Commitment in Debt Financing: The Role of Coordination Problem*

Yongseok Kim†

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Abstract

Creditors may fail to agree on a mutually beneficial debt restructuring due to externalities across them. This coordination problem increases the cost of financial distress, but it also benefits borrowers by serving as a commitment device. Using a unique law reform in Korea that mitigates the coordination problem, I provide a novel empirical test to isolate the benefits of the coordination problem. I find evidence that firms actively use the coordination problem as a commitment device. Therefore, mitigating this problem can impair firms' ability to commit and borrow. Contrary to conventional wisdom, my analysis suggests that the importance of commitment is not limited to environments with weak creditor protection.

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†Indiana University, Kelley School of Business. Email: yk80@iu.edu.

1 Introduction

Under incomplete contracting, parties may fail to agree on mutually beneficial contracts due to limitations in enforcing such contracts (Grossman and Hart, 1986; Hart and Moore, 1990; Hart, 2017). A key finding in the theoretical literature is that certain contractual features, even if they appear inefficient ex post, can be optimal for both parties if they contribute to establishing commitments and completing contracts. One application of this insight is the coordination problem among creditors in debt contracting. The coordination problem refers to the difficulty of reaching an agreement on debt restructuring, even when such restructuring would benefit all creditors involved (Gertner and Scharfstein, 1991). A common view is that the coordination problem increases the cost of financial distress by hindering efficient resolution, which ultimately weakens borrowers' ability to borrow.

However, theories also propose that the coordination problem can serve as a useful commitment device (Bolton and Scharfstein, 1996; Diamond and Rajan, 2001; Diamond, 2004). In an environment where borrowers have strategic incentives to default on their contracts, borrowers need to demonstrate an ex ante commitment to repayment. To establish this commitment and secure borrowing, borrowers may intentionally worsen the coordination problem and make default more costly. If this is the case, mitigating the coordination problem can impair borrowers' ability to commit and borrow. This theoretical proposition raises fundamental empirical questions: Do borrowers actively use the coordination problem for commitment? And if so, how important is it for their borrowing capacity? Despite its theoretical importance, empirical evidence remains scarce.

To address these questions, I provide a novel empirical test to isolate the benefits of the coordination problem for commitment. My empirical strategy is based on a thought experiment involving a law reform that mitigates the coordination problem. If the coordination problem serves as a commitment device, this reform would impair firms' ability to commit and borrow. To isolate this effect from other economic changes, I contrast the effect of this reform on a firm with a high value of commitment (firm H) with that on a firm with a low value of commitment (firm L). The idea behind this contrast is that firms with a high value of commitment should be more reliant on the coordination problem for commitment than those with a low value of commitment. Therefore, this reform would weaken the ability to commit and borrow in firm H more severely than in firm L, which, in turn, leads to a decrease in leverage for firm H relative to firm L. I label this mechanism as the *commitment channel*.

This strategy poses a challenge in measuring the value of commitment, as it reflects various hard-to-observe factors. One such factor is the inalienability of human capital, which can strengthen a borrower's threat of quitting projects (Hart and Moore, 1994). Personal reputation is another factor (Belenzon *et al.*, 2017; Diep-Nguyen and Dang, 2022). Borrowers can use their personal

reputation as a form of social collateral, which strengthens their commitment to repayment. While these factors strongly shape the value of commitment, evaluating them is difficult in real-world contexts.

To overcome this challenge, I propose a revealed preference approach based on a theoretical framework. The idea is that firms may choose a debt structure with dispersed creditors to increase the difficulty of renegotiations, particularly when the value of this commitment is high. Therefore, in equilibrium, firms with a high value of commitment would choose a high creditor dispersion. Building on this idea, I argue that creditor dispersion prior to the reform can indirectly reveal the value of commitment in a borrower. I provide a simple model to formalize a test based on this approach. Combined with the revealed preference approach, my model of the commitment channel predicts a stronger effect of the reform on firms with high creditor dispersion.

While the differential effect of the reform on firms with high creditor dispersion is a key prediction of the commitment channel I analyze, in principle, alternative channels could also rationalize this differential effect. One key alternative explanation arises from the aspect that the reform not only facilitates strategic defaults but also improves the efficiency of debt restructurings, which leads to a decrease in the cost of liquidity defaults (as opposed to strategic defaults). I refer to this mechanism as the *liquidity channel*. This liquidity channel can affect firms' leverage for two reasons. First, it can increase firms' demand for debt by lowering the cost of financial distress. Second, it can increase the credit supply by improving creditors' recovery rates.

Importantly, the liquidity channel can also have differential effects on firms with high creditor dispersion, because creditor dispersion may reflect a firm's exposure to the costs of liquidity defaults. Specifically, firms with lower exposure to liquidity defaults may have chosen higher creditor dispersion, as they are less concerned about the coordination problem during financial distress. Therefore, the liquidity channel also predicts the differential effect of the reform, suggesting that firms with high creditor dispersion would benefit less from the reduction in the cost of liquidity defaults and experience a smaller increase in leverage after the reform.

To isolate the commitment channel from the liquidity channel, I further contrast the differential effect of the reform among low default risk firms with that among high default risk firms. My theoretical framework illustrates that these two channels make opposing predictions regarding this contrast. The commitment channel predicts a stronger differential effect among low default risk firms. As a debt structure with dispersed creditors increases the cost of liquidity defaults, to effectively use this commitment device, a borrower should have a sufficiently low exposure to default. Therefore, dispersed creditors are more likely to reflect the value of commitment among low default risk firms. On the other hand, the liquidity channel suggests a weaker differential effect among low default risk firms, as these firms are less affected by changes in the cost of liquidity default. Therefore, incorporating this additional contrast allows me to disentangle the commitment channel from the liquidity channel.

My empirical test requires the isolation of a shock that solely affects the coordination problem in debt restructurings. However, achieving this isolation is challenging because other factors may be also involved in bankruptcy laws and reforms. To tackle this challenge, I exploit a unique law reform in Korea that significantly expands supermajority vote requirements in out-of-court corporate debt restructurings. The supermajority vote is considered as a classical solution to address coordination problems and facilitate debt restructurings (Gertner and Scharfstein, 1991).[1] Under this voting rule, once a plan is approved by a supermajority vote in a creditor meeting, the plan becomes binding even to dissenting creditors. As a result, the supermajority vote requirement mitigates the coordination problem and makes renegotiations across dispersed creditors easier.

Initially, the supermajority vote requirement in Korean out-of-court restructurings only applied to a limited number of firms. However, in March 2016, lawmakers expanded the scope of the voting rule to cover all firms. This expansion provides me with a broad sample of firms that experienced the mitigation of the coordination problem. In my analysis, I specifically focus on firms that were primarily affected by the reform. I use firms that were not affected by the 2016 reform in my falsification test to examine if other economic shocks differentially affect firms with high creditor dispersion.

My empirical test to isolate the commitment channel is to examine if there are significant differential effects of this reform on firms with high creditor dispersion and low default risk. I execute this test through a difference-in-differences regression with firm fixed effects and time fixed effects. This regression compares the changes in leverage ratios between firms with high and low creditor dispersion around the reform. As illustrated above, if the commitment channel is true, I expect to find a decrease in the leverage ratio of firms with high creditor dispersion after the reform. To disentangle the commitment channel from the liquidity channel, I further contrast this differential change among low default risk firms with that among high default risk firms. If the commitment channel is true, then the differential change should be more pronounced among low default risk firms.

I construct a novel dataset of firm-creditor relationships by manually collecting data from the footnotes of audited 10-K reports. This dataset allows me to observe the outstanding loans from the current creditors and construct a firm-level time-varying measure of creditor dispersion. My primary measure is the Herfindahl-Hirschman Index (HHI) of creditor shares in a firm. My sample mainly consists of small, private firms, which are not observable in many other settings. I view this sample composition as advantageous, because it helps mitigate alternative explanations from the substitution between equity and debt that may arise in larger, public firms. My sample is highly representative: it covers more than 70 percent of all firms in the DART universe. The

[1] Policymakers have introduced supermajority votes in various contexts. These contexts include the US chapter 11 voting rule (Skeel, 1992) (which has influenced bankruptcy laws in other countries) and Collective Action Clauses (CACs) in sovereign debts (Carletti *et al.*, 2020)

average firm has 3.4 creditors. These creditors are mostly banks, which is consistent with the bank-centric nature of the debt market in the country.

In this setting, I find that the leverage ratio in firms with high creditor dispersion decreases by 1 percentage points more than in firms with low creditor dispersion following the 2016 reform. Importantly, this differential change is more pronounced, with a 1.6 percentage-point decrease (a 8.5% relative effect to the mean), among low default risk firms. This additional contrast helps rule out explanations based on the liquidity channel and further strengthen explanations based on the commitment channel. I interpret this concentration of the differential effect among low default risk firms as evidence supporting the commitment channel.

The magnitude of the commitment channel should be understood in the context of the high persistence of the leverage ratio. Lemmon *et al.* (2008) find that a significant portion of variation in leverage is attributed to time-invariant factors within a firm. Moreover, firm characteristics commonly identified as key determinants of leverage explain relatively small variation in leverage. For comparison, a one-standard deviation change in size, market-to-book, profitability, or tangibility is associated with between a 2 to 4 percentage point change in leverage.[2] Overall, the magnitude of the commitment channel is comparable to the effect of a one-standard deviation change in these key determinants of leverage, which underscores its economic significance.

My identification assumption is that there are no other mechanisms that differentially affect the leverage ratios of firms based on their creditor dispersion, particularly among firms with low default risk. This assumption does not mean that the timing of the reform is uncorrelated with changes in economic conditions. I acknowledge that the reform can have effects on, or its timing can be correlated with, changes in economic conditions. However, these changes in economic conditions could be a threat to my interpretation only if they differentially affect firms with high and low creditor dispersion, particularly among firms with low default risk. For example, in principle, it is possible that firms with high creditor dispersion experience negative changes in investment opportunities after the reform, particularly among firms with low default risk. These negative changes would lead to a decrease in credit demand and leverage in these firms.

To address this possibility, I examine whether changes in economic conditions differentially affect firms with high and low creditor dispersion in a falsification test. In this test, I analyze firms that do not experience the mitigation of the coordination problem around the reform timing. If changes in economic conditions asymmetrically affect firms with high creditor dispersion, I should also observe a decrease in leverage in firms with high creditor dispersion (relative to those with low creditor dispersion) among these firms. However, in the falsification test, I find no differential change in leverage among the untreated firms, suggesting that changes in economic conditions do not differentially affect firms with high dispersion.

