Universitas Mercatorum

Università telematica delle Camere di Commercio Italiane

Università Pegaso

PHD PROGRAMME IN
CORPORATE FINANCIAL MANAGEMENT AND CRISIS PREVENTION

38th Cycle

PhD Dissertation in

Analyzing Settlement Agreements: A Data Driven Study of Corporate Financial Dynamics in Crisis

Dr / Ms / Mr Niccolò Fantone

Programme Coordinator Prof. Maria Antonella Tagliaferri _____		**Supervisor** Prof. / Dr. Francesco Paolone _____
		Co-Supervisor Prof. /Dott. Elbano De Nuccio _____

Academic Year 2025 / 2026

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2.3.2 Empirical Strategy: Variable Selection and Model Specification

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Abstract

The phenomenon of corporate crisis remains difficult to pin down. It brings together financial imbalance, managerial choices and legal intervention dimensions that still demand new ways of being studied and interpreted. This dissertation explores the Italian framework of preventive restructuring, with a specific focus on firms admitted to settlement agreement, combining legal insights with an econometric investigation of capital structure under distress. The empirical work is structured in two main stages and was entirely developed in R Studio, following the logic of a progressive deepening from binary classification to continuous estimation. First, a logistic specification estimates the probability of firms presenting negative equity, thus capturing the conditions of financial fragility. Second, an OLS model investigates the dynamics of the equity ratio among solvent firms, assessing the sustainability of capital structures under stability. Third, a separate OLS regression analyses distressed firms with negative equity, where the dependent variable is expressed as the log transformed absolute value of equity in order to trace the severity and progression of imbalance over time.

Explanatory factors include operating profitability (EBITDA), return on assets (ROA), financial expenses, temporal trends, and geographical location, allowing the study to disentangle the interaction between performance, debt costs, structural features, and regional effects. Because some relations between variables appeared nonlinear, I later introduced a Random Forest model to check whether the same predictors behaved consistently under a more flexible algorithm.

The results highlight how linear models reach their limits, while the use of machine learning adds depth to the interpretation. In addition to its methodological contribution, the study sheds light on the way firms in crisis rebuild their equity positions. The evidence offers useful elements for the academic discussion and provides indications that can support policymakers engaged in shaping effective restructuring tools.

Introduction

The purpose of this dissertation is to investigate the financial determinants of capital structure in firms undergoing settle agreements (concordato) a settlement procedure regulated under the Italian Codice della Crisi d'Impresa e dell'Insolvenza and legge fallimentare. The study addresses the increasing need to understand how firms in distress adjust their financial leverage, particularly when traditional solvency limit have already been crossed. While extensive literature has explored capital structure under normal conditions (Rajan & Zingales[1], 1995; Frank & Goyal[2], 2009) and financial distress prediction (Altman[3], 1968; Ohlson[4], 1980), limited attention has been devoted to the specific case of Italian firms entering settlement agreements. This dissertation contributes to filling this gap by (i) focusing on a unique dataset of Italian companies under preventive arrangement between 2014 and 2023, and (ii) combining classical econometric models with machine learning techniques (Random Forest) to test whether nonlinear approaches improve the explanatory power of leverage determinants. In particular, the dissertation addresses three central questions: What are the main financial and structural determinants of capital structure in Italian companies in settlement agreement?

Do profitability measures, such as EBITDA and ROA, still retain explanatory power in contexts of severe financial distress?

Does the use of nonlinear models, specifically Random Forest, enhance the explanatory capacity compared to traditional regression models?

To answer these questions, Based on these premises, the research defines the following working hypotheses: *H1: Among firms undergoing preventive settlement agreements, higher*

[1] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. Journal of Finance, 50(5), 1421-1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[2] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1-37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[3] Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. The Journal of Finance, 23(4), 589–609. https://doi.org/10.2307/2978933

[4] Ohlson, J. A. (1980). Financial Ratios and the Probabilistic Prediction of Bankruptcy. Journal of Accounting Research, 18(1), 109-131. https://doi.org/10.2307/2490395

profitability (EBITDA) is associated with lower leverage, indicating a more balanced and sustainable capital structure.

H2: Higher Financial expenses are associated with higher D/E ratio exacerbating financial distress.

H3: Temporal factors are expected to improve the sustainability of firms' capital structure under crisis conditions, producing a gradual reduction in leverage over time.

H4: Firms operating in regions with stronger institutions and more developed financial infrastructures tend to maintain more balanced capital structures, whereas those in peripheral areas face higher leverage and greater fragility.

The study of capital structure has been central in corporate finance for decades. Foundational works such as Modigliani and Miller[5] (1958) established the irrelevance principle under perfect market conditions, while later theories, including the trade off and the pecking order models, emphasized the role of taxes, bankruptcy costs, and asymmetric information (Myers[6], 1984; Rajan & Zingales[7], 1995). Empirical studies have consistently shown that firm profitability, asset tangibility, and growth opportunities are among the most influential determinants of leverage (Frank & Goyal[8], 2009). Parallel to this research on financial distress has produced seminal models of prediction, from Altman's Z score[9] (1968) to logit and hazard models (Ohlson[10], 1980; Shumway[11], 2001), later extended to machine learning approaches that capture non linearities more effectively (Strobl et al.[12], 2007; Barboza &

[5] Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. The American Economic Review, 48(3), 261-297.
[6] Myers, S. C. (1984). The capital structure puzzle. The Journal of Finance, 39(3), 575–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x
[7] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. Journal of Finance, 50(5), 1421-1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x
[8] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x
[9] Altman, E. I. (1968). Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy. Journal of Finance, 23(4), 589-609. https://doi.org/10.1111/j.1540-6261.1968.tb00843.x
[10] Ohlson, J. A. (1980). Financial Ratios and the Probabilistic Prediction of Bankruptcy. Journal of Accounting Research, 18(1), 109-131. https://doi.org/10.2307/2490395
[11] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665
[12] Strobl, C., Boulesteix, A.-L., Kneib, T., Augustin, T., & Zeileis, A. (2008). Conditional variable importance for random forests. BMC Bioinformatics, 9, 307. https://doi.org/10.1186/1471-2105-9-307

Altman, 2017). While research on capital structure and financial distress has largely focused on financial ratios and econometric prediction models, management and organizational scholars have progressively expanded the definition of business crisis beyond purely financial indicators. Traditionally, a crisis was equated with insolvency, namely the inability of a firm to meet its obligations. However, more recent literature interprets the crisis as a multidimensional and progressive phenomenon that involves financial, managerial, strategic, and reputational aspects. From this broader perspective, the crisis is not a static state but a process characterized by early warning signals and cumulative imbalances.

In this regard, Crutzen and Van Caillie[13] (2007) propose an integrative model of business failure that identifies a sequence of stages preceding insolvency and emphasizes the detection of early warning signals so called pre crisis symptoms such as declining market share, erosion of strategic focus, and poor governance practices. Their framework highlights how firms gradually evolve from a condition of vulnerability to one of irreversible distress unless corrective actions are implemented. Similarly Hambrick and D'Aveni[14] (1988) describe crisis as a stage in the organizational life cycle triggered by environmental turbulence and internal rigidity. More recent approaches from risk management interpret crisis as the failure to anticipate and mitigate systemic risks, a perspective reinforced after the global financial crisis, together with the rising importance of nonfinancial indicators such as ESG metrics and stakeholder trust. In the European context, studies such as Blazy and Chopard[15] (2012) have examined insolvency regimes and restructuring outcomes, while Hotchkiss et al[16]. (2006) investigated corporate reorganization mechanisms in comparative settings. Nevertheless, relatively few contributions have analyzed Italian firms specifically, despite the profound transformations introduced by the 2019 Codice della Crisi d'Impresa e dell'Insolvenza and the transposition of the EU Directive[17] 2019/1023. Moreover, even fewer works have combined econometric and machine learning methods to study capital

[13] Crutzen, N., & Van Caillie, D. (2008). The business failure process: An integrative model of the literature. Review of Business and Economics, 53(3), 287–316.

[14] Hambrick, D. C., & D'Aveni, R. A. (1988). Large Corporate Failures as Downward Spirals. Administrative Science Quarterly, 33(1), 1-23. https://doi.org/10.2307/2392853

[15] Blazy, R., Chopard, B., & Fimayer, A. (2008). Bankruptcy law: a mechanism of governance for financially distressed firms. European Journal of Law and Economics, 25(3), 253-267. https://doi.org/10.1007/s10657-008-9048-8

[16] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[17] European Parliament & Council of the European Union. (2019, June 20). Directive (EU) 2019/1023 on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132. Official Journal of the European Union, L 172, 18-55.

structure in firms subject to preventive settlement procedures. This leaves an important gap in the literature at the intersection of financial economics, insolvency law, and data driven methodologies

Chapter 1 Historical Evolution of the Italian Crisis and Insolvency Framework

1.1 Evolution of Bankruptcy Law from the Middle Ages to the Present

The historical evolution of bankruptcy law mirrors broader changes in economic systems, societal values, and the understanding of commercial risk. During the Middle Ages, bankruptcy was commonly treated as a moral and often criminal issue. In many European cities, insolvent merchants were subjected to severe punishments, including imprisonment and confiscation of assets. The act of default was not merely a financial failure but a breach of trust, equated with dishonor and fraud.

The early modern period marked the first attempts to regulate insolvency within more formal legal frameworks. The English Bankruptcy Act of 1542, often cited as the first statutory bankruptcy law, institutionalized the role of creditors and established procedures for asset liquidation. However, it continued to criminalize debtors, reflecting persistent moralistic interpretations of insolvency (Skeel, 2001)[18]. A more structured and commercially oriented approach began to emerge in continental Europe with the French Commercial Code of 1807, which introduced distinctions between honest and fraudulent bankruptcy and emphasized the economic role of credit and commerce in national development [19]Montanari, G. (2005) In Italy, the development of bankruptcy regulation followed a similar trajectory. The first important key codification occurred with the Commercial Code of 1865, which was later

[18] Skeel, D. A. (2001). *Debt's Dominion: A History of Bankruptcy Law in America*. Princeton University Press

[19] Montanari, G. (2005). Diritto fallimentare. Dalle origini al nuovo millennio. Giappichelli Editore.

superseded by the Royal Decree No. 267 of 194220, known as the "Legge Fallimentare." This legislation provided a comprehensive framework for the management of corporate insolvency, including liquidation, composition with creditors (Composition with Creditors and extraordinary administration. The primary focus remained on asset protection and creditor satisfaction, yet the inclusion of judicially supervised restructuring options signaled a shift toward preventive approaches to financial distress.

Recent reforms, especially those leading to the enactment of the Italian Insolvency Code (Codice della Crisi d'Impresa e dell'Insolvenza), have increasingly emphasized early warning mechanisms, corporate rescue procedures, and the continuity of economically viable businesses. These changes reflect a broader European trend toward preventive restructuring and second chance policies, consistent with the EU Directive[21] 2019/1023. The transformation of bankruptcy law thus reflects a paradigmatic shift, from punitive regulation focused on liquidation and sanction, to a modern framework oriented toward preserving business value, employment, and market stability. It highlights the increasing complexity of insolvency as a legal, economic, and managerial issue.

1.2 From the 1942 Bankruptcy Law to the First Reform Waves

The original framework of Italian bankruptcy law, established in 1942, reflected the prevailing legal and economic doctrines of the authoritarian state of that period. At its foundation, the legislation embodied a patrimonialistic vision that placed the satisfaction of creditors at the very center of insolvency procedures. This orientation translated into a

G. Fauceglia, La disciplina dell'insolvenza nella storia del diritto commerciale italiano, in Rivista di Diritto Commerciale, 107(3), 2009, pp. 345–372.

[21] European Parliament & Council of the European Union. (2019, June 20). *Directive (EU) 2019/1023 on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132*. Official Journal of the European Union, L 172, 18-55.

system primarily focused on liquidation, in which the debtor's assets were dismantled and redistributed among creditors with maximum procedural efficiency. Courts and delegated judges were vested with extensive responsibilities, combining jurisdictional and managerial powers to ensure full control over the trajectory of bankruptcy proceedings. This patrimonialistic and punitive approach was following the corporatist ideology of the fascist regime, where entrepreneurial failure was not only regarded as a financial default but also interpreted as a moral stigma, branding the debtor as unfit to remain in the market community. The normative structure of the 1942 law also implicitly linked insolvency with entrepreneurial fault. Bankruptcy was conceived as a form of moral condemnation, whereby the failed entrepreneur, deemed negligent or incompetent, was subject to asset forfeiture and personal restrictions. A clear manifestation of this punitive rationale could be found in Article 15, which, in its original version, granted the court discretion rather than obligation to hear the debtor during the pre bankruptcy phase. This reflected the limited procedural safeguards afforded to the debtor within the legislative configuration of the time. Such a configuration underscored a vision of insolvency centered on liquidation rather than continuity, prioritizing creditor recovery even at the cost of dismantling productive capacity an orientation that soon revealed its inadequacy in the industrial expansion of the post war period. Alongside the rules on bankruptcy in the strict sense, the 1942 legislation also included several other mechanisms for dealing with insolvency, such as forced administrative liquidation, composition with creditors, and controlled administration. All of these represented variants of liquidation oriented intervention, tailored to specific categories of debtors or circumstances. For instance, forced administrative liquidation was applicable to enterprises of public relevance, while composition with creditors was designed for the "honest but unfortunate" debtor, allowing the avoidance of bankruptcy through full repayment of secured claims and partial satisfaction of unsecured ones.

Controlled administration, on the other hand permitted a temporary suspension of payments under judicial supervision. Even in these cases, however, the preservation of the business was never the main objective, but only a secondary effect, provided that it did not conflict with the overriding interest of creditors (Fauceglia,[22] 2009). The structure of the 1942 bankruptcy law remained largely unchanged for decades, save for sporadic interventions by the Constitutional Court that sought to enhance debtor protections under Articles 24 and 111

[22] Fauceglia, G. (2009). Il diritto della crisi d'impresa: Fallimento, concordato preventivo, accordi di ristrutturazione e liquidazione coatta amministrativa. Giappichelli.

of the Italian Constitution. A notable example was the reinterpretation of Article 15, where the Court emphasized the debtor's right to be heard as an essential component of procedural guarantees. From the 1970s onwards, however, profound social economic transformations began to render the original model approach that result obsolete. The model centered on dismembering enterprises and maximizing creditor satisfaction no longer reflected the complexities of industrial organization or the dynamics of a globalizing economy. As economic structures grew more sophisticated, the limitations of a purely liquidative paradigm became increasingly evident. A turning point came with the enactment of Law No. 95 of 3 April 1979, commonly known as the "Prodi Law," which introduced extraordinary administration for large insolvent firms deemed systemically important. The procedure aimed to safeguard productive assets by enabling their continuation, restructuring, or recovery. Control of the enterprise was entrusted to special administrators, tasked with preparing a restructuring plan and ensuring that the company's economic functions could be preserved for up to four years. Rather than immediate liquidation, the intent was to keep productive units operating with a view to their eventual transfer to new ownership. Nevertheless, extraordinary administration revealed structural weaknesses, while it succeeded in protecting employment and maintaining assets in the short term, it often resulted in excessively lengthy procedures and was vulnerable to political interference, raising doubts about its efficiency and transparency. Despite this innovation, a comprehensive reform of the bankruptcy framework did not materialize until the 2000s. By that time, the 1942 law was increasingly considered suited to the realities of contemporary business, particularly in the context of globalized markets and financialization. The legislator began to adopt a new orientation, shifting away from the punitive logic of insolvency and moving toward a managerial and recovery oriented perspective. In this evolving view, bankruptcy was no longer seen primarily as a sanction for entrepreneurial misconduct, but rather as one of the possible outcomes of risk taking in uncertain and volatile markets. The emphasis gradually shifted from the dismemberment of firms toward the preservation of productive organizations, now recognized as entities of autonomous economic and social value, distinct from the mere aggregation of their assets. The reform trajectory therefore concentrated on several key innovations, exclusion of minor insolvencies from bankruptcy proceedings to reduce procedural overload, promotion of mechanisms aimed at preserving business continuity with a simplification and acceleration of procedures, and a gradual rebalancing of roles, with debtors and creditors acquiring greater powers in crisis management and the judiciary side increasingly limited to supervisory functions.

Special attention was devoted to the settlement agreement, initially conceived as an exceptionalimportant insights reserved for the “deserving” debtor, this procedure underwent essential transformation. Access conditions were progressively loosened, with the threshold moving from a strict insolvency to the broader condition of state of “crisis”,that’s minimum requirements for satisfying privileged creditors were abolished and the arrangement itself came to be interpreted as a contractual and flexible instrument rather than a rigid judicial imposition. This enhanced accessibility however, carried potential risks, scholars and practitioners noted that some debtors began to exploit the procedure opportunistically, using it as a shield to delay liquidation or reduce creditor satisfaction without presenting realistic restructuring strategies. To sum up the historical evolution of Italian bankruptcy law illustrates a gradual yet decisive transition, from a punitive, creditor centered analytical structures rooted in the authoritarian doctrines of the 1940s, to a more balanced system emphasizing recovery and continuity. The recognition of the enterprise as a productive institution of systemic relevance marked a profound change in perspective, promoting legal mechanisms that, while still safeguarding creditor rights, sought to preserve firms as engines of value creation and employment. This long reform process provided the intellectual and legislative groundwork for the Codice della Crisi d’Impresa e dell’Insolvenza of 2019, which systematized decades of gradual transformation into a coherent analytical structures aligned with European standards of preventive restructuring.

1.3.1 The Reform Season of 2005–2012 and the Shift toward Preventive Restructuring

The Reform Season of 2005-2012 and the First Openings to Over Indebtedness, the cycle of reforms launched between 2005 and 2012 marked a turning point in the Italian insolvency system, signaling the gradual abandonment of the punitive logic that had characterized the Bankruptcy Law of 1942. With Legislative Decree no. 5 of 9 January 2006, some of the most stigmatizing aspects of bankruptcy were dismantled, the obligation to surrender all

correspondence was reduced to that connected to the procedure; the bankrupt was no longer subject to restrictions beyond the mere duty to notify any change of residence; the Register of Bankrupts was abolished; and, for the first time, the discharge (esdebitazione) was introduced, providing an opportunity for a fresh start for the honest but unfortunate debtor. This trajectory was consolidated with Legislative Decree no. 169 of 12 September 2007, which eliminated the personal incapacities associated with bankruptcy upon closure of the proceedings and expanded the scope of access to discharge. In parallel, the legislature gave full recognition to private crisis resolution instruments, such as restructuring agreements (art. 182-bis) and certified recovery plans (art. 67, c. 3), which hinge on the preparation of a business plan certified by an independent expert. This reflected the growing awareness that negotiated solutions could in many cases better preserve value than forced liquidation. The 2012 reform season must be read in the context of the sovereign debt crisis and the widespread contraction of credit, which had a disproportionate impact on small and medium sized Italian firms reliant on bank financing. With Decree Law no. 83 of 22 June 2012 (converted into Law no. 134 of 7 August 2012), the Settlement Agreement was reshaped to facilitate agreements between debtors and creditors and to encourage restructuring financing. The guiding principle, shared internationally, was that where an enterprise in difficulty is still capable of generating wealth, negotiated solutions even if burdensome for creditors are preferable to immediate liquidation. In the same year, the Italian legal system also saw the introduction of an autonomous discipline of over indebtedness with Law no. 3 of 27 January 2012, later supplemented by Decree Law no. 179 of 18 October 2012 (converted into Law no. 221 of 17 December 2012). This reform was a response to the growing phenomenon of consumer and household indebtedness, accelerated since the 1990s by the liberalization of credit markets and the rapid expansion of consumer credit. For the first time, specific procedures were created for debtors who were not entrepreneurs in the strict sense, aligning Italy with a European trend that increasingly recognized the social and economic need for "second chance" approach. These reforms reflect a paradigm shift, The stigma of bankruptcy was progressively dismantled (abolition of registries of infamy, reduction of personal incapacities, introduction of discharge). The logic of liquidation gave way to a logic of reorganization, centered on business plans and independent attestations. The system began to embrace preventive solutions, albeit with limited coordination and a piecemeal approach that relied heavily on case law and practice. At the same time, doctrinal and empirical studies

(Fabiani; Jorio[23], 2010) have pointed out critical issues the widening of access to concordato and restructuring agreements also opened the door to opportunistic behavior, such as filings aimed at delaying enforcement actions rather than pursuing credible restructuring. This underscored the importance of judicial oversight and the role of the attestatore as guarantor of the reliability of the business plan.

Italy's reform trajectory during these years mirrors broader developments taking place across European jurisdictions, which, albeit with different timing and instruments, moved in the direction of preventive restructuring and second chance policies.

In France, the 2005 Loi de Sauvegarde radically changed the approach to insolvency, introducing procedures that intervene before firms reach insolvency.These mechanisms emphasized the importance of maintaining business continuity and protecting employment, while also reducing the stigma historically attached to insolvency. The French model also highlighted the facilitating role of the judiciary, which acts not only as a controller but as a supporter of negotiations, helping the debtor to achieve a restructuring plan with the consent of creditors. Compared to Italy's incremental reforms, France adopted a comprehensive approach in one stroke, providing a clear and coherent preventive path that would later inspire EU policy.

In Germany, the ESUG reform of 2012 (Gesetz zur weiteren Erleichterung der Sanierung von Unternehmen) reinforced the debtor in possession (DIP) model, allowing managers to remain in control of the firm during restructuring under the supervision of an insolvency practitioner. Creditors gained a stronger say in choosing the insolvency administrator a clear move toward a market oriented vision of how crises should be managed. This shift aimed to accelerate proceedings, reduce liquidation bias, and provide creditors with stronger incentives to support reorganization rather than immediate enforcement. While Italy was experimenting with important insights such as restructuring agreements and recovery plans, Germany embraced a more institutionalized creditor driven model, explicitly linking insolvency reforms to broader corporate governance and efficiency objectives.

In Spain, the Ley Concursal of 2003, and its subsequent reforms in 2009 and 2014, sought to consolidate a fragmented insolvency approach into a unified code, while introducing refinancing agreements (acuerdos de refinanciación) to encourage early renegotiation of debt. Spain's reforms were spurred by the severe impact of the global financial crisis on

[23] Jorio, A., & Fabiani, M. (Eds.). (2010). Il nuovo diritto fallimentare: Novità ed esperienze applicative a cinque anni dalla riforma. Zanichelli

highly leveraged firms and households. Spain's initial reform proved overly complex and bureaucratic, which slowed the practical use of early restructuring useful tools until later simplifications made them workable. Against this background, Italy positioned itself within the same European shift from liquidation to rescue, but did so in a more gradual and piecemeal fashion. Rather than introducing an entirely new code, Italian lawmakers layered successive reforms first tackling personal stigma (abolition of registers, discharge), then expanding restructuring instruments (182-bis, art. 67), and finally creating procedures for over indebtedness. This fragmented approach reflected both the caution of the legislator and the strong reliance on judicial practice to fill interpretative gaps. Ultimately, however, the lack of systematic coherence underscored the necessity of a later organic codification, which would materialize with the Codice della Crisi d'Impresa e dell'Insolvenza of 2019, aligning Italy more closely with the preventive and second chance philosophy endorsed by the EU Directive 2019/1023.

1.3.2 The 2017 Delegated Law and the Code of Business Crisis and Insolvency

The enactment of Delegated Law no. 155/2017 and its implementing Legislative Decree no. 14/2019 (the Codice della Crisi d'Impresa e dell'Insolvenza, or CCII) represents the most ambitious and comprehensive attempt at reorganizing Italian insolvency law since 1942. Unlike the incremental reforms of the 2000s, the CCII sought to create a systematic and unitary approach that would align Italy with the European paradigm of preventive restructuring and second chance policies, as crystallized in the EU Insolvency Directive 2019/1023. The core innovation lies in the redefinition of the very concept of "crisis." No longer understood merely as present insolvency, crisis is framed as the likelihood of future insolvency . This forward looking approach shifts the focus from punishment and liquidation to anticipation and prevention, encouraging timely intervention while value can still be preserved. As a result the Code abandons the traditional terminology of fallimento in favor of judicial liquidation, signaling a cultural move away from the stigma of entrepreneurial failure. Another structural novelty is the adoption of a single procedural model applicable to all categories of debtors (entrepreneurs, professionals, consumers, agricultural and craft

activities, with the exception of public entities). This unification responds to decades of legislative fragmentation and aims to streamline procedures, reduce costs, and avoid unequal treatment. Within this model proposals that guarantee business continuity are given priority over liquidation, even if continuity requires transferring the firm to a new entrepreneur. The Code also introduces an extensive catalogue of instruments designed to facilitate negotiated solutions, Certified recovery plans (piani attestati), Debt restructuring agreements (accordi di ristrutturazione), Moratorium agreements (convenzioni di moratoria), Restructuring plans subject to judicial approval, settlement agreement, including the simplified liquidation arrangement. These useful tools are all premised on negotiation between debtor and creditors, supported by an independent expert where necessary, and grounded in the presentation of a credible business plan. For non entrepreneurial debtors, the Code incorporates procedures for over indebtedness (such as consumer debt restructuring, minor arrangements, and controlled liquidation), thereby extending the logic of second chance to households, professionals, and micro enterprises. From a systematic perspective, the Code also repositions insolvency within corporate law, strengthening organizational duties through the amendment of art. 2086 c.c., which explicitly requires directors to establish adequate structures to detect and address crises. This is consistent with the European trend of linking insolvency prevention to corporate governance and directors' duties. Although the CCII represents a very important step forward, doctrine has highlighted both strengths and weaknesses. On the positive side the Code consolidates decades of fragmented reforms, enhances early warning mechanisms, and aligns Italian law with European preventive restructuring principles. On the other hand, critics (e.g., Panzani[24], 2019; Fabiani, 2020) have noted that the unification of procedures may obscure the specific needs of heterogeneous debtor categories, while the reliance on business continuity as a default option raises concerns about the feasibility and monitoring of plans, especially in SMEs with limited resources. Moreover, the exclusion of extraordinary administration for large enterprises from the CCII model perpetuates a dual track system, undermining the aspiration for complete unification. Comparatively, other jurisdictions such as France and Germany have integrated large firm insolvency into their ordinary model, while Spain, with its 2020 reforms, moved toward a more homogeneous system. To position the CCII within the European landscape,

[24] Panzani, L. (2019). Il preventive restructuring framework nella Direttiva 2019/1023 del 20 giugno 2019 ed il Codice della crisi. Assonanze e dissonanze. DirittoBancario.it (paper online)

Table X contrasts the trigger, instruments, institutional design and policy priorities across major jurisdictions and the Directive 2019/1023."

Jurisdiction / Instrument	Triggering Criteria	Main Procedures / Instruments	Institutional Model	Policy Orientation
France.	Early distress signals	Sauvegarde, Conciliation	Judicial, Debtor-led	Preventive restructuring
Germany	Imminent insolvency	ESUG Reform, Insolvenzplan	Debtor-in-possession	Creditor empowerment
Spain	Likelihood of insolvency	Ley Concursal, Refinancing Agreements	Judicial oversight	Pre-insolvency refinancing
Italy	Crisis indicators, imbalance	CCII, Negotiated Settlement	Judicial & expert-assisted	Business continuity
EU Directive 2019/1023	Probability of insolvency	Preventive Restructuring Frameworks	Hybrid (judicial/non-judicial)	Second chance / early warning

Table 1.1 situates the Italian Codice della crisi d'impresa e dell'insolvenza (CCII) within the broader European framework by comparing triggering conditions, available procedures and instruments, institutional set-ups and prevailing policy orientations across selected jurisdictions and the Preventive Restructuring Directive (EU) 2019/1023.

