1-17-2022

Unintended Consequences of the Dodd–Frank Act on Credit Rating Risk and Corporate Finance

Bina Sharma

Binay K. Adhikari

Anup Agrawal

Bruno R. Arthur
The University of Texas Rio Grande Valley, bruno.arthur@utrgv.edu

Monika K. Rabarison
The University of Texas Rio Grande Valley

Recommended Citation

Sharma, B., Adhikari, B., Agrawal, A., Arthur, B., & Rabarison, M. (2022). Unintended Consequences of the Dodd–Frank Act on Credit Rating Risk and Corporate Finance. Journal of Financial and Quantitative Analysis, 1-38. doi:10.1017/S0022109021000831

JOURNAL OF FINANCIAL AND QUANTITATIVE ANALYSIS

doi:10.1017/S0022109021000831

Unintended Consequences of the Dodd–Frank Act on Credit Rating Risk and Corporate Finance

Bina Sharma
Bellevue University College of Business
bisharma@bellevue.edu

Binay K. Adhikari
University of Texas at San Antonio Alvarez College of Business
binay.adhikari@utsa.edu

Anup Agrawal
University of Alabama Culverhouse College of Business
aagrawal@cba.ua.edu (corresponding author)

Bruno R. Arthur
University of Texas at Rio Grande Valley Vackar College of Business and Entrepreneurship
bruno.arthur@utrgv.edu

Monika K. Rabarison
University of Texas at Rio Grande Valley Vackar College of Business and Entrepreneurship
monika.rabarison@utrgv.edu

Abstract

Prior research finds that Dodd–Frank Act's regulations on credit rating agencies (CRAs) increase rated firms' risk of rating downgrades, regardless of their credit quality. Our difference-in-difference estimates suggest that after Dodd–Frank, low-rated firms, which face steep costs from a further downgrade, significantly reduce their debt issuance and investments compared to similar unrated firms. Our results are not driven by credit supply or the financial crisis. They reveal an unintended consequence of Dodd–Frank: Greater regulatory pressure on CRAs leads to negative spillover effects on firms concerned about credit ratings, regardless of their credit quality.

I. Introduction

Credit ratings play an important role in market participants' decisions about lending, investing, and managing credit risks. Credit ratings are also important for firms' financial decisions. For instance, Graham and Harvey's (2001) survey finds

We thank Mehran Azimi, Alex Butler, David Cicero, Soroush Ghazi, Incheol Kim, Sandy Klasa, Lei Kong, Mina Lee, and conference and seminar participants at the FIRS-Savannah and the Universities of Alabama, New Orleans, and Texas Rio Grande Valley for useful comments. Special thanks are due to an anonymous referee and to Jarrad Harford (the editor) for helpful suggestions. Agrawal acknowledges research support from the William A. Powell, Jr. Chair in Finance and Banking. Earlier drafts of the article were called "Dodd–Frank Act, Credit Rating Agencies and Corporate Financing and Investment Decisions."

that a majority (57%) of CFOs consider credit ratings as important or very important in deciding the amount of debt financing. Numerous reports in the news media also support the view that firms take preemptive financial decisions to protect their credit ratings.[1] Manso (2013) warns that credit rating downgrades can create feedback loops that affect a firm's solvency and threaten its survival (e.g., lower ratings → higher interest rates → optimal default decision → lower ratings).

Despite their key role in financial markets, credit rating agencies (CRAs) sometimes make mistakes, which can have serious consequences for the financial sector (see, e.g., White (2010)). The recent financial crisis has sparked renewed interest in credit ratings and CRAs, mainly because of their role in the ratings of structured financial products. But even before that, credit ratings have been frequently criticized for being inflated, riddled with conflicts of interests, and even uninformative and inaccurate (see, e.g., Jeon and Lovo (2013)).

The upshot is that even though credit ratings may be flawed, they can have tremendous implications for financial market participants. Several studies have examined how credit ratings affect firm value and policies, but most of them do so by using the levels of, or changes in, firms' existing credit ratings.[2] In general, it is challenging to separate the effect of credit ratings per se from the effect of credit risks because they are correlated. In this study, we exploit the passage of the Dodd–Frank Wall Street Reform and Consumer Protection Act (henceforth, Dodd–Frank), which increased the risk of credit rating downgrades for firms, even without a change in their underlying credit quality (see Dimitrov, Palia, and Tang (DPT) (2015)). We examine whether this effect of Dodd–Frank affected the financing and investment policies of some firms for which credit rating downgrades, regardless of fundamentals, are particularly costly.

In response to the 2008–2009 financial crisis, the U.S. Congress passed Dodd–Frank in 2010 to prevent another financial crisis. Dodd–Frank enacted sweeping new regulations to many parts of the financial services industry. CRAs came under fire and became a significant subject of Dodd–Frank because their ratings of structured financial products were believed to be an important contributor to the financial crisis. Many provisions of Dodd–Frank subject CRAs to much stricter regulations, as we discuss in more detail in Section IIIA. For example, the law makes it easier to bring private lawsuits against CRAs for issuing faulty credit ratings. The law also gives the Securities and Exchange Commission (SEC) substantially greater power to impose sanctions on CRAs for potential wrongdoing, including the ability to effectively derecognize their ratings.

[1]For example, the *Wall Street Journal* (2001) reports AT&T's plans for shrinking debt to avoid rating downgrades by selling some of their cable systems and their stake in Japan Telecom. The *New York Times* (2009) reports GE's decision to cut dividends and preserve cash partly because of the concern that the main rating agencies would lower the company's credit rating.

[2]Prior studies examine the effects of ratings on stock and bond prices (see, e.g., Hand, Holthausen, and Leftwich (1992), Ederington and Goh (1998), and Kisgen and Strahan (2010)), debt and equity issuance (see, e.g., Kisgen (2006), (2009)), debt structure and specialization (see, e.g., Rauh and Sufi (2010), Colla, Ippolito, and Li (2013)), and local credit supply (see Adhikari, Cicero, and Sulaeman (2021)). Kisgen (2006) exploits the features of existing ratings to separate the effect of credit ratings from credit risk.

As DPT (2015) argue, these reforms were intended to improve the quality of credit ratings by encouraging CRAs to invest more in due diligence, improve their rating methods, monitor their analysts, and strengthen internal controls. However, as Goel and Thakor (2011) suggest, the penalty for issuing erroneous credit ratings tends to be asymmetric because CRAs are more likely to be penalized for issuing optimistic ratings than for pessimistic ratings.[3] DPT find that CRAs were able to circumvent much of the additional regulatory cost imposed by Dodd–Frank by exploiting this simple insight. They empirically show that CRAs responded to these regulations with "cheap fixes" by simply issuing lower credit ratings, possibly below the levels justified by firm fundamentals. After Dodd–Frank, CRAs issue more pessimistic credit ratings, which are less informative and contain more false warnings of default. DPT document strong evidence of how Dodd–Frank changed the incentives and behavior of CRAs. Because credit ratings play a critical role in many firms' financial decisions, an important follow-up question is whether and how this change in CRAs' incentives, in turn, affects financing and investing decisions of firms rated by these agencies. To the best of our knowledge, there is no systematic evidence on this issue.

We attempt to fill this important gap in the literature. We exploit the passage of Dodd–Frank into federal law as an exogenous shock to the risk of firms' credit rating downgrades. We examine whether this risk influences the financing and investment policies of firms most affected by them. One strength of our approach is that it allows us to cleanly identify the causal effect of *ratings* on firm policies because Dodd–Frank increased the risk of credit rating downgrades, even without a change in firms' underlying credit quality. Our identification strategy relies on the fact that, in general, below-investment-grade (henceforth, low-rated) firms face much steeper costs of rating downgrades, so they are more likely to respond to an increased risk of downgrades than other firms. (We discuss this issue in more detail in Section II.) Our inferences are based on variation in firms' ex ante risk of downgrades and do not depend on whether these firms are actually downgraded. We test this hypothesis against a null hypothesis that there is no difference in financing and investment decisions between these 2 groups of firms because credit markets understand the changing incentives of CRAs, so firms do not expect to be adversely affected by downgrades that happen after Dodd–Frank.

Using both the full sample and a sample of carefully matched firms, we find that after Dodd–Frank, low-rated firms (i.e., the treated group) issue significantly less debt than a similar group of unrated firms (i.e., the control group), which are not affected by the risk of rating downgrades.[4] The reduction in debt issues is not offset by an increase in equity issues, forcing these firms to cut back their net investment. The economic magnitudes of these effects are substantial. Based on the full sample, the decline in net new security issues (net investments) represents an 85% (24%) reduction for low-rated firms after the shock compared to their unconditional preshock averages. Our results are consistent with the notion that increased concern

[3]In a related article, Goel and Thakor (2015) theoretically explain CRAs' choice of a coarse rating scale as a trade-off between their incentives for rating inflation and accuracy.

[4]We find generally similar results when we use investment-grade firms as an alternative control group. We discuss our choice of treatment and control firms in more detail in Section II.

about potential downgrades, even without a change in the underlying credit quality, forced noninvestment-grade firms to reduce debt issuance and cut back on investments. This is an unintended consequence of Dodd–Frank.

We consider and test several alternative supply-side explanations of our main results stemming from the fact that the Dodd–Frank Act and the financial crisis that preceded it affected many aspects of the financial system apart from CRAs. These tests try to separate the effect of credit rating risks from other possible confounding effects.[5] One alternative "better information" hypothesis posits that CRAs become more careful after Dodd–Frank, issuing more informative ratings, and that results in disproportionally more downgrades for low-rated firms. Under this story, the revelation of these firms' poorer credit quality, rather than their ratings per se, makes lenders less willing to lend to these firms. A second alternative "credit supply shock" story is that Dodd–Frank affected banks' incentives and ability to lend because it introduced regulations on banks' asset holdings, disclosure, governance, securitization, etc. Third, the financial crisis affected the liquidity and demand for corporate bonds, especially speculative-grade bonds. Therefore, our results may be driven by shocks to the supply of debt capital (bank loans and bonds), which may have affected our 2 groups of firms differently. Moreover, these differential effects may have lingered during the postcrisis years.

We conduct several cross-sectional tests, each of which examines one or more of these supply-side stories. First, we use Kisgen's (2006) plus or minus (POM) test, which exploits the features of existing ratings to separate the effects of underlying credit risk from the risk of a rating downgrade. These POM tests reveal that Dodd–Frank's effects on debt issuance are largely driven by a demand effect (i.e., firms refrain from issuing debt to guard against the risk of a downgrade). Second, we investigate whether the risk of being downgraded is made worse by negative liquidity shocks to the junk bond market, which would support the credit supply shock story. Following Chernenko and Sunderam (2012), we measure negative liquidity shocks to the corporate junk bond market by the aggregate net outflow of funds to junk bond mutual funds. We find no significant effect of these adverse liquidity shocks on debt issuance by treatment firms. This result does not support the credit supply shock explanation of our results. Third, we find that low-rated firms reduce both public (bond) and private (e.g., bank) debt, which indicates these firms' (demand side) decision to reduce debt. Because ratings are more important for public bonds than private debt, the information hypothesis would predict a reduction in public debt only, which is a supply-side effect. Fourth, our results remain robust after controlling for the possibility that low-rated and unrated firms differ in their reliance on bank debt. A final test suggests that treatment firms' response to Dodd–Frank cannot be explained by their differential exposure to the lingering effects of the financial crisis compared to control firms.

We further find that treatment firms' responses to Dodd–Frank vary with the importance of debt capital to them. For instance, Dodd–Frank leads to a sharper decrease in debt issuance and investments for low-rated firms that exhibit a higher demand for debt capital before Dodd–Frank. Moreover, Dodd–Frank's effects are attenuated in the presence of institutional investors, which make firms less

[5]We discuss these tests in detail in Section VI.

dependent on debt (e.g., Grennan, Michaely, and Vincent (2017)). Both these results also favor our demand-side story.

This study contributes to several strands of the literature. First, it contributes to the literature on the effects of Dodd–Frank. Our article is closely related to DPT (2015), who show that Dodd–Frank distorts CRAs' incentives and makes them more inclined to issue lower credit ratings, below those justified by the underlying credit risks. We offer an important extension to DPT's study by uncovering Dodd–Frank's effect on corporate policies and behavior.

Second, this article contributes to the literature on the unintended consequences of regulation. For example, prior studies uncover unintended effects of the SEC's short-swing rule on insider trading in takeover targets (see Agrawal and Jaffe (1995)), the Sarbanes–Oxley Act (SOX) on the demand and supply of directors (see Linck, Netter, and Yang (2009)), the small firm exemption of SOX on firm size (Gao, Wu, and Zimmerman (2009)), the adoption of International Financial Reporting Standards (IFRS) on contractual outcomes (Brüggemann, Hitz, and Sellhorn (2013)), and Dodd–Frank Act on credit ratings (DPT (2015)). All these studies examine the effects of regulations on firms that are *directly* targeted by the rules. Our novel evidence that Dodd–Frank's rule targeting CRAs indirectly influenced the decisions of a wide swath of public companies shows that regulatory changes can have widespread spillover effects, which policymakers need to consider.

Third, the article contributes to the emerging empirical literature that exploits exogenous shocks to firms' credit ratings that happen without any change in the underlying credit risk to study the importance of credit ratings per se for firm policies. The shock in Tang (2009) is Moody's credit rating refinements that attached numerical modifiers to broad rating classes. Almeida, Cunha, Ferreira, and Restrepo (2017) use the shock to firms' credit ratings caused by sovereign rating downgrades, given rating agencies' policies that require firms' ratings to be at or below the sovereign rating of their country of domicile. We add to this line of research by exploiting an exogenous regulatory event that led to an increase in the ex ante probability of being downgraded, without a change in the underlying credit risk. Finally, the article contributes to the literature on asymmetric effects of credit rating uncertainty on investment and noninvestment-grade firms (see, e.g., Kisgen (2006), Jorion and Zhang (2007), and May (2010)).

II. Treatment and Control Groups

Which firms are likely to be most affected by Dodd–Frank's regulations on CRAs? Although provisions of Dodd–Frank apply to all credit ratings assigned by CRAs, numerous studies have shown that changes in credit ratings affect lower-rated firms considerably more than higher-rated ones.[6] For instance, Jorion and

[6]See, for example, Katz (1974), Griffin and Sanvicente (1982), Holthausen and Leftwich (1986), Cornell, Landsman, and Shapiro (1989), Hand, Holthausen, and Leftwich (1992), Hull, Predescu, and White (2004), Jorion, Liu, and Shi (2005), and May (2010). The literature points to 2 main reasons for this nonuniform effect of credit ratings. First, noninvestment-grade bonds face the most significant liquidity issues, mainly because regulations prohibit many institutional investors from investing in them. Second, noninvestment-grade bonds also face higher regulatory scrutiny and uncertainty (see, e.g., Lemmon and Roberts (2010)).