[2] Lemmon *et al.* (2008) use US public firms for their analysis. I conduct an equivalent analysis using my sample of Korean firms and find similar results.

My approach does not require firms to have their creditor dispersion randomly. Instead, as discussed above, I argue that firms' creditor dispersion is shaped by, and thus correlated with, their value of commitment. In principle, creditor dispersion could also be correlated with other firm characteristics beyond the value of commitment and default risk. The presence of this correlation could be a threat to my interpretation only if these characteristics predict the exposure of firms to alternative channels through which the reform affects the leverage ratio. I address this issue by examining whether the differential effect is sensitive to controls for firm characteristics, such as industry, size, and age. If these alternative mechanisms drive the differential effect of the reform, then I should observe no or weaker differential effect once I include these controls. I find the differential effect is not sensitive to controls for firm characteristics, which suggests these alternative mechanisms cannot explain my results.

My approach does not rely on the assumption that firms with high and low creditor dispersion are matched to similar creditors. Instead, it allows for assortative matching between firms and creditors as long as the reform does not differentially affect the creditors matched with firms with high creditor dispersion. Assortative matching could be a concern if the creditors matched with firms with high creditor dispersion experience negative changes in their economic conditions after the reform, which leads to a decrease in credit supply. This differential change in the conditions of the matched creditors could subsequently result in a decrease in leverage in firms with high creditor dispersion (relative to firms with low creditor dispersion), even without the mitigation of the coordination problem. However, the absence of a differential effect in my falsification test suggests that this concern is unlikely. Nonetheless, I further address this concern by constructing a measure of matched bank conditions and estimating regressions with controls for matched bank conditions. I find that the differential effect is not sensitive to this control, which suggests that assortative matching cannot explain the differential effect.

Although I interpret my findings as evidence that firms actively use creditor dispersion to worsen the coordination problem and establish commitment, in principle, firms may use creditor dispersion for other purposes, such as the diversification of credit supplier risk (Detragiache *et al.*, 2000) or the mitigation of the hold-up problem (Rajan, 1992). However, even if creditor dispersion reflects a firm's exposure to the benefits from these mechanisms, the supermajority vote is unlikely to affect credit supplier risk or the hold-up problem. Therefore, these alternative motives for dispersed creditors cannot explain the differential effect after the reform, particularly among firms in low default risk. The absence of a differential effect in my falsification test further suggests that changes in these factors are unlikely to explain the differential effect of the reform.

In addition to my main findings, I further explore additional implications of the commitment channel. One prediction of the commitment channel is that creditor dispersion is more likely to reflect the value of commitment when firms have a lower liquidation efficiency. If assets-in-place are easy to liquidate, creditors would be less concerned about strategic default, which reduces the

need for commitment. Therefore, if the commitment channel explains my results, the differential effect should be more pronounced among low liquidation efficiency firms. To test this prediction, I measure liquidation efficiency by the real estate ratio, which is calculated as the sum of land and building values divided by total assets, and conduct a subsample analysis based on the real estate ratio. Consistent with the theoretical predictions from the commitment channel, I find a stronger differential effect among low real estate ratio firms.

Another prediction of the commitment channel is a convergence of creditor dispersion between firms with initially high and low creditor dispersion. Since the reform reduces the effectiveness of creditor dispersion in worsening the coordination problem and establishing commitment, the marginal benefit of increasing creditor dispersion would decline. As a result, firms would decrease their creditor dispersion after the reform. Moreover, this convergence in creditor dispersion should be more pronounced in firms where dispersed creditors are more likely to reflect the value of commitment. To test this prediction, I analyze the changes in creditor dispersion between firms with initially high and low creditor after the reform. Consistent with the theoretical predictions from the commitment channel, I find evidence of a convergence in creditor dispersion, particularly among firms with low default risk and low liquidation efficiency.

Overall, my empirical analysis provides compelling evidence that firms actively use the coordination problem as a commitment device. Therefore, mitigating the coordination problem can incur ex ante costs by making firms financially constrained. To my best knowledge, this is the first paper to show the benefits of the coordination problem for commitment in corporate debt financing. The commitment problem, which hinders efficient contracting à la Coase (1937), is salient in various economic contexts, ranging from politicians' election promise (Acemoglu, 2003) to sovereign debt financing (Bulow and Rogoff, 1989) and boundaries of firms (Grossman and Hart, 1986; Hart and Moore, 1990). Naturally, understanding how people and institutions overcome the commitment problem in real-world contexts has long been a central question in economics. Corporate debt financing has been extensively examined as a theoretical laboratory to study the commitment problem (e.g., Bolton and Scharfstein, 1990, 1996; Hart and Moore, 1994, 1998). On the empirical front, recent evidence has highlighted the significant threat posed by strategic default to creditors, even in well-developed markets (Roberts and Sufi, 2009; Dinc and Yonder, 2021), which underscores the empirical importance of commitment in this setting. My findings contribute to this extensive literature by examining the strategic use of the coordination problem by firms for commitment.

My paper also contributes to policy design for efficient resolution of financial distress. Although the supermajority vote is considered a key feature of the US Chapter 11 bankruptcy system (Gertner and Scharfstein, 1991), isolating its specific effects is challenging due to the presence of other features in bankruptcy laws. In the context of sovereign debt restructurings, Carletti *et al.* (2020) show that the introduction of supermajority votes in Eurozone countries primarily pro-

vides beneficial flexibility rather than commitment costs.[3] However, as sovereigns face minimal legal enforcement, these findings may not directly apply to settings with stronger legal enforcement mechanisms. My analysis examines the effect of supermajority votes in corporate debt financings and explores variations in this effect based on the efficiency of legal enforcement. My findings provide policy implications by contributing to a more comprehensive understanding of the relationship between the efficiency of legal enforcement and the facilitation of restructurings.

My findings relate to the literature on the effect of renegotiation frictions in corporate debt. Recent papers have examined the ex-post costs of these frictions, which hinder the efficient resolution of financial distress (Ivashina *et al.*, 2016; Chu, 2021). Additionally, the literature has investigated the ex-ante effects of renegotiation frictions on various outcomes, such as credit spreads (Davydenko and Strebulaev, 2007), equity risk (Favara *et al.*, 2012), investment (Favara *et al.*, 2017), and CDS spreads (Campello *et al.*, 2018). However, many of these papers rely on cross-country or cross-firm variations, which leads to challenges in isolating the effects. My study makes progress on these challenges by leveraging a unique exogenous shock that solely mitigates these frictions and by exploiting within-firm variation.

The remainder of the paper is organized as follows. Section 2 outlines a theoretical framework that serves as a basis for the empirical analysis. Section 3 describes my empirical strategy. Section 4 discusses the institutional background and the law reform. Section 5 describes the data. Sections 6 and 7 present the empirical results. Section 8 concludes.

[3]The evidence on the effect of easier renegotiations in sovereign debts is indeed mixed. Carletti *et al.* (2020) and Chung and Papaioannou (2020) provide evidence that supports the idea that easier renegotiations can have positive effects. However, using a different shock, Donaldson *et al.* (2021) present contrasting evidence, suggesting that easier renegotiations can actually increase borrowing costs for sovereigns, which highlights the importance of commitment in this context.

2 Theoretical Framework

I present a simple model to motivate my empirical analysis. Here, I focus on discussing the key intuitions from this framework. The formal analysis of the model is presented in Appendix A.

The starting point is the idea that firms have strategic incentives to default on and renegotiate contracts after borrowing. This ex post incentive makes it difficult for firms to credibly commit to repaying their debt, which ultimately limits their ability to borrow in the first place. Limited legal enforcement can be one source of this commitment problem. Another source is the inalienability of human capital (Hart and Moore, 1994). If the human capital of a manager is essential for the business, he can threaten creditors to quit at an interim stage. To agree on a contract, creditors will require firms to commit not to use this bargaining power for renegotiations.

In this environment, firms want to commit to repayment, as their ability to borrow will be shaped by such credible commitments. Suppose firms can build a financial structure where strategic defaults are costly for themselves. This financial structure will limit firms' incentives to default ex post. Understanding these improved incentives for repayment, creditors will be more willing to lend ex ante. In other words, a financial structure that is costly to renegotiate ex post can serve as a useful commitment device for firms. This idea has been highlighted by Bolton and Scharfstein (1996), Diamond and Rajan (2001), and Diamond (2004).

Specifically, creditor dispersion can provide such a commitment device. When creditors are dispersed, they may fail to reach an agreement on debt restructuring, even though such restructuring benefits all involved creditors. This coordination problem can arise because a creditor's debt concession becomes a public good that incentivizes other creditors to free-ride on concessions made by others (Gertner and Scharfstein, 1991). Firms can worsen this problem by increasing creditor dispersion in their debt structure. As the coordination problem is more severe, renegotiations become harder and more costly. Therefore, a debt structure with dispersed creditors makes strategic defaults less attractive for firms, which effectively establishes commitment.

A law reform that makes renegotiations easier ex post can limit firms' ability to commit and borrow ex ante. Consider a reform that facilitates coordinations among dispersed creditors. If firms find it less costly to renegotiate their debt across multiple creditors after the reform, a debt structure with dispersed creditors will become less effective for commitment. Therefore, this reform would decrease the benefits of having dispersed creditors and impair firms' ability to use this commitment device, which reduces their borrowing capacity. I refer to this mechanism as the *commitment channel*.

My framework illustrates how this commitment channel should have asymmetric effects across different types of firms. First, this channel should have a stronger effect on firms with a high value

of commitment, as these firms rely more on this commitment to borrow. For example, firms with a manager whose human capital is essential for the business would value this commitment more than those with easily replaceable managers. Firms with low personal reputation would also value this commitment more since borrowers can use their personal reputation as an alternative commitment device.

However, directly measuring those factors in real-world contexts is challenging, as it requires detailed information about a manager's skill, its complementarity with the business, and her personal background. Instead, one can indirectly measure the value of commitment by using a revealed preference approach: in equilibrium, prior to the reform, firms with a higher value of commitment should have a higher creditor dispersion. Combined with this revealed preference approach, my framework predicts a stronger effect of the commitment channel in firms with initially high creditor dispersion.

