7411	3.48	0.000
ADJUST_1	0.3501 ***	0.0768	4.56	0.000
DIM_1	0.1323 **	0.0449	2.94	0.003
PROFIT_1	−0.3101 ***	0.0441	−7.03	0.000
TANGIB_1	−0.0239	0.0303	−0.79	0.431
NDTS_1	−0.0140	0.0225	−0.62	0.532
EFTAX_1	−0.0025	0.0030	−0.84	0.403
constant	0.1137	0.1593	0.71	0.475
Test	Value	p-value		
AR (1)	−2.24 **	0.025		
AR (2)	1.13	0.261		
Hansen J (chi2)	5.56	0.592		

Note: Results were obtained using STATA software. Estimates—GMM with robust standard errors. ** $p < 0.05$; *** $p < 0.01$. For the variables' definition see Table 2. (2st) 2 steps lagged variable: corresponds to the one-period lag of the already lagged dependent variable, included in the model to capture the persistence of leverage over time, in accordance with the assumptions of the dynamic trade-off theory (Fama & French, 2002; Flannery & Rangan, 2006).

The lagged leverage variable presents a positive but statistically insignificant coefficient, suggesting limited persistence in capital structure adjustment among industrial SMEs. Although the estimated adjustment speed indicates relatively rapid convergence towards target leverage ratios, the absence of statistical significance implies that this adjustment mechanism is not particularly strong. This finding is consistent with the view that SMEs often face financial frictions, information asymmetries, and credit constraints that limit their ability to rebalance capital structures efficiently over time (Flannery & Rangan, 2006; Serrasqueiro & Caetano, 2015; Czerwonka & Jaworski, 2021).

Tax shields displays a positive and highly significant coefficient, indicating that firms increase leverage in response to the fiscal benefits associated with debt financing. The magnitude of the coefficient further suggests that tax incentives exert an economically meaningful effect on leverage decisions, supporting the predictions of the trade-off theory, according to which firms balance the benefits of debt against the expected costs of financial distress (Kraus & Litzenberger, 1973; Myers, 1984; Febrianti et al., 2024). More recent empirical research confirms that several firm-specific characteristics influence leverage decisions, particularly among SMEs, where financial structure tends to be shaped by both internal financial conditions and institutional factors (e.g., Pham & Hrdý, 2023).

The adjustment variable exhibits a positive and statistically significant effect, indicating that firms partially adjust leverage towards target levels over time. This result is consistent with the dynamic trade-off framework, which assumes that firms cannot instantly reach optimal leverage because of transaction costs, adjustment costs, and market frictions (e.g., Fischer et al., 1989; Frank & Goyal, 2009). More recent contributions also highlight that adjustment dynamics in SME capital structures depend on firm-specific characteristics and institutional conditions, reinforcing the importance of dynamic modelling approaches (e.g., Czerwonka & Jaworski, 2021; Boumlik et al., 2025).

Profitability presents a negative and highly significant coefficient, suggesting that more profitable firms rely less on external debt financing. This result strongly supports the pecking order theory, according to which firms prioritize internal funds before resorting

to external borrowing (Myers & Majluf, 1984; Qerimi et al., 2024; Ahmed et al., 2023). The magnitude of the coefficient also indicates that profitability constitutes one of the most economically relevant determinants of leverage among the SMEs included in the sample (Boumlík et al., 2025). This evidence suggests that financing decisions are influenced not only by target leverage considerations, but also by firms' internal financing capacity.

Firm size exhibits a positive and statistically significant effect, indicating that larger firms tend to maintain higher leverage ratios. This result is consistent with traditional corporate finance theory, which argues that larger firms generally face lower bankruptcy risk, experience fewer information asymmetries, and enjoy easier access to external finance (Titman & Wessels, 1988; Rajan & Zingales, 1995; Pham & Hrdý, 2023). In the SME context, larger firms may also possess stronger collateral positions and greater creditworthiness, facilitating access to bank financing (Czerwonka & Jaworski, 2021).

