

Low debt puzzle determinants: evidence from Brazil

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Abstract

Purpose – This study aims to investigate the determinants of zero or near-zero leverage among Brazilian non-financial firms from 2002 to 2024. It emphasizes how access to government-subsidized credit relates to capital structure decisions in an emerging market context.

Design/methodology/approach – The analysis combines two empirical strategies. First, binary logit models identify firm-specific and sectoral characteristics associated with low leverage. Second, hierarchical ordered multinomial logit models classify firms based on leverage and access to subsidized credit, enabling a deeper understanding of how structural and institutional factors interact.

Findings – The results show that access to subsidized credit is associated with firms' higher propensity to borrow. However, a substantial share of firms maintains conservative capital structures regardless of the availability of such funding.

Research limitations/implications – These findings stress the importance of incorporating institutional variables into capital structure theories, particularly in emerging economies.

Practical implications – Public policy design should account for how subsidized credit is related to leverage and financial risk, especially where private markets remain underdeveloped.

Social implications – Understanding conservative financial behavior offers insights into financial regulation, credit access policies and strategies to foster investment while containing excessive risk.

Originality/value – This study provides novel evidence from Brazil showing how structural firm features and institutional incentives jointly relate to conservative leverage decisions in emerging economies.

Keywords Capital structure, Low debt puzzle, Financial constraints, Subsidized credit, Emerging markets

Paper type Research paper

1. Introduction

Capital structure is one of the most extensively examined topics in Corporate Finance (Botta & Colombo, 2022). Modigliani & Miller (1958) made a foundational contribution, arguing that, under restrictive assumptions, a firm's value depends solely on its operational performance, independent of its financing choices. Relaxing these assumptions – by incorporating taxation, information asymmetry, bankruptcy, agency and



transaction costs – led to the recognition that capital structure can influence firm value (Hang, Geyer-Klingenberg, Rathgeber, & Stockl, 2018).

In recent years, research on capital structure has increasingly evaluated the low debt puzzle (LDP), which highlights the paradox of firms persistently maintaining low leverage despite the theoretical benefits of debt (Agrawal & Nagarajan, 1990; Strebulaev & Yang, 2013). Two explanations dominate this debate. The financial flexibility hypothesis views low leverage as a deliberate strategy to preserve the capacity to absorb shocks, exploit investment opportunities and mitigate distress costs (Sardo, Serrasqueiro, & Armada, 2024; Wu, Zhang, Fan, & Shi, 2024). Conversely, the financial constraints hypothesis attributes low debt to limited access to credit, particularly among smaller or younger firms, subject to information asymmetries and higher perceived risk (Hadlock & Pierce, 2010; Saona, Vallelado, & San-Martin, 2020).

Empirical evidence indicates that these mechanisms are not mutually exclusive. Firms may simultaneously value flexibility, face credit restrictions and seek to avoid distress risks, with the relative importance of each factor varying across firm characteristics and institutional contexts (Morais, Serrasqueiro, & Ramalho, 2021; Saona, San-Martin, & Vallelado, 2024). Flexibility tends to dominate in developed, market-based economies, while constraints are more influential in emerging markets, underscoring both the complexity and relevance of the LDP.

Despite extensive research on leverage determinants, the persistence of the LDP remains only partially understood. Prior studies often emphasize either flexibility or constraints, but their interaction and context-specific relevance – particularly in emerging markets – have received less attention. In such contexts, subsidized credit remains a key source of financing, meaning that firms' leverage choices may reflect not only market constraints or precautionary motives but also institutional incentives that can significantly influence firms' leverage, investment efficiency and financial flexibility (Kayo, Da Silva, & Martelanc, 2023; Yu, Yao, Zheng, & Zhang, 2020).

In this context, subsidized credit can be understood as an institutional mechanism that interacts with both financial flexibility and financial constraints. Rather than operating solely through cost reductions, it is associated with a broader set of access conditions and strategic incentives that may shape firms' financing choices in more complex ways. This gap highlights the need for an integrated perspective that accounts for firm-, sector- and macro-level factors, reflecting the unique economic and institutional conditions shaping capital structure choices.

This study investigates the determinants of zero or near-zero leverage and the factors associated with low indebtedness among Brazilian non-financial companies between 2002 and 2024, with particular attention to government-subsidized credit. To achieve this objective, the analysis uses a multi-method approach, using a binary logit model and a hierarchical ordered multinomial logit model to classify firms according to their level of indebtedness.

This study contributes to the literature in three main ways. First, it incorporates the institutional dimension of subsidized credit into the analysis of low and near-zero leverage. Focusing on the Brazilian context – where government-backed financing coexists with private capital markets – we examine how access to subsidized loans is correlated with firms' leverage decisions. Second, by focusing on an emerging economy characterized by hybrid financial arrangements, the study provides a richer understanding of how market mechanisms and state intervention coexist in shaping corporate financial behavior. Third, it captures firm heterogeneity by classifying companies by net debt position, revealing distinct leverage dynamics. Thus, the study contributes to a more nuanced understanding of how financial policies evolve in environments where state intervention and market mechanisms coexist.

2. Literature review

Although classical capital structure theories advocate an optimal mix of equity and debt, they fail to fully account for the so-called LDP. Empirically, many firms maintain very low or even zero leverage despite the theoretical advantages of debt financing, a phenomenon that has attracted increasing academic attention (Saona, Muro, & Gregoriou, 2023; Saona et al., 2024).

One stream of the literature interprets this behavior as a deliberate strategy to preserve financial flexibility. Ferrão, Curto, & Gama (2016) and Sardo et al. (2024) argue that low-leverage firms retain greater capacity to respond to adverse economic conditions and to exploit investment opportunities. In addition, this flexibility may lower the cost of capital (Kontuš, Soric, & Sarlija, 2023) and reduce the likelihood of financial distress.

Leary & Roberts (2005) show that firms dynamically rebalance their capital structures within a target range, suggesting that lower leverage may reflect an intentional effort to preserve future borrowing capacity rather than simply financing constraints. Evidence from Wu et al. (2024), comparing Chinese and US firms during the pandemic, indicates that firms with greater financial flexibility achieved superior performance, reinforcing its role as a resilience mechanism under uncertainty.