Furthermore, the differential effect in firms with high creditor dispersion should be more pronounced among firms with low default risk firms. The key intuition behind this result is that a more difficult and inefficient renegotiation implies not only a stronger commitment but also a more costly resolution of default even when it is not strategic (i.e., liquidity default). As in other models (e.g., Bolton and Scharfstein, 1990, 1996; Hart and Moore, 1998), strategic defaults are avoided in equilibrium, which suggests that the default risk captures the liquidity default risk. If firms have high default risk, then the expected cost can outweigh the benefits of building a debt structure with dispersed creditors. These firms would not use creditor dispersion as a commitment device, regardless of their value of commitment. Therefore, creditor dispersion should be more strongly linked to the value of commitment when firms have low default risk.

The reform, by making coordinations easier, not only facilitates strategic defaults but also reduce the cost of financial distress. I refer to this mechanism as the *liquidity channel*. Importantly, creditor dispersion may reflect firms' exposure to the liquidity default, as firms with lower exposure would choose higher creditor dispersion. Firms with high creditor dispersion may be less benefited by the liquidity channel, which leads to the differential effect of the reform. However, in contrast to the commitment channel, this differential effect of the liquidity channel should be less pronounced among low default risk firms, as these firms are less affected by changes in the cost of liquidity default. Therefore, the additional contrast based on default risk allows me to disentangle the commitment channel from the liquidity channel.

One additional implication of the commitment channel is a decrease in creditor dispersion after the reform, as the benefits of having dispersed creditors decline. This effect should be particularly strong among firms that initially value and rely more on this commitment. Combined with the revealed preference approach, my framework predicts a convergence of creditor dispersion between firms with initially high and low creditor dispersion after the reform. Furthermore, as

the link between creditor dispersion and the value of commitment should be more pronounced among low default risk firms, this convergence should be also stronger among these firms.

3 Empirical Strategy

My empirical strategy mirrors the theoretical analysis discussed in Section 2. To develop this strategy, I propose the following thought experiment. Imagine a law reform that mitigates the coordination problem.[4] If the coordination problem serves as a commitment device, this reform would weaken firms' ability to commit and borrow. To isolate this effect, I would like to contrast the effect of this reform on a firm with a high value of commitment (firm H), with that on a firm with a low value of commitment (firm L). The idea behind this contrast is that firms with a high value of commitment should be more reliant on the coordination problem for commitment than those with a low value of commitment. Therefore, as predicted by the model, this reform would impair the ability to commit and borrow in firm H more severely than in firm L, which, in turn, would lead to a decrease in leverage for firm H relative to firm L. I refer to this mechanism as the *commitment channel*.

However, implementing this strategy presents a challenge in measuring the value of commitment. This is because the value of commitment is determined by many different factors, as described in Section 2. One factor is the inalienability of human capital, where borrowers may use the threat of quitting projects to repudiate contracts (Hart and Moore, 1994). To illustrate this point, imagine an owner of a successful pizzeria who has a great pizza recipe. Suppose she wants to borrow money from a bank by collateralizing her restaurant. However, bankers are worrying about her leaving once they seize the restaurant. Without her expertise, the restaurant would not generate the same amount of cash flows, making bankers vulnerable to the threat of quitting. Another factor is one's personal reputation. Belenzon *et al.* (2017) and Diep-Nguyen and Dang (2022) show borrowers can use their personal reputation as a form of social collateral, strengthening their commitment to repayment. Understanding that defaults incur significant personal costs to borrowers, creditors would be less concerned about strategic defaults. While these examples highlight the importance of assessing human capital inalienability and personal reputation, measuring them in a large sample poses significant challenges.

To overcome this challenge, I propose a revealed preference approach based on my theoretical framework. Theories predict that a firm's creditor dispersion observed prior to the reform can indirectly reveal the value of commitment in the firm. The underlying intuition is that firms may choose dispersed creditors to worsen the coordination problem and make renegotiations more challenging, particularly when the value of commitment is high. Therefore, compared to those with low creditor dispersion, firms with high creditor dispersion should be more likely to have a high value of commitment. Building on this idea, I use creditor dispersion as a proxy to measure the value of commitment and analyze differential effects of the reform between firms with high and low creditor dispersion. The commitment channel predicts a decrease in leverage

[4] In Section 4, I discuss such a reform in real-world contexts.

for firms with high creditor dispersion relative to those with low creditor dispersion after the reform.

While the differential effect of the reform between firms with high and low creditor dispersion is a key prediction of the commitment channel I analyze, in principle, alternative channels could also rationalize this differential effect (even if it is perfectly identified). One key alternative explanation arises from the reduction in the cost of liquidity defaults (i.e., defaults that are beyond a manager's control), which I refer to as the *liquidity channel*. The reform, by mitigating the coordination problem, not only facilitates strategic defaults but also improves the efficiency of debt restructurings, which leads to a decrease in the cost of liquidity defaults. This liquidity channel can affect firms' leverage in two ways. First, it can increase firms' demand for debt by lowering the cost of financial distress. Second, it can increase the credit supply by improving creditors' recovery rates.

Importantly, the liquidity channel can also have differential effects on firms with high and low creditor dispersion, because creditor dispersion may reflect a firm's exposure to the costs of liquidity defaults. Specifically, firms with lower exposure to liquidity defaults may have chosen higher creditor dispersion, as they are less concerned about the coordination problem during times of financial distress. Therefore, the liquidity channel also predicts the differential effect of the reform, suggesting that firms with high creditor dispersion would experience a smaller increase in leverage after the reform, as they benefit less from the mitigation of coordination problem.

To isolate the commitment channel from the liquidity channel, I further contrast the differential effect of the reform among firms with low default risk, with that among firms with high default risk. My approach builds on the idea that these two channels make opposing predictions regarding this contrast. As discussed in Section 2, the commitment channel predicts a stronger differential effect among firms with low default risk. The intuition behind this prediction is that the cost of inefficient restructuring should be sufficiently low for firms to effectively utilize dispersed creditors as a commitment device. Therefore, dispersed creditors among firms with low default risk are more likely to reflect the value of commitment, as there firms have lower exposure to defaults. On the other hand, the liquidity channel suggests a weaker differential effect among firms with low default risk, as these firms are less affected by changes in the cost of liquidity defaults due to their lower exposure to defaults. Therefore, incorporating this additional contrast allows me to disentangle the commitment channel from the liquidity channel.

My empirical test to isolate the commitment channel is to examine if there are significant differential effects of the reform on firms with high creditor dispersion and low default risk. To execute this test, I employ a difference-in-differences regression model with firm and time fixed effects:

$$Y_{it} = \beta \cdot \text{Post}_t \times \text{High Dispersion}_i + \mu_i + \lambda_t + \varepsilon_{it} \tag{1}$$

where Y_{it} is the leverage ratio of firm i at time t, Post_t is an indicator that time t is in the post-reform period, and High Dispersion_i is an indicator that firm i has a high creditor dispersion prior to the reform. μ_i and λ_t are firm and time fixed effects, respectively. β captures the differential effect of the reform on leverage ratios between firms with high and low creditor dispersions, which is the main focus of my analysis. As discussed above, if the commitment channel is true, we expect to find $\beta < 0$. To disentangle the commitment channel from the liquidity channel, I further contrast β among firms with low default risk, with that among firms with high default risk. If the commitment channel is true, then the differential effect ($\beta < 0$) should be more pronounced among firms with low default risk. I interpret this concentration of the differential effect among firms with low default risk as evidence of the commitment channel.

My interpretation relies on the identification assumption that there are no other mechanisms that differentially affect the leverage ratios of firms with high creditor dispersion and low default risk. It is worth noting that my approach does not require the timing of the reform to be random. I acknowledge the reform can have effects on, or its timing can be correlated with, changes in economic conditions. These changes in economic conditions could be a threat to my interpretation only if they differentially affect firms with high and low creditor dispersion, particularly among firms with low default risk. For example, in principle, it is possible that firms with high creditors dispersion experience negative investment-opportunity shocks after the reform, particularly among firms with low default risk, leading to a decrease in credit demand and leverage in those firms.

I examine whether changes in economic conditions differentially affect firms with high and low creditor dispersion in a falsification test. In this test, I analyze firms that are not subject to the reform and, thus, do not experience the mitigation of the coordination problem around the reform timing. If these changes in economic conditions asymmetrically affect firms with high creditor dispersion, I should observe a decrease in leverage in firms with high creditor dispersion (relative to those with low creditor dispersion) among these firms. Therefore, I would interpret the no differential effect in this falsification test as evidence that these changes in economic conditions do not asymmetrically affect firms with high dispersion.

My approach does not require firms to have their creditor dispersion randomly. Instead, as discussed above, I argue that firms' creditor dispersion is shaped by, and thus correlated with, their value of commitment. Additionally, I acknowledge that creditor dispersion could be correlated with other firm characteristics (beyond the value of commitment). My approach allows for the presence of this correlation, as long as these characteristics do not predict the exposure of firms to alternative channels through which the reform affects the leverage ratio. The additional contrast based on default risk can help address this issue, because these alternative mechanisms should also explain a stronger differential effect among firms with low default risk, as the commitment channel does. The falsification test also addresses this to the extent of alternative channels related to changes in economic conditions. I further deal with this issue by examining whether the

differential effect is sensitive to controls for firm characteristics. If these alternative mechanisms drive the differential effect of the reform, then I should observe no or weaker differential effect once I control for firm characteristics.

Lastly, my approach does not not rely on the assumption that firms with high and low creditor dispersion are matched to similar creditors. Instead, it allows for assortative matching between firms and creditors, as long as the reform does not differentially affect the creditors matched with firms with high creditor dispersion. Assortative matching could be a concern if the creditors matched with firms with high creditor dispersion experience negative changes in their economic conditions after the reform, leading to a decrease in credit supply. This differential change in the conditions of the matched creditors could subsequently result in a decrease in leverage in firms with high creditor dispersion (relative to firms with low creditor dispersion), even without the mitigation of the coordination problem. While my falsification test also addresses this issue, I further address it by constructing a measure of matched bank conditions and examining if the differential effect of the reform is sensitive to this control. If the assortative matching is the primary driver of the differential effect, then I should observe a strong attenuation in the differential effect once I control for the conditions of the matched creditors.