1.4 The Entry into Force of the New Code of Corporate Crisis and Insolvency

This is certainly a relevant novelty for our legal system, which also opens to the principles contained in the aforementioned Insolvency Directive, whose Recital no. 2 programmatically highlights how the preventive restructuring models should first enable debtors to restructure effectively at an early stage and prevent insolvency and thus avoid the liquidation of healthy enterprises.

Due to the aforementioned 2000s reforms the fundamental principles of insolvency law have undergone substantial improvement with the enactment of Delegated Law No. 155/2017.
By giving up on the idea of exclusive creditor protection, even in cases when the undertaking may be held by a third party, the creation of a dynamic notion that keeps it operating is preserved. This constitutes a protected value which must be coordinated with the creditors' rights and which, indeed, may, where necessary, ensure that the restructuring process is not detrimental to creditors as compared to a hypothetical liquidation alternative, and result in a reasonable compression of those rights. The Crisis Code gets to the stage where it treats bankruptcy as redistribution rather than as a punishment. In addition to other fundamental principles imposed by the delegated law, the organic reform of the discipline of insolvency procedures is grounded in the following, The concept of crisis to be introduced by the Insolvency Directive will center on the likelihood of future insolvency and substitute the word "court settlement" for "bankruptcy," while also accounting for the developments in corporate science and upholding the existing definition of insolvency; select a single procedural model to assess the debtor's state of crisis or insolvency, with specific features for speed that apply to all debtor categories, such as natural or legal persons or collective bodies, consumers, professionals, or entrepreneurs engaged in commercial, agricultural, or craft activities, to the procedures for determining the state of crisis or insolvency, excluding public bodies only and giving priority treatment to proposals that involve resolving the crisis by guaranteeing business continuity, including through a different entrepreneur; standardize and simplify, alongside the telematic civil process regulations, the competition provisions regulate the different special rites. The most recent innovations have included redefining the concept of 'crisis' and allowing for express provision, in keeping with the principles of the Insolvency Directive for the safeguarding of employees of the obligation of prior trade union consultation for the employer who employs more than 25 employees and who intends to start a process of reorganization within a preventive restructuring approach. The Crisis and Insolvency Code is structured into four parts.
The first and predominant part contains the full set of rules on business crisis and insolvency (Articles 1–374). the second part introduces amendments to the Civil Code (Articles 375–384). the third part sets out guarantees in favour of purchasers of properties to be built (Articles 385–388), and finally, the fourth part contains the final and transitional provisions (Articles 389–391). The structure of the Code marks, also from the point of view of the

sequence of institutes, a decisive novelty25. It opens with some definitions and the enunciation of general principles, and then continues with all the institutions that the debtor can use to deal with the crisis and insolvency and only last is regulated the judicial liquidation, understood as extreme ratio. Although the Code brings together a large part of the insolvency institutions and therefore has a tendency to be unitary, the discipline of the extraordinary administration of large and very large enterprises in crisis has remained outside (as part of the discipline contained in numerous special laws regulating compulsory administrative liquidation), frustrating at least in part the idea of a single body of legislation. The legislator offers a varied catalogue of instruments, with the aim of allowing to face the risk of crisis, crisis and insolvency. A functional institution was created, with the scope to recover the company's values through a negotiation between debtor and creditors, facilitated by the presence of an expert.26 Instrument reserved for the debtor who is in a situation of financial or economic imbalance which makes its crisis or insolvency probable, but for which recovery is reasonably punishable. certified recovery plans27; debt restructuring agreements, the Convention of Moratorium, the restructuring plan subject to approval; the arrangement28 (and the simplified arrangement for the liquidation of the assets). they are instruments which the legislator has made available exclusively to debtors engaged in business activities and their distinguishing feature can be found in the nature of negotiations, in the sense that they presuppose a proposal from the debtor addressed to its creditors, with the object and purpose of satisfying creditors in execution of a business plan. in addition, over indebtedness procedures29 which, has already been noted will aim to provide different entities such as the consumer, the professional, the minor entrepreneur, the agricultural entrepreneur30 and innovative startups burdened with multiple debts, appropriate instruments to address the crisis or insolvency; the procedures made available by the legislator are the restructuring of the consumer's debts, the arrangement minor and the controlled liquidation of the over indebted.

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[25] Osti, M. (2020), Il concordato preventivo con continuità aziendale: analisi della disciplina vigente e prospettive future, in Il Fallimento, n. 7-8.

[26] Panzani, L. (2022), Il concordato preventivo nella legislazione previgente, in Ristrutturazioni aziendali: profili giuridici e operativi, pp. 10-25.

[27] Mucciarone, G. (2022). Su di alcuni limiti di liceità del contratto di concordato preventivo, Diritto Bancario, 28(6), 123–145.

[28] Ambrosini, S. (2021), L'emersione tempestiva della crisi e il concordato preventivo del terzo millennio, in Diritto della Crisi, pp. 45–67.

[29] Molinari & Partners (2017), Utilizzo del concordato preventivo in Italia: osservazioni empiriche, Convegno "La gestione della crisi d'impresa: strumenti e prospettive", Milano.

[30] Ambrosini, S. (2021), L'emersione tempestiva della crisi e il concordato preventivo del terzo millennio, pp. 45-67.

1.4.2 Structure and Classification of Insolvency Procedures under the CCII

The Italian insolvency approach is governed by a complex set of normative sources, the cornerstone of which is the Corporate Crisis and Insolvency Code (CCII). This legislative corpus consolidates and harmonizes the various instruments introduced by successive reforms over the past two decades, seeking to rationalize a field historically characterized by fragmentation. The only crucial exception to this unifying effort concerns compulsory administrative liquidation, which continues to be regulated by special sectoral laws, particularly those applicable to supervised entities such as banks and insurance companies. This partial exclusion reflects the persistence of differentiated regulatory needs and the State's role in safeguarding public and systemic interests. Insolvency proceedings represent the legal mechanisms through which situations of financial distress or insolvency are addressed under public supervision. Two fundamental traits distinguish such procedures, officiousness, meaning that proceedings are initiated and controlled by judicial or administrative authorities, and universality, as all assets belonging to the debtor at the time of the opening are subjected to a collective satisfaction process echoes the principle of par condicio creditorum. Unlike individual enforcement actions under civil procedural law, insolvency procedures aim at a coordinated and equitable distribution of the debtor's assets among all creditors, thereby ensuring collective justice rather than individual advantage. From a structural standpoint, Italian law distinguishes among judicial, administrative, and mixed insolvency procedures, depending on the nature of the supervising authority. To better contextualize the Italian approach within the broader European landscape, the following table provides a comparative summary of the main insolvency and restructuring mechanisms adopted in France, Germany, Spain, and at the EU level.

Comparative overview of European insolvency frameworks

Jurisdiction / Instrument	Triggering Criteria	Main Procedures / Instruments	Institutional Model	Policy Orientation
France.	Early distress signals	Sauvegarde, Conciliation	Judicial, Debtor-led	Preventive restructuring
Germany	Imminent insolvency	ESUG Reform, Insolvenzplan	Debtor-in-possession	Creditor empowerment
Spain	Likelihood of insolvency	Ley Concursal, Refinancing Agreements	Judicial oversight	Pre-insolvency refinancing
Italy	Crisis indicators, imbalance	CCII, Negotiated Settlement	Judicial & expert-assisted	Business continuity
EU Directive 2019/1023	Probability of insolvency	Preventive Restructuring Frameworks	Hybrid (judicial/non-judicial)	Second chance / early warning

Source: Based on national insolvency approaches and Directive (EU) 2019/1023

As shown, Italy's reform path mirrors the European trend toward early intervention and business rescue, yet its implementation remains more fragmented, requiring continuous adaptation to the principles of Directive (EU) 2019/1023.

Judicial procedures include debt restructuring agreements, moratoria, restructuring plans subject to court approval, the Composition with Creditors (composition with creditors), the simplified liquidation arrangement, and procedures addressing over indebtedness. Administrative procedures are represented by compulsory administrative liquidation, typically applicable to regulated sectors. Mixed procedures, such as extraordinary administration, involve both judicial and ministerial oversight, particularly for large enterprises whose continuity has public relevance. A further functional distinction may be drawn between reorganization procedures, which aim to restore the firm's financial equilibrium while preserving operational continuity, and liquidation procedures, whose primary goal is to maximize creditor recovery through asset disposal. However, the line between these categories has progressively blurred, even within liquidation processes, recent

reforms have introduced mechanisms enabling the sale of going concerns and the partial continuation of productive activities. This evolution reveals the legislator's growing emphasis on preserving enterprise value as a social and economic asset. The CCII introduces a unified procedural model that applies, with certain variations, to all categories of debtors natural persons, legal entities, professionals, and entrepreneurs engaged in commercial or agricultural activities. This unified approach simplifies access rules, accelerates decision making, and aligns domestic law with the European principle of early intervention in business distress. Nonetheless, the continued exclusion of extraordinary administration for large enterprises prevents full harmonization, maintaining a dual track system that separates ordinary insolvency law from special regimes. This duality highlights a structural tension within the Italian insolvency system, the coexistence of a codified, general discipline aimed at procedural unification and a set of exceptional regimes justified by public policy concerns. While the CCII has succeeded in consolidating most existing procedures under a coherent models, the persistence of parallel regimes reveals the difficulty of reconciling efficiency, equity, and systemic stability within a single legislative architecture.

1.4.4 From Liquidation to Business Continuity: A Paradigm Shift in the Italian Insolvency Framework

Moving from the 1942 Legge Fallimentare to the Codice della Crisi meant more than rewriting the rules, it reshaped the very attitude of lawmakers and judges toward business failure. Under Royal Decree No. 267 of 1942, insolvency was framed within a punitive logic in which the bankrupt entrepreneur was presumed to bear moral and managerial fault. Bankruptcy entailed loss of ownership and personal incapacitation, reinforcing the idea that insolvency constituted a social and legal stigma. This conception reflected the corporatist economic order of the early twentieth century, prioritizing the collective satisfaction of

creditors over the preservation of productive capacity (Fauceglia[31], 2009). Over the following decades, this model gradually revealed its obsolescence. The post war industrial expansion, the spread of limited liability forms, and the increasing complexity of financial intermediation underscored that insolvency frequently arises from structural market fluctuations rather than individual misconduct. From the 1970s onwards, Italian legal scholarship began to conceptualise insolvency as a phase of economic disequilibrium a situation requiring managerial and legal useful tools for recovery instead of moral sanction (Fabiani, 2011[32]).

This intellectual re orientation culminated in the reform process of the 2000s and, ultimately, in the 2019 CCII. Within this model, business continuity emerges as the guiding principle of insolvency law. Preserving the enterprise as a productive and social entity capable of generating employment, innovation, and fiscal returns is recognized as a matter of public interest that transcends the bilateral relationship between debtor and creditor (Panzani[33], 2019). As a result the CCII redefines the duties of corporate officers, imposing proactive obligations for the early identification of financial imbalance and the adoption of adequate organizational, administrative, and accounting measures to maintain going concern value. In doing so, the Italian legislator harmonized domestic law with the European policy set by Directive (EU) 2019/1023, which encourages preventive restructuring models to avert unnecessary liquidations and safeguard economic value (European Parliament & Council, 2019). Yet, Italy retains a distinct procedural orientation, unlike France or Germany where debtor in possession models emphasize managerial autonomy the Italian system preserves a stronger judicial presence and a structured role for independent experts in negotiation processes. This approach reflects a historical tendency toward procedural supervision and cautious debtor empowerment, ensuring that restructuring is monitored for fairness and feasibility (Rordorf[34], 2018). From a normative standpoint, this shift generates three major consequences. **First,** it transforms insolvency procedures from mechanisms of asset liquidation into instruments of value maximisation through reorganisation.

[31] Fauceglia, G. (2009). Il diritto della crisi d'impresa: Fallimento, concordato preventivo, accordi di ristrutturazione e liquidazione coatta amministrativa. Giappichelli

[32] Fabiani, M. (2011). Diritto fallimentare: un profilo organico. Zanichelli.

[33] Panzani, L. (2019, 14 ottobre). Il preventive restructuring framework nella Direttiva 2019/1023

[34] Rordorf, R. (2018). Verso un diritto della crisi d'impresa di nuova generazione. Rivista delle Società, 63(4), 895–910

Second, it introduces a graduated system of interventions from composizione negoziata to Preventive Arrangement and finally judicial liquidation allowing the law to act progressively across different degrees of financial distress.

Third, it rebalances creditor protection with the broader economic objective of sustaining viable firms, thereby replacing the patrimonial logic of creditor satisfaction with one centred on economic sustainability and collective welfare (Jorio & Fabiani[35], 2017). Nevertheless, challenges remain. The coexistence of the CCII with special regimes such as the amministrazione straordinaria for large enterprises perpetuates systemic fragmentation, preventing full unification. Moreover, the actual efficiency of early warning mechanisms depends heavily on SMEs' access to professional advice and real time accounting data conditions that remain uneven across Italy's economic landscape. Without an effective support network, the promise of timely intervention risks remaining theoretical.

Ultimately, the CCII represents the transition from a static and sanctioning model of insolvency to a dynamic and managerial one. Corporate crisis is no longer regarded as the terminal stage of business life but as a transformative phase in which continuity becomes both a legal duty and a public policy goal. This conceptual shift forms the analytical foundation for the empirical investigation presented in the following chapter, which explores how financial and organizational variables influence firms' recovery potential under the new Italian regulatory approach. This intellectual evolution culminated in the reforms of the 2000s and ultimately in the CCII, which places business continuity at the core of insolvency law. Continuity is no longer a secondary option but a policy priority, the preservation of the firm as an economic and social organism capable of generating employment, innovation, and fiscal contribution is seen as a collective interest that transcends the private relationship between debtor and creditor. Therefore the Code redefines the duties of directors, emphasizing early detection of financial distress and the adoption of appropriate organizational, administrative, and accounting measures to safeguard going concern value. This means that the CCII aligns Italian law with the European paradigm established by Directive (EU) 2019/1023, which promotes early restructuring models and preventive negotiation as tools to avoid value destruction. Yet, the Italian implementation displays a distinct orientation, while other jurisdictions, such as France and Germany, institutionalized debtor in possession regimes that favor managerial autonomy, the Italian model remains

[35] Fabiani, M. (2017). La legge di riforma organica delle procedure concorsuali. Foro Italiano, V(...)*, 317-317.

characterized by a stronger judicial and professional oversight through the appointment of independent experts. This reflects a traditional preference for procedural control and a cautious approach to debtor led restructuring. Nevertheless, the adoption of the principle of business continuity has produced essential normative consequences. First, it reorients the function of insolvency proceedings from mere liquidation to the maximization of value through reorganization. Second, it introduces a gradation of procedural instruments from negotiated settlement to composition with creditors and judicial liquidation designed to intervene at different stages of financial distress. Third, it establishes a renewed equilibrium between the interests of creditors and the preservation of viable economic activity, shifting from a strictly patrimonial logic to a model grounded in economic sustainability. Despite these advances, several critical issues remain. The coexistence of the CCII with special regimes, such as the extraordinary administration for large enterprises, fragments the system and limits full harmonization. Moreover, the practical effectiveness of early warning mechanisms largely depends on the ability of small and medium sized firms to access professional support and financial data in real time conditions that are not yet fully guaranteed. The true success of the CCII will therefore depend not only on the coherence of its legal architecture but also on the responsiveness of the business environment and the judiciary in implementing a culture of timely intervention. The Italian reform turns insolvency from a moment of punishment into a phase of management and potential recovery. The crisis is no longer treated as the endpoint of entrepreneurial activity but as a phase of transformation, in which the preservation of business continuity becomes both a legal duty and a policy objective. This paradigm shift lays the groundwork for the empirical investigation developed in the following chapter, which examines how financial and organizational variables influence the likelihood of corporate recovery under the new regulatory Analytical structure. The historical and regulatory evolution traced in this chapter illustrates a gradual but profound transformation in the philosophy underpinning Italian insolvency law. The passage from the 1942 Bankruptcy Law to the Corporate Crisis and Insolvency Code (CCII) reflects not only a legislative modernization but also a conceptual realignment, from a system primarily aimed at sanctioning insolvency and liquidating assets, to one that views financial distress as a reversible state capable of managerial recovery. This trajectory mirrors the broader European shift from failure management to failure prevention, as promoted by Directive (EU) 2019/1023. At the normative level, the CCII consolidates a culture of early intervention and managerial responsibility. The introduction of preventive restructuring tools, together with the codified notion of business continuity, represents a

decisive break from the punitive logic of the past. The law now acknowledges that insolvency is often the result of market dynamics, not necessarily of mismanagement or misconduct. This change has repositioned the debtor from an object of sanction to an active participant in the process of recovery, while creditors assume a more collaborative role in preserving going concern value. From a systemic perspective, the Italian reform also enhances coherence between private and public interests. The preservation of viable enterprises is no longer justified solely by the protection of creditors, but by the recognition that maintaining productive activities serves broader economic and social functions including employment, innovation, and territorial stability. At the same time, however, the persistence of parallel analytical structure such as the extraordinary administration of large enterprises highlights an incomplete unification that still challenges the internal coherence of the system. Summing up the CCII establishes a paradigm in which insolvency law no longer marks the end of corporate life but represents a phase of transition and renewal. It transforms the perception of corporate failure from a terminal condition into a phase of restructuring and renewal. This normative and cultural reorientation provides the theoretical foundation for the empirical analysis developed in the following chapter, which investigates how financial variables and firm level characteristics influence the likelihood of recovery and the sustainability of capital structures under the new crisis management analytical structure

CHAPTER 2: Methodology, Data Processing and Empirical Strategy

2.1 Data Collection and Sample Description

This research draws on a dataset of 731 Italian firms that entered Preventive Arrangement between 2014 and 2023. For these firms, complete accounting records are available for 2014–2023years, which constitutes the observation window used in the econometric models. The dataset stops at 2023, which is the last year with complete AIDA data, ensuring comparability among firm year observations. The dataset enables longitudinal tracking of firms under judicial restructuring, a feature still uncommon in Italian micro data sources. The focus on the period 2014-2023 also captures the transition from the pre reform insolvency regime to the implementation of the Codice della Crisi.

This sample size aligns with empirical standards in corporate finance research on distress and restructuring (Altman & Hotchkiss[36], 2006; Gilson[37], 1997). Although smaller than large cross-country datasets, this panel combines depth and legal homogeneity, offering an ideal setting to test firm-level hypotheses within a consistent institutional framework. Its longitudinal design, in particular, makes it possible to track the persistence of distress and potential recovery over time, a dimension that is often overlooked in static cross-sectional analyses (Shumway[38], 2001). This longitudinal perspective is consistent with prior studies that conceptualise financial distress as a dynamic process—through phases of solvency,

[36] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[37] Gilson, S. C. (1997). Transactions costs and capital structure choice: Evidence from financially distressed firms. The Journal of Finance, 52(1), 161–196. https://doi.org/10.1111/j.1540-6261.1997.tb03812.x

[38] Shumway, T. (2001). Forecasting Bankruptcy More Accurately: A Simple Hazard Model. Journal of Business, 74(1), 101-124. https://doi.org/10.1086/209665

crisis and possible rehabilitation rather than as a single event (Altman & Hotchkiss[39], 2006; Gilson[40], 1997). This temporal perspective allows the model to capture both short term shocks and medium term adjustment effects, which static cross sectional designs tend to overlook. Following Shumway's[41] (2001) approach to time dependent risk, adopting a multi year panel structure enhances predictive reliability and accounts for the persistence of distress over time.

This time frame was chosen to ensure a sufficiently long observation window that captures the evolution of corporate distress both before and after major institutional reforms in Italian insolvency law, most notably the Codice della Crisi d'Impresa e dell'Insolvenza (2019).

This legal transition marks a paradigm shift from liquidation oriented to rescue based insolvency regimes, reflecting the preventive philosophy later codified in Directive (EU) 2019/1023[42]. Including both pre and post reform firms thus allows the analysis to isolate how regulatory modernization interacts with financial behavior. The selection of this period also allows for the analysis of heterogeneous economic phases, encompassing both post crisis recovery and subsequent macro financial fluctuations. Financial and accounting information was retrieved from AIDA – Bureau van Dijk, a comprehensive and standardized database that consolidates official balance sheet data from the Italian Business Register. AIDA is widely used in academic research as a credible secondary source for empirical corporate finance analyses, ensuring consistency with international databases such as Orbis and Amadeus (Rajan & Zingales[43], 1995; Booth et al[44]., 2001). Its structure complies with the data quality requirements recommended by Wooldridge (2013), which stress the importance of standardized accounting formats for panel data modeling. AIDA provides longitudinally consistent accounts and wide firm coverage, which supports year to year comparability; for this reason it is widely used as a reference source in empirical work on

[39] Altman, E. I., & Hotchkiss, E. S. (2006). Corporate Financial Distress and Bankruptcy (3rd ed.). Hoboken, NJ: Wiley. https://doi.org/10.1002/9781118267806

[40] Gilson, S. C. (1997). Transactions costs and capital structure choice: Evidence from financially distressed firms. The Journal of Finance, 52(1), 161–196. https://doi.org/10.1111/j.1540-6261.1997.tb03812.x

[41] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

[42] European Parliament & Council of the European Union. (2019, June 20). Directive (EU) 2019/1023 on preventive restructuring frameworks, on discharge of debt and disqualifications, and on measures to increase the efficiency of restructuring, insolvency and discharge of debt, and amending Directive (EU) 2017/1132. Official Journal of the European Union, L 172, 18-55.

[43] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[44] Booth, L., Aivazian, V., Demirgüç-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320

distress. During the data import and cleaning stage, textual placeholders for missing values (such as “n.d.”, “n.s.”, and “n.a.”) were systematically converted into true NA entries to guarantee consistency in statistic and quantitative processing. The raw dataset originally structured in wide format, was reshaped into a firm–year panel, allowing each observation to represent a specific company in a given fiscal year. This panel configuration makes it possible to trace the financial trajectory of each firm over time and to distinguish between pre crisis, crisis, and post procedure periods. Two temporal benchmarks were extracted for every firm: (i) the starting year of the insolvency procedure (anno concordato), derived from the variable “Data di inizio procedura/cessazione”; and (ii) the latest available accounting year (anno ultimo bilancio). Only financial observations falling within these two temporal boundaries were retained, ensuring that the dataset captures the relevant time span surrounding the restructuring process. Firms were classified by registered office into three macro areas: North, including Lombardy, Liguria, Piedmont, Trentino Alto Adige ,Friuli Venezia Giulia, and Veneto, Center, including Tuscany, Lazio, Umbria, Marche, and Abruzzo, South and Islands, comprising all remaining Italian regions. This geographical distinction reflects the structural heterogeneity of Italy’s economic landscape, where differences in industrial specialization, infrastructure, and access to credit are known to affect firm survival and restructuring outcomes. Firms with incomplete financial statements, missing pre crisis data, or implausible accounting values in key variables (Debt/Equity, EBITDA, ROA, Financial Expenses, Total Assets) were excluded from the analysis. The resulting dataset is unbalanced as firms differ in the number of financial years available but this structure faithfully mirrors the heterogeneity of real data within AIDA and preserves the longitudinal depth necessary for robust econometric estimation. The preprocessing of financial variables follows best practices in econometric research, aiming to minimize heteroscedasticity and enhance comparability across firm sizes and sectors (Hair et al., 2019). Retaining an unbalanced panel ensures empirical realism, as it reflects the natural attrition of firms undergoing restructuring, conforming to the heterogeneity observed in distress related studies (Altman & Hotchkiss[45], 2006). The resulting dataset offers a detailed and internally consistent picture of Italian firms involved in insolvency proceedings over the past decade. Although balance sheet data may not capture off balance sheet liabilities, the rigorous selection and cleaning procedures minimize potential measurement bias. Before

[45] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

estimation, all quantitative variables were normalized to enhance comparability across firms and mitigate scale related distortions. Continuous measures (EBITDA , ROA , Oneri) were transformed using the best Normalize algorithm in R to approximate normality and stabilize variance, while the temporal dimension (Anno) was standardized through z-score transformation. To ensure data quality, observations with missing values in any key variable were excluded through listwise deletion.

This filtering process maintained a deliberate balance between statistical rigor and representativeness, only firms with a complete and coherent financial profile were retained, thus reinforcing internal validity and the reproducibility of results. In summary, the data preparation stage provides a consistent and transparent foundation for subsequent econometric modeling. The combination of profitability, leverage, and cost variables with regional and structural factors provides a full view of firm conditions. The dataset allows for a multidimensional analysis of corporate fragility within Italy's evolving insolvency landscape. In general the coherence and longitudinal depth of the dataset strengthen the credibility of the subsequent econometric analysis, allowing the results to capture genuine patterns of corporate fragility and recovery. By combining a long observation period with sectoral and regional diversity, the data make it possible to observe how financial fragility and recovery actually evolve over time. This research design ensures credible statistical outcomes and mirrors the preventive philosophy of the Codice della Crisi e dell'insolvenza (CCIII), offering insights into how firms evolve across solvency regimes under the influence of regulatory innovation.

2.1.2 Variable Definition and theoretical rationale

Preliminary data processing involved descriptive, diagnostic, and validation steps aimed at ensuring the statistical soundness of the dataset. Summary statistics and distributional analyses were first employed to assess central tendency, dispersion, and overall data coherence. Subsequently, filtering and validation procedures were applied to guarantee internal consistency across firm year observations. All computations were performed in R Studio, selected for its reproducibility, open source environment, and compatibility with structured datasets exported from AIDA and Fallco Web. The platform's integration of statistical and graphical libraries facilitated both exploratory data analysis and the subsequent implementation of econometric models.

X1 Geographical Location

Geographical disparities in institutional quality, infrastructure, and access to financial markets can substantial shape firms' financial strategies. Guiso et al[46] (2004) emphasize how regional financial development impacts corporate financing decisions. In the Italian context, companies in Northern regions often benefit from stronger industrial ecosystems and more efficient credit access compared to those in Southern regions, which may suffer from institutional inefficiencies and structural delays (Crescenzi et al., 2017). This territorial divide is also confirmed by empirical evidence from Pellegrino and Zingales[47] (2017), who document the differing performance dynamics between Northern and Southern Italian firms, highlighting how regional disparities shape the impact of debt financing on profitability during innovation cycles. In this study, the geographic variable is included as a categorical dummy coded 2 dummy variables: North (North=1, Center=0, South=0) and South/Islands (North=0, Center=0, South=1) Its inclusion controls for contextual asymmetries that influence firm behavior and financial outcomes during restructuring.

Including geographical dummies in the model therefore controls for institutional heterogeneity, allowing a more accurate interpretation of leverage behavior across regions.

Geographic heterogeneity is a well knowns and documented determinant of firm performance and access to credit. Guiso, Sapienza, and Zingales[48] (2004) highlight that local financial development strongly influences financing decisions, while Alessandrini, Presbitero, and Zazzaro[49] (2009) find that distance from financial institutions amplifies credit constraints among Southern Italian firms. Similarly, Beck, Demirgüç Kunt, and

[46] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502183

[47] Pellegrino, B., & Zingales, L. (2017). Diagnosing the Italian disease (NBER Working Paper No. 23964). https://doi.org/10.3386/w23964

[48] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? The Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502183

[49] Alessandrini, P., Presbitero, A. F., & Zazzaro, A. (2009). Banks, distances and firms' financing constraints. The Review of Finance, 13(2), 261–307. https://doi.org/10.1093/rof/rfn014

Maksimovic[50] (2005) demonstrate that regional disparities in institutional efficiency and legal enforcement shape cross country variations in leverage and recovery dynamics. The inclusion of regional dummies serves to account for long standing differences in institutional quality and access to finance between the main Italian macro areas.

