Leverage-value nexus in Italian small-medium enterprises: further evidence using dose-response function

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Abstract

Purpose – The study introduces a new approach to leverage-value relationship. Besides applying the classical regression models, the study deals with leverage as a continuous treatment variable implemented on the firm's value using the dose-response function (DFR).

Design/methodology/approach – After proper model calibration and splitting the treatment (leverage) into ten doses, a response function is generated, which enables the realization of the dose level at which the firm's value is maximized. Furthermore, the study tests the pecking order theory (POT) and the trade-off theory (TOT) using the threshold model to see whether firms are under or over-indebted. The analysis is carried out on panel data from small-medium enterprises (SMEs), providing more valuable insights than large and mature companies.

Findings – The study used two leverage measures: total liabilities ratio and bank debt ratio. Value is measured by the market capitalization and Tobin's Q. In general, the study finds a positive relationship between leverage and value; POT is not strongly supported, firms are below their optimal leverage and there is a certain leverage dose that would maximize firms' value.

Practical implications – Since the threshold model and DRF show that SMEs are under-indebted, firms could benefit from extra leverage doses without affecting the firm's risk profile, especially in a low-interest rate regime, and the potential increase in public-private expenditure after Italy obtained the European Recovery Funds.

Originality/value – The study contributes to new knowledge and understanding of financial leverage from new methodological perspectives, offering valuable insights from SMEs using novel approaches.

Keywords Capital structure, Leverage, Value, Tobin's Q, SMEs, Dose-response function, Threshold model

Paper type Research paper

1. Introduction

Financial structure choices have always drawn significant attention at academic and corporate levels. Different lenders bear various risks: while external lenders are responsible only for the amount lent, equity owners bear the entire business risk. Different levels of risk are associated with varying remuneration levels, according to the risk-return trade-off – the proportion of debt-to-equity influences firms' cost of capital and, consequently, their value.

The issue under consideration is essential for all organizations, but it is crucial for small businesses due to limited access to external financing. The forms of funding adopted are considered the basis of companies' growth and development possibilities; established literature recognizes the reasons for the endemic under-dimensioning of the Italian

production base in the intrinsic capital structure choice. Nevertheless, most of the research conducted on the Western world has focused on large American corporations or, conversely, on the emerging economies of Eastern Europe; little attention is given to the context of the individual countries belonging to central and southern Europe. Moreover, The importance of SMEs in the economy has led academic research toward the determinants of SMEs' performance. According to the existing literature (Daskalakis *et al.*, 2017), SMEs' financing exhibits considerable differences compared to large enterprises. Therefore, the willingness to investigate the financial structure for this type of company arises from three primary considerations. First, SMEs cannot be considered a small repurposing of large corporations, showing peculiar features that distance them significantly from the most dimensionally essential companies. Second reason is SMEs' economic and social roles in their economies. SMEs traditionally constitute the backbone of the Italian and European industrial systems; they account for 82% of the employment share in Italy (more than the European average) and constitute more than 92% of the companies operating in the area. The turnover attributed to SMEs is €886 billion (38% of GDP), while the added value and credits received amount, respectively, to €212 billion (12.6% GDP) and €223 billion (Prometeia, 2019). In Europe, SMEs make up more than 90% of total enterprises; they employ 66.6% of the workforce and represent 56.8% of added value, surpassing large companies' contributions representing 43.2%. SMEs have always had challenges obtaining external finance to fuel growth and innovation. SMEs' debt profile is overall oriented toward bank debt. The difficulties in accessing alternative capital are mainly due to information asymmetries and cyclical and structural conditions of the financing markets (European Commission *et al.*, 2018). Third, from a methodological standpoint, SMEs fit well the dose-response function (DRF) since it is more likely to find SMEs without leverage (treatment in this case) than in large mature companies.

Furthermore, focusing on listed SMEs offers some advantages to our study. Private SMEs can be considered a black box in terms of information availability and disclosure. Conversely, due to the substantial transparency in equity markets, publicly traded SMEs are often viewed as of higher quality. SMEs must pass specific standards set by financial markets and regulatory authorities to disclose more information as a publicly traded SME (Kenourgios *et al.*, 2019). SMEs play a crucial role in knowledge spillover, technology transfer and fostering innovations; such features contribute to a higher degree of informational asymmetry than large firms.

Consequently, this article intends to investigate the existence of a relationship between capital structure and value, testing the empirical compliance of capital structure theories in publicly traded SMEs in Italy using novel approaches.

2. Theoretical and empirical issues
The chance to build different combinations of equity and debt has drawn literature's attention over time, resulting in a thriving *body* of theoretical works. Specifically, existing efforts focused on identifying an optimal capital structure to maximize the value generated by each company for its lenders.

The starting point for the studies on the subject has been initiated by the well-known seminal work of Modigliani and Miller (1958) to the equally noted theory of the "capital structure irrelevance." In this first paper, Modigliani and Miller concluded that firms' leverage does not affect their market value without corporate taxes. Despite the numerous and restrictive underlying assumptions, the paper had the great merit of considerably contributing to the development of studies in this area, providing a quantitative formalization of the theoretical aspects only at a qualitative level, without any strict underlying logic.

Later on, Modigliani and Miller backtracked to their initial positions. They partially amended the results obtained, asserting that companies' expected returns at equivalent risk levels vary depending on the capital structure with the introduction of tax benefits' decisions (Modigliani and Miller, 1963). In other words, considering the effects generated by tax legislation within the model, the use of debt capital instead of equity capital can effectively increase the value generated by the companies; this is referred to as "the conservation of value." As a result of this study, several theories concerning capital structure issues have been advanced. Given the complexity of the phenomenon, the literature has increasingly been oriented toward a positive rather than a normative approach. As a result, researchers progressively shifted their focus, abandoning the attempt to identify abstractly more convenient financing methods and the analysis to understand the reasons underlying the companies' financial structure choices. The resulting theories are illustrated below.