Zhang (2007) show that credit rating downgrades lead to large negative market reactions among firms with lower prior credit ratings and virtually no effect on higher-rated firms. May (2010) finds a stronger market reaction to rating changes in bond markets among speculative-rated firms. Kisgen's (2006) tests reveal that ex ante credit rating concerns affect debt issuance decisions of low-rated firms much more than those of investment-grade firms.

Rating downgrades affect some firms much more than others because the differences in default rates, and hence the cost of capital, between adjacent ratings are much larger among low-rated firms than among investment-grade firms. For instance, Hamilton and Cantor (2005) estimate a 3-year cumulative default probability among Aaa, Aa, A, Baa, Ba, and B rated issuers in a stable outlook to be 0%, 0%, 0.44%, 1.24%, 4.64%, and 17.86%, respectively. Clearly, the consequence of being downgraded from Ba to B is much more severe than being downgraded from Aa to A for ex ante default risk. Similarly, Jorion and Zhang's (2007) estimates show that the difference in default probabilities between the firms with AA+ and AA ratings is 0.3 percentage points, whereas this difference between BB+ and BB is a whopping 4.7 percentage points, or about 15 times as large. This vast skewness in default probabilities faced by firms in different rating classes is also reflected in the differences in their cost of debt. For instance, Damodaran's estimates suggest that in 2013, borrowers rated A paid a mere 15 basis points more than A+ rated borrowers in default spreads on average. On the other hand, this difference between B+ and B rated borrowers was about 100 basis points.[7] The fact that low-rated firms face a massively steeper cost of rating downgrades makes them an ideal treatment group for this study, which focuses on the increased ex ante risk of downgrades due to Dodd–Frank.[8]

We follow prior studies (e.g., Lemmon and Roberts (2010)) and use firms without credit ratings as the control group. Because unrated firms face no risk of credit rating downgrades, they serve as the cleanest benchmark for isolating the differences that arise purely due to credit rating shocks, after controlling for other differences that are important for financing and investment decisions. For robustness, we also experiment with investment-grade firms as the control group and find generally similar results.

III. Background, Related Literature, and Hypothesis Development

A. Dodd–Frank and Regulation of CRAs

Dodd–Frank was signed into federal law by President Barack Obama on July 21, 2010, as a response to the financial crisis of 2008–2009. Dodd–Frank imposes

[7]Source: Professor Aswath Damodaran's website: http://www.stern.nyu.edu/~adamodar/pc/archives/bondspreads13.xls.

[8]Note that firms rated BBB− arguably also are a candidate for our treatment group. They are in the lowest end of investment-grade rating, so presumably the consequence of a one notch downgrade to junk status is very high for them. However, we argue that compared to the decision of downgrading a firm *within* investment or junk category, CRAs are likely to face a stronger backlash for downgrading an investment-grade firm to junk grade, unless it is strongly justified by its underlying credit quality. Therefore, we do not include firms rated BBB− in our main treatment group. However, including BBB− rated firms in the treatment group does not change our results qualitatively.

several new regulations on banks, nonbank financial companies, and CRAs. CRAs became a primary target of Dodd–Frank because inaccurate and inflated ratings of structured financial products, especially subprime mortgages, are believed to have been an important factor that contributed to the crisis.

Specifically, Sections 931–939 of Title IX (Investor Protections and Improvements to the Regulations of Securities), Subtitle C (Improvements to the Regulation of Credit Rating Agencies) introduce several new rules for CRAs and nationally recognized statistical rating agencies (NRSROs).[9] Most of these rules became effective immediately, so they likely affected CRAs' behavior right away. These rules emphasize that because of the systemic importance of credit ratings, functions of CRAs and NRSROs are matters of "national public interest." Therefore, these agencies' roles should be subject to the same higher standard of public oversight, accountability, and liability as auditors, security analysts, and investment bankers.

Greater liability and regulatory penalties are arguably the two most sweeping changes brought about by Dodd–Frank concerning CRAs.[10] Regarding the former, Dodd–Frank makes it much easier to bring private lawsuits against CRAs under Rule 10b-5 of the securities law for failing to conduct a reasonable investigation of securities they rate and issuing erroneous credit ratings. CRAs are subject to greater disclosure of their internal controls, rating methodologies, due diligence, and verification of the accuracy of already assigned ratings. These provisions also instruct the SEC to establish an Office of Credit Ratings to monitor the CRAs' internal control systems and rating procedures. Section 932 gives the SEC greater power to suspend or revoke an NRSRO's registration of a particular class of securities for issuing inaccurate ratings.

B. Related Literature and Hypotheses

How do CRAs respond to Dodd–Frank's sweeping new rules? DPT (2015) argue that since CRAs are rarely accused of issuing pessimistic ratings, they can effectively circumvent Section 932 by issuing slightly pessimistic ratings. Our study builds on DPT, who find that after Dodd–Frank, CRAs started issuing more pessimistic ratings, regardless of the borrower's underlying credit quality. Our hypotheses are also guided by Kisgen's (2006) credit rating–capital structure (CR-CS) theory and empirical evidence, as we discuss below.

The traditional trade-off theory of capital structure postulates that firms optimize their capital structures based on the trade-off between the benefits (e.g., interest tax shield and governance) and costs (e.g., bankruptcy risk) of debt. The trade-off theory predicts an inverse U-shaped curve for the relation between debt ratio and firm value. On the other hand, the CR-CS theory argues that ratings convey information on firm quality beyond other publicly available information. Therefore, rating changes can trigger events that lead to discrete changes in costs or

[9]An NRSRO is a CRA that issues credit ratings that the SEC recognizes for certain regulatory purposes such as ease of bond issuance by firms and meeting certain financial firms' net capital requirements or reserves. See SEC (2003) and Kisgen and Strahan (2010) for more detailed descriptions of these rules.

[10]See DPT ((2015), Appendix A) for a more detailed summary of these provisions.

benefits for firms, partly because regulators, investors, and other stakeholders (e.g., suppliers and contractors) often depend on credit ratings to deal with a firm.

As shown by Kisgen, credit rating effects add discrete breaks in the "debt-ratio firm-value" curve predicted by the traditional trade-off theory of capital structure. An important implication of the CR-CS theory is that 2 identical firms with similar underlying credit quality, but different credit ratings, can end up with significantly different optimal debt levels. Specifically, the risk of being downgraded often makes the optimal debt level lower than that predicted by the traditional trade-off theory. Moreover, as discussed in Section II, the cost of being downgraded is generally trivial for investment-grade firms,[11] but quite significant for low-rated firms (e.g., Hamilton and Cantor (2005), Jorion and Zhang (2007), and May (2010)). Therefore, low-rated firms are much more likely to respond to an increase in downgrade risk. These arguments and findings suggest our first hypothesis:

Hypothesis 1. Low-rated firms reduce net debt issues after the adoption of the Dodd–Frank Act to protect their credit ratings.

However, DPT find that after Dodd–Frank, CRAs issue less informative credit ratings, which contain more false warnings of default. If borrowers and credit markets acknowledge this changing behavior of CRAs, a null hypothesis is that Dodd–Frank does not affect the debt issuance decisions of these 2 groups of firms differently.

A firm that is compelled to reduce debt financing has two main choices: either to issue equity to continue with the same level of investments or to reduce investments. For several reasons, we do not expect low-rated firms to substitute equity for debt. First, while Dodd–Frank made debt financing costlier, it is unlikely to have changed a firm's investment opportunity set. So, for the same opportunity set, higher a cost of debt likely renders some previously feasible projects infeasible (i.e., turns them from positive net present value (NPV) to negative NPV). Because equity is generally more expensive than debt, substituting for equity is also unlikely to increase the feasible set of investments. Second, it has always been more difficult for low-rated firms to switch to equity financing (see, e.g., Lemmon and Roberts (2010)). This happens because, in general, bad news for bond markets is also bad news for equity markets, especially for lower-rated firms (see, e.g., Kwan (1996), Jorion and Zhang (2007)). So, higher downgrade risk after Dodd–Frank is unlikely to have improved these firms' access to equity markets. Moreover, Kadapakkam, Meisami, and Wald (2016) show that because of a wealth transfer effect, low-rated firms are not able to issue new equity when their outstanding debt becomes riskier. These arguments and findings suggest our second hypothesis:

Hypothesis 2. Low-rated firms reduce net investments due to the reduction in debt financing after the adoption of the Dodd–Frank Act.

[11] Except perhaps when they are downgraded to speculative grade, which is infrequent and unlikely to happen purely to circumvent Dodd–Frank's regulations. To deal with this issue, we follow Lemmon and Roberts (2010) and require the sample firms not to switch from investment grade to speculative grade or vice versa during the sample period.

A null hypothesis is that low-rated firms do not reduce net investments because, for reasons discussed earlier, they are not forced to reduce debt issuance.

IV. Data and Summary Statistics

A. Sample Description

Our empirical strategy largely builds on Lemmon and Roberts (2010), so we follow an approach similar to theirs to select our sample and design some of our tests. We consider July 2010, when Dodd–Frank passed, as our event date. Our sample period starts in 2005 and ends in 2015 so that we have a balanced time frame around the passage of Dodd–Frank. We obtain S&P domestic long-term issuer credit ratings from Compustat and supplement these with Moody's and Fitch's bond ratings obtained from Mergent Online database. Table A1 in the Appendix presents a short description of the credit ratings assigned by these 3 agencies. We define a firm as unrated if it does not have a credit rating from any of these agencies. Following the industry convention and prior literature, we consider credit ratings of AAA to BBB− (or equivalent) as investment grade and BB+ to C (or equivalent) as below-investment (also called noninvestment or speculative) grade.[12] We drop firms assigned "D" and "SD" from the sample because these ratings are assigned to firms currently in default on their financial obligations.

We obtain financial and stock price information from Compustat/CRSP merged database. We exclude financial and utility firms from the sample because these industries are highly regulated. We require all firm-year observations to have nonmissing and nonnegative values for total assets, sales, capital expenditure, and cash holding; require the latter two to not be greater than total assets; and require nonmissing values for operating income. For additional analysis, we collect information on debt structure from the Capital IQ database. Capital IQ provides information on 7 mutually exclusive sources of debt: commercial paper, drawn credit line, term loan, senior bonds and notes, subordinate bonds and notes, capital lease, and other debt. We obtain institutional ownership data from Thomson Reuters Institutional Holding (13F) filings.

Using a similar approach as Lemmon and Roberts (2010), we require all firms to have nonmissing net long-term debt issues, net short-term debt issues, net equity issues, net investments, market leverage, market-to-book ratio, and z-score. We also require that i) rated firms do not switch from investment grade to below-investment grade and vice versa throughout the sample period (although their ratings can vary over time within each broad group), ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. Table A2 in the Appendix provides definitions of all the variables used in this study. Our final full sample consists of a total of 18,440 firm-year observations corresponding to 4,102 unique firms in the sample.

[12]Kisgen (2006) and Lemmon and Roberts (2010) use the same procedure. For more information, please refer to https://www.moodys.com/researchdocumentcontentpage.aspx?docid=PBC_79004, https://www.standardandpoors.com/en_US/web/guest/article/-/view/sourceId/504352, and https://www.fitchratings.com/site/definitions.

TABLE 1

Summary Statistics

Table 1 presents descriptive statistics for the full sample, including unrated, below-investment-grade, and investment-grade firms from the annual Compustat database for the period 2005–2015. The firms are grouped by their credit ratings from S&P, Moody's, and Fitch. Investment-grade firms consist of all the firms rated AAA to BBB− (or equivalent), and low-rated firms consist of all the firms with BB+ (or equivalent) and lower credit ratings. Unrated firms consist of the rest of the firms in the sample, which does not have any credit rating during the sample period. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables.

	Unrated Firms					Below-Investment-Grade Firms					Investment-Grade Firms				
Variables	Mean	Std. Dev.	25%	50%	75%	Mean	Std. Dev.	25%	50%	75%	Mean	Std. Dev.	25%	50%	75%
NET_DEBT_ISSUES	0.02	0.09	−0.01	0.00	0.01	0.03	0.13	−0.03	0.00	0.05	0.02	0.08	−0.01	0.00	0.04
NET_LTD_ISSUES	0.01	0.09	−0.01	0.00	0.00	0.03	0.13	−0.03	0.00	0.05	0.02	0.08	−0.01	0.00	0.04
NET_STD_ISSUES	0.00	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00
NET_EQUITY_ISSUES	0.03	0.14	0.00	0.00	0.01	0.00	0.06	0.00	0.00	0.00	−0.03	0.05	−0.05	−0.01	0.00
TOTAL_NET_SECURITY_ISSUES	0.05	0.17	−0.03	0.00	0.05	0.03	0.14	−0.04	0.00	0.06	−0.01	0.09	−0.05	−0.02	−0.01
BOOK_LEVERAGE	0.15	0.24	0.00	0.07	0.22	0.39	0.21	0.25	0.37	0.50	0.24	0.13	0.15	0.23	0.32
NET_INVESTMENT	0.08	0.12	0.14	0.04	0.10	0.11	0.14	0.03	0.06	0.13	0.09	0.10	0.03	0.06	0.11
FIRM_SIZE	4.74	1.94	3.43	4.81	6.07	7.20	1.07	6.46	7.16	7.85	8.73	1.07	7.85	8.68	9.53
MB	1.67	1.40	0.79	1.22	2.02	1.20	0.70	0.77	1.03	1.41	1.58	0.98	0.94	1.32	1.97
ZSCORE	0.11	4.91	−0.07	1.48	2.49	1.36	1.40	0.77	1.36	2.08	2.08	0.97	1.46	1.98	2.59
FIRM_AGE	18.00	11.38	10.00	15.00	22.00	22.00	14.84	11.00	17.00	26.00	32.00	18.26	16.00	27.00	49.00
OPERATING_INCOME	0.04	0.24	0.01	0.09	0.16	0.12	0.13	0.08	0.12	0.16	0.16	0.08	0.11	0.15	0.19
TANGIBILITY	0.22	0.22	0.06	0.14	0.31	0.33	0.25	0.12	0.26	0.49	0.28	0.21	0.11	0.22	0.39
CASH	0.18	0.17	0.05	0.13	0.25	0.09	0.08	0.02	0.06	0.12	0.09	0.08	0.04	0.07	0.13
SP500	0.02	0.13	0.00	0.00	0.00	0.06	0.25	0.00	0.00	0.00	0.49	0.50	0.00	0.00	1.00
NYSE	0.10	0.35	0.00	0.00	0.00	0.54	0.50	0.00	1.00	1.00	0.75	0.43	0.00	1.00	1.00
No. of obs.	14,637					2,202					1,622				

B. Summary Statistics

Table 1 presents summary statistics for the unrated, low-rated, and investment-grade firms for our final full sample described in Section IVA. We winsorize all continuous variables at their 1st and 99th percentiles. Out of the total of 18,440 firm-year observations from 4,102 unique firms, 14,637 firm-years are unrated, 2,202 are rated low-rated, and 1,622 are rated investment grade. On average, unrated, low-rated, and investment-grade firms issue debt equal to 2%, 3%, and 2% of total assets, respectively. This indicates that low-rated firms have the highest dependence on long-term debt among the 3 groups of firms. Most of the debt issues are of a long-term nature. Unrated firms appear to issue the most equity relative to their size (3%). Unrated firms also have the highest total net security issuance (5% of total assets) among the 3 groups. Interestingly, investment-grade firms have net equity financing of a negative 3% of total assets because firms have more equity repurchases than equity issuance on average. Similarly, their net security issuance is −1% of total assets. These results may reflect the recent trend of stock repurchases and increased cash holdings by large established firms. The median equity, debt, and total security issuance of each type of firm are 0, which suggests that a typical firm does not raise any new capital in a given year.