X2 Return on Assets (ROA)

The Return on Assets (ROA) is introduced into the model as a central indicator of profitability, designed to capture the firm's ability to generate earnings from the total amount of resources employed. In contrast to financial fixed assets, which reflect a company's long term strategic positioning through investments in participations or bonds, ROA focuses directly on operational efficiency and the firm's capacity to transform its asset base into net income. This variable reflects short term operating efficiency and helps assess whether a firm's financial structure can remain sustainable in periods of stress. Profitability has long been recognized as a primary determinant of capital structure, with firms preferring internal financing over external borrowing when possible (Myers & Majluf[51], 1984; Frank & Goyal[52], 2009; Fama & French[53], 2002). Empirical evidence consistently shows that more profitable firms maintain lower leverage levels, confirming the inverse relationship between return on assets and debt dependence (Titman & Wessels[54], 1988). Conversely, high financial expenses amplify exposure to distress, as the marginal cost of debt outweighs its fiscal benefits. Studies such as Opler and Titman[55] (1994) and Andrade and Kaplan[56] (1998) demonstrate that excessive debt servicing costs reduce operating flexibility and accelerate

[50] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? The Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[51] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[52] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[53] Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. The Review of Financial Studies, 15(1), 1–33. https://doi.org/10.1093/rfs/15.1.1

[54] Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. The Journal of Finance, 43(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

[55] Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. The Journal of Finance, 49(3), 1015–1040. https://doi.org/10.1111/j.1540-6261.1994.tb00086.x

[56] Andrade, G., & Kaplan, S. N. (1998). How costly is financial (not economic) distress? The Journal of Finance, 53(5), 1443–1493. https://doi.org/10.1111/0022-1082.00062

equity erosion, particularly in firms facing liquidity constraints. Therefore the combination of ROA EBITDA, and financial expenses provides a multidimensional measure of financial performance linking profitability, operational efficiency, and debt burden to explain leverage behavior in distressed firms. Profitability has long been recognized as central in explaining capital structure choices. According to the pecking order hypothesis (Myers & Majluf,[57] 1984), firms prefer to finance new projects using internal resources whenever possible, resorting to debt only when retained earnings are insufficient, and turning to equity issuance as a last resort. Within this approach, more profitable companies – which accumulate a greater flow of internal funds – are less likely to rely on external borrowing. This theoretical expectation has been corroborated by an extensive body of empirical work. For example, the influential study by z covering seven major industrial economies, shows that profitability consistently exhibits a negative relationship with leverage, suggesting that profitable firms are better positioned to avoid debt accumulation. Similar evidence emerges in Booth et al[58]. (2001), who examine a wide panel of developing countries and conclude that, regardless of institutional differences, profitability remains one of the strongest and most robust determinants of capital structure.

Later contributions refine this view. Frank and Goyal[59] (2009) highlight profitability as a "core factor" in explaining leverage decisions, finding strong evidence that firms with higher ROA maintain lower levels of debt, both in large corporations and among small and medium sized enterprises. More recent literature has also emphasized the relevance of profitability in periods of financial stress. For instance, Gilson[60] (1990) demonstrates that firms with weak earnings are not only more exposed to debt overhang but also less able to manage the renegotiation of liabilities during restructuring. This means that profitability is not just a static indicator of past performance but also a forward looking measure of resilience, providing valuable insight into a company's ability to navigate financial distress.

Including ROA allows the model to connect operational results with the sustainability of capital structure decisions. This proves particularly relevant in the context of firms

[57] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[58] Booth, L., Aivazian, V., Demirgüç-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320

[59] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[60] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. Journal of Financial Economics, 27(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

undergoing restructuring, where the restoration of profitability often represents both the goal of the recovery plan and the main precondition for regaining access to credit markets. Moreover, ROA interacts with other determinants, such as firm size and asset tangibility, shaping the overall strategy adopted in response to crisis. From a methodological standpoint, the variable is measured as the ratio of net income to total assets, which allows comparability across firms with different sectoral profiles and scales of operation. This normalization is essential to ensure that the measure reflects efficiency rather than absolute magnitude. Ultimately, the inclusion of ROA strengthens the explanatory power of the model by embedding an element of dynamic performance, capable of illustrating not only how firms are positioned financially at a given moment but also their potential to sustain or improve that position in the face of external shocks. From a methodological standpoint, the model's robustness relies on well established theoretical premises linking firm value to leverage and cash flow generation capacity. Korteweg[61] (2010) empirically demonstrates that the net benefits of leverage depend on the trade off between tax advantages and distress costs, while Kaplan and Ruback[62] (1995) emphasize the role of operating cash flows as a predictor of financial resilience. Integrating these insights ensures that leverage adjustments are interpreted within a consistent approach balancing theoretical soundness and empirical validity.

X3 Financial Expenses (Oneri Finanziari)

Financial expenses represent a key indicator of the effective burden of indebtedness on a firm's operating performance. Unlike structural factors such as firm size or asset tangibility which capture potential capacity for growth or access to credit markets this variable directly reflects the short term cost of maintaining leverage and the immediate pressure exerted by debt servicing on profitability and liquidity. The inclusion of financial expenses is theoretically grounded in the Trade Off Theory, which highlights the balance between the tax benefits of debt and the costs associated with financial distress (Kraus & Litzenberger[63],

[61] Korteweg, A. (2010). The net benefits to leverage. The Journal of Finance, 65(6), 2137–2170. https://doi.org/10.1111/j.1540-6261.2010.01612.x

[62] Kaplan, S. N., & Ruback, R. S. (1995). The valuation of cash flow forecasts: An empirical analysis. The Journal of Finance, 50(4), 1059–1093. https://doi.org/10.1111/j.1540-6261.1995.tb04050.x

[63] Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. The Journal of Finance, 28(4), 911–922. https://doi.org/10.1111/j.1540-6261.1973.tb01415.x

1973). While interest deductibility generates fiscal advantages, rising financial expenses signal the tipping point where these benefits are offset by increasing default risk and reduced financial flexibility. In concrete terms, interest expenses show the actual cost firms face when borrowing funds and show when the balance between benefit and risk of debt begins to deteriorate. Empirical research consistently supports this interpretation. Gilson[64] (1990) demonstrates that firms entering bankruptcy or restructuring often exhibit unsustainable financial charges that erode operating margins and precipitate ownership or governance changes. Opler and Titman[65] (1994) further argue that high debt service requirements amplify vulnerability to external shocks, particularly in competitive industries where price pressures compress operating margins. Similarly, Andrade and Kaplan[66] (1998) show that even in the absence of economic downturns, financial distress imposes severe costs on firms, largely due to the inability to meet interest obligations rather than deteriorating fundamentals. The relevance of this variable has also been reinforced by the development of solvency indicators such as the Interest Coverage Ratio (ICR), widely adopted in both academic and credit risk analyses. A declining ICR driven by an increase in financial expenses relative to EBIT serves as an early warning of potential insolvency and shrinking negotiation capacity with creditors. In the present model, financial expenses are treated as a continuous variable, measured as the ratio of interest costs to operating revenues. This formulation ensures comparability across firms of different sizes and sectors, allowing the model to identify cases where the cost of debt servicing becomes disproportionately high relative to income generation. By integrating this variable, the analysis captures a fundamental aspect of financial fragility, complementing profitability (ROA) and other structural determinants in explaining how indebtedness evolves during crisis and recovery.

X4 EBITDA

[64] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. *Journal of Financial Economics, 27*(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

[65] Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. The Journal of Finance, 49(3), 1015–1040. https://doi.org/10.1111/j.1540-6261.1994.tb00086.x

[66] Andrade, G., & Kaplan, S. N. (1998). How costly is financial (not economic) distress? Journal of Finance, 53(5), 1443–1493. https://doi.org/10.1111/0022-1082.00062

Is incorporated into the model as a robust indicator of a firm's core operational profitability, independent of financial structure, tax context, or non cash expenses such as depreciation. As a measure of a firm's ability to generate recurring operating cash flows, EBITDA plays a critical role in evaluating financial autonomy and internal funding capacity. In restructuring scenarios, this metric becomes particularly relevant, as operational efficiency often determines survival and recovery prospects (Kaplan & Ruback[67], 1995).

Firms reporting higher EBITDA generally show healthier operations and tend to depend less on outside financing. Firms capable of sustaining cash flow through their core operations tend to be more resilient to debt pressure and better positioned to renegotiate terms or avoid excessive leverage (Fama & French[68], 2002). This interpretation is reinforced by empirical findings in the literature. For example, Frank, M.Z. & Goyal, V.K[69]. (2009) explore how leverage interacts with internal profitability in SMEs under pressure, showing EBITDA's predictive strength in stress environments. Similarly, Titman and Wessels[70] (1988) document that operational profitability remains one of the most substantial predictors of leverage across firms of varying sizes.

Therefore, EBITDA is treated as a continuous variable expressed in monetary terms (euros), included to assess the relationship between profitability and leverage in the face of crisis induced constraints. As Korteweg[71] (2010) argues, the effectiveness of restructuring hinges on the balance between creditor incentives, capital structure design, and firm specific adaptive strategies. Echoing this view, Hotchkiss [72](1995) provides an analytical framework grounded in structured financial management practices aimed at addressing the constraints faced by firms undergoing distress. In this perspective, leverage decisions can thus be interpreted as adaptive responses to financial stress. Thus the rationale behind this research is grounded in addressing a noticeable gap in the literature, while many studies have focused on default prediction or post-bankruptcy scenarios, relatively few have empirically investigated the determinants of financial leverage in firms that actively engage in pre

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[67] Kaplan, S. N., & Ruback, R. S. (1995). The valuation of cash flow forecasts: An empirical analysis. Journal of Finance, 50(4), 1059–1093. https://doi.org/10.1111/j.1540-6261.1995.tb04050.x

[68] Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. The Review of Financial Studies, 15(1), 1–33. https://doi.org/10.1093/rfs/15.1.1

[69] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[70] Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. The Journal of Finance, 43(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

[71] Korteweg, A. (2010). The net benefits to leverage. Journal of Finance, 65(3), 793–826. https://doi.org/10.1111/j.1540-6261.2010.01559.x

[72] Hotchkiss, E. S. (1995). Postbankruptcy performance and management turnover. The Journal of Finance, 50(1), 3–21. https://doi.org/10.1111/j.1540-6261.1995.tb05181.x

bankruptcy structured remedies such as the PSA. This omission is particularly striking considering the growing relevance of such procedures in Europe and Italy, where legal reforms have made these tools central to insolvency prevention strategies. By empirically investigating this underexplored area, the present research contributes to bridging a gap that previous studies have largely overlooked. To sum up the selection of these variables reflects the multidimensional nature of corporate fragility and aligns with recent efforts in the literature to move beyond static default prediction models. By focusing on firms engaged in preventive restructuring procedures, the analysis contributes to a deeper understanding of how financial performance, debt burden, and contextual factors jointly determine leverage dynamics in the pre bankruptcy phase.

2.2 Research Hypotheses and Expected Relationships

The discussion above helps explain how firms adapt their financing strategies when uncertainty increases or early signs of distress appear. Both models emphasize that capital structure adjustments result from a complex interplay between internal profitability, the cost of external financing, and the institutional constraints surrounding access to credit markets. On this conceptual ground the analysis now moves toward measurable relationships that can verify whether those theoretical expectations hold in real data. In this context, the formulation of research hypotheses allows the study to bridge the gap between theory and empirical analysis, identifying how the main determinants proposed by capital structure theories manifest within firms undergoing preventive arrangement procedures. The aim is to verify whether the traditional assumptions of the Trade Off and Pecking Order approaches remain valid when firms operate under the financial and institutional constraints imposed by distress and insolvency reforms. These hypotheses are grounded in the well known Trade Off and Pecking Order theories, which still provide a useful approaches for understanding how firms in difficulty adjust their financial choices. Although conceptually distinct both approaches converge on the notion that a firm’s capital structure reflects a balance between profitability, the cost of debt, and access to external financing dimensions that become particularly critical in times of financial distress. Within this study these theories serve as the conceptual foundation for examining how Italian firms undergoing preventive agreement procedures adjust their leverage while operating within a reformed insolvency environment.

From this reasoning emerge four working hypotheses, each reflecting a different aspect of how firms react to crisis profitability, cost of debt, time, and geography.

The hypoteses are the following, profitability and leverage H1: Among firms undergoing settlement agreements, higher profitability (EBITDA) is associated with lower leverage, indicating a more balanced and sustainable capital structure.

Financial burden and distress H2: Higher Financial expenses are associated with higher D/E ratio exacerbating financial distress.

Time and adjustment dynamics H3: Temporal factors are expected to improve the sustainability of firms' capital structure under crisis conditions, producing a gradual reduction in leverage over time.

Regional heterogeneity H4: Firms operating in regions with stronger institutions and more developed financial infrastructures tend to maintain more balanced capital structures, whereas those in peripheral areas face higher leverage and greater fragility. Viewed together, these hypotheses describe how profitability, financial pressure, and territorial context jointly influence leverage decisions in times of distress. Hence such firms face greater pressure to restructure their debt in order to restore financial viability, by explicitly grounding these hypotheses in a multidimensional methodological model, and by anchoring the study in the unique characteristics of the Italian restructuring ecosystem, this research contributes original insight to a poorly explored area of corporate finance. Building on the theoretical propositions developed in the previous section, the following empirical approaches operationalizes these relationships through a multi stage econometric design aimed at testing how profitability, financial burden, and contextual factors affect firms' leverage decisions under distress. The aim is less to produce perfect predictions than to understand the structure of the reaction firms adopt when financial distress unfolds, the reasoning developed so far provides the foundation for the first research hypothesis (H1). The underlying idea is that firm specific financial features are not neutral in times of restructuring but rather play a decisive role in shaping capital structure outcomes. Particular emphasis is placed on the composition of assets, on profitability captured both by operating performance indicators such as EBITDA and by broader efficiency measures like Return on Assets (ROA) and on the weight of financial expenses relative to revenues, which reflects the actual burden of debt servicing. These variables occupy a central role in corporate finance studies because they highlight how firms under pressure manage to generate internal liquidity, meet their financial obligations, and preserve operational continuity. Among these, financial expenses stand out

as one of the clearest indicators of distress, when debt servicing costs rise, the firm's leverage typically increases, amplifying exposure to financial fragility.

Hence, the second hypothesis (H2) assumes that a higher incidence of financial expenses corresponds to a higher debt to equity ratio, reflecting a heavier reliance on external financing and a reduced capacity for self financing. Building on this premise, the third hypothesis (H3) shifts the focus to the temporal dimension of financial adjustment. Within preventive settlement models, the passage of time may embody both institutional learning effects as firms and creditors internalize the new principles introduced by the Codice della Crisi d'Impresa e dell'Insolvenza (2019) and managerial adaptation processes, through which firms progressively renegotiate liabilities, rebalance their capital structure, or restore profitability. Prior evidence from the restructuring literature suggests that firms observed over longer time horizons tend to display improved leverage conditions, either by reducing indebtedness or by reinforcing internal capital (Altman & Hotchkiss[73], 2006; Gilson[74], 1997). As a result H3 posits that temporal factors exert a stabilizing influence on corporate capital structures under distress. Over time, the interaction between managerial choices, creditor negotiations, and institutional mechanisms is expected to mitigate fragility and promote a gradual convergence toward financial equilibrium. To assess this relationship, a time trend variable (Anno t) is introduced into the regression models. This variable allows the analysis to capture whether leverage evolves toward recovery or persists in imbalance. A negative and essential coefficient would indicate that financial vulnerability declines over time, providing empirical evidence that the preventive approach of the Italian insolvency reform produces measurable stabilization effects. The investigation of temporal patterns complements the previous hypotheses, moving beyond firm specific characteristics such as profitability and financial burden toward a broader dynamic understanding of how restructuring outcomes unfold over time. This perspective anchors the empirical analysis in the institutional logic of the Italian insolvency system, where the duration and persistence of adjustment efforts often determine the likelihood of recovery. The empirical analysis draws on a consolidated dataset combining information from the AIDA Bureau van Dijk database, one of the most authoritative and widely used sources in corporate finance research. These data ensure both legal and financial consistency across firms, minimizing noise and

[73] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[74] Gilson, S. C. (1997). Transactions costs and capital structure choice: Evidence from financially distressed firms. The Journal of Finance, 52(1), 161–196. https://doi.org/10.1111/j.1540-6261.1997.tb03812.x

discrepancies that often affect studies on distressed companies. Unlike datasets typically employed in Anglo American research, AIDA offers classification criteria that align with the Italian legal approach, guaranteeing greater comparability and institutional coherence. The sample includes firms that entered Preventive Arrangement procedures between 2013 and 2023, a period that captures the long lasting repercussions of the 2008 financial crisis and the gradual transition toward the reformed insolvency regime codified in 2019. This temporal window provides a balanced view of pre and post reform dynamics, making it particularly suitable for assessing the evolution of leverage and the stabilizing capacity of Italian restructuring mechanisms.

These years marked a paradigmatic shift in how capital structures were managed under the pressure of legal and creditor renegotiation mechanisms. Crucially, firms that underwent liquidation, merger, or dissolution during the observed period were excluded. This was necessary to ensure consistency in financial trajectories, as such events introduce discontinuities incompatible with comparative leverage analysis. The final dataset is skewed toward medium and large enterprises, reflecting the structure of commercial databases, which often underrepresent micro and small firms. While this limits direct generalization to Small Medium Enterprises, it enhances the robustness of the statistical models employed. The research is built upon a systematic selection of Italian companies that have formally entered into preventive settlement procedures over a ten year period. These firms were identified using primary data sources such as AIDA Bureau van Dijk and Fallco Web, filtered to ensure consistency and completeness of accounting records. This methodological approach designed to address the central research question, to what extent do financial variables such as profitability (EBITDA and ROA), financial burden (financial expenses), and asset composition influence corporate leverage and the likelihood of overcoming financial distress.

Research questions

Capital-structure dynamics: How do Italian companies in settlement agreements adjust their capital structure once distress is formalised? What share of firms manages to rebuild positive equity instead of continuing to deteriorate?

Determinants of leverage in distress: What are the main financial and structural determinants of capital structure in these firms (profitability, financial expenses, time, geography, firm size)?

Profitability under severe distress: Do traditional profitability measures, such as EBITDA and ROA, still retain explanatory power in contexts of severe financial distress?

Role of non-linear models: Does the use of non-linear models, specifically Random Forest, enhance the explanatory and predictive capacity compared with traditional regression models?

To what extent do financial variables such as profitability (EBITDA and ROA), financial burden (financial expenses), and asset composition influence corporate leverage and the likelihood of overcoming financial distress.As extensively examined by Baharin and Sentosa (2024) in their study on capital structure determinants among Malaysian firms, which similarly emphasize profitability and asset composition as key drivers, and geographical location affect leverage choices made during restructuring phases under legal constraint.

Following the foundational work of Altman[75] (1968), which emphasizes the role of financial indicators such as leverage, liquidity, and profitability ratios in forecasting bankruptcy among small and medium sized enterprises, this study extends the empirical scope to firms undergoing formal restructuring procedures. The inclusion of geographical variables follows the empirical findings of Beck, Demirgüç Kunt, and Maksimovic[76] (2005), who demonstrate how regional disparities in financial development and institutional access meaningful influence firms' recovery trajectories and capital structure dynamics. These perspectives are particularly pertinent in the Italian setting, where economic asymmetries between macro areas strongly condition financial behavior.

The legal tool of the preventive settlement agreement, highlighted as a strategic instrument by Wruck [77](1990) in her study on financial distress and reorganization, serves not only as a procedural solution but also as a context within which firms redefine their financial architecture. This view is further corroborated by Gilson[78] (1990), who illustrates how distressed firms adopt a combination of legal and financial mechanisms to navigate through restructuring in resource constrained environments.

H1 Operating Profitability (EBITDA) and Leverage

[75] Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. Journal of Finance, 23(4), 589–609. https://doi.org/10.2307/2978933

[76] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[77] Wruck, K. H. (1990). Financial distress, reorganization, and organizational efficiency. Journal of Financial Economics, 27(2), 419–444. https://doi.org/10.1016/0304-405X(90)90063-6

[78] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. Journal of Financial Economics, 27(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

A negative relationship is expected between EBITDA and the Debt to Equity ratio. Firms with stronger operating performance tend to rely less on external borrowing, as internally generated funds provide a self financing mechanism that reduces dependence on debt markets. This dynamic is in accordance with the Pecking Order Theory, according to which firms prefer to finance new investments through retained earnings before resorting to debt or equity issuance. In distressed contexts, solid operating margins not only improve liquidity but also enhance credibility with creditors and other stakeholders, signalling a higher likelihood of recovery and longvterm viability.

H2 Financial Expenses and Capital Structure Sustainability

Financial expenses, measured as the ratio of interest costs to operating revenues, represent the immediate burden of debt servicing on firm performance. Within the Trade Off Theory, this variable captures the point at which the fiscal advantages of debt are outweighed by the escalating costs of financial distress. As interest obligations rise, firms experience liquidity pressure, reduced flexibility, and increased exposure to default risk. Practically speaking, financial expenses function as an indicator of both the quantitative and qualitative dimensions of leverage sustainability

H3 Temporal Dynamics and Adjustment Processes

The third hypothesis examines how the duration of restructuring processes influences the evolution of firms' leverage profiles. Rather than considering time as a simple chronological measure, it is interpreted as an indicator of gradual adjustment and institutional consolidation. In the context of preventive settlements, longer observation horizons may reflect the combined effects of regulatory assimilation through which firms and creditors adapt to newly introduced insolvency practices and organisational learning, as management progressively improves financial discipline and operational control. Previous empirical studies suggest that firms able to persist over extended restructuring periods often achieve more stable financial configurations, either by reducing debt exposure, strengthening equity,

or restoring profitability (Altman & Hotchkiss[79], 2006; Gilson[80], 1997). For this reason this hypothesis assumes that extended time frames contribute to the progressive realignment of capital structures, fostering a slow but measurable transition toward financial balance and resilience. Considered collectively, the hypotheses offer a multidimensional analytical basis for exploring how distressed firms manage and adjust their leverage positions. By integrating firm specific characteristics (profitability and financial burden) with temporal and contextual dimensions, the study captures both microeconomic determinants and structural influences on financial adaptation.

The next section, these hypotheses into econometric form, outlining the dataset structure, variable coding, and model design adopted for empirical testing.

H4 Geographical Context The fourth hypothesis explores how spatial and institutional heterogeneity influences firms' leverage behaviour under distress conditions. Within the Italian context, regional disparities in infrastructure, institutional quality, and credit market development have long shaped firms' access to external financing and their ability to sustain balanced capital structures. The persistence of a North–South divide in economic performance, financial intermediation, and legal enforcement creates structurally asymmetric conditions that affect the way companies manage debt and equity during restructuring processes. Empirical evidence consistently supports this interpretation. Beck et al[81]. (2005) demonstrate that differences in institutional development and credit market efficiency generate momentous of cross country variation in firms' capital structures, while Rajan and Zingales[82] (1998) highlight that financial system depth and legal framework models are key determinants of leverage behaviour. More specifically, within the Italian setting, Guiso, Sapienza, and Zingales[83] (2004) and Alessandrini, Presbitero, and Zazzaro[84] (2009) document that regional asymmetries in financial development and institutional quality translate into unequal borrowing conditions for firms. Companies located in Northern

[79] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[80] Gilson, S. C. (1997). Transactions costs and capital structure choice: Evidence from financially distressed firms. The Journal of Finance, 52(1), 161–196. https://doi.org/10.1111/j.1540-6261.1997.tb03812.x

[81] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[82] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[83] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502183

[84] Alessandrini, P., Presbitero, A. F., & Zazzaro, A. (2009). Banks, distances and firms' financing constraints. Review of Finance, 13(2), 261–307. https://doi.org/10.1093/rof/rfn014

regions typically benefit from more efficient credit markets, denser banking networks, and stronger institutional support, while those in Southern areas face greater informational frictions, weaker enforcement mechanisms, and higher financing costs. Building upon these findings, the fourth hypothesis postulates that spatial context functions as a structural determinant of financial fragility. Regions characterized by advanced institutional frameworks and efficient financial infrastructures are expected to foster more sustainable leverage levels, whereas firms operating in peripheral or less developed areas are more likely to exhibit higher debt burdens and a greater probability of equity erosion.

2.3 Empirical strategy: Model specification and econometric design

Testing for statistical significance helps to check whether observed effects are genuine or simply the result of random noise. In the specific context of firms under restructuring, the rigorous testing of financial and operational predictors is essential for drawing trustworthy and actionable conclusions. This section outlines the methodological framework of the study, describes the statistical criteria employed to assess significance (e.g, p-values, R-squared, F-statistics), and presents the rationale for adopting Multiple Linear Regression (MLR) as the primary analytical tool. Multiple Linear Regression (MLR) was selected because it offers both robustness and transparency, and it is widely accepted in international corporate finance research. This methodological choice was particularly suited to the objectives of this research, as it allows an interpretable estimation of firm level determinants of leverage within a legally homogeneous environment such as the Italian preventive arrangement. Following the Trade Off and Pecking Order frameworks discussed earlier, the model jointly captures the balance between profitability, debt cost, and access to credit, which remain central to explaining leverage behavior in distress environments. Through MLR, I estimated the combined effect of variables such as EBITDA, financial expenses, and regional location on firms' leverage, (EBITDA, number of employees, and geographical location) on the dependent variable, the Debt/Equity ratio. Following the Trade Off and Pecking Order perspectives previously outlined, the model captures how profitability, debt cost, and access to credit jointly determine leverage outcomes under distress. As emphasized

by Booth et al.[85] (2001) and Rajan and Zingales[86] (1995), the multifactorial nature of capital structure decisions becomes even more critical under financial distress, particularly in diverse institutional environments. Gilson[87] (1997) further underscores that firm specific and macroeconomic conditions interact to shape restructuring trajectories, making multivariate analysis indispensable. The scientific community widely recognizes the methodological validity of MLR for identifying statistically keys predictors of leverage and financial vulnerability. Frank and Goyal[88] (2009) demonstrate that variables such as profitability, firm size, and asset tangibility repeatedly emerge as essential across models, thus reinforcing the empirical reliability of MLR in corporate finance. Similarly, Titman and Wessels[89] (1988) highlight the importance of carefully selected variables over simplistic proxies, advocating for models grounded in empirical evidence. Complementarily, Altman and Hotchkiss[90] (2006) emphasize the strategic importance of quantitative methods in early detection of financial distress, positioning MLR as a critical tool for both researchers and practitioners. In light of these contributions, MLR is not merely a methodological convenience but a scientifically validated framework capable of capturing the complexity of capital structure decisions in distressed contexts. While non linear models such as machine learning algorithms can reveal hidden patterns, MLR retains a key advantage in interpretability, which makes it especially suitable for theory driven analysis strong explanatory power and interpretability qualities essential for policy making and financial diagnostics. Flannery & Rangan (2006)[91]The statistical significance of each parameter within the MLR model is assessed using the following criteria. P-value, Reflects the probability that the relationship observed in the data has occurred by chance. Typically, a threshold of 0.05 is used for significance, and values below this indicate that the predictor contributes meaningfully to the model.

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[85] Booth, L., Aivazian, V., Demirgüç-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320

[86] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[87] Gilson, S. C. (1997). Transactions costs and capital structure choice: Evidence from financially distressed firms. The Journal of Finance, 52(1), 161–196. https://doi.org/10.1111/j.1540-6261.1997.tb03812.x

[88] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[89] Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. The Journal of Finance, 43(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

[90] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[91] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

R-squared and Adjusted R-squared, Measure the proportion of variance in the dependent variable explained by the model. Adjusted R-squared is particularly valuable in multivariate settings, as it accounts for the number of predictors.

2.3.2 Empirical Strategy: Variable Selection and Model Specification

An earlier and foundational contribution to this methodological framework is represented by FitzPatrick and Ogden ( ), whose work The Detection and Dynamics of Financial Distress laid the empirical foundations for identifying corporate vulnerability.