By contrast, cost of debt, effective tax rates, non-debt tax shields, and asset tangibility do not display statistically significant effects in the estimated model. Although these variables are frequently identified in the literature as important determinants of capital structure, their limited explanatory power in the present analysis may reflect the institutional and financial constraints faced by industrial SMEs. In particular, financing decisions in SMEs are often shaped by restricted access to credit, relationship-based lending, and firm-specific conditions that reduce the influence of traditional leverage determinants (Jensen & Meckling, 1976; Frank & Goyal, 2009; Febrianti et al., 2024). Recent empirical studies confirm that SME financing decisions are frequently influenced by firm-specific constraints and institutional conditions, rather than by standard capital structure determinants alone (e.g., Boumlík et al., 2025).

Overall, the empirical evidence suggests that the financing behaviour of the industrial SMEs analyzed cannot be fully explained by a single theoretical framework. Beyond statistical significance, the estimated coefficient magnitudes also reveal economically meaningful effects. The relatively large positive coefficient associated with the tax shield variable suggests that fiscal incentives continue to exert an important influence on leverage decisions among Portuguese SMEs. At the same time, the strong negative coefficient of profitability indicates that internally generated funds substantially reduce firms' dependence on external debt financing, providing economically relevant support for pecking-order behaviour. The magnitude of the adjustment coefficient further suggests that firms engage in partial but meaningful leverage rebalancing over time, although such adjustment remains constrained by institutional and financial frictions. Collectively, these results indicate that SME financing behaviour reflects not only gradual adjustment dynamics, but also economically significant internal financing constraints and contextual factors. Instead, the results appear to reflect the coexistence of several mechanisms predicted by different capital structure theories. While some findings are consistent with the trade-off theory, particularly regarding firm size and dynamic adjustment mechanisms, the negative relationship between profitability and leverage provides strong support for the pecking order theory. This type of mixed evidence is widely documented in the empirical literature, which increasingly recognizes that firms' financing decisions are influenced by multiple complementary mechanisms rather than by a single dominant theory (Frank & Goyal, 2009; Qerimi et al., 2024; Pham & Hrdý, 2023).

The diagnostic tests support the robustness of the estimated model. The use of the GMM estimator with robust standard errors helps mitigate potential endogeneity concerns. The AR (1) test indicates the expected first-order serial correlation in the differenced residuals, while the AR (2) test confirms the absence of second-order autocorrelation, a necessary condition for GMM consistency. In addition, the Hansen J test does not reject the validity of the instruments, suggesting that the model does not suffer from over-

identification problems. Overall, these results support the econometric reliability of the estimation.

6. Comparison and Discussion

Table 9 compares the estimates derived from variable values configured according to the assumptions of the dynamic trade-off model (Interpretation I) and the estimates obtained from the actual observed values (Interpretation II). This comparison will enable a critical assessment that is particularly relevant for evaluating the explanatory scope of the theoretical model within the context of Portuguese SMEs.

Table 9. Comparison of results.

Dependent: V_ENDIV	Perspective of Dynamic Trade-Off Model		Perspective of Observed Data	
	Coef.	t	Coef.	t
V_ENDIV(2st)	0.3491	1.20	0.1491	0.54
DC_1	0.0962 ***	5.24	−0.5702	−0.75
TS_1	2.1519 **	3.16	2.5816 ***	3.48
ADJUST_1	0.1508	1.89	0.3501 ***	4.56
DIM_1	0.3579 ***	6.08	0.1323 **	2.94
PROFIT_1	0.4122 ***	7.55	−0.3101 ***	−7.03
TANGIB_1	0.0997	1.99	−0.0239	−0.79
NDTS_1	−0.0667 *	−2.46	−0.0140	−0.62
EFTAX_1	−0.0227 ***	−3.62	−0.0025	−0.84
constant	0.0038	1.31	0.1137	0.71

Notes: Results were obtained using STATA software. Estimates—GMM with robust standard errors. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$. For the variables' definition see Table 2. (2st) 2 steps lagged variable. Comparison between the estimates based on the dynamic trade-off model and the perspective of the observed data.

From the perspective of the dynamic trade-off model, the results are broadly consistent with theoretical expectations. The tax shield, debt costs, and adjustment speed variables are statistically significant. Control variables, such as firm size, profitability, non-debt tax shields, and asset tangibility, generally display signs aligned with theoretical predictions. Overall, this suggests that firms adjust leverage by balancing tax benefits of debt against expected financial distress costs, converging gradually toward a target leverage ratio. At this stage, the evidence primarily supports internal model coherence rather than strong predictive validity.