Alternatively, another strand of research argues that low leverage often results from external financing constraints. Saona et al. (2020) show that companies are more likely to exhibit zero leverage when they are smaller and hold fewer tangible assets. This likelihood is also associated with limited growth opportunities (GO), more dispersed insider ownership and strong liquidity and profitability. Smaller and younger firms, which face greater information asymmetries and are perceived as riskier by capital providers, tend to have more limited access to external financing (Hadlock & Pierce, 2010). Extending this perspective, Morais, Serrasqueiro, & Ramalho (2025a) suggest that higher environmental, social and governance performance reduces the likelihood of zero-leverage (ZL) adoption by enhancing creditors' willingness to provide debt, rather than through firms' own financing decisions.

This duality between flexibility and constraint is examined by Ferrão et al. (2016) and Sardo et al. (2024), who identify three main reasons for adopting a zero-debt capital structure: the value placed on financial flexibility, restrictions on access to external resources and the perceived risks associated with financial distress, such as potential insolvency. These factors may coexist, with their relative importance varying according to firm-specific characteristics and the broader institutional and financial environment.

Evidence from Morais et al. (2021) indicates that financial flexibility tends to play a greater role in market-based economies, whereas Yasmin & Rashid (2019) highlight that, in developing countries, it also emerges as a determinant of low leverage. Similarly, Saona et al. (2024), analyzing the LDP in BRICS countries, conclude that while both hypotheses – flexibility and constraint – are relevant, financial constraints predominate in emerging markets, compelling firms to maintain low or no debt.

Other studies have further examined the relationship between financial constraints and conservative capital structure decisions. Whited & Wu (2006), for instance, investigate the complexity of this relationship, showing that financial distress and financial constraints can coexist – for example, in a firm on the verge of bankruptcy or in a young, rapidly growing firm, both confronting limited access to capital and elevated financial pressures. Li & Roberts (2023) find that financial constraints and the preference for financial flexibility shape ZL behavior, with dividend-paying firms – particularly those with GO – increasing short-term debt to sustain dividend payments. Finally, Chang, Kyi, Yang, & Wu (2025) and Morais, Ferreira, Marques, & Ramalho (2025b) provide evidence that a ZL policy can significantly enhance firm performance by mitigating corporate governance issues, lowering risk and improving overall value.

Beyond the dichotomy between financial flexibility and financing constraints, empirical evidence suggests that low- or zero-leverage decisions arise from a broader set of determinants operating across multiple analytical levels, including firm-specific characteristics, industry dynamics and institutional conditions (Saona et al., 2024).

At the firm level, attributes such as profitability, *GO* and asset tangibility play a central role in explaining ZL behavior (Saona et al., 2020; Strebulaev & Yang, 2013). Compared to their levered counterparts, ZL firms typically exhibit lower asset tangibility and substantially higher cash holdings, suggesting that limited collateral constrains access to external debt. At the same time, liquidity serves as a strategic substitute. Empirical evidence indicates that these firms hold, on average, significantly more cash, reinforcing their ability to rely on internal financing while preserving financial flexibility.

Moreover, ZL firms show a notable financial paradox: despite high profitability and substantial tax payments, they often forgo considerable tax shield benefits in favor of internal funding and relatively high dividend payouts (Strebulaev & Yang, 2013). This pattern suggests that dividend distributions may partially substitute interest payments, reflecting a deliberate and, in many cases, persistent financing policy rather than a temporary deviation from optimal capital structure.

Industry characteristics further shape corporate leverage decisions. Although innovation-intensive sectors are often associated with conservative financial policies, evidence suggests that the pursuit of financial flexibility does not primarily drive this pattern. Instead, debt avoidance reflects higher expected costs of financial distress, along with limited access to external capital because intangible assets are less collateralizable and highly uncertain (D'Mello & Gruskin, 2021; Ugur, Solomon, & Zeynalov, 2022). Moreover, market structure also plays a relevant role. Firms in more concentrated industries may strategically limit debt to preserve operational autonomy, avoid restrictive covenants and maintain flexibility amid competitive or adverse shocks (Balakrishnan & Fox, 1993; Hovakimian, Kayhan, & Titman, 2012).

Governance structures and managerial characteristics also shape leverage decisions. Strebulaev & Yang (2013) indicate that the likelihood of adopting a zero-debt policy increases with higher CEO ownership and longer tenure, particularly in family-controlled firms or in those with smaller and less independent boards. In these contexts, greater exposure of managers to firm-specific risk and the preference for maintaining long-term control tend to prevail over traditional capital structure considerations.

Institutional conditions further influence financing choices, especially in emerging economies. In countries such as Brazil, where government-subsidized credit coexists with private capital markets, access to these instruments is systematically associated with firms' leverage profiles. Firms that obtain subsidized loans tend to exhibit higher leverage, consistent with the view that such funding is associated with lower borrowing costs and eased credit constraints.

Evidence from the Brazilian context suggests that access to development bank financing is not random but reflects underlying firm characteristics and policy priorities. Studies on Brazilian Development Bank (BNDES) [1] lending indicate that subsidized credit is often directed toward firms with greater investment capacity or strategic relevance and is associated with higher levels of investment and financial activity (Carvalho, 2014; Lazzarini, Musacchio, Bandeira-de-Mello, & Marcon, 2015). This reinforces the interpretation that observed differences in leverage are embedded in broader patterns of firm selection and financial structure. Conversely, some firms deliberately avoid such funding – even when eligible – because of bureaucratic costs, operational rigidities or a strategic preference for financial autonomy (Kayo et al., 2023; Yu et al., 2020; DeAngelo, Gonçalves, & Stulz, 2018).

Taken together, these patterns suggest that the decision to access – or to avoid – subsidized credit reflects both institutional conditions and firm-level strategies. In this sense, state-sponsored financing operates as a context-specific correlate of leverage behavior, interacting with firms’ preferences for flexibility, risk management and independence.