4 Institutional Background

My empirical test requires the isolation of a shock that solely affects the coordination problem. However, achieving this isolation is challenging in many empirical settings due to the presence of other factors related to bankruptcy laws and reforms. To tackle this challenge, I exploit a unique law reform in Korea that significantly expands supermajority vote requirements in out-of-court corporate debt restructurings. This section provides an in-depth discussion of this law reform and its institutional background.

4.1 The Corporate Restructuring Promotion Act

4.1.1 The 1997 Crisis and Introduction of the Law in 2001

The supermajority vote requirement in Korean out-of-court debt restructurings was initially introduced in response to the urgent need for swift debt restructurings following the 1997 Asian Financial Crisis.[5] The period leading up to the crisis was marked by a significant expansion fueled by a heavy reliance on debt financing. For instance, by the end of 1996, the average debt-to-equity ratio in manufacturing firms exceeded 317%.[6] The economy then experienced severe recessions, as evidenced in Figure 1. In the first quarter of 1998, real GDP growth plummeted to -6.8%, and 3-year AA$-$ corporate bond yields soared to 20.7%. The excessive debt burden resulted in a wave of bankruptcies, with 17 out of 30 largest business groups and 16 out of 26 banks collapsing during the crisis.

To address this wave of bankruptcies, the government entered into a temporary agreement, known as the Corporate Restructuring Agreement (CRA), with financial institutions in July 1998. Under this agreement, companies were able to undergo restructuring with a 75 percent threshold for creditor approval. Between September 1998 and March 1999, a total of 79 companies, including 41 affiliates of 16 chaebols, underwent restructuring within this framework.

Following the expiration of the CRA in December 2000, concerns arose regarding the efficiency of the debt restructuring process, specifically related to the coordination problem among creditors (Cho, 2012). To address this concern and facilitate out-of-court debt restructuring, policymakers decided to enact a new law that would effectively succeed the CRA. As a result, the Corporate Restructuring Promotion Act (CRPA) was enacted in September 2001 with a sunset clause, having a specific focus on this collective decision-making process in debt restructuring. Under the CRPA, when a financially distressed firm submits a restructuring plan, creditors are required

[5] Coe and Kim (2002) provide a comprehensive summary of the crisis.

[6] Source: Financial Statement Analysis for 1996, *The Bank of Korea's Economic Statistics System* (https://ecos.bok.or.kr).

to make a collective decision through a supermajority vote in a creditor meeting. For the plan to be approved, more than 75 percent of creditors (weighted by their respective claims) must agree to it. This collective decision is binding even for dissenting creditors, compelling their participation and requiring them to provide concessions in line with the approved plan. Dissenting creditors have the option to sell and transfer their claims to other creditors but cannot hold out their claims and free-ride on concessions made by others.

This voting rule is considered as a classical solution of the coordination problem. To illustrate this point, imagine a financially distressed firm with five equal creditors, each holding a $20 claim (totaling $100), while the firm's ongoing value is only $80. If the creditors take the case to the bankruptcy court, the inefficiency of the court will decrease the firm's value to $75. Instead, if each creditor tenders a 20% debt concession, they can avoid inefficiency and collect $80. Despite the restructuring plan benefiting all creditors, it can still fail due to the incentive for each creditor to hold out their claim:

$$\underbrace{\frac{20}{20+4\times 16}\times \$75}_{\substack{\text{restructuring fails, but}\\ \text{larger claim in the court}}} = \$17.86 > \underbrace{\frac{16}{16+4\times 16}\times \$80}_{\text{no deviation}} = \$16.$$

With the introduction of the supermajority rule, creditors are no longer able to hold out their claims once the plan is collectively approved. As highlighted by Gertner and Scharfstein (1991), the introduction of the voting rule shifts the payoff for each creditor from their individual vote to the collective decision of all creditors. Consequently, each creditor makes a decision based solely on the collective outcome, which effectively mitigates the coordination problem.

4.1.2 The 2016 Reform

Initially, the CRPA only applied to a limited number of firms classified as "high debt," with financial debts exceeding 50 billion KRW, and it exclusively governed bank creditors. Consequently, even among a high debt firm, decisions made collectively by bank creditors were not binding to non-bank creditors, such as bondholders. However, in November 2014, as the fourth expiration date of the law approached in approximately a year, the Financial Supervisory Service (FSS) announced its intention to extend the expiration date and broaden the law's scope to include all firms and encompass all creditors, beyond just banks. This proposal was based on the findings of a research project commissioned to evaluate the CRPA.[7]

In May 2015, a reform bill was proposed by a lawmaker after collaboration with the FSS. Despite the efficiency benefits of the CRPA, the law faced ongoing opposition, particularly from a legal

[7] Push for Expansion of the Application of the Corporate Restructuring Promotion Act to Include All Companies (Korean), *The Chosun Biz*, Nov 2014.

standpoint (Kim, 2011). Critics argued that the law was unconstitutional and undermined the principles of legal certainty. They claim that the CRPA infringes upon private autonomy, equality, and individuals' property rights. As a result, intense debates emerged among lawmakers, making it challenging to anticipate the final outcome. Even in December 2015, media reports indicated that the ruling party advocated for the reform, while the opposition party argued for abolition.[8] Eventually, in March 2016, the reform bill was passed and promptly put into effect.

Figure 2 illustrates the changes in the CRPA's scope resulting from this reform. This expansion provides me with a broad sample of firms that have experienced mitigation in coordination problems among creditors. In my analysis, I specifically focus on "low debt" firms that had financial debts below 50 billion KRW prior to the reform and examine the differential effect of the reform (as discussed in Section 3) among these firms. These low debt firms were primarily affected by the reform, as they had not previously been subject to CRPA, regardless of the type of creditor. I utilize high debt firms that had already been treated by the CRPA prior to the reform in my falsification test (as discussed Section 3) to examine if other factors differentially affect firms with high and low creditor dispersion.

4.2 In-Court Bankruptcy in Korea

In-court bankruptcy can be an alternative to out-of-court debt restructurings. The 1997 crisis also had a significant impact on Korea's bankruptcy laws, prompting the need for their modernization as a condition for receiving bailouts from the International Monetary Fund (IMF) (Kim, 2014). In response, new bankruptcy laws were introduced in 2006, closely resembling the US Chapter 7 and Chapter 11 bankruptcy system. Schoenherr and Starmans (2022) examine this reform, with a particular focus on the introduction of the management stay.

In Korea, there are 14 bankruptcy courts located in different regions. Companies are required to file their bankruptcy cases with the court that has jurisdiction over their headquarters. However, due to the country's small geographical size and the concentration of economic activity in Seoul, approximately 40% of all cases are submitted to the Seoul court. Consequently, there is limited variation in court-level efficiency within my sample.

Djankov *et al.* (2008) survey insolvency practitioners from 88 countries and measure the efficiency of debt enforcement in each country. Based on their aggregated creditor rights index that ranges from 0 (weak creditor rights) to 4 (strong creditor rights), South Korea is assigned a score of 3, indicating that the country has relatively strong creditor protections in bankruptcy.

[8] Reason for Clash Between the Ruling and Opposition Parties over the Corporate Restructuring Promotion Act (Korean), *The JoongAng Monthly*, Dec 2015.

5 Data

5.1 Data Collection

Source My primary data source is audited 10-K reports, which are accessible through the DART system in Korea (https://dart.fss.or.kr). Regulatory requirements mandate that firms with total assets exceeding 12 billion KRW (approximately 10 million USD) upload their annual reports to DART, regardless of their public listing status. For this reason, my sample mainly consists of small, private firms, which are not observable in many other settings. These small, private firms would rely heavily on debt financing and have limited access to the equity market. I see this sample composition as advantageous, because it helps mitigate alternative explanations from the substitution between equity and debt. I extract financial information from the financial statements included in these reports. To gather information on firm-creditor relationships and lending details, I manually collect data from the footnotes of the annual reports with fiscal years ranging from 2012 to 2020. This creditor dataset allows me to observe the outstanding loans from the current creditors and construct a firm-level time-varying measure of creditor dispersion.

Verification To ensure the accuracy of the creditor dataset, I verify it by comparing the sum of outstanding loans from creditors with the total debt reported in the firm's balance sheet. If the difference between these two amounts exceeds 15 percent of the total debt, I drop the observation from the dataset. Panel A of Table 1 provides a summary of the number of firms after applying the matching procedure ($Matched$), the total number of firms that report financial statements in the DART ($Total$), and the percentage ratio of $Matched$ over $Total$. This table demonstrates that my sample is highly representative, covering more than 70 percent of all firms in the DART universe.

Panel B of Table 1 presents the top 10 creditors based on the total amount of outstanding loans during the period from 2012 to 2020. Consistent with the high concentration in the banking industry, the top 7 creditors (which are banks) account for 50% of the total outstanding loans in the dataset. This highlights the dominant role of large national banks in providing debt financing to the firms. Additionally, Panel C of Table 1 provides a summary of the private debt structures of firms in the dataset. The median firm in the sample has 3 creditors, and approximately 97 percent of its private debt comes from banks.

5.2 Variables

Creditor Dispersion I measure creditor concentration using the Herfindahl-Hirschman Index (HHI), which is calculated as the sum of squared creditor shares within a firm:

$$HHI_{it} = \sum_{j \in \mathcal{J}_{it}} s_{ijt}^2 \tag{2}$$

where $\mathcal{J}_{it}$ is the set of creditors in firm i at year t, and s_{ijt} denotes the share of creditor j in firm i's debt at year t. I address the unobservable nature of bond holders by assuming that bonds are widely held by an infinite number of investors with infinitesimal shares. Therefore, if a firm has only public debt, then HHI_{it} becomes 0. Since bonds represent a small proportion of total debt in my sample firms, my results would not be sensitive to this assumption.

In analysis, I use creditor dispersion ($Dispersion_{it}$), which is defined as

$$Dispersion_{it} = 1 - HHI_{it}. \tag{3}$$

Default Risk My measure of default risk is the KIS Credit Index, which has been developed and provided by NICE (https://www.niceinfo.co.kr). NICE is recognized as one of the top three credit rating agencies in Korea. The KIS Credit Index ranges from 1 (indicating the lowest risk) to 10 (indicating the highest risk). Using this index, firms are categorized into four groups based on their creditworthiness: *Excellent*, *Good*, *Average*, and *Bad*. Appendix B provides further details about the index.