The *trade-off theory* (TOT) starts from observing that financial debt cannot increase corporate value indefinitely, but only up to a specific limit at which marginal costs equal the marginal benefits of debt. Consequently, an optimal capital structure can be detected for each company. The existence of costs and benefits associated with the various financing sources allows determining the optimal combination of capital forms and enhancing corporate value by maximizing the aggregate benefits and minimizing costs. In other words, one channel through which leverage could create value is the cost of capital in which optimal capital structure reduces the overall weighted average cost of capital; hence, firm's value is maximized. In this regard, determining the cost of capital is challenging for SMEs due to many assumptions inserted and the lack of information in many cases. Academicians and practitioners often rely on traditional approaches to assessing the cost of capital, such as the capital asset pricing model (CAPM), the arbitrage pricing model (APT) and the three- or five-factor Fama-French model. However, other approaches have been developed to assess the cost of capital in non-traded SMEs, such as value-based management (VBM) and other qualitative-based approaches (Britzelmaier *et al.*, 2013).

DeAngelo and Masulis (1980) demonstrate the existence of an optimal capital structure through arbitrage arguments, proving the conclusions' robustness when bankruptcy costs correlated to an increase in debt exposures are introduced into the analysis. Bankruptcy costs mainly consist of lost earnings suffered by the company attributable to the greater risk perceived by stakeholders; indeed, as financial debt increases, the company's risk of not meeting its obligations increases proportionally. Unlike what Modigliani and Miller hypothesized, the cost of debt does not remain constant as leverage increases but grows due to the greater risk perceived by stakeholders.

On the other hand, Jensen and Meckling (1976) identify agency costs as the main charges to be offset against tax benefits related to financial debt. Agency costs arise whenever a divergence of interests between owners, financial lenders and managers occurs. In such a case, managers maximize their utility function by taking actions ascribable to the moral hazard paradigm, contrasting with the company's own interest. To prevent deviant behavior, debt-holders and shareholders must provide monitoring and incentive activities, representing a company's cost. The optimal ratio between debt and equity can minimize total agency costs.

Jensen (1986) extends the results obtained by Jensen and Meckling, focusing on the role of debt financing in mitigating the agency cost. He asserted that firms characterized by a low financial debt level, low growth expectations and high free cash flow (FCF) represent managers' ideal context to exercise action benefiting their interest (principle-agent problem). In this regard, and given the limited accessibility of SMEs to external finance, internally generated cash flows could be a way to overcome such finance obstacles; firms and SMEs, in particular, tend to accumulate cash holdings as a precautionary approach against certain adverse financial events (Dimitropoulos *et al.*, 2020; Martínez-Sola *et al.*, 2018; Opler *et al.*, 1999; Ozkan and Ozkan, 2004; La Rocca *et al.*, 2019).

The POT supports the existence of hierarchical order in financing sources, such that companies would tend to use primarily self-financing, subsequently debt and only eventually equity. Consequently, more profitable companies are characterized by lower levels of *financial leverage*. The results obtained arise from removing a perfectly efficient market hypothesis: according to Myers and Majluf (1984), in the presence of information asymmetries, share capital recourse signals to the market a potential overvaluation of the securities issued. This theory assumes that managers act in the exclusive interest of the preexisting shareholders and therefore refuse to issue new shares in the presence of undervaluation of the securities so as to not dilute their capital. Rational investors discount overvaluation's risk in their portfolio allocation, selling part of their stocks and prompting a price reduction.

In successive works, Baker and Wurgler (2002) and Jeremy (1996) have developed a new behavioral finance approach. The *market timing* theory arises from denying two central hypotheses: stock-market operators' perfect rationality and the markets' efficiency. Investors are unable to make a rational assessment of company shares in the existence of imperfect information; cyclically, there will be periods of overvaluation and undervaluation of equities. Managers take their financial structure's decisions based on these fluctuations: companies will employ share capital or debt capital depending on stock market trends.

Moreover, studies' attention focused on detecting an empirical confirmation of the theories set out. The research carried out is unanimous in confirming the existence of a positive relationship between financial debt and value. Similarly, the works investigating the TOT's operational compliance (Cheng *et al.*, 2010; Coricelli *et al.*, 2012) have concretely identified critical debt thresholds at which changes in the relationship between *leverage* and value can be observed.

Conversely, the conclusions obtained regarding the POT compliance are not univocal. In the plentiful literature on the subject, Friend and Lang, (1988), Kenourgios *et al.* (2019), Kester (1986), Rajan and Zingales (1995) and Salim and Yadav (2012) demonstrate the existence of a markedly negative relationship between profitability and debt ratio, confirming the first intuitions of Meyers and Majluf. On the contrary, Abor (2005), Fama and French (1998) and others do not identify an operational correspondence of the theory in question. It is possible to perceive a substantial heterogeneity of the results obtained even within the same study. If some theory's predictions seem to be confirmed, others are disclaimed by empirical evidence. In this manner, studies on SMEs capital structure dynamics in Europe have found that the effects of capital structure determinants do not differ significantly across size and country groups. The results suggest that profitability, asset structure and size have been the driving forces of listed SMEs' leverage (Kenourgios *et al.*, 2019). At a macroeconomic and institutional level, taxation plays a crucial role. Finally, the European sovereign debt crisis seems to increase the leverage of the listed SMEs in the periphery and the new member states, leaving the core countries practically unaffected (Kenourgios *et al.*, 2019).

Moreover, in an extensive study of SMEs capital structure in ten European countries (Germany, France, Italy, the United Kingdom, Belgium, Finland, Portugal, Spain, Sweden, Switzerland), Joeveer (2013) found that the smaller the companies, the greater the impact of country-specific factors on their structure, which explained about 10% of the debt variability. At the same time, the study showed that the larger the company, the more important the industry-specific factors became. In East Europe, Czerwonka and Jaworski (2021) confirmed the dominant role of firm-specific factors. Industry and country variables explain only 4% of capital structure. The role of firm-specific factors is consistent with the pecking order theory (POT). About one-fourth of SMEs can be considered under-indebted, and there is no evidence of the influence of the systematic industry business risk.

