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Romain Cailleau

Essays on the Relationship Between Corporate Governance and Bond Financing

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Essays on the Relationship Between Corporate Governance and Bond Financing

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ATA DE DEFESA DE TESE

ATA DA DEFESA DE TESE DE DOUTORADO EM ADMINISTRAÇÃO do Senhor **ROMAIN CAILLEAU**, REGISTRO Nº 293/2022. No dia 27 de julho de 2022, às 13:00 horas, reuniu-se remotamente, por videoconferência, a Comissão Examinadora de Tese, indicada pelo Colegiado do Centro de Pós-Graduação e Pesquisas em Administração do CEPEAD, em 01 de junho de 2022, para julgar o trabalho final intitulado "**Essays on the relationship between Corporate Governance and Bond Financing"**, requisito para a obtenção do **Grau de Doutor em Administração,** linha de pesquisa: **Finanças.** Abrindo a sessão, o Senhor Presidente da Comissão, Prof. Dr. Antônio Artur de Souza, após dar conhecimento aos presentes o teor das Normas Regulamentares do Trabalho Final, passou a palavra ao candidato para apresentação de seu trabalho. Seguiu-se a arguição pelos examinadores com a respectiva defesa do candidato. Logo após, a Comissão se reuniu sem a presença do candidato e do público, para julgamento e expedição do seguinte resultado final:

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( ) REPROVAÇÃO

O resultado final foi comunicado publicamente ao candidato pelo Senhor Presidente da Comissão. Nada mais havendo a tratar, o Senhor Presidente encerrou a reunião e lavrou a presente ATA, que será assinada por todos os membros participantes da Comissão Examinadora. Belo Horizonte, 27 de julho de 2022.

Prof. Dr. Antônio Artur de Souza
ORIENTADOR - CEPEAD/UFMG

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Commit to the Lord whatever you do,
and he will establish your plans.
(Holy Bible, Proverbs 16:3, NIV)

Abstract

This thesis aims to examine the relationship between corporate governance and bond financing. In particular, its objectives are i) to assess the overall causal effect that the revision of the Novo Mercado segment had on bond yields of listed firms during the 2015-2020 period, ii) to examine the individual contribution of the different corporate governance mechanisms, that were introduced with the revision, to the overall effect on bond yields, and iii) to examine debt renegotiation as a governance mechanism that reduces the agency costs of firms. First, as the revision of the Novo Mercado segment created a unique natural experiment, the research exploited multiple exogenous shocks on corporate governance practices to examine the overall causal effect that corporate governance has on bonds. Specifically, it exploited the staggered adoption of statutory reforms in companies listed in the Novo Mercado segment. Using a sample of 347 bonds issued by 111 Brazilian firms from the first quarter of 2015 until the last quarter of 2020, this research uses a difference-in-differences setting and demonstrates that the adoption of statutory reforms by listed companies had a negative impact on both yields-to-maturity and coupon rates of bonds issued by these firms. Second, companies already listed in the segment were given a period of time to comply with the corporate governance changes. As such, these companies had a progressive adaptation of their corporate governance, and the adoption of statutory reforms didn't lead to immediate changes in all the governance mechanisms. To examine how the adoption of statutory reforms has affected corporate governance mechanisms, corporate governance data was manually collected and merged with the existing dataset. Using a difference-in-differences design, this research finds that the adoption of statutory reforms led to changes in assessments of the management, in audit committee structures, and in internal auditing departments. The relationship between these changes and corporate bond yields was further examined using fixed effects regressions. The models indicate that improvements in assessments of the management and in audit committees decrease bond yields, but improvements in internal auditing departments increase bond yields. The combined effect of these corporate governance changes on corporate bond yields was negative. Third, given the importance of single governance mechanisms in decreasing bond yields, this thesis presents debt renegotiation as a governance mechanism. A structural model of credit risk was developed, with both rollover risk and debt renegotiation. The model uses two traditional reorganization schemes: debt-equity swap and strategic debt service. In both cases, renegotiating the debt is beneficial to both shareholders and bondholders, and debt renegotiation increases significantly the firm value. Debt renegotiation appears as a governance mechanism that can be used to reduce the agency conflicts of debt, especially when firms have to roll over their debt.

Keywords: Bond Yields. Corporate Governance. Debt Renegotiation. Governance Mechanisms. Novo Mercado.

Resumo

Esta tese tem como objetivo examinar a relação entre governança corporativa e financiamento por meio de debêntures. Em particular, os objetivos são i) avaliar o impacto geral que a revisão do Novo Mercado teve sobre os rendimentos de debêntures de empresas listadas durante o período de 2015-2020, ii) examinar a contribuição individual dos diferentes mecanismos de governança corporativa, que foram introduzidos com a revisão, para o efeito geral sobre os rendimentos de debêntures, e iii) examinar a renegociação da dívida como um mecanismo de governança que reduz os custos de agência das empresas. Primeiro, como a revisão do Novo Mercado criou uma experiência natural única, considerou-se os múltiplos choques exógenos nas práticas de governança corporativa para examinar o efeito causal que a governança corporativa tem sobre as debêntures. Em particular, considerou-se a adoção escalonada de reformas estatutárias em empresas listadas no segmento do Novo Mercado. Utilizando uma amostra de 347 debêntures emitidas por 111 empresas brasileiras desde o primeiro trimestre de 2015 até o último trimestre de 2020, esta pesquisa utiliza o método chamado "difference-in-differences" e demonstra que a adoção de reformas estatutárias por empresas listadas teve um impacto negativo, tanto no rendimento até o vencimento quanto nas taxas de cupom das debêntures emitidas por essas empresas. Em segundo lugar, foi dado às empresas já listadas no segmento um período de tempo para cumprir as novas exigências de governança corporativa decorrentes da revisão. Dessa forma, essas empresas tiveram uma adaptação progressiva de sua governança corporativa, e a adoção de reformas estatutárias não levou a mudanças imediatas em todos os mecanismos de governança. Para examinar como a adoção de reformas estatutárias afetou os mecanismos de governança corporativa, dados de governança corporativa relacionados à revisão do Novo Mercado foram coletados manualmente e adicionados ao conjunto de dados já existente. Utilizando o método "difference-in-differences", constatou-se que a adoção de reformas estatutárias levou a mudanças nas avaliações da administração, nas estruturas de comitês de auditoria e nos departamentos de auditoria interna. A relação entre essas mudanças e os rendimentos de debêntures foi ainda examinada usando regressões com efeitos fixos. Os modelos indicam que melhorias nas avaliações da administração e nos comitês de auditoria diminuem os rendimentos de debêntures, enquanto melhorias nos departamentos de auditoria interna aumentam estes rendimentos. O efeito combinado dessas mudanças na governança corporativa sobre os rendimentos de debêntures foi negativo. Em terceiro lugar, dada a importância de mecanismos únicos de governança na diminuição dos rendimentos de debêntures, esta tese apresenta a renegociação da dívida como um mecanismo de governança. Um modelo estrutural de risco de crédito foi desenvolvido, com risco de refinanciamento e com renegociação da dívida. Em particular, foram utilizadas duas formas tradicionais de reorganização: substituição de dívida por capital próprio e redução estratégica do custo da dívida (strategic debt service). Em ambos os casos, a renegociação da

dívida é benéfica tanto para os acionistas quanto para os credores, e a renegociação da dívida aumenta significativamente o valor da empresa. A renegociação da dívida aparece como um mecanismo de governança que pode ser usado para reduzir os conflitos de agência relacionados à dívida, especialmente quando as empresas têm que refinanciar suas dívidas.

Palavras-chave: Rendimento de Debêntures. Governança Corporativa. Renegociação da Dívida. Mecanismos de Governança. Novo Mercado.

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List of abbreviations and acronyms

ANBIMA	Brazilian Financial and Capital Markets Association
B3	São Paulo Stock Exchange
Bps	Basis Points
CVM	Brazilian Securities and Exchange Commission
DI	Interbank Deposit
FISD	Fixed Investment Securities Database
IBGE	Brazilian Institute of Geography and Statistics
IPCA	Extended National Consumer Price Index
IPO	Initial Public Offering
NASD	National Association of Securities Dealers
OTC	Over-The-Counter

Contents

1 Introduction

1.1 Topic and Research Problem

Corporate governance has received considerable attention over the last decades, the number of articles on the topic in the SCOPUS database being 2,027 in 2019, up from 1,487 in 2000. Despite the overwhelming number of articles in the literature, corporate governance remains a vast topic whose definition is often vague and whose understanding has evolved over time. In finance, it is usually defined as "*the way in which suppliers of capital assure themselves a return on their investment*"(SHLEIFER; VISHNY, 1997; BECHT; BOLTON; RÖELL, 2002; DENIS; MCCONNELL, 2003), and it is particularly relevant given that recent technological developments have eased the access to capital markets for investors, regardless of their funds.

Corporate governance relies fundamentally on contractual views of the firm: the firm is a nexus of contracts, and it is more efficient that the market at producing, as shown by Alchian and Demsetz (1972). Since companies are composed of shares representing claims on its assets and earnings, corporate ownership and control are very likely to diverge, especially in public companies (see COASE, 1937); hence, there exist inherent agency conflicts within them. Such conflicts emerge in the presence of contractual arrangements in which an agent acts on the behalf of a principal and both the agent and the principal have different utility functions or when there is imperfect information regarding the actions of the agent (ROSS, 1973).

From this perspective, principals are able to mitigate potential conflicts of interest with the agent either by aligning the agent's interests with theirs through appropriate incentives schemes or by monitoring the agent's actions. Moreover, principals can, in given situations, pay the agent to engage into bonding activities to ensure that principals' best interest is considered. Nonetheless, these activities are not sufficient to completely eliminate the existing divergence of interests, and a residual loss remains. In consequence, the existence of agency conflicts entails agency costs for the firm, and these agency costs are given as the sum of both monitoring and bonding costs and the residual loss (JENSEN; MECKLING, 1976).

The main purpose of corporate governance is to provide governance mechanisms that mitigate the agency conflicts within the firm, thereby reducing the agency costs associated with these conflicts. Most of the existing literature that examines corporate governance has focused on the shareholders-manager conflict (see, for example, JENSEN; MECKLING, 1976; JENSEN, 1986b; JENSEN; SMITH, 2000). In this context, debt is often cited as a governance mechanism that reduces empire-building incentives while also providing great monitoring and potential control of the firm (JENSEN, 1986a; STULZ, 1990; MORELLEC, 2004). However, the use of debt also create additional agency conflicts.

The agency conflict related to debt financing arises from managers' decisions that increase the wealth of shareholders while reducing that of creditors, which also have a claim on the firm. When managers' interests are only aligned with those of shareholders, managers have incentives to promote shareholders' interests at the expense of creditors' interests. In particular, managers can use the payout policy or increase the firm's risk to expropriate creditors (BLACK, 1976; JENSEN; MECKLING, 1976; KALAY, 1982; GAVISH; KALAY, 1983). Similarly, managers can opt to not fully disclose their private information, thus resulting in an adverse selection problem that greatly reduces the firm's value and increases financing costs (THATCHER, 1985; WEBB, 1987; GIAMMARINO, 1989; DETRAGIACHE, 1995).

In practice, companies can take on debt in three different ways: i) by contracting bank loans, ii) by issuing bonds, and/or iii) by using credit lines. While lines of credit are often used as liquidity buffers against short-term liquidity shocks (HOLMSTRÖM; TIROLE, 1998), bank loans and bonds are usually used to finance investment projects (MORELLEC; VALTA; ZHDANOV, 2015), and they are thus designed to be medium to long-term means of financing. In view of this, besides affecting the company's capital structure and financing decisions, the agency conflicts surrounding debt financing also affect the company's investment decisions and operational activities.

This thesis focuses on bond financing for three main reasons. First, bond financing is a significant source of funding, and expected bond returns help explain variations in financing flows and real activity (GILCHRIST; ZAKRAJSEK, 2012; MA, 2019). Second, since bonds cause the firm's debt to be borne by many different creditors, most of which having either low or no monitoring power at all, the agency costs associated with bonds tend to be greater. Third, bonds are traded in over-the-counter markets (OTC) with significant and time-varying trading costs (for studies on American bonds, see BAO; PAN; WANG, 2011; DICK-NIELSEN; FELDHÜTTER; LANDO, 2012), and their prices can greatly vary depending on macroeconomic conditions. The variation in bond prices can create additional agency conflicts between creditors and shareholders, as evidenced by He and Xiong (2012).

Even though firms can use restrictive bond covenants to mitigate the agency conflicts associated with bond financing (LEHN; POULSEN, 1991; SMITH; WARNER, 1979), such covenants are ineffective at eliminating the agency costs. Klock, Mansi, and Maxwell (2005) note that there exist substantial costs in writing, monitoring, and enforcing bond covenants. The authors further affirm that, anticipating the costs that will be imposed on them, bondholders will require bonds to be issued at a discount to cover these costs. Furthermore, there is still room for risk-shifting opportunities even with severe restrictions (JENSEN; MECKLING, 1976). Considering that equity can be modeled as a call option on the company's assets, the option value increases with the asset risk, and shareholders have

incentives to convince managers to shift to projects that are riskier (GAVISH; KALAY, 1983). However, since bonds are priced given the company's intent to invest in projects with given risk levels, bonds value will decline when the firm substitute these projects for riskier projects (SMITH; WARNER, 1979). Additional governance mechanisms are thus needed to minimize the agency costs associated with bond financing.

Examining the effects of corporate governance on the agency costs of debt is of foremost importance. This thesis aims to examine the relationship between corporate governance and bond financing. Existing research on the subject remains limited, with most articles focusing on single corporate governance mechanisms: board of directors (ANDERSON; MANSI; REEB, 2004; CHULUUN; PREVOST; PUTHENPURACKAL, 2014), executive compensation (DURU; MANSI; REEB, 2005; SUNDARAM; YERMACK, 2007; KABIR; LI; VELD-MERKOULOVA, 2013), disclosure and transparency (DICHEV; SKINNER, 2002; YU, 2005), creditor control (NINI; SMITH; SUFI, 2012), and corporate takeovers (WARGA; WELCH, 1993).

The results of these studies indicate that the aforementioned mechanisms have a negative effect on bond yields and thus reduce companies' financing costs. Yet, it is important to examine corporate governance as a whole since governance mechanisms can interact with each other and have different effects on the different agency conflicts. In line with this view, Cremers, Nair, and Wei (2007) find that the effect of shareholder control on the agency costs of debt depends on takeover vulnerability. Shareholder control is positively (negatively) related to bond yields if the company is exposed to (protected from) takeovers. Their article highlights how interactions between two shareholders governance mechanisms can modify the overall effect that these mechanisms have on bonds.

1.2 Objectives

Given the great number of agency conflicts and governance mechanisms that exist in the literature, it is impossible to consider all of them in the analyses. This thesis thus begin by focusing on the set of corporate governance practices originating from the revision of the Novo Mercado segment. In 2017, the São Paulo Stock Exchange (B3) approved the revision of that segment to ensure that it was up to international corporate governance standards. As such, it represents an exogenous shock to corporate governance practices, and since the revision wasn't motivated by the desire to promote bond financing, it provides a natural experiment to examine the causal effect that corporate governance has on bonds. Studies examining the effect that corporate governance has on bond yields have faced endogeneity issues, and natural experiments are the best solution to address these issues (WINTOKI; LINCK; NETTER, 2012). Hence, using the natural experiment, this thesis aims at examining the overall causal effect that the revision of the Novo Mercado segment had on corporate bond yields of that segment's companies.

Additionally, companies listed in the Novo Mercado segment could delay the adoption of the new corporate governance practices until the first shareholders' meeting of 2021. Hence, changes in corporate governance were progressive and there were no immediate changes in all the governance mechanisms. The second objective of this thesis is to examine the individual contribution of the corporate governance mechanisms, that were adopted with the revision of the Novo Mercado segment, to the overall effect on bond yields. Before the revision, the Novo Mercado and the Level II segments had similar governance requirements, with the only difference being that companies listed in the Level II could issue preferred shares. The revision widened the gap between the two segments by introducing additional governance mechanisms with respect to assessment of the management, audit committee, internal auditing, and corporate transparency (B3, 2017). Consequently, this thesis examines the individual contribution of each of these governance mechanisms to bond yields.

Lastly, given that individual governance mechanisms can have important effects on corporate bond yields, this paper presents debt renegotiation as a governance mechanism that can reduce the agency costs of these firms. Berkovitch and Kim (1990) already recognized that companies could mitigate the agency costs of debt by renegotiating prior debt contracts. When renegotiating debt, firms are able to save on bankruptcy costs and lighten their debt burden. However, the possibility to renegotiate debt also bears the risk of strategic default, according to which firms prefer to default even when they have the resources to meet their debt payments (HART; MOORE, 1998). In addition, existing studies have ignored interactions between liquidity risk and credit risk, and it is well-known that illiquidity on the secondary bond market affects the firm's credit risk through the rollover risk and may create further agency costs (HE; XIONG, 2012; HE; MILBRADT, 2014; CHEN et al., 2018).

1.3 Relevance

A research that focuses on corporate governance is relevant in several ways. Firstly, governments and policy makers worldwide have spent a lot of time creating and revising governance frameworks to enforce best governance practices in firms, and it is essential for them to assess the impact that these changes had on firms. Secondly, past governance failures have proved very detrimental for the society as a whole, as evidenced by the 2008 financial crisis (KIRKPATRICK, 2009; HAWLEY; KAMATH; WILLIAMS, 2011). It is thus important to get a better understanding of how governance mechanisms affect firms and what are the causes of governance failures. Thirdly, corporate governance has evolved rapidly in the last decades while also varying substantially among countries. The Organization for Economic Co-operation and Development (2015) recognizes the importance of having a governance structure that is adapted to the reality in which it is

implanted. Consequently, studies that examine corporate governance at the national level are of utter importance.

The introduction of corporate governance frameworks has important economic implications. Corporate governance encourages investment and eases firms' access to capital markets by increasing transparency and making firms more accountable to their stakeholders (ARMSTRONG; GUAY; WEBER, 2010). It also promotes ethical behaviors and trust, which are essential to have well-functioning and efficient markets (see, for example, MARRA; MAZZOLA; PRENCIPE, 2011). At the macroeconomic level, corporate governance aims to "*support economic efficiency, sustainable growth, and financial stability*" (ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, 2015). Economic efficiency ensures that assets are allocated to their best uses and that any residual waste or loss is minimized. Sustainable growth refers to an economic growth that can be maintained in the long run without running into economic problems. By mitigating the existing agency conflicts, corporate governance helps optimizing firms' financing and investment decisions and strives toward achieving economic efficiency and sustainable growth. Lastly, corporate governance improves financial stability by discouraging undue risk-taking and unsustainable business practices.

Studies on corporate bonds are also very important. Examining a set of more than 92,000 bonds issued by non-financial firms from 114 countries during the period from 2000 to 2019, Çelik, Demirtas, and Isaksson (2020) found a tremendous growth in corporate bond financing. The authors further found that these bonds experienced a decrease in both their credit quality and covenant protection. These results indicate that agency conflicts associated with bond financing have aggravated in the last years, and corporate governance is even more important to control these conflicts. Moreover, the corporate bond market provides a substitute for bank lending when credit supply tightens (BECKER; IVASHINA, 2014; KAYA; WANG, 2016), and it is essential for firms to remain solvent during economic and financial crises. Bond financing is particularly relevant in Brazil, since companies that belong to strategic business sectors rely on bonds to finance their activities. For example, Brazilian utility companies are among the biggest bond issuers, and bond financing is essential to sustain their operations. It is thus essential to minimize the cost of financing of these firms.

The relationship between corporate governance and bond financing remains understudied. The existing literature has mostly ignored the interactions among existing corporate governance mechanisms. To address this problem, this thesis analyzes a set of governance practices introduced with the revision of the Novo Mercado segment. Furthermore, research on corporate governance is plagued with endogeneity issues (WINTOKI; LINCK; NETTER, 2012; FLANNERY; HANKINS, 2013; DANG; KIM; SHIN, 2015). This research provides a natural experiment that can mitigate these issues and helps

establishing a causal relationship between corporate governance and bond yields. This approach can be reproduced to investigate further issues related to corporate governance. Lastly, there is a lack of studies examining the effect of Brazilian premium listing segments. To the best of my knowledge, there are no published articles examining the impact of these premium listing segments on bond yields.

Even though the corporate governance literature has mostly focused on the effect of single corporate governance mechanisms on bonds, it is still not obvious whether debt renegotiation can be considered a governance mechanism. Furthermore, it is not clear in the literature whether debt renegotiation can be used as a mean of reducing the agency costs associated with bond financing. Yet, there exists mixed evidence that debt renegotiation increases bond yields (ANDERSON; SUNDARESAN, 1996; HART; MOORE, 1998; FAN; SUNDARESAN, 2000; DAVYDENKO; STREBULAEV, 2007), and these studies have not considered the interactions between secondary bond market liquidity and credit risk.

1.4 Thesis Structure

This subsection outlines the structure of this thesis. The first section introduces the topic, presents the research problem, which was further decomposed into research objectives that are explored in sections 2, 3,and 4; and discusses the relevance of this thesis. The second and third sections present the first and second empirical articles respectively. The fourth section provides the last article and focuses on a theoretical model. The fifth section concludes the thesis by showing the main results, discussing the limitations of this research, and offering guidance for future studies.

Besides the three articles, this thesis also comprises four appendices. The two first appendices provide additional details about the revision of the Novo Mercado segment (A) and the difference with the Level II segment (B). The two remaining appendices provide additional texts that were produced during the thesis but were not used in the articles. Appendix (C) offers a detailed literature review about the agency theory, which is a basic foundation for all the three articles. This text was not included in the main parts of this thesis because it would be too long to fit in any of the three articles. Appendix (D) offers a literature review about the relationship between credit risk and cash holdings. This appendix, while not directly tied to the third article, is related to the suggestions on future research that were discussed in the conclusion.

The first empirical article entitled "Corporate Governance and Bond Yields: Evidence from Brazil" explores the first objective of this thesis. This article uses the staggered adoption of statutory reforms from 2015 to 2020 by Brazilian firms listed in the Novo Mercado segment to investigate the overall impact of better corporate governance practices on bond yields. Still, since there was a progressive adoption for the new corporate governance mechanisms. Consequently, the article "Revision of the Novo Mercado Segment: Which

Governance Mechanisms Matter to Bondholders?" explores the second objective and aims to examine the individual contribution of the different governance mechanisms to the overall effect on bond yields.

The last article entitled "Strategic Actions and Rollover Risk: Debt Renegotiation as a Governance Mechanism" focuses on a single governance mechanism: debt renegotiation. The article doesn't focus on Brazilian corporate governance. Instead, it focuses on corporate governance as a whole, independently of any country; therefore, its contents applies also to Brazil. The article contains a standalone structural model of credit risk that accounts for the effect of debt market illiquidity in firms' credit risk. The model is used to examine the effects of debt renegotiation on firms subject to rollover risk.

1.5 References

ALCHIAN, A. A.; DEMSETZ, H. Production, Information Costs, and Economic Organization. **The American Economic Review**, v. 62, n. 5, p. 939–961, 1972.

ANDERSON, R. C.; MANSI, S. A.; REEB, D. M. Board Characteristics, Accounting Report Integrity, and The Cost of Debt. **Journal of Accounting and Economics**, v. 37, n. 3, p. 315–342, 2004.

ANDERSON, R. W.; SUNDARESAN, S. Design and Valuation of Debt Contracts. **The Review of Financial Studies**, v. 9, n. 1, p. 37–68, 1996.

ARMSTRONG, C. S.; GUAY, W. R.; WEBER, J. P. The Role of Information and Financial Reporting in Corporate Governance and Debt Contracting. **Journal of Accounting and Economics**, v. 50, n. 2–3, p. 179–234, 2010.

B3. **Regulamento do Novo Mercado**. [S.l.: s.n.], 2017. Available from: <https://www.b3.com.br/data/files/B7/85/E6/99/A5E3861012FFCD76AC094EA8/Regulamento%20do%20Novo%20Mercado%20-%2003.10.2017%20%28Sancoes%20pecuniarias%202019%29.pdf>.

BAO, J.; PAN, J.; WANG, J. The Illiquidity of Corporate Bonds. **The Journal of Finance**, v. 66, n. 3, p. 911–946, 2011.

BECHT, M.; BOLTON, P.; RÖELL, A. Corporate Governance and Control. In: CONSTANTINIDES, G. M.; HARRIS, M.; STULZ, R. M. (Eds.). **Handbook of the Economics of Finance**. Amsterdam: North-Holland, 2002.

BECKER, B.; IVASHINA, V. Cyclicality of Credit Supply: Firm Level Evidence. **Journal of Monetary Economics**, v. 93, p. 76–93, 2014.

BERKOVITCH, E.; KIM, E. H. Financial Contracting and Leverage Induced Over- and Under-Investment Incentives. **The Journal of Finance**, v. 45, n. 3, p. 765–794, 1990.

BLACK, F. The Dividend Puzzle. **Journal of Portfolio Management**, v. 2, n. 2, p. 5–8, 1976.

ÇELIK, S.; DEMIRTAS, G.; ISAKSSON, M. **Corporate Bond Market Trends, Emerging Risks and Monetary Policy**. Paris, 2020.

CHEN, H. et al. Quantifying Liquidity and Default Risks of Corporate Bonds over the Business Cycle. **The Review of Financial Studies**, v. 31, n. 3, p. 852–897, 2018.

CHULUUN, T.; PREVOST, A.; PUTHENPURACKAL, J. Board Ties and the Cost of Corporate Debt. **Financial Management**, v. 43, n. 3, p. 852–897, 2014.

COASE, R. H. The Nature of the Firm. **Economica**, v. 4, n. 16, p. 386–405, 1937.

CREMERS, K. J. M.; NAIR, V.; WEI, C. Governance Mechanisms and Bond Prices. **The Review of Financial Studies**, v. 20, n. 5, p. 1359–1388, 2007.

DANG, V. A.; KIM, M.; SHIN, Y. In Search of Robust Methods for Dynamic Panel Data Models in Empirical Corporate Finance. **Journal of Banking & Finance**, v. 53, p. 84–98, 2015.

DAVYDENKO, S. A.; STREBULAEV, I. A. Strategic Actions and Credit Spreads: An Empirical Investigation. **The Journal of Finance**, v. 62, n. 6, p. 2633–2671, 2007.

DENIS, D. K.; MCCONNELL, J. J. International Corporate Governance. **Journal of Financial and Quantitative Analysis**, v. 38, n. 1, p. 1–36, 2003.

DETRAGIACHE, E. Adverse Selection and the Costs of Financial Distress. **Journal of Corporate Finance**, v. 1, n. 3–4, p. 347–365, 1995.

DICHEV, I. D.; SKINNER, D. J. Large-Sample Evidence on the Debt Covenant Hypothesis. **Journal of Accounting Research**, v. 40, n. 4, p. 1091–1123, 2002.

DICK-NIELSEN, J.; FELDHÜTTER, P.; LANDO, D. Corporate Bond Liquidity Before and After the Onset of the Subprime Crisis. **Journal of Financial Economics**, v. 103, n. 3, p. 471–492, 2012.

DURU, A.; MANSI, S. A.; REEB, D. M. Earnings-Based Bonus Plans and The Agency Costs of Debt. **Journal of Accounting and Public Policy**, v. 24, n. 5, p. 431–447, 2005.

FAN, H.; SUNDARESAN, M. Debt Valuation, Renegotiation, and Optimal Dividend Policy. **The Review of Financial Studies**, v. 13, n. 4, p. 1057–1099, 2000.

FLANNERY, M. J.; HANKINS, K. W. Estimating Dynamic Panel Models in Corporate Finance. **Journal of Corporate Finance**, v. 19, p. 1–19, 2013.

GAVISH, B.; KALAY, A. On the Asset Substitution Problem. **Journal of Financial and Quantitative Analysis**, v. 18, n. 1, p. 21–30, 1983.

GIAMMARINO, R. M. The Resolution of Financial Distress. **The Review of Financial Studies**, v. 2, n. 1, p. 25–47, 1989.

GILCHRIST, S.; ZAKRAJSEK, E. Credit Spreads and Business Cycle Fluctuations. **American Economic Review**, v. 102, n. 4, p. 1692–1820, 2012.

HART, O.; MOORE, J. Default and Renegotiation: A Dynamic Model of Debt. **The Quarterly Journal of Economics**, v. 113, n. 1, p. 159–184, 1998.

HAWLEY, J. P.; KAMATH, S. J.; WILLIAMS, A. T. **Corporate Governance Failures: The Role of Institutional Investors in the Global Financial Crisis**. [S.l.]: University of Pennsylvania Press, 2011.

HE, Z.; MILBRADT, K. Endogenous Liquidity and Defaultable Bonds. **Econometrica**, v. 82, n. 4, p. 1443–1508, 2014.

HE, Z.; XIONG, W. Rollover Risk and Credit Risk. **The Journal of Finance**, v. 67, n. 2, p. 391–430, 2012.

HOLMSTRÖM, B.; TIROLE, J. Private and Public Supply of Liquidity. **Journal of Political Economy**, v. 106, n. 1, p. 1–40, 1998.

JENSEN, M. C. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. **The American Economic Review**, v. 76, n. 2, p. 323–329, 1986.

_____. The Takeover Controversy: Analysis and Evidence. **Midland Corporate Finance Journal**, v. 4, n. 2, p. 1–56, 1986.

JENSEN, M. C.; MECKLING, W. H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. **Journal of Financial Economics**, v. 3, p. 305–360, 1976.

JENSEN, M. C.; SMITH, C. W. Stockholder, Manager, and Creditor Interests: Applications of Agency Theory. In: JENSEN, M. C. (Ed.). **A Theory of the Firm: Governance, Residual Claims and Organizational Forms**. Cambridge: Harvard University Press, 2000.

KABIR, R.; LI, H.; VELD-MERKOULOVA, Y. V. Executive Compensation and The Cost of Debt. **Journal of Banking & Finance**, v. 37, n. 8, p. 2893–2907, 2013.

KALAY, A. Stockholder-Bondholder Conflict and Dividend Constraints. **Journal of Financial Economics**, v. 10, n. 2, p. 211–233, 1982.

KAYA, O.; WANG, L. The Role of Bank Lending Tightening on Corporate Bond Issuance in the Eurozone. **The Quarterly Review of Economics and Finance**, v. 60, p. 1–11, 2016.

KIRKPATRICK, G. The Corporate Governance Lessons from the Financial Crisis. **Financial Market Trends**, v. 1, p. 1–30, 2009.

KLOCK, M. S.; MANSI, S. A.; MAXWELL, W. F. Does Corporate Governance Matter to Bondholders? **Journal of Financial and Quantitative Analysis**, v. 40, n. 4, p. 693–719, 2005.

LEHN, K.; POULSEN, A. Contractual Resolution of Bondholder-Stockholder Conflicts in Leveraged Buyouts. **The Journal of Law & Economics**, v. 34, n. 2, p. 645–673, 1991.

MA, Y. Nonfinancial Firms as Cross-Market Arbitrageurs. **The Journal of Finance**, v. 74, n. 6, p. 3041–3087, 2019.

MARRA, A.; MAZZOLA, P.; PRENCIPE, A. Board Monitoring and Earnings Management Pre- and Post-IFRS. **The International Journal of Accounting**, v. 46, n. 2, p. 205–230, 2011.

MORELLEC, E. Can Managerial Discretion Explain Observed Leverage Ratios? **The Review of Financial Studies**, v. 17, n. 1, p. 257–294, 2004.

MORELLEC, E.; VALTA, P.; ZHDANOV, A. Financing Investment: The Choice Between Bonds and Bank Loans. **Management Science**, v. 61, n. 11, p. 2580–2602, 2015.

NINI, G.; SMITH, D. C.; SUFI, A. Creditor Control Rights, Corporate Governance, and Firm Value. **The Review of Financial Studies**, v. 25, n. 6, p. 1713–1761, 2012.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT. **G20/OECD Principales of Corporate Governance**. [S.l.]: OECD Publishing, Paris, 2015.

ROSS, S. A. The Economic Theory of Agency: The Principal's Problem. **The American Economic Review**, v. 63, n. 2, p. 134–139, 1973.

SHLEIFER, A.; VISHNY, R. W. A Survey of Corporate Governance. **The Journal of Finance**, v. 52, n. 2, p. 737–783, 1997.

SMITH, C. W.; WARNER, J. B. On Financial Contracting: An Analysis of Bond Covenants. **Journal of Financial Economics**, v. 7, n. 2, p. 117–161, 1979.

STULZ, R. M. Managerial Discretion and Optimal Financing Policies. **Journal of Financial Economics**, v. 26, n. 1, p. 3–27, 1990.

SUNDARAM, R. K.; YERMACK, D. L. Pay Me Later: Inside Debt and Its Role in Managerial Compensation. **The Journal of Finance**, v. 62, n. 4, p. 1551–1588, 2007.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

WARGA, A.; WELCH, I. Bondholders Losses in Leveraged Buyouts. **The Review of Financial Studies**, v. 6, n. 4, p. 959–982, 1993.

WEBB, D. C. The Importance of Incomplete Information in Explaining the Existence of Costly Bankruptcy. **Economica**, v. 54, n. 215, p. 279–288, 1987.

WINTOKI, M. B.; LINCK, J. S.; NETTER, J. M. Endogeneity and the Dynamics of Internal Corporate Governance. **Journal of Financial Economics**, v. 105, n. 3, p. 581–606, 2012.

YU, F. Accounting Transparency and the Term Structure of Credit Spreads. **Journal of Financial Economics**, v. 75, n. 1, p. 53–84, 2005.

2 Corporate Governance and Bond Yields: Evidence from Brazil

2.1 Introduction

Bond markets have become increasingly important for non-financial companies to finance their activities. Over the last years, there was a steady increase in corporate bond borrowing by non-financial companies, which amounted to $2.1 trillion in 2019 (ÇELIK; DEMIRTAS; ISAKSSON, 2020). However, bond financing entails agency conflicts with creditors (see, for example, JENSEN; MECKLING, 1976; MYERS, 1977; GAVISH; KALAY, 1983; THATCHER, 1985). While the corporate governance literature has extensively examined agency conflicts between shareholders and managers, it has overlooked the conflicts inherent to debt financing, and the relationship between corporate governance and corporate bonds remains understudied. In particular, most studies usually focus on single mechanisms (see, for example, BHOJRAJ; SENGUPTA, 2003; ANDERSON; MANSI; REEB, 2004; YU, 2005; CHULUUN; PREVOST; PUTHENPURACKAL, 2014) and abstract from possible interactions among existing mechanisms. Few articles have tried to circumvent this problem by using governance indices that focused on the agency conflicts of equity. These articles disregarded the fact that agency costs associated with bond financing are caused by different agency conflicts, and it is necessary to examine additional governance mechanisms. For example, information asymmetry is one of the main determinants of the agency costs of debt (THATCHER, 1985; DETRAGIACHE, 1995), and very few studies have included transparency and/or disclosure in their analyses.

In addition, the literature that examines the relationship between corporate governance and bond yields often struggles with endogeneity, which can lead to biased estimates and inconsistent inferences, and it is not clear whether bond yields affect governance practices or vice-versa. Endogeneity issues usually stem from unobserved heterogeneity, which refers to unobserved differences among companies that affect the outcome variable; simultaneity, when one or more covariates and the outcome variable are determined simultaneously; and dynamic endogeneity, when past outcome values influence current values of independent variables (WINTOKI; LINCK; NETTER, 2012). Academic researchers have used fixed effects to overcome time-invariant unobserved heterogeneity. In doing so, researchers assume the absence of correlation between error terms and covariate values (strict exogeneity) and thus ignore the dynamic endogeneity problem. Similarly, dynamic panel models are often used to deal with dynamic endogeneity assuming that there are no omitted variables. Nonetheless, their estimates are often biased for panel data since the data is serially correlated (FLANNERY; HANKINS, 2013; DANG; KIM; SHIN, 2015).

These two approaches ignore part of the endogeneity issue, and natural experiments are the best way to identify a causal effect between the outcome variable and an explanatory variable (WINTOKI; LINCK; NETTER, 2012).

The revision of the Novo Mercado segment in 2018 created a natural experiment. Changes in corporate governance were required to ensure that the segment kept up with international corporate governance standards and preserved its value. Since these changes were not introduced with the intention of promoting bond financing, any potential impacts on bonds are likely to be unintended consequences of that segment's revision. Using this natural experiment, this paper aims to examine the causal impact of corporate governance on bond yields. In particular, it exploits the staggered adoption of statutory reforms across firms listed in the Novo Mercado segment. This approach is highly appealing from an empirical standpoint as it allows us to mitigate endogeneity issues and to identify a causal effect while avoiding pitfalls from studies that study a single shock: the potential biases and noise that confound the analysis (GAO et al., 2018).

Before conducting our main analyses, we test for potential endogeneity in the staggered adoption of statutory reforms: if the adoption is related to prevailing bond-quarters characteristics. We use Weibull hazard models to show that the timing of adoption of such reforms is not a function of preexisting bond or firm characteristics. Additionally, after estimating our main models, we perform placebo tests to confirm that our findings are not driven by chance or confounding shocks. We further examine parallel trends assumption, which is necessary in difference-in-differences settings, and confirm that pre-treatment trends in yields to maturity and coupon rates are indistinguishable between bonds issued by firms that later adopted statutory reforms and bonds issued by firms that didn't adopt such reforms.

Using a sample of 347 bonds issued by 111 Brazilian firms over the period from 2015 Q1 to 2020 Q4, we employ staggered difference-in-differences and find that the adoption of statutory reforms by firms listed in the Novo Mercado segment led to a decrease in yields to maturity and coupon rates of bonds issued by these firms. We further show that the segment's initial changes in corporate governance that were introduced with the revision in January, 2018, were associated with an increase in coupon rates and a decrease in yields to maturity of bonds issued by firms listed in that segment.