The investment activities of investment-grade and unrated firms are very similar, despite the former's bigger size. Both types of firms have lower net investment than low-rated firms. Low-rated firms have the highest book leverage (39%) among the 3 groups. Both below-investment and investment-grade firms are several times larger and more profitable than unrated firms. Low-rated and unrated firms are about 10–14 years younger than investment-grade firms. About 6% of low-rated firms, 2% of unrated firms, and 49% of investment-grade firms are in the S&P 500 index. These differences motivate our choice of control variables in analyses of the full sample and matched samples.

C. Univariate Analysis

As discussed in Section II, we consider low-rated firms as the treatment group and unrated firms as the control group to study the impact of Dodd–Frank on the financing and investment policies of firms worried about credit ratings. We start our analysis with some simple univariate tests.

Table 2 shows that before Dodd–Frank, low-rated firms have significantly more net debt issues and net long-term debt issues than unrated firms. But the former group significantly reduces net debt and net long-term debt issuance after Dodd–Frank. As a result, the differences between these 2 groups significantly narrow after the shock. Similarly, low-rated firms also appear to reduce their equity issues after Dodd–Frank. Thus, they diverge further away from unrated firms. Low-rated firms' net investment also reduces significantly after Dodd–Frank. Overall, the differences between these 2 groups narrow considerably after Dodd–Frank.

These univariate results generally support our hypothesis. However, these tests also show significant differences between these firms' characteristics that can be important for their financing and investment activities. Moreover, our sample period overlaps with the period of the recent financial crisis, which may

TABLE 2

Univariate Analyses

Table 2 presents mean differences in financing, investment, and other characteristics between unrated and below-investment-grade firms before and after the passage of Dodd–Frank. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. *** denotes statistical significance at the 1% level in 2-tailed tests.

	Before Dodd–Frank				After Dodd–Frank			
Variables	Below-Investment 1	Unrated 2	Difference 1 – 2	*t*-Statistics	Below-Investment 3	Unrated 4	Difference 3 – 4	*t*-Statistics
NET_DEBT_ISSUES	0.026	0.009	0.017***	4.15	0.019	0.014	0.006	1.49
NET_LTD_ISSUES	0.028	0.009	0.019***	4.84	0.018	0.013	0.006	1.61
NET_STD_ISSUES	−0.002	0.000	−0.002	−1.91	0.001	0.001	0.000	0.32
NET_EQUITY_ISSUES	0.007	0.027	−0.020***	−3.10	−0.006	0.022	−0.028***	−5.46
TOTAL_NET_SECURITY_ISSUES	0.033	0.036	−0.002	−0.32	0.013	0.036	−0.023***	−3.51
BOOK_LEVERAGE	0.394	0.131	0.263***	29.08	0.414	0.133	0.282***	31.27
NET_INVESTMENT	0.113	0.079	0.034***	6.06	0.089	0.073	0.016***	3.47
FIRM_SIZE	7.300	4.625	2.675***	32.20	7.440	4.788	2.653***	33.97
MB	1.136	1.678	−0.542***	−8.83	1.128	1.608	−0.480***	−8.69
ZSCORE	1.519	0.533	0.986***	5.14	1.395	0.127	1.268***	6.21
OPERATING_INCOME	0.123	0.060	0.062***	6.71	0.118	0.062	0.057***	6.81
TANGIBILITY	0.345	0.219	0.126***	12.53	0.344	0.216	0.128***	14.09
CASH	0.084	0.176	−0.091***	−12.28	0.091	0.187	−0.096***	−14.13
No. of obs.	5,645				5,950			

have uneven effects on the financing decisions of firms with different credit ratings. Our analysis in the following sections controls for these differences in firm characteristics and the potential influence of the financial crisis of 2008–2009.

V. Effect of Dodd–Frank on Financing and Investment

A. Main Specification and Results

Our main sample consists of all firm-years of low-rated rated or unrated firms from 2005 to 2015. We use the following difference-in-difference (DiD) regression model to examine the effect of credit rating shock on firms' financing and investment activities after the enactment of Dodd–Frank:

$$\text{(1)}\quad \text{Financing or investment policy}_{it} = \alpha + \beta_1 \text{POSTDF}_t + \beta_2 \text{POSTDF}_t \times \text{TREATED}_i + \gamma X_{it} + \theta_i + \varepsilon_{it}.$$

The dependent variable (Financing or investment policy) measures one of NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUES, TOTAL_NET_SECURITY_ISSUES, or NET_INVESTMENT. The index i indicates a firm, and t indicates a year. POSTDF is an indicator variable that takes the value of 1 for the post-Dodd–Frank period (fiscal years ending after July 2010), and 0 otherwise. TREATED is an indicator variable that takes the value of 1 for the low-rated, and 0 for unrated firms. Our main coefficient of interest is β_2 (coefficient of POSTDF × TREATED), which measures the treatment effect of our DiD estimator. X_{it} includes firm-level control variables found by prior studies to

TABLE 3

Dodd–Frank and Firm Policies: Results from the Full Sample

Table 3 reports our baseline regression results. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUE, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

	NET_DEBT_ ISSUES	NET_LTD_ ISSUES	NET_STD_ ISSUES	NET_EQUITY_ ISSUE	TOTAL_NET_ SECURITY_ISSUES	BOOK_ LEVERAGE	NET_ INVESTMENT
Variables	1	2	3	4	5	6	7
POSTDF	0.006*	0.003	0.003***	−0.000	0.006	−0.007	0.005
	(0.003)	(0.003)	(0.001)	(0.005)	(0.006)	(0.005)	(0.004)
POSTDF × TREATED	−0.022**	−0.024**	0.002	−0.006	−0.028**	0.012	−0.027**
	(0.011)	(0.011)	(0.001)	(0.007)	(0.011)	(0.014)	(0.011)
FIRM_SIZE	0.006	0.005	0.000	−0.020***	−0.014*	0.022***	0.008
	(0.004)	(0.004)	(0.001)	(0.006)	(0.008)	(0.006)	(0.005)
MB	0.002	0.002	−0.000	0.015***	0.016***	−0.007***	0.009***
	(0.001)	(0.001)	(0.000)	(0.002)	(0.003)	(0.002)	(0.001)
ZSCORE	0.001	0.001*	−0.000**	0.003**	0.004**	−0.011***	0.001*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.002)	(0.001)
ln(FIRM_AGE)	−0.015*	−0.010	−0.005**	−0.030**	−0.045***	0.011	−0.051***
	(0.008)	(0.008)	(0.002)	(0.014)	(0.017)	(0.015)	(0.013)
OPERATING_ INCOME	−0.064***	−0.057***	−0.007**	−0.063***	−0.127***	0.013	0.020*
	(0.014)	(0.013)	(0.003)	(0.021)	(0.027)	(0.026)	(0.011)
TANGIBILITY	−0.023	−0.024	0.001	−0.068***	−0.091***	0.116***	0.066**
	(0.020)	(0.020)	(0.004)	(0.025)	(0.034)	(0.038)	(0.027)
CASH	−0.009	−0.001	−0.008***	0.149***	0.141***	−0.104***	−0.149***
	(0.012)	(0.012)	(0.002)	(0.023)	(0.025)	(0.016)	(0.014)
SP500	0.015	0.014	0.001	−0.023**	−0.008	−0.039**	−0.008
	(0.015)	(0.014)	(0.002)	(0.010)	(0.018)	(0.016)	(0.019)
TREATED × CRISIS	−0.019	−0.019	0.001	0.021***	0.002	0.021	−0.025**
	(0.012)	(0.012)	(0.002)	(0.007)	(0.013)	(0.013)	(0.012)
CRISIS	−0.005**	−0.006**	0.001	−0.015***	−0.021***	0.004	−0.010***
	(0.003)	(0.003)	(0.001)	(0.004)	(0.005)	(0.003)	(0.003)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	11,308	11,308	11,308	11,308	11,308	11,277	11,308
Adj. R^2	0.063	0.065	0.010	0.347	0.299	0.777	0.260

influence firms' financing and investment decisions (firm size, market-to-book equity, *z*-score, age, operating income, tangibility, cash holdings, and S&P 500 indicator). X_{it} also includes an interaction term of TREATED with a binary indicator of the recent financial crisis period (2008–2009) to disentangle the effect of the crisis from that of Dodd–Frank.[13] All the variables are defined in Table A2 in the Appendix. The term θ_i indicates firm fixed effects, and ε_{it} represents the error term. The variable TREATED is perfectly collinear with firm fixed effects, and POSTDF is collinear with year fixed effects, so we do not estimate them separately. In

[13]We acknowledge that this method may not fully control for the effects of the financial crisis if such effects persist in postcrisis years. In Section VID, we introduce a variable that arguably captures firms' asymmetric and persistent exposure to financial crises following Fahlenbrach, Prilmeier, and Stulz (2012). Despite a substantial drop in sample size, our results remain the same.

Table A3 in the Appendix, we find similar results when we add the TREATED variable and omit firm fixed effects.

Table 3 reports the results from our full sample. Columns 1–5 report the results for financing activities, column 6 reports the results for book leverage, and column 7 reports the results for investment activities. The coefficients of the interaction term (POSTDF × TREATED) show that low-rated firms decrease their net external financing and net investment significantly after the regulatory shock to CRAs. Low-rated firms decrease their net debt issues by 2.2 percentage points, net long-term debt issues by 2.4 percentage points, and total net security issues by 2.8 percentage points after the enactment of Dodd–Frank. Similarly, they reduce net investments by 2.7 percentage points. The magnitude of the reduction in net investments is almost identical to that of net security issuance, both measured as a percentage of total assets. The decline in total net security issues (net investments) represents an 85% (24%) reduction for low-rated firms after the shock compared to their unconditional preshock averages.[14] Therefore, the economic significance of this policy shock is substantial for low-rated firms. The effect on net equity issuance is negative but small and statistically insignificant. So, as hypothesized, these firms did not substitute debt issues with equity. Accordingly, it seems that the treated firms reduce net security issues, mostly debt, and net investment almost in the same ratio. Book leverage also remains largely unchanged plausibly because assets decrease by about the same rate as debt. These findings are consistent with Lemmon and Roberts' (2010) findings.

Control variables such as firm size, market-to-book equity, *z*-score, age, operating income, tangibility, and cash holdings appear to be important in determining firms financing and investment policies because they are highly significant in most of the regressions. The financial crisis seems to have inhibited security issues and investment in general. Moreover, the interaction term TREATED × CRISIS also obtains significant coefficients in three regressions, suggesting that it is important to control for the asymmetric effect of the crisis in the financing and investing activities of these 2 groups of firms to cleanly identify the effect of Dodd–Frank.

Overall, our baseline results from the full sample analysis are consistent with our hypotheses that in response to higher regulatory costs imposed on CRAs by Dodd–Frank, which incentivized CRAs to issue lower ratings, low-rated firms curtail their debt financing. Moreover, because these firms are not able to switch to feasible equity financing, they also cut their investments.

B. Parallel Trends and the Confounding Effect of the Financial Crisis

We start by examining pretrends in several ways. In Table A4 in the Appendix, we find that the treatment and control groups do not show any statistically significant difference in the growth rates of debt or equity issuance or investments before the passage of Dodd–Frank. These results hold both for the full sample and the

[14]For low-rated firms, the mean of net security issues before Dodd–Frank in Table 2 is 3.3% of total assets. The reduction of 2.8 percentage points represents an 85% decrease. Similarly, the reduction in net debt issues is 85%, that in new long-term debt (LTD) issues is 86%, and that in net investment is 24% compared to their respective pre-Dodd–Frank means.

matched sample (we discuss matching in Section VD) and suggest that there is no pretrend in our main dependent variables of interest. Therefore, any difference after Dodd–Frank can be plausibly interpreted as a causal effect of Dodd–Frank.

However, there are some difficulties in visually examining unambiguous parallel trends in our setting for three reasons. First, debt issuance and net investments are more volatile from year to year than debt *levels.* Second, Dodd–Frank was proposed and passed in the aftermath of the financial crisis, which had a major effect on firms' financing decisions. Although we try to control the crisis in various ways, the proximity of the 2 events makes it difficult to fully separate the two effects. Finally, various versions of Dodd–Frank were proposed and discussed by Congress starting in 2009. So, as also acknowledged by DPT, even though it was signed in July 2010, there is likely a partial adjustment in anticipation of the law before its passage. In addition, many key provisions of Dodd–Frank related to the CRAs were implemented in later years. For instance, the office of credit ratings at the SEC was formed in 2012, and in Aug. 2014, SEC completed all mandatory rulemaking under the provisions of Section 932 (CRAs).[15] So some effects are likely to happen with a lag after uncertainties about enforcement were resolved.

Figure 1 shows the average annual residual debt issuance (Graph A) and net investment (Graph B) for the full sample of treated and control firms and the differences between them.[16] The residuals are obtained from regressions of debt issuance and net investments similar to those in Table 3 excluding POSTDF and its interaction variables. In Graph A, the residual debt issuance for treated firms exceeds that for control firms in most years before Dodd–Frank. This trend starts to reverse in 2009 perhaps partly due to the anticipation of Dodd–Frank and partly due to the continuing effect of the crisis. This difference becomes substantially more negative and stays mostly negative subsequent to Dodd–Frank. The effects appear to coincide with the implementation of Dodd–Frank provisions in later years. Graph B shows a similar pattern for residual investments. Clearly, both groups were affected by the financial crisis. However, the figure suggests that the recovery of debt issuance and investment in the treated group was hindered by Dodd–Frank.

We next examine the timeline of these effects using an alternate approach, where we reestimate the regressions shown in Table 3 after breaking down the POSTDF variable into indicator variables for each year in our sample and interacting them with the TREATED variable. The excluded base year is the fiscal year that ended immediately preceding July 26, 2010, the date of Dodd–Frank's passage. Figure 2 shows the coefficient estimates and 95% confidence bands on the interactions of the TREATED variable with the annual indicator variables. Graph A is for debt issuance, and Graph B is for net investment. In Graph A, the coefficient of the TREATED variable is positive and significant at the 5% level (i.e., the 95% confidence bands do not include 0) for all the years before the passage of Dodd–Frank. In contrast, annual estimates after the passage of Dodd–Frank in July 2010 are smaller and generally statistically insignificant. Graph B shows a similar pattern

[15]See the SEC web page (https://www.sec.gov/spotlight/Dodd–frank-section.shtml#932).