In light of the contributions illustrated, this paper investigates the influence of capital structure on SMEs' corporate value listed on the Alternative Investment Market (AIM [1]) Italia, verifying traditional capital structure theories using novel approaches.

3. Research methodology

3.1 Data and descriptive statistics

A sample of 35 companies listed on the Alternative Italian Market (FTSE-AIM-Italia) represents approximately 30% of the companies traded on AIM Italia. Financial values have been extracted from AIDA [2], a data set provided by Bureau van Dijk. The selection initially considered the entire population of firms belonging to the index. However, out of the 128 companies listed, only 83 presented financial data for the study period. We further cleaned the data set; we excluded firms lacking information. The final sample comprises 35 SMEs for four years, creating a balanced panel of 140 observations.

From a structural point of view, the goal was to investigate, in the first place, the existence of a significant empirical relationship between the market value and the financial structure of the sample of SMEs; secondly, to verify the effectiveness of the developed capital structure theories, the TOT and the POT, in explaining such a relationship within the context of the Italian SMEs. The existence of a statistically significant relationship between leverage measures and the value was investigated by implementing different multiple linear regression models on the entire sample and splitting it by the type of investors, industry and size.

The POT's compliance was first investigated by observing the SMEs' financial structure choices in question; secondly, by testing the relationship between leverage, profitability, and growth prospects with an appropriate regression model. The hypothesized assumptions are only partially confirmed.

The existence of an optimal capital structure, consistent with the TOT's expectations, was analyzed through the more complex threshold regression model developed by Hansen (1999).

The analyses, models and results reported in this paper are based on a set of independent, dependent and control variables presented in Table 1. Other variables were initially included in the analysis, and then dropped due to the lack of significance. For example, we had FCF as in Jensen's agency cost model (Jensen, 1986). However, FCF variable was insignificant in our models.

Private investors are persons or companies that invest their own money into a company, intending to help them succeed and return on their investment. There are four main types of private investors: friends and family, angel investors, venture capitalists and private equity firms. Private investors usually look for investment opportunities with growth potential.

The descriptive statistics of the collected variables are provided in Table 2.

The average total debt to total assets ratio equals 45.9%, while financial debts cover 13.6% of total assets. The results are consistent with previous European studies (Kenourgios *et al.*, 2019; Mateev *et al.*, 2013; Matias and Serrasqueiro, 2017) and highlight that the sample firms are highly heterogeneous in market value, according to the variety of the companies

Variable name	Variable type	Measurements
Firm's market value	Value	The market value of equity (*mln*)
Leverage 1	LEV.2	Total liabilities/Total assets
Leverage 2	LEV.1	Bank debt/Total assets
Firm size	Size	Natural log of total assets
Profitability	OROA	EBIT/Total assets
Sector dummy	SEC.	0 = Service industry
		1 = Manufacturing industry
Investor dummy	INV.	0 = Absence of private investors
		1 = Presence of private investors
Tobin's *Q*	TQ	Market value/Equity book value
Tangible assets	TANG.	Tangible assets/Total assets

Table 1. Variables and measurements

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	Median	Mean	St. Dev.	Minimum		Maximum
Firm value (*mln*)	25,719	37,510	35,281	1,462		214,111
Leverage 1	0.447	0.459	0.25	0.002		1,194
Leverage 2	0.108	0.136	0.12	0		0.462
Firm size	17,224	17,178	1,018	15,033		19,148
Profitability	0.007	−0.011	0.124	−0.601		0.322
Tobin's Q	1.751	2.528	3.034	−6.588		21.018
Tangible	0.013	0.079	0.125	0.000		0.492

By size	Micro	Small	Medium	Large	Holding	Mean
Liabilities	19.32%	60.57%	51.79%	41.35%	23.98%	44.45%
Short-term liabilities	88.47%	37.17%	34.30%	22.77%	43.11%	38.39%
Long-term liabilities	11.53%	62.83%	65.70%	77.23%	56.89%	61.61%
Bank debts/Liabilities	27.84%	22.16%	33.43%	33.24%	68.43%	35.98%
Fin. debts/Tot. assets	5.38%	13.42%	17.31%	13.75%	16.41%	14.78%
Equity	80.22%	34.89%	39.25%	55.10%	75.03%	50.30%

Table 2.
Descriptive statistics

examined. The bottom part of Table 2 shows the description of capital structure variables by firm size.

Companies included in the FTSE AIM are the Italian SMEs defined according to the European Union guidelines [3]. Since intercompany relations often prevent regulatory criteria from being applied, head offices (holdings) were separately classified in turn.

The descriptive analysis highlights how micro-enterprises and holding companies have low liabilities, showing a massive use of equity capital instead of debt due to various firm-specific reasons. The reduced liabilities exposure of micro-enterprises is widening due to their limited bargaining power, because of which payment extensions or favorable contractual conditions become hard to obtain. This hypothesis seems to be confirmed by the low levels of liabilities, but recourse to financial debt substantially aligned with the most structured firms. Of course, the use of debt is still modest if considered in absolute value (5.38%) due to the difficulties in accessing credit that smaller companies usually encounter. Concerning companies holding category, the low levels of liabilities likely depend on the high capitalization, rather than on criticalities in negotiating power, besides very often exercised vis-à-vis the subsidiaries themselves. Therefore, the high recourse to bank loans, both in absolute and relative terms, expresses the greater ease of access to credit that characterizes the more dimensionally structured companies.