We conduct a number of robustness checks on our main results. We include firms with negative net debt or equity; we repeat the analyses without winsorizing the variables; we use an alternative measure of tangibility for companies operating under concession arrangements as these companies have accounting specificities; we use bond fixed effects to further saturate the model and account for any time-invariant unobservable heterogeneity; we increase the comparability between control firms and treated firms by excluding observations from firms listed in the Bovespa Mais segment, which include companies that

didn't have an IPO yet; we further restrict the sample to firms listed in either the Novo Mercado or the Level II segment, which were the most similar prior to the revision. The negative effect of statutory reforms on yields to maturity and coupon rates remains.

Lastly, we examine possible channels for corporate governance to affect bond yields. We find that bond liquidity improves greatly after the adoption of statutory reforms. In addition, we show that firms adopting statutory reforms have lower return on assets and greater sales growth. However, since bond yields interact with bond liquidity and sales growth, there exist some feedback effects between the variables that are hard to disentangle.

Our paper contributes to the literature that investigates the determinants of bond yields by confirming that corporate governance is an important factor. It adds to the growing corporate governance literature by showing that sound and robust governance practices can significantly decrease financing costs and foster economic growth. This study also complements the literature that examines the impact of Brazilian premium listings. In particular, we don't know of any research trying to link Brazilian premium listings to bond markets. Finally, this paper provides empirical evidence on the impact of the COVID-19 pandemic on firms and bond markets.

The remainder of the paper is organized as follows: Section 2 provides a literature review and discusses research hypotheses, Section 3 discusses the research design and methodology, Section 4 presents and discusses the results, and Section 5 concludes.

2.2 Premium Listings and Secondary Bond Market

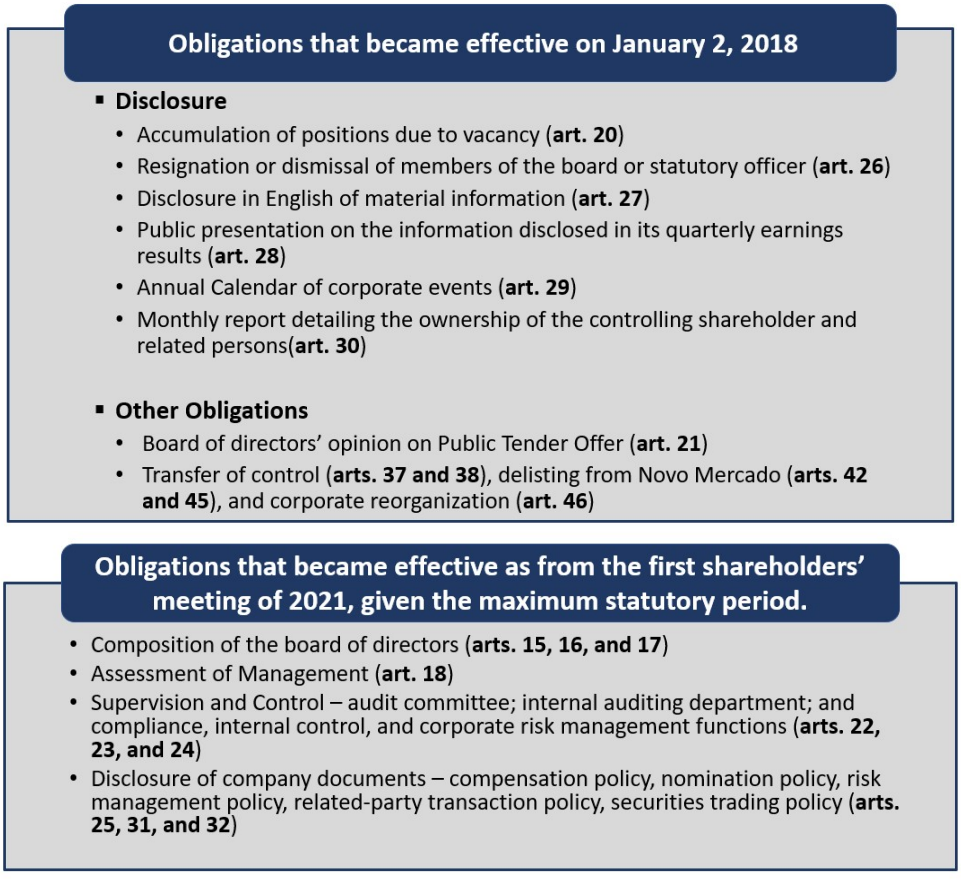
2.2.1 B3's Premium Listings

Despite improvements in corporate governance practices led by the Brazilian Institute of Corporate Governance in the 1990s, Brazilian capital markets have remained unattractive since many firms were family-owned and had a very concentrated ownership structure. Additionally, inappropriate monitoring mechanisms and a lack of transparency contributed to higher uncertainty and risk perceptions (CLAESSENS; KLINGEBIEL; LUBRANO, 2000). As a result, the volume of financial transactions on the São Paulo Stock Exchange - B3 (previously known as Bovespa) significantly decreased compared to other stock exchanges (CARVALHO; PENNACCHI, 2012). The Brazilian stock exchange responded in 2000 by creating three high-governance segments: Level I, Level II, and Novo Mercado. In Appendix A, we provide the requirements for each of the three segments.

The number of Initial Public Offering (IPO) skyrocketed during the 2000s. Most of these new public companies were listed in high-governance segments; and most existing public companies also decided to migrate to one of the new high-governance segments, as shown by Black, Carvalho, and Sampaio (2014). Faced with the ever-increasing governance

requirements worldwide caused by financial scandals in the early 2000s, the Bovespa revised its segment listing requirements in 2006. Another revision happened in 2011, after it was evidenced that governance failures were responsible for the 2008 financial crisis. Finally, an ultimate revision of the Novo Mercado segment was approved in 2017 to ensure that this premium listing was up to international standards. While initially the only difference between the Novo Mercado and the Level II was that companies listed on the Level II could issue preferred shares (with no voting rights), the revision created additional rules to the Novo Mercado segment.

Figure 2.1 – Revision of the Novo Mercado Segment



Source: B3 Website (2021)

Following the revision of the segment, applications and admissions of companies on the Novo Mercado made after December 28, 2017, were subject to the new listing regulation. As for existing listed companies, the regulation came into force gradually. Figure 2.1 summarizes the implementation of the new regulation. As of January 2, 2018, changes were introduced with respect to regular and sporadic disclosures of listed companies. Further changes came into effect for such corporate events as transfer of control, going private, and corporate reorganization. Yet, the new listing regulation also required companies to adapt their organizational structure and to revise their bylaws. Although companies were encouraged to contemplate all statutory changes until the first ordinary shareholders'

meeting of 2018, they were given the possibility to postpone some changes until the first ordinary shareholders' meeting of 2021. This deadline was extended to 2022 due to the COVID-19 pandemic.

2.2.2 Effects of the revision of the Novo Mercado segment on Bond Yields

The Agency Theory recognizes the existence of agency costs associated with bond financing. In the absence of alignment between managers' interests and those of bondholders, managers have strong incentives to expropriate bondholders by either using the dividend policy or increasing the firm's risk (JENSEN; MECKLING, 1976; KALAY, 1982; GAVISH; KALAY, 1983). In addition, the presence of risky debt instruments induces suboptimal investment decisions that create dead-weight losses for the firm. Myers (1977) finds that firms abandon profitable projects, with positive net present values, when most of the investment benefits accrue to bondholders. Finally, asymmetric information leads bondholders to underestimate firms' expected future cash flows when firms are unable to reveal their true cash flows. This underestimation leads to a greater credit risk and increased bond spreads (THATCHER, 1985).

If bondholders anticipate these costs, they will require an additional return to hold the bond. The firm will then bear the agency costs of debt, and its value will decrease. Consistent with this view, Leland (1998) shows that yield spreads increase significantly in the presence of agency costs. In practice, debt contracting and bond covenants are used to ensure that managers don't deviate from value-maximizing decisions. Yet, Smith and Warner (1979) affirm that debt contracting and bond covenants are imperfect given that some managers' actions are difficult to observe and expensive to monitor. Similarly, Klock, Mansi, and Maxwell (2005) note that since bond covenants are expensive to write, to monitor, and to enforce, bondholders would require bonds to be issued at a discount to compensate for these costs. Consequently, additional governance mechanisms are needed to minimize the agency costs of debt.

Academic researchers have explored the relationship between some governance mechanisms and bond yields. Empirical literature acknowledges that greater board independence, size, and expertise (ANDERSON; MANSI; REEB, 2004; CHULUUN; PREVOST; PUTHENPURACKAL, 2014), better transparency (YU, 2005), increased institutional ownership (BHOJRAJ; SENGUPTA, 2003), increased long-term institutional ownership (HUANG; PETKEVICH, 2016), greater takeover defenses (KLOCK; MANSI; MAXWELL, 2005), and stronger creditor rights (BOUBAKRI; GHOUMA, 2010) are associated with lower corporate bond spreads. While most studies examined only single mechanisms, it is essential to investigate how the existing corporate governance mechanisms influence each other. For example, Cremers, Nair, and Wei (2007) posit that the impact of controlling shareholders on yield spreads depends on takeover vulnerability.

B3's premium listings encourage firms to voluntarily subject themselves to more robust governance practices. Carvalho and Pennacchi (2012) note that violations of Level II or Novo Mercado requirements lead to mandatory arbitration by the Market Arbitration Panel, whose ruling has the same authority as that of the Brazilian Supreme Court. They further argue that premium listings act as a credible mechanism that reduces agency costs and information asymmetry. Consequently, we expect Brazilian firms listed in segments with stricter governance rules to have lower bond spreads, compared with similar firms adhering to less stringent governance rules. In particular, we expect that firms listed in the Novo Mercado segment and adopting statutory reforms as a result of the revision to experience a decrease in the yields of their bonds. Our testable hypothesis is given by:

H1. The adoption of statutory reforms led to a decreased in bond yields.

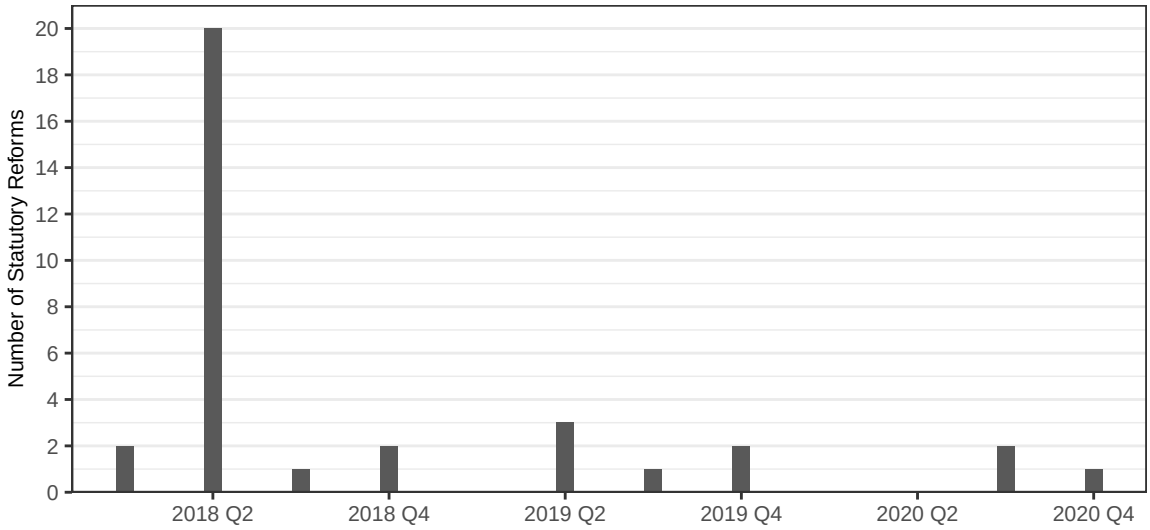
2.3 Research Methods

2.3.1 Sample

Our study focuses on the relation between corporate governance and corporate bond yields surrounding the revision of the Novo Mercado segment. From Economática, we first collect quarterly information on the secondary market pricing of bonds issued on the local market, also known as debentures, during the 2010-2020 period. A growing number of debentures emerged over the last years with either real guarantees or intra-group guarantees. Given that such guarantees have a direct effect on bond pricing, we examine debenture issue indentures for the existence of guarantees, using the Brazilian Financial and Capital Markets Association (ANBIMA) database. In presence of intra-group guarantees, we use a methodology similar to that used by credit rating agencies and substitute the issuer's financial information with the guarantor's. Consequently, we replace the Brazilian Securities and Exchange Commission (CVM) identification code of the issuer with that of the guarantor. In cases where there exist several listed companies acting as a guarantor, we exclude the underlying debentures.

We obtain additional data on the consolidated financial statements and stock information of listed companies from Economática. We merge this new dataset with the existing bond dataset using the CVM code. We then use the ANBIMA database to add further bond issuance data and to correct for existing discrepancies within our sample. We obtain data on firms' listing segments from the B3 website. We manually collect bond ratings from either Fitch Ratings, Standard & Poor's, or Moody's, depending on bonds. Similar to Carvalho and Pennacchi (2012), we exclude firms that belong to the financial sector, in accordance with the industry classification provided by the B3, since these firms have unique features that distinguish them from non-financial firms. To increase the

Figure 2.2 – Staggered Adoption of Statutory Reforms



This figure presents the number of firms that revised their bylaws to enforce the new regulation of the Novo Mercado segment.

Source: Author's calculations.

degree of similarity between firms, we also exclude bonds issued by private firms without intra-group guarantees. Given the lack of observations in the first years, we restrict our sample to the 2015-2020 period, and we remove observations for which data is lacking. Our sample is composed of 347 bonds issued by 111 Brazilian firms and backed by 65 listed companies.

To determine the quarters during which statutory reforms were adopted for the different listed companies, we examined their websites and manually gathered data from minutes of extraordinary shareholders' meetings. For companies already listed in the Novo Mercado segment, we use the date of the shareholders' meeting during which the revision of the bylaws was approved as the date of adoption of the statutory reform. As for companies migrating to the Novo Mercado segment after December 28, 2017, we use the first trading date on the new segment as the adoption date for the statutory reform.

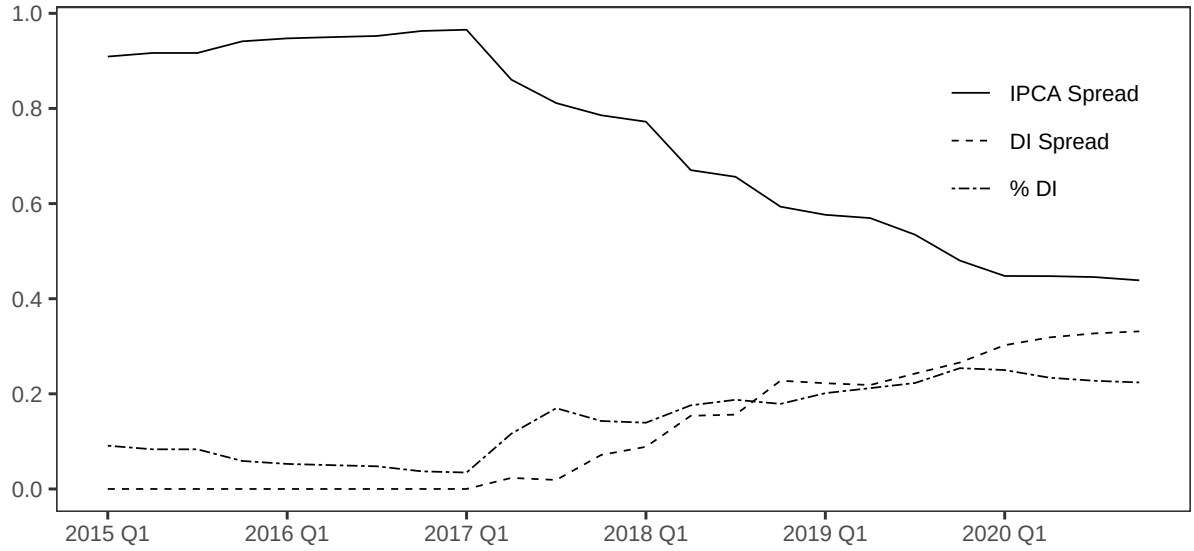
Figure 2.2 shows the distribution of adoption quarters for the 34 firms listed in the Novo Mercado that made statutory changes during the sample period. While most companies contemplated statutory changes during the first extraordinary shareholders' meeting of 2018, as suggested by the B3, the timing of adoption is dispersed over different quarters. This staggered adoption of statutory reforms permits us to analyze the effects of corporate governance practices on bond yields using a difference-in-differences setting.

2.3.2 Variables

Our variable of interest is the bond's yield to maturity. The Brazilian market for corporate bonds is quite different from bond markets in developed countries. Carvalho

and Marques (2020) find that bond principal values tend to be small, with most bonds having maturities lower than 10 years, and secondary markets are relatively illiquid. In addition, most Brazilian bonds have their yields link to indices, usually the inter-bank offered rate (DI) or the inflation rate (IPCA). Three different remuneration types emerged in our sample: IPCA + Spread, DI + Spread, and %DI. In Figure 2.3, we plot the proportions for each remuneration type over time. Not surprisingly, the number of bonds whose remuneration is linked to the DI rate has increased since 2017. Firms have benefited from the steady decrease in the DI rate that happened in the same period. To account for the fact that companies adapt their financing policy to macroeconomic factors, we maintain a unique sample with the three different remuneration types.

Figure 2.3 – Evolution of Bond Types



This figure shows the proportion of bond types over time. The solid line corresponds to bonds whose yields are given as a spread over the IPCA. The dashed and dash-dotted lines represent bonds whose yields are given as a spread over the DI rate and as a percentage of the DI rate respectively.

Source: Author's calculations.

In the secondary market, bond quotes are expressed as the spread being added to the underlying rate to which the bond is linked or as the percentage of the DI rate. In order to normalize bonds yields across the remuneration types, we correct for the underlying rate (DI or IPCA) to get the bond's total yield to maturity. IPCA and DI data are obtained using the Brazilian Institute of Geography and Statistics (IBGE) and the B3 websites respectively. Given that coupon rates are expressed in a similar fashion, we also compute total coupon rates using the same approach.

We follow the literature on the determinants of bond yields and use several explanatory variables from financial statements to control for firm characteristics that affect bond yields. The firm's size is defined as the natural logarithm of its total asset value. The firm's leverage is obtained as the net book value of debt divided by the sum of the

market value of equity and the net book value of debt. We control for firms' profitability using their return on assets (ROA), given as the sum of the Profit/Loss from Continuing Operations and the income attributable to non-controlling interests divided by the total asset value, as well as the firms' sales growth over the last year. We also control for growth opportunities using the Market-to-Book ratio (MB): the market value of assets divided by the book value of assets. The market value of assets is given as the sum of the firm's total assets and the market value of equity minus the book value of equity, which is equal to the common equity minus deferred taxes.

Our sample contains a large number of bonds issued by firms operating under service concession arrangements (e.g., electric companies). These companies develop, operate, and maintain infrastructure assets owned by either the government or the public sector. With the adoption of the ICPC-01 norm in Brazil, companies operating under such arrangements cannot recognize infrastructure assets as their Property, Plant, and Equipment (tangible assets). Consequently, these companies reclassified their fixed assets as intangible assets and presented tangibility values close to zero. To address this issue, we develop an alternative proxy for the tangibility value of these firms, which is given as the sum of the book value of intangible assets and the book value of tangible assets divided by the total asset value.

Since our analyses focus on bond yields, we also include bond characteristics as controls. We define the bond's maturity as the difference in years between the maturity date and the settlement date. We control for the size of the bond issue by taking the natural logarithm of the amount outstanding. We also control for the initial coupon rate and correct for the underlying rate (DI or IPCA) to capture unobservable determinants of the bond remuneration. We take into consideration bond liquidity using the bid-ask spread. However, both bid and ask quotes reflect the remuneration type of the bond, making it difficult to compare bonds with different remunerations. We thus divide the bid-ask spread by the fixed part of the coupon rate (i.e. either the spread over DI/IPCA or the percentage of the %DI) to normalize our liquidity proxy across the different bond types. We further control for firms' credit risk using bond ratings. We follow Murcial et al. (2014) and create an ordinal variable by transforming credit rating into numerical values. Finally, we control for the existence of call options and real guarantees using dummy variables.

We include control variables to capture specific characteristics of the Brazilian market. Under the Brazilian law, bonds that aim to finance infrastructure projects, Research and Development, and innovation, are exempt from income taxation. Since these bonds exhibit lower yields, we create a dummy variable that assumes the value of 1 for bonds whose income is tax exempt. We create two additional dummy variables to control for the bond type. These two variables take values of 1 if the bond remuneration is given as a spread over either the inflation rate (IPCA Spread) or the interbank rate (DI Spread)

respectively, thus leaving debentures for which the remuneration is based on a percentage of the DI rate as the reference category.

Lastly, the COVID-19 pandemic has created great and lasting disruptions for companies around the world (NOZAWA; QIU, 2021), and it has changed the way in which companies operate, with lockdowns and sanitary measures for example. In Brazil, the first cases and deaths started in early 2020. We observe a structural change in corporate bond yields starting from the first quarter of 2020. Since this structural shift can confound our analyses and create a bias in the estimation of the average treatment effect, we control for this change by creating a dummy variable that equals to one during the quarters of 2020 for companies adopting statutory reforms and zero otherwise.

With these variables in hand, we complete our cleaning procedure. We exclude bonds for which the bond rating becomes lower than 3 during their lifespan since these observations correspond to firms in financial distress. We also filter out observations that exhibit negative values of strictly positive variables (bond liquidity and yield to maturity) and observations of firms with negative book value of equity. We also filter out companies with negative net debt given that cash holdings reduce the existing agency costs of debt. We then winsorize our sample at the first and the 99th percentiles to reduce the effect of outliers, but our results are robust to the inclusion of such outliers.

The final sample comprises an unbalanced panel data set that consists of 2,672 bond-quarter observations over the period 2015-2020. Table 2.1 provides the summary statistics. As shown in the table, about 43.5% of bond-quarters observations are post-adoption observations, and 5.4% of these observations are during the coronavirus pandemic. The average firm in our sample exhibits a logarithm of total assets of 23.955 (or R\$25.3 billion). It is moderately levered, with a leverage of 28.59%, has a market-to-book ratio of 1.35, and owns tangible assets accounting for 62.1% of its total assets. As regards profitability, the average ROA is 1.2%, and the average growth of firms' sales over a year is 13.97%.

The average bond has a coupon rate of 4.75% and a yield to maturity of 4.05%, thus trading at a premium. Consistent with Carvalho and Marques (2020), the average bond is relatively new (2.24 years old), it has short maturity (4.82 years), and it is illiquid, with liquidity frictions accounting for 17.2% of the fixed part of the initial coupon rate. The average principal value is R\$ 288.7 million, and the average credit is AA or higher in the national scale. In terms of bond remuneration, 55.5% of bond-quarters observations have their remuneration tied to the IPCA, and another 23.9% have their remuneration given as a spread over the DI rate. The remaining 20.6% are observations whose remuneration is a percentage of the DI rate. In addition, 42% of the observations are tax-exempt, 66.2% are callable, and 10.2% have real guarantees.

Table 2.1 – Summary Statistics

	Mean	Std. Dev.	25%	75%
Panel A: Firm Variables				
Statutory Reform	0.435	0.496	0.000	1.000
Size	23.955	1.138	23.151	24.491
Leverage	28.590%	11.674%	21.363%	36.146%
Tangibility	62.102%	43.678%	29.990%	89.447%
Return On Assets	1.200%	1.538%	0.488%	1.914%
Market-to-Book	1.350	0.495	1.020	1.517
Sales Growth	13.967%	29.058%	−1.610%	22.008%
Panel B: Bond Variables				
Total Yield	4.047%	2.315%	2.190%	5.552%
Coupon Rate	4.754%	2.870%	1.807%	7.205%
Initial Coupon	5.197%	2.666%	2.676%	7.090%
Amount Outstanding	19.481	0.915	18.891	20.125
Age	2.240	1.707	1.058	2.831
Maturity	4.824	2.567	3.005	6.128
Liquidity	17.202%	27.928%	6.028%	16.491%
Credit Rating	6.919	0.347	7.000	7.000
IPCA Spread	0.555	0.497	0.000	1.000
DI Spread	0.239	0.426	0.000	0.000
DI Percentage	0.206	0.405	0.000	0.000
Supported	0.420	0.494	0.000	1.000
Real Guarantees	0.102	0.302	0.000	0.000
Call Option	0.662	0.473	0.000	1.000
Covid	0.054	0.227	0.000	0.000

Source: Elaborated by the author.

2.3.3 Empirical Methodology

We investigate whether the revision of the Novo Mercado segment led to lower bond yields. Statutory reforms were adopted by different listed Brazilian firms over the different quarters during the sample period, as shown in Figure 2.2. This staggered adoption allows us to examine the before-after effect of a change in governance practices in affected firms (or treated firms) vis-à-vis the before-after effect in firms that didn't adopt statutory reforms (control firms). To do so, we use a difference-in-differences design with multiple groups and a variation in treatment timing.

The traditional way to estimate treatment effects in difference-in-differences designs is to run two-way fixed effects regressions. However, it came to light that in the presence of multiple groups and time periods, the two-way fixed effects estimator is a weighted sum of the different treatment effects in each group and time period, the weights being proportional to group sizes and variances of treatment estimates for each group-time pair. As such, the estimator may not have a meaningful causal interpretation when weights are negative, a situation that arises when treatment effects vary over time. In addition, the treatment's estimate can be negative while the true effect is positive for all groups and time periods (CHAISEMARTIN; D'HAULTFOEUILLE, 2020; GOODMAN-BACON,

2021). To tackle these problems, we follow Sun and Abraham (2020) and estimate cohort (or group) average treatment effects. We implement their interaction-weighted model by running the following regression:

$$y_{i,t} = \alpha_i + \alpha_t + \sum_e \sum_{\ell \neq -1} \delta_{e,\ell}\Big(\mathbf{1}\{E_i = e\} \cdot D^{\ell}_{i,t}\Big) + \beta X^{firm}_{i,t} + \gamma X^{bond}_{i,t} + \epsilon_{i,t} \tag{1}$$

where y_{it} is the bond yield of firm i in time period t, $\delta_{e,\ell}$ denote the average treatment effects ℓ periods from the initial treatment for the cohort of units that receive the first treatment at time e, E_i is the time for unit i to initially receive the treatment, and $D^{\ell}_{i,t}$ is a dummy variable that takes value of one if the unit i being ℓ periods away from initial treatment at time period t is treated and zero otherwise. The vectors $X^{firm}_{i,t}$ and $X^{bond}_{i,t}$ denote firm and bond characteristics that affect bond yields, as discussed in Section 2.3.2. We add firm and time fixed effects to capture time-invariant unobserved factors at the firm level as well as macroeconomic factors.

It is possible to aggregate the coefficients $\widehat{\delta}_{e,\ell}$ to form aggregated causal parameters, as in Callaway and Sant'Anna (2020) and Sun and Abraham (2020). In particular, we're interested in the heterogeneity of treatment effects across groups and time periods. We compute the average treatment effect ℓ periods from the initial treatment for all cohorts as:

$$\theta_\ell = \sum_e \widehat{\delta}_{e,\ell} P\{E_i = e | E_i \in [-\ell, T-\ell]\} \tag{2}$$

where T is the maximum time period, and the weights $P\{E_i = e | E_i \in [-\ell, T-\ell]\}$ are sample shares of each cohort in the relevant period ℓ.

Similarly, we can compute the average treatment effect on relative period bin g for a given cohort of units first treated at time e as:

$$\theta_e = \frac{1}{|g|} \sum_{\ell \in g} \widehat{\delta}_{e,\ell} \tag{3}$$

where g is a set of relative periods $\ell \in [-T, T]$, and $|g|$ is the size of the bin.

We also compute the average effect of participating in the treatment by aggregating all cohort-time average treatment effects together. This is the interaction-weighted estimator from Sun and Abraham (2020) with g including all relative periods ℓ:

$$v_g = \frac{1}{|g|} \sum_{\ell \in g} \sum_e \widehat{\delta}_{e,\ell} P\{E_i = e | E_i \in [-\ell, T-\ell]\} \tag{4}$$

2.4 Results

2.4.1 Timing of Statutory Reforms

Difference-in-differences designs rely on the assumption that shocks are exogenous and randomly assigned. Given that listed firms could determine the date in which statutory

changes were contemplated, it is not clear whether the shock was exogenous. To alleviate any concerns about exogeneity and reverse causality, we examine whether the adoption of statutory reforms is a function of preexisting firm or bond characteristics. We follow Acharya, Baghai, and Subramanian (2014) and Wang, Yin, and Yu (2021) and estimate Weibull hazard models, where the "failure event" is the adoption of the statutory reform in a given firm.

Table 2.2 – Duration Models for Timing of Statutory Reform

	(1)	(2)	(3)	(4)	(5)	(6)
	Statutory Reform					
Total Yield	0.004					
	(0.032)					
Bond Age		0.088				
		(0.074)				
Bond Maturity			0.005			
			(0.018)			
Bond Rating				−0.057		
				(0.206)		
Bond Liquidity					0.010	
					(0.008)	
Coupon Rate						−0.039
						(0.027)
Initial Coupon	−0.047	−0.073**	−0.046	−0.046	−0.029	
	(0.032)	(0.032)	(0.030)	(0.031)	(0.031)	
Amount Outstanding	−0.009	−0.011	−0.010	−0.014	0.001	−0.007
	(0.076)	(0.075)	(0.075)	(0.078)	(0.073)	(0.077)
Size	0.034	0.021	0.034	0.035	0.039	0.035
	(0.075)	(0.073)	(0.073)	(0.075)	(0.073)	(0.074)
Leverage	−0.011	−0.010	−0.012	−0.011	−0.011	−0.011
	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)
Return on Assets	0.024	0.023	0.024	0.025	0.029	0.020
	(0.037)	(0.035)	(0.036)	(0.036)	(0.038)	(0.036)
Market-to-Book	0.030	−0.026	0.031	0.031	0.046	0.011
	(0.169)	(0.163)	(0.157)	(0.156)	(0.151)	(0.152)
Sales Growth	0.000	0.000	0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	Yes	Yes	Yes	Yes	Yes	Yes
Cluster at Firm Level	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,335	1,335	1,335	1,335	1,335	1,335

This table reports estimates from Weibull hazard models, where the "failure event" corresponds to the adoption of the statutory reform in a given firm. The dependent variable is *Statutory Reform*, which takes value of one in the quarter of the statutory reform and zero otherwise. Firms are dropped from the sample once they have adopted the reform. The explanatory variables represent bond-quarters observations of existing variables and are lagged by one year. A description of the variables can be found in Section 2.3.2. Robust standard errors clustered at the firm level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

The sample consists of 1335 bond-quarter observations over our sample period. Bond observations are dropped once firms issuing these bonds have adopted the reform. *Statutory Reform* is the dependent variable, and it equals one in the quarter of the reform and zero in previous quarters. We control for lagged values of firm characteristics as well as lagged values of bond characteristics, which are defined in Section 2.3.2. In particular, we control for the amount outstanding and the initial coupon of the bond to capture unobservable factors that affect the financing policy.

Table 2.2 presents the estimates of Weibull regression models. Columns 1 to 5 show that the independent variables of interest (bond characteristics) are not statistically significant. While significant in column 2, the variable Initial Coupon doesn't show any other significant estimates in other regressions, thus suggesting that the lagged variable has no impact on the adoption of statutory reforms. As regards firm characteristics, the coefficients are not significant in any of the models, and firm characteristics have no effects on the decision to adopt statutory reforms.

In column 6, we use the coupon rate as an alternative to our main variable of interest, which is the total yield to maturity. The coupon rate allows us to investigate the effect of the reform on the primary market while also providing an alternative measure of bond yields. Since the variable Initial Coupon controls for the bond's initial remuneration rate, we exclude the variable related to the coupon rate from the regression to avoid collinearity issues. As expected, we find similar results to those of Column 1.

In unreported results, we aggregated our data at the firm value and repeated the analyses. We found similar results for all variables, except for the Bond Liquidity that became significant. This surprising result might be explained by the fact that bonds issued by firms listed in the Novo Mercado segment already had a greater liquidity in the pre-treatment period, compared to those issued by other firms. Overall, the findings in our models indicate that both firm and bond characteristics are not determinants of the adoption of statutory reforms, supporting the assumption that the different shocks are exogenous and randomly assigned.

2.4.2 Baseline Regressions

We now examine the effect of statutory reforms on bond yields. To do so, we first estimate the treatment effects for all cohorts in the different time periods by using Eq.(1) and aggregate these estimators to form an average treatment effect by using Eq.(4). In difference-in-differences settings, the use of time-varying covariates at the individual level increases the precision of estimates, as long as these covariates are not affected by the treatment. Atanasov and Black (2016) suggest to use a dynamic specification of the model using leads and lags, also known as event study, and replace the outcome variable with covariates, one at a time, to examine whether or not covariates are affected by the

treatment. Unaffected covariates should have no significant coefficients for the average treatment effect.

We follow their approach and estimate several models with Eq.(1) after replacing the outcome variable by one of the time-varying covariates and dropping all the other time-varying variables. We control for firm, quarter, and listing segment fixed effects and include a number of time-invariant bond characteristics. Given that panel data are prone to serial correlation, we cluster standard errors at the individual level (bond level) to correct for both serial correlation and heteroskedasticity, as suggested by Bertrand, Duflo, and Mullainathan (2004). We find that three variables were affected by the treatment: bond liquidity, return on assets, and sales growth, and we exclude these variables from our main models.

Table 2.3 summarizes the results of the baseline regressions. Columns 1 and 4 present the regression estimates in the absence of time-varying covariates when the dependent variables are the yield to maturity and the coupon rate respectively. We find that the adoption of statutory reforms has a negative effect on the coupon rate, but this effect is not significant for the yield to maturity. In columns 2 and 5, we control for additional time-varying firm characteristics and find similar results. We further add time-varying bond controls in columns 3 and 6. Our results indicate that, after controlling for all variables, the adoption of statutory reforms has a significant and negative impact on yields on both the primary and secondary markets.

From Table 2.3, we find that none of the firm characteristics has a significant effect on the yield to maturity. These results contrast with existing empirical evidence on the effects of firm characteristics on bond spreads (see, for example, BHOJRAJ; SENGUPTA, 2003; ANDERSON; MANSI; REEB, 2004; CHULUUN; PREVOST; PUTHENPURACKAL, 2014; HUANG; PETKEVICH, 2016). On the other hand, firm characteristics affect coupon rates. Our results indicate that the firm's leverage is negatively related to the coupon rate. High levered firms have to pay a premium to issue additional debt to compensate for the higher credit risk they bear. In addition, asset tangibility acts as a proxy for bankruptcy costs, and increased tangibility leads to higher recovery rates for bondholders. As such, asset tangibility is negatively associated with coupon rates. Lastly, firms with high opportunity growths, as evidenced by a greater market-to-book ratio, benefit from lower financing costs since additional debt is used to obtain higher returns and to increase the asset value.

Our models provide evidence on the effects of the COVID-19 pandemic on the corporate debt market. We find that the Covid variable is positively associated with the yield-to-maturity, but it has no effect on bond issuance since the coupon rate coefficient is not significant. In other words, the COVID-19 pandemic has created economic shocks that resulted in a shock on the secondary bond market that decreased the bond prices of bonds

Table 2.3 – The Effects of Statutory Reforms on Bond Yields

	(1)	(2)	(3)	(4)	(5)	(6)
		Total Yield			*Coupon Rate*	
Average Treatment Effect	−0.254	−0.204	−0.337**	−0.313***	−0.306***	−0.266***
	(0.163)	(0.161)	(0.134)	(0.104)	(0.099)	(0.097)
Bond Age			−0.062**			0.074
			(0.026)			(0.054)
Bond Maturity			0.163***			−0.041*
			(0.011)			(0.023)
Credit Rating			−0.936***			0.072
			(0.215)			(0.107)
Size		0.123	0.080		−0.013	0.026
		(0.245)	(0.242)		(0.145)	(0.144)
Leverage		0.009	0.007		0.019***	0.020***
		(0.007)	(0.006)		(0.006)	(0.006)
Tangibility		0.012**	0.006		−0.009**	−0.007*
		(0.005)	(0.005)		(0.004)	(0.004)
Market-to-Book		−0.315***	−0.142		−0.399***	−0.440***
		(0.114)	(0.125)		(0.117)	(0.114)
Covid	0.710***	0.699***	0.732***	0.107***	−0.009	−0.024
	(0.172)	(0.177)	(0.177)	(0.030)	(0.044)	(0.039)
Initial Coupon	−0.183***	−0.184***	−0.079***			
	(0.033)	(0.033)	(0.024)			
Amount Outstanding	−0.059	−0.053	0.003	−0.002	−0.004	−0.010
	(0.043)	(0.043)	(0.024)	(0.057)	(0.056)	(0.056)
IPCA + Spread	4.822***	4.847***	4.473***	5.836***	5.838***	5.667***
	(0.232)	(0.237)	(0.169)	(0.185)	(0.183)	(0.218)
DI + Spread	1.407***	1.403***	1.345***	1.007***	1.006***	1.012***
	(0.128)	(0.130)	(0.098)	(0.149)	(0.147)	(0.144)
Tax Exempt	−0.694***	−0.717***	−0.969***	−0.688***	−0.713***	−0.480**
	(0.153)	(0.155)	(0.114)	(0.209)	(0.207)	(0.232)
Real Guarantees	−0.049	−0.016	−0.224**	0.521	0.538	0.628*
	(0.201)	(0.191)	(0.091)	(0.331)	(0.333)	(0.325)
Call Option	−0.209**	−0.207**	−0.030	−0.549***	−0.549***	−0.566***
	(0.092)	(0.090)	(0.050)	(0.149)	(0.149)	(0.140)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,672	2,672	2,672	2,672	2,672	2,672
Adj. R^2	0.845	0.846	0.865	0.928	0.929	0.930

This table reports results from interaction-weighted models, as defined in Eq.(1). The independent variable of interest is the *Average Treatment Effect*, which is found using Eq.(4). A definition of other independent variables and their summary statistics can be found in Section 2.3.2. Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

issued by firms that adopted statutory reforms. These results are consistent with the fact that the COVID-19 pandemic has created important liquidity shocks on bond markets (KARGAR et al., 2021). Nonetheless, the pandemic had no effect on the pricing of new bond issuance made by the same firms.