They emphasized how statistically derived financial indicators could detect the early stages of financial imbalance and impending failure, long before crisis becomes visible through operational breakdown. In defining the explanatory model, each variable has been selected for its relevance in academic research and its empirical significance in the context of financial restructuring. The Debt/Equity ratio is used as a proxy for capital structure tension, xonforming to its established role in measuring leverage and financial fragility, particularly during periods of corporate distress (Booth et al[92]., 2001). Its use has been widely validated in both cross country studies and firm level analyses. EBITDA, as a proxy for operational profitability, captures the internal earning capacity of firms and is particularly relevant in contexts of limited external financing. Kaplan and Ruback[93] (1995) provide a foundational framework for EBITDA's role in firm valuation and restructuring, showing its predictive capacity in distressed asset scenarios. More recently, Kayo and Kimura[94] (2011) demonstrated how profitability indicators like EBITDA correlate inversely with leverage, supporting the trade off hypothesis in capital structure theory.

Financial Expenses: Empirical studies have found that interest expenses are significantly associated with higher default probability, especially when they erode the stability of cash

[92] Booth, L., Aivazian, V., Demirgüç-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320

[93] Kaplan, S. N., & Ruback, R. S. (1995). The valuation of cash flow forecasts: An empirical analysis. Journal of Finance, 50(4), 1059–1093. https://doi.org/10.1111/j.1540-6261.1995.tb04050.x

[94] Kayo, E. K., & Kimura, H. (2011). Hierarchical determinants of capital structure. Journal of Banking & Finance, 35(2), 358–371. https://doi.org/10.1016/j.jbankfin.2010.08.015

flows. For instance, Bräuning, Joaquim, & Stein[95] (2023) show that increased interest expenses following monetary policy tightening raise firm distress risks via deteriorated interest coverage ratios. Similarly, in "A Proposed Corporate Distress and Recovery Prediction" (Figlioli et al., 2022[96]), financial burden from interest expenses is a component in predicting whether a firm will recover after entering distress. Also, among Pakistani firms, Waqas[97] (2018) includes variables related to interest or financial charges in models that predict financial distress, finding that firms with heavy financial expense loads are less likely to survive financial crises. Thus, in models of firm restructuring or preventive composition, financial expenses capture not just past obligations but constraints on future flexibility, high financing costs can hinder recovery, reduce investments, and limit the credibility of turnaround plans. They are a central explanatory variable when one assesses whether a firm can overcome a crisis.

Geographical Location is introduced not merely as a control variable, but as a critical structural moderator. Spatial disparities in infrastructure specially in Italy, institutional quality and credit availability play a decisive role in firm performance and access to restructuring resources. Iammarino et al[98]2019) further stress how persistent regional asymmetries in Italy contribute to divergence in leverage strategies and recovery capacity, especially between the North and South. This combination of variables enables a multidimensional analysis of the determinants of capital structure among distressed firms, aligning statistical rigor with conceptual coherence.

To operationalize this multidimensional setting the study introduces geographical classification as a categorical variable in both the linear regression and machine learning components. The linear model offers insights into average effects yet acknowledges its limitations in capturing non linearities and threshold phenomena. To overcome these limits the Random Forest regressor is implemented initially using KNIME, a visual analytics platform that ensures transparent workflow configuration and methodological

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[95] Bräuning, F., Joaquim, G., & Stein, H. (2023). *Interest expenses, coverage ratio, and firm distress* (Current Policy Perspectives Paper No. 96664). Federal Reserve Bank of Boston. SSRN: https://ssrn.com/abstract=4558413

[96] Figlioli, B., Ciampi, F., Cucinelli, D., & Giannotti, C. (2022). A proposed corporate distress and recovery prediction model: Evidence from Italy. Journal of Risk and Financial Management, 15(5), 215. https://doi.org/10.3390/jrfm15050215

[97] Waqas, H., & Md-Rus, R. (2018). Predicting financial distress: Importance of accounting and firm-specific market variables for Pakistan's listed firms. Cogent Economics & Finance, 6(1), Article 1545739. https://doi.org/10.1080/23322039.2018.1545739

[98] Iammarino, S., Rodríguez-Pose, A., & Storper, M. (2019). Regional inequality in Europe: Evidence, theory and policy implications. Journal of Economic Geography, 19(2), 273–298. https://doi.org/10.1093/jeg/lby021

reproducibility and later also with the use of Rstudio software. Lessmann et al[99] demonstrate that Random Forest models outperform traditional predictive algorithms in financial distress contexts by handling multicollinearity and latent interactions. Li and co authors also support its use for heterogeneous pattern recognition in capital structure modeling. By applying this layered approach the study investigates how firm level indicators interact with structural and territorial features to shape leverage outcomes among firms under restructuring.

2.3.3 Model Design and Econometric Specification

Building upon the data preparation described in the previous section, this study develops an empirical strategy aimed at identifying the determinants of financial leverage among Italian firms that entered preventive arrangement proceedings between 2014 and 2023. The analysis combines the methodological rigor of traditional econometrics with recent advances in data validation and model robustness assessment, creating a multi stage framework capable of capturing both the linear and non linear dynamics of financial distress. The analytical core of this framework relies on Multiple Linear Regression (MLR), selected as the main econometric instrument. MLR remains one of the most robust and interpretable econometric tools in corporate finance research, as it enables simultaneous estimation of how multiple independent variables such as profitability, financial burden, and regional heterogeneity affect a firm's capital structure. Its inferential transparency and statistical tractability make it particularly suited for hypothesis testing, policy interpretation, and crossectional comparability. The present study applies MLR to quantify the marginal effects of operational profitability (EBITDA), overall efficiency (ROA), on leverage levels, while controlling for territorial and temporal variations that may influence restructuring outcomes. The theoretical justification for this choice is rooted in a long tradition of research that has progressively refined the empirical modeling of corporate distress. Early quantitative approaches pioneered by Altman[100] (1968) through discriminant analysis and later formalized by Ohlson

[99] Lessmann, S., Baesens, B., Seow, H.-V., & Thomas, L. C. (2015). Benchmarking state-of-the-art classification algorithms for credit scoring: An update of research. European Journal of Operational Research, 247(1), 124–136. https://doi.org/10.1016/j.ejor.2015.05.030

[100] Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. Journal of Finance, 23(4), 589–609. https://doi.org/10.2307/2978933

(1980) with logistic regression demonstrated that financial failure can be predicted using a limited set of accounting indicators, primarily profitability, liquidity, and leverage. These models gradually evolved into multivariate frameworks, incorporating macroeconomic volatility and firm level heterogeneity. As Gilson, John, and Lang[101] (1990) argued, financial distress should not be reduced to a legal status but understood as a managerial and financial process shaped by governance structures, creditor coordination, and institutional settings. Parallel advances in capital structure theory most notably by Modigliani and Miller [102](1958), Myers[103] (1984), and Rajan and Zingales [104](1995) provided a broader conceptual foundation for understanding how firms decide between debt and equity financing. Profitability, asset tangibility, taxation, and information asymmetry were progressively recognized as key explanatory dimensions, later reinforced by large scale empirical studies such as Booth et al[105]. (2001) and Frank and Goyal[106] (2009), which confirmed the stability of leverage determinants across diverse institutional frameworks. In more recent years, Altman[107] and Hotchkiss [108](2006) and Hotchkiss et al. (2020) expanded this analytical perspective to include macroeconomic shocks and regulatory shifts demonstrating that the success of restructuring initiatives depends not only on internal financial performance but also on the institutional design of insolvency systems. Within this evolving research landscape, the empirical model adopted here seeks to bridge classical econometric analysis and machine learning validation. The first ensures theoretical consistency and interpretability, while the second introduces adaptive flexibility to detect complex, non linear patterns in the data that conventional methods might overlook. Combining regression and machine learning methods adds depth to the analysis without losing interpretability, reflecting the complexity of how financial distress actually develops within firms.

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[101] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. *Journal of Financial Economics, 27*(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

[102] Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. The American Economic Review, 48(3), 261–297. http://www.jstor.org/stable/1809766

[103] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[104] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[105] Booth, L., Aivazian, V., Demirgüç-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320

[106] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[107] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[108]

2.3.4 Econometric Specification and Stages of Analysis

The empirical framework developed in this study unfolds through a sequence of interconnected stages, each designed to explore a specific dimension of financial fragility. The underlying premise is that corporate distress rarely materializes as a sudden event; rather, it emerges progressively, as firms drift from balance to imbalance and, in some cases, regain stability through restructuring. To capture this evolving trajectory, the analysis progresses through three main stages, first, identifying the early conditions that anticipate the erosion of equity; second, examining how leverage behaves once companies move across different financial states (Step 2A and Step 2B); and finally, testing the robustness of these findings through a non linear validation phase.

This multi stage design allows the analysis to trace the transition from solvency to distress and back to recovery, aligning the empirical investigation with the study's central hypotheses. In doing so, it provides a dynamic testing environment for assessing how profitability, financial burden, and temporal factors jointly influence leverage decisions under crisis conditions. The empirical framework unfolds across three interconnected stages designed to capture the evolution of firms from solvency to distress and, in some cases, recovery. Each stage progressively increases analytical depth from identifying early warning signals to modelling leverage behaviour and validating results through non linear analysis.

Step 1 – Logistic Model: Probability of Negative Equity

The first stage investigates the initial transition from solvency to fragility, focusing on the likelihood that a firm's equity becomes negative in a given year. A logistic regression model is applied where the dependent variable takes value 1 when equity is negative and 0 otherwise. Explanatory variables include profitability (measured by EBITDA and ROA),

financial expenses, regional dummies, and year effects that account for macroeconomic variations. This specification follows the probabilistic approach pioneered by Altman [109](1968) and Ohlson (1980), later refined by Shumway[110] (2001), who demonstrated how accounting indicators could anticipate the deterioration of solvency. Unlike classical discriminant analysis, the logit framework allows for non linear relationships and probabilistic interpretation, identifying the conditions under which firms begin to lose their equity buffer. The outcome of this step is not an estimate of leverage intensity but a diagnostic reading of fragility, highlighting which dimensions profitability, cost of debt, or geographical context most clearly signal the boundary between financial balance and distress.

Having identified the probability of distress, the second stage turns to firms that remain solvent. Here, leverage is treated as a continuous variable, expressed through the Debt to Equity ratio, in order to evaluate how operational profitability, financial burden, regional heterogeneity, and time influence capital structure choices when equity is still positive. For these firms, debt remains largely a matter of strategy rather than survival. Profitability is expected to play a stabilizing role, as firms with strong internal cash generation tend to rely less on external borrowing, in accordance the Pecking Order Theory (Myers & Majluf[111], 1984). Conversely, financial expenses operate as a disciplining force, while a balanced level of leverage can support expansion, an excessive debt burden swiftly erodes managerial flexibility and heightens financial exposure. Including geographical dummies makes it possible to control for regional disparities in credit access and institutional efficiency, which are known to affect corporate financing behaviour in Italy (Beck et al[112]., 2005; Alessandrini et al[113]., 2009). This specification allows the analysis to capture the determinants of leverage under conditions of stability, revealing how firms weigh profitability against financing costs when they are still able to act proactively rather than reactively.

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[109] Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. Journal of Finance, 23(4), 589–609. https://doi.org/10.2307/2978933

[110] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

[111] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[112] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[113] Alessandrini, P., Presbitero, A. F., & Zazzaro, A. (2009). Banks, distances and firms' financing constraints. Review of Finance, 13(2), 261–307. https://doi.org/10.1093/rof/rfn014

Step 2A – Regression for Firms with positive Equity

Having identified the determinants of distress onset the second step focuses on firms that remain solvent. Now the Debt to Equity ratio is modelled as a continuous measure of leverage allowing the estimation of how profitability, financial burden, and regional heterogeneity influence capital structure choices when equity is still positive. This stage continues to address H1, H2, H3 and H4, testing whether internal profitability contributes to maintaining financial stability and whether rising financial expenses intensify leverage pressure. Profitability is expected to exert a stabilizing effect, as firms with stronger operating margins are better able to rely on internal funds and reduce dependence on external borrowing. In opposition, the weight of financial expenses imposes limits on flexibility, as persistent debt servicing obligations may erode cash flow and threaten the firm's solvency position. The inclusion of geographical controls allows the model to account for regional disparities in institutional quality and credit access, which are known to shape financing decisions in Italy (Beck et al[114]., 2005; Alessandrini et al[115]., 2009). This specification captures the determinants of leverage under conditions of relative stability, illustrating how firms balance profitability and debt sustainability before entering financial distress.

Step 2B – Step with negative equity

The last analytical stage focuses exclusively on firms already operating with negative equity, where the Debt to Equity ratio no longer represents a deliberate financing decision but a symptom of imbalance. Its absolute value reflects the severity of capital erosion and thus the depth of financial distress. This model primarily tests H1 to H4, analyzing how the cost of debt and the passage of time influence the persistence of distress. Conforming to Gilson[116]

[114] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[115] Alessandrini, P., Presbitero, A. F., & Zazzaro, A. (2009). Banks, distances and firms' financing constraints. Review of Finance, 13(2), 261–307. https://doi.org/10.1093/rof/rfn014

[116] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. Journal of Financial Economics, 27(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

(1990) and Altman & Hotchkiss[117] (2006), profitability often loses explanatory strength once the equity base has been eroded, while debt servicing costs remain central to determining whether firms move toward recovery or further insolvency. The inclusion of temporal effects enables the identification of adjustment patterns such as recapitalization, restructuring, or continued deterioration while regional variables capture institutional asymmetries that condition the speed and success of these adjustments (Crystal & Mokal, 2004). Step 2B therefore complements Step 2A by revealing the contrasting behavours of leverage once the solvency threshold has been crossed, completing the picture of how firms evolve through different stages of financial fragility. This two stage design probability of negative equity and linear leverage estimation provides a consistent framework for testing the hypotheses. The next section presents descriptive statistics and diagnostic checks. The next pages I will presents the descriptive statistics and diagnostic checks that verify the reliability and internal coherence of the dataset prior to regression estimation.

2.4.5 Descriptive Statistics and Diagnostic Checks

Descriptive statistics represent a fundamental stage in empirical research offering the first analytical insight into the structure, variability, and coherence of the dataset. As observed by Hair et al. (2019), a solid empirical investigation begins with the systematic exploration of data distribution, as this determines the reliability and interpretability of any subsequent inferential modelling. As noted by Shumway[118] (2001) and Campbell, Hilscher, and Szilagyi (2008), corporate distress datasets tend to display non normal distributions, with financial ratios exhibiting long right tails that reflect the accumulation of debt or negative earnings in the years preceding default. These properties make the descriptive phase not only a procedural formality but also a key interpretive moment to understand the dynamics of fragility before statistical modelling.

Total number of unique firms	731

[117] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[118] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

Firms included in filtered sample (complete data)	514
Total firm year observations	2,666
Observations with D/E 0	1,564
Observations with D/E < 0	1,102

Note:Table 2.1 The sample includes 514 Italian firms under preventive settlement procedures (2013–2023), yielding 2,666 firm year observations 1,564 with positive leverage (D/E > 0) and 1,102 with negative equity (D/E < 0).

The dataset comprises Italian firms that entered preventive settlement procedures between 2014 and 2023. The total initial sample includes 731 firms, of which 514 provided complete financial records suitable for longitudinal analysis. This corresponds to 2,666 firm year observations, distinguishing between 1,564 cases with positive leverage (D/E > 0) and 1,102 with negative equity (D/E < 0). The filtered sample ensures data consistency and continuity across the pre and post restructuring period. Observations reporting a debt to equity ratio equal to zero were excluded from the regression analyses. This methodological choice stems from both theoretical and statistical considerations. From an analytical standpoint, a D/E value of zero implies either the complete absence of financial debt or a purely equity based structure, which prevents the ratio from capturing any meaningful variation in leverage behaviour. Including such cases would artificially compress the variance of the dependent variable and bias the estimation of parameters related to financial burden and profitability. Conceptually, firms with no recorded debt are not exposed to the same trade offs between financial cost and solvency that characterize the population under investigation namely, companies navigating restructuring or distress conditions. Their inclusion would therefore blur the distinction between active leverage management and the structural absence of indebtedness, undermining the interpretative value of the model. In keeping with prior empirical research (Altman & Hotchkiss[119], 2006; Shumway[120], 2001; Campbell et al., 2008), the sample was thus restricted to firms exhibiting positive or negative leverage positions to ensure robustness and theoretical alignment.

[119] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

[120] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

In accordance with this rationale, the descriptive analysis that follows focuses exclusively on firms actively engaged in leverage dynamics, thereby providing a clearer representation of the mechanisms underlying financial adjustment and capital structure evolution under distress. Observations with a debt to equity ratio equal to zero were excluded to maintain theoretical and statistical consistency. This follows prior empirical studies on capital structure and financial distress (Altman, 1968; Shumway[121], 2001; Fama & French[122], 2002; Frank & Goyal[123], 2009; Wooldridge, 2013), which similarly limit samples to firms with active leverage positions. Following the methodological recommendations of Wooldridge (2013) and Gujarati and Porter (2009), firms were retained only when complete accounting information was available for at least two consecutive years both before and after the restructuring procedure. This design ensures temporal continuity and mitigates biases related to unbalanced reporting. Companies that underwent liquidation or merger were excluded to prevent discontinuities that could distort leverage dynamics. The final dataset, built from AIDA Bureau van Dijk sources, provides a trustworthy longitudinal panel capable of capturing the evolution of capital structure within distressed environments. Each observation includes data spanning the years before and after the insolvency filing, thereby capturing both the antecedents and consequences of financial distress. Continuous variables were normalized and standardized using the best Normalize and scale transformations in R to reduce heteroscedasticity and enhance comparability across firms of different sizes. Missing or inconsistent observations were removed through listwise deletion (na.omit), following the methodological guidance of Hair et al. (2019), while outliers were retained to preserve the variability that typically characterizes financial distress contexts.

Variable	Mean	Median	Standard Deviation	Max	Min
Debt to Equity (DE)	2.69	0.23	30.81	913.91	-513.10
Year (Anno)	2018.92	2019.00	2.56	2024.00	2014.00
EBITDA (€)	622.37	27.43	9,172.69	326,952.25	-72,034.34

[121] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

[122] Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. The Review of Financial Studies, 15(1), 1–33. https://doi.org/10.1093/rfs/15.1.1

[123] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

Return on Assets (ROA)	-4.68	-0.53	39.57	983.35	-368.91
Financial Expenses (Oneri)	5.46	0.96	13.08	100.00	0.00

Table 2.2 – Descriptive statistics for the main financial variables used in the empirical analysis.

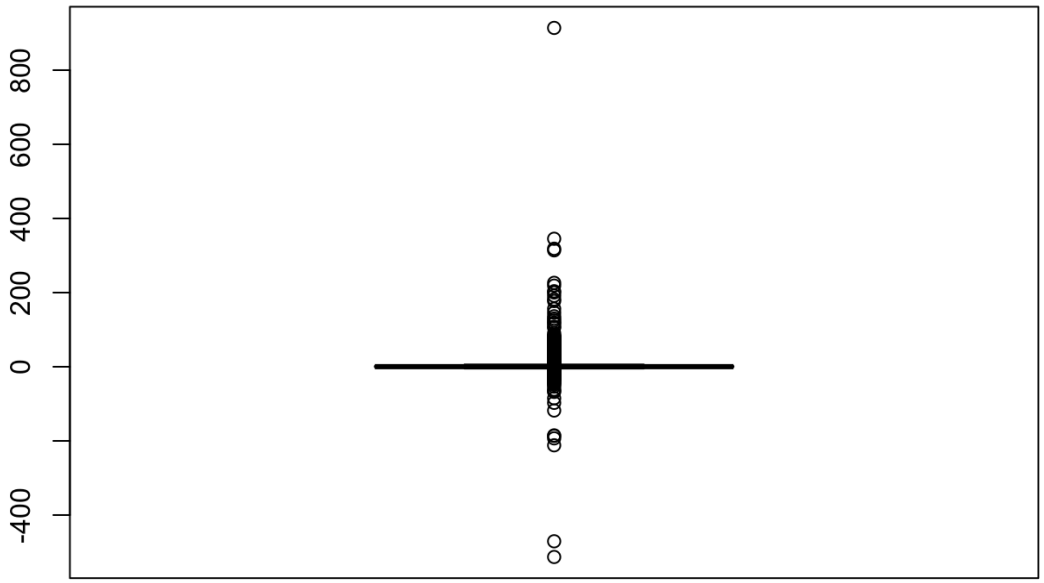
The coexistence of both positive and negative equity observations, together with the broad dispersion in profitability and financial expenses, confirms that the dataset effectively captures firms situated at different stages along the distress–recovery continuum. This multidimensional heterogeneity provides a solid rationale for adopting an econometric strategy capable of distinguishing among solvency, fragility and deep imbalance. Such heterogeneity justifies adopting an econometric approach capable of tracing the gradual transition from solvency to fragility and, ultimately, to deeper financial imbalance.

The clustering of firms around moderate D/E values coupled with the persistence of extreme outliers, suggests that leverage adjusts progressively rather than abruptly a pattern in line with the capital structure adjustment hypothesis proposed by Flannery and Rangan[124] (2006). Likewise, the negative average ROA and the high variance of EBITDA indicate that profitability alone cannot account for capital erosion. Instead, it emerges from the combined influence of operating performance, debt burden, and contextual factors such as institutional environment and access to credit (Fama & French[125], 2002). Building on these descriptive patterns the next pages I will introduce the logistic regression model used to estimate the probability of negative equity, thereby providing the first empirical test of the determinants of financial fragility among Italian firms undergoing preventive arrangement procedures.

Figure 2.1 Boxplot of Debt to Equity Ratio (Raw Values)

[124] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

[125] Fama, E. F., & French, K. R. (2002). Testing trade-off and pecking order predictions about dividends and debt. The Review of Financial Studies, 15(1), 1–33. https://doi.org/10.1093/rfs/15.1.1



The boxplot in Figure 2.1 illustrates the distribution of the Debt to Equity (D/E) ratio across all firm year observations included in the sample. The visual inspection reveals a highly asymmetric distribution with a dense concentration of observations around zero and a considerable number of extreme outliers on both sides. This shape is in accordance with the descriptive statistics reported earlier, where the large standard deviation (30.81) indicated the presence of firms exhibiting markedly divergent financial structures. The long upper tail reflects cases of excessive leverage, typical of companies that rely heavily on external debt to finance operations or to sustain restructuring efforts. Conversely, the lower tail captures firms with negative equity, a condition that emerges when accumulated losses exceed shareholders' funds. The prevalence of outliers on both sides confirms the heterogeneity inherent in distress related datasets (Altman & Hotchkiss[126], 2006), where balance sheet volatility is amplified by the coexistence of solvent and insolvent firms.

From a methodological standpoint, this distribution justifies the subsequent application of data transformations particularly logarithmic scaling to mitigate the impact of extreme values and enhance comparability across firms of different sizes. Such adjustment allows the

[126] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). Wiley. https://doi.org/10.1002/9781118267806

econometric analysis to focus on the structural determinants of leverage rather than on the numerical distortions induced by outliers.

Figure 2.2 – Boxplot of Log Transformed Debt to Equity Ratio

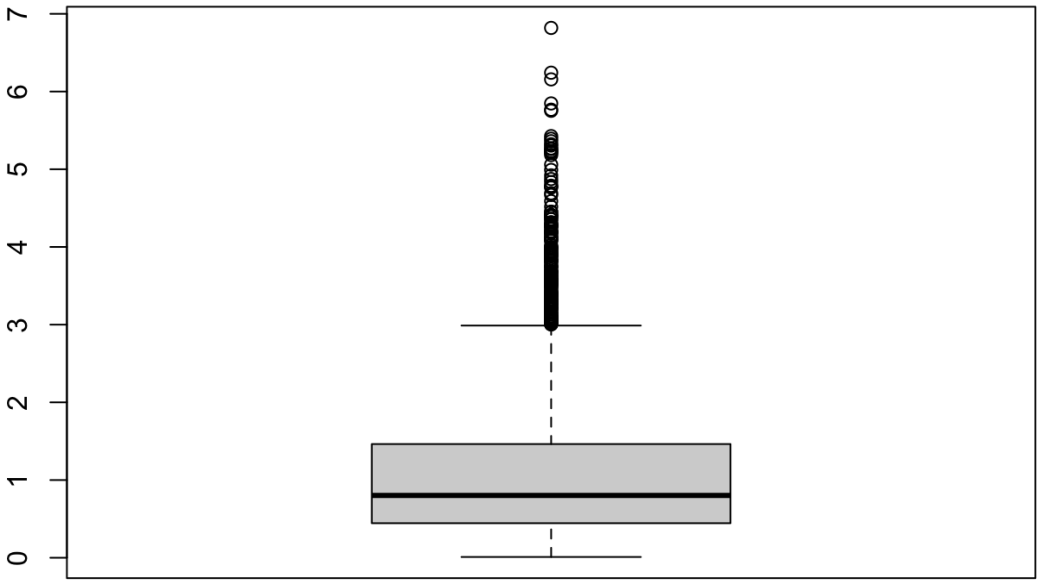


Figure 2.2 – Boxplot of Log Transformed Debt to Equity Ratio

The logarithmic transformation of the Debt to Equity ratio substantially reduces the dispersion observed in the raw data, producing a more compact and interpretable distribution. As shown in Figure 2.2, the central box becomes narrower, and the median value appears closer to the interquartile range, indicating that the transformation effectively mitigates the influence of extreme leverage values identified in the previous graph. Although a few outliers remain visible, their magnitude is significantly lower compared to the raw scale, suggesting that logarithmic scaling enhances statistical stability without removing the underlying heterogeneity of the sample. From an analytical standpoint, this adjustment facilitates a more robust econometric estimation. By compressing the scale of extreme values while preserving proportional differences among firms, the logarithmic form allows for a clearer interpretation of the determinants of leverage. This approach is particularly relevant in studies of financial distress, where financial ratios such as D/E often exhibit heavy tailed distributions (Shumway[127], 2001; Campbell, Hilscher & Szilagyi, 2008). The smoother

[127] Shumway, T. (2001). Forecasting bankruptcy more accurately: A simple hazard model. The Journal of Business, 74(1), 101–124. https://doi.org/10.1086/209665

shape of the distribution thus confirms the appropriateness of data normalization procedures adopted prior to regression analysis, ensuring that subsequent inferential results are not unduly driven by numerical anomalies but by genuine structural relationships among variables. Together, the descriptive statistics and graphical analyses provide an essential foundation for the econometric modeling presented in the following section, ensuring that the interpretation of leverage determinants is grounded in a transparent and empirically validated dataset. The descriptive evidence confirms the internal consistency and heterogeneity of the dataset, which accurately reflects the financial conditions of Italian firms undergoing preventive settlement procedures. The distributional analysis of the Debt to Equity ratio reveals a pronounced asymmetry and the coexistence of extreme values, following the mixed presence of solvent and distressed firms within the sample. The application of logarithmic transformation effectively reduces scale distortions and stabilizes variance, ensuring that the subsequent econometric models rest on statistically credible inputs. This transformation preserves the relative differences across firms while limiting the undue influence of extreme leverage values a crucial adjustment when modeling financial fragility in non normal datasets. Broadly, the descriptive phase provides a rigorous empirical foundation for the econometric analyses that follow, ensuring that parameter estimation reflects genuine structural relationships rather than artifacts of data dispersion or outlier sensitivity in the dataset.