When the model is estimated using observed data, the empirical pattern becomes more mixed. The tax shield and adjustment speed remain significant, supporting partial adjustment dynamics toward a target leverage ratio, which is central to the dynamic trade-off framework. However, debt costs lose significance, indicating that they do not consistently constrain leverage in practice. The effective tax rate exhibits a negative relationship with leverage, contrary to the predicted positive incentive effect. Asset tangibility is positive but not significant, suggesting limited collateral relevance. Firm size shows only a moderate positive effect, profitability is strongly negatively related to leverage, and non-debt tax shields do not exhibit the expected substitutive effect. Overall, the model captures adjustment dynamics, but has limited explanatory power for observed leverage behaviour.

A comparison of both perspectives highlights three main limitations of the dynamic trade-off model.

- (i) There is structural dependence on model specification: The model shows strong empirical support when operationalized according to its theoretical assumptions. This structural dependence means that a portion of the observed alignment arises from the configuration of variables themselves, rather than from independent predictive power, which diminishes when confronted with actual observed data.

- (ii) Empirical fragility of classical determinants: Key variables such as debt costs, asset tangibility, and firm size do not consistently reach statistical significance in real-world data. This reveals the influence of institutional, behavioural, and relational factors, particularly relevant in SMEs, that are not adequately represented within the framework of the model.
- (iii) Limited explanatory sufficiency in isolation: While partial adjustment dynamics are evident, leverage decisions of Portuguese SMEs are shaped by additional operational and contextual factors, including profitability and non-debt tax shields, which are not fully captured within the dynamic trade-off framework. Reliance on the model alone is therefore insufficient to explain real-world leverage behaviour.

From a critical standpoint, the dynamic trade-off model is conceptually coherent, but empirically incomplete. In Portuguese SMEs, characterized by financial constraints, strong reliance on bank lending, informational asymmetries, and relationship-based financing, leverage decisions cannot be reduced to a simple optimization between tax benefits and bankruptcy costs. Instead, capital structure outcomes reflect operational constraints, financing hierarchies, and institutional context that extend beyond the model's formal assumptions.

In conclusion, while the dynamic trade-off effectively captures the logic of partial adjustment toward a target leverage ratio, its empirical applicability is limited. Leverage decisions in Portuguese SMEs are shaped by a broader set of firm-specific and contextual factors that interact with, but are not fully explained by the model. This underscores the need for a more pluralistic framework that integrates multiple financing logics in explaining capital structure behaviour.

7. Conclusions

The primary objective of this study was to critically assess the limitations of the dynamic trade-off model in explaining the capital structure of Portuguese SMEs. A comparative methodological strategy was adopted, contrasting two empirical approaches: first, estimation using variables configured in strict accordance with the model's theoretical assumptions; and second, estimation based on observed data values. This design allows for the evaluation of both the internal coherence of the model and its external robustness when confronted with empirical reality.

Under the first methodological approach, the results are largely consistent with the dynamic trade-off framework. The adjustment variable shows a positive and weakly significant effect, while the tax shield is positive and statistically significant. Control variables also broadly align with theoretical expectations. Firm size and profitability display positive and statistically significant coefficients, whereas non-debt tax shields and the effective tax rate exhibit negative and significant effects. Asset tangibility is positive but only marginally significant. These results support the idea that firms adjust gradually toward a target leverage ratio. However, these findings are partially driven by variables configured in line with the model's own theoretical structure, which limits the extent to which they have independent explanatory power.

The second methodological approach, based on observed data, provides a more restrictive assessment of the model's validity. The adjustment variable remains positive and strongly significant, and the tax shield continues to exert a positive and significant effect, confirming partial adjustment dynamics. However, several traditional determinants lose explanatory power or diverge from theoretical predictions. Debt costs become negative and statistically insignificant, while asset tangibility also turns negative and loses significance. Non-debt tax shields are no longer significant. Firm size remains positive and significant across both specifications, while the effective tax rate retains a negative but insignificant coefficient. Most notably, profitability becomes negative and highly significant,

contradicting the positive relationship observed under the first specification. This result is more consistent with pecking order theory (Myers, 1984; Myers & Majluf, 1984), suggesting reliance on internal financing. These findings indicate that Portuguese SMEs' financing decisions reflect multiple behavioural logics, and that the dynamic trade-off model alone does not fully capture capital structure formation in Portuguese SMEs.