As regards bond characteristics, our models show that bond age and credit rating are negatively related to bond yields but have no effects whatsoever on coupon rates. Since bonds with a better credit rating are at lower risk of defaulting, they are in greater demand in the secondary market. Bond maturity, however, increases bond yields on the secondary market while decreasing bond yields on the primary market. The contrasting results between bond age and bond maturity can be explained by the interest rate risk, according to which changes in interest rates may deteriorate the market value of existing bonds. Since both older and short-term bonds have a lower duration, they are less exposed to the interest rate risk. Overall, the coefficient estimates for these bond characteristics are in line with previous studies on the determinants of bond spreads (see, for example LIN; LIU; WU, 2011).

From the table, on can observe that there is a greater demand for bonds with high remuneration rates, as evidenced by the negative relationship between the coupon rate at the emission and yields to maturity. We find that bonds remunerated with a spread over the inflation rate have a remuneration 5.67% and 4.66% greater on average than that of bonds remunerated as a spread over the DI rate and that of bonds remunerated as a percentage of the DI rate respectively. Still, we don't find any significant relationship between the size of the debt issuance and bond yields.

Table 2.3 further shows that tax exempt bonds, which are used to finance infrastructure and research and development, tend to have lower yields, and the effect is greater on the secondary market. Bonds with real guarantees tend to be issued at a higher remuneration rate on the primary market, but their yield to maturity tends to decrease. A possible explanation would be that firms using real guarantees are fundamentally riskier, and the risk perception on the secondary market is alleviated by the bond's guarantees. Lastly, callable bonds have lower coupon rates at the issuance. A possible explanation to this phenomenon is that companies using callable debt usually recall their bonds to adjust their cost of capital and benefit from lower financing costs.

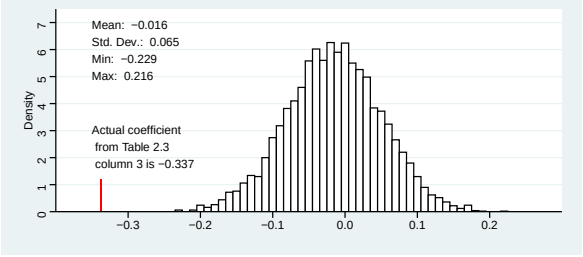
2.4.3 Placebo Tests

In this section, we assess the credibility of the staggered difference-in-differences design by running placebo tests. Similar to Wang, Yin, and Yu (2021) and Gao et al. (2018), for each bond issue that belongs to one of the 34 firms that adopted statutory reforms during our sample period, we randomly assign a pseudo quarter of adoption that is more than 2 quarters away from the real quarter of adoption. We then estimate the

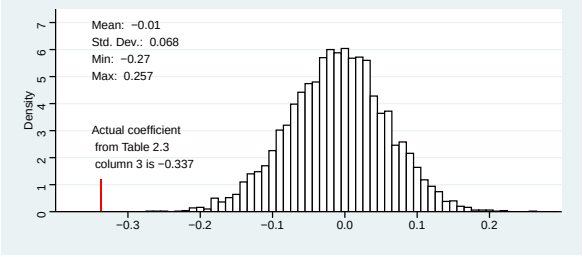
baseline regressions in columns 3 and 6 of Table 2.3, store the coefficient estimates of the average treatment effect, and repeat the procedure 5,000 times. To further ensure that our results are only driven by the adoption of statutory reforms, we repeat our analyses after assigning a pseudo quarter that is not within 1 quarter of the real quarter of adoption.

Figure 2.4 – Placebo Tests

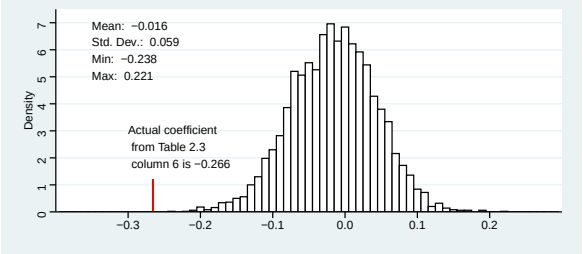
A. Histogram of the coefficient estimates of the average treatment effect when the dependent variable is *Total Yield* and pseudo treament is not within 2 quarters of real treatment quarter.



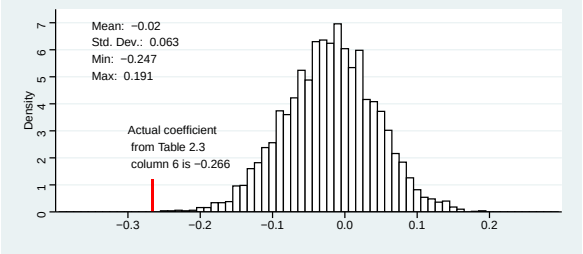
B. Histogram of the coefficient estimates of the average treatment effect when the dependent variable is *Total Yield* and pseudo treament is not within 1 quarter of real treatment quarter.



C. Histogram of the coefficient estimates of the average treatment effect when the dependent variable is *Coupon Rate* and pseudo treament is not within 2 quarters of real treatment quarter.



D. Histogram of the coefficient estimates of the average treatment effect when the dependent variable is *Coupon Rate* and pseudo treament is not within 1 quarter of real treatment quarter.



This figure illustrates the distribution of the coefficient estimates for the average treatment effect from 5,000 bootstrapped simulations of our interaction-weighted model used in Table 2.3. For each bond issue from firms that adopted statutory reforms, we randomly assign a pseudo quarter and estimate the baseline regressions in columns 3 and 6 of Table 2.3 using these placebo shocks. We save the coefficient estimates for the average treatment effect and repeat the procedure 5,000 times.

Source: Elaborated by the author.

We plot the distributions of these estimates in Figure 2.4. Panels A and B present the histograms of the estimates when the dependent variable is *Total Yield*. Coefficients from placebo tests indicate that the pseudo treatment has no effect on average, and the true effect based on Table 2.3 lies well to the left of the distribution, about five standard deviations from the mean. Panels C and D represent histograms of the estimates when the dependent variable is *Coupon Rate*. Similarly, our placebo estimates have a zero mean, and the true coefficient estimate lies well to the left of the distribution, about four standard

deviations from the mean. These results indicate that our main findings are not driven by luck or confounding events, but they are the result of the adoption of statutory reforms.

2.4.4 Pre-Treatment Trends

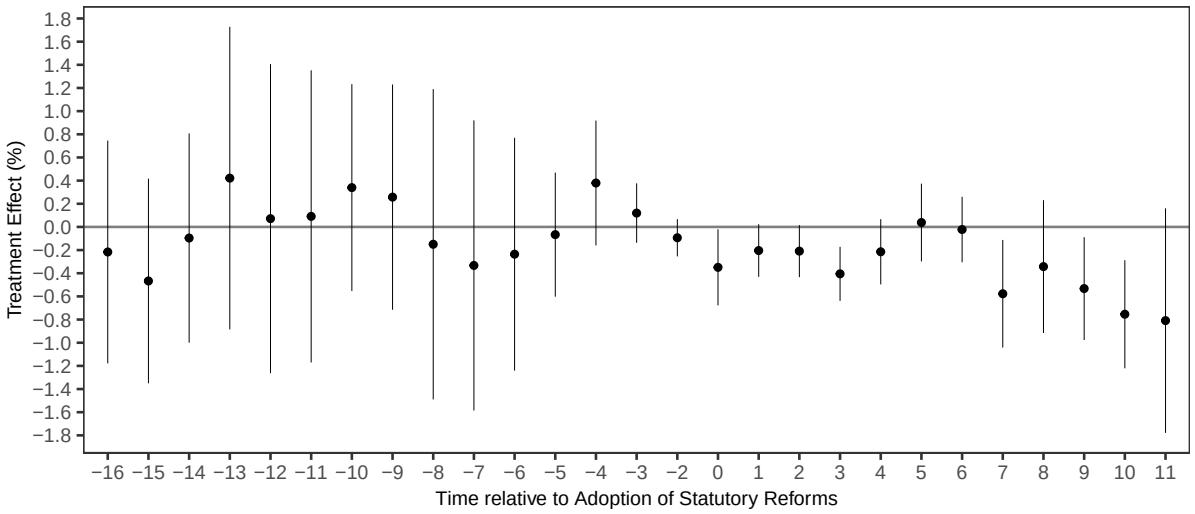
Staggered difference-in-differences require parallel trends in baseline outcomes. In other words, had the treated companies not adopted their statutory reforms, the yield of their bonds would have behaved in the same way as that of bonds issued by the control companies. To examine the parallel trends assumption in the pre-treatment period, we estimate cohort average treatment effects using Eq.(1), which allows us to avoid traditional contamination between leads and lags, and obtain aggregated effects ℓ periods from the initial treatment for all cohorts using Eq.(2). We include unaffected time-varying control variables, as well as time-invariant bond characteristics described in Section 2.3.2.

We're interested in the estimates of treatment leads. Figure 2.5 shows estimates for each leads and lags of the treatment effect, along with their 95% confidence interval. We exclude the quarter prior to the treatment date to avoid multicollinearity, as evidenced by Sun and Abraham (2020). In Panel A, the dependent variable is the bond's yield to maturity. Coefficients in the pre-treatment period are small and not statistically significant. Besides, there are no pre-trends existing before the adoption of statutory reforms that could confound our analysis. In panel B, we analyze treatment effects on the coupon rate. Similarly, we find no significant effects during the pre-treatment period and no existing pre-trends. Taking together, these evidences lend credibility to the fact that trends are parallel in the pre-treatment period. It also means that there is no reverse causality, in which past bond yields would affect governance practices. In addition, the lack of significant leads demonstrates that the early changes in corporate governance that came into effect on January 2, 2018, had no significant effects on the bond yields of companies listed in the Novo Mercado segment.

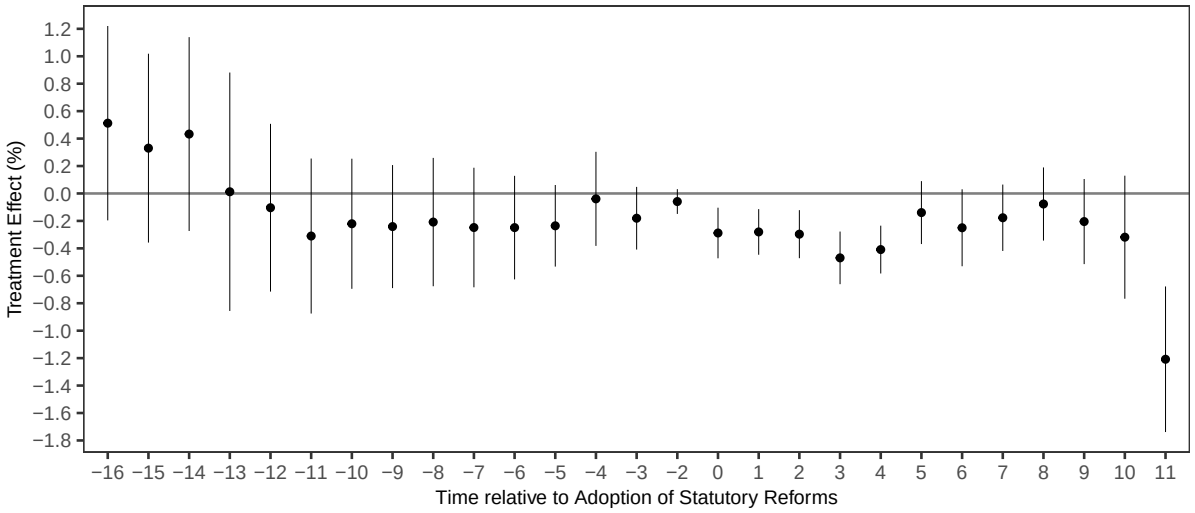
As regards the post-treatment period, average treatment effects on the yield to maturity are negative, significant, and persistent over time; while average treatment effects on the coupon rate tend to be significant in the first few periods. The findings indicate that bonds react quickly to changes in corporate bylaws. Moreover, since there were multiple exogenous shocks on corporate governance, we mitigate existing factors that could confound our analyses, such as the initial shock on corporate governance that originated from the revision in January, 2018. Our results further suggest that even though changes in corporate bylaws were anticipated by both firms and the bond market, there were no changes in the behavior of firms issuing bonds or in the behavior of bondholders.

Figure 2.5 – Pre-Treatment Trends

A. Yield to Maturity



B. Coupon Rate



This figure depicts the evolution of average treatment effects over time, as well as their 95% confidence interval. Effects on the bond's yield to maturity and coupon rate are shown in Panel A and B respectively. The results are obtained using the interaction-weighted model defined in Eq.(1), aggregating the effects for all cohorts using Eq.(2), and clustering standard errors at the firm level. We exclude the following time-varying covariates: Bond Liquidity, Return on Assets, and Sales Growth.

Source: Elaborated by the author.

2.4.5 Robustness Checks

We examine the robustness of our results in Table 2.4 by estimating a number of alternative models similar to those from columns 3 and 6 of Table 2.3. First, we investigate whether our findings are driven by our cleaning procedure. Panel A of Table 2.4 shows the results after including bond observations from firms with negative net debt. We find that the coefficients for the bond's yield to maturity (-0.332) and coupon rate (-0.270) remain negative and significant at the 5% level.

Similarly, we include observations from distressed firms with negative equity and repeat the analyses in Panel B. The coefficients for the yield to maturity (-0.362) and the coupon rate (-0.318) remain negative and significant at the 5% level. In Panel C, we examine whether our treatment of outliers affect our main results. As such, we redo the analyses without winsorizing time-varying variables. Again, we find negative coefficients for the yield to maturity (-0.322) and the coupon rate (-0.267) that are both significant at the 5% level.

Second, we re-examine our main models specification. Since we used firm fixed effects to evaluate the effect that bond characteristics have on the bond pricing, we re-estimate our main models in Panel D using bond fixed effects to control for time-invariant unobservable bond factors and further restrict the models. Not surprisingly, the results show that the coefficients for the yield to maturity (-0.229) and the coupon rate (-0.308) are negative and significant at the 10% and the 5% levels respectively. Notice, however, that the effect on the yield to maturity is lower.

Third, there is a concern that treated firms are different from their counterparts. Even though we control for time-varying variables at the firm level, control firms might still have unobservable differences with treated firms. In an attempt to alleviate these concerns, we begin by excluding bond observations of firms listed in the Bovespa Mais segment given that these firms have not yet held an IPO, and the segment was created to provide small and midsize companies a gradual access to capital markets. As shown in Panel E, we find that the coefficients for the yield to maturity (-0.374) and the coupon rate (-0.248) are negative and significant at the 5% level.

To further increase the similarity between treated and control observations, we restrict our sample to observations from firms listed in either the Level II or the Novo Mercado segment. As shown in the appendix A, before the revision of the Novo Mercado segment, the only difference in listing requirements between both segments was that Level II companies were able to issue preferred shares, which only provide voting rights in critical situations, while companies listed in the Novo Mercado could only issue common shares. We conduct the analyses using our new sample in Panel F. We find similar results to those aforementioned, the coefficient being greater for the yield to maturity (-0.391) and lower

Table 2.4 – Robustness Checks

	(1)	(2)
	Total Yield	*Coupon Rate*
Panel A. Including Bonds Issued by Firms with Negative Net Debt		
Average Treatment Effect	−0.332**	−0.270***
	(0.134)	(0.097)
Controls	Same control variables as Table 2.3	
Firm Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes
Observations	2,719	2,719
Adj. R^2	0.865	0.930
Panel B. Including Bond Observations for Firms with Negative Equity		
Average Treatment Effect	−0.362***	−0.318***
	(0.123)	(0.109)
Controls	Same control variables as Table 2.3	
Firm Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes
Observations	2,673	2,673
Adj. R^2	0.865	0.930
Panel C. Without Winsorization at the 1st and 99th Percentiles		
Average Treatment Effect	−0.322**	−0.267***
	(0.133)	(0.098)
Controls	Same control variables as Table 2.3	
Firm Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes
Observations	2,672	2,672
Adj. R^2	0.863	0.929
Panel D. Using Bond Fixed Effects		
Average Treatment Effect	−0.229*	−0.308***
	(0.137)	(0.071)
Controls	All time-varying controls from Table 2.3	
Firm Fixed Effects	No	No
Bond Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	No	No
Observations	2,672	2,672
Adj. R^2	0.868	0.958
Panel E. Excluding Bonds Issued by Firms Listed on the Bovespa Mais segment		
Average Treatment Effect	−0.332**	−0.250**
	(0.137)	(0.101)
Controls	Same control variables as Table 2.3	
Firm Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes
Observations	2,598	2,598
Adj. R^2	0.865	0.930

Source: Elaborated by the author.

Table 2.4 – Robustness Checks (cont.)

Panel F. Restricting Observations to Firms listed in either Level II or Novo Mercado		
Average Treatment Effect	-0.340^{**}	-0.254^{**}
	(0.159)	(0.120)
Controls	Same control variables as Table 2.3	
Firm Fixed Effects	Yes	Yes
Quarter Fixed Effects	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes
Observations	1,951	1,951
Adj. R^2	0.845	0.929

This table reports estimates from our main models with alternative specifications or samples. Our results are obtained using Eq.(1) and further aggregating the treatment effects with Eq.(4). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

for the coupon rate (-0.235).

2.4.6 Channels for Governance Practices to Affect Bond Yields

In this section, we provide evidence that the decrease in bond yields might be the result of changes in bond liquidity, return on assets, and sales growth. We found in Sections 2.4.2 and 2.4.5 that, after controlling for either firm or bond fixed effects, the adoption of statutory reforms by firms listed in the Novo Mercado segment led to lower bond yields on both the primary and secondary markets. As such, our findings are not caused by time-invariant characteristics. In addition, prior to estimating our main models, we examined whether each time-varying covariate was affected by the treatment and found that bond liquidity, return on assets, and sales growth were all affected covariates.

A number of studies recognize that corporate governance can increase stock liquidity by mitigating information asymmetry (CHUNG; ELDER; KIM, 2010; BALAKRISHNAN et al., 2014). However, the relationship between corporate governance and bond liquidity remains unexplored. Given that the adoption of statutory reforms reduced information asymmetry and reinforced audit processes, it should increase secondary bond market liquidity.

In Table 2.5, we re-estimate our main models using bond liquidity, return on assets, and sales growth as dependent variables. From columns 1 and 2, we find that the adoption of statutory reforms led to a decrease in bond illiquidity. It is well-known that bond liquidity is negatively related to corporate bond spreads (CHEN; LESMOND; WEI, 2007; HE; XIONG, 2012), and the sudden increase in secondary bond market liquidity can translate into lower bond yields on the secondary market. Alternatively, it is possible that reduced bond yields decreased the firm's credit risk, which in turn increased bond liquidity,

Table 2.5 – Channels Through Which Governance Practices Affect Bond Yields

	(1)	(2)	(3)	(4)	(5)	(6)
	Bond Liquidity		*Return on Assets*		*Sales Growth*	
Average Treatment Effect	−15.054***	−14.361***	−0.621***	−0.458***	23.613***	27.944***
	(4.356)	(4.207)	(0.165)	(0.153)	(4.338)	(4.164)
Bond Age	−0.182	4.889***	0.038*	1.931***	−1.693***	−6.125**
	(0.622)	(1.511)	(0.020)	(0.124)	(0.524)	(2.405)
Bond Maturity	−0.041	5.516	0.015*	0.513	−0.492*	13.779
	(0.273)	(6.676)	(0.008)	(0.633)	(0.260)	(14.518)
Credit Rating	−0.237	−1.174	0.096	0.109	−0.831	−3.944
	(1.415)	(1.164)	(0.116)	(0.100)	(3.195)	(3.147)
Size	0.829	−2.276	−0.149	−0.180	49.522***	56.580***
	(2.413)	(2.262)	(0.172)	(0.234)	(10.480)	(13.672)
Leverage	−0.101	−0.045	−0.031***	−0.029***	−0.814***	−0.693***
	(0.065)	(0.062)	(0.006)	(0.006)	(0.120)	(0.126)
Tangibility	0.216***	0.235***	−0.004	−0.000	−0.060	−0.117
	(0.074)	(0.065)	(0.006)	(0.006)	(0.151)	(0.156)
Market-to-Book	−3.841	−2.821	0.328**	0.277**	10.896**	11.512***
	(2.387)	(2.241)	(0.131)	(0.121)	(4.411)	(4.303)
Covid	30.217***	30.127***	−0.846***	−0.829***	−57.914***	−57.477***
	(7.540)	(7.362)	(0.135)	(0.135)	(4.823)	(4.738)
Initial Coupon	−1.459**		−0.035*		1.622***	
	(0.689)		(0.019)		(0.502)	
Amount Outstanding	−2.553***		0.005		−1.331*	
	(0.787)		(0.021)		(0.732)	
IPCA + Spread	9.652***		0.024		−6.505**	
	(3.250)		(0.102)		(2.938)	
DI + Spread	35.144***		−0.039		1.014	
	(2.604)		(0.061)		(2.191)	
Tax Exempt	−2.984		0.121*		5.355***	
	(2.265)		(0.067)		(1.790)	
Real Guarantees	2.743		−0.038		−4.412	
	(4.497)		(0.063)		(3.276)	
Call Option	4.233**		0.001		4.201***	
	(2.012)		(0.040)		(1.476)	
Firm Fixed Effects	Yes	No	Yes	No	Yes	No
Bond Fixed Effects	No	Yes	No	Yes	No	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	No	Yes	No	Yes	No
Observations	2672	2672	2672	2672	2672	2672
Adj. R^2	0.567	0.616	0.474	0.448	0.472	0.460

This table reports results from interaction-weighted models defined in Eq.(1) when the dependent variables are *Bond Liquidity*, *Return on Assets*, and *Sales Growth*. A definition of the variables, as well as their summary statistics can be found in Section 2.3.2. The independent variable of interest is the *Average Treatment Effect*, and it is found by aggregating cohort average treatment effects through Eq.(4). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

as in He and Milbradt (2014).

A large body of the literature examined the relationship between corporate governance and firm performance. However, the extensive research has produced mixed evidence that corporate governance is positively related to firm performance. From columns 3 and 4 of Table 2.5, our results indicate that the adoption of statutory reforms had a negative effect on firms' return on assets. It is important to note that the return on assets in columns 3 and 4 is contemporaneous. In unreported results, we repeated the analyses while using the lead values of the return on assets at time t+1, t+2, and so forth. We find that the effects of the adoption of statutory reforms on firms' return on assets are significant and slightly increasing up to time t+2. Since one would expect an increase in firms' returns resulting from the decrease in financing costs, it is safe to assume that companies suffered from organization costs as they adapted their organizational structure and revised their bylaws. In addition, since changes in firms' returns don't explain our main findings and vice-versa, there exist additional channels compensating for the effect at hand.

Our results in columns 5 and 6 further indicate that better governance practices had a great and positive impact on firm performance, as measured by the sales growth. The increase sales growth can lead to lower credit risk, which then reduces bond yields. However, it is also possible that the decrease in financing costs allowed firms to invest in additional projects that increased firms' sales. Overall, our results suggest that a combination of these factors is a possible candidate to explain the decrease in bond yields on both the primary and secondary markets. In particular, it is very likely that all these effects interact with each other.

It is also worth noticing that the COVID-19 pandemic has had a huge negative impact on firms. From Table 2.5, we find that firms that adopted statutory reforms have lost 0.857% and 59.661%, on average, on their return on assets and on their sales growth respectively during the pandemic. In addition, bonds issued by these firms experienced a 30.646% decrease in their liquidity. Taken together, these effects are responsible for the increase in bonds' yields to maturity that is associated with the pandemic.

2.5 Conclusion

This study investigates the effect of corporate governance changes on bond yields. To identify a causal relationship, we use multiple exogenous shocks on bonds: the staggered adoption of statutory reforms by Brazilian firms listed in the Novo Mercado segment. We find that bonds issued by firms listed in this segment experienced a significant decrease of their coupon rates and yields to maturity following the adoption of statutory reforms, relative to bonds issued by firms listed in other segments.

We then show that is it unlikely for our results to be driven by chance or confounding events. An examination of parallel trends shows the absence of anticipatory effects, as well as the absence of time trend difference in outcome in the pre-treatment period between bonds issued by firms that later adopted statutory reforms and bonds issued by firms that didn't adopt such reforms. We further conduct a number of robustness checks to assess the robustness of our results. Our findings remain the same throughout the different models. Finally, we provide evidence that possible channels through which corporate governance affect bonds are to improve liquidity on the secondary market and to increase firms' sales growth.

This study also provides evidence on how the COVID-19 pandemic has affected Brazilian firms and the secondary bond market. We find that the pandemic has greatly reduced firm performance, as measured by return on assets and sales growth. We also find that bond yields on the secondary market and bond illiquidity increased during the pandemic. While these variables are not the only ones affected by the pandemic, they provide evidence of the deteriorating economic and financing conditions resulting from the worldwide pandemic.

Our study has important policy implications for improving corporate governance standards. Our findings suggest that voluntary governance codes aiming to promote more robust practices can have real economic benefits for firms by decreasing financing costs and fostering growth. Such codes are more likely to have a greater impact in countries with relatively poor governance practices. Furthermore, voluntary governance codes can also have real benefits for capital markets by increasing the liquidity on these markets. This result is particularly relevant since corporate bond financing has been a significant source of capital for non-financial firms during the COVID-19 pandemic.

2.6 References

ACHARYA, V. V.; BAGHAI, R. P.; SUBRAMANIAN, K. V. Wrongful Discharge Laws and Innovation. **The Review of Financial Studies**, v. 27, n. 1, p. 301–346, 2014.

ANDERSON, R. C.; MANSI, S. A.; REEB, D. M. Board Characteristics, Accounting Report Integrity, and The Cost of Debt. **Journal of Accounting and Economics**, v. 37, n. 3, p. 315–342, 2004.

ATANASOV, V.; BLACK, B. Shock-Based Causal Inference in Corporate Finance and Accounting Research. **Critical Finance Review**, v. 5, p. 207–304, 2016.

BALAKRISHNAN, K. et al. Shaping Liquidity: On the Causal Effects of Voluntary Disclosure. **The Journal of Finance**, v. 69, n. 5, p. 2237–2278, 2014.

BERTRAND, M.; DUFLO, E.; MULLAINATHAN, S. How Much Should We Trust Differences-in-Differences Estimates? **The Quarterly Journal of Economics**, v. 119, n. 1, p. 249–275, 2004.

BHOJRAJ, S.; SENGUPTA, P. Effect of Corporate Governance on Bond Ratings and Yields: The Role of Institutional Investors and Outside Directors. **The Journal of Business**, v. 76, n. 3, p. 455–475, 2003.

BLACK, B. S.; CARVALHO, A. G.; SAMPAIO, J. O. The Evolution of Corporate Governance in Brazil. **Emerging Markets Review**, v. 20, p. 176–195, 2014.

BOUBAKRI, N.; GHOUMA, H. Control/Ownership Structure, Creditor Rights Protection, and the Cost of Debt Financing: International Evidence. **Journal of Banking & Finance**, v. 34, n. 10, p. 2481–2499, 2010.

CALLAWAY, B.; SANT'ANNA, P. H. C. Difference-in-Differences with multiple time periods. **Journal of Econometrics**, v. 225, n. 2, p. 200–230, 2020.

CARVALHO, A. G.; MARQUES, F. T. The Microstructure of the Brazilian Market for Corporate Bonds. **Revista Brasileira de Gestão de Negócios**, v. 22, p. 482–500, 2020.

CARVALHO, A. G.; PENNACCHI, G. G. Can a Stock Exchange Improve Corporate Behavior? Evidence from Firms' Migration to Premium Listings in Brazil. **Journal of Corporate Finance**, v. 18, n. 4, p. 883–903, 2012.

ÇELIK, S.; DEMIRTAS, G.; ISAKSSON, M. **Corporate Bond Market Trends, Emerging Risks and Monetary Policy**. Paris, 2020.

CHAISEMARTIN, C. de; D'HAULTFOEUILLE, X. Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects. **American Economic Review**, v. 110, n. 9, p. 2964–96, 2020.

CHEN, L.; LESMOND, D. A.; WEI, J. Corporate Yield Spreads and Bond Liquidity. **The Journal of Finance**, v. 62, n. 1, p. 119–149, 2007.

CHULUUN, T.; PREVOST, A.; PUTHENPURACKAL, J. Board Ties and the Cost of Corporate Debt. **Financial Management**, v. 43, n. 3, p. 852–897, 2014.

CHUNG, K. H.; ELDER, J.; KIM, J.-C. Corporate Governance and Liquidity. **Journal of Financial and Quantitative Analysis**, v. 45, n. 2, p. 265–291, 2010.

CLAESSENS, S.; KLINGEBIEL, D.; LUBRANO, M. **Corporate Governance Reform Issues in the Brazilian Equity Markets**. Washington, D. C., 2000.

CREMERS, K. J. M.; NAIR, V.; WEI, C. Governance Mechanisms and Bond Prices. **The Review of Financial Studies**, v. 20, n. 5, p. 1359–1388, 2007.

DANG, V. A.; KIM, M.; SHIN, Y. In Search of Robust Methods for Dynamic Panel Data Models in Empirical Corporate Finance. **Journal of Banking & Finance**, v. 53, p. 84–98, 2015.

DETRAGIACHE, E. Adverse Selection and the Costs of Financial Distress. **Journal of Corporate Finance**, v. 1, n. 3–4, p. 347–365, 1995.

FLANNERY, M. J.; HANKINS, K. W. Estimating Dynamic Panel Models in Corporate Finance. **Journal of Corporate Finance**, v. 19, p. 1–19, 2013.

GAO, H. et al. The Real Effect of Smoking Bans: Evidence from Corporate Innovation. **Journal of Financial and Quantitative Analysis**, v. 55, n. 2, p. 387–427, 2018.

GAVISH, B.; KALAY, A. On the Asset Substitution Problem. **Journal of Financial and Quantitative Analysis**, v. 18, n. 1, p. 21–30, 1983.

GOODMAN-BACON, A. Difference-in-differences with variation in treatment timing. **Journal of Econometrics**, v. 225, n. 2, p. 254–277, 2021.

HE, Z.; MILBRADT, K. Endogenous Liquidity and Defaultable Bonds. **Econometrica**, v. 82, n. 4, p. 1443–1508, 2014.

HE, Z.; XIONG, W. Rollover Risk and Credit Risk. **The Journal of Finance**, v. 67, n. 2, p. 391–430, 2012.

HUANG, K.; PETKEVICH, A. Corporate Bond Pricing and Ownership Heterogeneity. **Journal of Corporate Finance**, v. 36, p. 54–74, 2016.

JENSEN, M. C.; MECKLING, W. H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. **Journal of Financial Economics**, v. 3, p. 305–360, 1976.

KALAY, A. Stockholder-Bondholder Conflict and Dividend Constraints. **Journal of Financial Economics**, v. 10, n. 2, p. 211–233, 1982.

KARGAR, M. et al. Corporate Bond Liquidity during the COVID-19 Crisis. **The Review of Financial Studies**, v. 34, n. 11, p. 5352–5401, 2021.

KLOCK, M. S.; MANSI, S. A.; MAXWELL, W. F. Does Corporate Governance Matter to Bondholders? **Journal of Financial and Quantitative Analysis**, v. 40, n. 4, p. 693–719, 2005.

LELAND, H. E. Agency Costs, Risk Management, and Capital Structure. **The Journal of Finance**, v. 53, n. 4, p. 1213–1243, 1998.

LIN, H.; LIU, S.; WU, C. Dissecting Corporate Bonds and CDS Spreads. **The Journal of Fixed Income**, v. 20, n. 3, p. 7–39, 2011.

MURCIAL, F. C. d. S. et al. The Determinants of Credit Rating: Brazilian Evidence. **Brazilian Administration Review**, v. 11, n. 2, p. 188–209, 2014.

MYERS, S. C. Determinants of Corporate Borrowing. **Journal of Financial Economics**, v. 5, n. 2, p. 147–175, 1977.

NOZAWA, Y.; QIU, Y. Corporate Bond Market Reactions to Quantitative Easing During the COVID-19 Pandemic. **Journal of Banking & Finance**, v. 133, p. 1–56, 2021.

SMITH, C. W.; WARNER, J. B. On Financial Contracting: An Analysis of Bond Covenants. **Journal of Financial Economics**, v. 7, n. 2, p. 117–161, 1979.

SUN, L.; ABRAHAM, S. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. **Journal of Econometrics**, v. 225, n. 2, p. 175–199, 2020.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

WANG, Z.; YIN, Q. E.; YU, L. Real Effects of share repurchases legalization on corporate behaviors. **Journal of Financial Economics**, v. 140, n. 1, p. 197–219, 2021.

WINTOKI, M. B.; LINCK, J. S.; NETTER, J. M. Endogeneity and the Dynamics of Internal Corporate Governance. **Journal of Financial Economics**, v. 105, n. 3, p. 581–606, 2012.

YU, F. Accounting Transparency and the Term Structure of Credit Spreads. **Journal of Financial Economics**, v. 75, n. 1, p. 53–84, 2005.

3 Revision of the Novo Mercado Segment: Which Governance Mechanisms Matter to Bondholders?

3.1 Introduction

Corporate bond borrowing has significantly increased over the last years (ÇELIK; DEMIRTAS; ISAKSSON, 2020), and bond markets have proven essential to provide liquidity for non-financial companies in periods of financial turbulence, when credit supply tightens (BECKER; IVASHINA, 2014; KAYA; WANG, 2016). The empirical literature already acknowledges that bond financing represents a significant financing source for non-financial companies worldwide, even in the absence of financial turmoils (GILCHRIST; ZAKRAJSEK, 2012; MA, 2019). Nonetheless, bond financing entails agency conflicts between shareholders and bondholders given that both have a claim on the firm (see, for example, JENSEN; MECKLING, 1976).

Firms have tried to mitigate these conflicts by using restrictive bond covenants to restrict managers actions' and to prevent them to make decisions detrimental to creditors, but these covenants have proven ineffective to reduce the agency costs of debt. Indeed, it is very costly to write, monitor, and enforce such covenants, and bondholders will require bonds to be issued at a discount to compensate for these costs (KLOCK; MANSI; MAXWELL, 2005). Hence, the firm will bear the agency costs associated with bond financing, and corporate governance mechanisms are needed to mitigate the agency conflicts and to reduce the underlying costs.

In 2018, the São Paulo Stock Exchange (B3) introduced the revision of the Novo Mercado segment, a segment with high corporate governance requirements, to ensure that the segment remained competitive and preserved its value. The revision led to improvements in several corporate governance mechanisms: assessment of management, audit committee, internal auditing, and corporate transparency. Yet, firms already listed in the Novo Mercado segment were given until the first ordinary shareholders' meeting of 2021 to comply with the changes in their organization structure. Consequently, a great number of companies had a progressive adaptation, and the adoption of statutory reforms didn't cause immediate changes in all the governance mechanisms.

Since the revision was not motivated by concerns about bond financing, it is very likely that any effects on bond markets are unintended consequences of that segment's revision. Hence, it provides provides a natural experiment that allows us to mitigate endogeneity issues and to examine the causal relationship between corporate governance and bond yields. In particular, we use the staggered adoption of statutory reforms across companies listed in the Novo Mercado segment to investigate how corporate governance mechanisms have evolved in these companies. The objective of this paper is to examine the individual contribution of these corporate governance mechanisms to the overall effect that the revision of the Novo Mercado segment had on bond yields.

Using a sample of 302 bonds issued by 99 Brazilian firms over the period 2015 Q1 – 2020 Q4, we employ staggered difference-in-differences and find that the adoption of statutory reforms led to changes in assessments of the management, in audit committee structures, and in internal auditing departments. We then examine the relationship between these changes and corporate bond yields, using fixed effects regressions. We find that improvements in assessments of the management and in audit committee structures decrease bond yields, while improvements in internal auditing departments increase bond yields. The combined effect of these mechanisms tend to be negative for bonds issued by firms listed in the Novo Mercado segment. Additionally, we find that the individual effect of these mechanisms depends on existing corporate governance structures. Indeed, we find that the mechanisms have different effects depending on whether companies have an audit committee and whether it is statutory.

This paper contributes to the literature investigating Brazilian premium listing segments. It offers an overview of the corporate governance changes in Brazilian listed companies and that originated from the revision of the Novo Mercado segment. Interestingly, companies listed in other segments have also improved their corporate governance to remain attractive to investors. This article further complements the corporate governance literature. It offers supporting evidence that two corporate governance mechanisms, namely the assessment of the executive management and the audit committee, have a negative impact on corporate bond yields. By contrast, improvements in internal auditing tend

to increase bond yields. Our paper also shows that the effect on bond yields of a given governance mechanism depends on the set of corporate governance practices already in place. Lastly, this paper contributes to the literature that investigates the effects of the COVID-19 pandemic. It offers evidence that the pandemic has affected corporate governance practices in companies listed in the Novo Mercado segment.

The remainder of this article is as follows: Section 2 presents the literature review and research hypotheses, Section 3 describes the empirical methodology and the research design, Section 4 discusses the results, and Section 5 concludes the paper.

3.2 Governance Mechanisms and the Bond Market

3.2.1 The Revision of the Novo Mercado Segment (2017)

Verifying the need for additional reforms in premium listing segments in 2015, the São Paulo stock exchange - B3 (previously known as BM&F Bovespa) initiated the revision process of both the Level II and the Novo Mercado segments to preserve their value and recognition as both national and international benchmarks. This process included discussions with investors, stock issuers, and academics; as well as public and restricted hearings. At the end of the process, in 2017, companies that were listed in the Level II (19 companies) or on the Novo Mercado segment (131 companies) were asked to vote on the respective new basic regulation and on four additional rules relating to i) the management's assessment, ii) the tender offer by the acquisition of a relevant stake, iii) the disclosure of socio-environmental report, and iv) the replacement of the quorum for the Novo Mercado delisting tender offer to 50%. As a result, companies listed in the Level II rejected all of the B3's proposals for the segment, and there were no changes in the corporate governance requirements for the Level II segment. As for the Novo Mercado segment, companies voted in favor of both the new basic regulation and the rule relating to management's assessment, but they rejected the subsequent proposals.