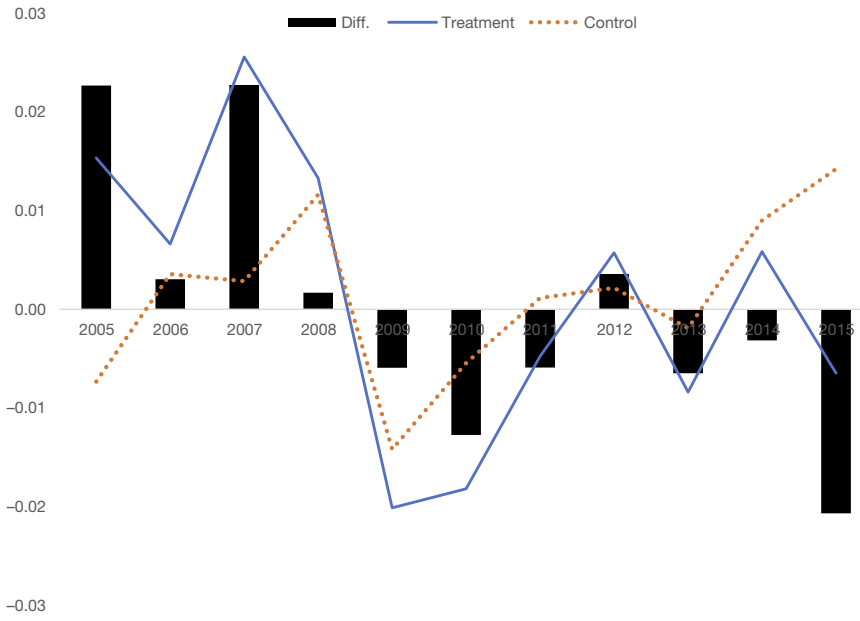
[16]The figures for the PSM sample are quite similar to those for the full sample discussed in this section. They are not shown for brevity.

FIGURE 1

Residual Net Debt Issuance and Net Investment Around Dodd–Frank

Graph A (B) of Figure 1 shows the annual average residuals from the regression of net debt issue (net investments), after omitting POSTDF and its interaction with TREATED. Blue solid lines are for the treated sample, and orange dotted lines are for the control sample. The bars represent the differences in the annual means of the treated and control groups.

Graph A. Difference in Residual Net Debt Issuance



Graph B. Difference in Residual Net Investment

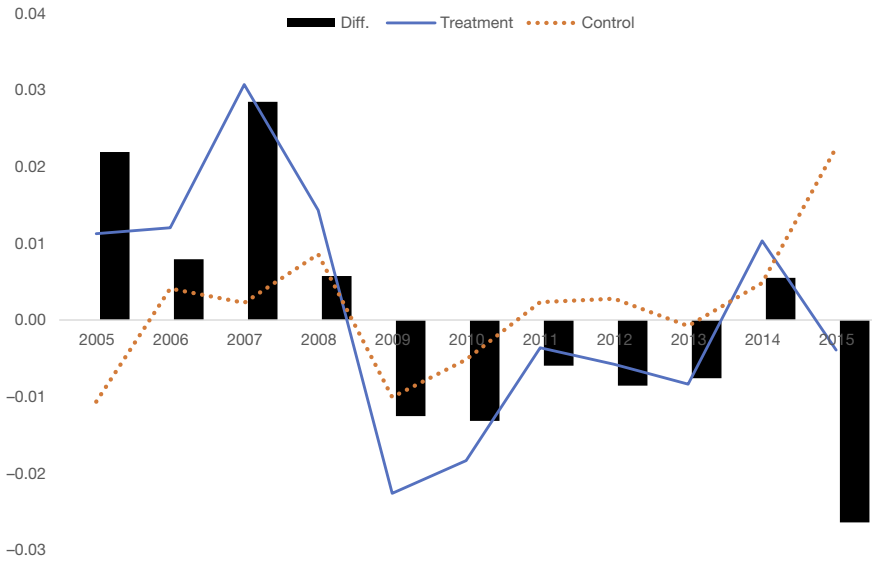
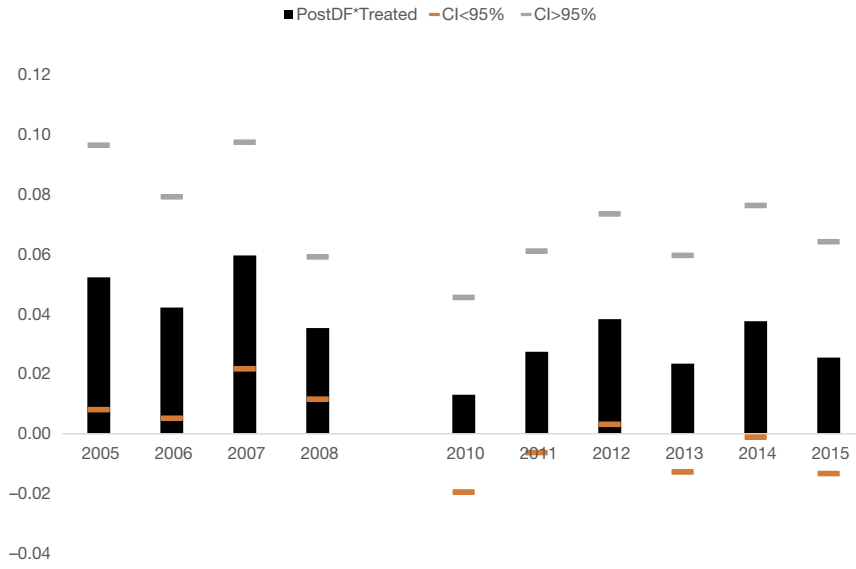


FIGURE 2

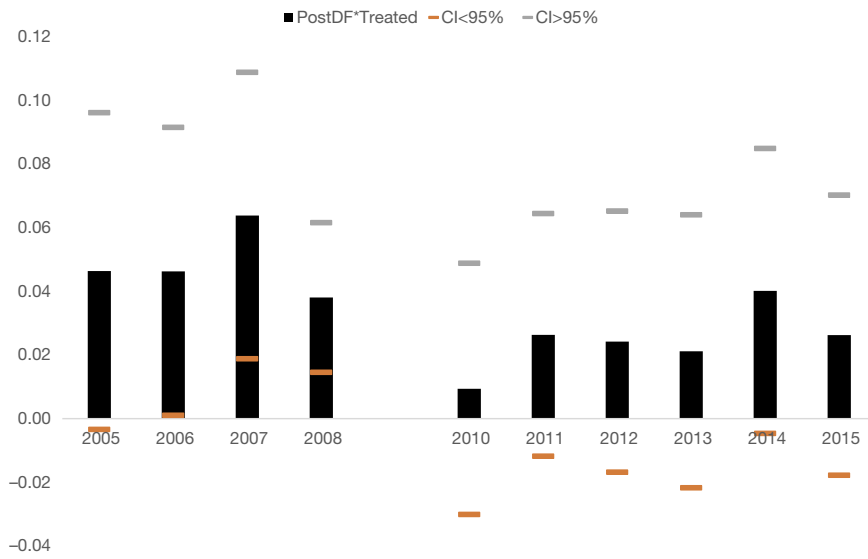
Timeline of the Effect of Dodd–Frank on Debt Issues and Net Investment

Graph A (B) of Figure 2 shows the estimated coefficients (in black bars) and 95% confidence bands (in gray and orange lines) from the regression of net debt issue (net investments) similar to Table 3, after replacing POSTDF and its interaction with TREATED by indicator variables for each year during our sample period. The omitted base year is the fiscal year that ended immediately preceding July 26, 2010, the date of Dodd–Frank's passage.

Graph A. Net Debt Issue: Coefficients of Treated by Year



Graph B. Net Investment: Coefficients of Treated by Year



for net investment. These patterns are consistent with the summary statistics in Table 2, which show that low-rated firms issued more debt, and invested more, than unrated firms before Dodd–Frank. However, the debt issuance and investments of the 2 groups converged after the passage of the law.

C. Alternative Treated and Control Groups

As discussed in Section II, prior theoretical and empirical findings guide our decision to consider low-rated and unrated firms as treatment and control groups, respectively. In this section, we consider a few alternative analyses.

Our discussion in Section II about the nonuniform effect of credit rating risks on investment-grade vs. low-rated firms points to the possibility that investment-grade firms may also serve as a potential control group. Accordingly, we experiment with analyses in which investment-grade firms serve as the control group and low-rated firms as the treatment group. We drop unrated firms from the sample and apply all the data requirements and additional criteria as before. We present the results in Table A5 in the Appendix. We find that many of the results are similar to, and sometimes even stronger than, those from our main analysis. After Dodd–Frank, low-rated firms issue less debt, raise less total capital, and invest less compared to investment-grade firms. An important difference is that low-rated firms also issue less equity compared to investment-grade firms. As a result, the difference in total security issuance is much larger compared to that found in the main analysis. While most results are similar to those of the main analysis as expected, the significant difference in equity issuance indicates that the results may also be driven by other differences in firm quality, rather than only by the differences in credit rating risks. Therefore, we follow previous studies on credit ratings (Lemmon and Roberts (2010)) and continue our analysis in which unrated firms serve as the control group.

Because provisions of Dodd–Frank to CRAs were not confined to the ratings of low-rated firms, we also experiment with investment-grade firms as an alternative treatment group and unrated firms as the control group. However, for the reasons discussed in Section II, we do not expect investment-grade firms to respond to credit rating downgrade shocks as strongly as their noninvestment-grade counterparts do. Table A6 in the Appendix presents these analyses. We drop low-rated firms from the sample and apply all the data requirements and additional criteria as before. We find no effect of Dodd–Frank on the debt issuance and net investment levels of investment-grade firms compared to unrated firms. We find a positive effect on equity issuance and a rather surprising increase in book leverage among the investment-grade firms compared to unrated firms. While we do not delve into these results further, they are quite different from the results using low-rated firms as the treatment group and are not consistent with increased concern about credit ratings. These results support our argument that investment-grade firms are not affected much by the threat of future rating downgrades compared to low-rated firms.

D. Propensity Score Matching

As seen in the summary tables, our treated and control firms are quite different in several firm characteristics and performance. Dodd–Frank followed the peak of

the financial crisis characterized by a drastic negative shock to the supply of credit. Plausibly, firms' exposure to these systemic credit shocks depends on their existing credit ratings and other firm characteristics such as size and expected profitability. These possibilities add to the challenge of disentangling the effects of demand vs. supply channels that underlie our main results. We argue, with some consistent results, that Dodd–Frank increased low-rated firms' worry of credit rating downgrades and reduced these firms' *demand* for debt. However, an alternative interpretation is that because of different exposure to credit shocks, the *supply* of credit to these firms dried up.

Our main models try to account for these differences by including several important control variables in the regressions. However, these linear specifications may be inadequate to control for potential nonlinear effects. As another way to deal with this issue, we next employ a DiD strategy on a matched sample. This strategy largely follows Lemmon and Roberts (2010). First, we ensure that the parallel trend assumption is satisfied. For this study, a parallel trend implies that in the absence of Dodd–Frank, there would be no difference in the growth rates of debt issuance and investments of the unrated and low-rated groups (i.e., DiD estimates would be 0). Table A4 in the Appendix reports the average growth rates of our main variables of interest before Dodd–Frank. The results show that our treated and control firms are not significantly different in terms of their financing and investment growth in the pre-Dodd–Frank era.

However, the first part of Panel A of Table 4 shows that our treated and control firms are significantly different in the levels of important firm characteristics before Dodd–Frank. Therefore, we employ a propensity score matching (PSM) strategy to find a sample of treated and control firms that are similar in important firm-level characteristics that can affect the demand for debt. Our matching procedure starts with a Probit model predicting the probability of being a below-investment-grade firm before the Dodd–Frank Act. We include all firm-level characteristics for the pre-Dodd–Frank period (Jan. 2005 to July 2010) and year fixed effects in this model.[17] Finally, following Lemmon and Roberts (2010), we include indicator variables for S&P 500 membership and NYSE listing, which serve as instrumental variables for differentiating the financing and investment decisions of unrated and rated firms as identified by previous studies. To obtain a sample of matched firms, we use the nearest neighborhood of predicted probabilities on common support using a caliper of 0.001 without replacement. We select samples with a common support, that is, we discard observations with predicted probabilities below the minimum of the treated group and above the maximum of the control group. This procedure yields a matched sample of a total of 678 firm-year observations. This sample includes equal observations for treatment and control firm-years, 221 unique control firms, and 143 unique treated firms.

Panel B of Table 4 reports parameter estimates from the Probit model, in which the dependent variable equals 1 if the firm is low-rated, and 0 if it is unrated. The

[17]We do not include growth rates of different types of financing pre-Dodd–Frank in the model because they are not significantly different for our treatment and control firms. Doing so substantially reduces sample size without improving match quality.