3. Methods

3.1 Data

We used annual accounting and financial data from Refinitiv (Thomson Reuters) and Economatica to construct the sample and converted all monetary values to US dollars. The analysis covers the period 2002–2024. The starting year was set to 2002 because firm-level accounting variables from Economatica and Refinitiv are substantially more limited and less consistently reported for Brazilian listed firms before this date, which would compromise comparability across panel observations. The selected period also encompasses relevant macroeconomic shocks for Brazilian firms, including the 2007–2008 global financial crisis and the 2015–2017 domestic recession.

The sample includes firms listed on the Brazilian Stock Exchange (B3). Table 1 shows that the final sample consists of 2,691 valid observations, corresponding to 231 distinct firms. On average, there are about 12 records per firm, reflecting the unbalanced nature of the panel data analyzed. The data set was refined using the following criteria:

- exclusion of observations with missing leverage data;
- removal of companies in the financial and utilities sectors;
- elimination of firms with sales growth (SG) exceeding 100%, and
- exclusion of firms with negative equity or operating revenue.

Continuous variables were winsorized at the 1st and 99th percentiles to reduce the influence of outliers.

3.2 Variables

This study defines leverage as the ratio of short- and long-term interest-bearing debt to total assets, both measured at book value. This specification aligns with prior studies on zero or near-zero leverage (Strebulaev & Yang, 2013; D’Mello & Gruskin, 2021).

Four alternative dependent variables are defined to capture different forms of conservative financing behavior:

- (1) Almost ZL firms (AZL1): a binary variable equal to 1 if the firm’s book leverage is less than or equal to 5%, and 0 otherwise.

Table 1. Sample composition

Sample composition	Observations
Total original observations	10,320
(–) Observations missing firm leverage data	3,565
(–) Observations removed by sector (Financials and utilities)	2,485
(=) Observations remaining after prior exclusions	4,270
(–) Observations removed because of other criteria	1,579
(=) Final observations	2,691
Number of distinct firms in the sample (after filtering procedures)	231

- (2) Negative net debt firms (*NND1*): binary variable equal to 1 if the firm's net debt is negative, and 0 otherwise.
- (3) *AZL2*: binary variable equal to 1 if the firm's book leverage is less than or equal to 5% with no use of government-subsidized credit, and 0 otherwise.
- (4) *NND2*: binary variable equal to 1 if the firm's net debt is negative with no use of government-subsidized credit, and 0 otherwise.

Table 2 reports the annual proportion of firms classified as *AZL1* and *NND1* over 2002–2024. The share of almost ZL firms (*AZL1*) is higher in the early 2000s and declines moderately over time, while firms with negative net debt (*NND1*) remain consistently present throughout the sample. Overall, a non-negligible fraction of firms maintains very low or negative leverage, confirming the relevance of the LDP in Brazil. Compared to [Strebulaev & Yang \(2013\)](#), who report about 22% of US firms with very low leverage and 32% with non-positive net debt, the Brazilian sample shows lower proportions, particularly in the 2000s, indicating differences in firms' financing patterns across countries.

In addition, **Table 3** shows the joint distribution of low-leverage and negative-net-debt observations according to firms' access to subsidized credit. Panel A shows that firms classified as low leverage and with access to subsidized credit (BNDES) account for 34 observations, corresponding to 9.3% of all low-leverage cases and 1.3% of the full sample (2,691 firm-year observations). Panel B indicates that firms with negative net debt and access

Table 2. Frequency of low-leverage and negative net debt firms (2002–2024)

Year	Low-debt – <i>AZL1</i> (%)	Negative net debt – <i>NND1</i> (%)	<i>N</i>
2002	21.667	36.667	60
2003	23.333	30.000	60
2004	24.590	27.869	61
2005	22.727	31.818	66
2006	20.312	32.812	64
2007	20.588	30.882	68
2008	14.141	19.192	99
2009	17.647	26.471	102
2010	14.783	22.609	115
2011	13.223	18.182	121
2012	11.628	20.155	129
2013	13.178	20.155	129
2014	11.450	22.137	131
2015	11.905	18.254	126
2016	13.008	24.390	123
2017	15.079	28.571	126
2018	13.281	24.219	128
2019	10.938	17.188	128
2020	10.078	20.930	129
2021	10.968	24.516	155
2022	9.239	21.196	184
2023	11.917	24.870	193
2024	10.309	23.196	194
Mean	13.638	23.560	117

Note(s): Values are expressed as percentages and correspond to the proportion of firm-year observations classified as low-debt or negative net debt relative to the total number of observations in each respective year. *N* denotes the total number of firm-year observations for that year

Table 3. Distribution of low-leverage and negative-net-debt observations by access to subsidized credit

Classification	Status	Subsidiary BNDES credit		Total
		Yes	No	
<i>Panel A: low leverage</i>				
Low leverage	Yes	34	333	367
	No	118	2,206	2,324
	Total	152	2,539	2,691
<i>Panel B: net debt</i>				
Negative net debt	Yes	70	564	634
	No	82	1,975	2,057
	Total	152	2,539	2,691

to subsidized credit total 70 observations, representing 11% of all negative-net-debt cases and 2.6% of the overall sample. Taken together, these results suggest that, although the incidence of subsidized credit among financially conservative firms is relatively limited, a non-negligible fraction of low-leverage and negative-net-debt firms still uses government-backed financing.

To examine the determinants of low corporate indebtedness, we group the explanatory variables into two main categories: firm-specific characteristics and sectoral characteristics. We select these variables from traditional capital structure theories and support them with recent empirical evidence.

For firm-specific characteristics that influence corporate leverage, we include general attributes, performance, operational efficiency, financial flexibility and governance. These variables provide a comprehensive view of how internal firm conditions correlate with debt decisions. Three variables capture general characteristics: firm age (*Age*), size (*Size*) and growth opportunities (*GO*). Age serves as a proxy for reputation and credit access and is generally linked to lower financial constraints (Saona et al., 2024). Size, measured as the logarithm of total assets, reflects the idea that larger firms have better access to credit (Hovakimian et al., 2012). *GO*, measured by the market-to-book ratio, indicates the firm’s strategic flexibility needs and a tendency to maintain lower leverage (Frank & Goyal, 2009).