Initially, the Level II and the Novo Mercado segments had similar corporate governance requirements, with the only difference being that companies listed in the Level II had the right to issue preferred shares with no voting rights attached, while companies listed in the Novo Mercado segment could only issue common shares with voting rights. The new regulation came into force gradually for companies already listed in the Novo Mercado segment. Changes with respect to regular and sporadic disclosures; as well as changes for such corporate events as tender offer, transfer of control, corporate reorganization, and delisting tender offer became effective as of January 2, 2018. As such, companies listed in the segment were given the possibility to contemplate the needed changes in their bylaws during the ordinary shareholder's meeting of 2018. Still, since companies listed in the segment also needed to adapt their organizational structure to comply with the new regulation, the stock exchange gave them some additional time to

make the required changes and to revise their bylaws. Consequently, the deadline for companies to meet the regulation was until the first ordinary shareholders' meeting of 2021, and this deadline was further extended to the first ordinary shareholders' meeting of 2022 due to the COVID pandemic, which caused significant disruptions worldwide. As regards migrating companies, applications and admissions of companies on the Novo Mercado segment made after December 28, 2017, were subject to the new regulation.

Following the revision of the segment, companies had to undergo several changes in their internal structure (B3, 2017). First, with regard to the composition of the board of directors, companies needed to consider the new rules for characterizing independent directors (art. 16) and the procedures related to the election (art. 17, I and II), as well as the board's statement regarding each candidate's adherence to the Nomination Policy (art. 25, I). Second, companies had to structure and to disclose a process of evaluation of the executive management, the board of directors, and its committees (art. 18). Third, companies had to install an audit committee, which could either be statutory or non-statutory and in accordance with the article 22. Fourth, companies needed to have their own internal auditing department meeting the requirements of article 23. Fifth, companies had to implement functions of compliance, internal controls, and corporate risks, and these functions must not be accumulated with operational activities (art. 24). Lastly, the company had to prepare and disclose all documents required by the regulation: the bylaws of the board of directors, of its advisory committees, and of the fiscal council, if any (art. 25); the code of conduct (art. 31); and policies with respect to remuneration, risk management, related-party transactions, securities trading, and the nomination of board members, committee members or executive managers (art. 32).

3.2.2 Governance Mechanisms and Bond Yields

Building upon the positive agency theory, which focuses on the conflicts of interests arising in companies and discusses the mechanisms that would resolve or reduce such conflicts, corporate governance puts great emphasis on mechanisms mitigating the agency costs of firms (EISENHARDT, 1989; MISANGYI; ACHARYA, 2014). Since prior academic studies have focused principally on the shareholder-manager conflict, debt financing is often cited as a governance mechanism reducing empire-building incentives while also providing effective monitoring and potential control of the firm (JENSEN, 1986; STULZ, 1990; MORELLEC, 2004). However, debt financing also entails new agency conflicts with creditors. When the interests of managers and creditors diverge, managers have strong incentives to engage into risk-shifting practices or to capitalize on the dividend policy while expropriating creditors (JENSEN; MECKLING, 1976; KALAY, 1982; GAVISH; KALAY, 1983). Furthermore, the use of risky debt induces a debt overhang problem, and firms end up abandoning profitable projects when most of the benefits would accrue to creditors, as evidenced by Myers (1977). Lastly, in presence of asymmetric information,

Thatcher (1985) shows that creditors will underestimate the future cash flows of firms that are unable to reveal their true cash flows.

Structural models of credit risk acknowledge that firms using bond financing bear the agency costs of debt. As bondholders anticipate these costs, they will require an additional return to hold the bond, thus reducing the bond's value and increasing the bond's yield-to-maturity (LELAND, 1998). While debt contracting can be used to restrict managers' actions, Smith and Warner (1979) note that debt covenants are imperfect since it is difficult to observe and expensive to monitor managers' actions. As such, governance mechanisms are essential to minimize the agency costs associated with bond financing. The academic literature provides evidence on the relationship between some corporate governance mechanisms and debt financing. In particular, we focus on the potential effects of the governance mechanisms that were introduced with the revision of the Novo Mercado segment.

With the introduction of evaluation processes for executive managers, boards of directors, and their advisory committees; we expect listed companies to reduce their agency costs of debt. Managers' remuneration is closely tied to their performance, and part of the remuneration is usually stock-based to ensure that managers' interests are align with those of shareholders, as evidenced by Murphy (1985). While stock-based compensations can worsen the asset substitution problem, which arises when the company substitutes low-risk projects for riskier ones, such compensations also increase effective monitoring by managers. Ertugrul and Hedge (2008) provide evidence that there exists a negative relationship between the percentage of stock-based remuneration and bond spreads, thus suggesting that the monitoring incentives are greater than the risk-shifting ones. As for board members, while their remuneration is often not tied to their performance, under-performing members are usually dismissed or not getting their terms renewed. John and Senbet (1998) note that the effectiveness of the board in monitoring managers is an increasing function of the board size and independence. Board independence, in addition to board expertise, is positively associated with credit ratings, thus translating into lower bond yield, as evidenced by Ashbaugh-Skaife, Collins, and Lafond (2006). Similarly, the existence and independence of advisory committees are essential to board monitoring (GILLAN; STARKS, 2000) and board decision-making (KESNER, 1988). Hence, our first testable hypothesis is given as:

H1. Improvements in the assessment of the management have a negative effect on bond yields.

Even though there exists a lack of theoretical guidance on why audit committees exist, academic researchers acknowledge that audit committees perform the tasks

of monitoring the financial reporting process and overseeing external auditors (COHEN et al., 2014; BRUYNSEELS; CARDINAELS, 2014). DeZoort et al. (2002) posit that there are four determinants of audit committee effectiveness: composition (e.g., independence, expertise), authority (responsibilities and influence), resources, and diligence (willingness to work as needed). In line with this view, Xie, Davidson, and DaDalt (2003) provide evidence that meeting frequency and members' financial expertise are negatively related to the likelihood of a firm engaging in earnings management practices, suggesting that these determinants would greatly reduce the agency costs of the firm. Similarly, Anderson, Mansi, and Reeb (2004) show that both audit committee independence and size are negatively related to bond spreads. Given that the new regulation of the Novo Mercado segment requires companies to install an audit committee with operational autonomy, its own budget approved by the board of directors, and a minimum size of 3 members, of whom at least 1 should be independent and at least 1 should have financial expertise; we expect this governance mechanism to be negatively related to bond yields. We define our second hypothesis as:

H2. Improvements in audit committee structures are negatively related to bond yields.

To comply with the new regulation, listed companies must also install an internal audit department. Internal auditing helps enhancing existing risk management, control, and governance processes; as well as providing critical information to the financial reporting stakeholders (ABBOTT; DAUGHERTY, et al., 2015; EGE, 2015). Additionally, there exists credible evidence that internal auditing increases fraud detection (CORAM; FERGUSON; MORONEY, 2008), mitigates earnings management practices (PRAWITT; SMITH; WOOD, 2009), reduces audit report delay (ABBOTT; PARKER; PETERS, 2012), and reduces instances of management misconduct (EGE, 2015). Altogether, these findings suggest that internal auditing is an essential governance mechanism that reduces the agency costs of debt, and our third hypothesis is given as:

H3. Improvements in internal auditing have a negative impact on bond yields.

Finally, the revision aimed at increasing corporate transparency, which can be defined as the availability of private information to those outside of public companies (BUSHMAN; PIOTROSKI; SMITH, 2004). The academic literature suggests that greater disclosure requirements allow for improved monitoring of the managers (BUSHMAN; SMITH, 2001), reduced information asymmetry (BOTOSAN; PLUMLEE, 2002), and reduced expropriation of corporate resources (HUANG; HUANG, 2012). While these

studies demonstrate that corporate transparency helps reducing firms' agency costs, greater transparency can also exacerbate existing agency conflicts. Consistent with this view, Hermalin and Weisbach (2012) find that greater transparency can be detrimental to managers, and as such they should be compensated for it, hence lowering the returns from greater monitoring. Consequently, managers might prefer lower disclosure levels. Even though improved disclosure requirements might have diminishing returns, we expect the increase in corporate transparency, resulting from the revision of the Novo Mercado segment, to reduce the agency costs of debt. We thus define our last hypothesis as:

H4. Improvements in corporate transparency have a negative impact on bond yields.

3.3 Research Methods

3.3.1 Sample

Our paper focuses on the relation between corporate governance mechanisms that were introduced with the revision of the Novo Mercado segment and bond yields. Examining bonds issued on the local market, also known as debentures, we first collect quarterly bond data on the secondary market from 2015 to 2020 using the Economática database. Given that a significant numbers of debentures have either intra-group or real guarantees attached to them, we use the Brazilian Financial and Capital Markets Association – ANBIMA database to identify the existence of such guarantees in bond indentures. We then control for intra-group guarantees by using the guarantor's data and replacing the Brazilian Securities and Exchange Commission (CVM) identification code of the issuer with that of the guarantor. Given the impossibility to replace the CVM code in cases where there exist multiple guarantors, we exclude such debentures. Similarly, we control for real guarantees using a dummy variable.

From Economática, we further obtain consolidated financial data and stock data of listed companies. Using the CVM code of each company, we're able to match a given company in the bond database to the corresponding one in the stock database. We then use public data from the ANBIMA website to obtain additional data on bond issues, as well as to cross-check and to reconcile existing bond data. From either Fitch Ratings, Standard & Poor's, or Moody's, we manually obtain bond ratings for each bond issue.

The existing Brazilian regulation requires listed companies to publicly disclose all relevant information by filling out reference forms and sending these forms to the CVM on a yearly basis. As such, we manually collect corporate governance data from reference forms in the CVM database. When data is lacking in the reference forms of a given firm, we also examine the underlying firm's website to obtain additional information. Similarly,

we gather data from minutes of extraordinary shareholders' meetings to determine the quarters in which companies listed in the Novo Mercado segment adopted statutory reforms. Consequently, we use the date of the shareholders' meeting during which the revision of the bylaws was voted as the date of the statutory reform for already listed companies. As for migrating companies, we use the first trading date on the Novo Mercado segment as the reference date.

Lastly, we exclude firms that belong to the financial sector, as defined by the B3 classification, and private firms, except for those with intra-group guarantees; given that these firms have unique features that distinguish them from the rest of our sample. After removing observations for which data is incomplete, our sample consists of 302 bonds issued by 99 Brazilian firms.

3.3.2 Variables

Our main variable of interest is the bond yield on the secondary market, most commonly referred to as the yield-to-maturity. In Brazil, bonds have their remuneration linked to indices: the inter-bank offered rate – DI or the inflation rate – IPCA. There exist three remuneration types in our sample: spread over the IPCA rate, spread over the DI rate, and percentage of the DI rate. As the DI rate has decreased since 2017, there was an increase in the number of bonds whose remuneration is given as a spread over the DI rate and an equivalent decrease in the number of bonds whose remuneration are based on the IPCA. This suggests that companies adapt the remuneration of their bonds to macroeconomic conditions in order to minimize their financing costs. Additionally, quotes on the secondary bond market are expressed as only the spread over the underlying rate to which the bond is linked or the percentage of the DI rate, without correcting for the associated index. Hence, we normalize bond yields across the different remuneration types by correcting for the underlying rate (DI or IPCA) to obtain total yields to maturity. We obtain data on IPCA and DI rates from the Brazilian Institute of Geography and Statistics (IBGE) and the B3 websites respectively.

Our second variables of interests are the corporate governance variables. We build upon the new regulation of the Novo Mercado segment to develop these variables, which are presented in Table 3.1. Changes in the existing regulation affect mostly four areas: assessment of management, audit committee, internal auditing, and corporate transparency. First, the value of variables relating to assessment of management can be found in the section 12.1 of reference forms. Second, variables related to the audit committee are more diverse and come from different sources. To determine the existence of annual and quarterly reporting, as well as the existence and functions of chairpersons, we use firms' website and analyze the committees' bylaws, whenever available, and consolidated financial statements. Variables about the committee composition are found in the sections 12.5/6 and 12.7/8 of

reference forms. As regards the functions of the committee, we also examine sections 12.1, 5.1, and 5.3. Third, as regards internal auditing departments, data is available in sections 5.1, 5.3, and 5.4 of reference forms. Lastly, data on corporate bylaws can be found in the section 12.1 of reference forms, while data on corporate policies is found on firms' website.

Table 3.1 also presents the summary statistics of these governance variables for the whole sample. As shown in the table, about 77.9% of the quarterly observations have a formal process of evaluation for the board of directors. This number drops to 69% for the process of evaluation of the executive management. There is an even bigger decrease in the number of observations that have such a process for advisory committees, and only 42% of the observations have one. Similarly, most companies in our sample have an audit committee, and these companies represent 84.6% of the sample. However, a large number of audit committees don't comply with the new requirements from the revision of the Novo Mercado segment. The average audit committee is composed of 3 members, of which 2 are independent. Furthermore, less than half of the observations have an internal auditing department that contributes to risk management, control, and governance processes. Most of these departments don't have their duties and responsibilities approved by the board of directors, nor do they have their budget and structure assessed by the board. Lastly, with the exception of the nomination policy, companies tend to disclose their policies. About 63% of the observations disclose policies related to risk management, securities trading, or related-party transactions. Likewise, companies often disclose the bylaws of their board, but they do it less frequently for their advisory committees.

We follow the literature and control for several firm characteristics that may affect bond yields. The firm's size is given as the natural logarithm of the firm's asset value. We compute the firm's leverage by dividing the net book value of debt by the sum of the market value of equity and the net book value of debt. We obtain the firm's return on assets as the sum of the Profit/Loss from Continuing Operations and the income attributable to non-controlling interests divided by the total asset value. We also control for growth opportunities, using the Market-to-Book ratio: the market value of assets divided by the book value of assets, with the market value of assets being equal to the sum of the total asset value and the market value of equity minus the book value of equity, which is given as the common equity minus deferred taxes. We further include past sales growth, measured as the sales growth over the previous year.

Table 3.1 – Description and Summary Statistics – Corporate Governance Variables

	Description	Mean	Std. Dev.	25%	75%
I. Assessment of Management					
Aval_CA	Firm has a process of assessment of the board of directors	0.690	0.462	0.000	1.000
Abr_CA	Scope of the assessment: by individual (1), by governing body (2), or both (3)	1.492	1.253	0.000	3.000
Proced_CA	Firm discloses the procedures used to perform the assessment	0.635	0.481	0.000	1.000
Metod_CA	Firm discloses the methodology used and any changes made	0.635	0.481	0.000	1.000
Freq_CA	Firm discloses the frequency with which it performs the assessment	0.682	0.463	0.000	1.000
Aval_Dir	Firm has a process of assessment of the executive officers	0.779	0.415	0.000	1.000
Abr_Dir	Scope of the assessment: by individual (1), by governing body (2), or both (3)	1.792	1.038	2.000	2.000
Proced_Dir	Firm discloses the procedures used to perform the assessment	0.761	0.426	0.000	1.000
Metod_Dir	Firm discloses the methodology used and any changes made	0.730	0.444	0.000	1.000
Freq_Dir	Firm discloses the frequency with which it performs the assessment	0.779	0.415	0.000	1.000
Aval_Com	Firm has a process of assessment of the executive officers	0.423	0.494	0.000	1.000
Abr_Com	Scope of the assessment: by individual (1), by governing body (2), or both (3)	0.777	1.049	0.000	1.000
Proced_Com	Firm discloses the procedures used to perform the assessment	0.420	0.494	0.000	1.000
Metod_Com	Firm discloses the methodology used and any changes made	0.420	0.494	0.000	1.000
Freq_Com	Firm discloses the frequency with which it performs the assessment	0.422	0.494	0.000	1.000
II. Audit Committee					
Com_Audit	Firm has an audit committee	0.846	0.361	1.000	1.000
Audit_Est	Audit committee is statutory	0.441	0.497	0.000	1.000
Audit_Est_Regim	Audit committee discloses its bylaws	0.518	0.500	0.000	1.000
Audit_Est_FRE	Audit committee discloses its functions in the reference form	0.666	0.472	0.000	1.000
Audit_RCA	Audit committee reports on its activities to the board every quarter	0.538	0.499	0.000	1.000
Memb_Comp_Audit	Number of members in the audit committee	2.920	1.522	3.000	3.000
Indep_Comp_Audit	Number of independent members in the audit committee	2.100	1.250	1.000	3.000
Coord_Audit	Audit Committee has a chairperson	0.589	0.492	0.000	1.000
Coord_Audit_Fun	Activities of the chairperson are defined in the bylaws	0.469	0.499	0.000	1.000
Relat_Annual_Audit	Firm publishes annually the report of the audit committee	0.493	0.500	0.000	1.000

Source: Elaborated by the author.

Table 3.1 – Description and Summary Statistics – Corporate Governance Variables (cont.)

	Description	Mean	Std. Dev.	25%	75%
III. Internal Auditing					
Audit_Intern_Report	Department reports activities to the board or to the audit committee	0.458	0.498	0.000	1.000
Audit_Intern_Approv	Department has its duties and responsibilites approved by the board	0.196	0.397	0.000	1.000
Audit_Intern_Struct	Department has sufficient budget and structure according to an assessment	0.042	0.200	0.000	1.000
Audit_Intern_Process	Department examines risk management, control, and governance processes	0.489	0.500	0.000	1.000
IV. Corporate Transparency					
Regim_Intern_CA	Company discloses bylaws of the board	0.681	0.466	0.000	1.000
Regim_Intern_CF	Company discloses bylaws of the fiscal council, if it has one	0.607	0.488	0.000	1.000
Regim_Intern_Com	Company discloses bylaws of the advisory committees	0.415	0.493	0.000	1.000
Pol_Indic	Company discloses its nomination policy	0.391	0.488	0.000	1.000
Pol_Risk	Company discloses its risk management policy	0.638	0.481	0.000	1.000
Pol_RPT	Company discloses its related-party transaction policy	0.634	0.482	0.000	1.000
Pol_ST	Company discloses its securities trading policy	0.642	0.480	0.000	1.000

Source: Elaborated by the author.

In our sample, we find that a large number of bonds were issued by firms operating under service concession arrangements. Under such arrangements, the government or the public sector remain the owner of infrastructure assets, but they let companies develop, operate, and maintain these infrastructure assets. With the adoption of the ICPC-01 normal, Brazilian companies operating in this regime cannot recognize infrastructure assets as their Property, Plant, and Equipment (tangible assets). Hence, the fixed assets of these companies are classified as intangible assets, and companies operating under service concession arrangements have tangibility values close to zero. To address this problem, we compute the asset tangibility as the sum of the book value of tangible assets and the book value of intangible assets divided by the total asset value.

Similarly, we consider bond variables that have an impact on bond yields. We define the bond's age as the difference in years between the settlement date and the issue date. Bond's maturity, on the other hand, is given as the difference in years between the maturity date and the settlement date. We control for the issue size of the bond offering by using the natural logarithm of the amount issued. We further control for additional determinants of the bond offering by taking the initial coupon rate and correcting for the underlying rate (DI or IPCA). Bond liquidity is also considered using the bid-ask spread. However, this metric depends on the bond's remuneration type, and it is difficult to use this metric to compare bonds with different remuneration types. To tackle this issue, we normalize the metric across the remuneration type. We thus divide the bid-ask spread by the fixed part of the coupon rate at issuance; that is, either the spread over the DI rate or the IPCA rate or the percentage of the DI rate. We also consider firms' credit risk using their bond ratings. These ratings are then transformed into an ordinal variable with numerical values, as in Murcial et al. (2014). Last, we include dummy variables that control for the existence of real guarantees and call options.

In Brazil, bonds that are used to finance infrastructure projects, research and development, and/or innovation are exempt from taxation. We expect these bonds to have lower yields and use a variable (Supported) that takes the value of 1 when the bond is exempt from income taxes. We also use two dummy variables to take into consideration the bond's remuneration type: IPCA Spread and DI Spread. These two variables take value of 1 when the remuneration of the bond is given as a spread over the inflation rate of the interbank rate respectively. This choice leaves us with bonds whose remuneration is given as a percentage of the interbank rate as the reference group.

The COVID-19 pandemic has triggered significant liquidity shocks on bond markets (KARGAR et al., 2021). In addition, the pandemic has caused great and lasting disruptions for companies worldwide (NOZAWA; QIU, 2021), and it has changed the way in which these companies operate because of sanitary measures and lockdowns. In Brazil, the first cases and deaths started in early 2020. The COVID-19 pandemic created a structural

shift that can coonfound the analysis and create a bias in the estimation of our regression models. Consequently, we control for this structural break by creating a dummy variable taking values of one during the quarters of 2020 for companies that adopting statutory reforms and zero otherwise.

Table 3.2 – Summary Statistics - Firm and Bond Variables

	Mean	Std. Dev.	25%	75%
Panel A: Firm Variables				
Statutory Reform	0.432	0.496	0.000	1.000
Size	23.993	1.153	23.193	24.467
Leverage	28.378%	12.168%	20.609%	36.306%
Tangibility	58.785%	42.037%	27.805%	79.490%
Return On Assets	1.215%	1.585%	0.461%	1.998%
Market-to-Book	1.370	0.506	1.035	1.542
Sales Growth	14.931%	30.746%	−0.946%	23.072%
Panel B: Bond Variables				
Total Yield	4.083%	2.335%	2.228%	5.552%
Coupon Rate	4.787%	2.854%	1.896%	7.181%
Initial Coupon	5.219%	2.633%	2.690%	7.081%
Amount Outstanding	19.488	0.940	18.859	20.212
Age	2.292	1.770	1.058	2.914
Maturity	4.751	2.531	2.928	6.044
Liquidity	17.410%	28.264%	6.066%	16.522%
Credit Rating	6.915	0.359	7.000	7.000
IPCA Spread	0.558	0.497	0.000	1.000
DI Spread	0.244	0.430	0.000	0.000
DI Percentage	0.197	0.398	0.000	0.000
Supported	0.414	0.493	0.000	1.000
Real Guarantees	0.105	0.306	0.000	0.000
Call Option	0.663	0.473	0.000	1.000
Covid	0.233	0.423	0.000	0.000

Source: Elaborated by the author.

We clean the sample and exclude observations that correspond to firms in financial distress. As such, we filter out observations with credit ratings lower than B, which translates into bond ratings lower than 3. Likewise, we filter out observations with negative book value of equity. We exclude observations with negative values for variables that should be strictly positive, such as bond liquidity or yield-to-maturity. We also exclude observations with negative net debt, since these companies have low leverage levels and an excess of cash holdings and are likely to have reduced agency costs of debt. Lastly, we exclude observations for which data is lacking. The sample is then winsorized at the 1% and 99% levels to control for the existence of outliers.

The final sample consists of an unbalanced panel with 2,389 bond-quarter observa-

tions during the period from the first quarter of 2015 until the last quarter of 2020. The summary statistics for the firm and bond characteristics are shown in Table 3.2. About 43.2% of the observations correspond to bonds issued by companies that have already adopted the statutory reforms after the revision of the Novo Mercado segment, and 23.3% of the observations correspond to quarters in which there was the COVID-19 pandemic. In our sample, the average firm has a total asset value of R\$26.3 billion and a market-to-book ratio equals to 1.37. It is moderately levered, with a leverage ratio of 28.38%, and its tangible assets account for 58.79% of the total assets. The firm's average profitability is equal to 1.22%, as given by the return on assets, and the average growth of the firm's sales is equal to 14.931%.

The average bond trades at a premium since the yield on the secondary market is greater than the coupon rate. It is relatively new (2.3 years old) with a medium maturity (less than 5 years) and great illiquidity, which accounts for a significant fraction of the initial coupon rate. These results are consistent with the findings of Carvalho and Marques (2020). The average bond has a principal value of R\$397.2 million and is AAA-rated on the national scale. As regards the remuneration type, most observations are based on the inflation rate (55.8%). The remaining observations are well divided between remuneration given as a spread over the DI rate and that expressed as a percentage of the DI rate, with a slight preference for the former. 66.3% of the observations correspond to callable bonds, 41.4% are tax exempt, and 10.5% have real guarantees attached to them.

3.3.3 Empirical Methodology

While the revision introduced new governance mechanisms, listed firms had a period of time to contemplate all the required changes in corporate governance. We thus examine the effect of the revision on the different governance mechanisms to understand which of these mechanisms are responsible for the reduction in bond yields.

Companies adopted statutory reforms in a staggered way, with most companies contemplating the changes as early as the second semester of 2018. Empirical literature on difference-in-differences designs acknowledges that traditional regressions with unit and time fixed effects fail to capture meaningful causality when there exists a variation in the treatment timing (CHAISEMARTIN; D'HAULTFOEUILLE, 2020; GOODMAN-BACON, 2021). We address this issue using the interaction-weighted model of Sun and Abraham (2020) and estimate cohort average treatment effects using:

$$y_{i,t} = \alpha_i + \alpha_t + \sum_{e} \sum_{\ell \neq -1} \delta_{e,\ell} \Big(\mathbf{1}\{E_i = e\} \cdot D_{i,t}^{\ell} \Big) + \beta X_{i,t}^{firm} + \gamma X_{i,t}^{bond} + \epsilon_{i,t} \tag{5}$$

where y_{it} denotes the dependent variable for the firm i at time t, α_i and α_t denote the firm and time fixed effects, $\delta_{e,\ell}$ are the average treatment effects ℓ periods from the initial adoption of statutory reforms for the cohort of firms that first adopted the reforms at

time e, E_i denotes the time for firm i to initially adopt the statutory reforms, and $D_{i,t}^{\ell}$ is a dummy variable that takes value of one if the firm i being ℓ periods away from the initial adoption at time period t is treated and zero otherwise. The vectors $X_{i,t}^{firm}$ and $X_{i,t}^{bond}$ correspond to firm and bond characteristics.

In particular, we're interested in the average treatment effect for all cohorts and use the interaction-weighted estimator:

$$v_g = \frac{1}{|g|} \sum_{\ell \in g} \sum_{e} \widehat{\delta}_{e,\ell} P\{E_i = e | E_i \in [-\ell, T - \ell]\} \tag{6}$$

where g is a set of relative periods ℓ and include all relative periods.

3.4 Results

3.4.1 Assessment of Management

We now examine how the adoption of statutory reforms affected corporate governance variables in companies listed in the Novo Mercado segment. We begin by estimating the effects on the assessment of management and estimate the average treatment effect using equations (5) and (6). We excluded three variables that were affected by the adoption of statutory reforms: bond liquidity, return on assets, and sales growth. Furthermore, we find that some variables are highly correlated to each other. We thus only present the relevant and significant variables associated with the assessment of management. Lastly, since panel data are prone to serial correlation, we follow Bertrand, Duflo, and Mullainathan (2004) and cluster the standard errors at the bond level to correct for both heteroskedasticity and serial correlation.

Table 3.3 presents the estimates from the interaction-weighted model when the dependent variables are: (1) $Metod\_Dir$, (2) Abr_Dir, (3) $Aval\_CA$, (4) Abr_CA, and (5) $Metod\_Com$. The results indicate that there was an increase in the assessment of the executive management in companies listed in the Novo Mercado segment, following the adoption of statutory reforms. However, there are also significant negative coefficients associated with the assessment of the board and its advisory committees. In other words, the assessment of the board and its advisory committees didn't improve as much for companies of the Novo Mercado segment as it did for companies listed in other segments. These findings suggest that the latter companies kept up with the new corporate governance practices to remain attractive on the financial markets.

From Table 3.3, we find that the firm's size is positively associated with each of the dependent variables. Still, this result doesn't mean that size deteriorates governance mechanisms related to the assessment of the management. Instead, it means that smaller firms tend to present improved corporate governance practices. Similarly, we find that firms with improved assessment of the board and its advisory committees are less levered

Table 3.3 – The Effects of Statutory Reforms on the Assessment of Management

	(1)	(2)	(3)	(4)	(5)
Average Treatment Effect	0.068*	0.210**	−0.124***	−0.305**	−0.097**
	(0.035)	(0.097)	(0.044)	(0.127)	(0.043)
Bond Age	−0.011	−0.040**	−0.017**	−0.051**	−0.017**
	(0.007)	(0.020)	(0.007)	(0.021)	(0.007)
Bond Maturity	0.003	0.001	0.002	0.002	−0.001
	(0.002)	(0.006)	(0.003)	(0.009)	(0.003)
Credit Rating	0.005	−0.105*	−0.034	−0.113	−0.040
	(0.030)	(0.058)	(0.024)	(0.076)	(0.026)
Size	−0.160***	−0.199**	−0.347***	−0.755***	−0.185***
	(0.043)	(0.090)	(0.069)	(0.141)	(0.040)
Leverage	−0.001	0.002	−0.006***	−0.014***	−0.004***
	(0.001)	(0.002)	(0.001)	(0.004)	(0.001)
Tangibility	0.000	−0.001	0.006***	0.010***	0.004***
	(0.001)	(0.002)	(0.001)	(0.003)	(0.001)
Market-to-Book	−0.015	−0.001	−0.091***	−0.182**	−0.062*
	(0.013)	(0.024)	(0.028)	(0.088)	(0.032)
Covid	0.004	−0.008	0.002	−0.024	−0.009
	(0.005)	(0.020)	(0.013)	(0.029)	(0.012)
Initial Coupon	−0.003	0.003	0.005	0.019	0.010*
	(0.006)	(0.016)	(0.006)	(0.018)	(0.005)
Amount Outstanding	0.006	0.006	−0.006	−0.014	−0.007
	(0.005)	(0.012)	(0.007)	(0.021)	(0.007)
IPCA + Spread	−0.002	−0.045	−0.038	−0.160	−0.065**
	(0.034)	(0.085)	(0.034)	(0.107)	(0.033)
DI + Spread	−0.001	−0.025	0.015	0.017	0.000
	(0.022)	(0.058)	(0.022)	(0.067)	(0.020)
Tax Exempt	0.023	0.111	0.016	0.086	0.021
	(0.032)	(0.083)	(0.023)	(0.073)	(0.023)
Real Guarantees	−0.055	−0.103*	−0.094	−0.232	−0.055
	(0.034)	(0.061)	(0.078)	(0.205)	(0.064)
Call Option	0.004	0.003	−0.011	−0.051	−0.030*
	(0.021)	(0.053)	(0.016)	(0.050)	(0.017)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations	2387	2387	2387	2387	2387
Adj. R^2	0.942	0.930	0.879	0.892	0.916

This table reports results from interaction-weighted models defined in Eq.(5) when the dependent variables are *Metod_Dir*, *Abr_Dir*, and *Aval_CA*, *Abr_CA*, and *Metod_Com*. A definition of the variables, as well as their summary statistics can be found in Section 3.3.2. The independent variable of interest is the *Average Treatment Effect*, and it is found by aggregating cohort average treatment effects through Eq.(6). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

and have higher tangibility values and market-to book ratios. We also find that bond age is negatively related with most corporate governance variables. This result shows that the recent bond issues were made by firms with well developed assessment of their management. Still, we find no effects of the COVID-19 pandemic on the governance mechanisms presented in the table.

In unreported results, we repeated the analyses using time and bond fixed effects to further saturate the models and to examine the robustness of our results. We found that the adoption of statutory reforms led to significant increases in the variables *Metod_Dir* and *Abr_Dir* while also decreasing the variable *Aval_CA*. We also found similar results with regards to bond and firm variables.

3.4.2 Audit Committee

We then examine the impact that the adoption of statutory reforms has on audit committees. For the sake of brevity, we only include regressions with dependent variables for which the treatment effect is significant. Table 3.4 presents the regression estimates when the dependent variables are: (1) *Com_Audit*, (2) *Audit_Est*, (3) *Audit_Est_Regim*, (4) *Audit_RCA*, (5) *Relat_Annual_Audit*, (6) *Memb_Comp_Audit*, and (7) *Indep_Comp_Audit*. A description of these variables can be found in Table 3.1.

The adoption of statutory reforms led to great improvements in audit committee structures for companies listed in the Novo Mercado segment. We observe an increase in the number of companies that possess a statutory audit committee. These committees are more likely to report to the board every trimester, and they are also getting bigger and more independent. We also observe improvements in disclosures related to the audit committee, with increased disclosure of both the bylaws and the annual report. Nonetheless, the COVID-19 pandemic has reduced board sizes, as shown by the negative estimates. Since the absolute values of these coefficients are lower than 1, it means that some companies' boards of directors remained unaffected by the pandemic. This is consistent with the fact that the pandemic has had a varying effect depending on the business sector.

From Table 3.4, we find that firms with well developed audit committee structures are less levered and have higher tangibility values and lower market-to-book ratios. The results further indicate that size is negatively with the *Com_Audit* variable, while being positively associated with most of the remaining variables. As such, smaller companies are more likely to have audit committees, and among these firms, the greater the firm, the more developed its audit committee.

The results further show that the variable *Initial Coupon* is negatively related to the audit committee variables. This result shows that firms with well-developed audit committees tend to have lower financing costs, thus suggesting that the audit committee is valuable to creditors by reducing information asymmetry and the ensuing agency costs

Table 3.4 – The Effects of Statutory Reforms on the Audit Committee

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Average Treatment Effect	0.118**	0.116**	0.148***	0.215***	0.166***	0.434*	0.446**
	(0.056)	(0.056)	(0.057)	(0.047)	(0.059)	(0.221)	(0.184)
Bond Age	0.013**	0.013**	0.011*	0.008	0.011*	0.020	0.034**
	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)	(0.020)	(0.016)
Bond Maturity	0.004**	0.005**	0.002	0.002	0.003	0.011*	0.010
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.006)
Credit Rating	0.075	0.210***	0.214***	0.230***	0.088	0.489**	0.601***
	(0.061)	(0.044)	(0.047)	(0.044)	(0.060)	(0.236)	(0.200)
Size	−0.143**	0.145*	0.082	0.268***	0.085	0.780**	0.334
	(0.056)	(0.078)	(0.090)	(0.072)	(0.096)	(0.304)	(0.247)
Leverage	−0.002	−0.007***	−0.006***	−0.003**	−0.005***	−0.008	−0.005
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)
Tangibility	0.006***	0.006***	0.006***	0.003**	0.008***	0.015**	0.005
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.007)	(0.006)
Market-to-Book	−0.083***	−0.044	−0.088***	−0.002	−0.101***	−0.738***	−0.213**
	(0.028)	(0.036)	(0.033)	(0.029)	(0.034)	(0.129)	(0.090)
Covid	0.008	0.004	−0.003	0.002	−0.007	−0.254***	−0.200***
	(0.011)	(0.011)	(0.010)	(0.009)	(0.014)	(0.049)	(0.058)
Initial Coupon	−0.014***	−0.019***	−0.008	−0.015**	−0.009	−0.039**	−0.055***
	(0.005)	(0.007)	(0.006)	(0.006)	(0.006)	(0.019)	(0.015)
Amount Outstanding	0.007	0.005	0.004	−0.004	0.003	−0.004	0.011
	(0.005)	(0.006)	(0.007)	(0.006)	(0.007)	(0.019)	(0.015)
IPCA + Spread	0.033	0.066*	−0.003	0.041	0.002	0.087	0.215**
	(0.032)	(0.037)	(0.034)	(0.034)	(0.035)	(0.119)	(0.108)
DI + Spread	0.007	0.028	0.007	0.033	0.009	0.041	0.078
	(0.016)	(0.020)	(0.021)	(0.020)	(0.021)	(0.068)	(0.061)
Tax Exempt	0.008	−0.009	0.042*	0.020	0.040*	0.025	−0.027
	(0.021)	(0.022)	(0.022)	(0.023)	(0.022)	(0.078)	(0.070)
Real Guarantees	−0.004	0.172***	0.139***	0.166**	0.111***	−0.071	−0.057
	(0.030)	(0.052)	(0.050)	(0.069)	(0.040)	(0.154)	(0.119)
Call Option	0.019	0.024	0.039***	0.021	0.036**	0.047	0.056
	(0.012)	(0.015)	(0.015)	(0.016)	(0.015)	(0.042)	(0.041)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2387	2387	2387	2387	2387	2387	2387
Adj. R^2	0.867	0.899	0.890	0.915	0.900	0.880	0.870

This table reports results from interaction-weighted models defined in Eq.(5) when the dependent variables are *Com_Audit*, *Audit_Est*, *Audit_Est_Regim*, *Audit_RCA*, *Relat_Annual_Audit*, *Memb_Comp_Audit*, and *Indep_Comp_Audit* respectively. A definition of the dependent variables can be found in Table 3.1. The independent variables are also defined in Section 3.3.2. The independent variable of interest is the *Average Treatment Effect*, and it is found by aggregating cohort average treatment effects through Eq.(6). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

of debt. Consistent with this view, the results also indicate that companies with well developed audit committees benefit from higher credit ratings.

Moreover, regarding bond variables, we notice that companies benefiting from improved audit committee structures tend to have older bonds with greater maturities, with call options and real guarantees, and whose remuneration is linked to the IPCA rate. Nonetheless, there is no association between the amount outstanding of bond issues and corporate governance.

In unreported results, we examined the robustness of the results by repeating the analyses with bond fixed effects. We found that all the audit committee variables remained significant, and they increased for companies listed in the Novo Mercado segment following the adoption of statutory reforms. The significance and estimates of both firm and bond variables also remained similar to the above-mentioned results. Finally, the effect of the COVID-19 pandemic on the composition of audit committees are robust to the inclusion of bond fixed effects.

3.4.3 Internal Auditing

This subsection examines the effects of the adoption of statutory reforms on internal auditing departments. Table 3.5 exhibit the regression estimates when the dependent variables are: (1) $Audit\_Intern\_Report$, (2) $Audit\_Intern\_Approv$, (3) $Audit\_Intern\_Struct$, and (4) $Audit\_Intern\_Process$.