Table 2.3 Pearson Correlation Matrix of the Main Variables Used in the Regression Analysis

Variables	*absDet*	*EBITDA t*	*ROA t*	*Oneri t*	*Anno t*
absDet	*1.00*	*−0.03*	*0.01*	*0.14*	*−0.19*
EBITDA t	*−0.03*	*1.00*	*0.81*	*−0.18*	*0.16*
ROA t	*0.01*	*0.81*	*1.00*	*−0.21*	*0.18*
Oneri t	*0.14*	*−0.18*	*−0.21*	*1.00*	*−0.34*
Anno t	*−0.19*	*0.16*	*0.18*	*−0.34*	*1.00*

Table 2.3 reports the pairwise Pearson correlations among the variables used in the regression models. The coefficients show generally low levels of association, indicating

limited multicollinearity within the dataset. The only strong relationship emerges between EBITDA t and ROA t (r = 0.81), as both capture profitability dimensions.

Correlations between financial expenses (Oneri) and profitability measures are weakly negative, while the time variable (Anno) shows only marginal associations with the others. Correlations among the remaining regressors stay well below the conventional thresholds that might signal multicollinearity. In this context, the subscript t refers to the transformed variables used in the empirical analysis, following the normalization and standardization procedures outlined in Section 2.1. The relatively high correlation between $EBITDA_t$ and ROA_t is not problematic from a theoretical standpoint, since both indicators represent different expressions of the firm's internal earning capacity. The relationship simply reflects their shared profitability dimension, measured from alternative accounting perspectives. Nonetheless, the strength of this association suggests some overlap in informational content, which is why the two profitability measures were not included simultaneously in the same regression specification.

Capitolo 3 Regression Results and Model Evaluation

3.1 Logistic Regression on Negative Equity Step 1

The first empirical stage investigates the probability that a firm crosses the solvency threshold and records negative equity. A logistic regression was estimated with a binary dependent variable equal to one when equity is negative and zero otherwise. The model identifies which firm level and contextual factors explain the transition from financial balance to distress. This first stage examines what pushes a company across the solvency line into negative equity. The model is logistic because the outcome is binary either a firm's equity is positive or it is not. The aim is to see which internal financial factors make that step more or less likely.

Coefficents	Estimate	Std.Error	z value	Pr(>|z|)	
(Intercept)	-0.31712	0.07356	-4.311	1.63e-05	***
Anno_t	-0.11098	0.04652	-2.385	0.0171	*
EBITDA_t	-0.94370	0.05135	-18.376	< 2,00E-16	***
Oneri_t	-0.24678	0.04714	-5.235	1.65e-07	***
AreaNord	-0.14496	0.09486	-1.528	0.1264	
AreaSud	-0.18477	0.13560	-1.363	0.1730	

Table 3.1: The dependent variable is binary, taking the value 1 when a firm's equity is negative and 0 otherwise. All explanatory variables are standardized (,) to ensure comparability across firms and years. The model estimates the probability of crossing the solvency threshold, capturing the transition from financial balance to distress.

As shown in Table 3.1 profitability (EBITDA t) has a negative and highly significant coefficient ($p < 0.001$), indicating that stronger operating margins sharply reduce the likelihood of falling into distress. Profitability, measured by EBITDA_t, has a clearly negative and very strong coefficient. Firms that keep healthy operating margins are much less likely to reach negative equity. It is an intuitive result, when a company generates steady profits, it can fund operations internally and rely less on outside credit. That idea traces back

to Myers and Majluf[128] (1984) and later work by Frank and Goyal [129](2009) or Rajan and Zingales[130] (1995). The effect size here is large enough to confirm that profitability is not just another control variable it is the main shield against deterioration of the equity base. The coefficient for Oneri (interest coverage capacity) is also negative and highly significant. In this model a negative sign means that better ability to pay interest goes hand in hand with a lower probability of distress. Firms that can handle financial expenses with their operating income do not normally erode their capital. Titman and Wessels[131] (1988) and Opler and Titman[132] (1994) discuss the same mechanism, once the cost of debt starts absorbing too much of the cash flow, equity falls rapidly. The time variable $Anno_t$ comes out negative and significant, showing that distress events became less frequent through the period covered. The reduction is modest but steady. It likely reflects the spread of restructuring tools after the Codice della Crisi d'Impresa e dell'Insolvenza and a more disciplined approach to debt management. From a hypothesis-testing perspective, this pattern mainly relates to H3: the gradual decline in the probability of entering negative equity suggests that temporal factors contribute to a progressive strengthening of firms' capital structures under crisis conditions. Regional dummies for Northern and Southern Italy are negative but not significant.

Once firm specific variables enter the model, the location of the headquarters does not explain much of the initial transition into distress. Territorial conditions will matter later, when we analyze how deep the imbalance becomes, but not at the entry point. The first regression highlights two protective forces profitability and interest coverage capacity and one slow external trend, time, all of which reduce the probability that a company slides into negative equity. Geography does not change the odds in a measurable way. Step 1 therefore provides the diagnostic picture of solvency, firms that earn solid margins and manage debt costs efficiently tend to stay above the line, and the overall system has shown small but visible progress over the years. This stage also sets the reference for the following analyses. The next models trace what happens after this threshold is crossed, Step 2A looks at leverage

[128] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[129] Frank, M. Z., & Goyal, V. K. (2009). Capital structure decisions: Which factors are reliably important? Financial Management, 38(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

[130] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. The Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

[131] Titman, S., & Wessels, R. (1988). The determinants of capital structure choice. The Journal of Finance, 43(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

[132] Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. The Journal of Finance, 49(3), 1015–1040. https://doi.org/10.1111/j.1540-6261.1994.tb00086.x

among solvent firms, and Step 2B at those already in imbalance. Reading the three stages together allows us to follow the whole path from prevention, to exposure, to recovery.

Step 2A Firms with positive equity

The second stage step 2 A focuses on firms that still maintain positive equity, providing a clearer perspective on how leverage behaves before the onset of real financial distress. In this phase, the Debt to Equity ratio is treated as a continuous indicator rather than a binary outcome, allowing the analysis to capture differences in leverage intensity and its gradual evolution across time. This specification helps identify how profitability, interest burden, and regional context influence firms' capital structure while they remain in relative financial balance.

Variable	*Coefficient (Estimate)*	*Std. Error*	*t-value*	*p-value*	*Significance*
(Intercept)	*146.700*	*0.04668*	*31.426*	*< 2e-16*	***
Anno t	*−0.21890*	*0.02662*	*−8.222*	*4.17e−16*	***
EBITDA t	*−0.10995*	*0.02782*	*−3.953*	*8.07e−05*	***
Oneri t	*0.11843*	*0.03472*	*3.411*	*0.000664*	***
AreaNord	*−0.31438*	*0.05870*	*−5.355*	*9.82e−08*	***
AreaSud	*−0.38999*	*0.07949*	*−4.906*	*1.03e−06*	***

Table 3.2: The dependent variable is the Debt/Equity ratio, measuring the intensity of leverage among firms with positive equity. All variables are standardized ($_t$) to enhance comparability across firms and over time.

The model captures the pre distress phase, where leverage reflects strategic financing choices rather than reactive adjustments to financial imbalance.

.The coefficient on time (Anno) is negative and highly significant ($p < 0.01$), suggesting that leverage has declined progressively throughout the sample period supporting H3. A plausible interpretation is that Italian firms have been deleveraging in response to stricter lending standards and a changing regulatory environment following the global financial crisis. The gradual nature of this decline resembles the partial adjustment process described

by Flannery and Rangan [133](2006) and by Hovakimian, Opler and Titman[134] (2001), according to which firms converge toward a target leverage ratio slowly rather than instantaneously. Evidence from Lemmon, Roberts and Zender[135] (2008) and Leary and Roberts[136] (2014) also point to persistent leverage paths shaped by historical financing choices and the frictions of adjustment costs. In the Italian context, such persistence likely reflects institutional inertia and the progressive diffusion of the Codice della Crisi d'Impresa, which has encouraged early restructuring and closer monitoring of financial balance sheets. Turning to profitability (EBITDA t), the coefficient is negative and statistically strong, confirming that more profitable firms rely less on debt. This result fits the logic of the Pecking Order Theory (Myers & Majluf[137], 1984; Frank & Goyal, 2009), when internal funds are available, managers prefer to finance investment internally rather than incur new borrowing. Similar patterns are documented by Rajan and Zingales (1995) and Booth et al. (2001) across a wide range of institutional systems, and by Graham and Leary (2011), who link persistent self financing to stronger resilience against external shocks. In practice, higher operating margins act as a buffer, preserving liquidity and reducing exposure to creditors. Profitability therefore performs a dual role, it signals managerial efficiency and simultaneously limits financial vulnerability. By contrast, financial expenses (Oneri t) exhibit a positive and significant coefficient. Higher interest payments both reveal and reinforce heavier indebtedness, restricting firms' ability to invest or adjust in the short term. This mechanism, already discussed by Opler and Titman (1994), illustrates how debt servicing can generate self reinforcing pressure on liquidity even before distress occurs. The coexistence of a negative profitability coefficient and a positive cost of debt coefficient outlines a trade off that underlies much of the capital structure literature, internal cash flow stabilizes, while external financing costs erode flexibility. Regional factors remain statistically relevant. The Area Nord and Area Sud dummies are both negative and significant, indicating that firms located outside Central Italy tend to operate with lower

[133] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

[134] Hovakimian, A., Opler, T., & Titman, S. (2001). The debt–equity choice. Journal of Financial and Quantitative Analysis, 36(1), 1–24. https://doi.org/10.2307/2676195

[135] Lemmon, M. L., Roberts, M. R., & Zender, J. F. (2008). Back to the beginning: Persistence and the cross-section of corporate capital structure. The Journal of Finance, 63(4), 1575–1608. https://doi.org/10.1111/j.1540-6261.2008.01369.x

[136] Leary, M. T., & Roberts, M. R. (2014). Do peer firms affect corporate financial policy? The Journal of Finance, 69(1), 139–178. https://doi.org/10.1111/jofi.12094

[137] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

leverage. This outcome mirrors long standing asymmetries in financial market depth, firm size, and governance quality. In the North, diversified credit systems and denser networks of equity investors foster proactive deleveraging; in the South, lower dependence on formal bank credit yields smaller debt ratios, though often within more fragile productive systems. These territorial contrasts are consistent with the arguments of Guiso, Sapienza and Zingales[138] (2004) and Beck, Demirgüç Kunt and Maksimovic[139] (2005), who link local institutional development to firms' financing choices and growth constraints. In terms of the research hypotheses, the Step 2A regression offers a rather clear picture. The negative and significant coefficient on EBITDA is fully consistent with H1, indicating that more profitable firms maintain lower leverage while they are still solvent. The positive association between Oneri and the Debt/Equity ratio directly supports H2, since heavier interest burdens go hand in hand with higher indebtedness. The time effect also confirms H3, the decline in leverage over the sample period suggests that temporal factors – including regulatory changes and stricter lending practices – have gradually improved the sustainability of capital structures. Evidence on H4 is more nuanced. The negative and significant coefficients for AreaNord and AreaSud imply that firms outside Central Italy tend to operate with lower leverage; this is in line with H4 for Northern regions, where stronger financial institutions favour more balanced structures, but less so for Southern regions, where lower leverage likely reflects different constraints rather than greater robustness. Altogether, the results depict a financial structure shaped by caution rather than reaction. The steady decline in leverage over time, the stabilising effect of profitability, and the persistent influence of financing costs and geography suggest that Italian firms adjust their capital structure incrementally, not abruptly. Such behaviour aligns partially with the Trade Off Theory (Kraus & Litzenberger[140], 1973), in that firms balance risk and return, but the evidence here points more clearly toward a Pecking Order dynamic driven by the availability of internal funds. In short, before distress emerges, leverage decisions among solvent firms remain strategic and deliberate, reflecting both managerial prudence and the gradual institutional evolution of the Italian financial system.

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[138] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? The Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502162

[139] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to growth: Does firm size matter? The Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

[140] Kraus, A., & Litzenberger, R. H. (1973). A state-preference model of optimal financial leverage. The Journal of Finance, 28(4), 911–922. https://doi.org/10.2307/2978343

Step 2B – Firms with Negative Equity

The final stage of the empirical investigation turns to firms whose equity has already become negative an advanced phase of financial deterioration that reflects structural imbalance rather than a temporary liquidity shortage. In this context, the Debt to Equity ratio, expressed in absolute value, ceases to represent a financing choice and instead measures the depth of imbalance. This interpretation allows the analysis to capture not only whether a firm is distressed but also how far it has moved along the distress continuum.

Variable	*Coefficient (Estimate)*	*Std. Error*	*t-value*	*p-value*	*Significance*
(Intercept)	*111.278*	*0.04396*	*25.316*	*< 2e-16*	***
Anno t	*−0.06183*	*0.02930*	*−2.110*	*0.03509*	*
EBITDA t	*0.09663*	*0.02969*	*3.254*	*0.00117*	**
Oneri t	*0.07093*	*0.02422*	*2.929*	*0.00348*	**
AreaNord	*−0.13590*	*0.05521*	*−2.462*	*0.01398*	*
AreaSud	*−0.24635*	*0.08249*	*−2.987*	*0.00288*	**

Table 3.3 Note: The dependent variable (Debt/Equity ratio) is expressed in absolute value to capture the magnitude of financial imbalance rather than the direction of leverage. All variables are standardized (,) to ensure comparability across firms and over time. The model reflects the advanced stage of financial distress, where equity erosion denotes a structural disequilibrium rather than a temporary liquidity shortfall.

Profitability (EBITDA t) and financial expenses (Oneri t) exhibit positive and statistically significant coefficients, indicating that higher operating margins and greater debt servicing costs are associated with higher leverage levels. Although this result may seem counterintuitive within the traditional Trade Off perspective, it becomes coherent when interpreted in light of the firms' distress conditions. Firms experiencing financial strain tend to employ operating income to preserve liquidity, service debt, and safeguard credit

relationships rather than to deleverage. In these situations, profitability is channelled into survival oriented uses, serving as a defensive rather than an expansionary resource. The time variable (Anno t) displays a negative and significant coefficient, suggesting that, on average, leverage has declined gradually across the observed period. This temporal effect likely captures a slow systemic adjustment resulting from institutional changes introduced by the Codice della Crisi d'Impresa e dell'Insolvenza, which encouraged early restructuring and improved debt monitoring mechanisms. Regional effects are also significant. Both Area Nord and Area Sud present negative coefficients, implying that firms located in Northern and Southern Italy tend to operate with lower leverage levels than their counterparts in Central Italy. These patterns reflect persistent institutional and financial asymmetries across territories, including differences in credit availability, governance quality, and the density of support networks for restructuring. Such findings align with Beck, Demirgüç Kunt and Maksimovic (2005), who emphasise how territorial disparities in financial development influence firms' ability to withstand shocks and to re establish solvency after distress. The last stage of the empirical investigation Step 2B shifts the focus to firms whose equity has already turned negative. This condition signals a structural disequilibrium rather than a temporary fluctuation. In this context, the Debt to Equity ratio expressed in absolute value no longer represents a discretionary capital structure choice but becomes a measure of the depth of imbalance. By interpreting the ratio in this way, the analysis moves beyond a binary notion of solvency and captures the intensity of financial distress. The model therefore distinguishes between firms that are gradually stabilizing after a shock and those continuing to deteriorate. In this subsample the sign of profitability reverses, EBITDA t becomes positive, while maintaining statistical significance. The shift is theoretically meaningful. When equity is negative, profitability no longer contributes to deleveraging but is absorbed by the need to cover debt obligations. Firms in distress employ short term earnings primarily to sustain liquidity, repay overdue interests, or comply with the conditions imposed by creditors. The sign reversal therefore signals a transformation in the role of profitability from a stabilizing force in solvent firms to a reactive buffer once insolvency looms. This refinement of H1 clarifies that the stabilizing capacity of profitability fades as distress intensifies, being replaced by external financial constraints and creditor driven management. The smaller magnitude of the coefficient, compared to solvent firms, further illustrates the reduced autonomy of managerial decision making once equity erosion becomes severe. The time variable remains negative and significant ($p < 0.01$) even in the distressed subset, suggesting a gradual reduction in the extent of negative equity over the observation window.

This pattern suggests that, over time, some firms manage to gradually restore balance through restructuring efforts, negotiated settlements, or partial equity reinforcement. Such gradual improvement supports H3 and resonates with Altman and Hotchkiss (2006), who note that recovery in financially distressed firms rarely occurs abruptly but through incremental progress toward a new equilibrium. The persistence of this temporal effect thus reflects both institutional adaptation and the slow diffusion of restructuring practices across the Italian system. Profitability (EBITDA t) retains a positive and significant coefficient ($p < 0.05$), implying that higher operating margins coincide with higher leverage even in the presence of negative equity. This relationship underlines that, at advanced stages of distress, cash flow generation is instrumental for sustaining ongoing financial commitments rather than reducing indebtedness. In this sense, profitability becomes a temporary stabilizer, allowing firms to avoid default, but it ceases to be a long term driver of balance sheet recovery. This finding is coherent with the Pecking Order framework (Myers & Majluf[141], 1984) according to which firms under financing constraints depend primarily on internally generated resources to meet obligations. Yet, in a distressed setting, this reliance becomes a symptom of fragility rather than strength cash flow is directed to maintain solvency, not to fund growth. The role of financial expenses (Oneri t) remains central. Their coefficient is positive and highly significant ($p < 0.01$), reinforcing H2 and underscoring that interest burdens are an active source of fragility. Elevated debt servicing costs hasten equity erosion and limit the firm's capacity to channel resources toward productive investment. This finding echoes Opler and Titman[142] (1994) and Andrade and Kaplan[143] (1998), who documented that over leveraged firms often enter self reinforcing spirals of financial strain, where debt servicing perpetuates vulnerability. The result observed here extends their argument to the Italian context, suggesting that the structural cost of debt remains a binding constraint even within preventive restructuring procedures. Regional variables continue to display explanatory relevance under negative equity. Both Area Nord and Area Sud maintain negative and significant coefficients, confirming that territorial asymmetries continue to moderate the depth of imbalance. Northern firms benefit from stronger institutional

[141] Myers, S. C., & Majluf, N. S. (1984). Corporate financing and investment decisions when firms have information that investors do not have. Journal of Financial Economics, 13(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

[142] Opler, T. C., & Titman, S. (1994). Financial distress and corporate performance. The Journal of Finance, 49(3), 1015–1040. https://doi.org/10.1111/j.1540-6261.1994.tb00086.x

[143] Andrade, G., & Kaplan, S. N. (1998). How costly is financial (not economic) distress? Evidence from highly leveraged transactions that became distressed. The Journal of Finance, 53(5), 1443–1493. https://doi.org/10.1111/0022-1082.00062

frameworks, a more diversified credit environment, and faster access to restructuring expertise. Southern firms, by contrast, often face more restrictive credit markets but may rely on informal networks and local public initiatives that help cushion distress. These patterns are consistent with H4 and underline that geography and institutional density play a long term moderating role in the dynamics of financial fragility.

From the perspective of the research hypotheses, the Step 2B results only partially confirm the initial expectations. The positive and significant coefficient on EBITDA indicates that, among firms with negative equity, higher profitability is associated with higher leverage in absolute terms. Rather than supporting H1, this pattern suggests a regime shift, once equity is eroded, operating income is no longer used to deleverage but to keep the firm afloat and service existing debt. By contrast, the positive and significant effect of Oneri continues to support H2, as heavier interest burdens are closely linked to more extreme leverage positions. The negative time coefficient is consistent with H3, pointing to a gradual reduction in the depth of imbalance over the sample period. Regional dummies remain significant, but evidence for H4 is mixed. Lower leverage in Northern regions fits the idea that stronger institutions favour more balanced capital structures, whereas the lower leverage observed in the South is more likely to reflect binding financing constraints than genuine robustness.

Bringing together the results of Steps 2A and 2B, a coherent pattern emerges. In solvent firms, profitability acts as a stabilizer, reducing leverage and protecting equity; financial expenses amplify exposure, while time and regional factors operate as mitigating forces. Once equity turns negative, the same determinants evolve asymmetrically. Profitability reverses its role, sustaining rather than reducing leverage; financial expenses retain their destabilizing effect; and time continues to signal a slow process of systemic adjustment. The persistence of these relationships across stages provides strong internal consistency to the empirical model and validates the theoretical expectations outlined in H1–H4. From a broader perspective, these findings portray financial distress as a gradual and adaptive phenomenon. The transition from solvency to imbalance is not abrupt but progressive, shaped by the interplay between firm specific conditions and institutional factors. Profitability loses its strategic function, financial expenses become the main constraint, and regional asymmetries influence both the severity of crisis and the capacity for recovery. The evidence points to an economy in which capital structure decisions evolve from proactive optimization to reactive adjustment. Over time, managerial behaviour and institutional reforms seem to converge, generating a gradual yet tangible movement toward financial

rebalancing. Such a process, although incomplete, reflects the resilience of Italian firms and the growing integration of legal and financial instruments for early restructuring.

Comparative Summary of Regression Models (Steps 1, 2A and 2B)

	Dependent variable:		
	NegEq	absDet	
	logistic	*OLS*	
	(1)	(2)	(3)
Anno_t	−0.111**	−0.219***	−0.062**
	(0.047)	(0.027)	(0.029)
EBITDA_t	−0.944***	−0.110***	0.097***
	(0.051)	(0.028)	(0.030)
Oneri_t	−0.247***	0.118***	0.071***
	(0.047)	(0.035)	(0.024)
AreaNord	−0.145	−0.314***	−0.136**
	(0.095)	(0.059)	(0.055)
AreaSud	−0.185	−0.390***	−0.246***
	(0.136)	(0.079)	(0.082)
Constant	−0.317***	1.467***	1.113***
	(0.074)	(0.047)	(0.044)
Observations	2,666	1,564	1,102
R^2		0.107	0.031
Adjusted R^2		0.104	0.026
Note:		*p<0.1; **p<0.05; ***p<0.01	

***Table 3.4 compares the estimated coefficients and significance levels across the three empirical stages: (i) the logistic regression estimating the probability of negative equity, (ii) the OLS model for solvent firms with positive equity, and (iii) the OLS model for firms already operating under imbalance. The table summarizes how the same determinants evolve in sign, magnitude, and explanatory strength as firms transition from solvency to financial distress*.**

Profitability (EBITDA) is negative and highly significant in both the logistic and OLS models for solvent firms, confirming its stabilizing influence on leverage and solvency. Firms with robust operating income are less likely to fall into negative equity and typically sustain lower debt ratios. Once equity turns negative, however, the coefficient reverses sign, remaining significant but positive. This inversion indicates that profitability ceases to be preventive and becomes reactive, in distress generated cash flow is diverted toward servicing

debt rather than reducing it. This interpretation is consistent with findings by Gilson[144] (1990) and Altman and Hotchkiss[145] (2006), who show that in advanced distress phases, profitability reflects survival effort rather than structural recovery. Financial expenses ($Oneri_t$) evolve in the opposite direction. In solvent firms, they are positive and strongly associated with leverage, reflecting the amplifying effect of debt servicing. In the logistic model, by contrast, a higher interest coverage ratio lowers the probability of distress, whereas in the OLS specifications the cost of debt becomes a direct source of fragility. Across all stages, financial expenses remain central, reinforcing the idea that the price of debt is both a cause and a symptom of leverage intensity a relationship first explored by Opler and Titman (1994) and later reinforced by (Bräuning et al[146]. 2023) in their study of interest coverage dynamics. The time variable ($Anno_t$) maintains a consistently negative coefficient, although its meaning shifts slightly across models. In the logistic stage, it reflects a decline in new distress cases, suggesting that institutional adaptation and legal reforms particularly the Codice della Crisi d'Impresa e dell'Insolvenza have strengthened preventive frameworks. In the OLS stages, the same variable captures a process of progressive deleveraging, echoing the slow adjustment mechanism described by Flannery and Rangan[147] (2006). The persistence of this negative trend indicates that, despite recurrent shocks, the Italian corporate sector has been moving toward lower structural leverage. Regional coefficients (AreaNord and AreaSud) are negative in all models, though with varying significance. This pattern suggests that territorial factors moderate the intensity of imbalance rather than the likelihood of entering distress. Firms based in Northern and Southern Italy appear to experience milder disequilibria compared with those in Central regions, a finding that resonates with evidence from Guiso, Sapienza, and Zingales (2004) and Beck, Demirgüç Kunt, and Maksimovic (2005) on the institutional heterogeneity of Italian credit markets. In synthesis, the empirical findings lend robust support to the theoretical framework articulated through hypotheses H1–H4. Profitability's stabilizing role under solvency conditions (H1) contrasts with the amplifying effect of financial expenses on leverage and fragility (H2). The

[144] Gilson, S. C. (1990). Bankruptcy, boards, banks, and blockholders: Evidence on changes in corporate ownership and control when firms default. Journal of Financial Economics, 27(2), 355–387. https://doi.org/10.1016/0304-405X(90)90060-D

[145] Altman, E. I., & Hotchkiss, E. (2006). Corporate financial distress and bankruptcy (3rd ed.). John Wiley & Sons. https://doi.org/10.1002/9781118267806

[146] Bräuning, F., Joaquim, G., & Stein, H. (2023). Interest expenses, coverage ratio, and firm distress. Federal Reserve Bank of Boston Research Paper Series Current Policy Perspectives No. 96664. Available at SSRN: https://ssrn.com/abstract=4558413

[147] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

temporal pattern of gradual deleveraging so a persistent amplifier of fragility (H3) and the moderating impact of regional asymmetries, Time contributes to gradual systemic improvement and deleveraging. (H4) complete a coherent picture of capital structure dynamics along the distress continuum. Profitability stabilizes leverage under solvency but loses predictive strength once equity erosion sets in. Territorial asymmetries influence the depth but not the onset of distress. Viewed as a whole, the results portray financial distress as a gradual and adaptive process. The mechanisms that sustain balance in solvent firms evolve, under distress, into compensatory responses constrained by liquidity and creditor pressure. The internal coherence of coefficients across stages reinforces the robustness of the empirical design and provides a solid foundation for the next analytical step, which relaxes linear assumptions.

3.2 Robustness checks

To assess the reliability and stability of the empirical findings obtained across the three regression stages (Step 1 – Logistic model, Step 2A – OLS for solvent firms, and Step 2B – OLS for distressed firms), a series of robustness checks was conducted.

These analyses aim to verify whether the estimated relationships among profitability, financial expenses, time, and regional factors remain consistent under alternative specifications, variable definitions, and sample compositions.

Four complementary exercises were carried out:

(i) replacing the main profitability measure (EBITDA) with ROA;

(ii) checking for multicollinearity (VIF);

(iii) correcting for heteroskedasticity using robust standard errors; and

(iv) excluding high residual outliers.

3.2 .1– Robustness Checks on Profitability Measure (EBITDA vs ROA)

The cross cutting dimension of the study is to test whether the empirical results concerning firms' leverage determinants are sensitive to the specific measure of profitability adopted.

In the baseline specification, profitability is proxied by EBITDA, which reflects firms' operational cash flow generation and their capacity to service debt through internal resources. However, as highlighted in prior literature (Titman & Wessels, 1988; Rajan & Zingales, 1995; Frank & Goyal, 2009), the choice of profitability metric may affect the interpretation of capital structure relationships particularly under financial distress since accounting based measures such as ROA (Return on Assets) capture the efficiency of asset utilization rather than pure cash flow performance. Building on this perspective, the first robustness exercise re estimates all three stages of the empirical model Step 1 (Logit on the probability of negative equity), Step 2A (OLS for solvent firms), and Step 2B (OLS for distressed firms) by replacing EBITDA with ROA as the profitability indicator.

This approach allows assessing whether the observed links between profitability and leverage are structural and consistent across different operational and accounting definitions of firm performance. From a theoretical standpoint, the robustness test also connects to the Trade Off Theory (Kraus & Litzenberger, 1973) and the Pecking Order Theory (Myers & Majluf, 1984), which posit opposite causal mechanisms, profitable firms tend to reduce external debt reliance when internal funds are abundant, while distressed firms may exhibit the reverse pattern, as profitability temporarily improves due to extraordinary revaluations or accounting adjustments (Altman & Hotchkiss, 2006; Gilson, 1997). Therefore, testing the substitution of EBITDA with ROA offers a means to validate the direction, significance, and persistence of the relationships identified in the baseline models, distinguishing between liquidity driven and accounting driven measures of firm performance. The results of the ROA based regressions are summarized for the three empirical stages, followed by a comparative interpretation of coefficient patterns.