Variables related to the firm’s asset composition and performance include asset tangibility (*Tang*) and profitability (*Prof*). Tangibility measures the capacity to provide collateral, mitigating informational asymmetries and favoring higher debt levels (Rajan & Zingales, 1995). Profitability is proxied by EBITDA margin. Evidence on ZL firms shows that highly profitable firms often avoid borrowing, even at the cost of foregoing tax benefits (Strebulaev & Yang, 2013; Hovakimian et al., 2012).

We also consider variables that capture operational efficiency and financial flexibility. *SG* and market share (*MS*) indicate expansion and competitive positioning, while asset turnover (*AT*) measures how efficiently assets generate revenue (D’Mello & Gruskin, 2021; Morellec, Nikolov, & Schurhoff, 2012). Financial flexibility is assessed by current liquidity (*Liq*), which indicates the firm’s capacity to withstand economic and financial shocks without resorting to debt (Kim & Park, 2015).

The variables related to risk management, governance and agency costs complete the firm-specific profile. Financial soundness (*Z-score*) is measured by the Altman *Z-score* adjusted for emerging markets, capturing the tendency of solvent firms in volatile economies to adopt a cautious approach to debt (Altman, 2005; Saona et al., 2024). Dividend payments

(Div) and non-debt tax shields (NDTS), proxied by depreciation and amortization, operate as substitutes for debt in mitigating agency conflicts, consistent with evidence that zero-debt firms often distribute higher dividends (Frank & Goyal, 2003; Strebulaev & Yang, 2013).

Beyond governance-related factors, access to government-subsidized credit appears associated with firms' financing choices. *Non-BNDES* is a binary variable that captures the association between access to public financing and leverage decisions. Specifically, *Non-BNDES* = 1 indicates that the firm has no operations or subsidized loans with the BNDES, while *Non-BNDES* = 0 indicates the existence of such operations. Access to subsidized credit is typically associated with lower borrowing costs and fewer financing frictions, which may, in turn, be linked to greater debt use.

From a sectoral perspective, the median industry leverage level (ILL) is included to control for financial practices common among comparable firms, as industry leverage serves as a benchmark for managers in defining the firm's capital structure (Degryse, Goeyj, & Kappert, 2012; Frank & Goyal, 2009). Industry concentration was represented by the Herfindahl–Hirschman Index (HHI), which captures the degree of competition. More concentrated markets may influence both operational risk and capital decisions (Ugur et al., 2022). Additionally, we controlled for industry effects by including sector-specific dummy variables, allowing fixed effects across segments of the economy.

Finally, time-fixed effects controlled for macroeconomic conditions in the Brazilian context through year-specific dummy variables. Table A1 in the Appendix reports the variables used in the analysis.

3.3 Models

3.3.1 Binary logit model. As an initial approach, we use a binary logit model, following the methodologies of Devos, Dhillon, Jagannathan, & Krishnamurthy (2012) and Strebulaev & Yang (2013). This model identifies the main factors explaining low leverage, negative net debt and the absence of subsidized borrowing. The study uses four alternative-dependent variables to capture different forms of conservative financing behavior: *AZL1* is a binary variable equal to 1 when a firm's book leverage is less than or equal to 5% and 0 otherwise, identifying almost all ZL firms; *NND1* is also binary and equals 1 when the firm's net debt is negative – indicating that cash holdings exceed total debt – and 0 otherwise; *AZL2* and *NND2* follow the same definitions as *AZL1* and *NND1*, respectively, but are restricted to firms that do not use government-subsidized credit. Specifically, *AZL2* equals 1 for firms with book leverage less than or equal to 5% and no access to subsidized credit, while *NND2* equals 1 for firms with negative net debt under the same restriction, and 0 otherwise.

In Models 1 and 2, the variable referring to access to government-subsidized credit is included as an explanatory variable rather than as a restriction on the sample. This approach allows the models to assess whether access to – or lack thereof – subsidized credit is associated with the probability of a firm belonging to the low-leverage group, while maintaining all firms in the estimation regardless of their access to government credit.

Given the longitudinal nature of the data, the model is estimated using a random-effects panel specification, allowing it to capture unobserved heterogeneity across firms. Equation (1) shows the general formulation of the model:

$$Pr(Y_{it} = 1 | X_{it}, \alpha_i) = \frac{1}{1 + e^{-(\alpha_i + X_{it}\beta)}} \quad (1)$$

where $Y_{it} \in \{AZL1, NND1, AZL2, NND2\}$ represents the binary dependent variable for firm i at time t ; X_{it} is the vector of explanatory variables; β is the vector of coefficients to be

estimated; and σ_i is the firm-specific random effect term, assumed as $\sigma_i \sim N(0, \sigma_a^2)$, uncorrelated with the covariates. The independent variables included in the model specification covered both firm-level and industry-level dimensions. Additionally, we introduced year- and industry-fixed effects to control for unobserved variation at these levels. We estimated the model using heteroskedasticity-robust standard errors clustered at the firm level (Petersen, 2009).

3.3.2 Hierarchical ordered multinomial logit model. Subsequently, we adopt a hierarchical ordered multinomial logit model (mixed linear model), as proposed by Ferrão et al. (2016). A key advantage of this framework is its ability to account for nested data, which better captures the high heterogeneity of firm leverage, particularly across sectors (Kayo & Kimura, 2011).

This framework tested two distinct dependent variables, each capturing a different dimension of financial policy. The first variable, LGC – Leverage Group Classification, was defined according to four mutually exclusive ordinal categories, as proposed by Ferrão et al. (2016). These categories reflect different degrees of financial leverage and liquidity position: zero debt; almost zero leverage (AZL); book leverage above 5% with negative net debt; and book leverage above 5% with positive net debt.

The second dependent variable, LGS (Leverage and Subsidy Classification), captures the interaction between firms' leverage levels and their access to subsidized credit instruments, such as government-backed financing programs. It comprises four mutually exclusive categories. The first group includes firms with low leverage (book leverage $\leq 5\%$) that make use of subsidized credit. The second group consists of low-leverage firms that do not rely on subsidized financing. The third group comprises firms with high leverage (book leverage $> 5\%$) that access subsidized credit, while the fourth group includes highly leveraged firms that do not use subsidized credit. This variable allows analysis of whether leverage profiles differ systematically by access to preferential financing conditions.