3.2 Models
The analysis is divided into three main parts: testing the relationship between leverage and value with the classical models, applying the dose-response function (DFR) and finally testing the pecking order and trade-off theories. To capture the impact of leverage on value for the SMEs sample using the classical models, we followed the previous literature by configuring the base model in the following way:

$$Value_{it} = \alpha + \beta_1 LEV1_{i,t} + \beta_2 LEV2_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 OROA_{i,t} + \gamma_1 D_{sec.} + \gamma_2 D_{inv.} + \varepsilon_t$$

where *Value* represents the market capitalization, *LEV1* and *LEV2*, and the two leverage measures, *SIZE* is the firms' assets, *OROA* is the operating return on assets and $D_{sec.}$ and $D_{inv.}$ are the dummies for the sector and the presence of private investors, respectively. This model was applied to the entire data set by the type of investors, industry and SME dimensions (micro, small and holding firms).

3.2.1 Dose-response function (DRF). This paper's novelty is that we introduce the DRF to test the effect of leverage on value. The model has been used mainly for policy analysis and evaluation. In this context, considering leverage a long-term policy intervention at the firm's level, DRF fits, in this case, to figure out the level of policy intervention (leverage in our case) that maximizes the firm's value. This model assumes that leverage is a continuous treatment on a firm's value that could take values from 0 (no treatment) to 1 (full treatment); the model splits the sample into treated and untreated groups. Then we split the treatment into ten doses, 10% for each additional dose of leverage, to verify which dose of leverage could maximize the firm's value. Given the model characteristics, SMEs fit better than large companies since there is more chance of finding SMEs without treatment (leverage). The model is estimated with ordinary least squares (OLSs) under conditional mean independence because we reject the endogeneity hypothesis; therefore, our treatment variable (leverage) is exogenous. We do not use instrumental variables in this estimation. In this context, the DRF is equal to the average treatment effect (ATE) given the level of treatment t [that is, ATE(t)], with t representing the continuous treatment variable. The model has been used to test the impacts of intervention in many socioeconomic and epidemiological contexts. We believe that this model fits well the leverage-value relationship. We are interested in estimating the causal effect of the treatment variable t *(leverage)* on an outcome y *(value)* within the observed sample, assuming that treated and untreated units both may respond differently to specific observable confounders. The normality assumption is not a need for this model. We will not be exhaustive in explaining the model, but more econometric details are found in Cerulli (2015). We can write the regression line of the response y simply as:

$$y_i = \mu_0 + w_i \times ATE + X_i\delta_0 + w_i \times \left(X_i - \overline{X}\right)\delta + w_i \times \left\{h(t_i) - \overline{h}\right\} + \eta_i$$

y_i, w_i, x_i, t_i are a set of random variables, y_i is the random treated unit (firms with leverage), w_i is the treatment indicator taking a value of 1 when treated and 0 when untreated, x_i is the random and exogenous observable characteristics, t_i takes values within the continuous range [0, 100], as the continuous treatment indicator (firm's exposure to leverage), and defines $h(t_i)$ as a general derivable function of t_i. μ, δ, ATE are the regression parameters, and $\eta_i = e_{0i} + w_i \times (e_{1i} - e_{0i})$, and e_1 and e_O are two random variables having 0 unconditional mean and constant variance. Finally, we used bootstrapping to estimate the standard errors for the DRF.

Then to test the POT, the following model has been applied to test whether there is a relationship between leverage, profitability and growth prospects:

$$LEV2_{it} = \alpha + \beta_1 OROA_{i,t} + \beta_2 TQ_{i,t} + \beta_3 LEV1_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 TANG_{\cdot i,t} + \gamma_1 D_{sec.}$$
$$+ \gamma_2 D_{inv.} + \varepsilon_t$$

where $T.Q$ is Tobin's Q as a proxy for a firm's potential growth, and $TANG$ is the ratio of tangible assets to total assets as a proxy for tangible collateral for accessing bank credit. The rest of the variables have the same previous definitions.

Finally, a threshold regression model was implemented to test compliance with the TOT to verify a non-monotonic relationship between financial leverage and firms' value. Threshold regression models are nonregular regression models that depend on change points or thresholds. They provide a simple but elegant and interpretable way to model certain kinds of nonlinear relationships between the outcome and a predictor (value and leverage in this case). Threshold regression is run using a fixed-effect model.

$$Value_{it} = \alpha + \beta_1 LEV1_{i,t} + \beta_2 LEV2_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 OROA_{i,t} + \varepsilon_t$$

In the same regard, we also applied nonlinear models, such as the quadratic regression, to test whether there is an optimal relationship between leverage measures and value. We find no proof of such a quadratic relationship; therefore, this model's results are not reported here, but they are available if requested.

3.3 Multicollinearity and heteroskedasticity

Regression models based on the OLS method require several assumptions to be tested. Gauss-Markov theorem states that OLS returns are the best linear unbiased estimator without autocorrelation and heteroskedasticity. Correlation among independent variables is also an essential factor to avoid multicollinearity.

Collinearity was tested using Pearson's correlation analysis and variance inflation factor (VIF). Table 3 provides the outcome obtained. Since all the coefficients are less than 0.5, no collinearity issues were detected. VIF is commonly used for assessing multicollinearity problems. As a rule of thumb, a VIF of more than 10 or a tolerance of less than 0.1 suggests the presence of harmful collinearity (Gujarati, 2003; Vittinghoff *et al.*, 2012). The test performed depicts that VIF coefficients fall within this range.

It is worth highlighting three correlations; size, profitability and private investors' presence are negatively correlated with LEV.1 (total liabilities/total assets) and positively correlated with LEV.2 (ratio of bank debt). Lending banks could perceive the three variables as positive signals of the creditworthiness of the borrowing firm. Therefore, bigger SMEs, more profitable SMEs and SMEs backed by private investors are more likely to be granted credit from banks, ultimately enhancing firms' value.

Heteroskedasticity refers to the hypothesis that variance is equal within different sample subgroups. Heteroskedasticity affects the possibility of applying the OLS method. OLS estimator remains unbiased and consistent but becomes inefficient; confidence intervals and hypothesis tests are lost in reliability, and results cannot be inferentially extended to the entire population. Under the null hypothesis of homoscedasticity, Breusch-Pagan's test leads to a nonsignificant Lagrange multiplier (LM), suggesting that the OLS model's estimated coefficients are efficient.