TABLE 4
Propensity Score Matching Analysis

Table 4 reports results from univariate analysis (Panel A) and Probit model (Panel B) before and after matching the treated and control firms. Firms are matched based on their pre-Dodd–Frank period (Jan. 2005 to July 2010) variables. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. Panel A reports results from pairwise comparisons of the variables on which matching is performed, except for the year indicators. Panel B reports parameter estimates from the Probit models. In Panel B, the dependent variable equals 1 if the firm is below-investment grade, and 0 if it is unrated. The Prematch (column 1) uses the full sample before 2010. The Postmatch (column 2) reports comparisons or estimates on only the matched subsample after matching. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Panel A. Pairwise Comparison

	Before Dodd–Frank Using Full Sample				Before Dodd–Frank Using PSM Sample			
Variables	Unrated 1	Below-Investment Grade 2	Mean Difference 2 − 1	*t*-Statistics	Unrated 3	Below-Investment Grade 4	Mean Difference 4 − 3	*t*-Statistics
FIRM_SIZE	4.647	7.307	2.660***	32.93	7.080	6.980	−0.101	−1.42
MB	1.679	1.138	−0.541***	−8.79	1.369	1.213	−0.156**	−2.41
ZSCORE	0.531	1.519	0.988***	5.14	1.701	1.509	−0.192	−0.92
ln(FIRM_AGE)	2.753	2.910	0.157***	5.71	2.860	2.886	0.026	0.57
OPERATING_INCOME	0.060	0.123	0.063***	6.73	0.142	0.131	−0.012*	−1.87
TANGIBILITY	0.217	0.337	0.120***	12.29	0.299	0.316	0.017	0.98
CASH	0.176	0.084	−0.091***	−12.27	0.099	0.095	−0.003	−0.49
SP500	0.017	0.100	0.083***	11.63	0.071	0.065	−0.006	−0.30
NYSE	0.137	0.589	0.452***	26.82	0.531	0.507	−0.024	−0.61
N	5,638				678			

Panel B. Probit Regression Results

Variables	Prematch 1	Postmatch 2
FIRM_SIZE	0.638***	−0.069
	(0.049)	(0.082)
MB	−0.308***	−0.110
	(0.077)	(0.099)
ZSCORE	−0.117***	−0.005
	(0.014)	(0.027)
ln(FIRM_AGE)	−0.072	0.066
	(0.105)	(0.131)
OPERATING_INCOME	0.773*	−0.437
	(0.421)	(0.917)
TANGIBILITY	0.536*	0.195
	(0.296)	(0.344)
CASH	−1.447**	0.108
	(0.581)	(0.812)
SP500	0.014	0.016
	(0.231)	(0.298)
NYSE	0.453***	−0.043
	(0.129)	(0.157)
Constant	−4.635***	0.508
	(0.426)	(0.658)
Year FE	Yes	Yes
Firm-level cluster	Yes	Yes
Treated (unique firms)	171	143
Control (unique firms)	1,566	221
No. of obs.	5,526	678
Pseudo-R^2	0.420	0.010
χ^2 *p*-value	0.000	0.800
Area under ROC curve	0.930	

Probit model using the full sample shows that our treated and control firms are significantly different in important characteristics before matching. The pseudo-R^2 of 42% with a corresponding p-value close to 0 indicates that our matching variables capture a significant variation in the probability of having a below-investment rating. Moreover, an area under the receiver operating characteristic (ROC) curve of 0.93 indicates that our Probit model is strong enough to discriminate between the rated firms and unrated firms.[18] Accordingly, in the Probit model using the matched sample, none of the variables are significantly different between the treated and control firms before Dodd–Frank. The pseudo-R^2 declines to nearly 0 with a corresponding χ^2 p-value of 0.80, which indicates that the matching process results in treatment and control samples which are very similar in important observable firm characteristics before Dodd–Frank. As shown in the second half of Panel A, the mean differences in important firm characteristics between the treated and matched control samples before Dodd–Frank are very small mostly statistically insignificant. This result suggests that our empirical methodology is successful in identifying and controlling for the key differences between the unrated and low-rated firms. So, any difference after Dodd–Frank using the PSM sample can be plausibly interpreted as the causal effect of a shock to credit rating.

TABLE 5

Main Results Using the Propensity-Score-Matched Sample

Table 5 reports regression results from the propensity-score-matched (PSM) sample obtained from the analysis reported in Table 4. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUE, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. **, and * denote statistical significance at the 5%, and 10% levels, respectively, in 2-tailed tests.

	NET_DEBT_ ISSUES	NET_LTD_ ISSUES	NET_STD_ ISSUES	NET_EQUITY_ ISSUE	TOTAL_NET_ SECURITY_ISSUES	BOOK_ LEVERAGE	NET_ INVESTMENT
Variables	1	2	3	4	5	6	7
POSTDF	0.008	0.005	0.002	−0.006	0.002	0.007	0.005
	(0.007)	(0.007)	(0.002)	(0.005)	(0.008)	(0.013)	(0.008)
POSTDF × TREATED	−0.023*	−0.027**	0.004*	−0.008	−0.030**	−0.005	−0.032**
	(0.012)	(0.012)	(0.002)	(0.007)	(0.013)	(0.017)	(0.013)
TREATED × CRISIS	−0.021	−0.023	0.002	0.007	−0.013	0.003	−0.024*
	(0.015)	(0.015)	(0.003)	(0.007)	(0.015)	(0.015)	(0.014)
CRISIS	−0.004	−0.004	0.000	−0.010**	−0.014**	0.017**	−0.011
	(0.007)	(0.007)	(0.002)	(0.004)	(0.007)	(0.008)	(0.008)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	2,545	2,545	2,545	2,545	2,545	2,540	2,545
Adj. R^2	0.035	0.038	−0.003	0.270	0.152	0.854	0.231

[18]In short, the area under ROC can take a value ranging from 0.50 to 1.0. A value of 0.50 indicates that the model has no ability to discriminate (i.e., equal chance of assigning a higher probability score to a false observation). A value of 0.90 or above is considered outstanding discrimination (see, e.g., Hosmer and Lemeshow (2013)).

Next, we estimate DiD regressions on the PSM sample using similar specifications as before. Table 5 reports the results. We find that the results from the PSM sample are very similar to our results from the full sample. These results reveal that after the policy shock to CRAs by the enactment of Dodd–Frank, low-rated firms reduce net debt issues and net long-term debt issues by about 2.3 and 2.7 percentage points and net total security issues by about 3.0 percentage points. There is some evidence that treatment firms use more short-term debt financing after Dodd–Frank, but its effect on total new financing is small. Accordingly, these firms also reduce net investment by about 3.2 percentage points compared to the matched unrated firms. Overall, our results suggest that credit rating shock has strong implications on the financing and investment policies of low-rated firms that are vulnerable to downgrade risks.

VI. Channels: Demand or Supply?

We find so far that low-rated firms avoid borrowing after Dodd–Frank. This finding is consistent with our demand-side hypothesis that these firms avoid borrowing due to concerns about downgrades following Dodd–Frank. But they are also consistent with several supply-side stories. One possibility is that Dodd–Frank forced CRAs to invest more in due diligence and produce more informative credit ratings, which accurately reveal the poorer credit quality of speculative-grade firms to the credit market. This revelation made it harder for these firms to raise debt capital. Moreover, Dodd–Frank and the preceding financial crisis affected many aspects of the financial system apart from CRAs. For instance, Dodd–Frank also introduced regulations on banks' asset holdings, mortgage lending, disclosure, governance, and securitization, which likely affect banks' ability and incentives to lend. Likewise, the financial crisis affected the liquidity and demand for corporate bonds, especially speculative-grade bonds (see, e.g., Chernenko and Sunderam (2012)). If our treated and control firms differ in their primary source of debt capital, our results may stem from the shocks to the supply of debt capital. Another possibility is that our treatment and control groups continue to be affected differentially by the financial crisis during the postcrisis years. We refer to these explanations collectively as "supply-side" stories. In this section, we conduct several cross-sectional analyses, each of which examines one or more of these supply-side explanations. We thus dig deeper to investigate whether the observed reduction in debt issuance by our treatment firms primarily comes from these firms' reluctance to issue debt due to worries about downgrades (i.e., a demand-side effect) or from supply-side effects.

A. Firms Near a Rating Change

In this section, we evaluate our main findings against an alternative supply-based hypothesis based on a "better information" channel. This hypothesis postulates that Dodd–Frank's provisions encourage CRAs to work harder and assign more accurate ratings that are more informative of the rated firms' underlying credit quality. And conceivably, low-rated firms may turn out to be of poorer credit quality than revealed by their prior credit ratings. Therefore, a more accurate revelation of

their poorer credit quality makes the market more reluctant to lend to them. DPT find that the quality of credit ratings did not improve after Dodd–Frank; in fact, it became worse. This finding makes the "better information" channel less plausible. In addition, we conduct the following test to evaluate this hypothesis.

We follow Kisgen's (2006) approach for separating the effect of credit *rating* risk from credit *quality* risk. Kisgen identifies firms near credit rating upgrades (downgrades) as those with a plus (minus) modifier (POM) in their ratings (e.g., B+ (B−)) and shows that such firms worry more about further rating downgrades than firms without such a modifier (e.g., B). One reason for this behavior is that regulators usually do not differentiate between notches within a broad rating category (e.g., BB+ vs. BB vs. BB−), but differentiate across broad ratings such as A− vs. BBB+ and BB− vs. B+. Moreover, because the market tends to pool together firms of similar credit ratings, a firm at the higher end of a slightly lower rating (say, B+) likely faces a substantially higher cost of debt than a firm at the lower end of a slightly higher rating (say, BB−), even if the credit quality of the former may only be marginally worse than that of the latter. Kisgen (2006) argues that firms with POM ratings have greater incentives to protect their existing ratings than firms with non-POM ratings.[19] Accordingly, he finds that the former group of firms issue less debt than the latter, even though the 2 groups should have similar underlying credit quality, on average.[20] We examine one implication of these POM tests for our study. If we find that the subgroup of our treatment firms with POM ratings reduces debt issuances after Dodd–Frank more than the rest of the treatment group, that will support the credit rating risk channel. On the other hand, if there is no difference in debt issuances between these 2 subgroups, that will favor the information hypothesis.

Accordingly, we redo our main tests by dividing our treated firms into 2 groups: firms near broad rating upgrades or downgrades (i.e., firms with POM rating: TREATED_POM) and firms not near a rating change (TREATED_OTHER). Table 6 reports the results from our analyses of the full sample in Panel A and the PSM sample in Panel B. In both panels, within the group of low-rated firms, while the subgroup of firms with POM ratings significantly reduces net debt issues and net investments in response to Dodd–Frank, the magnitude of debt reduction by non-POM firms is much smaller and statistically insignificant. Although these 2 coefficients are not statistically different between POM and non-POM firms, they are always substantially different in economic magnitude in our hypothesized direction.

To summarize, while the inherent credit quality of absolute-rated firms (say, BB) are, on average, unlikely to be different from that of a group consisting of both POM ratings (BB+ and BB−), the latter is likely much more worried about downgrades (or missing upgrades). In other words, POM rating should matter for

[19]For a firm with a minus modifier, a 1-notch downgrade brings them down to a lower broad rating category (e.g., B− to CCC+). For a firm with a plus modifier, a notch downgrade substantially decreases their opportunity for a rating upgrade to the next broad category (e.g., from CCC+ to B−). On the other hand, firms with unsigned credit ratings (e.g., B) are likely less concerned about each of these possibilities.

[20]Consider, for example, 2 groups of 4 firms each. In the first group, all 4 firms have unsigned BB ratings, while the second group has 2 firms with BB+ and the other 2 with BB− ratings. Both groups have average rating of BB.

TABLE 6
Firms Near a Rating Change (POM ratings)

Table 6 reports regression results for firms near a rating change. Panel A presents results for the full sample, and Panel B reports results for the propensity-score-matched (PSM) sample. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUE, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. TREATED_POM is an indicator variable that equals 1 if the treated firm has a plus or minus modifier in its rating, and 0 otherwise. TREATED_OTHER is an indicator variable that equals 1 if a treated firm is unrated or has no plus or minus modifier in its rating, and 0 otherwise. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ ISSUES 1	NET_LTD_ ISSUES 2	NET_STD_ ISSUES 3	NET_ EQUITY_ ISSUE 4	TOTAL_ NET_SECURITY_ ISSUES 5	BOOK_ LEVERAGE 6	NET_ INVESTMENT 7
Panel A. Full Sample							
POSTDF	0.006*	0.003	0.003***	−0.000	0.006	−0.007	0.005
	(0.003)	(0.003)	(0.001)	(0.005)	(0.006)	(0.005)	(0.004)
POM	0.005	0.009	−0.004	−0.021*	−0.016	0.054**	−0.005
	(0.017)	(0.017)	(0.003)	(0.012)	(0.018)	(0.023)	(0.020)
POSTDF × TREATED_POM	−0.026*	−0.029**	0.003**	−0.001	−0.026*	−0.008	−0.027**
	(0.014)	(0.014)	(0.002)	(0.007)	(0.015)	(0.017)	(0.013)
POSTDF × TREATED_OTHER	−0.015	−0.015	−0.000	−0.017	−0.032**	0.052**	−0.026
	(0.014)	(0.014)	(0.003)	(0.012)	(0.016)	(0.021)	(0.019)
TREATED_POM × CRISIS	−0.026	−0.028*	0.002	0.026***	0.000	0.005	−0.028*
	(0.016)	(0.016)	(0.002)	(0.008)	(0.017)	(0.015)	(0.015)
TREATED_OTHER × CRISIS	−0.005	−0.003	−0.003	0.010	0.004	0.054***	−0.020
	(0.019)	(0.019)	(0.004)	(0.013)	(0.018)	(0.021)	(0.020)
CRISIS	−0.005**	−0.006**	0.001	−0.015***	−0.021***	0.004	−0.010***
	(0.003)	(0.003)	(0.001)	(0.004)	(0.005)	(0.003)	(0.003)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,308	11,308	11,308	11,308	11,308	11,277	11,308
Adj. R^2	0.063	0.065	0.010	0.347	0.299	0.777	0.260
Test: POSTDF × TREATED_POM − POSTDF × TREATED_OTHER = 0							
F-statistic	0.270	0.450	0.960	1.460	0.070	5.510**	0.000
Panel B. PSM Sample							
POSTDF	0.008	0.006	0.002	−0.006	0.002	0.006	0.005
	(0.007)	(0.007)	(0.002)	(0.005)	(0.008)	(0.012)	(0.008)
POM	0.011	0.015	−0.004	−0.012	−0.001	0.056**	0.005
	(0.019)	(0.019)	(0.004)	(0.011)	(0.019)	(0.024)	(0.021)
POSTDF × TREATED_POM	−0.030*	−0.034**	0.004*	−0.005	−0.034**	−0.021	−0.037**
	(0.016)	(0.016)	(0.002)	(0.008)	(0.017)	(0.020)	(0.016)
POSTDF × TREATED_OTHER	−0.011	−0.013	0.002	−0.014	−0.025	0.029	−0.024
	(0.016)	(0.016)	(0.003)	(0.011)	(0.016)	(0.023)	(0.020)
TREATED_POM × CRISIS	−0.029	−0.034*	0.004	0.010	−0.019	−0.014	−0.030*
	(0.019)	(0.019)	(0.003)	(0.008)	(0.019)	(0.017)	(0.017)
TREATED_OTHER × CRISIS	−0.005	−0.004	−0.001	0.002	−0.004	0.038	−0.014
	(0.020)	(0.021)	(0.004)	(0.011)	(0.019)	(0.023)	(0.021)
CRISIS	−0.004	−0.004	0.000	−0.010**	−0.014*	0.017**	−0.011
	(0.007)	(0.007)	(0.002)	(0.004)	(0.007)	(0.008)	(0.008)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,545	2,545	2,545	2,545	2,545	2,540	2,545
Adj. R^2	0.034	0.038	−0.003	0.270	0.152	0.876	0.231
Test: POSTDF × TREATED_POM − POSTDF × TREATED_OTHER = 0							
F-statistic	0.780	0.920	0.360	0.610	0.180	3.310*	0.260

https://doi.org/10.1017/S0022109021000831 Published online by Cambridge University Press

firms' willingness to borrow more (demand side), but not for creditors' willingness to lend (supply-side). Therefore, these results are consistent with our demand-side hypothesis that worries about future downgrades are the main cause of the observed changes in low-rated firms' financing and investment policies after Dodd–Frank.