Following Snijders & Bosker (2012), the general formulation of this model is:

$$\text{logit}(Pr(Y_{ij} \leq K)) = \theta_k - (X'_{ij}\beta + Z'_j\gamma_j + u_j) \quad (2)$$

where Y_{ij} denotes the ordinal leverage category for firm i in sector j ; θ_k are the cutoff points between ordinal categories; X'_{ij} is the vector of firm-level independent variables; β is the vector of fixed coefficients for firm-level covariates; Z'_j represents sectoral covariates with random coefficients γ_j ; and $u_j \sim N(0, \sigma_u^2)$ is the sector-specific random intercept.

The firm-level independent variables (X'_{ij}) were the same as those used in the binary logit model. In addition to sector-level random effects, we included year-fixed effects to control for unobserved macroeconomic shocks and institutional changes that may have affected all firms simultaneously during the analysis period (2002–2024).

4. Results

Table 4 presents descriptive statistics for the variables used in empirical analysis. Age and Size display relatively low dispersion, reflecting a sample composed mostly of relatively young firms with comparable scale (median Size = 20.53). *GO* shows moderate variation, with a long right tail (95th percentile = 3.05), consistent with a subset of high-valuation firms.

Tangibility (*Tang*) is centered at 0.24, with large variation across quartiles, indicating different asset structures within the sample, while Profitability (*Prof*) and *SG* exhibit wide dispersion and include negative values, consistent with economic fluctuations and heterogeneous operational performance. Market dynamics also vary considerably. *MS* ranges

Table 4. Descriptive statistics

Variables	Mean	SD	Min.	5%	25%	Median	75%	95%	Max.
<i>Age</i>	2.305	0.938	0.000	0.000	1.792	2.485	2.944	3.538	4.419
<i>Size</i>	20.535	1.781	16.300	17.707	19.376	20.488	21.599	23.556	25.105
<i>GO</i>	1.365	0.811	0.421	0.651	0.906	1.111	1.519	3.047	5.364
<i>Tang</i>	0.270	0.212	0.001	0.005	0.091	0.241	0.400	0.682	0.840
<i>Prof</i>	0.167	0.218	−0.792	−0.104	0.073	0.148	0.254	0.528	0.782
<i>SG</i>	0.074	0.297	−0.636	−0.375	−0.125	0.053	0.262	0.618	0.846
<i>MS</i>	0.288	0.348	0.000	0.004	0.032	0.110	0.427	1.000	1.000
<i>AT</i>	0.739	0.522	0.052	0.118	0.379	0.636	0.962	1.714	3.000
<i>Liq</i>	2.078	1.378	0.402	0.695	1.260	1.758	2.438	4.581	8.910
<i>Z-score</i>	3.957	3.858	−4.999	−0.896	1.731	3.284	5.368	11.190	20.225
<i>Div</i>	0.020	0.033	0.000	0.000	0.000	0.007	0.025	0.088	0.200
<i>NDTS</i>	0.033	0.026	0.000	0.000	0.014	0.029	0.045	0.085	0.136
<i>ILL</i>	0.286	0.124	0.000	0.052	0.216	0.288	0.358	0.500	0.587
<i>HHI</i>	0.455	0.297	0.103	0.129	0.198	0.379	0.664	1.000	1.000

Note(s): Firm-level variables – *Age*, *Size*, Growth opportunity (*GO*), Asset tangibility (*Tang*), Profitability (*Prof*), Sales Growth (*SG*), Market Share (*MS*), Asset turnover (*AT*), Liquidity (*Liq*), Financial soundness (*Z-score*), Dividends (*Div*) and Non-debt tax shields (*NDTS*). Sector-level variables – Herfindahl–Hirschman Index (*HHI*) and Industry leverage level (*ILL*)

from near zero to monopoly-level values (max = 1), while *AT* varies substantially, indicating diverse operating models across sectors.

The sample also exhibits substantial heterogeneity in liquidity and financial soundness indicators. *Liq* is right-skewed (95th percentile = 4.58), suggesting that a subset of firms hold unusually high liquid asset positions. Financial soundness (*Z-score*) presents similarly high dispersion, with values spanning from severe distress levels to very robust financial positions (max = 20.22).

Dividend payments (*Div*) are generally low in magnitude, consistent with the low mean (0.02) and concentration at zero – a common pattern in Brazilian corporate finance. *NDTS* and *ILL* show limited dispersion, while industry concentration (*HHI*) reveals a mix of competitive and highly concentrated sectors.

Table 5 reports the estimation results from the binary logit models, which show consistent patterns across specifications explaining both almost-zero leverage (*AZL1* and *AZL2*) and negative net debt (*NND1* and *NND2*). Firm size is negatively associated with the probability of maintaining extremely low or negative debt ratios, indicating that smaller firms are more likely to operate with little or no leverage. This result supports the view that larger firms benefit from lower information asymmetry and better access to credit markets (Dong & Jiang, 2025). For all four models, Table 5 reports both the estimated logit coefficients and, in brackets, the corresponding average marginal effects (AME).

Liq and financial soundness (*Z-score*) show positive and highly significant coefficients in all models, suggesting that firms with greater internal resources and lower financial risk tend to avoid external borrowing (Haque & Varghese, 2023). This pattern aligns with the view that financially sound firms preserve flexibility by relying on internal funds rather than engaging in debt markets. In the Brazilian context, this result can be further understood in light of institutional and macroeconomic conditions. Historically high interest rates and segmented credit markets incentivize firms to adopt more conservative financing strategies. As a result, even solvent firms may exhibit lower leverage as a precautionary response to financial volatility and borrowing costs.