Other Firm Characteristics *Size* is quantified using the book value of total assets. *Industry* is measured using 2-digits KSIC (Korea Standard Industry Code). *Age* is defined as years from a firm's establishment date to a given fiscal year. *RE Ratio* is calculated as the sum of land and building values divided by total assets.

5.3 Samples and Summary Statistics

Construction I begin with a sample of 39,035 unique firms with available financial data and non-missing creditor dispersion. I exclude firms in the finance, insurance, and real estate sectors, as well as those with missing industry information. Next, I remove observations where the auditor did not express a qualified opinion on the financial statement, and those with zero or negative total assets or sales, resulting in a final sample of 57,916 observations from 7,911 unique firms covering the period from 2012 to 2020.

Summary Statistics Table 2 presents summary statistics of my sample firms. All ratio variables are winsorized at 1 percent by year. It is worth noting a few points here. The average leverage ratio ratio across the sample firms is 39 percent. Furthermore, consistent with the bank-centric nature of the debt market in Korea, public debts constitute about 1 percent of the total debts for the average firm. This has two implications for my analysis. First, it helps alleviate concerns regarding the assumption on bond holders that each bond holder's share is infinitesimal. Second, it suggests that high debt firms were predominantly untreated by the law reform as those firms had already been able to renegotiate with bank creditors under the CRPA .

There is a notable cross-sectional variation in creditor dispersion, with the first quartile (Q1) at 0.157 and the third quartile (Q3) at 0.661. This ensures that my regression analysis compares firms that exhibit notable differences in creditor dispersion. Additionally, 95 percent of the sample firms are privately held, which implies that they have limited access to the equity market. Consequently, the firm's choice between debt and equity, as explored in capital structure theories, is less likely to be a major factor in this sample. Lastly, 90% of sample firms are classified as treated firms. This suggests that the reform had a significant impact on expanding the scope of the CRPA within the economy.

Motivating Pattern Figure 5 presents the unconditional mean of leverage ratios for firms with high and low creditor dispersion over time. High (low) creditor dispersion represents firms with creditor dispersion above (below) the median value as of 2015. A visual inspection confirms that after the reform in 2016, firms with high creditor dispersion experience a decrease in their leverage ratio relative to those with low creditor dispersion. While this differential effect of the reform on firms with high creditor dispersion is a key prediction of the commitment channel, as discussed in Section 3, it is not conclusive evidence as the liquidity channel also can explain this pattern.

6 Results

6.1 Baseline Results

Table 3 presents results estimated following the approach described in Section 3. In this analysis, I focus on low debt firms that are primarily affected by the reform, as discussed in Section 4. I set *High Dispersion* equal to one for firms of which *Dispersion* (defined in Section 5) is above the median value as of 2015. I set *Low Risk* equal to one for firms of which the KIS Credit Index category is either Excellent or Good as of 2015. I analyze an event window ranging from year $t-4$ to $t+4$ from the reform year. I include firm fixed effects as well as industry, size, and age fixed effects interacted with year fixed effects across all specifications.

In the analysis with two subsamples and a triple interaction term, I find a differential effect of the reform for firms with high creditor dispersion and low default risk. In column 1, I analyze the differential effect of the reform using a subsample of low default risk firms. Relative to firms with low creditor dispersion, I estimate a 1.8 percentage-point decrease of the leverage ratio in firms with high creditor dispersion (a 10% relative effect to the mean).

In column 3, I analyze the differential effect of the reform using a subsample of high default risk firms. In contrast to the results for the low default risk firms, I estimate no differential effect for firms with high creditor dispersion. To examine a statistical significance of this contrast, in column 5, I analyze the differential effect of the reform using all low debt firms with a triple interaction term of *Post* with *Low Risk* and *High Dispersion*:

$$\begin{aligned} Y_{it} = \beta_1 \cdot \text{Post}_t \times \text{High Dispersion}_i + \beta_2 \cdot \text{Post}_t \times \text{Low Risk}_i \times \text{High Dispersion}_i \\ + \beta_3 \cdot \text{Post}_t \times \text{Low Risk}_i + \mu_i + \lambda_t + \varepsilon_{it}. \end{aligned} \tag{4}$$

The estimated coefficient of *Post* × *Low Risk* × *High Dispersion* is a 1.6 percentage-point relative decrease and statistically-significant with a t-statistic of -2.41. I find similar results when I use *Dispersion* instead of *High Dispersion* (columns 2, 4, and 6).

I interpret this concentration of the differential effect among firms with high creditor dispersion and low default risk as evidence of the commitment channel. These findings align with the detailed predictions from the commitment channel analyzed in Section 2. My identification assumption is that alternative mechanisms cannot explain these differential changes for firms with high creditor dispersion and low default risk around the reform. As discussed in Section 3, the contrast of these effects between firms with low and high default risk addresses concerns regarding the liquidity channel.[9]

[9] I also examine the sensitivity of the differential effect in high creditor dispersion firms to credit rating fixed

The magnitude of the commitment channel should be understood in the context of the high persistence of the leverage ratio. Lemmon *et al.* (2008) find that a significant portion of variation in leverage is attributed to time-invariant factors within a firm. Moreover, firm characteristics commonly identified as key determinants of leverage explain relatively small variation in leverage. For comparison, a one-standard deviation change in size, market-to-book, profitability, or tangibility is associated with a 2 to 4 percentage point change in leverage.[10] Overall, the magnitude of the commitment channel is comparable to the effect of a one-standard deviation change in these key determinants of leverage, which highlights its economic significance.

6.2 Results with Treated Firms that Do Not Rely on Bonds

As explained in Section 5, the creditor dispersion measure includes the assumption that bonds are widely held by an infinite number of investors with infinitesimal shares. I examine the previous effects using a subset of low debt firms that do not rely on bonds as of 2015. This approach simplifies the measurement of creditor dispersion and allows for a clear contrast for a falsification test with high debt firms. I use the same specification as in Table 3.

Table 4 presents my findings. Similar to the previous results, in column 1, I estimate a 1.8 percentage-point decrease of the leverage ratio in high creditor dispersion firms within a subsample of low default risk firms. In column 3, I focus on high default risk firms; again I find no or much weaker differential effect. The estimated coefficient of the triple interaction term is statistically-significant with a t-statistics of -2.47 (column 5). The results are robust when I use *Dispersion* instead of *High Dispersion* (columns 2, 4, and 6). Overall, these findings suggest that the differential effect is not sensitive to the assumption regarding bond holders.

6.3 Falsification Test with Untreated Firms

As described in Section 4, firms with financial debts exceeding 50 billion KRW are not affected by the reform. To address concerns that other changes in economic conditions could explain the baseline results, I implement the baseline regressions in these untreated firms that are not affected by this reform. As discussed in Section 3, if other changes in economic conditions explain

effects interacted with year fixed effects. Table C1 present the results. The results are robust to this control for exposures to the liquidity channel, providing additional evidence that the liquidity channel cannot explain this differential effect.

[10] Lemmon *et al.* (2008) use US public firms for their analysis. I conduct an equivalent analysis using my sample of Korean firms and find similar results (Table C2). Specifically, when including firm fixed effects, the adjusted R-squared increases from 20% in a pooled OLS model to 85%. In the regression with firm fixed effects, a one-standard deviation change in profitability or real estate ratio is associated with between a 2.9 to 4.7 percentage point change in leverage.

the differential effect on firms with high creditor dispersion, I should also find the same effect within this group.

Table 5 presents the results of this falsification test. To establish a clear untreated group, I only include high debt firms that do not rely on bonds as of 2015. In contrast to the results in treated firms, I find no differential effect for high creditor dispersion firms within the untreated firms. These results indicate that, in the absence of the reform, there are no differential effects for firms with high creditor dispersion around this time period. It is important to note that the identification assumption I require is that even if there is an alternative mechanism that has a differential effect for high creditor dispersion firms, this mechanism cannot explain a stronger differential effect among low default risk firms. In this sense, the absence of a differential effect for high creditor dispersion firms provides *stronger* evidence than what I actually require. Overall, these findings provide evidence that other economic shocks are unlikely to explain the baseline results.

6.4 Sensitivity of Results to Controls

As discussed in Section 3, one concern regarding the baseline results is that creditor dispersion could be correlated with other firm characteristics (beyond the value of commitment) that predict the exposure of firms to alternative channels through which the reform affects the leverage ratio. While the falsification test with high debt firms address this concern by examining alternative channels, I further address this concern by testing the sensitivity of the results to different controls for basic firm characteristics, which could be correlated with creditor dispersion.

Table 6 presents the results of this sensitivity test. I use a specification with a triple interaction term of *Post* with *High Dispersion* and *Low Risk*. In column 1, I include firm and industry-year fixed effects and estimate a 1.6 percentage-point relative decrease of the leverage ratio in firms with high creditor dispersion and low default risk. Then, in columns 2 and 3, I estimate the same triple interaction term by gradually adding size-year fixed effects and age-year fixed effects. Across different specifications, I consistently find a differential effect of 1.4 percentage-points, suggesting that the results are not sensitive to controls for basic firm characteristics.

Spatial clustering could be a concern if firms with high creditor dispersion are concentrated in certain geographic regions, and these regions asymmetrically experience changes in their economic conditions after the reform. To address this issue, in column 4, I include province-year fixed effects and find again a differential effect of 1.4 percentage-point with a statistical significance. These results provide additional evidence that alternative mechanisms cannot explain the baseline results.

Another concern stems from potential assortative matching between firms and creditors. As discussed in Section 3, assortative matching could be a concern if the creditors matched with firms with high creditor dispersion experience negative changes in their economic conditions after the reform, leading to a decrease in credit supply for those firms. While my falsification test also addresses this issue, I further address it by constructing a measure of matched bank conditions and examining the sensitivity of the results to a control for bank shocks.

I construct a measure of matched bank conditions following Chodorow-Reich (2014). First, I define the quantity of loans made by bank b relative to other banks as:

$$l_{b,t} = \frac{L_{b,t}}{\sum_{b \in \mathcal{B}_t} L_{b,t}} \tag{5}$$

where $L_{b,t}$ denotes bank b's outstanding corporate loan at year t, and $\mathcal{B}_t$ represents the set of banks in year t.[11] Then, the measure of matched bank conditions uses a weighted average of $l_{b,t}$:

$$\tilde{l}_{i,t} = \sum w_{i,b} l_{b,t} \tag{6}$$

The weight $w_{i,b}$ is determined by bank b's share in firm i's outstanding loans made by all banks in the last pre-reform period:

$$w_{i,b} = \frac{L_{i,b,2015}}{\sum_{b \in \mathcal{B}_{i,2015}} L_{i,b,2015}} \tag{7}$$

where $\mathcal{B}_{i,2015}$ represents the set of banks that extend loans to firm i in 2015.[12]

In column 5, I estimate the triple interaction term with the control for bank shocks. Again, the differential effect is not sensitive to this control (a 1.3 percentage-point). This result provides additional evidence that assortative matching and matched bank shocks cannot explain the baseline results.