4. Analysis and empirical results

4.1 Leverage and firm value: the base model

The relationship between financial leverage and firm value is investigated through multiple regression models with panel estimation, representing the best linear unbiased estimator for the sample analyzed. At first, the regression model was run, considering only the two leverage variables as explanatory variables.

Table 4 (model 1 without control variables) displays a negative relation between LEV1 (total liabilities/total assets) and firm value, while revealing a positive relationship between LEV2 (banks debt/total assets) and market value, statistically significant at a 95% confidence level. Such relationships imply that an increase in the liabilities' ratio negatively affects firm value, *ceteris paribus*; conversely, a higher financial debt (bank debt) ratio is associated with increased market capitalization. In model 2, we follow the literature by introducing other variables likely to influence firms' value. The model results assert a statistically significant relationship between financial debt and value, a negative association with total liabilities ratio and a positive relationship with bank debt ratio consistent with model 1. The regression provides the following results considering the additional variables that explain the corporate value.

Total liabilities ratio (LEV1) and profitability show negative and statistically significant relationships with corporate value; on the contrary, the financial debt (bank debt, LEV2) ratio

	Value	LEV.1	LEV. 2	SIZE	OPM	INV.	SEC.	TQ	TANG.	Tol.	VIF
Value	1										
LEV.1	−0.329	1.000								0.599	1.669
LEV.2	0.034	0.478	1.000							0.701	1.426
SIZE	0.658	−0.073	0.099	1.000						0.778	1.286
OPM	0.094	−0.060	0.145	0.284	1.000					0.837	1.195
INV.	0.096	−0.173	0.006	0.038	−0.095	1.000				0.838	1.193
SEC.	0.306	−0.310	−0.030	0.335	−0.014	−0.194	1.000			0.693	1.444
TQ	−0.025	0.179	0.182	−0.279	−0.240	−0.093	−0.131	1.000		0.007	1.216
TANG.	0.497	−0.105	0.202	0.346	0.009	0.009	0.520	−0.053	1	0.000	0.648

Breusch-Pagan's test

Multiple R	0.292
R square	0.0852
Adjusted R square	0.0293
Observations	140
Sign. F	0.1788
LM	89,521
Sign. LM	0.1763

Table 3.
Correlations and
diagnostic statistics

Variables	(1) Firm's value	(2) Firm's value
LEV.1	−63,239***	−54,735***
	−43,266	−44,119
LEV.2	72,791***	50,786***
	23,998	21,340**
SIZE		23,154***
		86,591
OROA		−41,523*
		−19,686
INV.		−0.1318
		−0.2516
SEC.		−0.2752
		−0.4775
Constant	56,621***	−340,495
	83,706	−76,109***
Observations	140	140
R-squared	0.1561	0.5461
Std. error	32,728	24,487
Sign. F	0.0002	0.0000

Note(s): The dependent variable is the firm value, LEV1(total liability ratio) and LEV2 (bank debt ration) are the leverage measures, SIZE is the firm's assets, OROA is the operating return on assets, INV and SEC are the dummies for private investors and sector (industrial or service), respectively
Coefficients and t-stats reported
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 4.
Leverage-value relationship: the base model

and companies' size positively influence firm value. Therefore, the firm's value is enhanced if the firms obtain bank credit. Such a connection could be plausible since market investors perceive bank credit as a positive signal, guaranteeing its financial and operating performance. Banks do not grant credit to firms unless they ensure paying back the debt. However, this could also be the other way round; banks lend large SMEs with higher market capitalization. Such insight is evidenced in the positive correlation between firm size and LEV2 (ratio of bank debt).

Regarding private investors and industry dummies, no statistically significant relationship was found. These findings allow us to affirm the existence of a linear correlation between debt and value. Specifically, when we consider financial debt as a proxy of financial leverage, the positive relationship posited by Modigliani and Miller in the presence of corporate taxes seems to be confirmed. Consequently, capital structure and financial structure choices are not irrelevant from the perspective of value creation.

In order to disclose possible structural differences, regression models were carried out by splitting the sample into the type of industries, investors and firm size.

As can be observed from Table 5(1), both in the manufacturing and service industry, liabilities ratio and profitability are negatively correlated with corporate value, whereas LEV2 (bank debt ratio) and firm size maintained their positive relationship with value. The novelty finding in this section concerns private investors' presence; private investors' significance in both sectors is rather different – a positive effect of private investors on industrial/manufacturing firms' value, whereas a negative impact on service sector firms' value. The industrial sector requires more capital than the service sectors; therefore, private investors' support is more evident in securing private and bank capital to feed the potential firm's growth. The noteworthy change is the intensity of the relationships encountered; both leverage measures and firm size seem to exercise, in absolute value, a more significant

Variables	(1) By industry		(2) By investor		(3) By size	
	Manufacturing Firm's value	Service Firm's value	No PI Firm's value	Mixed Firm's value	Small Firm's value	Large Firm's value
LEV.1	−99,891***	−52,936***	−59,749***	−92,524***	−67,168***	−86,228**
	−38,309	−46,187	−33,564	−42,840	−57,435	−26,122
LEV.2	126,395***	40,476**	76,929**	68,900*	38,319*	125,028*
	24,149	21,073	25,761	16,342	19,727	19,233
SIZE	35,125***	17,284***	23,289***	25,470***	14,108***	35,946***
	70,566	76,145	46,456	80,818	54,695	53,833
OROA	−60,406**	−52,079**	−34,742	−43,451	−55,455***	−0.627
	−20,335	−22,299	−11,806	−15,594	−33,330	−0.046
INV.	18,619**	−10,210*			−0.8876*	21,107*
	22,414	−17,841			−17,366	17,752
SEC.			−20,288*	0.8854	−0.9518*	0.2086
			−16,863	13,196	−19,919	0.1424
Constant	−555,336***	−235,484***	−333,958***	−372,623***	−174,351***	−578,381***
	−63,548	−64,476	−41,996	−68,695	−40,632	−47,880
Observations	64	76	64	76	80	48
R-squared	0.6363	0.6013	0.4922	0.6665	0.5459	0.6560
Std. error	27,314	15,620	23,570	23,197	15,862	29,542
Sign. F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Note(s): The dependent variable is the firm's value, LEV1(total liability ratio) and LEV2 (bank debt ratio) are the leverage measures, SIZE is the firm's assets, OROA is the operating return on assets, INV is the dummy for the presence of private investors and SEC is the dummy for the sector (industrial or service). PI (private investors), Mixed (mixed investors)
Coefficients and t-stats reported
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 5.
Leverage-value by
industry, investors'
type and size