B. Demand for Debt Capital

We expect credit rating risks to affect treatment firms with higher demand for debt capital more than those with lower demand. To test this conjecture, we divide our sample firms into firms with higher and lower leverage, based on their average book leverage in the pre-Dodd–Frank period (Jan. 2005 to June 2010). We define high leverage firms with an indicator variable that equals 1 if the firm has above-median book leverage in the year 2009, and 0 otherwise. We define low leverage firms similarly.

Columns 1 and 2 of Table 7 report the results from our analyses of the full sample in Panel A and the PSM sample in Panel B. For brevity, we only show the regressions of net debt issues and net investments, but the results are similar for net long-term debt issues and net security issues. The results show that treatment firms with higher demand for debt capital before Dodd–Frank experience a sharper decrease in both debt financing and investment after Dodd–Frank. On the other hand, treated firms that exhibit lower demand for debt capital remain mostly unaffected.[21] These results help us establish a stronger link between firms' need for debt financing and their response to the shock to rating downgrade risks, and further alleviate the concern that this response was due to the revelation of poorer firm quality.

In another test, we redo the analyses in Table 7 by keeping only firms rated BB+ to B− in the treated sample (i.e., excluding firms rated CCC+ and below) to address the possibility that our results might have been influenced by excessive leverage used by poorer credit quality firms (e.g., those rated CCC+ or lower). As shown in Table A7 in the Appendix, our results do not change.

One concern with our previous test strategy is that debt reduction by firms with higher existing leverage may simply reflect mean reversion. So we next examine firms' demand for debt predicted by their institutional ownership levels. This analysis is motivated by a recent article by Grennan, Michaely, and Vincent (2017), who find that firms with higher institutional ownership are less dependent on debt because institutional ownership substitutes for the disciplinary benefits of debt.[22] Moreover, institutional investors may serve as an alternative source of financing. In particular, institutional investors likely monitor firms closely (see, e.g., Appel, Gormley, and Keim (2016)), so they may not rely as much on credit ratings to lend to these firms. One benefit of this approach is that institutional ownership is less endogenous than existing leverage because the former is chosen

[21]Because ratings are more important for public debt than for private debt, we repeat this analysis based on the demand for public debt instead of total debt. We divide our treatment sample into 2 subgroups with high and low demand for public debt based on the ratio of public debt outstanding to total assets. The results are qualitatively similar, so we do not tabulate them for brevity.

[22]Prior studies find that institutional ownership serves as a powerful governance mechanism (see, e.g., Ferreira and Matos (2008), Brav, Jiang, and Kim (2015), and Appel, Gormley, and Keim (2016)).

TABLE 7

Variation Based on Demand for Debt Capital

Table 7 reports regression results based on firms' demand for debt capital and institutional ownership. Panel A (B) presents results for the full (propensity-score-matched (PSM)) sample. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. HIGH_LEV (LOW_LEV) is an indicator variable that equals 1 if the firm's average book leverage in the pre-Dodd–Frank period (Jan. 2005 to June 2010) is greater (less) than the sample median, and equals 0 otherwise. HIGH_INST (LOW_INST) is an indicator variable that equals 1, if the institutional ownership in the firm is greater (less) than the sample median, and equals 0 otherwise. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and equals 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ISSUES 1	NET_INVESTMENT 2	NET_DEBT_ISSUES 3	NET_INVESTMENT 4
Panel A. Full Sample				
POSTDF	0.006*	0.005	0.006*	0.005
	(0.003)	(0.004)	(0.003)	(0.004)
POSTDF × TREATED × HIGH_LEV	−0.024**	−0.028***		
	(0.011)	(0.011)		
POSTDF × TREATED × LOW_LEV	0.015	0.014		
	(0.014)	(0.020)		
POSTDF × TREATED × HIGH_INST			−0.015	−0.022*
			(0.012)	(0.012)
POSTDF × TREATED × LOW_INST			−0.034***	−0.036***
			(0.013)	(0.013)
HIGH_INST			0.007	0.022***
			(0.005)	(0.005)
TREATED × CRISIS	−0.019	−0.025**	−0.019	−0.025**
	(0.012)	(0.012)	(0.012)	(0.012)
CRISIS	−0.006**	−0.010***	−0.006**	−0.010***
	(0.003)	(0.003)	(0.003)	(0.003)
Firm-level controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of obs.	11,308	11,308	11,308	11,308
Adj. R^2	0.063	0.260	0.063	0.261
F-statistics (diff. in high vs. low interactions)	6.530**	3.870**	2.260	1.300
Panel B. PSM Sample				
POSTDF	0.005	0.002	0.009	0.005
	(0.007)	(0.008)	(0.007)	(0.008)
POSTDF × TREATED × HIGH_LEV	−0.030**	−0.041***		
	(0.013)	(0.014)		
POSTDF × TREATED × LOW_LEV	0.001	−0.003		
	(0.013)	(0.016)		
HIGH LEV	0.081***	0.044***		
	(0.009)	(0.010)		
POSTDF × TREATED × HIGH_INST			−0.008	−0.023
			(0.016)	(0.018)
POSTDF × TREATED × LOW_INST			−0.028**	−0.036***
			(0.013)	(0.013)
HIGH_INST			0.001	−0.009
			(0.007)	(0.010)
TREATED × CRISIS	−0.025*	−0.026*	−0.021	−0.023*
	(0.014)	(0.014)	(0.015)	(0.014)
CRISIS	−0.008	−0.014*	−0.003	−0.011
	(0.007)	(0.008)	(0.007)	(0.008)
Firm-level controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of obs.	2,545	2,545	2,545	2,545
Adj. R^2	0.088	0.241	0.036	0.231
F-statistics (diff. in high vs. low interactions)	5.610**	6.460**	2.290	0.860

by outside actors, while the latter is chosen internally by the firm (see, e.g., Agrawal and Knoeber (1996)).

Accordingly, we divide our sample firms into higher and lower institutional ownership based on the median institutional ownership ratio of our sample firms. High (low) ownership is an indicator variable that equals 1 if the firm's institutional ownership ratio is greater (less) than the sample median, and 0 otherwise. Columns 3 and 4 of Table 7 present the results. In both the full sample and the matched sample analyses, we find that treated firms with higher institutional ownership do not significantly change debt issuance in response to the threat of rating downgrades. But treated firms with lower institutional ownership significantly cut back debt and investment in response to the shock.[23] These results are consistent with the notion that institutional owners make firms less dependent on credit ratings to issue debt capital. Consequently, they are less vulnerable to credit rating risk.

C. Liquidity Shocks to the Junk Bond Market

We next examine whether the risk of being downgraded is made worse by negative liquidity shocks to the junk bond market. We follow Chernenko and Sunderam (2012) and Cardella, Fairhurst, and Klasa (2018) and measure these shocks by the flow of funds to high-yield bond mutual funds. We use this test to further distinguish between demand-side and supply-side explanations of our finding that junk-rated firms substantially cut down debt financing after the adoption of the Dodd–Frank Act. The demand-side story says that these firms reduce their demand for debt issues after DFA because of concerns about further rating downgrades. If so, a negative liquidity shock to the junk bond market should be immaterial to them. On the other hand, the supply-side story says that the reduction in their debt issues is due to lenders being unwilling to lend them due to concerns about their credit quality. If so, a negative liquidity shock to this market should affect these firms more.

We obtain annual data on net flows into high-yield bond mutual funds over our sample period directly from the Investment Company Institute, the trade group of the mutual fund industry. We measure a negative liquidity shock to the junk bond market (ILLIQSHOCK) by a dummy variable for the years with negative net flows to junk bond mutual funds. Next, we estimate regressions similar to those in Table 3 after adding a triple interaction term POSTDF × TREATED × ILLIQSHOCK and its related interactions and main effects. The supply-side story implies that the coefficient of the triple interaction term should be negative (i.e., the coefficient of POSTDF × TREATED should become more negative during years of negative liquidity shocks to the junk bond market), whereas the demand-side story implies that it should be nonnegative. As shown in columns 1 and 2 of Table 8, the coefficient of this term is statistically 0 in predicting both net debt issuance and net investments. These results cast further doubt on the supply-side explanation of our findings.

[23]The differences between the 2 interaction terms are statistically significant in the PSM sample.

TABLE 8

Alternative Supply-Side Channels: Liquidity Shocks and Financial Crisis

Table 8 reports regression results based on the effect of the financial crisis and supply of debt capital after the crisis. All accounting, stock return, and credit rating variables are from Compustat and CRSP. Data on liquidity shocks to the junk bond market are from the Investment Company Institute from 2005 to 2015. All firms meet the initial data requirements and the three criteria described in Section III.A. The dependent variables are NET_DEBT_ISSUES and NET_INVESTMENTS. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, and ** denote statistical significance at the 1%, and 5% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ISSUES 1	NET_INVESTMENT 2	NET_DEBT_ISSUES 3	NET_INVESTMENT 4
POSTDF	0.012***	0.009**	0.001	−0.001
	(0.003)	(0.004)	(0.004)	(0.006)
POSTDF × TREATED	−0.020*	−0.028***	−0.021**	−0.032***
	(0.011)	(0.011)	(0.010)	(0.011)
POSTDF × TREATED × ILLIQSHOCK	−0.012	0.002		
	(0.015)	(0.016)		
POSTDF × ILLIQSHOCK	0.001	0.001		
	(0.004)	(0.005)		
TREATED × ILLIQSHOCK	0.013	0.015		
	(0.012)	(0.013)		
ILLIQSHOCK	0.013***	0.009***		
	(0.003)	(0.003)		
POSTDF × CRISISRET_07_08			−0.001	0.003
			(0.004)	(0.005)
IND_MEDIAN_ROA			0.041**	0.110***
			(0.020)	(0.031)
IND_MEDIAN_DEBT_ISSUES			0.953***	0.688***
			(0.054)	(0.065)
IND_MEDIAN_LEVERAGE			0.047***	0.008
			(0.016)	(0.019)
TREATED × CRISIS	−0.020	−0.027**	−0.019	−0.028**
	(0.012)	(0.011)	(0.012)	(0.012)
CRISIS	−0.006**	−0.009***	−0.004	−0.005
	(0.003)	(0.003)	(0.003)	(0.004)
Firm-level controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
No. of obs.	11,308	11,308	7,687	7,687
Adj. R^2	0.068	0.262	0.158	0.267

D. Persistent Effect of the Financial Crisis and Industry Effects

To investigate the possibility that unrated and low-rated firms were affected differently by the crisis, we include the interaction of the indicator variable for a treated firm with the years indicating the peak of the recent financial crisis (years 2008 and 2009) in our main specification. However, this approach does not address the possibility that our treatment and control groups continue to be affected differentially by the financial crisis during the postcrisis years. To address this possibility, we follow Fahlenbrach, Prilmeier, and Stulz (FPS) (2012) and calculate each firm's stock return during the recent financial crisis from July 2007 to Dec. 2008 (CRISISRET_07_08) as a proxy of a firm's exposure to financial crises. CRISISRET_07_08 varies across firms but remains the same within a firm. FPS make a persuasive case that these "crisis returns" substantially capture a firm's persistent exposure to financial crises because they are highly correlated

within a firm across different crisis periods.[24] Intuitively, in our context, a firm's CRISISRET_07_08 captures the market's expectations about the cumulative effects of various aspects of the financial crisis (e.g., financing constraints) on the firm's future policies and performance. Notably, CRISISRET_07_08 potentially incorporates the effects of the crisis even from sources unobservable to a researcher, and it predates discussions about Dodd–Frank. A firm with a worse crisis return is likely more exposed to the adverse effects of the crisis, and this exposure likely lingers for several years.

We add the interaction of CRISISRET_07_08 with POSTDF in columns 3 and 4 of Table 8 to examine the possibility that our results are driven by persistent and differential exposures of unrated and low-rated firms to the effects of the crisis. For instance, if low-rated firms are more exposed to the lingering effects of the financial crisis than the unrated group, then POSTDF × CRISISRET_07_08 should subsume the observed effect of POSTDF × TREATED. In these regressions, we also control for industry-level (defined by 3-digit SIC codes) median debt issuance, leverage, and performance (ROA) to address the concern that the financial crisis may have affected a subset of industries and industry affiliation may be correlated with credit ratings.

This exercise results in a substantial loss of data because CRISISRET_07_08 is undefined for firms that are not in the sample from July 2007 to Dec. 2008. Despite that, we have 2 main results. First, there is no significant difference in both the mean and median CRISISRET_07_08 between our treatment and control groups.[25] Second, and more importantly, the inclusion of POSTDF × CRISISRET_07_08 and industry-level performance, leverage, and debt issuance variables leave the coefficient of POSTDF × TREATED largely intact. These results provide further assurance that our observed treatment effect is not driven by these 2 groups' differential exposure to any lingering effects of the financial crisis.

E. Debt Structure

Another possible explanation of our main results stems from the fact that Dodd–Frank introduces several regulations on bank lending and asset-holding practices that affect banks' ability to lend. So the law may influence debt financing through its impact on the banking industry if the treated firms are more reliant on banks to provide capital. In this section, we analyze how Dodd–Frank affected treatment firms' debt structure (i.e., their use of various sources of debt capital). For this analysis, we use the Capital IQ database, which annually reports the breakdown of firms' outstanding debt by the type of debt. We focus on public bonds (sum of all bonds and notes) and bank loans (sum of term loans and drawn lines of credit). We calculate the annual changes in each type of debt from Capital IQ and scale the dollar changes by lagged total assets to construct our dependent variables analogous to our main debt issuance variables. We merge our debt structure data set to the

[24]FPS focus on banks, but they also find similar results with nonfinancial institutions (see, e.g., their Table VI).

[25]The mean (median) of CRISISRET_07_08 for the unrated group is −16% (−27%) and for the low-rated group is −18% (−23%). In contrast, for investment-grade firms, the mean (median) value of this variable is 2% (0%).