These results support the broader view that capital structure theories should be interpreted as complementary rather than mutually exclusive. Firm financing outcomes appear to arise from the interaction of adjustment toward target leverage, hierarchical financing preferences, and institutionally embedded constraints. Rather than rejecting the dynamic trade-off framework, the evidence highlights its limitations as a standalone explanatory model. In the context of Portuguese SMEs—characterized by strong reliance on bank lending, financial constraints, informational asymmetries and relationship-based financing—capital structure decisions are shaped by a multifaceted set of forces that extend beyond the optimization of tax benefits and bankruptcy costs.

7.1. Theoretical and Methodological Contributions

The principal contribution of this article lies in its critical examination of the model's limitations through the implementation of an innovative comparative strategy, contrasting theoretically constructed variables with empirically observed data. By placing internally configured measures alongside raw empirical evidence, the study moves beyond conventional model testing and introduces a more demanding framework for assessing theoretical validity. This approach establishes a meaningful methodological precedent within the literature: namely, the possibility of extending a similar comparative procedure to other capital structure theories, and even to perspectives grounded in behavioural finance. In doing so, it encourages a more reflexive and plural evaluation of theoretical models, reinforcing the importance of confronting formal assumptions with the complexity of observed corporate practice.

7.2. Practical Implications

For managers of SMEs, the results suggest that the determination of capital structure should not be driven exclusively by a logic of tax optimization and adjustment towards a predefined target leverage ratio. The management of internal profitability, relationship-based access to credit, and the institutional characteristics of the domestic financial system prove to be decisive elements in financing decisions.

For public policymakers, the evidence reinforces the importance of the institutional and fiscal framework, indicating that the tax authorities should take these dynamics into consideration when designing and implementing fiscal policy. Moreover, at the level of credit allocation and loan management, greater coherence and consistency within the banking system are required in order to create more equitable financing opportunities for smaller firms, whose structural constraints often limit their effective access to external capital.

7.3. Limitations of the Study and Future Research

Although this study has identified limitations in the dynamic trade-off model, it is not without constraints of its own, most notably its focus on a single national setting and a specific time horizon. Also, the interpretation of the first-stage results should be approached with caution, as the specification was designed primarily as a theoretical benchmark rather than as a fully independent empirical test.

Future research may replicate this comparative approach in alternative institutional contexts or apply an analogous methodology to pecking order theory, thereby deepening the critical analysis and enabling a systematic comparison of the explanatory reach of competing frameworks under equivalent methodological scrutiny. In particular, ex-

tending the same procedure to the pecking order perspective would make it possible to ascertain whether its empirical robustness similarly derives from internal consistency in operationalization, or whether it retains explanatory strength when tested against variables not preconfigured in accordance with the hierarchy-of-financing-preferences assumptions, especially within the context of SMEs.

Accordingly, beyond advancing a critical appraisal of the dynamic trade-off model, this study implicitly proposes a more demanding research agenda, grounded in the comparative assessment of the internal and external robustness of the principal theories of corporate finance.

In summary, the results indicate that the dynamic trade-off model retains considerable explanatory relevance, particularly with regard to the partial adjustment mechanism and the role of tax benefits. However, the comparison between interpretations based on theoretically configured variables and those grounded in observed data clearly highlights the model's limitations in fully accounting for the capital structure of Portuguese SMEs.

Capital structure formation therefore emerges as a multifaceted phenomenon, necessitating an integrative and complementary approach that considers insights from multiple financial theories. While the dynamic trade-off model remains a central conceptual pillar, it is not the sole framework capable of capturing the realities of corporate financing behaviour. This critical and quantitative assessment further reveals that the divergence between the theoretical assumptions of the dynamic trade-off model and the actual behaviour of firms is somewhat more pronounced than is conventionally acknowledged in the literature that tends to favour this framework.

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