influence on companies engaged in manufacturing activities. The results are consistent with the sector's properties in which industrial firms generally require more extensive fixed capital investments than companies providing services. Since these are capital-intensive industries, structural investments are needed to ensure growth and competitiveness.

Moreover, tangible assets in the manufacturing sector can be used as collateral for bank financing. Therefore, the market player positively interprets a high financial debt ratio. In a healthy business environment, financial debt is considered an indication of a high level of investments and is strongly correlated with its growth opportunities. On the other hand, the service sector is characterized by the accumulation of intangible assets – mainly generated by innovation activity – that are less considered to guarantee credit lines. Banks can also perceive innovation as a risky activity that might impede bank financing to service sectors.

Table 5(2) shows the regression results clustered by the type of investors. Profitability and industry turn insignificant on firms' value. In companies characterized by the absence of private investors, the increase in liabilities ratio harms the corporate value confirming the results found in the entire sample analysis; the LEV2 index (bank debt ratio), on the contrary, shows a positive, significant and more intense relationship with market capitalization. Firms characterized by private investors' existence show a more markedly negative relationship between total debt ratio and value, while financial debt ratio is less statistically correlated with corporate value. That is, private investors' presence reduces the positive effects generated by debt on the firm's value compared to the situation where private investors are absent. These findings might be explained in light of private investors' bounded rationality, which could lead them to overprice the risk of default connected to an increase in debt exposures, neglecting, by contrast, the tax benefits' convenience related to indebtedness.

Finally, in Table 5(3), we decompose the leverage-value relationship with the firm's size. The size is defined consistently with the guidelines in the European Recommendation 361/2003. The micro-enterprises model's application has led to statistically insignificant results due to the limited number of enterprises in the sample belonging to this category. We did not report the results here, but they are available upon request.

Overall, the size analysis reveals that the total debt ratio (LEV1) still exerts a significantly negative impact on corporate value, slightly higher in absolute value for large companies and head offices. Nevertheless, this SME group demonstrates a markedly more significant financial debt (LEV2) effect on corporate value. Therefore, an increase in financial debt exposure seems to generate value for small-size SMEs, albeit to a lesser extent than in larger SMEs. The estimated coefficients also show how small-size SMEs operating in the service sector are more rewarded than those engaged in the traditional sectors, probably because they have more significant innovative potential. Moreover, the type of investors turned out to be positive in large SMEs. Hence, private investors are more attracted to the upper-scale SMEs, and they seem to be positively associated with the firm's value.

Ultimately, the regression models implemented highlight how, to varying degrees and intensity, the total debt ratio always, *ceteris paribus*, reduces the market value. On the contrary, an increase in the financial debt ratio positively impacts the stock market value.

4.2 Results of the dose-response function (DRF)
The results of the DRF with exogenous variables are shown in Table 6(1). Results show a moderate R-squared with a positive and significant ATE, equal to around +0.37; for each dose of leverage, the value increases by 0.37 Tobin's *Q*. On average, overall values taken by leverage means that the effect of leverage on value is positive. More insights on the dose-response are presented in Figure 1; it shows that the relationship is weakly increasing and quite precisely estimated for lower values of the dose; it is more strongly decreasing but less precisely estimated for higher levels of the dose as shown in the upper left and lower right graphs. We can also notice that the leverage that maximizes the value which is indicated at

Variables	(1) DRF Tobin's Q	(2) Pecking order LEV.2	(3) Trade-off Firm's value
LEV.1		0.2570***	−360,977
		59,692	−1.58
LEV.2			1,429,619
			0.25
Treatment (leverage)	0.3697		
	0.30		
SIZE	−0.4571	0.0018	0.22577
	−1.42	0.1564	0.22
OROA	−6.4838**	0.2228**	−0.40366
	−2.61	26,215	−0.13
SEC.	−0.7483	0.0162	
	−1.17	0.6301	
INV.	−0.7841	0.0382*	
	−1.16	18,156	
Tw_1	0.0027		
	0.03		
Tw_2	0.0017		
	0.73		
Tw_3	−0.00002		
	−1.00		
TQ		0.0072**	
		20,930	
TANG.		0.2239**	
		23,792	
Threshold			0.2076
F (5.65)			4
Constant	10.671*	−0.0737	
	2.01	−0.3868	
Observations	140	140	
R-squared	0.2043	0.3686	0.2788
Std. error	2.8710	0.0091	
Sign. F	0.0039	0.0002	0.0031

Note(s): (1) is the dose-response function where the dependent variable is the firm's value measured by Tobin's Q. (2) is OLS to test POT where the dependent variable is leverage measured by bank debt ratio (LEV2). (3) is the threshold regression to test the TOT where the dependent variable is the firm value. Treatment is the effect of leverage doses (bank debt ratio), LEV1(total liability ratio), SIZE is the firm's assets, OROA is the operating return on assets, TQ is Tobin's Q (a measure of growth prospects), INV and SEC are the dummies for private investors and sector (industrial or service), Tw is coefficient for the polynomial degrees in the DRF (in this case we have 3°), TANG is the ratio of tangible assets (collateral measure)
Coefficients and t-stats reported
***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table 6.
DFR, pecking order and trade-off results

around 60% but is less predicted since that area exhibits high standard error; thus, we expect the optimal value at leverage dose to be lower than indicated. Finally, the DRF derivative is parabolic, which means that the DRF is cubic, and more than one optimal solution could be found.