TABLE 9

Changes in Debt Structure

Table 9 reports regression results based on changes in firms' debt structure. Data on debt structure are from Capital IQ, and all other variables are from the Compustat and CRSP merged databases for the period 2005–2015. All firms meet the initial data requirement and the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. In addition, we require that i) the sum of all types of drawn debt in Capital IQ not exceed total assets in Compustat and ii) this sum be nonmissing in the pre-Dodd–Frank period. The dependent variables are annual changes in outstanding bonds, term loans, and drawn credit lines all scaled by previous year-end total assets. For example, ΔBONDS_NOTES is the amount of bonds and notes this year minus their amount last year as reported in Capital IQ, scaled by last year's total assets. PRE_BANK_DEPENDENCE is the mean of the ratio of all types of drawn and committed bank debt scaled by the sum of all types of debt in Capital IQ before the Dodd–Frank Act. Variables with IND_MEDIAN are annual industry medians based on 3-digit SIC codes. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 in the Appendix shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	ΔBONDS_NOTES 1	ΔTERM_LOANs 2	ΔDRAWN_CREDIT_LINES 3	ΔBONDS_NOTES 4	ΔTERM_LOANs 5	ΔDRAWN_CREDIT_LINES 6
POSTDF	0.010***	0.004	−0.001	0.001	0.018***	0.004
	(0.003)	(0.003)	(0.002)	(0.007)	(0.005)	(0.003)
POSTDF × TREATED	−0.032**	−0.035**	0.000	−0.028*	−0.039***	−0.001
	(0.016)	(0.015)	(0.004)	(0.016)	(0.015)	(0.005)
POSTDF × PRE_BANK_DEPENDENCE				0.011	−0.018***	−0.007***
				(0.007)	(0.004)	(0.002)
IND_MEDIAN_ROA				−0.003	−0.042	−0.012
				(0.046)	(0.032)	(0.021)
IND_MEDIAN_NET_DEBT_ISSUES				0.213**	0.269***	0.192***
				(0.084)	(0.082)	(0.054)
IND_MEDIAN_LEVERAGE				−0.021	−0.007	−0.001
				(0.028)	(0.025)	(0.015)
TREATED × CRISIS	−0.016	−0.024	−0.011	−0.015	−0.025*	−0.011
	(0.022)	(0.015)	(0.008)	(0.022)	(0.015)	(0.008)
CRISIS	0.002	0.001	−0.001	0.003	0.001	−0.000
	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
No. of obs.	7,351	7,351	7,351	7,351	7,351	7,351
Adj. R^2	0.021	−0.006	−0.042	0.023	0.000	−0.038
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes

annual Compustat database. Because the data frequency in Capital IQ does not match that in Compustat, we exclude the firm-years in which the sum of all types of debt in Capital IQ exceeds total assets in Compustat, which are very likely cases of mistakes. We also require that the sum of all debt types in Capital IQ database must be nonmissing at least once in the pre-Dodd–Frank period. Since many Compustat firms are not covered in Capital IQ, sample sizes drop considerably.

Table 9 reports the results from regressions of each type of debt in a framework similar to that of Panel A of Table 3. We find that compared to unrated firms, low-rated firms significantly reduce their use of debt from both public (bonds) and private (term loan) sources by about 3.2 and 3.5 percentage points, respectively, after the credit rating shock. There is no effect on the difference in the drawn revolving credit line. Next, we examine the possibility that this relation is driven by firms' dependence on bank capital. First, using data obtained from Capital IQ database, we find that our treatment firms are, in fact, less reliant on bank capital.[26]

[26]Sample sizes drop considerably in these tests because many Compustat firms are not in Capital IQ.

The average bank debt (including term loans and drawn and committed credit lines) to total debt ratio for the treatment firms before Dodd–Frank (PRE_BANK_DEPENDENCE) is 0.51, whereas this ratio for the control firms is 0.75. Moreover, as shown in columns 4–6, our results remain virtually unchanged if we add an interaction of PRE_BANK_DEPENDENCE with POSTDF along with industry median of debt issuance, leverage, and performance.

Bonds and bank loans are 2 major sources of debt capital, so these results support our previous findings of the reduction of total debt issuance by treatment firms. Moreover, these results further bolster our demand-based credit-rating risk hypothesis over the supply-based information hypothesis. Because credit ratings are more important for public bond markets than for banks, the supply-based hypothesis would predict a decrease in debt issuance only from the bond market.

VII. Conclusion

We discover an unintended spillover effect of Dodd–Frank's regulations on CRAs that incentivize them to issue lower credit ratings, and, in turn, affect the fates of firms vulnerable to the risk of rating downgrades. We build on DPT's (2015) findings that greater regulatory costs imposed by Dodd–Frank on CRAs incentivized them to issue lower credit ratings, possibly below the levels justified by the underlying credit quality of the rated firms. Prior studies find that low-rated firms face much steeper costs of rating downgrades, which suggests that they are likely to respond more strongly to Dodd–Frank to prevent downgrades. Consistent with this conjecture, we find that the increased risk of being downgraded due to Dodd–Frank's rules forced low-rated firms to cut back on debt issuance to protect their existing ratings. The reduction in debt issuance is not offset by an increase in equity issues, forcing these firms to cut back on net investment. The economic magnitudes of these effects are quite large. Based on the full sample, the decline in total net security issues (net investments) represents an 85% (24%) reduction for low-rated firms after the shock compared to their unconditional preshock averages.

A battery of additional tests helps rule out several alternative supply-side explanations of our results. One explanation is that Dodd–Frank led to CRAs producing more informative credit ratings, which revealed these firms' poorer credit quality and led to the drying up of their supply of debt capital. Another explanation is that Dodd–Frank and the preceding financial crisis affected many aspects of the financial system apart from CRAs, which likely affect banks' ability and incentives to lend. Likewise, the financial crisis affected the liquidity and demand for corporate bonds, especially junk bonds. If our treated and control firms differ in their primary source of debt capital, our results may stem from the shocks to the supply of debt capital. Another possibility is that our treatment and control groups continue to be affected differentially by the financial crisis during the postcrisis years. Our extensive cross-sectional analyses do not provide much support to these supply-side stories. Instead, our results are consistent with Kisgen's (2006) CR-CS theory that increased risk of downgrades led to a decrease in these firms' demand for debt, even without a change in their underlying credit quality.

We show that Dodd–Frank's efforts to make credit ratings more informative by putting pressure on CRAs negatively affected a broader range of firms that became vulnerable to rating downgrades. Our results point to another instance of unintended consequences of regulatory changes, even for firms not directly targeted by the regulation.

Appendix

TABLE A1

Rating Descriptions

Table A1 provides detailed information on the credit ratings used in this study for the period 2005–2015. We used monthly credit ratings provided by 3 nationally recognized credit rating agencies: S&P, Moody's, and Fitch. S&P domestic long-term issuer debt ratings are from the Compustat database. Moody's and Fitch ratings are collected from the Mergent Online database. Investment grade and below-investment grade refer to firms with AAA to BBB− and BB+ to CC ratings, respectively. We drop all firms that are rated C or below for this study.

Numerical Rating Scale	S&P/S&P Domestic Long-Term Issuer Debt Rating	Moody's	Fitch
1	AAA	Aaa	AAA
2	AA+	Aa1	AA+
3	AA	Aa2	AA
4	AA−	Aa3	AA−
5	A+	A1	A+
6	A	A2	A
7	A−	A3	A−
8	BBB+	Baa1	BBB+
9	BBB	Baa2	BBB
10	BBB−	Baa3	BBB−
11	BB+	Ba1	BB+
12	BB	Ba2	BB
13	BB−	Ba3	BB−
14	B+	B1	B+
15	B	B2	B
16	B−	B3	B−
17	CCC+	Caa1	CCC+
18	CCC	Caa2	CCC
19	CCC−	Caa3	CCC−
20	CC	Ca	CC
21	C	C	C
22	D	N/A	DDD/DD/D
23	SD		

TABLE A2

Variable Definitions

NET_LTD_ISSUES: (Long-term debt issues (DLTIS) − Long-term debt reduction (DLTR)) ÷ Previous-year-end total assets (AT)

NET_STD_ISSUES: Change in current debt (DLCCH) ÷ Previous-year-end total assets

NET_DEBT_ISSUES: Net LTD issues + Net STD issues

NET_EQUITY_ISSUES: (Sale of common and preferred stock (SSTK) − Purchase of common and preferred stock (PRSTKC)) ÷ Previous-year-end total assets

TOTAL_NET_SECURITY_ISSUES: Net debt issues + Net equity issues

TOTAL_DEBT: Total long-term debt (DLTT) + Total debt in current liabilities (DLC)

BOOK_LEVERAGE: Total debt ÷ Total assets

NET_INVESTMENT: (Capital expenditures (CAPX) + Acquisitions (AQC) + Increase in investments (IVCH) − Sale of property (SPPE) − Sale of investments (SIV)) ÷ Previous-year-end total assets

POSTDF: An indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise

FIRM_SIZE: Natural logarithm of sales, where sales is deflated by the 2004 GDP deflator

MB: Market value of assets ÷ Total assets (AT), where Market value of assets = Stock price (PRCC_F) × Common shares outstanding (CSHO) + Total debt + Preferred stock liquidating value (PSTKRV) − Deferred taxes and investment tax credit (TXDITC)

ZSCORE: (3.3 × Pre-tax income (EBIT) + Sales + 1.4 × Retained earnings (RE) + 1.2 × (Current assets (ACT) − Current liabilities (LCT))) ÷ Total assets

ln(FIRM_AGE): Natural logarithm of one plus firm age, the number of years the firm has been listed on Compustat

OPERATING_INCOME: Operating income before depreciation (OIBDP) ÷ Total assets (AT)

TANGIBILITY: Total net property, plant, and equipment (PPENT) ÷ Total assets (AT)

CASH: Cash ÷ Total assets (AT)

SP500: Indicator variable that equals 1 if the firm is in the S&P 500 index, and 0 otherwise

NYSE: Indicator variable that equals 1 if the firm is listed on the NYSE, and 0 otherwise

CRISIS: Indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise

HIGH(LOW)_INST: Indicator variable that equals 1 if the institutional ownership in the firm is greater (less) than the sample median, and 0 otherwise

HIGH(LOW)_LEV: Indicator variable that equals 1 if the firm's book leverage in the pre-Dodd–Frank period is greater (less) than the sample median, and 0 otherwise

POM: Indicator variable that equals 1 if the firm has a POM sign in its credit rating, and 0 otherwise

ILLIQSHOCK: Indicator variable that equals 1 for the years with negative aggregate flows to junk bond mutual funds, and 0 otherwise

PRE_BANK_DEPENDENCE: (Sum of term loans + Sum of drawn and undrawn credit lines) ÷ Sum of all debt from Capital IQ database, averaged over pre-DF period

BONDS_NOTES: Sum of senior and subordinate bonds and notes ÷ Previous-year-end total assets (AT)

TERM_LOAN: Sum of term loans ÷ Previous-year-end total assets (AT)

DRAWN_CREDIT_LINE: Sum of drawn credit lines ÷ Previous-year-end total assets (AT)

CRISISRET_07_08: Buy-and-hold stock returns from July 2007 to Dec. 2008

IND_MEDIAN: Industry median calculated based on 3-digit SIC and fiscal year

TABLE A3

Dodd–Frank Act and Firm Policies: Without Firm Fixed Effects

Table A3 reports our baseline regression results. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUES, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. Treated is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

	NET_DEBT_ ISSUES	NET_LTD_ ISSUES	NET_STD_ ISSUES	NET_EQUITY_ ISSUES	TOTAL_NET_ SECURITY_ISSUES	BOOK_ LEVERAGE	NET_ INVESTMENT
Variables	1	2	3	4	5	6	7
POSTDF	0.003	0.001	0.001**	−0.008**	−0.005	0.010*	−0.006**
	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.005)	(0.003)
POSTDF × TREATED	−0.022**	−0.024**	0.002	−0.002	−0.024**	0.025	−0.031***
	(0.010)	(0.010)	(0.001)	(0.006)	(0.011)	(0.016)	(0.011)
TREATED	0.020**	0.023**	−0.003**	0.017***	0.038***	0.214***	0.021*
	(0.009)	(0.009)	(0.001)	(0.006)	(0.010)	(0.018)	(0.011)
FIRM_SIZE	0.003***	0.003***	0.000	−0.007***	−0.004***	0.006***	0.004***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.002)	(0.001)
MB	0.004***	0.004***	−0.000	0.016***	0.020***	−0.001	0.011***
	(0.001)	(0.001)	(0.000)	(0.002)	(0.002)	(0.002)	(0.001)
ZSCORE	0.000	0.000	−0.000	−0.000	−0.000	−0.010***	−0.000
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.002)	(0.000)
ln(FIRM_AGE)	−0.005***	−0.005***	−0.001*	−0.016***	−0.022***	−0.019***	−0.020***
	(0.002)	(0.002)	(0.000)	(0.003)	(0.003)	(0.006)	(0.003)
OPERATING_ INCOME	−0.059***	−0.053***	−0.007***	−0.185***	−0.244***	−0.011	0.063***
	(0.007)	(0.007)	(0.002)	(0.019)	(0.021)	(0.025)	(0.010)
TANGIBILITY	0.014***	0.016***	−0.002*	0.044***	0.058***	0.141***	0.118***
	(0.005)	(0.005)	(0.001)	(0.007)	(0.008)	(0.020)	(0.009)
CASH	−0.021***	−0.013**	−0.008***	0.081***	0.060***	−0.310***	−0.070***
	(0.006)	(0.006)	(0.001)	(0.013)	(0.015)	(0.020)	(0.008)
SP500	−0.001	−0.001	−0.000	−0.025***	−0.027***	−0.024	0.010
	(0.005)	(0.005)	(0.001)	(0.008)	(0.009)	(0.022)	(0.009)
NYSE	0.000	0.000	0.000	0.000	0.001	−0.014	−0.004
	(0.003)	(0.003)	(0.001)	(0.003)	(0.004)	(0.009)	(0.004)
TREATED × CRISIS	−0.019*	−0.019*	−0.000	0.019***	0.000	0.025	−0.027**
	(0.011)	(0.011)	(0.002)	(0.007)	(0.012)	(0.017)	(0.011)
CRISIS	−0.006**	−0.006***	0.000	−0.018***	−0.024***	0.015***	−0.012***
	(0.002)	(0.002)	(0.001)	(0.003)	(0.004)	(0.004)	(0.003)
Firm FE	No	No	No	No	No	No	No
No. of obs.	11,324	11,324	11,324	11,324	11,324	11,297	11,324
Adj. R^2	0.020	0.018	0.005	0.197	0.169	0.305	0.119

TABLE A4

Tests of Parallel Trends Before DFA

Table A4 presents mean differences in financing and investment growth rates between below-investment-grade firms and unrated firms during the pre-Dodd–Frank period (2005–2010). The first set of results is from the full sample, and the second set is from the propensity-score-matched sample. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after Dodd–Frank. All continuous variables are winsorized at their 1st and 99th percentiles. Table A2 defines the variables.