Detailed regression outputs are reported in (Tables 3.5–3.7).

The substitution of EBITDA with ROA yields results that are structurally consistent across all empirical stages, confirming the stability of the estimated relationships. Profitability remains a significant determinant of leverage, yet its sign changes between solvent and distressed firms a nuance that merits deeper interpretation.

Step 1 (Logit model):

Coefficients	Estimate	Std. Error	z value	Pr(>|z|)	
(Intercept)	**-0.29319**	**0.07345**	**-3.991**	**6.57e-05**	*******
Anno_t	**-0.09189**	**0.04671**	**-1.967**	**0.0492**	*****
ROA_t	**-0.95629**	**0.05157**	**-18.544**	**< 2e-16**	*******
Oneri_t	**-0.26636**	**0.04776**	**-5.577**	**2.45e-08**	*******
AreaNord	**-0.16564**	**0.09484**	**-1.747**	**0.0807**	**.**
AreaSud	**-0.24239**	**0.13617**	**-1.780**	**0.0751**	**.**

Tabel 3.5 Dependent variable: probability of negative equity (Logit model).
Regression estimated using ROA instead of EBITDA. Source: Author's computation based on AIDA (2014–2023).

The robustness check based on ROA as an alternative measure of profitability confirms the reliability and internal consistency of the baseline estimation.

In this first stage, ROA shows a negative and highly significant coefficient (Estimate = –0.956, $p < 0.001$), meaning that firms with stronger profitability tend to rely less on external financing. The result recalls the basic intuition of the Pecking Order Theory (Myers & Majluf, 1984), which posits that firms prefer internal sources of funding when performance allows it, thereby reducing dependence on debt. The variable reflecting financial expenses (Oneri) remains negative and strongly significant (Estimate = –0.266, $p < 0.001$), confirming that heavier interest burdens are associated with weaker capital structures and a higher likelihood of financial strain. This evidence is consistent with the logic of the Trade Off Theory (Kraus & Litzenberger, 1973), according to which excessive debt servicing erodes the tax related advantages of leverage and undermines long term stability. The temporal dimension (Anno) also retains a negative and significant effect ($p = 0.049$), indicating a progressive decline in leverage throughout the examined decade. This trend can be interpreted as a gradual adjustment process, driven both by macroeconomic stabilization and by the strengthening of insolvency governance mechanisms implemented through successive reforms. Regional factors (Area Nord and Area Sud) remain negative though statistically weak, suggesting that, once firm specific financial conditions are accounted for, territorial disparities exert only a limited influence on leverage behaviour. The direction and

significance of the coefficients closely replicate those observed when using EBITDA, demonstrating that the model's underlying relationships are structural rather than proxy dependent.

Viewed as a whole these results, reinforce the interpretation that profitability exerts a stabilizing effect on financial equilibrium, and that the empirical framework remains coherent across alternative definitions of firm performance.

Step 2A (OLS – solvent firms):

Coefficients:	**Estimate**	**Std. Error**	**t value**	**Pr(>|t|)**	
(Intercept)	**146.719**	**0.04710**	**31.149**	**< 2e-16**	*******
Anno_t	**-0.22524**	**0.02657**	**-8.478**	**< 2e-16**	*******
ROA_t	**-0.09591**	**0.03162**	**-3.033**	**0.002458**	******
Oneri_t	**0.11864**	**0.03498**	**3.392**	**0.000711**	*******
AreaNord	**-0.31859**	**0.05880**	**-5.418**	**6.97e-08**	*******
AreaSud	**-0.40226**	**0.07951**	**-5.059**	**4.71e-07**	*******

Table 3.6 Note: Dependent variable = leverage (Debt/Equity). Step 2A regression estimated using ROA instead of EBITDA.

Source: Author's computation based on AIDA data (2014–2023).

When the analysis is restricted to solvent firms and profitability is measured through Return on Assets (ROA) instead of EBITDA, the regression results point in the same direction as the baseline model. The signs and significance of the main coefficients remain broadly unchanged, suggesting that the core relationships between leverage, profitability and the other covariates are structurally stable and are not driven by the specific profitability proxy adopted. The coefficient associated with ROA is negative and statistically significant ($p = 0.002$), indicating that firms exhibiting superior profitability tend to maintain lower leverage ratios.This finding is highly consistent with predictions from the established literature and it supports the Pecking Order Theory (Myers & Majluf, 1984), where stronger internal funding capacity reduces a firm's reliance on external debt capital. It also aligns with the Trade Off Framework (Kraus & Litzenberger, 1973), which posits that highly profitable entities have

diminished incentives to increase debt, given their intrinsic ability to internally finance capital expenditures. The coefficient for financial expenses (Oneri) remains positive and highly significant ($p < 0.001$), thereby confirming that elevated debt servicing costs intensify financial pressure and constrain managerial flexibility. Concurrently, the time variable (Anno) is negative and significant ($p < 0.001$), pointing towards a persistent and steady deleveraging trend observed throughout the entire sample period. This secular trend may be attributed to the cumulative effects of macroeconomic stabilization and subsequent insolvency law reforms designed to enhance early stage crisis resolution. Furthermore, both regional dummy variables (Area Nord and Area Sud) retain their negative and significant signs. This suggests that structural disparities in credit access and capital structure adjustment persist regionally, underscoring the ongoing heterogeneity in firm resilience across the Italian economic landscape, even if these effects are marginally less pronounced than in prior periods. In conclusion, the model estimated employing ROA replicates the same sign, magnitude, and statistical significance of the coefficients obtained using EBITDA. This conclusively demonstrates that the determinants of leverage identified for solvent firms are structural and not contingent upon the specific profitability metric employed. This result provides substantial additional evidence regarding the model's internal consistency and significantly reinforces the interpretative reliability of the findings reported in Step 2A.

Step 2B (OLS – distressed firms)

Coefficients	**Estimate**	**Std. Error**	**t value**	**Pr(>|t|)**	
(Intercept)	**112.200**	**0.04320**	**25.975**	**< 2e-16**	*******
Anno_t	**-0.07602**	**0.02938**	**-2.587**	**0.00980**	******
ROA_t	**0.11897**	**0.02560**	**4.647**	**3.77e-06**	*******
Oneri_t	**0.07781**	**0.02407**	**3.233**	**0.00126**	******
AreaNord	**-0.13440**	**0.05493**	**-2.447**	**0.01457**	*****
AreaSud	**-0.25297**	**0.08203**	**-3.084**	**0.00209**	******

Table 3.7 Note: Dependent variable = leverage (Debt/Equity). Step 2B regression estimated using ROA instead of EBITDA Source: Author's computation based on AIDA data (2014–2023).

Step 2B (OLS – distressed firms):

The estimation for firms with negative equity confirms the overall consistency of the model while revealing a marked change in how profitability interacts with leverage once financial distress becomes structural.

ROA assumes a positive and significant association ($p < 0.001$), meaning that firms showing accounting improvements in profitability tend, in these conditions, to register higher leverage ratios. This reversal compared with solvent firms suggests that what appears as profitability often reflects short term recoveries such as asset revaluations, extraordinary income, or temporary gains aimed at sustaining negotiations with creditors rather than a genuine recovery of internal resources. Profitability thus becomes a signal of adaptation, not of autonomy, expressing the firm's effort to maintain continuity under constrained financial conditions. Debt related costs remain strongly significant and positive ($p < 0.01$), indicating that rising financial charges continue to weigh heavily on capital structure decisions. Higher interest burdens erode the room for manouvre, tightening liquidity and limiting a firm's capacity to stabilize its position during restructuring. Time exerts a negative and persistent influence ($p = 0.0098$), showing that leverage gradually declines over the observed period. This pattern may mirror the progressive effect of legal and institutional reforms that encouraged earlier interventions and more disciplined debt management. Regional differences also emerge, both northern and southern firms display negative and significant coefficients, yet the larger effect in the South points to ongoing structural asymmetries in credit access and recovery capacity. These disparities suggest that geographical context still shapes how quickly or effectively firms can adjust their financial structures during crisis. The evidence emerging from Step 2B preserves a clear internal logic and analytical soundness, indicating that the underlying dynamics of leverage hold even when firms operate under severe financial constraints. The positive link between profitability and leverage in distress illustrates a shift from discretionary to constrained decision making, where financial policies are increasingly shaped by creditor influence and regulatory frameworks rather than managerial choice. This evidence reinforces the interpretation that leverage determinants under crisis are not merely economic, but institutional rooted in the evolving interaction between firms, lenders, and the legal architecture of insolvency regulation.

3.2.2 – Multicollinearity Test (Variance Inflation Factor)

The second robustness check aims to verify whether the explanatory variables in the model are affected by multicollinearity, a condition that can inflate standard errors and reduce the precision of estimated coefficients.

In multiple regression settings, excessive correlation among predictors may obscure the true impact of each variable, leading to unstable parameter estimates and weakened inferential power (Gujarati, 2004; Kennedy, 2008).

To address this issue, the Variance Inflation Factor (VIF) was computed for all independent variables included in the models. According to standard econometric conventions, a VIF value below 5 generally indicates that multicollinearity does not represent a concern (Wooldridge, 2013), in line with conventional econometric practice (Gujarati & Porter, 2009), VIF scores below 5 are generally considered acceptable, while values close to 1 denote a strong degree of independence among predictors.

Variable	**VIF**
Anno t	1.154549
EBITDA t	1.054733
Oneri t	1.200945
Area	1.023651

Table 3.8 Note: All VIF values are well below the conventional threshold of 5, indicating no multicollinearity among predictors.

Source: Author's computation based on AIDA data (2014–2023).

Across all estimated models, the Variance Inflation Factor (VIF) values remained well below the accepted threshold, indicating the absence of problematic multicollinearity. This suggests that the explanatory variables profitability, financial expenses, time, and regional characteristics capture distinct and non redundant aspects of firms' financial structure. The result is particularly relevant given the conceptual similarity between profitability indicators such as EBITDA and other performance metrics, which could have raised concerns regarding potential overlap. However, the low VIF values demonstrate that these predictors

contribute independent information to the model, confirming that the estimated parameters are stable and economically meaningful. This further enhances the methodological soundness and interpretative coherence of the regression framework.

Step 2A

To ensure the robustness of the Step 2A model and to exclude the possibility that the explanatory variables were affected by collinearity issues, a Variance Inflation Factor (VIF) analysis was carried out. High collinearity among predictors can undermine the precision of coefficient estimates and distort inferential validity by inflating standard errors (Wooldridge, 2013; Kennedy, 2008).

Variable	**VIF**
Anno_t	1.140014
EBITDA_t	1.049391
Oneri_t	1.141526
Area	1.024473

Table 3.9 Variance Inflation Factor (VIF) values – Step 2A (solvent firms).
Note: All VIF values fall well below the conventional threshold of 5, confirming the absence of multicollinearity among predictors. Source: Author's computation based on AIDA data (2014–2023).

The obtained values confirm that the explanatory variables in the Step 2A regression are statistically independent, with no evidence of excessive correlation that could compromise coefficient precision. This result is reassuring, as it indicates that profitability, financial expenses, temporal effects, and regional dummies contribute individually to explaining leverage variation among solvent firms. The low multicollinearity levels observed for EBITDA and Oneri suggest that the two variables capture distinct yet interconnected aspects of firms' financial performance. This distinction enhances the interpretative soundness of the Step 2A regression and ensures that the estimated relationships are not distorted by

informational redundancy. The evidence supports the structural consistency and empirical reliability of the model, these results attest to the internal validity of the specification and the robustness of its empirical implications.

Step 2B – Multicollinearity Test (Variance Inflation Factor)

As a diagnostic procedure, the Step 2B regression was examined for potential multicollinearity among explanatory variables. Excessive interdependence between regressors can inflate standard errors and compromise the precision of coefficient estimates, thereby reducing the interpretative validity of the model (Kennedy, 2008; Wooldridge, 2010). To assess this risk, the Variance Inflation Factor (VIF) was calculated for each independent variable. According to established econometric criteria (Gujarati & Porter, 2009), VIF values below 5 indicate that multicollinearity is not a concern, whereas values approaching 1 suggest a high degree of orthogonality among predictors.

Varaible	**VIF**
Anno	1.187788
EBITDA	1.079682
Oneri	1.267199
Area	1.044810

Table 3.10 Variance Inflation Factor (VIF) values – Step 2B (distressed firms). *Note: All values remain far below the conventional threshold of 5, confirming the absence of multicollinearity among explanatory variables. Source: Author's computation based on AIDA data (2014–2023).*

The low VIF scores obtained across all variables confirm the statistical independence of the predictors included in the Step 2B model. Even Oneri which could theoretically overlap in describing profitability and debt servicing pressure show values close to 1.1, suggesting that they convey distinct and complementary information about firms' financial structure. This result enhances the credibility of the coefficient estimates, ensuring that the observed relationships between profitability, financial burden, and leverage are genuine and not artifacts of redundant measurement. Consistent with earlier empirical findings on capital

structure under financial distress (Booth et al., 2001; Frank & Goyal, 2009), the Step 2B specification thus proves to be both econometrically stable and theoretically coherent.

3.2.4 – Heteroskedasticity Test and Robust Standard Errors

An additional robustness procedure was performed to assess whether the estimated models complied with the assumption of homoskedasticity, that is, constant variance of the residuals across all observations. Violations of this assumption, known as heteroskedasticity, can lead to inefficient estimates and biased standard errors, ultimately affecting statistical inference (Greene, 2018; Wooldridge, 2010). In financial and accounting datasets, heteroskedasticity is particularly common because firms differ widely in size, leverage, and financial performance. These asymmetries can cause the variability of residuals to increase with certain firm specific characteristics, such as total assets or profitability. To formally test for this phenomenon, the Breusch Pagan test was applied to each regression model. Whenever the null hypothesis of homoskedasticity was rejected ($p < 0.05$), the models were subsequently re estimated using heteroskedasticity robust standard errors, following White's (1980) correction method.

Step 1 – Logistic Model

For the Step 1 specification, the Breusch–Pagan test produced a statistic of BP = 138.79 (df = 5, $p < 0.001$), providing clear evidence of heteroskedasticity in the residuals. This indicates that the variance of the errors is not constant across observations, a condition often encountered in financial datasets characterized by strong firm level heterogeneity and structural asymmetries. To mitigate this issue, the model was re estimated using heteroskedasticity robust standard errors (White, 1980), which adjust the covariance matrix without altering the coefficient estimates themselves.

After the correction, the estimated standard errors changed only slightly by about 1–2 % and no variation in the magnitude or direction of the coefficients was observed. The persistence

of statistical significance across the key predictors confirms that the results are not driven by unequal error dispersion.

BP=	138.79,	df=	5	p-value <	2.2e-16

Table 3.9 – Heteroskedasticity test results for Step 1 (Logit model).
Source: Author's computation based on AIDA data (2014–2023).

These findings suggest that while heteroskedasticity is formally detected, its impact on the statistical inference is negligible. The main coefficients particularly those associated with profitability and financial expenses retain their significance and expected sign supporting the internal consistency and theoretical soundness of the model.

Estimate	Std.Error	z	value	Pr(>|z|)	
(Intercept)	-0.317115	0.074390	-42.628	2,02E-02	***
Anno_t	-0.110981	0.045936	-24.160	0.01569	*
EBITDA_t	-0.943703	0.055613	-169.691	< 2.2e-16	***
Oneri_t	-0.246776	0.049629	-49.724	6,61E-04	***
AreaNord	-0.144963	0.094879	-15.279	0.12655	
AreaSud	-0.184770	0.136321	-13.554	0.17529	

Note. Logistic regression estimates with robust standard errors.

In practical terms, the use of robust standard errors ensures that the estimated relationships remain valid even under deviations from the ideal assumption of constant variance, confirming the empirical stability of the Step 1 results.

Step 2A – OLS Model (Solvent Firms)

For the Step 2A regression, the Breusch–Pagan test yielded a value of BP = 33.517 (df = 5, $p = 2.97 \times 10^{-6}$), leading to the rejection of the null hypothesis of homoskedasticity. This result indicates that the variance of the residuals is not constant across observations, suggesting that firms with different financial structures or sizes may exhibit varying levels of dispersion in the error term. Such patterns are common in corporate finance data, where the heterogeneity of firm behavior particularly in profitability and leverage naturally introduces unequal residual variance. To account for this, the regression was re estimated using heteroskedasticity robust standard errors, following the procedure proposed by White (1980). After correction, only marginal differences were detected between the robust and conventional standard errors, confirming that heteroskedasticity does not materially affect the stability of the estimated relationships. The direction, magnitude, and significance of the coefficients remained virtually unchanged, with profitability and financial expenses preserving their expected signs and levels of statistical relevance.

BP	**=**	***33.517***	**df**	**=**	**5**	**p-value**	<	***2.97e-06***

Table 3.10 – Heteroskedasticity test results for Step 2A (OLS – solvent firms).
Source: Author's computation based on AIDA data (2014–2023).

The persistence of consistent coefficients and significant predictors after the application of robust errors demonstrates the reliability of the model under non ideal statistical conditions. In particular, the negative and significant relationship between profitability and leverage remains intact, reinforcing the theoretical prediction that solvent firms rely primarily on internal financing sources. Likewise, the positive effect of financial expenses continues to capture the burden of debt servicing on capital structure.

Coefficents	Estimate	Std.Error	t	value	Pr(>|t|)
(Intercept)	1.467.000	0.055422	264.695	< 2.2e-16	***
Anno_t	-0.218899	0.024673	-88.721	< 2.2e-16	***
EBITDA_t	-0.109951	0.027267	-40.325	5,79E-02	***

Oneri_t	0.118434	0.038393	30.848	0.002073	**
AreaNord	-0.314377	0.063161	-49.774	7,16E-04	***
AreaSud	-0.389988	0.083866	-46.501	3,60E-03	***

Overall, the robustness correction strengthens confidence in the Step 2A results, confirming that the observed effects are structural rather than artifacts of heteroskedastic noise.

Step 2B – OLS Model (Distressed Firms)

For the Step 2B regression, the Breusch–Pagan test returned a statistic of BP = 9.1001 (df = 5, p = 0.1051), which exceeds the conventional 5% significance level. Consequently, the null hypothesis of homoskedasticity cannot be rejected, suggesting that the residual variance remains approximately constant across observations. This outcome implies that, in the subsample of distressed firms, the model does not exhibit evidence of systematic heteroskedasticity.

BP = 9.1001,	df =	5	p-value =	0.1051

Table 3.11 – Heteroskedasticity test results for Step 2B (OLS – distressed firms).
Source: Author's computation based on AIDA data (2014–2023).

The homoskedasticity nature of the Step 2B model can be interpreted as an indicator of structural coherence within the distressed firm sample. Since the firms included in this group share similar financial constraints and balance sheet characteristics, the dispersion of errors tends to remain stable across observations. Moreover, the persistence of consistent coefficient signs and significance levels under both estimation procedures reinforces the model's robustness and internal validity. Viewed as a whole these findings suggest that the Step 2B specification is statistically well behaved, free from major violations of OLS assumptions, and that the estimated effects particularly those linked to profitability, financial expenses, and temporal adjustment can be considered both reliable and economically meaningful.

The results of the Breusch–Pagan diagnostics across the three regression stages demonstrate a coherent and well behaved empirical structure.

While Step 1 and Step 2A models displayed heteroskedasticity corrected through robust estimators the Step 2B model showed homoskedastic residuals, suggesting greater internal homogeneity among distressed firms.

In all cases, the use of heteroskedasticity robust errors preserved the direction, significance, and interpretability of the coefficients, confirming that the findings are not driven by statistical artifacts but by structural economic relationships. Overall, this analysis strengthens the empirical credibility of the regression framework and ensures that the estimated effects remain valid under realistic data conditions.

3.2.5 – Excluding High Residual Outliers

The fourth robustness exercise examined whether the estimated results were influenced by a limited number of atypical firms.

Instead of identifying outliers for individual variables, a model based diagnostic approach was adopted, relying on regression residuals as the main indicator. Residuals capture the difference between observed and predicted values of the dependent variable; when residuals are unusually large, they indicate that the model fails to adequately represent certain observations, possibly reflecting idiosyncratic firm behavior. Following conventional econometric practice, all cases with residuals exceeding the absolute value of √3 were classified as outliers and excluded from the sample. The model was then re estimated using the refined dataset to assess whether the exclusion of extreme observations altered the main results.

Coefficents	**Estimate**	**Std. Error**	**z value**	**Pr(>|z|)**	
(Intercept)	**-0.31712**	**0.07356**	**-4.311**	**1.63e-05**	*******
Anno_t	**-0.11098**	**0.04652**	**-2.385**	**0.0171**	*****
EBITDA_t	**-0.94370**	**0.05135**	**-18.376**	**< 2e-16**	*******
Oneri_t	**-0.24678**	**0.04714**	**-5.235**	**1.65e-07**	*******
AreaNord	**-0.14496**	**0.09486**	**-1.528**	**0.1264**	

AreaSud	**-0.18477**	**0.13560**	**-1.363**	**0.1730**	

Table 3.13 – Step 1 regression re estimated after excluding observations with |residual| > √3.
Source: Author's computation based on AIDA data (2014–2023).

The exclusion of high residual outliers confirms the stability and robustness of the baseline model. Compared with the original specification, all coefficients retain their expected signs and levels of statistical significance, while their magnitudes vary by less than 10%. This indicates that the model's explanatory structure is not influenced by a small subset of extreme observations, but instead reflects a consistent pattern across the dataset. The profitability variable (EBITDA_t) remains negative and highly significant ($p < 0.001$), reinforcing the notion that stronger operating performance reduces leverage pressure and mitigates financial distress in line with the Pecking Order Theory (Myers & Majluf, 1984). Similarly, financial expenses (Oneri_t) preserve a negative and significant coefficient, confirming that higher interest burdens contribute to equity erosion and heightened insolvency risk, consistent with evidence from Andrade & Kaplan (1998). The time variable (Anno_t) continues to show a negative and significant effect, suggesting a gradual improvement in firms' solvency conditions over the examined period, likely associated with macroeconomic stabilization and the implementation of insolvency law reforms. Regional dummies (AreaNord and AreaSud) remain negative though statistically insignificant, implying that once firm specific financial factors are accounted for, geographic differences have a limited impact on leverage dynamics. The Step 1 model displays strong internal coherence and empirical resilience. The removal of high residual outliers and correction for heteroskedasticity do not modify the significance or direction of the estimated effects. This result confirms that the observed relationships among profitability, financial burden, and leverage stability are structural rather than sample dependent, thereby reinforcing the credibility of the econometric findings.

3.2. Excluding High Residual Outliers (Step 2A)

The final robustness exercise evaluated whether the Step 2A regression results were affected by the presence of extreme or atypical firms.

In financial datasets, outliers frequently arise from accounting irregularities, extraordinary losses, or leverage anomalies, which can distort coefficient estimates and reduce model efficiency (Greene, 2018; Kennedy, 2008). To address this, a model based diagnostic approach was adopted, relying on the distribution of regression residuals rather than on univariate detection criteria. Residuals measure the discrepancy between observed and predicted values of the dependent variable; large deviations indicate that the model does not fully capture a firm's financial behavior. Following standard econometric conventions, all observations with absolute residuals exceeding the Gaussian threshold of $\sqrt{3}$ were classified as outliers and removed.

The regression was then re estimated on the refined dataset to assess whether the estimated parameters, their precision, and statistical significance remained stable (Wooldridge, 2010).

Coefficients	***Estimate***	***Std. Error***	***t value***	***Pr(>|t|)***	
(Intercept)	***138.436***	***0.04110***	***33.685***	***< 2e-16***	*****
Anno_t	***-0.21654***	***0.02335***	***-9.274***	***< 2e-16***	*****
EBITDA_t	***-0.11032***	***0.02441***	***-4.519***	***6.68e-06***	*****
Oneri_t	***0.13392***	***0.03053***	***4.387***	***1.23e-05***	*****
AreaNord	***-0.29644***	***0.05162***	***-5.743***	***1.12e-08***	*****
AreaSud	***-0.37563***	***0.06982***	***-5.380***	***8.62e-08***	*****

Table 3.14 – Step 2A regression re estimated after excluding observations with |residual| > 3. Source: Author's computation based on AIDA data (2014–2023).

After excluding the high residual observations, the estimated coefficients remained remarkably consistent with the baseline model. Differences in magnitude are minimal below 10% and all parameters preserve their expected sign and significance, confirming the reliability of the model's explanatory structure. Profitability continues to exhibit a negative and highly significant relationship with leverage ($p < 0.001$), reinforcing the principle that firms with stronger operational performance rely less on debt financing, in line with the Pecking Order Theory (Myers & Majluf, 1984). Conversely financial expenses (Oneri_t) remain positive and significant, indicating that higher interest burdens intensify leverage and financial fragility consistent with the Trade Off Theory (Kraus & Litzenberger, 1973). The

time variable (Anno_t) retains a robust negative coefficient, suggesting a progressive deleveraging trajectory over the decade, possibly driven by improved financial governance and the consolidation of post crisis reforms. Regional factors (AreaNord and AreaSud) remain negative and significant, indicating persistent structural asymmetries in access to credit and capital structure adjustments across Italian macro areas. These findings demonstrate that the Step 2A results are structurally stable and empirically resilient. The exclusion of extreme residuals does not compromise the interpretative strength of the model, but rather reinforces confidence in the validity and consistency of its core financial relationships.

3.2.5 Excluding High Residual Outliers (Step 2B)

In order to verify that the estimated relationships observed in distressed firms were not driven by exceptional or idiosyncratic cases, an additional robustness control was conducted by excluding observations with unusually high residuals.

Firms experiencing severe financial distress often display volatile or non linear behavior, as extraordinary write offs, restructuring costs, or temporary cash injections can distort statistical inference (Kennedy, 2008; Greene, 2018).

To mitigate this risk, a model based diagnostic approach was adopted. Observations whose residuals exceeded the conventional Gaussian cut off ($|residual| > \sqrt{3}$) were classified as outliers and removed prior to re estimation.

Coefficients	Estimate	Std. Error	T value	Pr(>|t|)	value
(Intercept)	**104.713**	**0.03624**	**28.894**	**<2,00E-16**	*******
Anno_t	**-0.05169**	**0.02415**	**-2.140**	**0.032596**	*****
EBITDA_t	**0.07815**	**0.02443**	**3.199**	**0.001421**	******
Oneri_t	**0.05951**	**0.01988**	**2.994**	**0.002821**	******
AreaNord	**-0.16365**	**0.04546**	**-3.600**	**0.000333**	*******
AreaSud	**-0.20116**	**0.06761**	**-2.975**	**0.002994**	******

Table 3.15 – Step 2B regression re estimated after excluding observations with |residual| > 3.
Source: Author's computation based on AIDA data (2014–2023).

The results obtained after excluding high residual firms confirm the persistence of the main empirical patterns and reinforce the reliability of the estimated relationships.

The coefficients maintain both direction and significance, while their magnitude changes only marginally a sign that the model's internal balance is not contingent upon a handful of anomalous observations. A closer examination of the coefficients reveals a distinctive dynamic that contrasts with the behavior of solvent firms. The positive and significant association between profitability (EBITDA t) and leverage suggests that, once equity becomes negative, firms no longer use profits primarily to deleverage but rather to sustain debt obligations or finance restructuring strategies. This inversion of the profitability leverage link reflects a shift from a discretionary to a constrained financial regime, where internal resources are absorbed by survival needs rather than capital optimization.