The results show that there was an increase in the number of internal auditing departments whose budget and structure are deemed sufficient and adequate by the board of directors for companies listed in the Novo Mercado segment following the adoption of statutory reforms. In addition, the number of internal auditing departments whose duties and responsibilities are approved by the board of directors didn't increase as much for companies that adopted statutory reforms as it did for companies that were listed in other segments and didn't adopt such reforms.

The results further indicate that size and leverage are negatively related to internal auditing variables, but tangibility is positively related to these variables. There is no evidence that either market-to-book ratios or credit ratings have a positive relationship with any of the internal auditing variables. These findings show that companies with better developed internal auditing departments are smaller and less levered, and they have greater tangibility values.

Table 3.5 provides evidence on the impact of the COVID-19 pandemic on internal auditing departments in Brazilian listed companies. We find that the pandemic has led to slight increases in the number of internal auditing departments that: i) report their activities to the board or the audit committee; and/or ii) examine risk management,

Table 3.5 – The Effects of Statutory Reforms on Internal Auditing

	(1)	(2)	(3)	(4)
Average Treatment Effect	0.008	−0.058***	0.042*	0.023
	(0.038)	(0.015)	(0.022)	(0.037)
Bond Age	−0.001	0.007**	−0.001	−0.001
	(0.007)	(0.004)	(0.000)	(0.005)
Bond Maturity	0.001	0.003***	0.000	0.001
	(0.002)	(0.001)	(0.000)	(0.002)
Credit Rating	0.084	−0.030	−0.000	0.060
	(0.073)	(0.019)	(0.000)	(0.071)
Size	−0.203***	−0.225***	−0.001	−0.119**
	(0.066)	(0.050)	(0.001)	(0.051)
Leverage	−0.004***	−0.006***	−0.000*	−0.003***
	(0.001)	(0.001)	(0.000)	(0.001)
Tangibility	0.006***	0.002**	0.000	0.003**
	(0.001)	(0.001)	(0.000)	(0.001)
Market-to-Book	−0.030	−0.017	0.001*	−0.019
	(0.031)	(0.014)	(0.001)	(0.018)
Covid	0.024***	0.004	0.000*	0.011**
	(0.008)	(0.005)	(0.000)	(0.005)
Initial Coupon	−0.011	−0.010***	0.000	−0.004
	(0.007)	(0.003)	(0.000)	(0.005)
Amount Outstanding	−0.003	0.010***	−0.001	0.003
	(0.007)	(0.003)	(0.000)	(0.004)
IPCA + Spread	0.035	0.063**	0.003	0.026
	(0.041)	(0.026)	(0.003)	(0.025)
DI + Spread	0.038	0.029**	0.000	0.036**
	(0.024)	(0.014)	(0.001)	(0.017)
Tax Exempt	0.013	−0.045***	−0.005	−0.008
	(0.026)	(0.016)	(0.004)	(0.020)
Real Guarantees	−0.052	0.001	0.000	−0.008
	(0.054)	(0.022)	(0.001)	(0.028)
Call Option	−0.037**	−0.006	0.000	−0.033**
	(0.017)	(0.007)	(0.001)	(0.014)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes	Yes	Yes
Observations	2387	2387	2387	2387
Adj. R^2	0.920	0.953	0.982	0.949

This table reports results from interaction-weighted models defined in Eq.(5) when the dependent variables are *Audit_Intern_Report*, *Audit_Intern_Approv*, *Audit_Intern_Struct*, and *Audit_Intern_Process* respectively. A definition of the dependent variables can be found in Table 3.1. The independent variables are also defined in Section 3.3.2. The independent variable of interest is the *Average Treatment Effect*, and it is found by aggregating cohort average treatment effects through Eq.(6). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

control, and governance processes; and/or iii) have their budget and structure deemed adequate and sufficient by the board of directors. It is important to note that the impact of the pandemic varies greatly with business sectors, and changes in corporate governance structures might reflect that impact.

The table also shows the lack of significant relationship between internal auditing variables and time-varying bond variables, except for the variable *Audit_Intern_Approv*. There is evidence, however, that companies with well-governed internal auditing departments are less likely to issue callable bonds and more likely to issue bonds indexed on the interbank rate. Lastly, companies whose internal auditing departments have their activities approved by the board tend to issue bonds that don't benefit from tax exemptions, with reduced initial coupon rate and greater maturities and amount outstanding.

In reported results, we re-estimated the regression models using bond fixed effects to examine the robustness of our results. We found that the effects of the adoption of statutory reforms remained significant. We also found similar results for bond and firm characteristics. However, the effect of the COVID-19 pandemic on the variable *Audit_Intern_Process* disappeared after controlling for bond effects.

3.4.4 Corporate Transparency

Last, we assess the impact that the adoption of statutory reforms had on corporate transparency. All the variables in Table 3.1 that relates to the disclosure of bylaws and policies were included. The results are reported in Table 3.6 for the following dependent variables: (1) *Regim_Intern_CA*, (2) *Regim_Intern_CF*, (3) *Regim_Intern_Com*, (4) *Pol_Indic*, (5) *Pol_ST*, (6) *Pol_RPT*, and (7) *Pol_Risk*.

From Table 3.6, we observe an increase in the disclosure of the bylaws of the fiscal council. We also find that, following the adoption of statutory reforms, companies listed in the Novo Mercado segment didn't increase their disclosure of corporate policies as much as companies listed in other segments did. Yet, after the inclusion of bond fixed effects, we don't find any significant effects for the variables *Regim_Intern_CF* and *Pol_ST*. In addition, since many firms don't have a fiscal council, there's a chance that the treatment effect is biased. To tackle this issue, we repeated the analysis after restricting the sample to firms with fiscal councils and found no significant effects of the variable *Regim_Intern_CF*.

Table 3.6 also shows that companies with better disclosure practices tend to be less levered and to have higher tangibility values. There is mixed evidence, however, regarding the sign of the relationship of either firms' size or market-to-book ratios and corporate transparency variables. The table also provides evidence on the effects of the COVID-19 pandemic on corporate transparency. It has had a negative effect on the disclosure of the bylaws of the fiscal council and a positive effect on the disclosure of both the securities

Table 3.6 – The Effects of Statutory Reforms on Corporate Transparency

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Average Treatment Effect	0.020	0.151*	0.035	−0.093	−0.277***	−0.143*	−0.123*
	(0.086)	(0.089)	(0.068)	(0.059)	(0.053)	(0.084)	(0.067)
Bond Age	−0.006	0.004	0.018***	0.005	0.005	−0.007	0.022***
	(0.008)	(0.008)	(0.005)	(0.009)	(0.007)	(0.008)	(0.006)
Bond Maturity	0.001	0.001	0.006**	0.004	0.007**	−0.004	0.004*
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)
Credit Rating	0.074	0.037	−0.005	0.006	−0.040	0.036	−0.025
	(0.052)	(0.053)	(0.027)	(0.037)	(0.035)	(0.049)	(0.033)
Size	0.150	0.362***	−0.128**	0.143*	−0.330***	0.002	−0.205***
	(0.119)	(0.097)	(0.055)	(0.086)	(0.071)	(0.070)	(0.062)
Leverage	−0.000	−0.000	0.000	−0.004**	−0.010***	−0.001	−0.007***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Tangibility	−0.002	−0.002	0.007***	0.010***	0.001	0.004**	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Market-to-Book	0.216***	0.046	−0.200***	−0.149***	−0.057	0.012	0.184**
	(0.055)	(0.075)	(0.039)	(0.055)	(0.037)	(0.073)	(0.073)
Covid	0.013	−0.099***	−0.015	0.203***	0.177***	0.008	0.031
	(0.019)	(0.033)	(0.010)	(0.019)	(0.029)	(0.020)	(0.020)
Initial Coupon	−0.005	−0.007	−0.006	−0.005	−0.010*	0.010	−0.026***
	(0.008)	(0.009)	(0.005)	(0.008)	(0.006)	(0.007)	(0.007)
Amount Outstanding	−0.008	−0.002	0.005	0.012*	0.009	0.004	0.016***
	(0.007)	(0.008)	(0.006)	(0.007)	(0.007)	(0.008)	(0.006)
IPCA + Spread	0.018	0.048	0.037	−0.005	0.030	−0.021	0.141***
	(0.043)	(0.053)	(0.027)	(0.043)	(0.038)	(0.042)	(0.046)
DI + Spread	0.010	0.016	0.027	−0.007	0.002	−0.013	0.033
	(0.028)	(0.029)	(0.017)	(0.028)	(0.022)	(0.025)	(0.023)
Tax Exempt	0.031	0.034	0.005	0.058*	−0.050*	0.036	−0.064**
	(0.033)	(0.039)	(0.019)	(0.033)	(0.025)	(0.028)	(0.028)
Real Guarantees	0.094**	−0.014	−0.180***	−0.082	−0.018	−0.048	0.027
	(0.040)	(0.081)	(0.061)	(0.065)	(0.070)	(0.075)	(0.034)
Call Option	0.019	0.034	0.037**	0.043**	−0.049***	0.044**	−0.013
	(0.023)	(0.024)	(0.016)	(0.022)	(0.016)	(0.020)	(0.016)
Firm Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2387	2387	2387	2387	2387	2387	2387
Adj. R^2	0.837	0.776	0.890	0.821	0.871	0.834	0.875

This table reports results from interaction-weighted models defined in Eq.(5) when the dependent variables are *Regim_Intern_CA*, *Regim_Intern_CF*, *Regim_Intern_Com*, *Pol_Indic*, *Pol_ST*, *Pol_RPT*, and *Pol_Risk* respectively. A definition of the dependent variables can be found in Table 3.1. The independent variables are also defined in Section 3.3.2. The independent variable of interest is the *Average Treatment Effect*, and it is found by aggregating cohort average treatment effects through Eq.(6). Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

trading and related party transaction policies.

Furthermore, we find that bond age and bond maturity are positively related to corporate transparency, and companies with better transparency practices have issued older bonds with greater maturities. We find no significant relationship between credit ratings and corporate transparency. In addition, there is mixed evidence about the sign and the significance of the relationship between the existence of tax exemptions, real guarantees, or call options; and corporate governance variables related to transparency. Last, companies disclosing their securities trading policies have lower initial coupon rates. This result suggests that creditors value the disclosure of this policy.

In unreported results, we examined the robustness of our regression estimates by re-estimating the regression models using bond fixed effects. We found that the results are robust for bond and firm characteristics, as well as for the effects of the COVID-19 pandemic on corporate transparency.

3.4.5 Relationship Between Corporate Governance Mechanisms and Bond Yields

Now that we've established the effects of the adoption of statutory reforms on corporate governance mechanisms, it is essential to examine the relationship between these governance mechanisms and bond yields. To do so, we estimate fixed effects models where the dependent variable is the total yield to maturity. Similar to the previous regression models, we cluster standard errors at the individual level (bond level) to correct for heteroskedasticity and serial correlation.

The result of these models are presented in Table 3.7. Columns (1) presents the results from the standard fixed effects model with firm, listing segments, and quarters fixed effects when the dependent variable is the total yield to maturity. In column (2), we assessed the robustness of the estimates by including bond fixed effects. These two columns show that the bond yield to maturity is positively related to *Com_Audit* and *Audit_Intern_Approv*, but it is negatively related to the disclosure of the annual audit report in financial statements. In the previous sections, we've demonstrated that the adoption of statutory reforms led to an increase in the variables *Com_Audit* and *Relat_Annual_Audit* and to a decrease in the variable *Audit_Intern_Approv*. As such, the overall effect of the adoption of statutory reforms on bond yields is negative.

While the overall effect on bonds is negative, it is important to note that the effect varies for different corporate governance structures. Since a lot of companies already have a statutory audit committee, it is possible that the estimates are biased for companies that don' have one. To gain a better understanding of the effects of corporate governance mechanisms, we restrict our sample to companies that don't have a statutory audit committee and repeat the analyses in columns (3) and (4). We find similar results for the variables *Relat_Annual_Audit* and *Audit_Intern_Approv*. However, the variable

Table 3.7 – Corporate Governance Mechanisms and Bond Yields

	(1)	(2)	(3)	(4)	(5)	(6)
			Total Yield			
Metod_Dir	1.060	0.185	0.824	0.241	−0.166	0.006
	(0.803)	(0.969)	(1.012)	(1.029)	(1.120)	(1.101)
Abr_Dir	−0.289	0.029	−0.804***	−0.497**	0.177	0.138
	(0.314)	(0.378)	(0.261)	(0.251)	(0.470)	(0.484)
Aval_CA	0.185	0.314	0.024	0.413	0.251	0.162
	(0.196)	(0.204)	(0.288)	(0.260)	(0.279)	(0.288)
Abr_CA	−0.118	−0.149	−0.016	−0.074	−0.318**	−0.261*
	(0.102)	(0.114)	(0.148)	(0.178)	(0.140)	(0.151)
Metod_Com	−0.245	−0.419**	−0.201	−0.554**	0.263	0.081
	(0.188)	(0.208)	(0.276)	(0.261)	(0.351)	(0.330)
Com_Audit	1.556***	1.614***	−0.860*	−1.138***		
	(0.573)	(0.590)	(0.457)	(0.419)		
Audit_Est	−0.402	−0.559			−0.224	−0.619
	(0.462)	(0.504)			(0.644)	(0.539)
Audit_RCA	0.101	0.164	1.766***	1.520***	−0.234	0.071
	(0.340)	(0.405)	(0.476)	(0.431)	(0.603)	(0.505)
Relat_Annual_Audit	−0.914**	−0.992***	−1.179***	−1.203***	−0.801*	−0.909**
	(0.365)	(0.364)	(0.358)	(0.323)	(0.429)	(0.425)
Memb_Comp_Audit	0.007	0.041	0.020	0.075	0.046	0.099
	(0.104)	(0.104)	(0.210)	(0.208)	(0.121)	(0.115)
Indep_Comp_Audit	0.046	−0.015	0.050	0.027	0.087	0.043
	(0.106)	(0.106)	(0.179)	(0.166)	(0.104)	(0.100)
Audit_Intern_Approv	0.782***	0.790***	0.345*	0.609**		
	(0.182)	(0.200)	(0.206)	(0.251)		
Audit_Intern_Struct	0.142	0.302			0.227	0.366
	(0.278)	(0.302)			(0.276)	(0.301)
Pol_ST	−0.025	0.061	−0.140	−0.003	0.004	−0.049
	(0.123)	(0.127)	(0.136)	(0.151)	(0.138)	(0.141)
Pol_RPT	−0.015	−0.011	0.183	0.215	0.037	0.090
	(0.145)	(0.154)	(0.173)	(0.177)	(0.188)	(0.190)
Controls	Same Controls as Table 3.3					
Firm Fixed Effects	Yes	No	Yes	No	Yes	No
Bond Fixed Effects	No	Yes	No	Yes	No	Yes
Quarter Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Listing Segment Fixed Effects	Yes	No	Yes	No	Yes	No
Observations	2389	2389	1336	1336	2020	2020
Adj. R^2	0.868	0.868	0.893	0.899	0.863	0.865

This table reports results from fixed effects models when the dependent variable is *Total Yield*. Columns (1) and (2) use the whole sample, while the remaining columns use restricted samples. In columns (3) and (4), we restrict the sample to companies that don't have a statutory audit committee. Columns (5) and (6) restrict the sample to companies that already have an audit committee. A definition of the corporate governance variables can be found in Table 3.1. Additional bond and firm characteristics are defined in Section 3.3.2. Robust standard errors clustered at the bond level are in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Source: Elaborated by the author.

Com_Audit is now negatively related to bond yields. In addition, there is a negative and positive relationship between bond yields and the assessment of executive managers and the fact that there are quarterly reports from the audit committee respectively. These findings demonstrate that the effect of the revision of the Novo Mercado segment was more important for companies that didn't have a statutory audit committee.

Similarly, since there is a significant number of observations without audit committee, we restrict the sample to companies that have an audit committee and re-estimate the regression models in columns (5) and (6). The variable *Audit_Intern_Approv* was removed from the model because of multicollinearity. The results indicate that bond yields are negatively related with the variables *Abr_CA* and *Relat_Annual_Audit*. The adoption of statutory reforms led to a decrease in the coefficient associated with the variable *Abr_CA*. As such, the overall effect of the revision of the Novo Mercado segment on bond yields was negative for companies that already had an audit committee.

Our findings provide support for the hypothesis H1, and the adoption of evaluation processes has a negative impact on bond yields. Contrary to our beliefs, the models show that improvements in internal auditing departments have a positive impact on bond yields, and hypothesis H3 is rejected. Additionally, corporate transparency didn't contribute to the effects of the revision of the Novo Mercado segment. We find no relationship between corporate transparency and bond yields, thus rejecting hypothesis H4. Lastly, the effects of audit committee structures on bond yields are mixed and depends on the committee characteristics. Hence, we don't have enough evidence to conclude on hypothesis H2. These results show that the overall effect of a combined set of corporate governance practices depends on existing corporate governance structures.

3.5 Conclusion

This paper aims at examining the individual contribution of corporate governance mechanisms, that were introduced with the revision of the Novo Mercado segment, to the overall effect that the revision had on bond yields. To evaluate the effects of the revision on corporate governance practices, we use the staggered adoption of statutory reforms by Brazilian firms listed in the segment and a difference-in-differences design with a variation in treatment timing.

We find that, following the adoption of statutory reforms, companies listed in the Novo Mercado segment made improvements in the assessment of their executive management, in their audit committee structures, and in the structure of their internal auditing departments. However, these companies also didn't improve as much their assessment of boards and advisory committees, their corporate transparency, or their supervision of internal auditing departments as much as other companies did. Additionally, we provide evidence that the COVID-19 pandemic has reduced the number of independent members in

corporate boards, has increased the number of companies disclosing their nomination and securities trading policies, and has increased the number of internal auditing department that report their activity to either the board or the audit committee and/or that examine risk management, control, and governance processes in companies listed in the Novo Mercado segment. Our results are robust to the inclusion of bond fixed effects.

To further understand how these changes have affected corporate bond yields, we estimated fixed effects regressions and added the new corporate governance variables. We find that having an audit committee and having internal auditing departments whose duties and responsibilities are approved by the board greatly increase yields to maturity. On the other hand, disclosing annual audit reports greatly decrease yields to maturity. Moreover, our findings show that there exist interactions between corporate governance mechanisms, and the effect of these mechanisms on bond yields depends on existing corporate governance structures. Companies that didn't have statutory audit committees benefited from the existence of audit committees, the disclosure of annual audit reports, and improvements of the assessment of executive managers. Taken together, these results indicate that the overall effect of the revision of the Novo Mercado segment on bond yields tend to be negative.

Our paper has important implications for decreasing firms' financing costs. Our findings suggest that firms could improve their audit committee structures and their assessments of the management to reduce their bond yields and increase their market value. In particular, firms should put a greater emphasis on the audit committee to increase their credit ratings and to decrease their coupon rate. This paper also offers interesting insights for policy makers: creditors value corporate governance mechanisms that help monitoring managers' actions and reducing the information asymmetry.

3.6 References

ABBOTT, L. J.; DAUGHERTY, B., et al. Internal Audit Quality and Financial Reporting Quality: The Joint Importance of Independence and Competence. **Journal of Accounting Research**, v. 54, n. 1, p. 3–40, 2015.

ABBOTT, L. J.; PARKER, S.; PETERS, G. F. Internal Audit Assistance and External Audit Timeliness. **Auditing: A Journal of Practice & Theory**, v. 34, n. 4, p. 3–20, 2012.

ANDERSON, R. C.; MANSI, S. A.; REEB, D. M. Board Characteristics, Accounting Report Integrity, and The Cost of Debt. **Journal of Accounting and Economics**, v. 37, n. 3, p. 315–342, 2004.

ASHBAUGH-SKAIFE, H.; COLLINS, D. W.; LAFOND, R. The Effects of Corporate Governance on Firms' Credit Ratings. **Journal of Accounting and Economics**, v. 42, n. 1-2, p. 203–243, 2006.

B3. **Regulamento do Novo Mercado**. [S.l.: s.n.], 2017. Available from: <https://www.b3.com.br/data/files/B7/85/E6/99/A5E3861012FFCD76AC094EA8/Regulamento%20do%20Novo%20Mercado%20-%2003.10.2017%20%28Sancoes%20pecuniarias%202019%29.pdf>.

BECKER, B.; IVASHINA, V. Cyclicality of Credit Supply: Firm Level Evidence. **Journal of Monetary Economics**, v. 93, p. 76–93, 2014.

BERTRAND, M.; DUFLO, E.; MULLAINATHAN, S. How Much Should We Trust Differences-in-Differences Estimates? **The Quarterly Journal of Economics**, v. 119, n. 1, p. 249–275, 2004.

BOTOSAN, C. A.; PLUMLEE, M. A. A Re-examination of Disclosure Level and the Expected Cost of Equity Capital. **Journal of Accounting Research**, v. 40, n. 1, p. 21–40, 2002.

BRUYNSEELS, L.; CARDINAELS, E. The Audit Committee: Management Watchdog or Personal Friend of the CEO? **The Accounting Review**, v. 89, n. 1, p. 113–145, 2014.

BUSHMAN, R. M.; PIOTROSKI, J. D.; SMITH, A. J. What Determines Corporate Transparency? **Journal of Accounting Research**, v. 42, n. 2, p. 207–252, 2004.

BUSHMAN, R. M.; SMITH, A. J. Financial Accounting Information and Corporate Governance. **Journal of Accounting and Economics**, v. 32, n. 1–3, p. 207–252, 2001.

CAILLEAU, R.; SOUZA, A. A. **Corporate Governance and Bond Yields: Evidence from Brazil**. Belo Horizonte, 2022.

CARVALHO, A. G.; MARQUES, F. T. The Microstructure of the Brazilian Market for Corporate Bonds. **Revista Brasileira de Gestão de Negócios**, v. 22, p. 482–500, 2020.

ÇELIK, S.; DEMIRTAS, G.; ISAKSSON, M. **Corporate Bond Market Trends, Emerging Risks and Monetary Policy**. Paris, 2020.

CHAISEMARTIN, C. de; D'HAULTFOEUILLE, X. Two-Way Fixed Effects Estimators with Heterogeneous Treatment Effects. **American Economic Review**, v. 110, n. 9, p. 2964–96, 2020.

COHEN, J. R. et al. The Effect of Audit Committee Industry Expertise on Monitoring the Financial Reporting Process. **The Accounting Review**, v. 89, n. 1, p. 243–273, 2014.

CORAM, P.; FERGUSON, C.; MORONEY, R. Internal Audit, Alternative Internal Audit Structures and the Level of Misappropriation of Assets Fraud. **Accounting & Finance**, v. 48, n. 4, p. 543–559, 2008.

DEZOORT, T. et al. Audit Committee Effectiveness: A Synthesis of the Empirical Audit Committee Literature. **Journal of Accounting Litterature**, v. 21, p. 38–75, 2002.

EGE, M. S. Does Internal Audit Function Quality Deter Management Misconduct? **The Accounting Review**, v. 90, n. 2, p. 495–527, 2015.

EISENHARDT, K. M. Agency Theory: An Assessment and Review. **The Academy of Management Review**, v. 14, n. 1, p. 57–74, 1989.

ERTUGRUL, M.; HEDGE, S. Board Compensation Practices and Agency Costs of Debt. **Journal of Corporate Finance**, v. 14, n. 5, p. 512–531, 2008.

GAVISH, B.; KALAY, A. On the Asset Substitution Problem. **Journal of Financial and Quantitative Analysis**, v. 18, n. 1, p. 21–30, 1983.

GILCHRIST, S.; ZAKRAJSEK, E. Credit Spreads and Business Cycle Fluctuations. **American Economic Review**, v. 102, n. 4, p. 1692–1820, 2012.

GILLAN, S. L.; STARKS, L. T. Corporate Governance Proposals and Shareholder Activism: The Role of Institutional Investors. **Journal of Financial Economics**, v. 57, n. 2, p. 275–305, 2000.

GOODMAN-BACON, A. Difference-in-differences with variation in treatment timing. **Journal of Econometrics**, v. 225, n. 2, p. 254–277, 2021.

HERMALIN, B. E.; WEISBACH, M. S. Information Disclosure and Corporate Governance. **The Journal of Finance**, v. 67, n. 1, p. 195–233, 2012.

HUANG, J.-Z.; HUANG, M. How Much of the Corporate-Treasury Yield Spread Is Due to Credit Risk? **The Review of Asset Pricing Studies**, v. 2, n. 2, p. 153–202, 2012.

JENSEN, M. C. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. **The American Economic Review**, v. 76, n. 2, p. 323–329, 1986.

JENSEN, M. C.; MECKLING, W. H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. **Journal of Financial Economics**, v. 3, p. 305–360, 1976.

JOHN, K.; SENBET, L. W. Corporate Governance and Board Effectiveness. **Journal of Banking & Finance**, v. 22, n. 4, p. 371–403, 1998.

KALAY, A. Stockholder-Bondholder Conflict and Dividend Constraints. **Journal of Financial Economics**, v. 10, n. 2, p. 211–233, 1982.

KARGAR, M. et al. Corporate Bond Liquidity during the COVID-19 Crisis. **The Review of Financial Studies**, v. 34, n. 11, p. 5352–5401, 2021.

KAYA, O.; WANG, L. The Role of Bank Lending Tightening on Corporate Bond Issuance in the Eurozone. **The Quarterly Review of Economics and Finance**, v. 60, p. 1–11, 2016.

KESNER, I. F. Directors' Characteristics and Committee Membership: An Investigation of Type, Occupation, Tenure, and Gender. **Academy of Management Journal**, v. 31, n. 1, p. 66–84, 1988.

KLOCK, M. S.; MANSI, S. A.; MAXWELL, W. F. Does Corporate Governance Matter to Bondholders? **Journal of Financial and Quantitative Analysis**, v. 40, n. 4, p. 693–719, 2005.

LELAND, H. E. Agency Costs, Risk Management, and Capital Structure. **The Journal of Finance**, v. 53, n. 4, p. 1213–1243, 1998.

MA, Y. Nonfinancial Firms as Cross-Market Arbitrageurs. **The Journal of Finance**, v. 74, n. 6, p. 3041–3087, 2019.

MISANGYI, V. F.; ACHARYA, A. G. Substitutes or Complements? A Configurational Examination of Corporate Governance Mechanisms. **Academy of Management Journal**, v. 57, n. 6, p. 1681–1705, 2014.

MORELLEC, E. Can Managerial Discretion Explain Observed Leverage Ratios? **The Review of Financial Studies**, v. 17, n. 1, p. 257–294, 2004.

MURCIAL, F. C. d. S. et al. The Determinants of Credit Rating: Brazilian Evidence. **Brazilian Administration Review**, v. 11, n. 2, p. 188–209, 2014.

MURPHY, K. J. Corporate Performance and Managerial Remuneration: An Empirical Analysis. **Journal of Accounting and Economics**, v. 7, n. 1–3, p. 11–42, 1985.

MYERS, S. C. Determinants of Corporate Borrowing. **Journal of Financial Economics**, v. 5, n. 2, p. 147–175, 1977.

NOZAWA, Y.; QIU, Y. Corporate Bond Market Reactions to Quantitative Easing During the COVID-19 Pandemic. **Journal of Banking & Finance**, v. 133, p. 1–56, 2021.

PRAWITT, D. F.; SMITH, J. L.; WOOD, D. A. Internal Audit Quality and Earnings Management. **The Accounting Review**, v. 84, n. 4, p. 1255–1280, 2009.

SMITH, C. W.; WARNER, J. B. On Financial Contracting: An Analysis of Bond Covenants. **Journal of Financial Economics**, v. 7, n. 2, p. 117–161, 1979.

STULZ, R. M. Managerial Discretion and Optimal Financing Policies. **Journal of Financial Economics**, v. 26, n. 1, p. 3–27, 1990.

SUN, L.; ABRAHAM, S. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. **Journal of Econometrics**, v. 225, n. 2, p. 175–199, 2020.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

XIE, B.; DAVIDSON, W. N.; DADALT, P. J. Earnings Management and Corporate Governance: The Role of the Board and the Audit Committee. **Journal of Accounting Litterature**, v. 9, n. 3, p. 295–316, 2003.

4 Strategic Actions and Rollover Risk: Debt Renegotiation as a Governance Mechanism

4.1 Introduction

The possibility to renegotiate debt bears the inherent risk of shareholders engaging into strategic actions. Strategic default happens when the firm chooses to default even when it possesses the resources to meet its debt payment. As such, creditors may prefer to write-off a fraction of borrowers' debt when liquidation is costly, since liquidating the firm may leave them worse off (HART; MOORE, 1998). When creditors have little bargaining power, a large part of bond spreads may be due to the possibility of strategic default risk. Empirical evidence has shown that strategic default leads to an increase in corporate bond spreads (see, for example, ANDERSON; SUNDARESAN, 1996; MELLA-BARRAL; PERRAUDIN, 1997; FAN; SUNDARESAN, 2000). Despite the apparent effects of strategic actions on bond spreads, Davydenko and Strebulaev (2007) found that allowing for debt renegotiation didn't add to the fit of observed spreads and suggested that creditors had large bargaining power.

While empirically testing the effects of strategic default on bond spreads, academic researchers ignored the effects that debt market illiquidity has on credit risk. It is well-known that credit risk and liquidity risk interact with each other, and bond spreads can be decomposed into their credit and liquidity components (HE; MILBRADT, 2014; CHEN et al., 2018). Intuition suggests that while debt renegotiation increases the threat of strategic default, it also increases liquidity on the secondary market by increasing the bond value. This is particularly relevant since the current COVID-19 crisis has triggered large liquidity shocks on bond markets (KARGAR et al., 2021; O'HARA; ZHOU, 2021).

In this paper, we develop a theoretical model to examine the effects of debt renegotiation on firms subject to rollover risk. In particular, this paper examines the extent to which debt renegotiation acts as a governance mechanism reducing the agency costs of debt, as well as the impact of debt renegotiation on bond spreads. We build on the structural credit risk model of He and Xiong (2012). Their framework is appealing as it provides a rollover risk channel through which bond market liquidity interacts with credit risk. In addition, the existence of rollover risk creates an agency conflict between shareholders and bondholders, given that shareholders have to pay for rollover losses to avoid default, while creditors are paid in full.

We extend this framework and introduce debt renegotiation. Following the literature, we consider two formulations for debt renegotiation: debt-equity swap and strategic debt service. In the first formulation, bondholders exchange their claims on the firm for equity, and the firm then becomes an all-equity firm. Shareholders and bondholders bargain over the firm's asset value since tax benefits, bankruptcy costs, and rollover losses don't exist anymore. In the second formulation, both claimants negotiate to reduce the debt service. As long as the debt service is reduced, the firm loses its tax benefits, but future tax benefits can be claimed as soon as contractual debt payments are resumed. Shareholders and bondholders now renegotiate on the firm's market value, which includes future tax benefits and illiquidity costs.

A key result of our paper is that, even in the absence of shareholders' bargaining power, debt renegotiation can increase the equity value due to a decrease in rollover losses. When renegotiating the debt, bondholders receive a greater payoff at default, compared with the payoff associated with liquidating the firm. The new payoff increases the value of their claims, while simultaneously reducing rollover losses. As a result, debt renegotiation increases both the bond and equity values by reducing the agency costs of debt. Moreover, our model shows that, even when bond markets are liquid, debt renegotiation can reduce bond spreads. Shareholders have incentives to default earlier when renegotiating debt, thus increasing the firm's credit risk. The claimants now bargain over a greater value, and the recovery rates of bonds may increase. The effects of this increase are twofold: there is a reduction in credit risk, as bonds become less risky, and there is a reduction in liquidity-driven credit risk, as rollover losses decrease.

This paper has important implications for empirical studies on debt renegotiation. Examining interactions between debt market liquidity and credit risk is essential to examine the effects of debt renegotiation on bond spreads. Such studies should focus on periods of relative illiquidity to capture large changes in bond spreads. This paper also complements the corporate governance literature by highlighting debt renegotiation as a governance mechanism that can reduce agency costs associated with bond financing. Furthermore, this study presents evidence that corporate governance can significantly reduce firms' financing costs. While we focused on the agency conflict originating from the rollover risk, our main results remain valid for different agency conflicts between shareholders and creditors, such as those related to debt overhang (MYERS, 1977) or informational asymmetry (THATCHER, 1985).

The remaining of the paper is organized as follows. Section 1 presents the theoretical framework. Section 2 introduces closed-form solutions under the two formulations of debt renegotiation. Section 3 presents the baseline parameters and numerical results. Section 4 concludes the paper.

4.2 The Model

4.2.1 Asset Value

We begin by building on the generic setting developed by He and Xiong (2012), which allows us to characterize the interactions between credit risk and liquidity risk, and further incorporate debt renegotiation when the firm fails to meet its payments to creditors. Consider any company whose firm's unlevered asset value follows a geometric Brownian motion under the equivalent martingale measure $\mathbb{Q}$:

$$dV_t = (r - \delta)V_t dt + \sigma V_t dZ_t, \tag{7}$$

Where r is the constant risk-free rate, δ is the constant payout rate, V represents the firm's fundamentals, σ is the constant asset volatility, and dZ is the increment of a standard Wiener process.

As in traditional structural models, the firm's fundamentals is the state variable. We treat it as exogenous to focus on the effects of debt renegotiation on bond spreads. We suppose that there exist proportional bankruptcy costs $(1 - \alpha)$ so that if creditors fail to reach private agreements with shareholders, they suffer from such deadweight costs as legal costs and a significant part $(1 - \alpha)$ of the firm's asset value is consumed. In addition, there are no other frictions than liquidity in the equity market. This assumption ensures that interactions between illiquidity on the secondary bond market and debt renegotiation are isolated.

4.2.2 Stationary Debt Structure

We also adopt a stationary debt structure, in which the default boundary V_B is constant and endogenously defined. Consider that the firm continuously sells bonds whose aggregate values of principal and annual coupon payment are respectively P and C. Each bond has the same maturity T, principal value $p = \frac{P}{T}$, coupon rate $c = \frac{C}{T}$, and seniority. They are redeemed at par and rolled over upon maturity. The number of bonds equals T such that a fraction $\frac{1}{T}dt$ of the bonds matures between time t and time $t + dt$. As long as the firm meets its debt service payments, the aggregate value of outstanding bonds P remains constant and outstanding bonds are uniformly spread over the interval $[t, t + T]$. The value of one unit of a bond is a function of the firm's fundamentals V and time-to-maturity τ, and it is denoted by $B(V, \tau)$. When bonds are rolled over, market prices of newly issued bonds might be higher or lower than principal values of maturing bonds. Shareholders are the residual claimants of rollover gains or losses: $B(V, \tau) - p$. We suppose that gains are immediately distributed to shareholders and losses are borne by issuing additional equity at the market price.

Leland and Toft (1996) notice that, in this setting, the firm will generally not declare bankruptcy whenever its cash flows available for payout are insufficient to meet

the required net debt service payments. Instead, bankruptcy will generally occur when net debt service requirements exceed available cash flows. The firm survives to this point by raising funds from existing shareholders or by issuing additional equity. While this setting is appealing for our analysis, it is possible to consider alternative settings in which the firm would sell its assets to compensate for the rollover losses. Even though bond covenants generally restrain asset sales to protect bondholders, such covenants allow firms to sell their assets if the proceeds are given to bondholders.

4.2.3 Secondary Bond Market

Similar to He and Xiong (2012), we assume the liquidity on the secondary market to be constant and exogenous. In addition, each bond is subject to an idiosyncratic liquidity shock that follows a Poisson process with rate ξ. This shock force bond investors to exit their position by selling their bond holdings at a proportional cost k that represents market imperfections. It is easy to think of this idiosyncratic shock as a macroeconomic shock affecting the bond market. For example, the COVID pandemic has led to massive sell-offs in bond markets.

When liquidity shocks hit the debt market, the firm is impacted twice. First, the firm has to pay an increased liquidity premium. Since bond investors anticipate the fractional cost k at which they will exit their position on the secondary market, they require the bond to be issued at a discount. Second, given that shareholders bear the rollover losses, they become more inclined to let the firm go bankrupt even when the deterioration is due to the liquidity shock intensity (ξ) rather than firms' bond trading costs (k). As a result, there is an increase in the default boundary V_B, which in turn leads to an increase in the default premium of bond spreads.

4.2.4 Debt Renegotiation

Lastly, we follow the literature and assume that debt renegotiation can happen in one of two ways: debt-equity swap (see, for example, FAN; SUNDARESAN, 2000; ERICSSON; RENAULT, 2006) or strategic debt service (see ANDERSON; SUNDARESAN, 1996; MELLA-BARRAL; PERRAUDIN, 1997). In the case of debt-equity swap, creditors exchange their old debt claims for equity and sell it at the market value. The firm then becomes an all-equity firm. In the case of strategic debt service, creditors and borrowers renegotiate the debt service payments, with the understanding that borrowers lose tax benefits when they don't serve the debt contract as promised. In this case, equity holders can under-perform on their debt servicing without triggering liquidation. Because the firm's value is deteriorated by illiquidity costs, creditors and debtors bargain over the firm's market value. We assume that debt renegotiation is costless. Otherwise, there would exist a trade-off for creditors between both liquidation and illiquidity costs, in the absence

of renegotiation, and renegotiation costs associated with restructuring the debt. Moreover, since debt dispersion is associated with higher renegotiation frictions, stationary debt structure ensures that no such frictions appear in our model.

Anderson and Sundaresan (1996) show that shareholders of distressed firms can renegotiate the debt to avoid inefficient and costly liquidation. This behavior encourages early default and increases credit spreads on corporate debt. Consequently, it might be in the interest of bondholders to forgive part of the debt service payments if it can avoid wasteful liquidations. Furthermore, by introducing the possibility of renegotiating the debt contract, the default can occur at positive equity value. This contrasts with the Leland's model (1994), in which the default occurs when the equity value reaches zero because issuing new equity is costless.