4.3 Empirical evidence of the pecking-order theory (POT)
As explained earlier, given the presence of information asymmetries, the POT asserts the existence of hierarchical sorting in funding sources. It would be possible to identify companies' absolute preference to exploit first internal resources, subsequently external debt
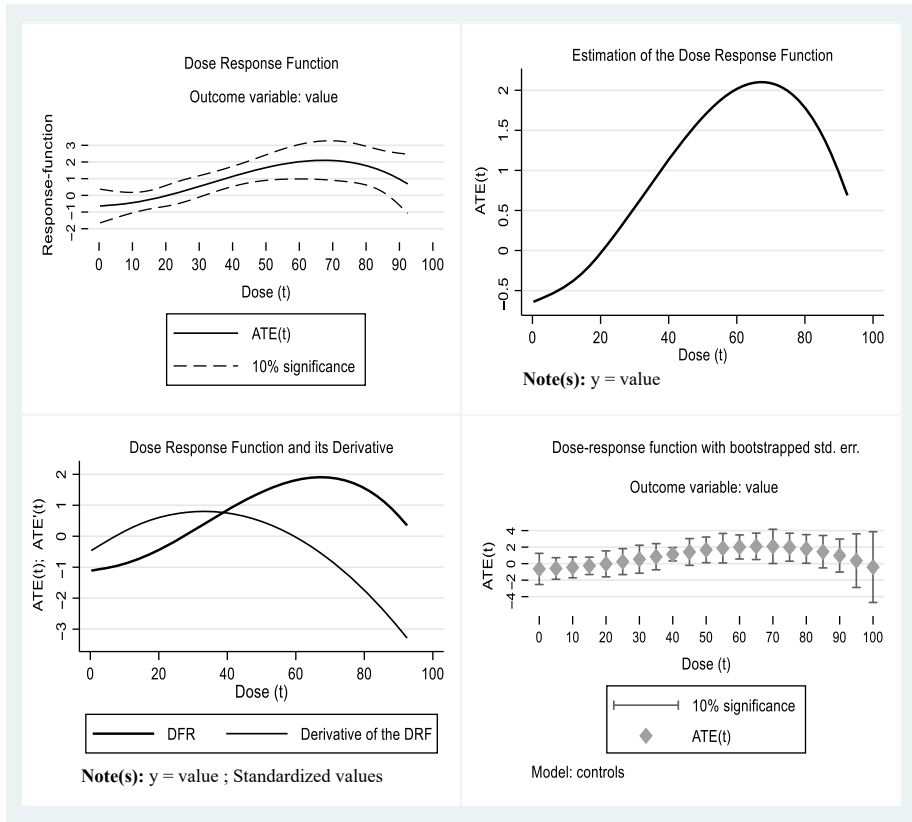
Figure 1.
Leverage doses
and value

and, finally, equity capital. Studies show that the POT barely exists in reality; many profitable firms that generate internal FCFs refer to the market for external financing using debt or equity capital. Regarding our sample, all the companies exploit various capital sources; some even prefer equity capital over debt, contradicting information asymmetries and the cost of capital consideration under the POT. Consequently, the present section aims to verify the compliance of two further assumptions advocated by the *pecking-order* supporters: the existence of a negative relationship between profitability and financial leverage, and a positive relationship between growth prospects, measured by Tobin's Q, and financial leverage. For this purpose, a further multiple regression analysis was implemented, considering the financial debt ratio (LEV2) as the dependent variable. To ensure consistency within the study, we maintain all the variables assumed in the previous models as control variables, preliminary testing their significance from the novel perspective. The percentage of tangible fixed assets on total assets was considered additional explanatory variables to be homogeneous with the seminal research with the same research goal.

The results demonstrated in Table 6(2) show a positive and statistically significant relationship between profitability and Tobin's Q with financial debt ratio. The existence of a positive relationship between profitability and leverage contradicts the POT's claims. High profitability levels should correspond to a low debt ratio due to the most profitable companies' greater ability to resort to self-financing. On the contrary, the evidence is

consistent with what was framed by the TOT's proponents. The future growth prospects (Tobin's Q) seem instead to confirm the intuitions of the POT. Nevertheless, the positive relation between profitability and financial leverage excludes the theory's compliance under consideration.

4.4 Empirical evidence of the trade-off theory (TOT)
The current section presents the empirical findings on a non-monotonic relationship between financial leverage and firms' value. In order to test the compliance of the TOT, a threshold regression model was implemented. The threshold regression framework was initially developed by Hansen (2000). This method split the sample depending on the relationship between financial leverage and firm value, managing to identify critical financial debt thresholds at which the leverage-value relation ceases to be an increasing function. The statistical significance of the thresholds obtained must be assessed using the bootstrap method. The sample analyzed is considered the entire reference population, and numerous subsamples are created. Indeed, according to Hansen (2000), thresholds do not have a standard chi-square distribution, and bootstrapped standard errors enable identifying the sample's asymptotic distribution. Within the study, 300 subsamples with the bootstrap method were extracted. Table 6(3) summarizes the relevant evidence from implementing the threshold model. Since the threshold framework requires strongly balanced panel data, industry and investors' dummy variables are omitted from the analysis.

As we observe from the results, although the model in itself is significant (Prob $> F = 0.003$), none of the coefficient estimates shows a statistically significant relationship with corporate value; all the p-values associated with explanatory variables are well above the predetermined level of significance (0.05). Consequently, the null hypothesis of the optimal debt ratio's nonexistence must be accepted, and the opposite alternative hypothesis must be rejected.