I find similar results when I use *Dispersion* instead of *High Dispersion* (columns 6 to 10). Overall, these results provide additional evidence that alternative mechanisms cannot explain the differential effect around the reform on firms with high creditor dispersion and low default risk.

6.5 Falsification Test with Placebo Reform Years

Table 7 presents the results of falsification tests using placebo reform years prior to the actual reform year. I use the same event window ranging from year $t-4$ to $t+4$ relative to the placebo

[11] I obtain this information from the KFSC (https://www.fsc.go.kr).

[12] Following Chodorow-Reich (2014), for mergers that occur prior to the reform, I treat borrowers of the acquired bank as if they had borrowed from the acquiring bank.

reform year. Treated firms and high creditor dispersion firms are determined as of the last year before the placebo reform year.

To avoid overlapping with the actual post-reform period, in column 1, I start with the placebo reform year of 2011. In columns 3 and 5, I further conduct the falsification test with the placebo reform years of 2009 and 2007. Across different placebo reform years, I find no decrease in the leverage ratio of firms with high creditor dispersion. I find similar results when I use *Dispersion* instead of *High Dispersion* (columns 2, 4, and 6). These results provide additional evidence that, in the absence of the reform, my approach does not detect any effects among firms with high creditor dispersion.

6.6 Alternative Explanations for Creditor Dispersion

While I interpret my findings as evidence that firms actively use creditor dispersion to worsen the coordination problem and establish commitment, in principle, firms may use creditor dispersion for other purposes as well. One argument is the diversification of credit supplier risk (Detragiache *et al.*, 2000). Relying on a single creditor is risky, because firms may not be able to finance their project once that creditor is hit by a negative liquidity shock. Switching to other creditors after such a shock can be challenging, particularly when there is the learning-by-lending effect. To address this issue, firms may want to have multiple creditors to diversify their risk exposure.

Another argument is the mitigation of the hold-up problem (Rajan, 1992). The hold-up problem arises when a creditor gathers private information about a borrower and can use this information to extract surplus from that borrower. If a firm has only one creditor, that creditor may hold up the firm and extract all the surplus, knowing that the firm has no alternative sources of financing for its investments. To address this issue, firms may choose multiple creditors to introduce competition among them and prevent expropriation.

However, even if creditor dispersion reflects a firm's exposure to the benefits from these mechanisms, the supermajority vote is unlikely to affect credit supplier risk or the hold-up problem. Therefore, these alternative motives for dispersed creditors cannot explain the differential effect after the reform.

7 Additional Implications

7.1 Role of Liquidation Efficiency

Creditor dispersion is more likely to reflect the value of commitment when firms have a low liquidation efficiency. If the assets-in-place are easy to liquidate, creditors would be less concerned about strategic default, which reduces the need for commitment. Therefore, firms with a high liquidation efficiency are less likely to choose dispersed creditors as a commitment device, regardless of their value of commitment. This result implies that creditor dispersion is more likely to reveal the value of commitment when the liquidation efficiency is low, which is a key requirement for the revealed preference approach. Therefore, the differential effect based on creditor dispersion should be more pronounced among firms with low liquidation efficiency.

To examine this prediction, I conduct an analysis using two subsamples and a triple interaction term based on the real estate ratio (*RE Ratio*). I argue the real estate ratio can be a proxy for liquidation efficiency, as these assets are easier to liquidate due to their high redeployability.

Table 8 presents the results of this analysis. In column 1, I examine the differential effect of the reform using a subsample of low real estate ratio firms. Relative to firms with low creditor dispersion, I estimate a 1.8 percentage-point decrease of the leverage ratio in firms with high creditor dispersion (a 5.5% relative effect to the mean). In column 3, I analyze a subsample of high real estate ratio firms. In contrast to the results for the low real estate ratio firms, I estimate no differential effect for firms with high creditor dispersion. To examine a statistical significance of this contrast, in columns 5, I analyze the differential effect of the reform using all low debt firms with a triple interaction of *Post* with *Low RE Ratio* and *High Dispersion*:

$$\begin{aligned} Y_{it} = \beta_1 \cdot \text{Post}_t \times \text{High Dispersion}_i + \beta_2 \cdot \text{Post}_t \times \text{Low RE Ratio}_i \times \text{High Dispersion}_i \\ + \beta_3 \cdot \text{Post}_t \times \text{Low RE Ratio}_i + \mu_i + \lambda_t + \varepsilon_{it}. \end{aligned} \tag{8}$$

The estimated coefficient of $Post \times Low\ RE\ Ratio \times High\ Dispersion$ is statistically-significant with a t-statistic of -2.26. I find similar results when I use $Dispersion$ instead of $High\ Dispersion$ (columns 2, 4, 6). Overall, my results suggest a stronger differential effect among firms with low liquidation efficiency. These findings align with the detailed predictions from the commitment channel.

7.2 Convergence of Creditor Dispersion

Another prediction of the commitment channel is a convergence of creditor dispersion between firms with initially high and low creditor dispersion, particularly among firms where dispersed

creditors are more likely to reflect the value of commitment. To test this prediction, I estimate a cross-sectional regression model:

$$\begin{aligned}\Delta\text{Dispersion}_i(\tau) = \beta_1 \cdot \text{High Dispersion}_i + \beta_2 \cdot \text{High Dispersion}_i \times D_i \\ +\beta_3 \cdot D_i + X_i^\top \Gamma + \varepsilon_i. \end{aligned} \tag{9}$$

where $\Delta\text{Dispersion}_i(\tau)$ denotes the change in creditor dispersion from 2015 to year τ within firm i. D_i is an indicator for firms with low default risk or low real estate ratio, where dispersed creditors are more likely to reflect the value of commitment. The coefficient β_2 captures the differential convergence rate of creditor dispersion after the reform, which is the interest of this analysis. If the commitment channel is true, then we expect to find $\beta_2 < 0$, indicating a stronger convergence among firms with low default risk or low real estate ratio. It is important to note that even if there is a mean-reversion of creditor dispersion, it cannot explain this *differential* convergence rate.

Table 9 presents the results of the convergence test by default risk, and Table 10 presents the results by real estate ratio. In columns 1 to 5, I regress the change in creditor dispersion from 2015 to a post-reform year ranging from 2016 to 2020. Across different post-reform years, I find a stronger convergence of creditor dispersion among firms with low default risk or low real estate ratio. These results are consistent with the theoretical predictions from the commitment channel analyzed in Section 2.

8 Conclusion

The coordination problem among creditors can serve as a useful commitment device for firms. Using a unique law reform in Korea that mitigates the coordination problem, I provide a novel empirical test of this proposition. The central idea behind this test is that if the proposition is true, the reform should asymmetrically affect firms that have a high value of commitment. Building on a revealed preference approach, I document a differential effect of the reform on the leverage ratio of firms with high creditor dispersion and low default risk. The concentration of this effect among low default risk firms addresses alternative explanations that a reduction in the cost of liquidity defaults leads to these results. I further address alternative explanations by a falsification test with firms that are not affected by the reform. Consistent with the theory, I also find a stronger differential effect among firms with low liquidation efficiency and a convergence of creditor dispersion after the reform between firms with initially high and low creditor dispersion. Overall, these results suggest that firms actively use the coordination problem as a commitment device, and thus, mitigating this problem can impair firms' ability to commit and borrow.

Of course, the importance of commitment could vary depending on institutional features, particularly on how well creditors are protected in bankruptcy. In legal systems with ineffective and costly enforcement, creditors are more vulnerable to strategic defaults, thereby increasing the importance of commitment (Dewatripont and Maskin, 1995; Diamond, 2004; Djankov *et al.*, 2007). However, Korea has an in-court bankruptcy system similar to that of the United States and exhibits relatively strong debt enforcements (Djankov *et al.*, 2008). Therefore, my findings suggest that the importance of commitment is not limited to environments with weak legal enforcement: Even when creditors enjoy robust protections in bankruptcy, the value of commitment remains significant.

The coordination problem, once it arises ex post, can increase the cost of financial distress (e.g., Gertner and Scharfstein, 1991; Ivashina *et al.*, 2016; Chu, 2021). Recognizing this issue, policymakers have introduced various measures, such as the supermajority vote (Skeel, 1992; Carletti *et al.*, 2020; Kim *et al.*, 2019), to tackle this problem. By showing the benefits of the coordination problem, my paper call policymakers' attention to the ex ante implications when addressing such frictions.

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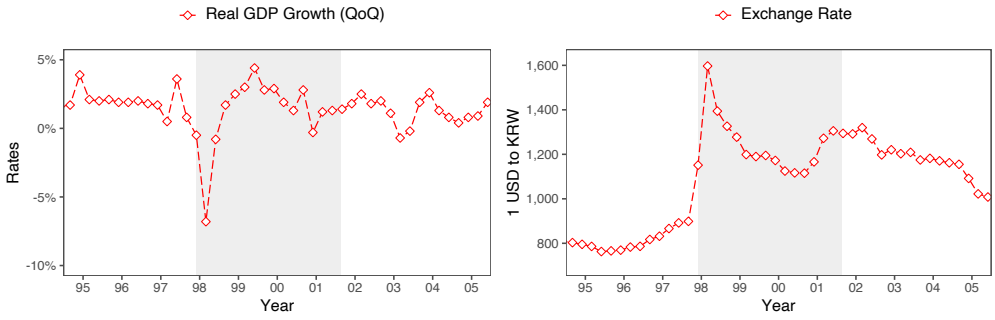
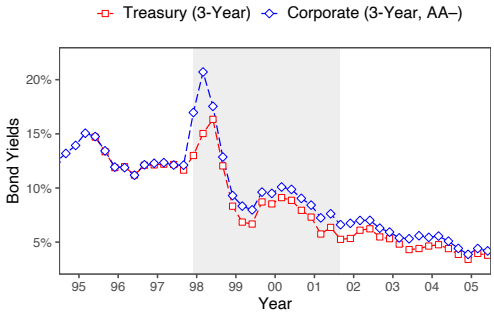
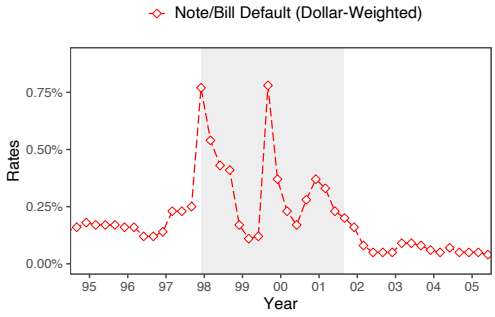


(A) Real GDP Growth Rates

(B) Exchange Rates



(C) Bond Yields



(D) Note/Bill Default Rates

Figure 1: Macroeconomic Conditions around the 1997 Crisis

This figure presents macroeconomic conditions in Korea around the 1997 Crisis. Panel A shows real GDP growth rates by quarter. Panel B illustrates 1USD-to-KRW exchange rates by quarter. Panel C plots 3-year treasury bond yields (red rectangles) and 3-year AA− corporate bond yields (blue diamonds) by quarter, respectively. Panel D demonstrates dollar-weighted note and bill default rates by quarter. The gray shaded area indicates the IMF bailout period. All data used in this figure is sourced from the Bank of Korea's Economic Statistics System (https://ecos.bok.or.kr).