Table 5. Estimation results for binary logit models

Variables	Model 1: AZL1	Model 2: NND1	Model 3: AZL2	Model 4: NND2
Constant	27.650*** -0.044 [-0.002]	21.298*** -0.132 [-0.007]	29.866*** -0.092 [0.003]	21.171*** -0.053 [-0.003]
Age	-1.604*** [-0.058***]	-1.047*** [-0.058***]	-1.575*** [-0.058***]	-0.970*** [-0.055***]
Size	-0.454 [-0.016]	-0.475 [-0.026]	-0.480 [-0.016]	-0.429 [-0.024]
GO	-0.440 [-0.016]	-4.659*** [-0.257**]	-0.404 [-0.014]	-4.645*** [-0.264**]
Tang	-1.126 [-0.040]	-1.769*** [-0.098**]	-1.207 [-0.044]	-1.817*** [-0.103**]
Prof	-0.483 [-0.017]	-0.222 [-0.012]	-0.454 [-0.017]	-0.254 [-0.014]
SG	2.724** [0.098**]	1.820* [0.100*]	2.781** [0.102**]	1.691* [0.096*]
MS	-0.915* [-0.033*]	-1.112* [-0.061 **]	-0.866 [-0.033*]	-0.997* [-0.057*]
AI	0.452** [0.016***]	0.589*** [0.032***]	0.449*** [0.017***]	0.569*** [0.032***]
Liq	0.363*** [0.013***]	0.540*** [0.030***]	0.363*** [0.013***]	0.515*** [0.029***]
Z-score	0.139 [0.005]	3.456 [0.191]	-1.357 [-0.023]	1.046 [0.059]
Div	4.973 [0.179]	-1.238 [-0.068]	6.298 [0.216]	-0.257 [-0.015]
NDTS	2.822*** [0.102***]	0.875 [0.048]		
Non-BNDES	-9.843*** [-0.354***]	-9.132*** [-0.504***]	-9.790*** [-0.364***]	-9.448*** [-0.536***]
ILL	-2.614* [-0.094*]	-0.807 [-0.045]	-2.672* [-0.098*]	-0.840 [-0.048]
HHI	YES	YES	YES	YES
Sector dummies	YES	YES	YES	YES
Year dummies	YES	YES	YES	YES
Observations (n)	2,691	2,691	2,691	2,691
Wald χ^2	842.17	273.04	167.90	284.81
p-Value (Wald test)	<0.0001	<0.0001	<0.0001	<0.0001
Log pseudolikelihood	-421.597	-638.431	-426.145	-642.12
Sigma_u (σ_u)	2.972	2.832	2.907	2.767
Rho (ρ)	0.729	0.709	0.720	0.699

Note(s): The first line reports the estimated logit coefficients. The values reported in brackets correspond to the average marginal effects (AME). Firm-level variables – Age, Size, Growth opportunity (GO), Asset tangibility (Tang), Profitability (Prof), Sales growth (SG), Market share (MS), Asset turnover (AT), Liquidity (Liq), Financial soundness (Z-score), Dividends (Div), Non-debt tax shields (NDTS). Sector-level variables – Herfindahl–Hirschman Index (HHI) and Industry leverage level (ILL). The significance levels are represented as follows: ***significance at 1%, **significance at 5%, *significance at 10%

In Model 1, *MS* is positively and significantly associated with the probability of maintaining low leverage, implying that firms with stronger competitive positions rely more on internal funds to preserve strategic flexibility (Marchica & Mura, 2010). *AT* exerts a negative effect, reinforcing the notion that firms with higher operational efficiency are less likely to remain unlevered (Margaritis & Psillaki, 2010). The positive coefficient of the *Non-BNDES* dummy (where 1 indicates no access to subsidized credit) suggests that the absence of BNDES financing is associated with a higher likelihood of low or near-zero leverage. This finding is consistent with the interpretation that access to subsidized credit is associated with looser financing constraints and greater debt use. In the Brazilian context, where credit frictions matter, BNDES funding helps expand access to long-term financing. Empirical evidence shows that BNDES credit positively affects firms' investment capacity and mitigates financial constraints (Oliveira, 2019; Silva, Kayo, & Martelanc, 2020), supporting the interpretation that the absence of such funding is linked to persistent low leverage.

Model 2 identifies two other significant determinants. Asset tangibility (*Tang*) and profitability (*Prof*) present negative and significant coefficients, reinforcing the notion that firms with higher EBITDA relative to revenue and more collateralizable assets are less likely to maintain low leverage ratios in terms of net negative debt, as these characteristics enhance their ability and incentive to use external financing (Frank & Goyal, 2009; DeMarzo, 2019).

Industry-level variables further influence leverage behavior. Both the *HHI* and *ILL* are negative and significant in Model 1, while *ILL* remains negative and significant in Model 2. These results indicate that firms operating in highly leveraged and more concentrated industries are less likely to maintain low leverage, suggesting that structural industry characteristics are associated with capital structure decisions. In particular, greater industry concentration is associated with higher leverage, implying that firms in concentrated sectors may benefit from more stable cash flows and reduced uncertainty, which enhances their access to external financing. This environment may weaken the incentive to maintain conservative capital structures, as competitive pressure is lower and debt can be used more strategically (Frank & Goyal, 2009; Kayo & Kimura, 2011; Thakor & Lo, 2022).

Given that subsidized credit appears statistically and economically relevant in Model 1, we further test whether these patterns persist when focusing on firms that maintain low leverage without relying on government-subsidized credit. This robustness analysis lets us assess whether the determinants of low leverage remain consistent when we exclude firms with access to government loans, capturing a more "pure" form of conservative financing behavior.

Results for Model 3 (*AZL2*) and 4 (*NND2*) are broadly consistent with previous specifications. The signs and significance of key variables, particularly firm size, *MS*, liquidity and financial soundness, remain stable, reinforcing the robustness of the findings. Again, smaller firms with higher *MS*, greater liquidity and stronger financial soundness are more likely to maintain near-zero leverage, suggesting that conservative financial behavior is driven not only by the availability of subsidized credit but also by structural and strategic considerations.

Notably, the negative and significant coefficients for tangibility and profitability persist in Model 4, indicating that firms with more tangible assets and higher profitability find it easier to access external financing, likely because of the availability of collateral. The negative effect of *AT* – which appears only in Model 4 – together with the negative coefficients of *ILL* in both models and *HHI* in Model 3, further suggests that operational efficiency and industry structure also appear to be associated with firms' preference for maintaining minimal debt levels.