Beyond econometric results, it is reasonable to expect that, over a certain value, an increase in financial debt reduces a firm's value. When the percentage of debt on total assets becomes excessive, the company is perceived as riskier, both by equity holders and debt holders. The increase in debt exposure affects the enterprise's solidity and intensifies the risk of bankruptcy; consequently, it must incur a higher cost of financing. Therefore, the lack of a statistically significant threshold in the model presumably underlies that, for the companies examined, the optimal level of indebtedness is higher than that adopted. Indeed, the empirical studies concerned with testing the TOT's empirical correspondence have identified relatively high threshold debt ratios. Coricelli *et al.* (2012) developed a model that identifies a threshold equal to 0.33; in our sample, only 3 out of 35 companies show a similar financial debt level. In the research conducted by Cheng *et al.* (2010), the debt ratio capable of maximizing corporate value is equal to 0.54; in the sample presented, no company is characterized by such a high debt exposure. These considerations strengthen the idea that the absence of a debt threshold in the proposed study is symbolic of the possibility, for the companies analyzed, of increasing their debt exposure while preserving the beneficial effect of this product on corporate value. We shall also keep in mind that leverage-value association is also dependent on the countries' tax levels; corporate, personal and capital gain taxation might influence the optimal (threshold) level of debt.

5. Discussion and conclusions
This paper empirically verifies the leverage-value relationship applied to listed SMEs in Italy (FTSE-AIM Italia). In particular, we tested the linkage on the entire sample of 35 listed SMEs for four years. Then we split the sample by the types of investors (absence or existence of

private investors), by the type of sector (industrial or service) and by the size of the SMEs (micro, medium and large). We also apply the DRF in the relationship between leverage and value, which we consider a novel contribution of this paper. Finally, we tested the two prominent capital structure theories: the POT and the TOT. Listed SMEs present unique characteristics that make the application of the testing leverage theories highly relevant. They represent most firms in the European and Italian economic contexts; they are smaller in terms of assets and investments than large mature firms; they can also enjoy a degree of innovation clustering with high growth potentials; they can be family or private equity-backed. Consequently, information asymmetries arise.

This paper's findings enable us to conclude that capital structure affects firms' value, thanks to financial interests' tax-deductibility. The impact generated by financial debt on market value is more significant for manufacturing firms than for enterprises engaged in providing services. Simultaneously, there is no clear evidence of private investors' role in this context; private investors' presence does not enhance value creation through leverage. The relationship between leverage and corporate value maintains its characteristics in the context of listed SMEs. Still, they tend to exert the leverage benefits on capital enhancement to a lesser extent than larger companies. Additionally, conventional literature on the leverage-value relationship could also benefit from valid models utilized in other fields such as the DRF, which adequately represents such a nexus.

In the light of the results obtained, it is possible to assert that the use of bank loans should represent a privileged form of financing: the greater economic convenience due to the tax benefits associated with debt seems to be correctly priced by the market, even in the presence of private investors; therefore, economic convenience ultimately translates into financial benefits. Given the positive relationship between size and value and between leverage and value, it looks advantageous for smaller companies to increase their size and financing growth with financial debt, especially in an era of very low-interest rates. In this way, they could benefit from the double-positive impact produced by the joint increase in size and financial debt. Moreover, the TOT noncompliance in the current sample allows hypothesizing an optimal debt level higher than that effectively adopted by the companies analyzed supported by the dose-response analysis. Consequently, it appears to remain a range within which SMEs' debt exposure to financial institutions can still be increased without leading to a decline in market value.

The study provides a statistically significant relationship between debt and value on a sample of listed SMEs characterized by high potential growth. Consideration of companies belonging to a stock market index made it possible to employ a market-based approach, analyzing directly and immediately the relationship between leverage and market value. However, it is legitimate to ask whether the conclusions obtained are extendible to unlisted SMEs. Private SMEs represent most small and medium-sized enterprises of the national production pool with family ownership marked. Corporate valuation methods pave the way for the possibility of testing whether the use of financial debt has a positive impact on value even in unlisted companies. In this regard, a lack of studies has been detected to date. Finally, the DRF could be an interesting approach to investigate the leverage-value relationship after the proper model calibration.

6. Implications
Since the threshold model and DRF show that SMEs are under-indebted, firms could benefit from extra leverage doses without affecting the firm's risk profile, especially in a low-interest rate regime, and the potential increase in public-private expenditure after Italy obtained the European Recovery Funds (between loan and grant) in the aftermath of COVID-19 pandemic to be invested between 2021 and 2026. Italy has translated the funds into a national recovery

plan to make the country a fairer, greener and more inclusive country, with a more competitive, dynamic and innovative economy. The plan mobilizes over 300 billion euros; the 210 billion coming from the EU Next Generation program are complemented by the funds allocated with the 2021–2026 budget planning. Furthermore, SMEs should be aware of the role of institutional and private investors, who can be only hit-and-run investors capitalizing on the growth opportunities and firm's innovation.

7. Limitations

We agree that this study is not limitation-free; we focused on a small SMEs sample from Italy; further research could benefit by extending the sample and the contexts, including comparable countries in the region, and verifying the relevance of the dose-response model in measuring and mapping the leverage-value relationship. We consider our study to be novel in paving the way by introducing such models in the finance field.

Notes

1. AIM stands for "Mercato Alternativo del Capitale," which is a multilateral trading facility (multilateral trading facility or MTF) dedicated to small and medium-sized Italian companies with high growth potential regulated and managed by Borsa Italiana.

2. AIDA (Analisi Informatizzata delle Aziende Italiane) – Bureau Van Dijk. (Update 287 - Software Version 103.00 Data Update 23/12/2020 ($n°$ 28704).

3. The EU recommendation 2003/361 defines SMEs accordingly to three main criteria: staff headcount and either turnover or balance sheet total. The specific numerical limits are shown below.

Company category	Staff headcount	Turnover	Balance sheet total
Medium	<250	$\leq$ € 50 m	$\leq$ € 43 m
Small	<50	$\leq$ € 10 m	$\leq$ € 10 m
Micro	<10	$\leq$ € 2 m	$\leq$ € 2 m

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