4.3 Valuation and Endogenous Default

4.3.1 Partial Differential Equations

In this section, we apply our model under two reorganization schemes: debt-equity swap and strategic debt service. While the two cases share standard partial differential equations for both bond and equity valuations, they imply different boundary conditions. We first derive the partial differential equations referring to bond and equity valuations. To do so, we assume that the default boundary V_B is given. In Sections 4.3.2 and 4.3.3, we present the boundary conditions associated with the two formulations of debt renegotiation and the resulting expressions of the bankruptcy boundaries.

Proposition 4.3.1.1. *The standard partial differential equation for the value $B(V_t, \tau)$ of one unit of a bond is*

$$(r + \xi k)B(V_t, \tau) = c - \frac{\partial B(V_t, \tau)}{\partial \tau} + (r - \delta)V_t \frac{\partial B(V_t, \tau)}{\partial V_t} + \frac{1}{2}\sigma^2 V_t^2 \frac{\partial^2 B(V_t, \tau)}{\partial V_t^2}. \tag{8}$$

Proof. The equation is obtained using a replicating strategy (hedging portfolio) under no-arbitrage conditions.

The left-hand side $(r + \xi k)B(V_t, \tau)$ represents the required return for holding bonds subject to liquidity shocks with probability ξdt. The right-hand side represents the expected change in the bond value. The first term represents the payment coupon to bondholders. The second term covers the effects of a change in time-to-maturity τ on bond value. The last two terms cover expected value changes arising from changes in the firm's asset value V_t.

It follows from the stationary debt structure that the firm's total debt value $D(V)$ at any time t is given by

$$D(V_t) = \int_t^{t+T} B(V_t, u)du. \tag{9}$$

Similarly, we can derive the partial differential equation for the equity valuation, which gives us the following proposition:

Proposition 4.3.1.2. *The standard partial differential equation for the equity value $E(V_t)$ is given as follows*

$$rE(V_t) = \delta V_t - (1-\pi)C + B(V_t, T) - p + (r-\delta)V_t\frac{\partial E(V_t)}{\partial V_t} + \frac{1}{2}\sigma^2 V_t^2\frac{\partial^2 E(V_t)}{\partial V_t^2}. \tag{10}$$

Proof. The equation is obtained using a replicating strategy (hedging portfolio) under no-arbitrage conditions.

The left-hand side in Equation (10) represents the required return (in dollars) to hold shares of the firm. Right-hand side terms represent the expected value change in equity. The first term represents the net payment to equity-holders. In this model, the net cash flow NC_t to equity-holders over any time interval $[t, t+dt]$ is equal to $NC_t = [\delta V_t - (1-\pi)C + B(V_t, T) - p]\,dt$. The second and third terms represent expected value changes due to changes in the firm's asset value V_t.

4.3.2 Debt-Equity Swap

In this subsection, we define the sharing rule at the reorganization boundary in the debt-equity swap case. When performing the swap, the firm becomes an all-equity firm, and there are no tax benefits or bankruptcy costs associated with debt anymore. Additionally, the firm doesn't issue additional bonds to replace maturing bonds, and there are no rollover losses. As such, the firm value is now equal to its asset value, and both shareholders and creditors bargain over the firm's asset value. The optimal sharing rule between claimants at the new default boundary $\widehat{V_B}$ is given by:

$$E(\widehat{V_B}) = \theta\widehat{V_B}, \text{ and } B(\widehat{V_B}) = (1-\theta)\widehat{V_B}. \tag{11}$$

Where θ represents the sharing rule for the firm's asset value at the trigger point $\widehat{V_B}$.

We assume that the sharing rule is exogenous and constant. Since there are no fixed bankruptcy costs in our model, the parameter θ also represents equity holders' bargaining power. Note that shareholders must provide bondholders with a sufficient value to dissuade them from liquidating the firm. If the firm goes bankrupt, bondholders share the firm's liquidation value αV_B. Similarly, equity holders would only renegotiate if the bargaining value is positive. As such, the variable θ must lie in the interval $]0, (1-\alpha)\frac{V_B}{\widehat{V_B}}[$.

As in Leland and Toft (1996), we value the debt by decomposing the different possible debt payoffs. Let $f(V_t, s)$ and $F(V_t, s)$ denote respectively the density and the cumulative distribution functions of the first passage time s to $\widehat{V_B}$ from V. The bond value can be decomposed into three components as follows

$$B(V_t,\tau) = c\int_0^\tau e^{-(r+\xi k)s}[1-F(V_t,s)]ds + e^{-(r+\xi k)\tau}p[1-F(V_t,s)] + \frac{(1-\theta)\widehat{V_B}}{\tau}\int_0^\tau e^{-(r+\xi k)s}f(V_t,s)ds.$$

The first integral relates to coupon payments as long as the firm remains solvent, the second term relates to the principal payment if the firm remains solvent for the entire period, and the third term relates to debt payments when the company goes bankrupt. This decomposition allows us to determine the following proposition:

Proposition 4.3.2.1. *The bond value in the debt-equity swap case is given by*

$$B(V_t,\tau) = \frac{c}{r+\xi k} + e^{-(r+\xi k)\tau}\left[p - \frac{c}{r+\xi k}\right](1-F(V_t,\tau)) + \left[\frac{(1-\theta)\widehat{V_B}}{T} - \frac{c}{r+\xi k}\right]G(V_t,\tau), \tag{12}$$

Where

$$F(V_t,\tau) = N\left(\frac{-v_t - \left((r-\delta)-\frac{\sigma^2}{2}\right)\tau}{\sigma\sqrt{\tau}}\right) + e^{v_t\left(1-2\frac{r-\delta}{\sigma^2}\right)}N\left(\frac{-v_t + \left((r-\delta)-\frac{\sigma^2}{2}\right)\tau}{\sigma\sqrt{\tau}}\right),$$

$$G(V_t,\tau) = e^{v_t(-a+\hat{z})}N\left(\frac{-v_t - \hat{z}\sigma^2\tau}{\sigma\sqrt{\tau}}\right) + e^{v_t(-a-\hat{z})}N\left(\frac{-v_t + \hat{z}\sigma^2\tau}{\sigma\sqrt{\tau}}\right),$$

$$v_t = ln\left(\frac{V_t}{\widehat{V_B}}\right),\ a = \frac{r-\delta-\frac{\sigma^2}{2}}{\sigma^2},\ \hat{z} = \frac{\sqrt{a^2\sigma^4 + 2(r+\xi k)\sigma^2}}{\sigma^2}.$$

Proof. Once the decomposition is done, the solution is obtained by using integration by parts.

Traditionally, equity value is derived from the difference between total firm value and debt value. Nonetheless, this method does not fit the model for two reasons. First, rollover losses are financed by issuing additional equity that dilutes existing equity value, providing a channel through which rollover losses affect the equity value. Moreover, liquidity shocks exacerbate trading costs and decrease the total firm value. An essential attribute of He and Xiong's model is that the equity value is jointly assessed by both the firm's fundamentals and future rollover losses/gains. Using Laplace transforms, it is possible to solve Eq. (4). We then define our next proposition as:

Proposition 4.3.2.2. *The equity value in the debt-equity swap case is*

$$
\begin{aligned}
E(V_t) = V_t &- \frac{\widehat{V_B}}{z\sigma^2} e^{-\gamma v}\left(\frac{\delta}{\gamma+1} + \left(r-\delta-\frac{1}{2}\sigma^2\right)\theta\right) \\
&- \frac{(1-\pi)C + (1-e^{-(r+\xi k)T})\left(p - \frac{c}{r+\xi k}\right)}{z\sigma^2}\left[\frac{1}{\eta} + \frac{(1-e^{-\gamma v})}{\gamma}\right] \\
&+ \frac{1}{z\sigma^2}\left[e^{-(r+\xi k)T}\left(p-\frac{c}{r+\xi k}\right)A(a) - \left(\frac{(1-\theta)\widehat{V_B}}{T} - \frac{c}{r+\xi k}\right)A(\hat{z})\right] \\
&+ \frac{\theta}{2z} e^{-\gamma v}(\gamma \widehat{V_B} - 1),
\end{aligned}
\tag{13}
$$

With

$$
A(x) = \frac{1}{z-x}\left(K(a,x,\gamma) + k(a,-x,-\eta)\right) + \frac{1}{z+x}\left(K(a,-x,\gamma) + k(a,x,-\eta)\right),
$$

$$
\begin{aligned}
K(a,x,\gamma) = e^{-\gamma}&\left[N(x\sigma\sqrt{T}) - e^{\frac{1}{2}\left((\gamma-a)^2+x^2\right)\sigma^2 T} N\left((\gamma-a)\sigma\sqrt{T}\right)\right] \\
&+ e^{-\gamma} e^{\frac{1}{2}\left((\gamma-a)^2+x^2\right)\sigma^2 T} N\left(\frac{-v + (\gamma-a)\sigma^2 T}{\sigma\sqrt{T}}\right) \\
&- e^{-(a+x)v} N\left(\frac{-v + x\sigma^2 T}{\sigma\sqrt{T}}\right),
\end{aligned}
$$

$$
\begin{aligned}
k(a,x,-\eta) = e^{\frac{1}{2}[(-\eta-a)^2 - x^2]\sigma^2 T} e^{\eta v} N&\left(\frac{-v + (-\eta-a)\sigma^2 T}{\sigma\sqrt{T}}\right) \\
&- e^{-(a+x)v} N\left(\frac{-v + x\sigma^2 T}{\sigma\sqrt{T}}\right).
\end{aligned}
$$

Proof. The solution is obtained using Laplace Transform Methods (see HE; XIONG, 2012) with the boundary conditions defined in (11).

Lastly, we derive the endogenous default boundary $\widehat{V_B}$ using the smooth-pasting condition: $E'\left(\widehat{V_B}\right) = 0$. The result of the bankruptcy boundary is resumed in the following proposition.

Proposition 4.3.2.3. *The ensuing bankruptcy boundary is derived as*

$$
\widehat{V_B} = \frac{\frac{(1-\pi)C + \left(1-e^{-(r+\xi k)T}\right)\left(p-\frac{c}{r+\xi k}\right)}{\eta} + \frac{1}{2}\sigma^2\theta + \left[\left(p-\frac{c}{r+\xi k}\right)\left[b(-a)+b(a)\right] + \frac{c}{r+\xi k}\left[B(-\hat{z})+B(\hat{z})\right]\right]}{\frac{\delta}{\eta-1} - \theta\left(r-\delta-\frac{1}{2}\sigma^2(1-\eta)\right) + \frac{(1-\theta)}{T}\left[B(-\hat{z})+B(\hat{z})\right]},
\tag{14}
$$

With

$$
b(x) = \frac{1}{z+x} e^{-(r+\xi k)T}\left[N\left(x\sigma\sqrt{T}\right) - e^{rT} N\left(-z\sigma\sqrt{T}\right)\right],
$$

$$
B(x) = \frac{1}{z+x}\left[N\left(x\sigma\sqrt{T}\right) - e^{\frac{1}{2}[z^2-x^2]\sigma^2 T} N\left(-z\sigma\sqrt{T}\right)\right],
$$

$$
a = \frac{r-\delta-\frac{\sigma^2}{2}}{\sigma^2},\ z = \frac{\sqrt{a^2\sigma^4 + 2r\sigma^2}}{\sigma^2},\ \eta = z-a,\ \hat{z} = \frac{\sqrt{a^2\sigma^4 + 2(r+\xi k)\sigma^2}}{\sigma^2}.
$$

Proof. See He and Xiong (2012) for the proof without debt renegotiation.

4.3.3 Strategic Debt Service

In this subsection, we now consider the second option for reorganizing the firm. Equity holders and creditors are now negotiating to reduce the debt service (coupon payment) while the firm keeps operating. Such a setting allows the firm to benefit from future tax benefits while temporarily losing the tax shield. Additionally, since the firm continues to replace maturing bonds, it remains subject to debt market illiquidity. As such, the claimants are now bargaining over the market value of the firm, which is given as the asset value plus the value of potential tax benefits minus the value of illiquidity costs. Notice that, since debt renegotiation leads to a successful bargain, there are no bankruptcy costs. We first determine the firm's levered value $v(V_t)$. The result is summarized in the next lemma.

Lemma 1. *For a given renegotiation threshold $\overline{V_B}$, the total value of the firm when the asset value falls below the renegotiation threshold is*

$$v(V_t) = V_t + \frac{\gamma \frac{\pi C}{r+\xi k}}{\eta + \gamma} \left(\frac{V_t}{\overline{V_B}} \right)^{\eta} - \kappa, \quad \forall V_t \leq \overline{V_B}. \tag{15}$$

Where κ represent illiquidity costs associated with rolling over the debt, $\eta = z - a$, and $\gamma = z + a$.

Proof. The demonstration for a firm with a liquid secondary market can be found in Fan and Sundaresan (2000).

From Lemma 1, the optimal sharing rule between shareholders and creditors at the new trigger point $\overline{V_B}$ is

$$E(\overline{V_B}) = \tilde{\theta} \left(\overline{V_B} + \frac{\gamma \frac{\pi C}{r+\xi k}}{\eta + \gamma} - \kappa \right), \text{ and } B(\overline{V_B}) = (1 - \tilde{\theta}) \left(\overline{V_B} + \frac{\gamma \frac{\pi C}{r+\xi k}}{\eta + \gamma} - \kappa \right). \tag{16}$$

Where $\tilde{\theta}$ represents the sharing rule at the new trigger point $\overline{V_B}$.

As in the debt-equity swap case, we can value the bond by decomposing the bond cash flows using the new boundary condition at the bankruptcy boundary $\overline{V_B}$. The bond value is given in the following proposition.

Proposition 4.3.3.1. *The bond value in the strategic debt service case is*

$$\begin{aligned} B(V_t, \tau) = {} & \frac{c}{r + \xi k} + e^{-(r+\xi k)\tau} \left[p - \frac{c}{r + \xi k} \right] (1 - F(V_t, \tau)) \\ & + \left[\frac{(1 - \tilde{\theta}) \left(\overline{V_B} + \gamma \frac{\pi C}{(\eta+\gamma)(r+\xi k)} - \kappa \right)}{T} - \frac{c}{r + \xi k} \right] G(V_t, \tau). \end{aligned} \tag{17}$$

Where the functions $F(V_t, \tau)$ and $G(V_t, \tau)$ and parameters v_t, a, and $\hat{z}$ are given in Proposition 4.3.2.1.

Proof. The proof is similar to Proposition 4.3.2.1.

The equity valuation is more complex as we have to account for the reduction in coupon payments. Using the new debt service, we can rewrite the partial differential equation when the asset value falls below the renegotiation threshold as follows:

$$\forall V_t \leq \overline{V_B}, \quad rE(V_t) = \delta V_t - S(V_t) + B(V_t, T) - p + (r - \delta)V_t \frac{\partial E(V_t)}{\partial V_t} + \frac{1}{2}\sigma^2 V_t^2 \frac{\partial^2 E(V_t)}{\partial V_t^2}.$$

Where $S(V_t)$ represents the strategic debt service.

Using the boundary condition on the equity value (10), we can estimate the new debt service amount as:

$$S(V_t) = \delta V_t(1 - \tilde{\theta}) + B(V_t, T) - p - r\tilde{\theta}\left(\frac{\gamma \frac{\pi C}{r + \xi k}}{\eta + \gamma} - \kappa\right). \tag{18}$$

In this scenario, equity holders pay a proportion of the firm's cash flows adjusted for rollover gains or losses. Bondholders suffer fixed opportunity costs associated with the future tax benefits that equity holders gain when the firm value goes above the renegotiation boundary. In addition, bondholders also benefit from gains associated with the part of illiquidity costs that is paid by equity holders.

As in the debt-equity swap case, one can obtain the equity valuation using the Laplace transformation on the partial differential equation (4) and boundary conditions (16). The next proposition summarizes the result.

Proposition 4.3.3.2. *The equity value in the strategic debt service case is*

$$\begin{aligned}
E(V_t) = V_t &- \frac{\overline{V_B}}{z\sigma^2} e^{-\gamma v}\left(\frac{\delta}{\gamma + 1} + \left(r - \delta - \frac{1}{2}\sigma^2\right)\tilde{\theta}\right) \\
&- \frac{e^{-\gamma v}}{z\sigma^2}\left(r - \delta - \frac{1}{2}\sigma^2\right)\tilde{\theta}\left(\gamma \frac{\pi C}{(\eta + \gamma)(r + \xi k)} - \kappa\right) \\
&- \frac{(1 - \pi)C + (1 - e^{-(r+\xi k)T})\left(p - \frac{c}{r+\xi k}\right)}{z\sigma^2}\left[\frac{1}{\eta} + \frac{(1 - e^{-\gamma v})}{\gamma}\right] \\
&+ \frac{1}{z\sigma^2}\left[e^{-(r+\xi k)T}\left(p - \frac{c}{r + \xi k}\right)A(a) - \left(\frac{(1 - \tilde{\theta})\left(\overline{V_B} + \gamma \frac{\pi C}{(\eta+\gamma)(r+\xi k)} - \kappa\right)}{T} - \frac{c}{r + \xi k}\right)A(\hat{z})\right] \\
&+ \frac{\tilde{\theta}}{2z} e^{-\gamma v}\left(\gamma\left(\overline{V_B} + \gamma \frac{\pi C}{(\eta + \gamma)(r + \xi k)} - \kappa\right) - 1\right).
\end{aligned} \tag{19}$$

Where the function $A(x)$ and its components are given in Proposition 4.3.2.2.

Proof. Using Laplace Transform Methods (see HE; XIONG, 2012) and passing new boundary conditions defined in (16) yields the equity value.

Finally, the renegotiation threshold is found by using the smooth-pasting condition $E'(\overline{V_B}) = 0$. The result is shown in the proposition below.

Proposition 4.3.3.3. *The ensuing bankruptcy boundary can be derived as*

$$\begin{aligned}\overline{V_B} = & \frac{\frac{(1-\pi)C+\left(1-e^{-(r+\xi k)T}\right)\left(p-\frac{c}{r+\xi k}\right)}{\eta}}{\frac{\delta}{\eta-1}-\tilde{\theta}\left(r-\delta-\frac{1}{2}\sigma^2(1-\eta)\right)+\frac{(1-\tilde{\theta})}{T}[B(-\hat{z})+B(\hat{z})]} \\ & + \frac{\left(r-\delta-\frac{1}{2}\sigma^2\right)\tilde{\theta}\left(\gamma\frac{\pi C}{(\eta+\gamma)(r+\xi k)}-\kappa\right)+\frac{1}{2}\sigma^2\tilde{\theta}\left(1+\eta\left(\gamma\frac{\pi C}{(\eta+\gamma)(r+\xi k)}-\kappa\right)\right)}{\frac{\delta}{\eta-1}-\tilde{\theta}\left(r-\delta-\frac{1}{2}\sigma^2(1-\eta)\right)+\frac{(1-\tilde{\theta})}{T}[B(-\hat{z})+B(\hat{z})]} \\ & + \frac{\left[\left(p-\frac{c}{r+\xi k}\right)[b(-a)+b(a)]+\left(\frac{c}{r+\xi k}-\frac{(1-\tilde{\theta})}{T}\left(\gamma\frac{\pi C}{(\eta+\gamma)(r+\xi k)}-\kappa\right)\right)[B(-\hat{z})+B(\hat{z})]\right]}{\frac{\delta}{\eta-1}-\tilde{\theta}\left(r-\delta-\frac{1}{2}\sigma^2(1-\eta)\right)+\frac{(1-\tilde{\theta})}{T}[B(-\hat{z})+B(\hat{z})]}.\end{aligned} \tag{20}$$

Where the functions $B(x)$ and $b(x)$ are given in Proposition 4.3.2.3. Other parameters can be also found in the previous propositions.

Proof. See He and Xiong (2012) for the proof without debt renegotiation.

4.4 Numerical Results

4.4.1 Baseline Parameters

In this section, we examine the impact of debt renegotiation on the firm subject to rollover risk. To this end, we focus on an increase in liquidity risk through the liquidity premium ξk. Similar to He and Xiong (2012), this increase is caused by a permanent increase in the liquidity shock intensity ξ. Table 4.1 exhibits the parameters that are used in our analysis. The parameters are chosen so as to be consistent with the literature on structural credit risk models. The model is calibrated to fit American BB-rated bonds (i.e., high yield bonds). As in Ericsson and Renault (2006), we choose a continuously compounded risk-free rate of $r = 5\%$, which is close to the average of Treasury rates during the period 1990-2010. The average payout ratio for S&P 500 firms over the period 1987-2010 is close to 41%. Given that, in the absence of dividends, the log value of unlevered firms has a risk-neutral drift $r = 5\%$, we set the payout rate to $\delta = 2\%$, which represents roughly 41% of the drift r. Zhang, Zhou, and Zhu (2009) show that the average annual asset volatility of BB-rated firms is equal to 23%; hence, we set the annual asset volatility to 23%. Corporate tax rate requires some additional calculations. Following He and Xiong (2012) and considering a tax rate of bond income of 35%, a marginal corporate tax rate of

15%, and an effective bond income tax rate of 25% given tax exemptions, the debt tax benefit π can be computed as:

$$1 - \frac{(1 - 0.035)(1 - 0.15)}{(1 - 0.25)} = 0.265 \approx 27\%.$$

Huang and Huang (2012) calibrated their model to fit historical default probabilities of senior unsecured bonds for S&P 500 companies. They used unsecured bonds recovery rates reported by Moody's. We use a recovery rate of 62.2% that corresponds to the average recovery rate of senior unsecured bonds over the period 1987-2010. The yield spread is obtained from Rossi (2014). Using both TRACE (bond transaction data originating from the National Association of Securities Dealers (NASD)) and FISD data (Fixed Investment Securities Database), Rossi (2014) sums up senior unsecured corporate bonds data across the period 2004-2011. He shows that the average end-of-month bond spread for BB-rated bonds is 328 basis points (bps) when the bond maturity ranges from 0 to 4 years. He and Xiong (2012) shows that short-term debt amplifies rollover risk. We set the maturity T to be 1 year to emphasize the effects of debt renegotiation on bond spreads. Given that the model holds for any firm's unlevered value of assets V_0, we normalized it to $V_0 = 100$ for ease of analysis. Consistent with estimates of Bao, Pan, and Wang (2011), bond transaction costs k are equal to 1% for BB-rated firms.

Table 4.1 – Model Parameters

	Symbol	Value	
1. Parameters			
Firm's Fundamentals	V_0	100	
Risk-free Rate	r	0.05	
Asset Volatility	σ	0.23	
Payout Rate	δ	0.02	
Corporate Tax Rate	π	0.27	
Recovery Rate	α	0.622	
Transaction Costs	k	0.01	
Liquidity Shock Intensity	ξ	1	
Debt Maturity	T	1	
Shareholders' Bargaining Power	θ	0.3	
2. Implied Variables			
		Debt-Equity Swap	Strategic Debt Service
Annual Coupon	C	5.34	6.35
Aggregate Principal	P	64.46	76.69

Source: Elaborated by the author.

As He and Xiong based their model on Leland and Toft's and extended it to account for exogenous secondary bond market liquidity, it is intuitive to think of Leland and Toft's

model as a benchmark for He and Xiong's model when ξ goes to zero. Then, setting a given degree of secondary market illiquidity allows us to directly assess the impact of both debt market illiquidity and rollover risk. That's why we choose both annual coupon and aggregate principal so that the bond is issued at par ($B(V_0, T) = p$) and has a bond spread of 328 bps ($y - r = 0.0328$) when ξ tends to zero. This is especially important to decompose bond spreads and assess the impact of strategic renegotiation on bond spreads. The bond spread represents the difference between the bond yield and the risk-free rate. The bond yield is computed as the equivalent return on a buy-and-hold strategy for which default doesn't occur. Given the bond value $B(V_t, T)$, the bond yield y is computed by solving the following equation:

$$B(V_t, T) = \frac{c}{y}\left(1 - e^{-yT}\right) + pe^{-yT} \tag{21}$$

Using these two conditions, we find the values of annual coupon payment to be 5.34 and 6.35, respectively, for debt-equity swap and strategic debt service. As regards the aggregate principal, the respective values for each reorganization scheme are given by 64.46 and 76.69. We use the same method to calibrate both Leland and Toft's and He and Xiong's models. All parameters are identical except for coupon rate and bond principal. We recalibrate both models for the needs of our analysis and find $\overline{C} = 5.15$ and $\overline{P} = 62.16$ for the values of the annual coupon payment and aggregate principal respectively. Note that in a perfectly liquid market, both models share the same calibration parameters.

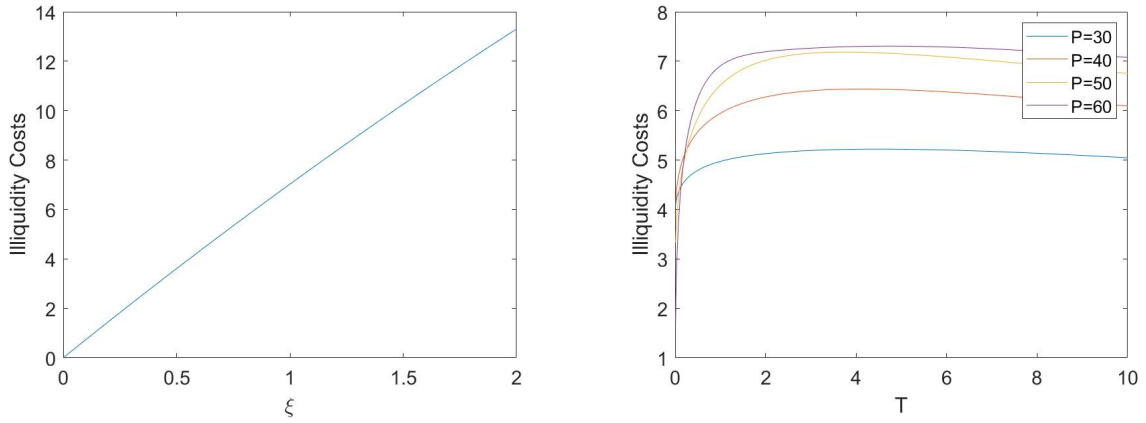
4.4.2 Rollover Risk and Illiquidity Costs

In the presence of rollover risk, existing illiquidity costs deteriorate the firm's market value. Since Leland and Toft's model represents the limit of He and Xiong's when the secondary market is perfectly liquid ($\xi = 0$), we compute illiquidity costs as the difference between the firm's market value derived by Leland and Toft (1996) and the one derived by He and Xiong (2012), when both models are calibrated to issue a bond at par ($B(V_0, T) = p$) with a bond spread of 328 bps in a liquid secondary market ($\xi \to 0$). Such an approach allows us to further decompose bond spreads between credit and liquidity components.

Figure 4.1 plots the value of illiquidity costs as a function of three parameters: liquidity shock intensity ξ, debt maturity T, and aggregate principal P. The first panel focuses on the impact of liquidity shock intensity. Naturally, illiquidity costs tend to zero in a perfectly liquid market, showing a perfect convergence of He and Xiong's model to Leland and Toft's. It is important to note that illiquidity costs are linear and increasing in ξ in our model. We recall that under a Poisson process with rate ξ, the probability of observing a liquidity shock between t and $t + dt$ is equal to ξdt. As long as the liquidity shock intensity ξ is positive, even when close to zero, there exists a liquidity risk and thus

a rollover risk. Therefore, increasing liquidity shock intensity translates into increasing rollover risk and illiquidity costs.

Figure 4.1 – Illiquidity Costs



(A) Effects of Liquidity Shock Intensity (B) Effects of Debt Maturity and Leverage

This figure uses the baseline parameters shown in Table 1. Panel A plots the evolution of illiquidity costs as a function of the liquidity shock intensity ξ. Panel B depicts illiquidity costs a function of the aggregate principal value P and bond maturity T. In this panel, there is no fixed bond spread anymore, the coupon rate is obtained assuming that the bond is issued at par.

Source: Author's calculations.

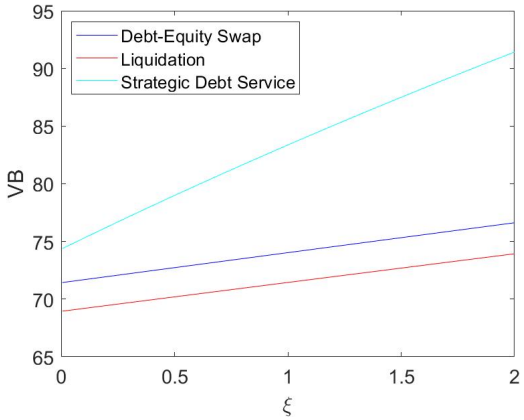
The second panel introduces changes in both debt maturity and aggregate principal values. Interestingly, illiquidity costs are concave and increasing in the debt maturity T. The steepness of the curve shows how fast illiquidity costs explode when rolling over short-term debt. As debt maturity tends to zero, illiquidity costs are still positive and significant. Since short-term debt is associated with higher rollover frequency, equity holders absorb greater losses per unit of time and decide to default at a higher threshold. It corresponds to the amplification mechanism of short-term debt as defined by He and Xiong (2012).

Another interesting dimension that has not been fully explored is leverage. Figure 4.1 shows that higher leverage translates into higher concavity. Even though it is possible to achieve lower illiquidity costs with very short maturities and higher leverage, illiquidity costs skyrocket as debt maturity increases. This result has interesting empirical implications. Financial firms with very short debt maturities could increase their leverage to lower their illiquidity costs. Nonetheless, for non-financial firms whose bond maturity generally exceeds 1 year, higher leverage ratios lead to higher illiquidity costs. Therefore, rollover risk helps explaining why financial firms maintain high leverage ratios.

4.4.3 Effects of Debt Renegotiation

We now assess the impact that the two formulations of debt renegotiation, namely the debt-equity swap and the strategic debt service, have on the firm. We begin by examining the behavior of shareholders and the subsequent threshold at which they decide to default on their debt payments and to engage into debt renegotiation. Figure 4.2 depicts the evolution of the default boundary when there is an increase in illiquidity in the secondary bond market. Results are shown for both configurations of debt renegotiation, as well as the baseline model without debt renegotiation (He and Xiong's model).

Figure 4.2 – Firm's Default Boundary



This figure shows the evolution of the bankruptcy boundary as a function of the liquidity shock intensity ξ. The blue and light blue lines correspond to the two reorganization schemes, debt-equity swap and strategic debt service respectively. The red line corresponds to the baseline model with no renegotiation. A description of the parameters can be found in Table 4.1.

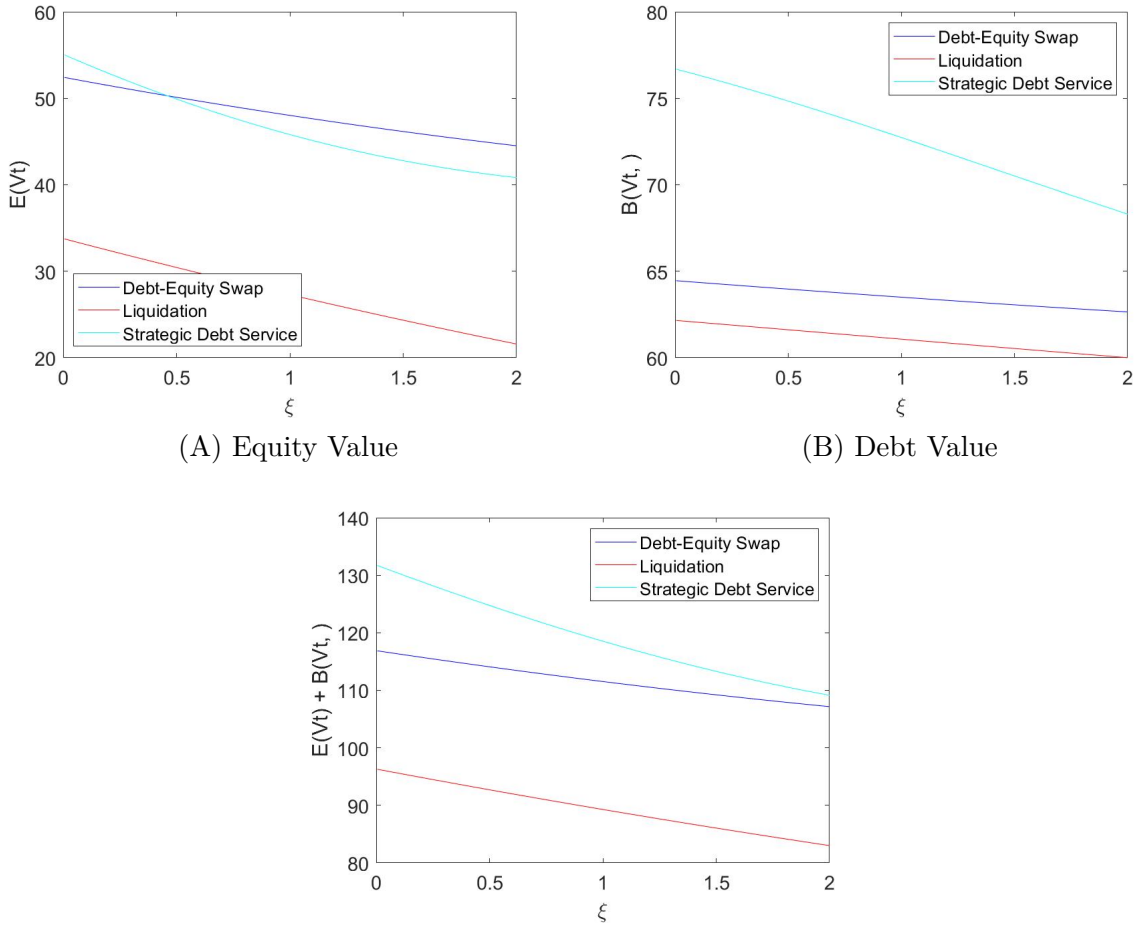
Source: Author's calculations.

As expected, shareholders decide to default earlier when there exists debt renegotiation. When performing debt equity swap, the firm ends up only saving on the agency costs related to bankruptcy. Given that these costs are constant, the evolution of the default boundary is parallel to that of the default boundary without debt renegotiation. Similarly, since shareholders strategically servicing debt split illiquidity costs as well as future tax benefits, they are willing to default at higher thresholds. Additionally, because illiquidity costs increase with the liquidity shock intensity, the default boundary increases at a faster pace, compared with that of other models.

Now that we have shown that the existence of debt renegotiation leads shareholders to default earlier, we examine the subsequent impact on the firm's capital structure. In Figure 4.3, we show the impact of debt renegotiation on the capital structure of firms subject to the rollover risk. One can notice that in all three models, the equity value decreases as liquidity on the secondary market deteriorates. This is the result of the rollover

risk channel according to which illiquidity on the secondary bond market feeds back into the equity value when the firm refinances its debt.

Figure 4.3 – Firm's Capital Structure



(A) Equity Value

(B) Debt Value

(C) Firm Levered Value

This figure plots the evolution of the firm's capital structure following an increase in debt market illiquidity. Panels A and B represent the equity and debt values respectively, while Panel C represents the firm levered value, which is the sum of both the equity and debt values. The blue and light blue lines represent the debt-equity swap and the strategic debt service. The red line represents the baseline model with no renegotiation (He and Xiong). The parameters used are given in Table 4.1.

Source: Author's calculations.

The two reorganization schemes under consideration have similar effects on the capital structure. Debt-equity swap drastically increases the equity value through *ex post* renegotiation gains to shareholders and savings on bankruptcy costs and rollover losses. When performing strategic actions, equity holders no longer wait for the equity value to fall to zero to declare bankruptcy. Even though equity holders default at a higher threshold, debt-equity swap slightly increases the bond value, suggesting that *ex post* renegotiation gains for creditors outweigh the costs associated with early default.

Likewise, reducing the coupon payment increases greatly the bond value since creditors save on bankruptcy costs and benefit from potential future tax benefits. Still, creditors bargain over the firm's market value, which is subject to illiquidity costs. As liquidity risk increases, the debt value is impacted twice: through the liquidity premium *ex ante* and through the illiquidity costs *ex post*. Consequently, the effect of the rollover risk channel is aggravated, as shown in Panel B. The strategic debt service also increases the equity value. However, similar to bondholders, shareholders remain subject to illiquidity costs, which further deteriorate the equity value. That's why shareholder have a preference for swapping the debt for equity when facing high illiquidity costs, as evidenced in Panel C.

In our model, both shareholders and bondholders are left better off after renegotiating debt, as the firm levered values under the two reorganization schemes are higher than that in the baseline model with no renegotiation. As such, renegotiating debt is the most efficient outcome for both sides, regardless of liquidity shocks and the renegotiation methods.

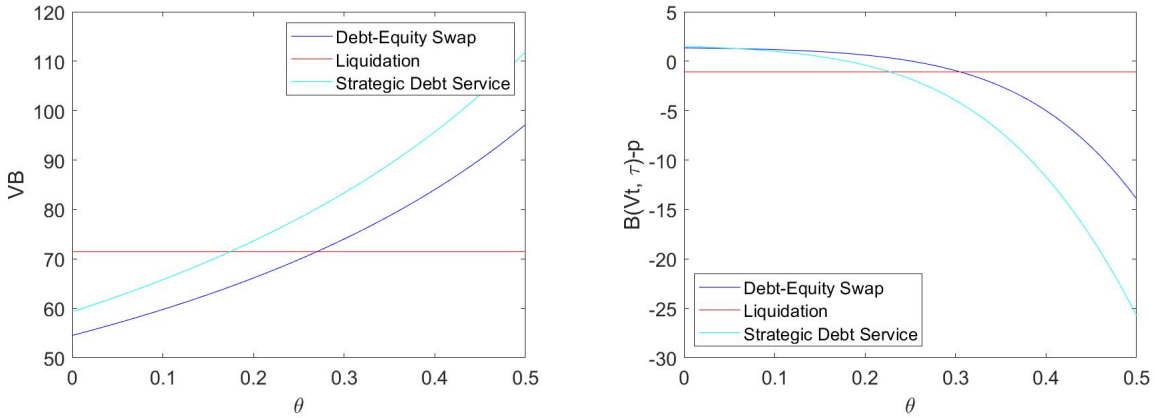
4.4.4 Sharing Rule

In this subsection, we aim to assess the impact of the sharing rule on the firm valuation. While we abstract from bargaining considerations, the parameter θ can be seen as a proxy of shareholders' bargaining power. The existence of proportional bankruptcy costs $(1-\alpha)$ in our model limits equity holders' bargaining power in our model. In order for the renegotiation to be successful, creditors should receive at least the liquidation value αV_B. In section 4.4.3, we assumed a relatively important equity holders' bargaining power ($\theta = 0.3$), given existing bankruptcy costs. However, it is well known that the impact of strategic actions on the firm depends on the distribution of bargaining power between claimants (see, for example, MELLA-BARRAL, 1999; FAN; SUNDARESAN, 2000).