	Before Dodd–Frank Using Full Sample				Before Dodd–Frank Using Propensity-Score-Matched Sample			
Variables	Unrated 1	Below-Investment Grade 2	Mean Difference 2 − 1	*t*-Statistics	Unrated 1	Below-Investment Grade 2	Mean Difference 2 − 1	*t*-Statistics
NET_DEBT_ISSUES_GROWTH	−1.371	−1.149	0.222	0.39	−0.984	−1.660	−0.676	−0.680
NET_LTD_ISSUES_GROWTH	−1.157	−0.816	0.341	0.68	−0.898	−0.916	−0.018	−0.020
NET_STD_ISSUES_GROWTH	−1.043	−0.773	0.27	0.81	−1.295	−0.422	0.874	1.460
NET_EQUITY_ISSUE_GROWTH	1.886	0.617	−1.269	−1.39	1.268	0.967	−0.301	−0.210
TOTAL_NET_SECURITY_ISSUES_GROWTH	−0.186	−0.695	−0.509	−0.91	0.226	−0.912	−1.138	−1.160
NET_INVESTMENT_GROWTH	0.312	0.148	−0.164	−0.98	0.263	0.199	−0.064	−0.350

TABLE A5

Results from Alternative Control Group (Below-Investment-Grade vs. Investment-Grade Firms)

Table A5 reports regression results where we change the control group firms to be investment-grade firms. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) investment-grade firms remain in the below-investment-grade category throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUES, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is investment grade, and 0 if it is unrated. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in the parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 shows credit rating scales, and Table A2 defines the variables. ***, and ** denote statistical significance at the 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ISSUES 1	NET_LTD_ISSUES 2	NET_STD_ISSUES 3	NET_EQUITY_ISSUES 4	TOTAL_NET_SECURITY_ISSUES 5	BOOK_LEVERAGE 6	NET_INVESTMENT 7
POSTDF	0.009	0.006	0.003	0.001	0.010	0.027**	0.003
	(0.007)	(0.007)	(0.002)	(0.005)	(0.008)	(0.011)	(0.008)
POSTDF × TREATED	−0.025**	−0.026**	0.001	−0.023***	−0.048***	−0.046***	−0.032**
	(0.012)	(0.012)	(0.002)	(0.007)	(0.013)	(0.014)	(0.013)
CRISIS × TREATED	−0.037**	−0.040***	0.003	−0.015**	−0.052***	−0.009	−0.042***
	(0.015)	(0.014)	(0.002)	(0.007)	(0.015)	(0.013)	(0.014)
CRISIS	0.006	0.007	−0.001	0.004	0.009	0.016**	0.002
	(0.007)	(0.007)	(0.002)	(0.005)	(0.008)	(0.008)	(0.008)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	2,150	2,150	2,150	2,150	2,150	2,144	2,150
Adj. R^2	0.038	0.045	−0.039	0.341	0.157	0.860	0.272

TABLE A6

Results from Alternative Treated Group (Investment-Grade vs. Unrated Firms)

Table A6 reports regression results where we change the treated group to investment-grade firms (ALT_TREATED). Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUES, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in the parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ ISSUES 1	NET_LTD_ ISSUES 2	NET_STD_ ISSUES 3	NET_EQUITY_ ISSUE 4	TOTAL_NET_ SECURITY_ISSUES 5	BOOK_ LEVERAGE 6	NET_ INVESTMENT 7
POSTDF	0.006*	0.003	0.002***	−0.001	0.005	−0.010**	0.006
	(0.003)	(0.003)	(0.001)	(0.005)	(0.006)	(0.005)	(0.004)
POSTDF × ALT_TREATED	0.003	0.002	0.001	0.012**	0.015**	0.053***	−0.001
	(0.006)	(0.005)	(0.002)	(0.005)	(0.007)	(0.009)	(0.007)
ALT_TREATED × CRISIS	0.011	0.013**	−0.002	0.028***	0.038***	0.011	0.006
	(0.007)	(0.006)	(0.002)	(0.006)	(0.009)	(0.007)	(0.008)
CRISIS	−0.007***	−0.008***	0.001	−0.014***	−0.022***	0.003	−0.010***
	(0.003)	(0.003)	(0.001)	(0.004)	(0.004)	(0.003)	(0.003)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	11,513	11,513	11,513	11,513	11,513	11,485	11,513
Adj. R^2	0.061	0.063	0.006	0.357	0.305	0.734	0.252

TABLE A7

Results from the Subsample of Treated Firms Rated BB+ to B−

Table A7 reports regression results from the subsample of treated firms which excludes all CCC+ and lower rated firms. Data are from the annual Compustat database for the period 2005–2015. In addition to the initial data requirements, the firms meet the three criteria described in Section IV.A: i) below-investment-grade firms remain in the below-investment-grade category throughout the sample period, ii) unrated firms remain unrated throughout the sample period, and iii) each firm has at least one observation before and after the Dodd–Frank Act. The dependent variables are NET_DEBT_ISSUES, NET_LTD_ISSUES, NET_STD_ISSUES, NET_EQUITY_ISSUES, TOTAL_NET_SECURITY_ISSUES, BOOK_LEVERAGE, and NET_INVESTMENT. POSTDF is an indicator variable that equals 1 if the fiscal year ending date is after July 2010, and 0 otherwise. TREATED is an indicator variable that equals 1 if the firm is below-investment grade, and 0 if it is unrated. HIGH_LEV is an indicator variable that equals 1 if the firm has above sample median book leverage in the pre-Dodd–Frank period, and 0 otherwise. Alternatively, LOW_LEV is an indicator variable that equals 1 if the firm has below sample median book leverage in the pre-Dodd–Frank period, and 0 otherwise. CRISIS is an indicator variable that equals 1 for the years 2008 and 2009, and 0 otherwise. The regressions include firm-level controls as in Table 3 and firm fixed effects. Robust standard errors, clustered at the firm level, are reported in parentheses. All continuous variables are winsorized at their 1st and 99th percentiles. Table A1 shows credit rating scales, and Table A2 defines the variables. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively, in 2-tailed tests.

Variables	NET_DEBT_ ISSUES 1	NET_LTD_ ISSUES 2	NET_STD_ ISSUES 3	NET_ EQUITY_ ISSUE 4	TOTAL_ NET_SECURITY_ ISSUES 5	BOOK_ LEVERAGE 6	NET_ INVESTMENT 7
POSTDF	0.006*	0.003	0.003***	−0.000	0.006	−0.007	0.005
	(0.003)	(0.003)	(0.001)	(0.005)	(0.006)	(0.005)	(0.004)
POSTDF × TREATED × HIGH_LEV	−0.024**	−0.026**	0.002*	−0.005	−0.029**	0.010	−0.028**
	(0.011)	(0.011)	(0.001)	(0.007)	(0.012)	(0.015)	(0.011)
POSTDF × TREATED × LOW_LEV	0.015	0.015	0.000	−0.024**	−0.008	0.012	0.014
	(0.014)	(0.014)	(0.001)	(0.011)	(0.017)	(0.021)	(0.020)
TREATED × CRISIS	−0.018	−0.019	0.001	0.021***	0.003	0.021	−0.025**
	(0.013)	(0.013)	(0.002)	(0.007)	(0.013)	(0.013)	(0.012)
CRISIS	−0.006**	−0.006**	0.001	−0.016***	−0.021***	0.004	−0.010***
	(0.003)	(0.003)	(0.001)	(0.004)	(0.005)	(0.003)	(0.003)
Firm-level controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of obs.	11,287	11,287	11,287	11,287	11,287	11,258	11,287
Adj. R^2	0.062	0.064	0.011	0.350	0.301	0.776	0.257

References

Adhikari, B.; D. C. Cicero; and J. Sulaeman. "Does Local Capital Supply Matter for Public Firms' Capital Structures?" *Journal of Financial and Quantitative Analysis*, 56 (2021), 1809–1843.

Agrawal, A., and J. F. Jaffe. "Does Section 16b Deter Insider Trading by Target Managers?" *Journal of Financial Economics*, 39 (1995), 295–319.

Agrawal, A., and C. R. Knoeber. "Firm Performance and Mechanisms to Control Agency Problems Between Managers and Shareholders." *Journal of Financial and Quantitative Analysis*, 31 (1996), 377–397.

Almeida, H.; I. Cunha; M. A. Ferreira; and F. Restrepo. "The Real Effects of Credit Ratings: The Sovereign Ceiling Channel." *Journal of Finance*, 72 (2017), 249–290.

Appel, I.; T. Gormley; and D. B. Keim. "Passive Investors, Not Passive Owners." *Journal of Financial Economics*, 121 (2016), 111–141.

Brav, A.; W. Jiang; and H. Kim. "The Real Effects of Hedge Fund Activism: Productivity, Asset Allocation, and Labor Outcomes." *Review of Financial Studies*, 28 (2015), 2723–2769.

Brüggemann, U.; J.-M. Hitz; and T. Sellhorn. "Intended and Unintended Consequences of Mandatory IFRS Adoption: A Review of Extant Evidence and Suggestions for Future Research." *European Accounting Review*, 22 (2013), 1–37.

Cardella, L.; D. Fairhurst; and S. Klasa. "What Determines the Composition of a Firm's Total Cash Reserves?" *Journal of Corporate Finance*, 68 (2021), 101924.

Chernenko, S., and A. Sunderam. "The Real Consequences of Market Segmentation." *Review of Financial Studies*, 25 (2012), 2041–2069.

Colla, P.; F. Ippolito; and K. Li. "Debt Specialization." *Journal of Finance*, 68 (2013), 2117–2141.

Cornell, B.; W. Landsman; and A. C. Shapiro. "Cross-Sectional Regularities in the Response of Stock Prices to Bond Rating Changes." *Journal of Accounting, Auditing and Finance*, 4 (1989), 460–479.

Dimitrov, V.; D. Palia; and L. Tang. "Impact of the Dodd–Frank Act on Credit Ratings." *Journal of Financial Economics*, 115 (2015), 505–520.

Ederington, L. H., and J. C. Goh. "Bond Rating Agencies and Stock Analysts: Who Knows What When?" *Journal of Financial and Quantitative Analysis*, 33 (1998), 569–585.

Fahlenbrach, R.; R. Prilmeier; and R. M. Stulz. "This Time Is the Same: Using Bank Performance in 1998 to Explain Bank Performance During the Recent Financial Crisis." *Journal of Finance*, 67 (2012), 2139–2185.

Ferreira, M. A., and P. Matos. "The Colors of Investors' Money: The Role of Institutional Investors Around the World." *Journal of Financial Economics*, 88 (2008), 499–533.

Gao, F.; J. S. Wu; and J. Zimmerman. "Unintended Consequences of Granting Small Firms Exemptions from Securities Regulation: Evidence from the Sarbanes–Oxley Act." *Journal of Accounting Research*, 47 (2009), 459–506.

Goel, A. M., and A. V. Thakor. "Credit Ratings and Litigation Risk." Working Paper, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1787206 (2011).

Goel, A. M., and A. V. Thakor. "Information Reliability and Welfare: A Theory of Coarse Credit Ratings." *Journal of Financial Economics*, 115 (2015), 541–557.

Graham, J. R, and C. R. Harvey. "The Theory and Practice of Corporate Finance: Evidence from the Field." *Journal of Financial Economics*, 60 (2001), 187–243.

Grennan, J.; R. Michaely; and C. J. Vincent. "The Deleveraging of U.S. Firms and Institutional Investors' Role." Working Paper, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1941902 (2017).

Griffin, P. A., and A. Z. Sanvicente. "Common Stock Returns and Rating Changes: A Methodological Comparison." *Journal of Finance*, 37 (1982), 103–119.

Hamilton, D. T., and R. Cantor. "Rating Transitions and Defaults Conditional on Rating Outlooks Revisited: 1995–2005." *Moody's Investors Service Special Comment*, December (2005).

Hand, J. R. M.; R. W. Holthausen; and R. W. Leftwich. "The Effect of Bond Rating Agency Announcements on Bond and Stock Prices." *Journal of Finance*, 47 (1992), 733–752.

Holthausen, R. W., and R. W. Leftwich. "The Effect of Bond Rating Changes on Common Stock Prices." *Journal of Financial Economics*, 17 (1986), 57–89.

Hosmer Jr, D. W.; S. Lemeshow; and R. X. Sturdivant. *Applied Logistic Regression*. Hoboken, NJ: John Wiley & Sons (2013).

Hull, J.; M. Predescu; and A. White. "The Relationship Between Credit Default Swap Spreads, Bond Yields, and Credit Rating Announcements." *Journal of Banking and Finance*, 28 (2004), 2789–2811.

Jeon, D.-S., and S. Lovo. "Credit Rating Industry: A Helicopter Tour of Stylized Facts and Recent Theories." *International Journal of Industrial Organization*, 31 (2013), 643–651.

Jorion, P.; Z. Liu; and C. Shi. "Informational Effects of Regulation FD: Evidence from Rating Agencies." *Journal of Financial Economics*, 76 (2005), 309–330.
Jorion, P., and G. Zhang. "Information Effects of Bond Rating Changes: The Role of the Rating Prior to the Announcement." *Journal of Fixed Income*, 16 (2007), 45–59.
Kadapakkam, P.-R.; A. Meisami; and J. K. Wald. "The Debt Trap: Wealth Transfers and Debt-Equity Choices of Junk-Grade Firms." *Financial Review*, 51 (2016), 5–35.
Katz, S. "The Price Adjustment Process of Bonds to Rating Reclassifications: A Test of Bond Market Efficiency." *Journal of Finance*, 29 (1974), 551–559.
Kisgen, D. J. "Credit Ratings and Capital Structure." *Journal of Finance*, 61 (2006), 1035–1072.
Kisgen, D. J. "Do Firms Target Credit Ratings or Leverage Levels?" *Journal of Financial and Quantitative Analysis*, 44 (2009), 1323–1344.
Kisgen, D. J., and P. E. Strahan. "Do Regulations Based on Credit Ratings Affect a Firm's Cost of Capital?" *Review of Financial Studies*, 23 (2010), 4324–4347.
Kwan, S. H. "Firm-Specific Information and the Correlation Between Individual Stocks and Bonds." *Journal of Financial Economics*, 40 (1996), 63–80.
Lemmon, M., and M. R. Roberts. "The Response of Corporate Financing and Investment to Changes in the Supply of Credit." *Journal of Financial and Quantitative Analysis*, 45 (2010), 555–587.
Linck, J. S.; J. M. Netter; and T. Yang. "The Effects and Unintended Consequences of the Sarbanes–Oxley Act on the Supply and Demand for Directors." *Review of Financial Studies*, 22 (2009), 3287–3328.
Manso, G. "Feedback Effects of Credit Ratings." *Journal of Financial Economics*, 109 (2013), 535–548.
May, A. D. "The Impact of Bond Rating Changes on Corporate Bond Prices: New Evidence from the Over-the-Counter Market." *Journal of Banking and Finance*, 34 (2010), 2822–2836.
Rauh, J. D., and A. Sufi. "Capital Structure and Debt Structure." *Review of Financial Studies*, 23 (2010), 4242–4280.
Tang, T. T. "Information Asymmetry and Firms' Credit Market Access: Evidence from Moody's Credit Rating Format Refinement." *Journal of Financial Economics*, 93 (2009), 325–351.
U.S. Securities and Exchange Commission (SEC). "Concept Release: Rating Agencies and the Use of Credit Ratings Under the Federal Securities Laws," available at https://www.sec.gov/rules/concept/33-8236.htm (2003).
White, L. J. "Markets: The Credit Rating Agencies." *Journal of Economic Perspectives*, 24 (2010), 211–226.