A similar pattern emerges for financial expenses (Oneri), whose positive and significant coefficient indicates that, in distressed contexts, higher debt servicing costs accompany higher leverage levels. This aligns with the Trade Off Theory, according to which financially constrained firms may accept higher borrowing costs in exchange for liquidity continuity or temporary relief from creditors (Kraus & Litzenberger, 1973). The temporal coefficient (Anno t) remains negative and significant ($p = 0.03$), implying that despite the structural fragility of distressed firms, a slow but measurable deleveraging trend persisted during the observed decade possibly a reflection of institutional reforms and gradual balance sheet restructuring. Finally both regional dummies (Area Nord and Area Sud) remain negative and statistically significant, highlighting the persistence of territorial disparities in financial resilience. Firms located in Southern regions continue to exhibit comparatively weaker recovery capacity and higher dependence on debt refinancing, while Northern firms, though still affected, display slightly greater adjustment flexibility. Overall, the exclusion of high residual outliers strengthens the credibility of the Step 2B results, confirming that the estimated coefficients reflect structural, rather than episodic, relationships. The direction, significance, and relative stability of the parameters provide consistent evidence that the financial behavior of distressed firms follows distinct but systematic patterns shaped by constraint, adaptation, and institutional context rather than random data anomalies.

3.2.6 – Summary of Robustness Evidence

The series of robustness tests conducted across the three empirical stages (Step 1 – Logistic model, Step 2A – OLS for solvent firms, and Step 2B – OLS for distressed firms) collectively confirm the internal validity and structural coherence of the econometric framework.

By applying alternative specifications, diagnostic procedures, and data treatments, the analysis ensured that the estimated relationships are not artifacts of model design or sample composition, but instead reflect consistent behavioral regularities within Italian firms undergoing concordato preventivo procedures. The substitution of profitability indicators (EBITDA vs. ROA) demonstrated that the results are not sensitive to metric changes, reinforcing the conclusion that profitability and leverage maintain a stable inverse relationship in solvent firms and an adaptive one in distressed contexts. Similarly the Variance Inflation Factor tests confirmed the absence of multicollinearity, indicating that each explanatory variable contributes distinct information to the model. The Breusch–Pagan test and subsequent correction with heteroskedasticity robust standard errors validated the statistical reliability of the estimates, as coefficient significance and direction remained unchanged even after adjusting for non constant variance in residuals. In the end the exclusion of high residual outliers across all stages revealed that the models' explanatory power is not driven by exceptional cases, but by systematic economic mechanisms consistently observed across the sample. These robustness exercises establish that the empirical findings are both methodologically sound and theoretically consistent. The results persist across specifications, transformations, and diagnostic corrections, confirming that the relationships between profitability, financial expenses, leverage, and temporal dynamics are structural and not sample dependent. This strengthens the credibility of the regression outcomes as an authentic representation of the financial behavior of Italian firms in crisis, providing a reliable basis for the interpretive and policy implications discussed in the concluding section of the thesis.

3.3 Discussion of Empirical Results and Robustness Evidence

The empirical evidence collected across the three regression stages provides a coherent representation of how Italian firms under preventive settlement and distress conditions adjust their capital structure when profitability, financial pressure, and time interact under regulatory constraints. The results demonstrate that the determinants of leverage are not episodic or model specific, but structural in nature, revealing a consistent behavioural pattern that persists across alternative specifications and estimation techniques.

Profitability stands out as the variable with the strongest association with leverage patterns, but its contribution changes in intensity and sign as firms progress through worsening financial states. Among solvent firms (Step 2A), higher profitability measured through EBITDA or ROA is associated with lower leverage ratios. This supports the view that profitable companies rely on internal funds to finance operations, limiting their exposure to debt. The finding aligns with the Pecking Order Theory (Myers & Majluf, 1984) and complements the logic of the Trade Off Theory (Kraus & Litzenberger, 1973), according to which firms balance the fiscal advantage of debt against its expected cost of financial distress. This behaviours reflects a cautious attitude typical of companies capable of maintaining operating surpluses even during phases of moderate uncertainty. When firms shift from solvency to distress (Step 2B), however, profitability assumes an opposite function. The positive and significant coefficient of ROA in the distressed sample indicates that increases in accounting profitability are often observed when firms undertake restructuring initiatives, revaluation of assets, or short term earnings management intended to sustain debt renegotiations. Profitability therefore becomes a reactive rather than preventive variable, it no longer protects the capital base, but reflects temporary adjustments that accompany crisis management. This transition from stabilizing to compensatory profitability echoes the findings of Altman & Hotchkiss (2006) and Gilson (1997), who document similar shifts in the determinants of leverage during corporate turnaround processes. Financial expenses remain positive and highly significant in every specification, indicating that the burden of servicing debt systematically increases financial strain. As debt servicing costs rise, firms experience a progressive loss of financial flexibility, with interest payments increasingly absorbing resources that would otherwise sustain equity. This dynamic reflects a well-documented pattern of financial fragility, already highlighted in Minsky's seminal work (1986) and corroborated by recent empirical evidence, including

Bräuning et al[148]. (2023). The effect is particularly pronounced among financially distressed firms, where elevated interest burdens tend to entrench existing weaknesses rather than facilitate adjustment.

Time acts like a steady hand over the whole period. Its negative pull in every step hints that deleveraging picked up steam over the decade, probably thanks to economic bounces, new regs, and the rollout of early alerts and restructuring tools from the Codice della Crisi d'Impresa e dell'Insolvenza. Think of time as a stand in for getting smarter with rules and adapting, showing that big picture changes are starting to show up in real balance sheets.

Location differences keep showing up too. Northern firms edge out with slightly lower leverage than southern ones, highlighting ongoing gaps in credit access and toughness. This north south divide, though it's eased a bit lately, still shapes how distressed companies hang on, underscoring that regional quirks are part of Italy's business scene.

On the methods side, all the robustness checks back this up. Variance inflation stays low, so no multicollinearity worries; Breusch Pagan tests say variances aren't messing with our conclusions; and kicking out big outliers barely budges the numbers or their importance. Overall, it means these links aren't just model tricks they're real ties between profits, squeezes, and the bigger setup. This whole thing frames distress as a sliding scale of adaptation. Companies don't just drop their capital drivers—they adapt them as the environment grows more challenging. Profitability goes from guardrail to emergency tool, finance costs shift from daily drags to deep rooted blocks, and time via reforms and tweaks slowly brings things back in line. It's a fresh take on crisis dynamics in finance, tying firm level fixes to Italy's evolving bankruptcy rules. The following chapter applies a Random Forest approach, allowing for nonlinear relationships and variable interactions that conventional regressions may overlook. This extension tests whether profitability, debt cost, and territorial context retain predictive relevance once the model is freed from functional constraints, offering a broader and more flexible view of firms' financial trajectories.

[148] Bräuning, F., Joaquim, G., & Stein, H. (2023). *Interest expenses, coverage ratio, and firm distress* (Current Policy Perspectives Paper No. 96664). Federal Reserve Bank of Boston. SSRN: https://ssrn.com/abstract=4558413

3.3 Introduction to Random Forest

After estimating the regressions, I reexamined the data with a machine learning lens, to see whether non linear relations emerged and interactions that standard regressions tend to miss. The Random Forest algorithm is therefore introduced as an additional analytical layer aimed at testing the robustness and generalizability of the previous findings. Random Forest belongs to the family of ensemble learning methods and operates by aggregating multiple decision trees to improve predictive accuracy while minimizing overfitting. This technique has gained broad recognition in empirical finance for its ability to handle heterogeneous data and reveal latent structures within noisy or unbalanced datasets. As highlighted by Lessmann et al[149]. (2015), ensemble based models often outperform linear estimators in credit risk and financial distress prediction, offering a richer understanding of firm behavior under uncertainty. By integrating Random Forest into the empirical design, the study combines the explanatory power of econometric models with the adaptive flexibility of machine learning, providing a more nuanced representation of how distressed firms adjust their capital structures within dynamic and uncertain environments. Complementing the traditional approach Random techniques were subsequently applied to assess whether using the same set of predictors, with the objective of testing whether non linear modeling could uncover deeper relational patterns particularly those obscured by collinearity or hierarchical interactions. The comparison between these two methodological frameworks MLR and Random Forest is designed not only to assess predictive strength but also to explore variable relevance in high dimensional, heterogeneous financial contexts.

One of the issues that emerged during data collection concerned the uneven availability of complete financial statements, especially for privately owned or very small firms. In many of these cases the reporting routines are minimal, and the financial documents that are filed tend to be incomplete or not fully aligned from one year to the next. As a result, the sample inevitably skews toward firms with more structured accounting practices. This is a known limitation in restructuring studies, where preserving the reliability of the data generally takes

[149] Lessmann, S., Baesens, B., Seow, H.-V., & Thomas, L. C. (2015). Benchmarking state-of-the-art classification algorithms for credit scoring: An update of research. European Journal of Operational Research, 247(1), 124–136. https://doi.org/10.1016/j.ejor.2015.05.030

precedence over achieving perfect coverage. A further limitation stemmed from sector specific reporting inconsistencies. Industries with lower disclosure thresholds such as niche manufacturing and small scale retail were less represented in the final dataset. Likewise, firms located in Southern Italy were more frequently characterized by incomplete reporting, likely reflecting broader macroeconomic vulnerabilities. These limitations inevitably affect the full representativeness of the sample, but as Rajan and Zingales[150] (1995) demonstrate, the analytical depth and comparability of structured datasets can generate robust and replicable insights, even when some degree of sample limitation is acknowledged. While acknowledging these limitations, the methodological rigor applied during the filtering process is intended to preserve analytical consistency across the dataset. The longitudinal architecture and multivariate structure of the dataset lay the empirical groundwork for a robust and comparative analysis of leverage dynamics across different legal, structural, and economic conditions. The insights derived from this investigation aim to illuminate the critical drivers of financial resilience and support more effective policy and managerial responses to corporate distress. Among the various algorithms that have grown out of the intersection between statistics and computer science, Random Forest has earned a rather peculiar position. It is not the most refined from a theoretical standpoint, nor the easiest to interpret, yet its practical robustness is difficult to match. Breiman's contribution did not consist in inventing a new classifier from scratch, but in rethinking the weaknesses of decision trees and turning them into an advantage by letting many of them work together. The idea relies on two forms of randomness, the data are repeatedly resampled through bootstrapping, and only a selection of predictors is considered at each split. This simple mechanism produces an ensemble that smooths out the instability of individual trees and yields predictions that are consistently reliable across different settings. What makes Random Forest particularly appealing is its pragmatic flexibility. Regression techniques rest on a set of assumptions linearity, homoscedasticity, and well behaved residuals that real data do not always respect. Random Forest, instead, works well even when the data are irregular, nonlinear, or shaped by complex interactions. This ability has made it appealing in many fields, which adopted it much earlier than finance did. Ecologists used it early on for complex classification problems, agronomists adopted it for yield prediction when linear models proved insufficient, and only later did finance and accounting begin to explore its potential.

[150] Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Yet its contribution in these fields has been far from marginal, it has performed better than logistic regression in predicting distress in several emerging markets, incorporated textual information from corporate reports into bankruptcy models, and offered new ways of examining the cost of equity in sectors such as insurance. These examples show not only how adaptable the method is, but also how it can uncover structures and relationships that often remain hidden when relying solely on classical econometrics. At the same time, its strengths come with clear interpretative limits. Random Forest does not deliver coefficients with a straightforward economic meaning; instead, it offers measures of variable relevance and predicted probabilities. Even these metrics if not properly corrected can introduce biases, and the method is often described as operating like a "black box": highly effective in prediction, less direct in causal interpretation. In this study, Random Forest is not meant to replace regression but to complement it. Regression provides the analytical backbone needed to test the hypotheses and determine the direction of the relationships at stake. The forest, in contrast, works without parametric constraints and is more responsive to non linearities and interaction effects. Looking at the evidence through both perspectives—the structure offered by regression and the predictive insight of the forest—makes it possible to obtain a fuller picture of how financial distress takes shape and develops over time.

3.4 Transition to Empirical Results

Traditional regression models remain useful for the clarity with which they summarize the main relationships. In situations of financial distress, however, the link between profitability and leverage rarely behaves in a linear fashion. When firms enter procedures such as the concordato preventivo, the picture becomes even more articulated, profitability, interest burdens, capital erosion and creditor dynamics interact in ways that are neither linear nor additive, making the underlying patterns more difficult to capture through standard parametric approaches. Linear models risk forcing a fixed functional shape onto data that moves in more complex ways. For instance, in financial flow forecasting, shows that machine learning can uncover non linear patterns in periods of abnormal capital movement that linear models tend to oversimplify. Thus, after estimating regression models as a benchmark, To circumvent restrictive functional form assumptions, this study employs a Random Forest methodology. This approach aggregates multiple decision trees into an

ensemble, thereby facilitating the identification of complex interactions and non monotonic associations among the predictors (Bitetto, Filomeni & Modina[151], 2025). This flexibility is essential in distress settings, where the marginal impact of additional EBITDA may depend crucially on the firm's equity position or past commitments. The trade off, of course, is that Random Forest does not yield classical coefficients that ease interpretation. To address this interpretability gap, I relied on SHAP values, a method inspired by cooperative game theory. Building on Shapley's original idea—where the value created by a coalition is split among its members—SHAP breaks down each prediction into the individual contribution of every feature. Rather than relying on a single average coefficient, SHAP computes local contributions for each observation, which can then be aggregated to derive global insights. As Czasonis, Kritzman & Turkington[152] (2023) argue, relevance based measures like SHAP are crucial in disentangling predictor influence in complex, non linear models.

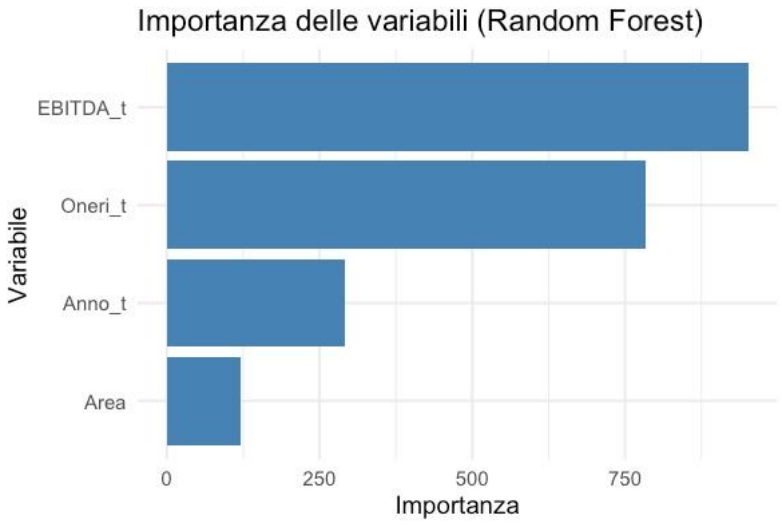

Figure 3.4 The chart reports the variable importance scores derived from the Random Forest algorithm. EBITDA t and Oneri t dominate the model's predictive structure, indicating that profitability and debt servicing costs primarily drive leverage dynamics, while temporal and regional factors exert a secondary but consistent effect.

[151] Bitetto, A., Filomeni, S., & Modina, M. (2025). Machine Learning for the Unlisted: Enhancing MSME Default Prediction with Public Market Signals. Journal of Corporate Finance. https://doi.org/10.1016/j.jcorpfin.2025.102830

[152] Czasonis, M., Kritzman, M., & Turkington, D. (2023). Relevance-based importance: A comprehensive measure of variable importance in prediction. MIT Sloan Research Paper No. 7150-24. https://doi.org/10.2139/ssrn.4962100

Before investigating the non linear relationships between individual predictors and the Debt Equity ratio, I first examined the relative importance of the explanatory variables within the Random Forest model. Figure 2.3 reports the variable importance ranking, which highlights EBITDA t and Oneri as the most influential predictors, followed by the time variable (Anno t) and the regional dummy (Area). This preliminary analysis confirms that profitability and debt servicing costs dominate the capital structure dynamics of distressed firms, while temporal and territorial dimensions exert a secondary but non negligible influence. Assessing variable importance serves as a diagnostic step before turning to interpretability methods such as SHAP, allowing to verify that the most relevant drivers identified by the algorithm are consistent with theoretical expectations from capital structure literature. Applied to my sample of Italian firms in judicial restructuring, the SHAP results for EBITDA reveal a pronounced parabolic pattern. Moreover, SHAP's visual outputs dependence charts, summary plots make it possible to see whether a variable exerts a linear, threshold, or parabolic effect on the outcome and this Illustrate how combining machine learning with SHAP can reveal structural relationships in regional growth models that standard regressions miss. Similarly, Buckmann, Joseph & Robertson153 (2021) emphasize that interpretability tools are essential to "open the black box" and support credible inference rather than pure prediction. Applied to my sample of Italian firms in judicial restructuring, the SHAP results for EBITDA reveal a pronounced parabolic pattern. At low levels of operating profitability, increases in EBITDA correspond to higher leverage, minor improvements signal survival and justify new borrowing, particularly in the early distress phase. However, this upward effect is mitigated among firms with negative equity, where credibility is constrained and creditors remain cautious. As EBITDA climbs above a threshold, the relationship reverses, greater profitability is associated with deleveraging. Firms with positive equity dominate this region, indicating that once solvency is regained, new earnings are directed toward strengthening the capital base instead of accumulating debt. This pattern recalls the traditional views on capital structure, enriched here by the evidence from the machine learning analysis, in the early stages, debt can help keep the business running and impose discipline, whereas in later phases firms tend to rely more on internally generated funds. Notes that Shapley based decompositions allow explanatory power to shift among predictors depending on context here, EBITDA transitions from enabling debt to driving equity

[153] Buckmann, M., Joseph, A., & Robertson, H. (2021). Opening the Black Box: Machine Learning Interpretability and Inference Tools with an Application to Economic Forecasting. In Data Science for Economics and Finance (pp. 43-63). Springer. https://doi.org/10.1007/978-3-030-66891-4_3

recovery. Random Forest and the SHAP analysis allow for a reading that is more complete than what regression alone can offer. The regressions provide the structural benchmark, while the non linear view helps to see how the role of EBITDA changes across the different stages of distress and subsequent recovery.

Ebitda

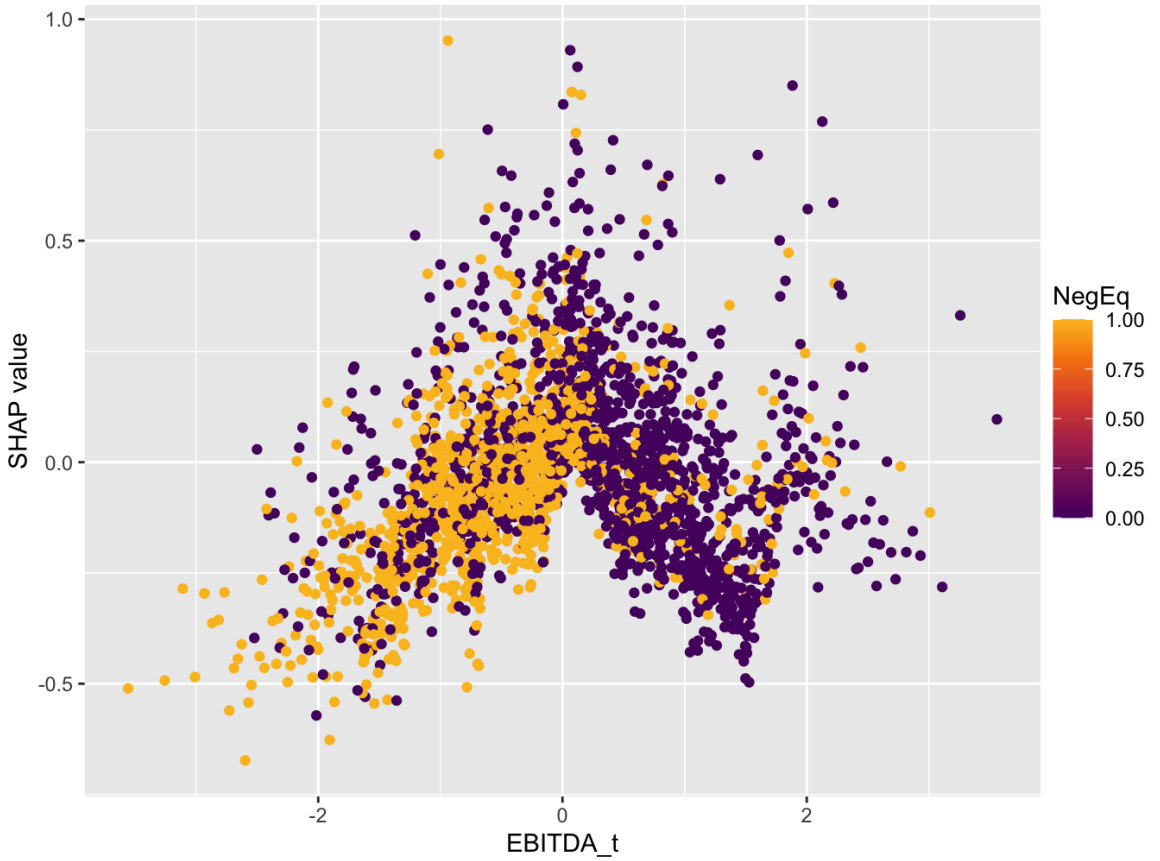

Figure 2.4 shows that the relationship between EBITDA and predicted leverage is not linear.

When EBITDA is low, an increase in operating performance is associated with higher leverage, which is typical of firms in the early stages of distress. Past a certain level however, the pattern reverses better profitability is linked to a lower predicted leverage, indicating that firms start reducing their debt exposure as conditions improve.. At low values of EBITDA, the SHAP impact on leverage is predominantly positive, indicating that marginal improvements in operating profitability tend to increase debt reliance. In this initial region dominated by firms with negative equity (orange points) the model attributes higher SHAP values to EBITDA increases, meaning that additional earnings are often channelled into renewed borrowing or short term liquidity absorption. This pattern reflects the “survival

lending" behaviour typical of early distress phases, when modest improvements in profitability temporarily sustain external financing rather than reduce leverage. As EBITDA approaches the neutral range (around zero), SHAP values reach their peak and then start to decline sharply After that point the direction of the relationship changes higher profitability is linked to lower predicted leverage. In the part of the figure where most observations appear in purple, indicating solvent firms, the Random Forest detects a stabilizing effect of EBITDA. As profits rise, firms rely more on retained earnings and progressively reduce their debt, which helps them rebuild their equity position. The resulting parabolic profile thus captures a dynamic transition between two financial regimes. In the left tail, leverage intensifies as profitability improves, following the short term credit support to distressed firms. In the right tail, profitability becomes a driver of recovery, favouring internal recapitalisation over new borrowing. This asymmetry aligns with the theoretical interpretation proposed by Flannery and Rangan[154] (2006) on gradual capital structure adjustment and echoes the dual phase mechanism observed in the regression results of Step 2A and 2B. Ultimately, the SHAP analysis provides a richer, context sensitive view of EBITDA's role showing that its contribution to leverage is conditional on the firm's solvency status and evolves endogenously along the distress recovery continuum.

[154] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

Oneri finanziari

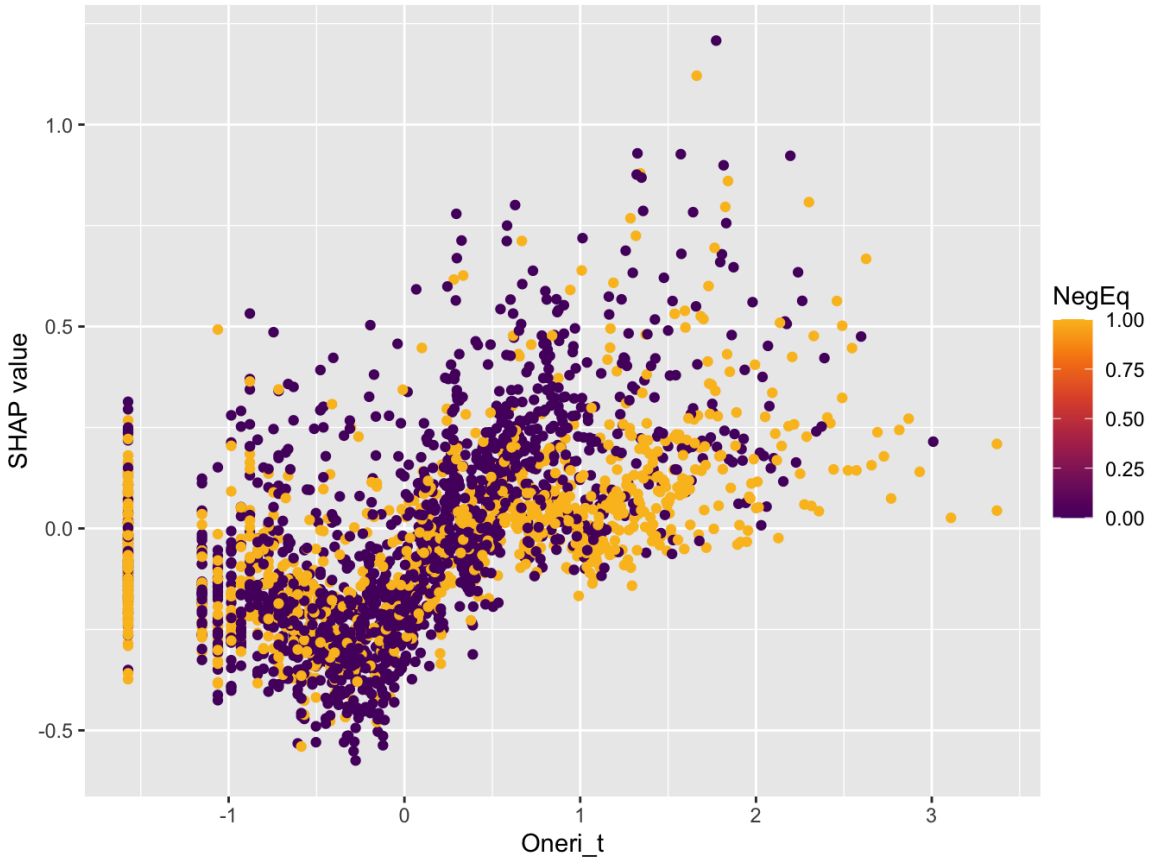

Figure 2.5: SHAP dependence plot for Financial Expenses (Oneri t), colour coded by equity condition (NegEq = 1 in orange, NegEq = 0 in purple). The plot illustrates the marginal contribution of debt servicing costs to the leverage predictions of the Random Forest model.

Figure 2.5 shows that financial expenses are a major driver of predicted leverage in the model. For most observations, SHAP values for Oneri are positive, meaning that heavier interest costs are associated with higher predicted leverage. This monotonic trend aligns with the econometric results, where financial expenses emerged as one of the most persistent and statistically essential determinants of both leverage intensity and distress probability. In the lower range of Oneri (to the left of the plot), SHAP values remain close to zero, reflecting the limited influence of modest financing costs on capital structure. In this segment mainly associated with solvent firms (purple dots) interest expenses are proportionate to earnings capacity and do not substantially alter the firm's financial balance. As financial charges increase, however, SHAP values rise steeply, marking a transition toward a regime in which debt servicing becomes a destabilising factor. The orange gradient, representing firms in negative equity, becomes increasingly dense in this upper region, confirming that elevated

interest burdens are closely tied to distressed conditions. his pattern is consistent with the idea that debt costs do not only reflect leverage but also amplify it. When interest expenses grow faster than operating income, they set in motion a self reinforcing loop of erosion and dependency, as highlighted by Andrade and Kaplan[155] (1998) and Bräuning et al[156]. (2023). In such cases, firms allocate a rising share of cash flow to debt service, crowding out investments and limiting the possibility of equity replenishment. The smooth but upward sloping shape of the SHAP curve also indicates that the marginal impact of Oneri on leverage is cumulative rather than abrupt. This gradual escalation suggests that financial vulnerability builds up over time an interpretation echoes the evolutionary nature of distress identified in Steps 2A and 2B. The fact that solvent and insolvent firms are interspersed across intermediate values further supports the view that financial fragility is not a binary state but a continuum shaped by the balance between interest burden and profitability. Figure 2.5 supports the view that financing costs act both as a signal of distress and as a channel through which distress intensifies. The Random Forest model, through SHAP decomposition, makes this relationship visible across the solvency spectrum, where debt remains affordable, leverage serves strategic purposes; where interest obligations escalate, it becomes the channel through which fragility deepens. The visual outcome thus complements the regression results, providing an intuitive depiction of how financial expenses progressively transform from an operational cost into a mechanism of structural imbalance.