To gain a better understanding of how relative bargaining power between claimants affects strategic actions, we first examine the evolution of both the renegotiation boundary and rollover losses when shareholders' bargaining power varies. The results are shown in Figure 4.4. Panel A shows that the renegotiation threshold increases with shareholders' bargaining power in the two models of debt renegotiation. Since shareholders are able to extract additional gains from the debt renegotiation, they are willing to default on their debt payments and renegotiate earlier. As shareholders' bargaining power increases, the payout to bondholders in the event of renegotiation becomes smaller. Consequently, bond prices and subsequent rollover losses increase, as shown in Panel B. In addition, the effect of shareholders' bargaining power on rollover losses is more pronounced in the model with strategic debt service as the increase in rollover losses creates a feedback loop through illiquidity costs. Similarly, when shareholders have low bargaining power, most

benefits accrue to bondholders. As the bond becomes less risky, both the bond price and subsequent rollover losses decrease, thus lowering the threshold at which shareholders are willing to default.

Figure 4.4 – Sharing Rule, Default Boundary, and Rollover Losses



(A) Default Boundary (B) Rollover Losses/Gains

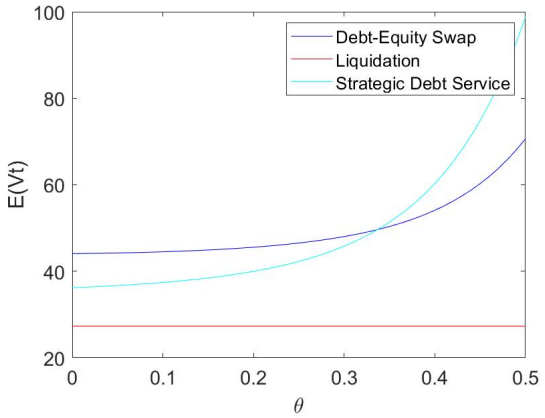
This figure shows the evolution of both the bankruptcy boundary and rollover losses as a function of shareholders' bargaining power. Panel A represents the default boundary and Panel B represent the rollover losses. The blue and light blue lines correspond to the two reorganization schemes, namely debt-equity swap and strategic debt service. The red line corresponds to the baseline model with no renegotiation. The parameters used are given in Table 4.1.

Source: Author's calculations.

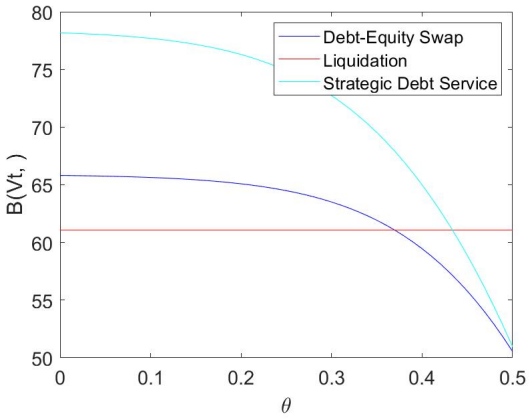
Second, we examine firm valuation when shareholders' bargaining power varies. Figure 4.5 illustrates the effect of shareholders' bargaining power on the firm's capital structure. Equity value is positively related to the renegotiation gains that shareholders make, as shown in Panel A. Notice that in both models, the equity value remains significantly higher than that of the baseline model with no debt renegotiation, even when shareholders have no bargaining power at all. This suggest that the two renegotiation strategies are viable to reduce agency costs associated with bond financing. Even though Panel C shows that the firm levered value is greater under strategic debt service, shareholders have a preference for debt-equity swap when their bargaining power is "low" ($\theta < 0.337$).

By contrast, debt value is negatively related to shareholders' renegotiation gains, as evidenced in Panel B. Bondholders have a strong preference for strategic debt service, regardless of shareholders' bargaining power. For debt renegotiation to be successful, bondholders have to receive more than the value they would receive by liquidating the firm. Accordingly, we compute the value of theta that makes bondholders indifferent between renegotiating the debt and liquidating the firm and find 0.37 and 0.433 for the debt-equity swap and the strategic debt service respectively. In addition, the bond value is always greater in the strategic debt service as long as the parameter theta remains lower or equal

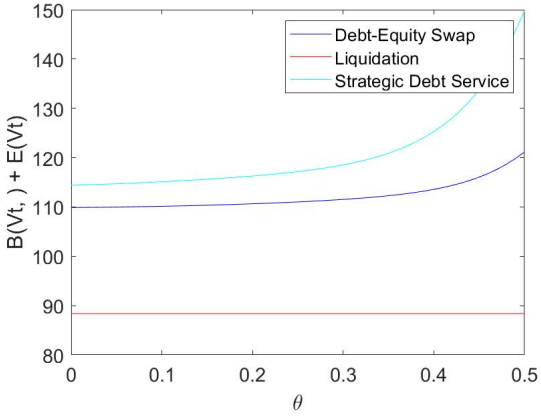
Figure 4.5 – Sharing Rule and Capital Structure



(A) Equity Value



(B) Debt Value



(C) Firm Levered Value

This figure depicts the evolution of the firm's capital structure when there is an increase in shareholders' bargaining power θ. Panels A and B show the equity and debt valuation respectively, and Panel C represents the firm levered value. The parameters are defined in Table 4.1.

Source: Author's calculations.

to 0.391. Consequently, the best payout for both claimants is reached when the parameter theta lies between 0.337 and 0.391. If bondholders have a high bargaining power, they would set the parameter theta as closes as possible to 0.337. Conversely, if shareholders have a high bargaining power, they would set the parameter close to 0.391. Overall, the results indicate that debt renegotiation can greatly increase the firm value by reducing the agency costs of debt.

4.4.5 Bond Spreads

Lastly, we examine the effect of debt renegotiation on bond spreads. Bond spreads represent the yield spread of firms' bonds relative to the risk-free interest rate and are used to assess firms' financing costs. In their model, He and Xiong (2012) recognize the

existence of an agency conflict associated with rolling over the debt since shareholders bear the rollover losses to avoid default, while creditors are paid in full. As such, shareholders choose to default at a higher threshold, and bond yields increase accordingly. This is the rollover risk channel, according to which liquidity risk on the secondary market adds to the existing bond's credit risk.

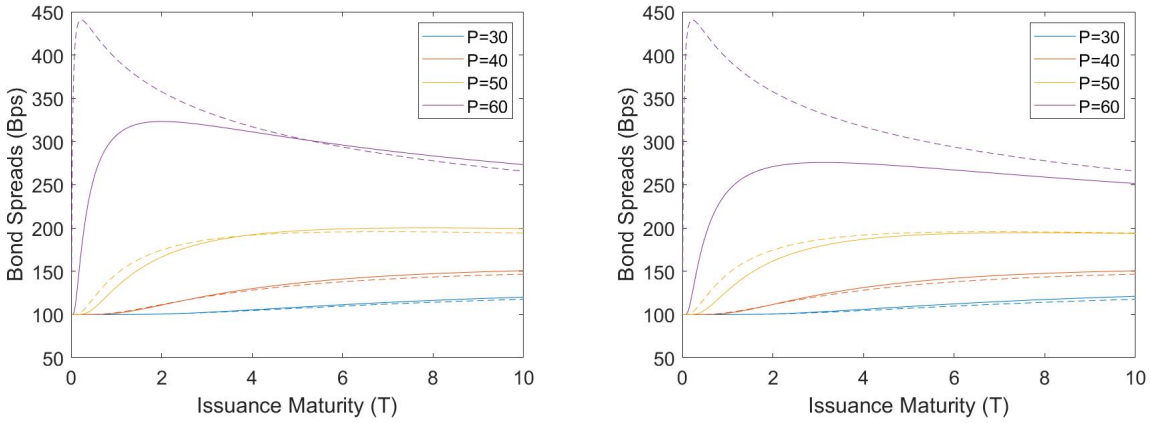
When renegotiating debt, shareholders and creditors are able to significantly increase the value of their respective claims on the firm, thereby reducing the agency costs of the firm. We therefore expect debt renegotiation to have a negative effect on bond spreads. In Figure 4.6, we plot the term structure of bond spreads for bonds with different principal values. We find that debt renegotiation has a mixed effect on bond spreads. Indeed, debt renegotiation reduces bond spreads when the bond maturity is short and the principal value is high, but it also increases bond spreads for longer maturities and lower principal values. Furthermore, the magnitude of these effects depends on the firm's credit rating. In unreported calculations, we calibrate the models to A-rated firms and find the impact of debt renegotiation to be lower.

To further understand the impact of debt renegotiation on bond spreads, it is essential to understand the effect that liquidity and credit risks have on bond spreads. The spreads can be decomposed as the sum of two components: the default component and the liquidity component. In addition, the default component can be further decomposed into a pure-default part, which is equal to the firm's credit risk, and a liquidity-driven default part, which is the rollover risk (see HE; MILBRADT, 2014; CHEN et al., 2018). The liquidity component in our model is only composed of the liquidity frictions on the secondary bond market: ξk. Figure 4.6 shows the constant liquidity premium of 100 bps when bond maturity tends to zero.

When renegotiating the debt, the firm is affected twice. First, the terms of the renegotiation affects the firm's credit risk through both equity and bond valuation. Fan and Sundaresan (2000) note that the effect on credit risk is the result of the combining effect of default probabilities and recovery rates. Then, as the bond's market value changes, the value of rollover losses changes and feeds back into the valuation of claims on the firm, thus affecting the rollover risk.

From Figure 4.6, we observe that debt renegotiation greatly reduces bond spreads for bonds subject to high rollover risk; that is, those with short maturities and high principal values. However, debt renegotiation has the opposite effect for bonds with low rollover risk. We saw in Section 4.4.3 that the default boundary is positively related to the firm's rollover risk. By defaulting at a higher equity value, shareholders also increase both default probabilities and recovery rates of bonds. While increases in default probabilities lead to an increase the default part of bond spreads, the effect of increases on recovery rates is twofold: it decreases the default part and the liquidity-driven default part. Consequently,

Figure 4.6 – Term Structure of Bond Spreads



(A) Debt-Equity Swap (B) Strategic Debt Service

The figure plots the term structure of bond spreads for different aggregate principal values and under the two reorganization schemes. In both panels, the dashed line represents the baseline model with no debt renegotiation. The annual coupon payment is obtained assuming that the debt is issued at par. Other parameters are given in Table 4.1.

Source: Author's calculations.

the effect of debt renegotiation is a trade-off between changes in pure credit risk and changes in liquidity-driven credit risk. The effects are more pronounced under strategic debt service given that both shareholders and creditors also bargain over the future tax benefits and current illiquidity costs.

4.5 Conclusion

This paper presents a structural model to analyze the effects of debt renegotiation on default boundaries, firm valuation, and bond spreads, when both credit and liquidity risk interact through rollover risk. In the absence of renegotiation, illiquidity on the secondary bond market adds to the agency conflicts of debt since shareholders have to absorb the firm's losses from rolling the debt over to avoid default. As such, debt market illiquidity deteriorates the firm's value, and illiquidity costs are concave in bond maturity and principal values. This implies that rollover risk is exacerbated by high leverage ratios and short-term debt.

We explicitly consider two reorganization schemes: debt-equity swap and strategic debt service. The default boundary and the coupon reduction are endogenously solved. The two formulations of debt renegotiation lead to a significant increase in both equity and bond values. We also examine variations in the sharing rule used in the renegotiation process and find similar results, even when bondholders have all the bargaining power. A key feature of the model is that renegotiation gains for bondholders also affect the equity value through a decrease in rollover losses. These findings indicate that debt renegotiation

acts as a governance mechanism that significantly reduces the agency costs of debt.

Our model also shows that shareholders default earlier when debt renegotiation exists. While debt renegotiation increases the risk of strategic default, it also reduces the liquidity-driven credit risk by increasing the recovery rate of bonds. We find that renegotiating the debt leads to a decrease in yield spreads for bonds with high rollover risk. Conversely, the yield spreads of bonds subject to low rollover risk increase slightly. Furthermore, even when markets are relatively liquid, debt renegotiation yields similar results. Overall, our model shows that debt renegotiation is a governance mechanism that can effectively reduce firms' financing costs.

This study has important empirical implications for managing the firm's credit risk. Increases in liquidity risk makes it more expensive for firms to refinance their debt. The COVID-19 pandemic has shown that very large and unanticipated liquidity shocks can affect bond markets. By renegotiating the debt, shareholders are able to reduce their exposure to such shocks and the subsequent firm's credit risk. Moreover, it may be in bondholders' best interests to contribute to part of the illiquidity costs associated with these shocks.

4.6 References

ANDERSON, R. W.; SUNDARESAN, S. Design and Valuation of Debt Contracts. **The Review of Financial Studies**, v. 9, n. 1, p. 37–68, 1996.

BAO, J.; PAN, J.; WANG, J. The Illiquidity of Corporate Bonds. **The Journal of Finance**, v. 66, n. 3, p. 911–946, 2011.

CHEN, H. et al. Quantifying Liquidity and Default Risks of Corporate Bonds over the Business Cycle. **The Review of Financial Studies**, v. 31, n. 3, p. 852–897, 2018.

DAVYDENKO, S. A.; STREBULAEV, I. A. Strategic Actions and Credit Spreads: An Empirical Investigation. **The Journal of Finance**, v. 62, n. 6, p. 2633–2671, 2007.

ERICSSON, J.; RENAULT, O. Liquidity and Credit Risk. **The Journal of Finance**, v. 61, n. 5, p. 2219–2250, 2006.

FAN, H.; SUNDARESAN, M. Debt Valuation, Renegotiation, and Optimal Dividend Policy. **The Review of Financial Studies**, v. 13, n. 4, p. 1057–1099, 2000.

HART, O.; MOORE, J. Default and Renegotiation: A Dynamic Model of Debt. **The Quarterly Journal of Economics**, v. 113, n. 1, p. 159–184, 1998.

HE, Z.; MILBRADT, K. Endogenous Liquidity and Defaultable Bonds. **Econometrica**, v. 82, n. 4, p. 1443–1508, 2014.

HE, Z.; XIONG, W. Rollover Risk and Credit Risk. **The Journal of Finance**, v. 67, n. 2, p. 391–430, 2012.

HUANG, J.-Z.; HUANG, M. How Much of the Corporate-Treasury Yield Spread Is Due to Credit Risk? **The Review of Asset Pricing Studies**, v. 2, n. 2, p. 153–202, 2012.

KARGAR, M. et al. Corporate Bond Liquidity during the COVID-19 Crisis. **The Review of Financial Studies**, v. 34, n. 11, p. 5352–5401, 2021.

LELAND, H. E.; TOFT, K. B. Optimal Capital Structure, Endogenous Bankruptcy, and the Term Structure of Credit Spreads. **The Journal of Finance**, v. 51, n. 3, p. 987–1019, 1996.

LELAND, H. E. Corporate Debt Value, Bond Covenants, and Optimal Capital Structure. **The Journal of Finance**, v. 49, n. 4, p. 1213–1252, 1994.

MELLA-BARRAL, P. The Dynamics of Default and Debt Reorganization. **The Review of Financial Studies**, v. 12, n. 3, p. 535–578, 1999.

MELLA-BARRAL, P.; PERRAUDIN, W. Strategic Debt Service. **The Journal of Finance**, v. 52, n. 2, p. 531–556, 1997.

MYERS, S. C. Determinants of Corporate Borrowing. **Journal of Financial Economics**, v. 5, n. 2, p. 147–175, 1977.

O'HARA, M.; ZHOU, X. A. Anatomy of a Liquidity Crisis: Corporate Bonds in the COVID-19 Crisis. **Journal of Financial Economics**, v. 142, n. 1, p. 46–68, 2021.

ROSSI, M. Realized Volatility, Liquidity, and Corporate Yield Spreads. **The Quarterly Journal of Finance**, v. 4, n. 1, p. 1–42, 2014.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

ZHANG, B. Y.; ZHOU, H.; ZHU, H. Explaining Credit Default Swap Spreads with the Equity Volatility and Jump Risks of Individual Firms. **The Review of Financial Studies**, v. 22, n. 12, p. 5099–5131, 2009.

5 Conclusion

5.1 Main Results

This thesis aimed at examining the relationship between corporate governance and bond financing. To do so, the main objective was decomposed into three smaller research objectives that were explored in the three articles of this thesis.

The first article investigated the overall impact that better corporate governance practices have on bond yields. It exploited multiple exogenous shocks on corporate governance to identify a causal effect: the staggered adoption of statutory reforms by Brazilian firms listed in the Novo Mercado segment. We first verified that these shocks were indeed

exogenous and randomly assigned, and the adoption of statutory reforms was not a function of prevailing firm or bond characteristics. Using difference-in-differences with a variation in treatment timing, we then found that the adoption of statutory reforms by listed firms led to a decrease in yields-to-maturity and coupon rates of bonds issued by these firms. We then performed placebo tests and confirm that the findings were not driven by luck or confounding events. We also examined the parallel trends assumption and found that there were no existing trends in the data prior to the adoption of statutory reforms. The results are robust to a number of alternative models with different samples and variables. We further explored the possible channels through which corporate governance affects bond yields and show that there was a decrease in bond liquidity and firms' return on assets and an increase in sales growth following the adoption of statutory reforms. This article also provides evidence on the effects of the COVID-19 pandemic on Brazilian firms and the secondary bond market. The pandemic has reduced firms' return on assets and sales growth and increased bond liquidity and yields-to-maturity.

This first article contributes to the literature investigating the determinants of corporate bond yields by proving that corporate governance is a significant determinant. It complements the growing corporate governance literature and shows that sound and robust governance practices can significantly decrease financing costs and foster economic growth. Furthermore, this study examines the combined effect of a set of corporate governance practices, instead of focusing solely on single mechanisms. This study also demonstrates that the staggered adoption of statutory reforms qualifies as a natural experiment that can be used with a staggered difference-in-differences design to investigate further research problems. This study also adds to the literature on the impact of Brazilian premium listings. In particular, we don't know of any research trying to link Brazilian premium listings to bond markets. Last, it contributes to the literature examining the effects of the COVID-19 pandemic by providing empirical evidence that the pandemic has had a significant impact on firms and bond markets.

In the second article, we explored how the adoption of statutory reforms affected the adoption of governance mechanisms. To do so, corporate governance data was added to the existing sample, and we used the same empirical methodology. We found that the adoption of statutory reforms led to increases in corporate governance variables related to the assessment of the management, audit committee structures, and internal auditing departments in companies listed in the Novo Mercado segment. We then examined how the corporate governance changes affected bond yields. We estimated fixed effects regressions and found that improvements in assessments of the management and in audit committee structures decreased bond yields while improvements in internal auditing departments increased bond yields. The combined effect of these mechanisms on bond yields is negative. In addition, this article shows that the effects of single governance mechanisms depends on the existing corporate governance structure. Lastly, the article provides evidence that

the COVID-19 pandemic has affected corporate governance by reducing the number of independent members in corporate boards, by increasing the number of companies disclosing their nomination and securities trading policies, and by increasing the number of internal auditing departments that report their activity to the board or audit committee and/or that examine risk management, control, and governance processes in companies listed in the Novo Mercado segment.

This second article contributes to the literature that investigates Brazilian premium listing segments. It provides an overview of the corporate governance changes, in Brazilian listed companies, originating from the revision of the Novo Mercado segment. It is important to note that these changes were not limited to that segment. Instead, companies listed in other segments also improved their corporate governance practices to remain attractive to investors. This article also adds to the corporate governance literature as it provides supporting evidence that two corporate governance mechanisms have a negative effect on corporate bond yields. Particularly, two mechanisms stood out, the assessment of the executive management and the audit committee. This study also contributes to the literature examining the effects of the COVID-19 pandemic and provides evidence that the pandemic has affected corporate governance in listed firms.

Finally, given the importance of single governance mechanisms in reducing bond yields, the third article introduced debt renegotiation as a governance mechanism. It examined the effects of debt renegotiation on firms subject to rollover risk to further understand the extent to which debt renegotiation can reduce the agency costs of debt. We developed a structural model of credit risk based on the model of He and Xiong (2012), with both debt renegotiation and rollover risk. The model shows that debt renegotiation reduces both the agency costs of debt and corporate bond spreads. These effects originate from the rollover risk channel. When bondholders renegotiate the debt, the firm's value is impacted twice: the market value of debt increase and rollover losses decrease. As a result, shareholders greatly benefit from debt renegotiation, even when their bargaining power is low, and they can act strategically to reduce their exposure to the rollover risk. The model highlights the importance of debt market liquidity in examining the effects of debt renegotiation.

This third article has important implications for empirical studies examining debt renegotiation. It is essential to take into consideration interactions between liquidity on the secondary bond market and credit risk when investigating the effects of debt renegotiation on corporate bond spreads. In this article, we showed that debt renegotiation affects the market value of bond on the secondary market, and it thus affects the firm's market value. Moreover, such empirical studies should focus on periods of relative illiquidity to capture large changes in bond spreads. This article also complements the corporate governance literature by highlighting debt renegotiation as a governance mechanism that

can reduce agency costs associated with bond financing. Furthermore, it presents evidence that corporate governance can significantly reduce firms' financing costs. Even though this article focused on the agency conflict associated with the rollover risk, the main results remain true for different agency conflicts between shareholders and creditors, such as those related to debt overhang (MYERS, 1977) or informational asymmetry (THATCHER, 1985).

5.2 Research Limitations

This subsection presents the thesis' research limitations. Starting with the two empirical articles, the sample size is limited despite our efforts to show otherwise. Even though corporate bond issuance has increased in the last years, there were very few issues prior to 2015. This limited sample size can decrease the reliability of our estimates and raise concerns about over-fitting issues. Another issue that deserves attention is the interpretation of the results, because they may be related specifically to the Brazilian market. It is possible that the captured effects may be specific to the Brazilian market and not representative of the rest of the world. Additional studies are thus needed to examine whether the results remain valid in other countries. In addition, in the second article, we interpreted the coefficient estimates in the light of the existing empirical literature, which has mostly ignored the interactions among existing corporate governance mechanisms. Last but not least, there is a lack of studies using natural experiments to examine the effects of corporate governance. Similarly, there is a lack of papers examining the link between corporate governance and corporate bonds. As such, this thesis lacks studies to support some of its research decisions.

As for the theoretical article, the research limitations are mostly related to the model's assumptions. For example, there are no transaction costs associated with stock issuance, and shareholders can inject as much capital as needed to absorb the rollover losses. In this case, the market price of liquidity is equal to zero, thus eliminating the need for any cash holdings. However, this limitation is not restricted to this thesis, but it is standard in the literature. Similarly, we considered two standard reorganization schemes while abstracting from bargaining considerations and assuming zero renegotiation costs. This choice made the model mathematically tractable, with closed-form solutions. However, debt renegotiation is more complex in practice, and it can take different forms. While studying renegotiation of debt contracts in private credit agreements between U.S. public firms and financial institutions, Roberts and Sufi (2009) found that debt renegotiation was frequent, occurred early in the contract's life, and resulted in larges changes to the amount, maturity, and pricing of the contracts. In addition, we didn't consider extensions of the model of He and Xiong (2012) with feedback effects from the credit risk to the bond market liquidity (see HE; MILBRADT, 2014). However, such models are really complex,

and it becomes increasingly difficult to disentangle the different effects at hand. As such, it becomes very difficult to evaluate the direct impact of corporate governance on bond yields.

5.3 Suggestions for future research

This subsection provides guidance for future studies on corporate governance and financing policies. There exist two main directions for future research: debt maturity and corporate cash holdings. First, it would be important to explore the relationship between debt maturity structure and corporate governance (or agency conflicts). It is well-known that short-term debt helps reducing agency conflicts between managers and shareholders (JENSEN, 1986a,b; STULZ, 1990; MORELLEC, 2004). Yet, the use of short-term debt entails an inherent agency conflict between shareholders and creditors similar to the debt overhang problem, by amplifying the rollover risk (HE; XIONG, 2012). In some cases, shorter maturities can even exacerbate the debt overhang problem (DIAMOND; HE, 2014) and induce changes in shareholder's risk-taking incentives (DELLA SETA; MORELLEC; ZUCCHI, 2020). We thus theorize that since firms with good governance have already significantly reduced agency conflicts between shareholders and managers, these firms should prefer long-term debt so as to not create additional conflicts with creditors. Firms with weaker governance, however, would prefer shorter maturities. An examination of the determinants of the debt maturity structure could be carried out along the lines of the work of Stohs and Mauer (1996), using corporate governance as an additional determinant. A further decomposition of governance focus could be made between the manager-shareholders conflict and the agency costs of debt.

The second topic worth exploring is the relationship between corporate governance (or agency conflicts) and cash holdings. On the one hand, cash holdings aggravates the existing agency conflicts by increasing resources under the manager's control (JENSEN, 1986a). The manager can then prefer to engage into empire-building activities or managerial entrenchment rather than maximizing the firm value. Consistent with this view, there is empirical evidence that the marginal value of cash is negatively related to the amount of cash, and it is positively related to external financing costs (FAULKENDER; WANG, 2006). On the other hand, cash holdings are used as a precautionary motive to protect companies from liquidity shocks and adverse cash-flow shocks (HE; XIONG, 2012; DELLA SETA; MORELLEC; ZUCCHI, 2020). Given that governance mechanisms aim to reduce agency conflicts within the firm, we theorize that better governance practices could reduce the agency conflict associated with cash holdings. Corporate governance would then appear as a determinant of corporate cash holdings.

5.4 References

DELLA SETA, M.; MORELLEC, E.; ZUCCHI, F. Short-Term Debt and Incentives for Risk-Taking. **Journal of Financial Economics**, v. 137, n. 1, p. 179–203, 2020.

DIAMOND, D. W.; HE, Z. A Theory of Debt Maturity: The Long and Short of Debt Overhang. **The Journal of Finance**, v. 69, n. 2, p. 719–762, 2014.

FAULKENDER, M.; WANG, R. Corporate Financial Policy and The Value of Cash. **The Journal of Finance**, v. 61, n. 4, p. 1957–1990, 2006.

HE, Z.; MILBRADT, K. Endogenous Liquidity and Defaultable Bonds. **Econometrica**, v. 82, n. 4, p. 1443–1508, 2014.

HE, Z.; XIONG, W. Rollover Risk and Credit Risk. **The Journal of Finance**, v. 67, n. 2, p. 391–430, 2012.

JENSEN, M. C. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. **The American Economic Review**, v. 76, n. 2, p. 323–329, 1986.

_____. The Takeover Controversy: Analysis and Evidence. **Midland Corporate Finance Journal**, v. 4, n. 2, p. 1–56, 1986.

MORELLEC, E. Can Managerial Discretion Explain Observed Leverage Ratios? **The Review of Financial Studies**, v. 17, n. 1, p. 257–294, 2004.

MYERS, S. C. Determinants of Corporate Borrowing. **Journal of Financial Economics**, v. 5, n. 2, p. 147–175, 1977.

ROBERTS, M. R.; SUFI, A. A Test of the Free Cash Flow Hypothesis: The Case of Bidder Returns. **Journal of Financial Economics**, v. 93, n. 2, p. 159–184, 2009.

STOHS, M. H.; MAUER, D. C. The Determinants of Corporate Debt Maturity Structure. **The Journal of Business**, v. 69, n. 3, p. 279–312, 1996.

STULZ, R. M. Managerial Discretion and Optimal Financing Policies. **Journal of Financial Economics**, v. 26, n. 1, p. 3–27, 1990.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

Appendix

APPENDIX A – B3's Premium Listings Requirements Before 2018

Level I

This premium listing focuses on better disclosure and greater share dispersion among shareholders. The requirements for Level I are as follows:

- the free-float should be a minimum of 25% of capital;
- Public offerings must include mechanisms that favor capital dispersion;
- Improved quarterly reports, consolidated financial statements and special audit revision;
- Equity transactions made by controlling shareholders should be disclosed monthly;
- Annual calendar of corporate events should be disclosed.

Level II

In addition to the obligations of Level I, Level II companies must comply with a wider range of corporate governance practices and minority shareholders rights. The additional criteria are given as follows:

- The Board of Directors must be composed of at least 5 members, which have a two-year unified mandate, and of which at least 20% are independent;
- Annual balance sheet must comply with IFRS standards;
- Tag-along rights for common and preferred shareholders;
- In the event of incorporation, spin-off, or merger, as well as approval of contracts between related parties, voting rights must be granted to preferred shares;
- In the event of delisting, the company must hold a tender offer by the economic value criteria;
- Adherence to the Market Arbitration Panel for resolution of corporate disputes.

Novo Mercado (Before 2018)

Companies listed in the Novo Mercado must respect all the rules from the Level II and issue only common shares (with voting rights).

APPENDIX B – Evolution of the Novo Mercado Segment compared to the Level II Segment.

Table B1 – Post-Revision Comparison Between Novo Mercado and Level II Segments

	NM	**Level II**
Share Capital	Only common shares	Common and preferred shares (with additional rights)
Minimum Percentage of Oustanding Shares (Free Float)	25% or 15%, if the ADTV (Average Daily Trading Volume) is above R$ 25 million	25%
Public Offering of Shares	Share dispersion efforts, except for offers pursuant to CVM's Instruction 476	Share dispersion efforts
Prohibition to statutory provisions	Voting limitation of less than 5% of the voting capital, qualified quorum and "immutable clauses"	Voting limitation of less than 5% of the voting capital, qualified quorum and "immutable clauses"
Composition of the Board of Directors	Minimum of 3 members, of which at least 2 or 20% (whichever is greater) must be independent	Minimum of 5 members, of which at least 20% must be independent
Prohibition of cumulation of positions	Chairman of the Board and CEO or Main Officer	Chairman of the Board and CEO or Main Officer (3-year grace period from ascension)
Board of Directors' duties	Statement on any public tender offer for the acquisition of shares issued by the company	Statement on any public tender offer for the acquisition of shares issued by the company
Financial Statements	As per legislation in force	Translated into English
Simultaneous disclosure in English and in Portuguese	Material Information or Benefit distribution information and results press releases	No specific regulation
Annual Public Meeting	Public meeting must be hold until 5 business days after the disclosure of the quarterly and annual financial statements	Mandatory (in-person)
Disclosure of additional information	Internal regulations of the Board of Directors, its Advisory Committees and the Fiscal Council, as well as additional disclosures [1]	Securities negotiation policy and code of conduct

Source: B3 Website (2021).

Table B1 – Post-Revision Comparison Between Novo Mercado and Level II Segments (cont.)

	NM	**Nível 2**
Tag-along rights	100% for common shares	100% for common and preferred shares
Delisting from the Segment / Public Tender Offer	Compulsory Public Tender Offer, at least for the fair price, with minimum acceptance quorum of 1/3 (or higher, as established in the bylaws) of the free float shareholders	Compulsory Public Tender Offer in case of registration canceling or segment exit
Becoming a Member of the Market Arbitration Chamber	Mandatory	Mandatory
Audit Committee	Mandatory setting up of an audit committee or statutory audit committee in compliance	Optional
Internal Auditing	Mandatory setting up of an auditing department in compliance	Optional
Compliance	Mandatory setting up of a compliance, internal controls and corporate risks department. It is not allowed the accumulation of compliance and operational functions	Optional

Source: B3 Website (2021).

APPENDIX C – The Agency Theory

Theoretical Background

This text presents the theoretical foundations of the agency theory, as well as the main insights from the theory. We further elaborate on the manager-shareholder conflict and on the shareholder-bondholder conflict. We then provide some of the empirical evidence about the agency costs originating from both the manager-shareholder and the shareholder-bondholder conflicts.

From the financial perspective, the agency theory represents the cornerstone of corporate governance. It is rooted in the famous work of Berle and Means (1932), which represented the first significant attempt to analyze the firm and acknowledged changes in the way American corporations were organized in the 1920's. The authors noted the emergence of a small number of firms with substantial power. Those firms drew most of their power from the concentration of capital that built up over the past decades in the United States. While such firms were growing, their original owners struggled to keep pace with the growth and to maintain the control of the firm. The ownership of the firm became dispersed among numerous small shareholders. Berle and Means (1932) conclude that this dispersal led to the unexpected appropriation of power by firms' managers.

The authors already recognized that managers weren't acting in shareholders' best interests; instead, firms' managers gave preference to decisions increasing their own wealth. This view was later shared by Burnham (1941), who described managers' actions as self-interested and opportunistic. Using a sample of the 200 largest American firms in 1929, excluding the financial sector, Berle and Means (1932) found that 88 firms representing 58% of the sample total assets had no investors owning as much as 20% of the firm. According to them, the 20% threshold was the minimum to have an effective control over the firm. Given the fact that the majority of the US corporations exhibited disperse ownership, their main concern was that the separation between ownership and control made the managers unaccountable to both the firms' owners and the society as a whole (MIZRUCHI, 2004).

The agency theory also stems from the well-known work of Coase (1937), in which he examines why firms exist and what their purpose is. Breaking with the neoclassic views of the firm as a black box that produces for outsiders (DEMSETZ, 1995), Coase shows that firms exist as a form of economic co-operation that provides an alternative to the market. According to him, the agents can operate either inside an organization or directly through the market. Since agents are rational and want to maximize their profits, they would use firms whenever the costs of internalizing the exchanges are lower than the costs

of transacting through the market. The latter costs are labeled as "*transaction costs*" and refer to such costs as the costs of searching for information and counterparts, or the costs of negotiating and concluding the contracts. In addition, an exchange takes place as long as the costs of making the exchange are lower than its benefits. Consequently, transaction costs affect both contractual arrangements and the firm production.

Following Coase's theoretical breakthrough, contractual views of the firm emerged and contested the idea that firms are governed by authority. Alchian and Demsetz (1972) developed a theory of the firm based on team production, synthesizing the studies on property rights of the past decade. They consider the firm as a structure of property rights that are defined by a set of contracts. In this view, the firm is no different from the market and offers the same authority or disciplinary action as ordinary market contracting. The real difference lies on the team use of inputs and the existence of a party common to the contractual arrangements of all other inputs (the owner). The team use of inputs allows the firm to yield an output superior to the sum of the outputs that would be produced by each inputs taken separately. It is characterized by several types of resources belonging to more than one person.

To be efficient, the team production needs to assess the marginal productivity of the inputs. This assessment is difficult to make and costly because of the non-separability of some of the products, and the fact that there is a synergy. The impossibility to allocate rewards according to the productivity of the input would lead inputs to engage into free-riding, defined as the negative incentive to control or minimize production costs, and shirking, defined as the positive incentive to supply less effort (LEIBOWITZ; TOLLISON, 1980). The marginal productivity can be measured and controlled within the firm by having a specialist (monitor) that observes inputs behavior and checks the performance of team members. The monitor earns the residual reward gained from reducing shirking practices. To discipline team members, the monitor has the rights to renegotiate each input's contract independently of the other existing contracts. Given the above-mentioned considerations, the market cannot have an efficient team production. Consequently, the firm arises as a contractual structure that enhances the efficient organization of joint production (ALCHIAN; DEMSETZ, 1972).

The Theory

While Jensen and Meckling (1976) are currently credited for the development of the agency theory, it is Ross (1973) that first formulated the principal-agent problem and laid the foundations for the agency view of the firm. He defines agency relationships as contractual arrangements in which the agent acts on the behalf of the principal and which involves some decision-making. Agency problems arise when i) the agent and the principal

have different utility functions, and ii) there is imperfect information regarding the actions of the agent. Ross notes that agency problems are not only restricted to the firm, but they also prevail in the society (e.g., between the state and the governed). From his perspective, the agency problem essentially lies on economic incentives. Consequently, the principals should look forward to design compensation contracts that maximize their expected utility, as well as that of the agent. The solution to the agency problem consists in aligning the interests of the agent through an appropriate compensation system.

Using insights from the aforementioned studies, Jensen and Meckling (1976) further developed the agency theory and applied the agency problem to the theory of the firm. Contrasting with Alchian and Demsetz (1972) and their emphasis on team production, Jensen and Meckling (1976) recognize the importance of contractual relations within the firm, not only with employees but with all stakeholders. As such, the firm is viewed as a contractual structure, that is, a nexus for a set of contracts among self-interested individuals. They also recognize that agency problems are embedded into such contractual arrangements. In line with the work of Ross (1973), they acknowledge that the agency problem exists "*in all organizations and in all cooperative efforts - at every level of management in firms*". Yet, they focus on agency problems associated with outside claims on the firm, respectively the outside equity that is borne by shareholders and debt from bondholders.

Aiming to explain the ownership structure of firms, Jensen and Meckling (1976) recognize that there are some agency costs associated with outside financing – outside equity and debt. Assuming that markets are efficient, both outside equity and debt values should incorporate agency costs and redistributions caused by the agency relationship, thus causing the manager to bear agency costs. The manager will then determine his capital structure by minimizing the total agency costs. Since the fraction of the manager's equity (inside equity) falls as outside financing increases, the manager will have more incentives to act against shareholders' best interest. As such, Jensen and Meckling (1976) argue that the marginal benefits of monitoring will increase, which will in turn raise the optimal level of monitoring. In addition, they show that it's not optimal for the manager to have all of its wealth invested in the firm due to the risk involved. The manager would then gain from diversifying his portfolio, and he has a marginal gain from reducing his own claim on the firm. The optimal amount is then obtained by equating the marginal gain to the marginal agency cost that the manager bears.