Overall, Models 3 and 4 provide additional evidence that low leverage in Brazil is a persistent and multifaceted phenomenon influenced by firm fundamentals, sectoral dynamics and managerial decisions regarding independence from government-backed financing.

For the hierarchical ordered models, [Table 6](#) reports the estimated coefficients, while [Table A2](#) in the [Appendix](#) presents the corresponding AME by outcome category. Model 5 uses LGC, which categorizes firms into four groups based on leverage and liquidity, capturing varying degrees of indebtedness and net financial positions. Model 6 uses LGS, which classifies firms by both leverage and access to government-subsidized credit, allowing assessment of how preferential financing relates to capital structure decisions.

In Models 5 (LGC) and 6 (LGS), firm size, *Prof* and *AT* are positively associated with higher leverage categories. Conversely, *MS*, *Liq*, financial soundness (*Z*-score) and dividends (*Div*) present negative and significant effects. All signs align with theoretical expectations. Smaller firms, with lower growth opportunities, profitability and operational performance, tend to maintain lower levels of indebtedness, consistent with the idea that limited internal resources and higher financing constraints reduce their access to external capital. In contrast, firms with higher market share, liquidity, financial soundness and dividend distributions show a negative relationship with leverage, suggesting that financially sound and dominant firms may prefer conservative capital structures and rely more on internal financing. [Table A2](#) in the [Appendix](#) reports the AME by leverage category, providing a more detailed view of how each

Table 6. Estimation results for hierarchical ordered multinomial logit models

Variables	Model 5 (LGC) coef.	Model 6 (LGS) coef.
<i>Age</i>	0.046	0.041
<i>Size</i>	0.731***	0.741***
<i>GO</i>	0.056	0.058***
<i>Tang</i>	-0.532	-0.527
<i>Prof</i>	1.484***	1.493***
<i>SG</i>	0.222	0.215
<i>MS</i>	-1.365***	-1.331***
<i>AT</i>	0.467***	0.463**
<i>Liq</i>	-0.201***	-0.207***
<i>Z-score</i>	-0.214***	-0.214***
<i>Div</i>	-8.491***	-8.353***
<i>NDTS</i>	-2.939	-2.953
Non-BNDES	-0.822**	
<i>Year dummies</i>	Yes	Yes
Observations (<i>n</i>)	2.691	2.691
Log-likelihood	-1,537.234	-1,540.012
<i>p</i> -Value (Wald test)	<0.0001	<0.0001
LR test vs logit model	$\chi^2(3) = 196.36$	$\chi^2(3) = 200.64$
<i>p</i> -Value (LR test)	<0.0001	<0.0001
Variance: industry leverage	44.685	46.764
Variance: HHI	7.436	7.765
Random intercept variance (sector)	2.316	2.518
Cut1	10.003	11.089
Cut2	11.977	13.061
Cut3	13.290	14.371

Note(s): Firm-level variables – *Age*, *Size*, Growth opportunity (*GO*), Asset tangibility (*Tang*), Profitability (*Prof*), Sales growth (*SG*), Market share (*MS*), Asset turnover (*AT*), Liquidity (*Liq*), Financial soundness (*Z*-score), Dividends (*Div*), Non-debt tax shields (*NDTS*). Sector-level variables – Herfindahl–Hirschman Index (*HHI*) and Industry leverage level (*ILL*). The significance levels are represented as follows: ***significance at 1%, **significance at 5%, *significance at 10%. Average marginal effects by outcome category are reported in [Table A2](#) in the [Appendix](#)

determinant is associated with the probability of firms being classified across different leverage levels.

In addition, in Model 5, the *Non-BNDES* dummy exhibits a negative and significant coefficient, indicating that the absence of access to subsidized credit (*Non-BNDES* = 1) is associated with lower leverage categories. In other words, firms benefiting from government loans tend to be more leveraged, consistent with the view that subsidized credit is associated with lower financing costs and eased borrowing constraints. While the binary model captures the likelihood of remaining in a low-leverage position, the hierarchical model captures transitions across multiple leverage categories. Taken together, the findings suggest that BNDES financing is associated with less conservative capital structures, with higher leverage levels consistent with its role as a key supply-side source of credit in Brazil.

From an institutional perspective, these findings align with the argument that subsidized credit represents a key supply-side determinant of capital structure in emerging markets (Tarantin & Valle, 2015). This role is particularly relevant in Brazil, where long-term private credit markets remain relatively underdeveloped and government-backed loans tend to offer more favorable conditions than market alternatives.

However, the results also suggest an important nuance. Although access to BNDES funding is associated with leverage, a substantial proportion of firms continues to operate with low or near-zero debt even when such funding is available. This indicates that subsidized credit does not fully eliminate conservative financial behavior. Instead, firms' capital structure choices reflect a combination of institutional conditions and strategic preferences, including financial flexibility, risk aversion and a desire for independence from external monitoring.

This interpretation aligns with evidence that Brazilian firms face structural limitations in external financing and often rely on internal funds, not necessarily by choice but because of limited alternatives in credit and capital markets (Prates & Leal, 2005). At the same time, some firms may deliberately avoid subsidized credit because of bureaucratic costs, conditionalities or strategic considerations related to autonomy – factors frequently highlighted in the literature on state-sponsored financing (Lazzarini et al., 2015; Carvalho, 2014). Taken together, the evidence suggests that BNDES financing plays a dual role. On the one hand, it is associated with alleviating financial constraints and higher leverage; on the other, it coexists with persistent conservative behavior, suggesting that access to credit alone cannot fully explain Brazil's low-debt puzzle.

5. Conclusions

This study examines the determinants of zero and near-zero leverage among Brazilian non-financial firms, highlighting the role of institutional features – particularly government-subsidized credit – in firms' financing decisions in an emerging market context. The results indicate that smaller, more liquid and financially sound firms are more likely to maintain conservative capital structures, while industry conditions also play a relevant role. Although access to subsidized credit is associated with a greater likelihood of borrowing, the persistence of low leverage – even after excluding beneficiary firms – suggests that conservative financial behavior reflects strategic choices rather than solely credit constraints.