Time Dimension (Anno)

[155] Andrade, G., & Kaplan, S. N. (1998). How costly is financial (not economic) distress? Journal of Finance, 53(5), 1443–1493. https://doi.org/10.1111/0022-1082.00062

[156] Bräuning, F., Joaquim, G., & Stein, H. (2023). *Interest expenses, coverage ratio, and firm distress* (Current Policy Perspectives Paper No. 96664). Federal Reserve Bank of Boston. SSRN: https://ssrn.com/abstract=4558413

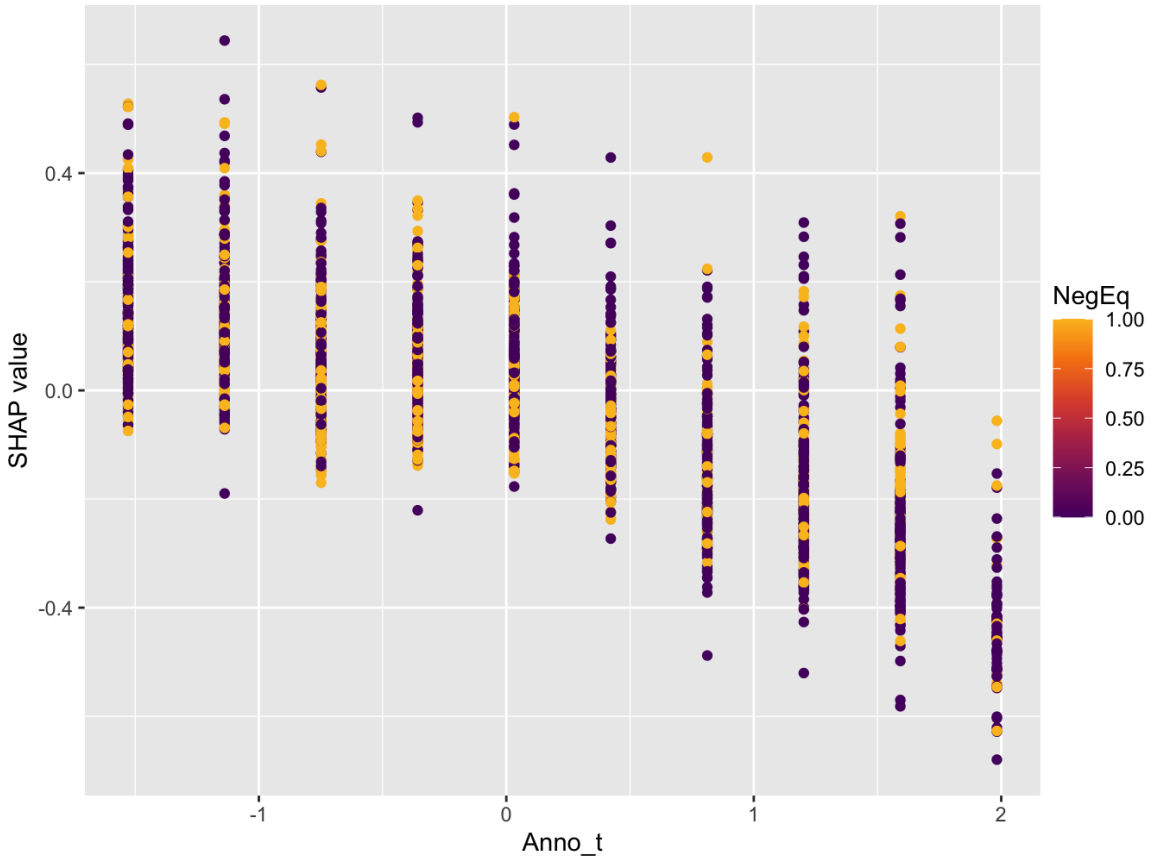

Figure 2.6: SHAP dependence plot for the variable Year (Anno t), colour coded by equity condition (NegEq = 1 in orange, NegEq = 0 in purple). The plot captures the temporal evolution of SHAP contributions to the leverage predictions generated by the Random Forest model.

The SHAP dependence plot in Figure 2.Z highlights the temporal pattern underpinning leverage behaviour over the observation window (2014–2023). The distribution of SHAP values follows a clear downward trend, indicating that the marginal contribution of time to predicted leverage decreases gradually across years. In practical terms, this means that, as the sample period progresses, the model attributes lower predictive weight to debt accumulation, suggesting a systemic movement toward financial stabilization. This declining trajectory is consistent with evidence the econometric results, where the coefficient of Anno t was negative and vital. The SHAP results provide an additional, non linear validation of that finding, rather than an abrupt structural break, the pattern reveals a slow, cumulative process of adjustment. Firms appear to have progressively reduced their leverage exposure, either through internal deleveraging, negotiated restructuring, or equity reinforcement. Such gradual improvement aligns with the “target adjustment” hypothesis of

Flannery and Rangan[157] (2006) and reflects the institutional effects of post crisis regulatory reforms aimed at promoting early detection and resolution of distress. The colour gradient adds an important interpretive layer. In the earlier years (left side of the plot), orange points dominate, indicating that firms with negative equity were more prevalent and their SHAP values higher signifying stronger contributions to leverage risk. As time advances, the distribution shifts towards darker purple, showing that solvent firms progressively increase their weight within the sample and that the marginal impact of the temporal variable becomes smaller and more homogeneous. This visual evolution suggests that the system's overall financial fragility has diminished over time, with fewer firms remaining in deep distress conditions. The findings suggest that Anno t reflects the macroeconomic and institutional shifts that occurred alongside Italy's gradual implementation of insolvency and restructuring reforms, including D.Lgs. 14/2019 and D.Lgs. 83/2022. The negative SHAP gradient confirms that the probability of excessive leverage and by extension, of financial distress declines gradually over the observed period. From a theoretical standpoint, this temporal stabilization supports the idea that financial adjustment among distressed firms follows an evolutionary rather than discontinuous process, time itself acts as a corrective dimension through which structural imbalances are progressively absorbed and the capital structure converges toward sustainable configurations.

Geographical Area

[157] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

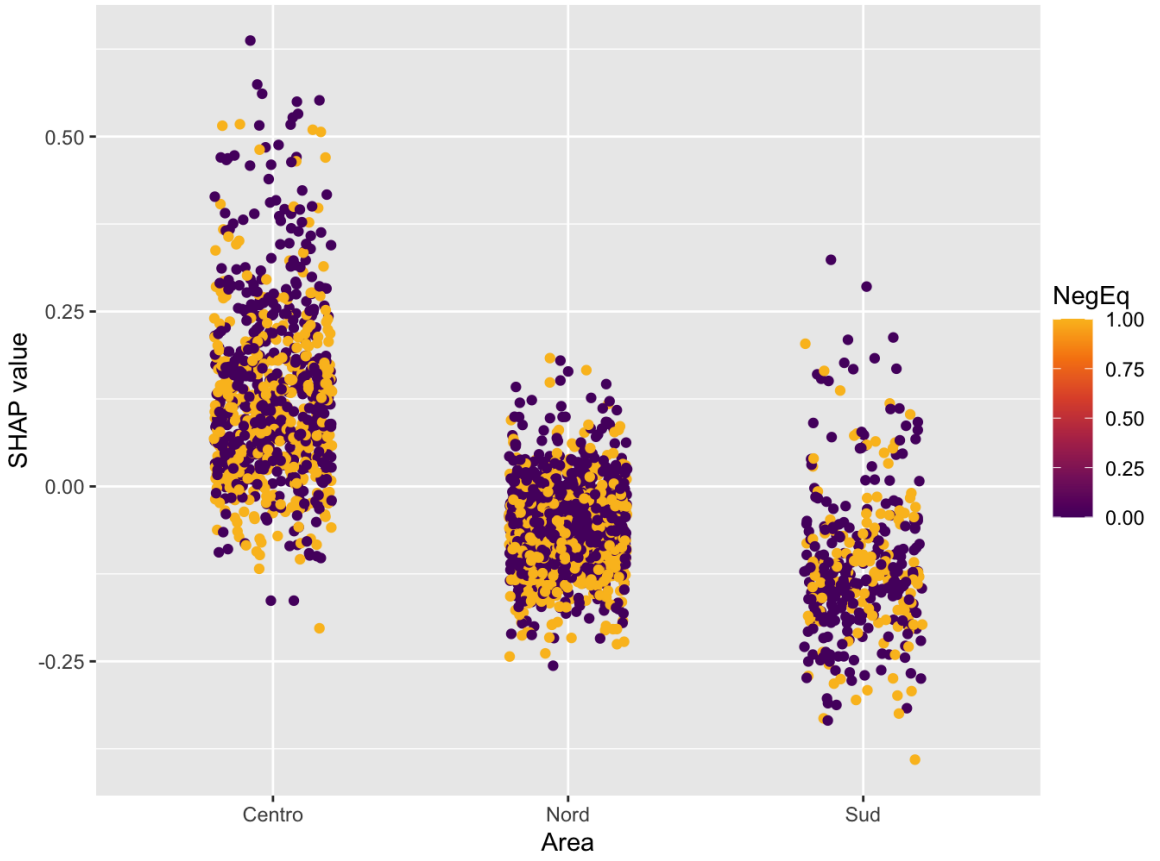

Figure 2.7 : SHAP dependence plot for the categorical variable Area (Centro, Nord, Sud), colour coded by equity condition (NegEq = 1 in orange, NegEq = 0 in purple).

The plot visualizes the marginal contribution of geographical location to predicted leverage outcomes. The SHAP dependence plot in Figure 2.7 highlights how territorial factors contribute to explaining leverage behaviour across Italian regions. The model assigns systematically higher SHAP values to firms located in Central Italy, indicating that belonging to this macro area exerts a stronger positive contribution to predicted leverage levels. In contrast, observations from Northern and Southern regions cluster around lower SHAP values, suggesting a comparatively weaker association between geographical position and leverage intensity. This finding mirrors the econometric evidence discussed in the regression analysis, where both Area Nord and Area Sud coefficients were negative and essential. The SHAP results enrich this interpretation by illustrating that the effect is not only statistically relevant but also consistent across the ensemble model's structure firms in the Centre tend to sustain higher leverage, whereas those in the North and South display patterns of relative moderation. The visual distribution also reinforces the notion of structural and institutional asymmetry within the Italian business environment. Central Italy, characterized by a dense presence of medium sized manufacturing and service firms, often exhibits tighter

credit interdependence and slower capital turnover. This may increase the reliance on debt financing, particularly in the early phases of distress. Conversely, Northern firms typically operate in more competitive and capitalized markets, benefitting from stronger relationships with financial institutions and diversified funding channels. Southern firms, though generally smaller and less capitalized, display lower leverage exposure likely reflecting limited credit access rather than conservative financial policies, as noted by Iammarino et al. (2019) and Guiso, Sapienza, and Zingales[158] (2004). The colour gradient (orange for distressed firms, purple for solvent ones) further contextualizes this territorial divide. Central Italy shows a higher concentration of orange points, signalling a greater proportion of firms with negative equity, whereas the North and South exhibit more balanced distributions. This pattern suggests that institutional quality and local financial ecosystems condition firms' ability to manage leverage under stress. As Beck, Demirgüç Kunt, and Maksimovic[159] (2005) argue, differences in credit market infrastructure and enforcement environments can significantly influence the resilience of firms facing insolvency pressures. In general the SHAP visualization confirms that geography operates as a structural moderator rather than a primary determinant of leverage. While its predictive weight is lower than that of profitability or financial expenses, territorial disparities shape the amplitude and persistence of financial fragility. The model thus corroborates the view that Italy's regional dualism economic maturity in the North, institutional fragility in the South, and credit density in the Centre translates into distinct patterns of capital structure adjustment across the solvency insolvency continuum.

Synthesis and Interpretation of SHAP Based Evidence

The SHAP analysis shows how firm specific and structural factors interact in shaping leverage behaviour in Italian firms involved in preventive settlement proceedings. While the regressions offer a clear linear reading of the main effects, the Random Forest combined

[158] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502183

[159] Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2005). Financial and legal constraints to firm growth: Does firm size matter? Journal of Finance, 60(1), 137–177. https://doi.org/10.1111/j.1540-6261.2005.00727.x

with the SHAP analysis brings out patterns that are nonlinear and strongly shaped by context. These additional insights help refine the overall interpretation of how financial fragility develops. Among the explanatory variables, EBITDA displays the most distinctive parabolic pattern, at low profitability levels, incremental increases in operating income are associated with higher leverage, suggesting that firms in early distress phases tend to use marginal gains to sustain external financing and avoid liquidity shortfalls. However, once profitability surpasses a critical threshold, the relationship reverses indicating that solvent firms redirect new earnings toward equity reinforcement rather than additional borrowing. This transition reflects the dual role of profitability in distressed contexts, oscillating between survival financing and balance sheet recovery. By contrast, financial expenses (Oneri) show a consistently positive monotonic relationship with predicted leverage, confirming their nature as a structural constraint rather than a discretionary choice. Higher interest costs amplify fragility and reduce financial flexibility, especially when credit conditions tighten or debt renegotiation fails to occur. The stability of this pattern across the entire sample highlights the self reinforcing dynamics of indebtedness, where excessive debt servicing both signals and perpetuates financial vulnerability. The temporal dimension (Anno t) introduces an evolutionary perspective. SHAP values decline steadily over the observation window, pointing to a gradual reduction in the marginal contribution of time to leverage risk. This downward trend supports the econometric evidence of deleveraging and indicates that Italian firms, on average, experienced a slow process of rebalancing after the major post 2015 restructuring wave. The trend aligns with Flannery and Rangan[160] (2006) and the progressive institutional adaptation brought by the Codice della Crisi d'Impresa (D.Lgs. 14/2019) and its corrective decrees. Time, practically speaking functions as a systemic variable of adjustment through which market, legal, and managerial responses collectively mitigate structural fragility. Finally, the geographical component acts as a structural moderator within this dynamic system. SHAP distributions confirm that firms located in Central Italy contribute more positively to leverage predictions, while those in the North and South exhibit comparatively lower SHAP values. This pattern mirrors Italy's long standing territorial asymmetries, credit market concentration and industrial density in the Centre sustain higher leverage exposure, whereas the North benefits from greater financial diversification and the South remains constrained by limited credit access. The spatial dimension, though secondary

[160] Flannery, M. J., & Rangan, K. P. (2006). Partial adjustment toward target capital structures. Journal of Financial Economics, 79(3), 469–506. https://doi.org/10.1016/j.jfineco.2005.03.004

to firm level factors, continues to influence the pace and depth of capital structure adjustment, validating prior findings by Guiso, Sapienza and Zingales [161](2004) and Iammarino et al. (2019). Therefore the SHAP results show that financial distress changes over time rather than remaining fixed. Profitability and time help firms slowly regain stability, while financial costs and local conditions tend to aggravate their fragility.The transition from solvency to insolvency and potentially back again emerges not as an abrupt event but as an adaptive process governed by interactions among internal performance, financial discipline, and institutional context. When considered jointly, the machine earning results echo the econometric ones and help explain them, what appeared linear in the regressions unfolds with subtle non linear twists once the algorithm maps variable interactions. The convergence between econometric and machine learning results strengthens the validity of the findings and provides a solid foundation for the following robustness checks, which will further assess the internal consistency and predictive reliability of the proposed models.

Conclusions

The empirical analysis conducted across the three modelling stages provides a clear assessment of the four hypotheses formulated at the outset of the study. Overall the evidence confirms the central role of profitability, debt servicing burden, temporal adjustment, and territorial heterogeneity in shaping the capital structure of firms undergoing concordato preventivo. However the strength and direction of these effects differ markedly between solvent and distressed firms, suggesting that the leverage decision making process evolves as the crisis deepens. The first hypothesis is strongly supported in the sample for firms with positive equity. Higher profitability measured through EBITDA exerts a clear and statistically significant downward pressure on leverage, consistent with the Pecking Order Theory (Myers & Majluf, 1984), which posits that profitable firms rely less on external debt because they can self finance operations and restructuring efforts. This pattern does not hold in the Step 2B sample (firms with negative equity). Once equity becomes negative, profitability changes role, it ceases to reduce leverage and instead becomes positively associated with the debt ratio. This shift reflects the fact that distressed firms experiencing

[161] Guiso, L., Sapienza, P., & Zingales, L. (2004). Does local financial development matter? Quarterly Journal of Economics, 119(3), 929–969. https://doi.org/10.1162/0033553041502183

temporary improvements in performance often rely more heavily on short term credit to sustain operations, negotiate with creditors, or finance urgent working capital needs.

In other words, profitability remains relevant, but its economic meaning changes, in solvent firms, it is a stabilizing buffer, in distressed firms, it becomes a residual resource used to secure credit and preserve continuity. H1 is confirmed only for solvent firms, while distressed firms display a different adjustment dynamic.

The second hypothesis receives consistent empirical confirmation across all three modelling stages. The interest burden is always statistically significant and associated with higher leverage, reinforcing what theory anticipates, as financial expenses increase, liquidity pressure intensifies and firms rely on further borrowing to roll over existing obligations.

This finding echoes classical insights from Kraus & Litzenberger (1973) and empirical evidence from Andrade & Kaplan (1998), showing that debt servicing commitments magnify the costs of distress. The robustness of this result across solvent and distressed firms underscores that the interest burden is the most persistent structural driver of fragility in the context of concordato preventivo. So H2 is fully confirmed.

The third hypothesis is strongly supported by all specifications. The temporal factor (anno) consistently displays a negative coefficient, indicating that, over the decade observed, firms involved in restructuring processes tend to move toward lower leverage levels. This effect may be interpreted as the result of several intertwined mechanisms, progressive institutional consolidation following insolvency reforms; managerial adaptation to stricter financial disciplines, creditor learning, which reduces opportunistic behaviour and introduces more predictable negotiation dynamics. The finding aligns with the insights of Altman & Hotchkiss (2006), who emphasize that successful restructuring unfolds as a gradual, path dependent process. So H3 is confirmed with evidence pointing to a slow but persistent improvement in the sustainability of firms' capital structures.

The fourth hypothesis is supported, although with some nuances. The regional dummies are generally negative indicating that firms in Northern regions have more favourable leverage conditions compared to those in the South but their significance varies across specifications, for example Step 1 and Step 2B have significant differences, confirming the presence of structural asymmetries; Step 2A, the differences remain directionally consistent but lose statistical strength. This pattern suggests that territorial disparities become especially relevant when firms enter deeper stages of distress, aligning with evidence from Guiso, Sapienza & Zingales (2004) and Alessandrini, Presbitero & Zazzaro (2009) showing that

credit market frictions are more binding for weaker firms. H4 is confirmed in its main intuition, though its relevance is more pronounced in distressed firms.

Limitations of the Study

Despite the breadth of the empirical analysis and the multi stage econometric strategy, several limitations should be acknowledged. These constraints do not undermine the validity of the findings, but they delineate the boundaries within which the results should be interpreted. First the study relies on financial statements submitted by firms involved in concordato preventivo, which even when verified may be affected by distortions typical of restructuring contexts. Accounting reclassifications, asset revaluations, and extraordinary items can influence profitability and equity measures, especially in the years preceding the procedure. Although the econometric design mitigates these effects through sample segmentation and robustness checks, a degree of measurement bias remains unavoidable.

Second, the empirical model captures only a subset of the determinants that theory suggests may influence capital structure under distress. Variables such as corporate governance, creditor concentration, banking relationships, ownership structure, and the nature of restructuring proposals (liquidatorio vs. in continuità) could not be incorporated due to data limitations. Consequently, the estimated relationships though significant represent a partial view of the complex decision making processes underlying financial adjustment in crisis scenarios.

Third the analysis is conducted on a sample of Italian firms, within a regulatory and institutional architecture significantly shaped by the reforms of the CCII and the historical North–South divide. While this context provides a unique and meaningful environment for studying financial distress, it also limits the generalizability of the findings. Countries with different insolvency frameworks, creditor protection standards, and financial market depth may display alternative leverage dynamics, particularly with reference to the role of profitability and regional heterogeneity.

Fourth, the distinction between solvent and distressed firms based on equity thresholds captures a relevant financial turning point, but does not fully reflect the underlying heterogeneity of distress conditions. Firms with marginally positive or negative equity may behave differently from those in severe deterioration. A more nuanced classification (for instance, using Altman Z scores, liquidity thresholds, or cash flow adequacy ratios) might reveal additional layers of complexity in firms' capital structure responses. In the end, although extensive robustness checks were implemented (alternative profitability measures,

heteroskedasticity corrections, outlier removal, and multicollinearity diagnostics), the models remain linear. This imposes a structural constraint on how relationships are estimated. The Random Forest exercise introduced in the appendix demonstrates that non linear dynamics are likely to be present but remain outside the main methodological focus of this thesis.

Directions for Future Research

Building on these limitations, several avenues emerge for future investigations into leverage dynamics under crisis conditions. 1) Incorporating qualitative and institutional variables
Future research could benefit from integrating qualitative dimensions that influence restructuring outcomes, negotiation strategies, the role of the attestatore, the behaviour of major creditors, and the nature of proposed restructuring plans. Combining econometric models with qualitative case studies or text analysis of court documents would deepen our understanding of how financial variables interact with institutional and behavioural factors.
2) Exploring nonlinear and machine learning approaches, The Random Forest test performed in this thesis already suggests that capital structure determinants may follow non inear patterns, especially in distressed firms. Future work could systematically compare linear and nonlinear models Random Forest, Gradient Boosting, SHAP analysis to identify interaction effects, thresholds, and tipping points that OLS and Logit cannot detect. This shift toward hybrid modelling would align with recent developments in financial distress prediction and restructuring analytics.
3) Extending the analysis to post reform periods and cross country datasets, As the full implementation of the CCII continues to unfold, future datasets may reveal long run effects of the new early warning mechanisms, the composizione negoziata, and the reconfiguration of creditor priorities. Extending the time window to include five or ten additional years would allow researchers to evaluate the structural impact of reforms. Similarly, comparing Italian firms with those in EU countries implementing the 2019/1023 Directive could illuminate how institutional architecture shapes the resilience of distressed firms.
4) Integrating banking and credit supply variables
The availability and cost of credit during restructuring remain crucial but insufficiently explored elements. Future research could incorporate data from banks, credit registers, or CRIF datasets to analyse whether the behaviour of financial intermediaries reinforces or

mitigates leverage imbalances. This would align with the literature on credit frictions and institutional asymmetries (Guiso et al., 2004; Beck et al., 2005).

5) Differentiating across types of restructuring plans, The current study distinguishes only between solvent and distressed firms. A natural extension would be to differentiate between concordati in continuità and concordati liquidatori. These two procedures entail radically different financial dynamics and creditor expectations. Understanding how leverage evolves within each subgroup could offer insights for practitioners, policymakers, and scholars of insolvency law. 6) Micro level dynamics during negotiations, future research could analyze how leverage, liquidity, and profitability interact within the timeline of a restructuring process before, during, and after filing. A dynamic or panel based econometric approach could reveal whether the inflection point of crisis occurs earlier than balance sheet figures suggest, thereby strengthening early warning tools.

General Conclusion

This dissertation set out to investigate how Italian firms undergoing preventive settlement procedures adjust their capital structure in the face of financial distress, and whether profitability, debt servicing costs, temporal dynamics, and regional asymmetries can explain the evolution of leverage during crisis. By integrating the theoretical contributions of the Pecking Order and Trade Off frameworks with the institutional developments introduced by the Codice della Crisi d'Impresa e dell'Insolvenza, the study provides an empirical reading of how distressed firms respond to pressures that are at once operational, financial, and regulatory. Across the different model specifications, a consistent pattern emerges. Profitability stands out as a key stabilizing force, confirming H1 for solvent firms enterprises capable of generating operating margins tend to rely less on external capital, preserving a more sustainable balance between debt and equity. This finding resonates with longe stablished theories (Myers & Majluf, 1984; Frank & Goyal, 2009) and highlights the centrality of internal cash generation in navigating crisis conditions. Yet, in line with recent distress literature (Hotchkiss et al., 2020), results show that this stabilizing role of profitability progressively weakens—and may even reverse—when equity becomes negative, signaling that once firms cross a threshold of structural fragility, operating performance alone is insufficient to re equilibrate their financial position.

The analysis also provides strong evidence in support of H2, financial expenses remain a powerful amplifier of distress. Higher interest burdens correlate systematically with elevated leverage ratios, reinforcing the idea that rising debt servicing costs compress managerial flexibility and accelerate capital erosion. This insight, aligned with the Trade Off perspective (Kraus & Litzenberger, 1973) and empirical contributions on distress escalation (Andrade & Kaplan, 1998), confirms that the sustainability of a firm's capital structure depends not only on the quantity of debt but also on the conditions under which it is serviced.

Regarding H3, the models indicate that temporal dynamics contribute positively to the rebalancing of capital structures, as reflected by the negative and significant time coefficients for both solvent and distressed sub samples. Although the effect varies in intensity between the two groups, the overall pattern suggests a gradual adjustment process, partly propelled by institutional reforms, the progressive assimilation of new governance practices, and the learning mechanisms triggered by prolonged exposure to restructuring settings. Time in this sense, functions not merely as a chronological marker but as an indicator of regulatory maturation and financial adaptation. Finally the study confirms H4 by documenting the persistent influence of regional disparities on leverage behaviour. Firms located in more institutionally developed areas—typically Northern regions—tend to display more balanced leverage profiles, whereas companies in structurally weaker territories experience comparatively higher financial pressure. This outcome is in line with the broader literature on territorial heterogeneity in credit markets (Guiso, Sapienza & Zingales, 2004; Alessandrini, Presbitero & Zazzaro, 2009) and underscores the need to integrate geographic context into analyses of financial fragility and restructuring dynamics.

Taken in their broader context, the results point to a configuration of financial behaviours that is far from linear, reflecting both firm level determinants and institutional influences, the determinants of leverage in distressed firms follow trajectories that are neither linear nor static, but evolve according to the firm's financial condition, institutional environment, and ability to generate operational resources. Profitability, debt burden, time, and geography interact to shape the paths through which companies attempt to restore balance during crisis. In doing so, the study adds empirical depth to research on financial distress and offers a structured interpretation of how firms behave when navigating preventive restructuring mechanisms. Besides validating the four hypotheses, the evidence also suggests a number of wider implications. They highlight the importance of early intervention, the centrality of profitability as a protective factor, the destabilizing role of excessive financial charges, and the weight of regional asymmetries in influencing firms' resilience. They also suggest that

the transition from solvency to distress marks a genuine structural discontinuity—a point at which traditional leverage determinants lose explanatory power and new constraints, shaped by liquidity scarcity and creditor negotiation, come to dominate. The dissertation contributes to the understanding of corporate financial adjustment under distress by offering a systematic, data driven analysis grounded in both financial theory and the evolving institutional framework of Italian insolvency law. The results underline the need for integrated approaches that consider firm level dynamics, financial market conditions, and the broader legal environment. This multidimensional perspective represents both the strength of the present study and a foundation upon which future research can build.

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