According to Shleifer and Vishny (1997), agency relationships in the firm are, by nature, incomplete since any contract between shareholders and managers cannot encompass all the possible scenarios that the firm might face. Thus, residual control rights, defined as the rights to make decisions in circumstances not fully foreseen by the contract, should be allocated within the firm. However, in practice, most of those rights belong

to managers, which have both the qualifications and the information necessary to make decisions. This discretionary latitude opens up new possibilities of managers' misbehavior and opportunism. The authors further note that managerial discretion can lead to different forms of managerial expropriation, as evidenced by such financial scandals as the Tyco scandal in 2002, in which top executives ran a fraud scheme and stole money from the company.

The literature on agency theory has then split into two complementary streams, respectively the positive agency theory and the Principal-Agent stream of research (JENSEN; MECKLING, 1976; JENSEN, 1983; EISENHARDT, 1989; JENSEN; SMITH, 2000). The former focuses on explaining the conflicts of interests and their origins, while also discussing the governance mechanisms that would resolve or reduce such conflicts, especially in large companies. According to Eisenhardt (1989), agency problems can be solved by using outcome-based contracts and information monitoring systems. The principal-agent literature, however, aims at developing theoretical frameworks to study the principal-agent relationship and puts a greater emphasis on assumptions and is more mathematically-oriented. It focuses on contract design and seeks to determine optimal contracts within a given firm. Although the normative approach could bring forth complementary elements with respect to contract design, it doesn't seek to explain causes of agency conflicts or the resulting costs. Therefore, we favor the positive approach to answer the research problem.

The Owner-Manager Conflict

This subsection studies the agency problem that arises from the divergence of interests between shareholders (principals) and the manager (agent). Shareholders are the residual claimants on the firm since they bear the residual risk [of having no returns at all]. The manager, however, has discretionary latitude as he has contracts with other stakeholders, makes decisions, and allocates resources. When the manager is also the owner of the whole firm, he will make decisions that maximize his or her utility. Nevertheless, as his fraction of equity falls, the manager owns a lower fraction of the firm outcome, thus causing him to appropriate a larger proportion of the firm's resources in the form of perquisites. As the manager owns a lower fraction of the firm, he also becomes less inclined to devote efforts to such creative activities as searching for new profitable projects (JENSEN; MECKLING, 1976).

While the authors offer a sound explanation for managers' divergence of interests with regard to shareholders, they assume that the manager had an initial claim on the firm. Since then, the literature has offered additional determinants of managers' behavior. Jensen and Smith (2000) posit that the agency conflict between managers and owners is caused by a) the manager's choice of effort, which is perceived negatively for a manager that

tries to maximize his payoff for a given level of effort; b) the differential in risk exposure, in which shareholders have diversified portfolios and are protected against firm-specific risks, but managers have a large proportion of their wealth in firm-specific assets and are thus vulnerable to such risks; and c) the differential in horizons, in which managers have short-term claims on the firm compared to those of shareholders that are long-term oriented, and causing managers to attribute lower values for cash flows taking place away from their horizon than those that would be implied by the market.

Faced with asymmetric information and moral hazard, shareholders can limit the potential conflicts of interest in two different ways: either through incentives to ensure that managers' interests are in line with theirs or by monitoring the managers' actions. The monitoring costs incurred to limit the activities of the agent represent one type of agency costs. Jensen and Meckling (1976) note that the principals can, in some situations, pay the agent to expend resources, which are named bonding costs, to guarantee that shareholders' best interest is considered. Even assuming optimal monitoring and bonding activities, there will still be some divergence of interests that will incur costs for shareholders, that is, the residual loss. According to the authors, the total agency costs are given as the sum of i) monitoring costs, ii) bonding costs, and iii) the residual loss.

What About Creditors?

Assuming that financing the firm's projects using outside equity is increasingly costly, the manager could theoretically use debt financing as a cheaper alternative. However, similar to outside equity financing, debt financing is also associated with agency conflicts. The agency relationship between creditors and shareholders is the second most important source of agency costs after the owner-manager conflict. The agency problem arises from the manager's decisions that increase the wealth of shareholders while reducing that of creditors (bondholders). In the most extreme form of such agency problem, the company can escape the burden of the debt by paying all of its assets as dividends and leave creditors with an empty shell (BLACK, 1976).

It is well-known that a firm's dividend policy is an important driver of the agency conflict between fixed and residual claimants. It can be used to transfer wealth from creditors to shareholders (BLACK; SCHOLES, 1973; JENSEN; MECKLING, 1976; KALAY, 1982; JENSEN; SMITH, 2000). Kalay (1982) defines two ways to make such a transfer: i) through the so-called investment financed dividends, when the firm "*reduces planned investments or depletes existing assets*" and uses the cash to pay dividends; and ii) through the so-called debt financed dividends, when the firm uses debt issuance to pay dividends. Still, Kalay (1982) notes that there is a transfer of wealth only if creditors don't anticipate such payments. Similarly, the firm may favor dividend payments over investments in

projects with positive net present value (JENSEN; MECKLING, 1976). Because such practices reduce the firm assets and increase the firm's credit risk for creditors, bondholders usually restrict the dividend policy using bond covenants (SMITH; WARNER, 1979).

Since creditors only receive fixed debt payments and don't participate in the firm's profit, any actions that aims at increasing the firm's profitability, as long as they change the firm risk, are harmful to creditors. In this regard, claim dilution represents another major source of agency conflict between stockholders and bondholders. When bonds are priced assuming that no additional debt would be issued by the firm, any new debt that the firm takes on reduces the bond value and the subsequent creditor's wealth, regardless of the new debt seniority. Similarly, when bonds are priced given the firm's intent to engage in low-risk projects, then the bond value is going to decline and the equity value will rise if the firm substitutes such projects for high-risk ones (SMITH; WARNER, 1979). This practice is known as the asset substitution problem. Using the option pricing theory, one can model the equity as a call option, which is increasing in the asset risk. This gives incentives for shareholders to convince managers to shift to high-risk projects (JENSEN; MECKLING, 1976; GAVISH; KALAY, 1983).

The presence of risky debt within the firm's capital structure also creates agency costs by inducing suboptimal investment decisions that create dead-weight losses. In a seminal article, Myers (1977) shows that, in some cases, the firm can pass up on projects with positive net present value since most of the investment benefits would accrue to bondholders. While book values reflect assets in place, market values also reflect growth opportunities (assets not yet in place) and can be valued using the option pricing theory. In this framework, growth opportunities correspond to call options on real assets. The strike price is given by the corresponding asset price. Myers (1977) demonstrates that the firm's value is a decreasing function of the debt principal and that any promised payoffs to creditors cause the firm to abandon some profitable projects in the future. He also shows that there exists a debt overhang, in which the firm cannot borrow more even at higher costs. This situation can be explained by the fact that the debt value is a concave function of the debt principal.

Another agency problem relates to the informational asymmetry. The notion of informational asymmetry was put forth by Akerlof (1970) in his seminal article on the market for Lemons. It is the result of two phenomena: adverse selection and moral hazard. Assuming a relationship between the firm and creditors, adverse selection corresponds to the situation in which the firm's manager has private information about the firm and only gives creditors the good informations. Moral hazard, however, relates to a situation in which the firm's manager changes its actions once a contract is signed with creditors. One of its most common manifestations is the asset substitution problem. As shown by Thatcher (1985), asymmetric information lead bondholders to underestimate the expected

firm cash flows when the firm is unable to reveal its true future cash flows. In such case, a call provision can be used to buy the debt back and issue further debt once the true cash flows are revealed. Moreover, Bernanke and Gertler (1989) demonstrate that, in presence of asymmetric information, the higher the amount of "collateralizable" assets, the lower the expected agency costs.

Empirical Evidence

Since the development of the agency view of the firm, there has been a great deal of work on the agency theory, the article of Jensen and Meckling (1976) being cited more than 80,000 times in the literature. Due to the high number of papers related to this assumption and the vastness of the topic, it is highly difficult to offer a full representation of the work that has been done. My objective is more modest and aims at summarizing the main results of the literature with regards to agency costs. I first begin with the empirical evidence from the agency costs that arise from the divergence of interests between managers and shareholders. I then focus on the shareholder-bondholder conflict and bring forward some empirical evidence with respects to the agency costs of debt

Empire-building is an agency problem that received a particular attention from academic researchers. It corresponds to managers' incentives to grow the firm beyond its optimal size, to maintain redundant resources, and to invest excessively. Managers engaging into empire-building practices are usually motivated by compensation, power, status, and prestige (JENSEN, 1986a; HOPE; THOMAS, 2008). Free Cash-Flows (FCF) are traditionally used to proxy such incentives (STULZ, 1990; MORELLEC, 2004; MASULIS; WANG; XIE, 2007). Jensen (1986a) defines FCF as "*the cash flow in excess of that required to fund all projects that have positive net present values when discounted at the relevant cost of capital*". The FCF problem arises from the conflict of interest surrounding the payout policy: managers with important FCF may prefer to invest the cash in projects with low or negative net present value, as long as they increase the manager's perquisites, rather than distributing it to shareholders through either dividends or stock repurchases.

The literature on agency costs provides supportive evidence for Jensen's findings. Empirical work on agency costs usually comes in the form of event studies. Still, traditional event studies suffer from announcement selection, in which managers give better news than the average one since such announcements are not mandatory (SHLEIFER; VISHNY, 1997). This problem can be solved by studying any events for which there exist public announcements such as tender offers. Consistent with Jensen's results that value-destroying acquisitions are more likely to be undertaken by firms with high cash flows and unused borrowing power, Lang, Stulz, and Walkling (1991) examine the FCF hypothesis in tender offers and show that the bidder's gains are negatively related to the bidder's returns for

low q firms. Academic researchers also found supportive evidence using self-tender stock repurchases (PERFECT; PETERSON; PETERSON, 1995; NOHEL; TARHAN, 1998; SCHLINGEMANN, 2004) and open-market share repurchases (GRULLON; MICHAELY, 2004).

Similar to public takeovers, Leveraged Buyouts (LBOs) have been studied extensively to understand the impact of FCF. The decision to go private can mitigate agency problems between owners and managers by transferring residual claims to the management, thus internalizing most of the wealth effects, and significantly increasing the amount of debt (JENSEN, 1986a,b; STULZ, 1990). The FCF hypothesis received mixed results using going-private transactions. Lehn and Poulsen (1989), Denis (1992), and Opler and Titman (1993) provide strong evidence supporting the FCF hypothesis by showing that LBOs are motivated by agency motives and that LBOs gains are linked to undistributed cash flow. However, Maupin, Bidwell, and Ortegren (1984), Kieschnick (1998), and Servaes (1994) offer contrasting evidence and show that such transactions have other motives. In an attempt to reconcile the different results, Halpern, Kieschnick, and Rotenberg (1999) developed the heterogeneity hypothesis and showed that the LBO population is segmented into two groups, depending on managerial shareholdings.

Other than the work of Jensen (1986a), very few articles addressed the measurement issue associated with the agency costs of the equity. Since agency costs are include in the firm's value and reduce the firm's total value, it is difficult to estimate them. The agency costs are usually given as the difference in firm value between a situation in which the firm's value is maximized and the current situation. An example of how to find the firm's maximum value can be found in Habib and Ljungqvist (2005). In addition to the aforementioned approach, Ang, Cole, and Lin (2000) compute agency costs as the difference in the asset turnover ratio, given by the ratio of annual sales to total assets, between a firm whose manager is the sole owner and a given firm. In line with the insights provided by Jensen and Meckling (1976) and Fama and Jensen (1983), they find that the agency costs of equity are negatively related to the managerial ownership. Moreover, external monitoring by a bank tends to reduce agency costs. Extending the work of Ang, Cole, and Lin (2000) on small companies, Singh and Davidson III (2003) analyzed large companies. They find similar results using the asset turnover ratio; however, the relation becomes insignificant when using the SG&A expense ratio, given as the ratio of selling, general and administrative expenses (SG&A) to total assets.

The agency conflicts that surround the use of debt are the second most severe agency conflicts that exist within the firm. I now focus on the empirical evidence that relates to debt-induced agency costs. Most of the empirical literature on debt-related agency conflicts examines the firm's capital structure. A precise estimate of such agency costs can be obtained using the Contingent Claim Analysis (CCA). The CCA stems

from the option pricing theory. Black and Scholes (1973) demonstrated that corporate liabilities can be represented by combinations of option contracts and thus be valued as such. Consolidating this view, Merton (1974, 1977) refined and generalized what became the CCA. Contingent claim models usually take the stochastic process of either the firm's asset value or the firm's cash flow as given. The underlying parameters can be calibrated to fit observed data. Both the equity and debt value are then derived using the underlying process. In such models, agency costs can usually be found by contrasting situations in which the firm's policy is contracted before and after the debt is. For example, Leland (1998) compares two situations: i) the *ex ante* case in which the firm can choose both its debt structure and risk policy and ii) the *ex post* case in which the firm chooses its risk once the debt is contracted, to capture the effects of the asset substitution problem. While the asset value is maximized in the first case, it is the equity value that is maximized in the second one. In this model, agency costs are given by the difference between the *ex ante* and the *ex post* cases.

Using contingent claim valuation methods, Mello and Parsons (1992) extended the work of Brennan and Schwartz (1985) to demonstrate how debt-induced agency costs affect the production decisions of a mine and its capital structure. They show that the agency costs of debt are significant and depend on such several factors as the asset value, the debt principal, and the debt maturity. They conclude that it's an important determinant of firms' capital structure. Similarly, Green and Talmor (1986) examined the impact of the agency costs of debt on firms' capital structure and found that the risk-shifting incentives of shareholders increase with the debt principal and the debt market value. This view was latter supported by numerical simulations, as in Parrino and Weisbach (1999). More recently, Doukas and Pantzalis (2003) examined the capital structure of multinational firms. Such firms exhibit higher short-term debt and lower long-term debt ratios, compared with similar domestic firms. The authors find that the differences in debt ratios between domestic and multinational firms is explained partly by the agency costs of debt. The authors offer evidence that the agency costs of debt have a negative effect on long-term debt ratios. They also add that this effect becomes more pronounced as the firm becomes more involved in overseas.

The agency costs of debt have a huge impact on the firm's dividend and financing policies. It is widely recognized that both the policies are set so as to minimize the agency costs of both debt and equity (HAUGEN; SENBET, 1979; ROZEFF, 1982; EASTERBROOK, 1984; JENSEN; SOLBERG; ZORN, 1992). Using a sample of bond indentures, Kalay (1982) shows that stockholders restrict their ability to transfer wealth from bondholders. In addition, the author notes that the restriction is not binding since stockholders don't pay all the allowed amount of wealth transfer. As regards the firm's financing policy, Barnea, Haugen, and Senbet (1981) demonstrate that the supply curve of debt is downward sloping when the firm faces residual agency costs that are not eliminated through either

complex securities or market forces. Jensen, Solberg, and Zorn (1992) examine the relation between managerial ownership, debt, and dividend policies. They show that managerial ownership is tied to the firm's financial decisions. The authors conclude that both agency and bankruptcy costs influence a firm's financing decisions.

The literature acknowledges some methods to mitigate the agency costs of debt. Following Berkovitch and Kim (1990), the contracting methods can be classified into three groups: i) the ones that aim at eliminating or neutralizing the impact of the existing debt before undertaking a new project, ii) the ones that aim at renegotiating prior debt contracts, and iii) the ones that focus on designing debt contracts *ex ante*. The third group gather the most used methods and has been significantly explored by Smith and Warner (1979). They show that bondholders use debt covenants to ensure that shareholders' behavior is constrained to not deviate from value-maximizing decisions. While bondholders can theoretically restrict any actions, some are more expensive than others to monitor. Since it is very difficult to observe and costly to monitor the firm's production and investment policy, the authors suggest to restrict it by using dividend and financing policy covenants so that the firm's value is maximized. The restriction of the financing policy can be done using secured debt, obtained through the collateralization of some asset. Restricting dividends and other cash distributions ensures that the firm keeps internal funds and invests in profitable projects. Berkovitch and Kim (1990) find that, in presence of asymmetric information, restrictions on dividends create an opposite effect and exacerbate over-investment incentives, that is, asset substitution. In the same way, debt seniority also has a dual impact on investment incentives.

References

AKERLOF, G. A. The Market for "Lemons": Quality Uncertainty and the Market Mechanism. **The Quarterly Journal of Economics**, v. 84, n. 3, p. 488–500, 1970.

ALCHIAN, A. A.; DEMSETZ, H. Production, Information Costs, and Economic Organization. **The American Economic Review**, v. 62, n. 5, p. 939–961, 1972.

ANG, J. S.; COLE, R. A.; LIN, J. W. Agency Costs and Ownership Structure. **The Journal of Finance**, v. 55, n. 1, p. 81–106, 2000.

BARNEA, A.; HAUGEN, R. A.; SENBET, L. W. An Equilibrium Analysis of Debt Financing Under Costly Tax Arbitrage and Agency Problems. **The Journal of Finance**, v. 36, n. 3, p. 569–581, 1981.

BERKOVITCH, E.; KIM, E. H. Financial Contracting and Leverage Induced Over- and Under-Investment Incentives. **The Journal of Finance**, v. 45, n. 3, p. 765–794, 1990.

BERLE, A.; MEANS, G. **The Modern Corporation and Private Poverty**. New York: Harcourt, Brace & World, 1932.

BERNANKE, B.; GERTLER, M. Agency Costs, Net Worth, and Business Fluctuations. **The American Economic Review**, v. 79, n. 1, p. 14–31, 1989.

BLACK, F. The Dividend Puzzle. **Journal of Portfolio Management**, v. 2, n. 2, p. 5–8, 1976.

BLACK, F.; SCHOLES, M. The Pricing of Options and Corporate Liabilities. **The Journal of Political Economy**, v. 81, n. 3, p. 637–654, 1973.

BRENNAN, M. J.; SCHWARTZ, E. S. Evaluating Natural Resource Investments. **The Journal of Business**, v. 58, n. 2, p. 135–157, 1985.

BURNHAM, J. **The Managerial Revolution: What is Happening in the World**. [S.l.]: John Day Company, 1941.

COASE, R. H. The Nature of the Firm. **Economica**, v. 4, n. 16, p. 386–405, 1937.

DEMSETZ, H. **The Economics of the Business Firm: Seven Critical Commentaries**. Cambridge: Cambridge University Press, 1995.

DENIS, D. J. Corporate Investment Decisions and Corporate Control: Evidence from Going-Private Transactions. **Financial Management**, v. 21, n. 3, p. 80–94, 1992.

DOUKAS, J. A.; PANTZALIS, C. Geographic Diversification and Agency Costs of Debt of Multinational Firms. **Journal of Corporate Finance**, v. 9, n. 1, p. 59–92, 2003.

EASTERBROOK, F. H. Two Agency-Cost Explanations of Dividends. **The American Economic Review**, v. 74, n. 4, p. 650–659, 1984.

EISENHARDT, K. M. Agency Theory: An Assessment and Review. **The Academy of Management Review**, v. 14, n. 1, p. 57–74, 1989.

FAMA, E. F.; JENSEN, M. C. Separation of Ownership and Control. **Journal of Law and Economics**, v. 26, p. 301–325, 1983.

GAVISH, B.; KALAY, A. On the Asset Substitution Problem. **Journal of Financial and Quantitative Analysis**, v. 18, n. 1, p. 21–30, 1983.

GREEN, R. C.; TALMOR, E. Asset Substitution and The Agency Costs of Debt Financing. **Journal of Banking and Finance**, v. 10, n. 3, p. 391–399, 1986.

GRULLON, G.; MICHAELY, R. The Information Content of Share Repurchase Programs. **The Journal of Finance**, v. 59, n. 2, p. 651–680, 2004.

HABIB, M. A.; LJUNGQVIST, A. Firm Value and Managerial Incentives: A Stochastic Frontier Approach. **The Journal of Business**, v. 78, n. 6, p. 2053–2094, 2005.

HALPERN, P.; KIESCHNICK, R.; ROTENBERG, W. On the Heterogeneity of Leveraged Going Private Transactions. **The Review of Financial Studies**, v. 12, n. 2, p. 281–309, 1999.

HAUGEN, R. A.; SENBET, L. W. New Perspectives on Informational Asymmetry and Agency Relationships. **Journal of Financial and Quantitative Analysis**, v. 14, n. 4, p. 671–694, 1979.

HOPE, O.-K.; THOMAS, W. B. Managerial Empire Building and Firm Disclosure. **Journal of Accounting Research**, v. 46, n. 3, p. 591–626, 2008.

JENSEN, G. R.; SOLBERG, D. P.; ZORN, T. S. Simultaneous Determination of Insider Ownership, Debt, and Dividend Policies. **The Journal of Financial and Quantitative Analysis**, v. 27, n. 2, p. 247–263, 1992.

JENSEN, M. C. Organization Theory and Methodology. **The Accounting Review**, v. 58, n. 2, p. 319–339, 1983.

_____. Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers. **The American Economic Review**, v. 76, n. 2, p. 323–329, 1986.

_____. The Takeover Controversy: Analysis and Evidence. **Midland Corporate Finance Journal**, v. 4, n. 2, p. 1–56, 1986.

JENSEN, M. C.; MECKLING, W. H. Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure. **Journal of Financial Economics**, v. 3, p. 305–360, 1976.

JENSEN, M. C.; SMITH, C. W. Stockholder, Manager, and Creditor Interests: Applications of Agency Theory. In: JENSEN, M. C. (Ed.). **A Theory of the Firm: Governance, Residual Claims and Organizational Forms**. Cambridge: Harvard University Press, 2000.

KALAY, A. Stockholder-Bondholder Conflict and Dividend Constraints. **Journal of Financial Economics**, v. 10, n. 2, p. 211–233, 1982.

KIESCHNICK, R. L. Free Cash Flow and Stockholder Gains in Going Private Transactions Revisited. **Journal of Business Finance & Accounting**, v. 25, n. 1-2, p. 187–202, 1998.

LANG, L. H. P.; STULZ, R. M.; WALKLING, R. A. A Test of the Free Cash Flow Hypothesis: The Case of Bidder Returns. **Journal of Financial Economics**, v. 29, n. 2, p. 315–335, 1991.

LEHN, K.; POULSEN, A. Free Cash Flow and Stockholder Gains in Going Private Transactions. **The Journal of Finance**, v. 44, n. 3, p. 771–787, 1989.

LEIBOWITZ, A.; TOLLISON, R. Free Riding, Shirking, and Team Production in Legal Partnerships. **Economic Inquiry**, v. 18, n. 3, p. 380–394, 1980.

LELAND, H. E. Agency Costs, Risk Management, and Capital Structure. **The Journal of Finance**, v. 53, n. 4, p. 1213–1243, 1998.

MASULIS, R. W.; WANG, C.; XIE, F. Corporate Governance and Acquirer Returns. **The Journal of Finance**, v. 62, n. 4, p. 1851–1889, 2007.

MAUPIN, R. J.; BIDWELL, C. M.; ORTEGREN, A. K. An Empirical Investigation of the Characteristics of Publicly-Quoted Corporations Which Change to Closely-Held Ownership Through Management Buyouts. **Journal of Business Finance & Accounting**, v. 11, n. 4, p. 435–450, 1984.

MELLO, A. S.; PARSONS, J. E. Measuring the Agency Cost of Debt. **The Journal of Finance**, v. 47, n. 5, p. 1887–1904, 1992.

MERTON, R. C. On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. **The Journal of Finance**, v. 29, n. 2, p. 449–470, 1974.

_____. On the Pricing of Contingent Claims and the Modigliani-Miller Theorem. **Journal of Financial Economics**, v. 5, n. 2, p. 241–249, 1977.

MIZRUCHI, M. S. Berle and Means Revisited: The Governance and Power of Large U.S. Corporations. **Theory and Society**, v. 33, n. 5, p. 579–617, 2004.

MORELLEC, E. Can Managerial Discretion Explain Observed Leverage Ratios? **The Review of Financial Studies**, v. 17, n. 1, p. 257–294, 2004.

MYERS, S. C. Determinants of Corporate Borrowing. **Journal of Financial Economics**, v. 5, n. 2, p. 147–175, 1977.

NOHEL, T.; TARHAN, V. Share Repurchases and Firm Performance: New Evidence on the Agency Costs of Free Cash Flow. **Journal of Financial Economics**, v. 49, n. 2, p. 187–222, 1998.

OPLER, T.; TITMAN, S. The Determinants of Leveraged Buyout Activity: Free Cash Flow vs. Financial Distress Costs. **The Journal of Finance**, v. 48, n. 5, p. 1985–1999, 1993.

PARRINO, R.; WEISBACH, M. S. Measuring Investment Distortions Arising from Stockholder-Bondholder Conflicts. **Journal of Financial Economics**, v. 53, n. 1, p. 3–42, 1999.

PERFECT, S. B.; PETERSON, D. R.; PETERSON, P. P. Self-Tender Offers: The Effects of Free Cash Flow, Cash Flow Signalling, and the Measurement of Tobin's q. **Journal of Banking and Finance**, v. 19, n. 6, p. 1005–1023, 1995.

ROSS, S. A. The Economic Theory of Agency: The Principal's Problem. **The American Economic Review**, v. 63, n. 2, p. 134–139, 1973.

ROZEFF, M. S. Growth, Beta, and Agency Costs as Determinants of Dividend Payout Ratios. **The Journal of Financial Research**, v. 5, n. 3, p. 249–259, 1982.

SCHLINGEMANN, F. P. Financing Decisions and Bidder Gains. **Journal of Corporate Finance**, v. 10, n. 5, p. 683–701, 2004.

SERVAES, H. Do Takeover Targets Overinvest? **The Review of Financial Studies**, v. 7, n. 2, p. 253–277, 1994.

SHLEIFER, A.; VISHNY, R. W. A Survey of Corporate Governance. **The Journal of Finance**, v. 52, n. 2, p. 737–783, 1997.

SINGH, M.; DAVIDSON III, W. N. Agency Costs, Ownership Structure, and Corporate Governance Mechanisms. **Journal of Banking and Finance**, v. 27, n. 5, p. 793–816, 2003.

SMITH, C. W.; WARNER, J. B. On Financial Contracting: An Analysis of Bond Covenants. **Journal of Financial Economics**, v. 7, n. 2, p. 117–161, 1979.

STULZ, R. M. Managerial Discretion and Optimal Financing Policies. **Journal of Financial Economics**, v. 26, n. 1, p. 3–27, 1990.

THATCHER, J. S. The Choice of Call Provision Terms: Evidence on the Existence of Agency Costs of Debt. **The Journal of Finance**, v. 40, n. 2, p. 549–561, 1985.

APPENDIX D – Credit risk and Cash Holdings

He and Xiong (2012) assume that there are no transaction costs when issuing new stocks. There exits a dilution effect that lowers the value of existing shares. The absence of such costs allows shareholders to inject as much capital as needed to absorb rollover losses. Indeed, existing studies assume that equity holders have great financial resources and absorb rollover losses (HE; XIONG, 2012; HE; MILBRADT, 2016) or that companies sell assets to meet debt payments (BRUNNERMEIER; YOGO, 2009). Assuming that companies can issue new stocks at no costs, structural models of rollover risk consider the market price of liquidity to be zero. That's why such models don't take into consideration cash holdings in their analyses, the optimal level of cash holdings being zero (ACHARYA; HUANG, et al., 2006). However, in practice, companies can use liquid assets or cash holdings to refinance their debt. Such practices have received empirical support: Harford, Klasa, and Maxwell (2014) show that companies keep cash holdings because of the existence of rollover risk. When focusing only on market liquidity, He and Xiong forgot an indirect channel through which internal liquidity interacts with external liquidity: the deterioration of firm's fundamentals. That deterioration affects both debt and equity, thus increasing rollover losses.

Based on the evidence that underwriter spreads form a U-shaped function of the amount of capital raised (ALTINKILIÇ; HANSEN, 2000), Leary and Roberts (2005) demonstrate that firms suffer from adjustment costs for equity and debt. Both issuance costs contain a fixed and convex cost component, with fixed costs and convexity being greater for equity. The consequence is that equity issues happen less frequently but are larger in size. A trade-off appears between equity and debt, the capital structure could be adjusted by reducing debt and the resulting firm's leverage or issuing costly equity. Kuehn and Schmid (2014) show that equity adjustment costs are the key financial friction as removing equity issuance costs makes it cheaper for the firm to rollover maturing debt and cover cash shortfalls. Finally, the optimal capital structure in a static model such as He and Xiong's has important implications as initial leverage is a key component of future capital structure and most of the variation in capital structure is time-invariant (LEMMON; ROBERTS; ZENDER, 2008).

Equity issuance costs give incentives for the firm to build up liquidity buffers to absorb operating and rollover losses (BOLTON; CHEN; WANG, 2011, 2013; DELLA SETA; MORELLEC; ZUCCHI, 2020). Besides offering a protection against future adverse liquidity shocks (precautionary motive), cash holdings reduce transaction costs associated with asset sales (transaction motive). Cash holdings also reduce bankruptcy costs and protect creditors from costly liquidation. While, in practice, managers could use cash holdings to

pay dividends to shareholders, creditors use bond covenants to shield themselves against managers' deviant actions. In addition, holding cash reserves involves some costs: a cost of opportunity as companies could use these reserves to invest in projects (WRIGHTSMAN; TERNINKO, 1971), an agency cost and costs related to fiscal distortions (GRAHAM, 2000). Consistent with the fact that there exists a trade-off between costs and benefits associated with holding cash reserves, Opler et al. (1999) show that companies have an optimal level of cash holdings to reach and adjust their reserves in order to achieve that level. Assuming that companies have optimal cash holdings, a new channel appears when cash holdings decrease, amplifying rollover losses. As shown by Della Seta, Morellec, and Zucchi (2020), such decrease results in lower debt value and higher rollover losses, which further depress cash reserves. Rollover risk is a key determinant of cash holdings, which are used to mitigate it (HARFORD; KLASA; MAXWELL, 2014). While theoretically, firms could use both cash holdings and credit lines to compensate for rollover losses, the authors demonstrate that financially constrained firms are less likely to use credit lines as a substitute for cash holdings. Finally, Lins, Servaes, and Tufano (2010) conclude that cash reserves are used as a protection against liquidity shocks while credit lines are used to seize future growing opportunities.

Empirical studies demonstrated that companies have increased their cash reserves recently (BATES; KAHLE; STULZ, 2009). To explain corporate excessive cash holdings, academic researchers conducted various analyses of the determinants of cash holdings. The literature acknowledged various determinants and emphasized the importance of a few ones: precautionary motive, transaction motive, fiscal motive and agency motive. According to the precautionary motive, companies build up cash reserves to deal with adverse shocks when external financing is costly (HAN; QIU, 2007). The transaction motive states that companies build up cash reserves to lower transaction costs. When financing is costly, companies can use internal funds to reduce transaction costs. For example, the agency theory recognizes that external financing using either debt and equity is associated with some agency costs. According to the fiscal motive, companies keep higher cash reserves when facing negative fiscal consequences related to the repatriation of foreign income (FOLEY et al., 2007). Agency conflicts between managers, shareholders, and creditors also influence cash holdings due to agency costs. Even though cash holdings can be valuable to the firm, such holdings can also be detrimental by increasing managers' empire-building practices or managerial entrenchment. In line with this view, Faulkender and Wang (2006) show that the marginal value of cash is negatively related to the amount of cash and leverage, and it is positively related to external financing costs.

In spite of the substantial interest shown by researchers in the role of corporate cash holdings in capital structure, very few studies examined the impact of cash holdings on credit risk and rollover losses. To my knowledge, there exists only one study that focuses on cash holdings and rollover risk: Della Seta, Morellec, and Zucchi (2020). Their paper creates

a dynamic model with financing frictions and time-varying financing opportunities to examine the relation between debt maturity, cash holdings, and credit risk. Managers choose the dividend policy, the financing policy and the cash policy endogenously. Della Seta, Morellec, and Zucchi (2020) show that operational loss can add to rollover risk. A negative shock on the firm's cash flows leads to a decrease in cash holdings, which in turn increase rollover losses due to deterioration of firm's fundamentals. The amplification mechanism becomes stronger as debt maturity lowers. This mechanism isn't unique because cash flow deterioration may lower debt maturity and amplify rollover risk (HE; MILBRADT, 2016). Furthermore, the authors state that companies on the verge of bankruptcy with short-term debt can experience rollover losses higher than their cash flows. In such a case, the company burns its cash holdings to finance rollover losses. This scenario is called "rollover trap" and increases both shareholders and equity holders' risk appetite.

Some studies examined interactions between cash holdings and credit risk with no considerations for rollover risk. Acharya, Huang, et al. (2006) examined the extent to which cash holdings affect strategic debt service and the resulting credit. Previous studies used strong hypotheses that limited the impact of optimal cash management. When issuance costs are high, companies can use cash reserves to prevent bankruptcy and costly liquidation. However, it comes at a cost for equity holders because, in case of bankruptcy, creditors take over the company and get cash reserves. Equity holders could decide to serve debt strategically to keep benefiting from cash reserves in the case of a successful bargaining with creditors. Acharya, Huang, et al. (2006) proved that strategic debt service has a reduced effect when equity issuance costs are high, and that, surprisingly, bond spreads decrease in that case. The effect is stronger for lower external financing costs and causes bond spreads to increase. More recently, Acharya, Davydenko, and Strebulaev (2012) developed a model of optimal cash policy with bankruptcy costs, external financing frictions and absence of commitment regarding future cash flows. In their model, factors that affect credit risk impact bond spreads and default probabilities in two ways. First, when both depend on these factors, a slight change in one of these factors has a direct influence on both bond spreads and default probabilities (direct effect). Second, the slight change can lead to changes in cash cash holdings, which in turn affects bond spreads and default probabilities (indirect effect). Cash holdings variations induced by factors related to credit risk are positively correlated to bond spreads and default probabilities on the long-term, the indirect effect being stronger. On the contrary, independent variations in cash holdings are negatively correlated to bond spreads and default probabilities.

References

ACHARYA, V.; DAVYDENKO, S. A.; STREBULAEV, I. A. Cash Holdings and Credit Risk. **The Review of Financial Studies**, v. 25, n. 12, p. 3572–3609, 2012.

ACHARYA, V.; HUANG, J., et al. When Does Strategic Debt Service Matter? **Economic Theory**, v. 29, n. 2, p. 363–378, 2006.

ALTINKILIÇ, O.; HANSEN, R. S. Are There Economies of Scale in Underwriting Fees? Evidence of Rising Financing Costs. **The Review of Financial Studies**, v. 13, n. 1, p. 191–218, 2000.

BATES, T. W.; KAHLE, K. M.; STULZ, R. M. Why Do U.S. Firms Hold So Much More Cash Than They Used To? **The Journal of Finance**, v. 64, n. 5, p. 1985–2021, 2009.

BOLTON, P.; CHEN, H.; WANG, N. A Unified Theory of Tobin's Q, Corporate Investment, Financing, and Risk Management. **The Journal of Finance**, v. 66, n. 5, p. 1545–1578, 2011.

_____. Market Timing, Investment, and Risk Management. **Journal of Financial Economics**, v. 109, n. 1, p. 40–62, 2013.

BRUNNERMEIER, M. K.; YOGO, M. A Note on Liquidity Risk Management. **American Economic Review**, v. 99, n. 2, p. 578–583, 2009.

DELLA SETA, M.; MORELLEC, E.; ZUCCHI, F. Short-Term Debt and Incentives for Risk-Taking. **Journal of Financial Economics**, v. 137, n. 1, p. 179–203, 2020.

FAULKENDER, M.; WANG, R. Corporate Financial Policy and The Value of Cash. **The Journal of Finance**, v. 61, n. 4, p. 1957–1990, 2006.

FOLEY, C. F. et al. Why Do Firms Hold So Much Cash? A Tax-Based Explanation. **Journal of Financial Economics**, v. 86, n. 3, p. 579–607, 2007.

GRAHAM, J. R. The Motivation and Impact of Pension Fund Activism. **The Journal of Finance**, v. 55, n. 5, p. 1901–1941, 2000.

HAN, S.; QIU, J. Corporate Precautionary Cash Holdings. **Journal of Corporate Finance**, v. 13, n. 1, p. 43–57, 2007.

HARFORD, J.; KLASA, S.; MAXWELL, W. F. Refinancing Risk and Cash Holdings. **The Journal of Finance**, v. 69, n. 3, p. 975–1012, 2014.

HE, Z.; MILBRADT, K. Dynamic Debt Maturity. **The Review of Financial Studies**, v. 29, n. 10, p. 2677–2736, 2016.

HE, Z.; XIONG, W. Rollover Risk and Credit Risk. **The Journal of Finance**, v. 67, n. 2, p. 391–430, 2012.

KUEHN, L.-A.; SCHMID, L. Investment-Based Corporate Bond Pricing. **The Journal of Finance**, v. 69, n. 6, p. 2741–2776, 2014.

LEARY, M. T.; ROBERTS, M. R. Do Firms Rebalance Their Capital Structures? **The Journal of Finance**, v. 60, n. 6, p. 2575–2619, 2005.

LEMMON, M. L.; ROBERTS, M. R.; ZENDER, J. F. Back to the Beginning: Persistence and the Cross-Section of Corporate Capital Structure. **The Journal of Finance**, v. 63, n. 4, p. 1575–1608, 2008.

LINS, K. V.; SERVAES, H.; TUFANO, P. What Drives Corporate Liquidity? An International Survey of Cash Holdings and Lines of Credit. **Journal of Financial Economics**, v. 98, n. 1, p. 160–176, 2010.

OPLER, T. et al. The Determinants and Implications of Corporate Cash Holdings. **Journal of Financial Economics**, v. 52, n. 1, p. 3–46, 1999.

WRIGHTSMAN, D.; TERNINKO, J. The Motivation and Impact of Pension Fund Activism. **The Journal of Finance**, v. 26, n. 4, p. 947–950, 1971.