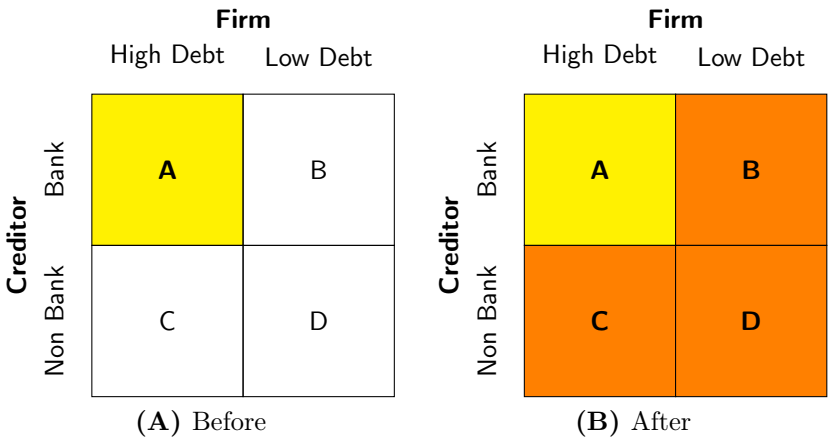


Figure 2: The Changes in the CRPA's Scope

This figure illustrates the changes in the CRPA's scope resulting from the 2016 reform. Panel A represents the pre-reform period, during which the law applied solely to a limited number of "high debt" firms with financial debts exceeding 50 billion KRW, and it exclusively governed bank creditors. Panel B illustrates the post-reform period, wherein the CRPA's scope expanded to include all firms and encompass all types of creditors.

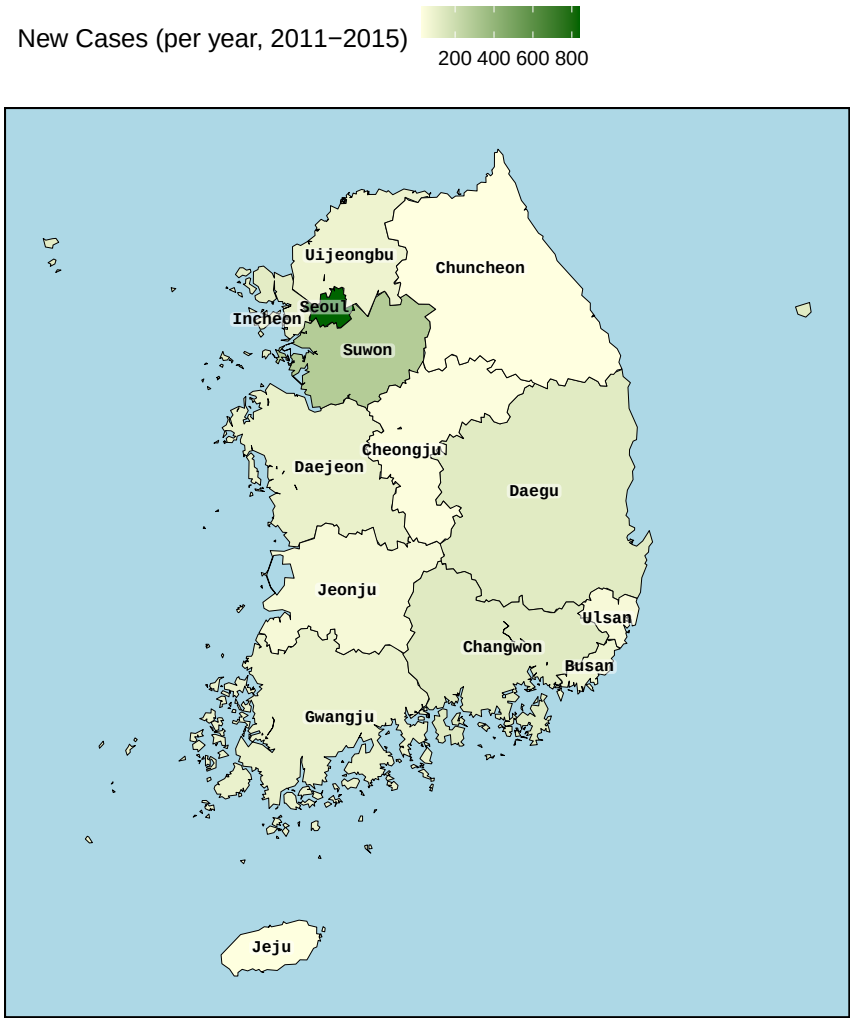


Figure 3: The Number of Submitted Cases, 2011-2015

This figure presents the number of Chapter 7 and Chapter 11 cases submitted to 14 bankruptcy courts located in different regions during the period 2011-2015. All the data used in this figure is sourced from the Supreme Court of Korea (https://scourt.go.kr).

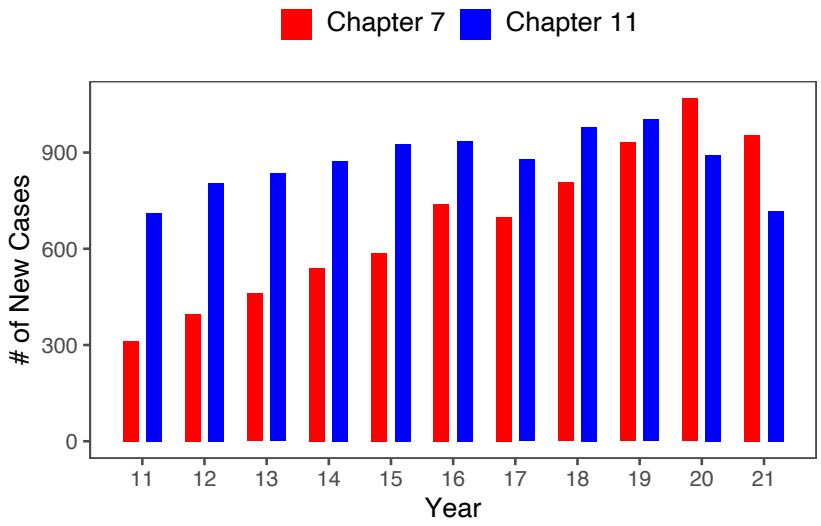


Figure 4: Time Trends in Reorganization and Liquidation Cases

This figure provides a summary of time trends in reorganization and liquidation cases around the 2016 reform. The data used in this figure is sourced from the Supreme Court of Korea (https://scourt.go.kr).

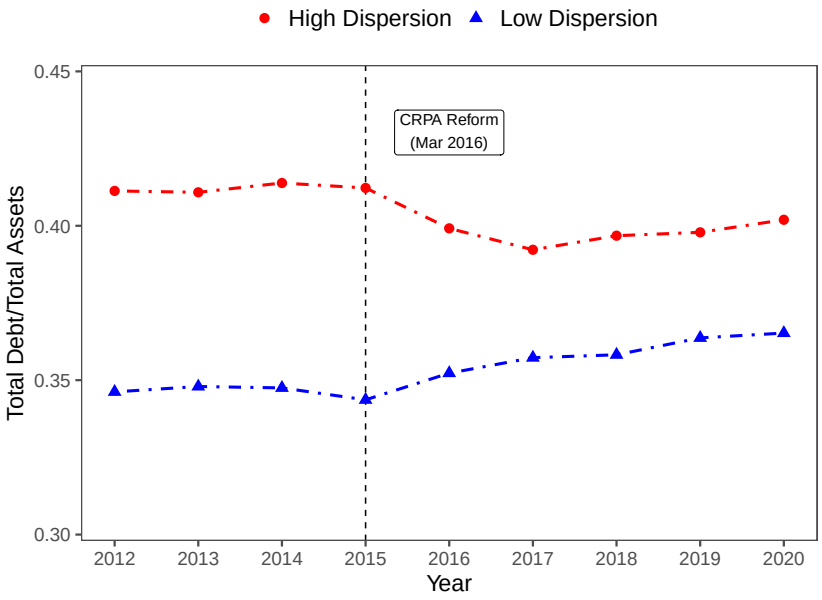


Figure 5: Leverage Ratio around the 2016 Reform

This figure presents the unconditional mean of leverage ratio for low debt firms with high (blue circles) and low (red triangles) creditor dispersion around the 2016 CRPA reform. Creditor dispersion is measured using the dollar-weighted HHI, and high (low) dispersion denotes a firm's creditor dispersion is above (below) the median value as of 2015. The black dashed vertical line indicates the last year before the reform.

Table 1: Summary Statistics: The Creditor Dataset

Panel A provides a summary of the number of firms after applying the matching procedure (*Matched*), the total number of firms that report financial statements in the DART (*Total*), and the percentage ratio of *Matched* over *Total* (%). Panel B displays the top 10 creditors based on the total amount of outstanding loans during the period from 2012 to 2020. Panel C provides a summary of the private debt structures of firms during the same period. The unit is trillion KRW.