These findings have important policy implications. In environments where public credit coexists with underdeveloped private debt markets, improving credit system functioning is essential. Expanding private credit channels, reducing informational frictions and increasing predictability in lending conditions may foster more efficient capital allocation and reduce firms' reliance on precautionary liquidity.

The results also indicate that policies focused only on expanding credit supply may be insufficient. More solvent and liquid firms tend to avoid debt, suggesting that institutional quality – rather than credit availability alone – plays a central role in financing decisions. In this context, policy efforts should prioritize simplifying access to subsidized programs, improving coordination between public and private credit markets and developing instruments such as credit guarantees to reduce firms' precautionary behavior.

This study has some limitations. The analysis relies on observable firm- and industry-level characteristics and does not fully capture other institutional dimensions or factors such as managerial preferences and governance structures. In addition, the empirical strategy is associational and does not fully address potential endogeneity in access to subsidized credit, including selection bias and unobserved heterogeneity, which limits causal interpretation. Accordingly, the results should be interpreted as conditional correlations rather than causal effects. Future research could address these limitations by using alternative identification strategies, such as instrumental variables or policy discontinuities. Further work could also examine firms' transitions across leverage regimes and conduct cross-country comparisons to assess the external validity of the findings.

Overall, the results suggest that the LDP in Brazil reflects the interaction between firm fundamentals and institutional conditions, underscoring the importance of policies that promote deeper, more transparent and more efficient financial markets in emerging economies.

Note

- [1.] BNDES is Brazil's federal development bank, responsible for financing long-term investments in strategic sectors of the economy.

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Further reading

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Appendix

Table A1. Definition of variables used in the low-leverage models

Variables	Definition
<i>Firm-level</i>	
<i>Age</i>	Natural logarithm of the number of years since the firm became publicly listed
<i>Size</i>	Natural logarithm of total assets
Growth opportunity (<i>GO</i>)	Ratio of the firm's market value of equity to its book value of equity
Asset tangibility (<i>Tang</i>)	Ratio of property, plant and equipment to total assets
Profitability (<i>Prof</i>)	Ratio between EBITDA and revenue
Sales growth (<i>SG</i>)	Year-on-year growth rate of sales
Market share (<i>MS</i>)	Ratio between the firm's sales and total industry sales
Asset turnover (<i>AT</i>)	Ratio between operating revenue and total assets
Liquidity (<i>Liq</i>)	Ratio between current assets and current liabilities
Financial soundness (<i>Z-score</i>)	Adjusted Altman Z-score for emerging markets
Dividends (<i>Div</i>)	The ratio between dividends and total assets
<i>NDTS</i>	The ratio between depreciation and amortization and total assets
<i>Non-BNDES</i>	Dummy variable equal to 1 if the firm has no operations or subsidized loans with the BNDES, and 0 otherwise
<i>Sector-level</i>	
Herfindahl–Hirschman index (<i>HHI</i>)	Industry concentration index
Industry leverage level (<i>ILL</i>)	Median industry leverage for each year and sector
<i>Control variables</i>	
Sector dummies	Binary variables representing firm sectors (based on industry classification)
Year dummies	Binary variables for each year from 2002 to 2024

Table A2. Average marginal effects by outcome category

Variable	Outcome (1)	Outcome (2)	Outcome (3)	Outcome (4)
<i>Panel A: Model 5 (LGC)</i>				
<i>Age</i>	−0.003	−0.001	−0.000	0.005
<i>Size</i>	−0.055***	−0.018**	−0.003	0.076***
<i>GO</i>	−0.004	−0.001	−0.000	0.006
<i>Tang</i>	0.040	0.013	0.002	−0.056
<i>Prof</i>	−0.111***	−0.037*	−0.006	0.155***
<i>SG</i>	−0.017	−0.006	−0.001	0.023
<i>MS</i>	0.103***	0.034**	0.006	−0.143***
<i>AT</i>	−0.035***	−0.012*	−0.002	0.049***
<i>Liq</i>	0.015***	0.005*	0.001	−0.021***
<i>Z-score</i>	0.016***	0.005*	0.001	−0.022***
<i>Div</i>	0.638***	0.214*	0.035	−0.887***
<i>NDTS</i>	0.221	0.074	0.012	−0.307
<i>Non-BNDES</i>	0.062**	0.021	0.003	−0.086**
<i>Panel B: Model 6 (LGS)</i>				
<i>Age</i>	−0.003	−0.001	−0.000	0.004
<i>Size</i>	−0.056***	−0.018**	−0.002	0.076***
<i>GO</i>	−0.004	−0.001	−0.000	0.006
<i>Tang</i>	0.040	0.012	0.002	−0.054
<i>Prof</i>	−0.113***	−0.035*	−0.005	0.154***
<i>SG</i>	−0.016	−0.005	−0.001	0.022
<i>MS</i>	0.101***	0.032**	0.004	−0.137***
<i>AT</i>	−0.035***	−0.011*	−0.002	0.048***
<i>Liq</i>	0.015***	0.005*	0.001	−0.021***
<i>Z-score</i>	0.016***	0.005*	0.001	−0.022***
<i>Div</i>	0.634***	0.198*	0.028	−0.860***
<i>NDTS</i>	0.224	0.070	0.010	−0.304

Note(s): This table reports average marginal effects (AME) from hierarchical ordered logit models. Panel A presents results for Model 5 (*LGC*), and Panel B presents results for Model 6 (*LGS*). Each column corresponds to a specific outcome category of the dependent variable (from 1 to 4), and entries represent the change in the predicted probability of being in that category for a one-unit increase in the explanatory variable, holding other variables constant. Because of the properties of ordered choice models, the marginal effects across all outcome categories sum to zero for each variable. Statistical significance is based on delta-method standard errors. Significance levels are denoted as follows: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Firm-level variables include *Age*, *Size*, Growth opportunity (*GO*), Asset tangibility (*Tang*), Profitability (*Prof*), Sales growth (*SG*), Market share (*MS*), Asset turnover (*AT*), Liquidity (*Liq*), Financial soundness (*Z-score*), Dividends (*Div*) and Non-debt tax shields (*NDTS*)

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