(A) Matching Ratio

	All Firms			Firms with Private Debt		
Year	Matched	Total	(%)	Matched	Total	(%)
2012	15,983	21,208	75.36	12,351	17,397	70.99
2013	17,292	22,390	77.23	13,163	18,089	72.77
2014	18,928	24,108	78.51	14,308	19,323	74.05
2015	20,079	25,024	80.24	14,977	19,757	75.81
2016	22,001	27,135	81.08	16,346	21,299	76.75
2017	24,070	29,444	81.75	17,798	22,982	77.44
2018	25,474	31,012	82.14	19,117	24,406	78.33
2019	26,421	31,744	83.23	20,706	25,762	80.37
2020	25,879	30,560	84.68	20,125	24,530	82.04

(B) Top 10 Creditors

	Type	N. Firms	Amount	(%)	Cum. (%)
KDB	Bank	6,540	405.01	10.72	10.72
Woori	Bank	10,914	325.79	8.62	19.35
IBK	Bank	14,846	313.48	8.30	27.64
Shinhan	Bank	12,318	252.58	6.69	34.33
Hana	Bank	10,610	207.57	5.49	39.83
KB	Bank	10,691	202.59	5.36	45.19
NH	Bank	7,414	189.12	5.01	50.20
Export-Import	Bank	1,468	73.02	1.93	52.13
Boosan	Bank	2,369	72.64	1.92	54.05
Nat'l Pension Fund	Pension	56	47.66	1.26	55.31

(C) Private Debt Structure

	Obs.	Mean	Std.	P25	P50	P75
N. Creditors	148,891	3.430	2.633	2.000	3.000	4
Bank (%)	148,891	73.828	37.501	55.079	97.043	100

Table 2: Summary Statistics: Firm-level

All ratio variables are winsorized at 1 percent by year. *Treated Firm* is an indicator for firms of which financial debt is below 50 billion (i.e., firms that experience the changes in coordination problems resulting from the 2016 reform). *Public Firm* is an indicator for firms that are publicly traded. The unit is billion KRW.

	Obs.	Mean	Std.	P1	P25	P50	P75	P99
Total Assets	57,916	82.624	708.984	9.632	19.645	31.505	61.147	665.920
Firm Age	57,887	21.218	12.030	3.000	13.000	19.000	27.000	60.000
Private Debt/ Total Assets	57,916	0.381	0.245	0.002	0.190	0.362	0.527	1.013
Public Debt/ Total Assets	57,916	0.013	0.041	0.000	0.000	0.000	0.000	0.230
Total Debt/ Total Assets	57,916	0.395	0.246	0.005	0.202	0.381	0.546	1.034
Dispersion	57,916	0.427	0.287	0.000	0.157	0.480	0.661	0.953
Public Firm	57,916	0.049	0.217	0.000	0.000	0.000	0.000	1.000
Treated Firm	57,916	0.910	0.286	0.000	1.000	1.000	1.000	1.000
RE Ratio	57,916	0.278	0.245	0.000	0.042	0.246	0.435	0.935
KIS Credit Index	57,893	5.812	1.834	2.000	5.000	6.000	7.000	10.000

Table 3: Baseline Results: The Differential Effect

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. Columns 1 and 2 present regression results for treated firms with low default risk, and columns 3 and 4 present regression results for treated firms with high default risk. Columns 5 and 6 present regression results for all treated firms with a triple interaction term of $Post_t$ with $Low\ Risk_i$ and $High\ Dispersion_i$. $Low\ Risk_i$ is an indicator for firms of which the KIS Credit Index category is either Excellent or Good as of 2015. See Table B1 for details of KIS Credit Index. $Post_t$ is an indicator of the reform year (2016) and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of 2015. *Industry* is measured by 2-digits KSIC (Korea Standard industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets					
Sample Firm:	Treated Firms					
	Low Risk		High Risk		All	
	(1)	(2)	(3)	(4)	(5)	(6)
Post×High Dispersion	-0.0160^{***}		-0.0081^{**}		-0.0068^{*}	
	(−2.63)		(−2.23)		(−1.89)	
Post×Dispersion		-0.0342^{***}		-0.0188^{***}		-0.0158^{**}
		(−3.34)		(−2.75)		(−2.34)
Post×Low Risk ...						
... ×High Dispersion					-0.0141^{**}	
					(−2.03)	
... ×Dispersion						-0.0269^{**}
						(−2.25)
Fixed Effects:						
– Firm	✓	✓	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓	✓	✓
– Age×Year	✓	✓	✓	✓	✓	✓
Obs	12,568	12,568	40,096	40,096	52,664	52,664
Adj. R^2	0.73	0.73	0.81	0.81	0.84	0.84
Mean of Dep. Var.	0.19	0.19	0.44	0.44	0.38	0.38

Table 4: Treated Firms without Bond

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. I focus on a subset of treated firms that do not rely on bonds as of 2015. The regression specifications are the same as in Table 3. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets					
Sample Firm:	Treated Firms without Bond					
	Low Risk		High Risk		All	
	(1)	(2)	(3)	(4)	(5)	(6)
Post×High Dispersion	-0.0168^{***}		-0.0075^{*}		-0.0063	
	(-2.65)		(-1.89)		(-1.58)	
Post×Dispersion		-0.0386^{***}		-0.0181^{**}		-0.0152^{**}
		(-3.53)		(-2.37)		(-2.01)
Post×Low Risk ...						
... ×High Dispersion					-0.0152^{**}	
					(-2.07)	
... ×Dispersion						-0.0316^{**}
						(-2.42)
Fixed Effects:						
– Firm	✓	✓	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓	✓	✓
– Age×Year	✓	✓	✓	✓	✓	✓
Obs	12,235	12,235	32,998	32,998	45,233	45,233
Adj. R^2	0.72	0.72	0.82	0.82	0.85	0.85
Mean of Dep. Var.	0.18	0.18	0.43	0.43	0.37	0.37

Table 5: Falsification Test with Untreated Firms

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. Columns 1 to 4 present regression results for untreated firms. $Post_t$ is an indicator of the reform year (2016) and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of 2015 $Industry$ is measured by 2-digits KSIC (Korea Standard industry Code) codes. $Size$ is decile of a firm's total assets within an industry as of 2015. Age is quintile of a firm's age as of 2015. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets			
Sample Firm:	Untreated Firms			
	(1)	(2)	(3)	(4)
Post×High Dispersion	−0.0047	−0.0049		
	(−0.34)	(−0.35)		
Post×Dispersion			−0.0069	−0.0062
			(−0.27)	(−0.25)
Fixed Effects:				
– Firm	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓
– Age×Year		✓		✓
Obs	4,370	4,370	4,370	4,370
Adj. R^2	0.89	0.89	0.89	0.89
Mean of Dep. Var.	0.58	0.58	0.58	0.58

Table 6: Sensitivity Test: Firm Characteristics and Credit Supply

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. Columns 1 to 6 present regression results for all treated firms with a triple interaction term across different controls. *Low Risk* is an indicator for firms of which the KIS Credit Index category is either Excellent or Good as of 2015. See Table B1 for details of KIS Credit Index. $Post_t$ is an indicator of the reform year (2016) and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of 2015 *Industry* is measured by 2-digits KSIC (Korea Standard industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. *Province* denotes 17 provinces in Korea. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets									
Sample Firm:	Treated Firms									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post×High Dispersion	−0.0039	−0.0068*	−0.0068*	−0.0067*	−0.0056					
	(−1.09)	(−1.88)	(−1.89)	(−1.84)	(−1.49)					
Post×Dispersion						−0.0092	−0.0152**	−0.0158**	−0.0155**	−0.0147**
						(−1.38)	(−2.26)	(−2.34)	(−2.28)	(−2.06)
Post×Low Risk ...										
... ×High Dispersion	−0.0143**	−0.0143**	−0.0141**	−0.0138**	−0.0130*					
	(−2.08)	(−2.06)	(−2.03)	(−1.98)	(−1.79)					
... ×Dispersion						−0.0274**	−0.0266**	−0.0269**	−0.0257**	−0.0270**
						(−2.30)	(−2.22)	(−2.25)	(−2.15)	(−2.10)
Fixed Effects:										
– Firm	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
– Size×Year		✓	✓	✓	✓		✓	✓	✓	✓
– Age×Year			✓	✓	✓			✓	✓	✓
– Province×Year				✓	✓				✓	✓
Bank Shocks Control					✓					✓
Obs	52,693	52,693	52,664	52,664	48,392	52,693	52,693	52,664	52,664	48,392
Adj. R^2	0.84	0.84	0.84	0.84	0.83	0.84	0.84	0.84	0.84	0.83
Mean of Dep. Var.	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38

Table 7: Falsification Test with Placebo Reform Years

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. Columns 1 to 6 presents regression results across different placebo reform years for treated firms as of the last year before the placebo reform year. $Post_t$ is an indicator of the placebo reform year and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of the last year before the placebo reform year. $Industry$ is measured by 2-digits KSIC (Korea Standard industry Code) codes. $Size$ is decile of a firm's total assets within an industry as of the last year before the placebo reform year. Age is quintile of a firm's age as of 2015. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets					
Sample Firm:	Treated Firms					
Placebo Reform Year:	2011		2009		2007	
	(1)	(2)	(3)	(4)	(5)	(6)
Post×High Dispersion	0.0089*		0.0035		0.0011	
	(1.88)		(0.56)		(0.13)	
Post×Dispersion		0.0225***		0.0086		0.0042
		(2.61)		(0.76)		(0.24)
Fixed Effects:						
– Firm	✓	✓	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓	✓	✓
– Age×Year	✓	✓	✓	✓	✓	✓
Obs	25,514	25,514	16,256	16,256	7,619	7,619
Adj. R^2	0.83	0.83	0.82	0.82	0.79	0.79
Mean of Dep. Var.	0.37	0.37	0.36	0.36	0.34	0.34

Table 8: Additional Implication: The Role of Liquidation Efficiency

The dependent variable is *Total Debt/Total Assets*, which is total debt over total assets of firm i at year t. Columns 1 and 2 present regression results for treated firms with a low real estate ratio, and columns 3 and 4 present regression results for treated firms with a high real estate ratio. Columns 5 and 6 present regression results for all treated firms with a triple interaction term of $Post_t$ with $Low\ RE\ Ratio_i$ and $High\ Dispersion_i$. $Low\ RE\ Ratio_i$ is an indicator for firms of which *RE Ratio* is above the median value as of 2015. $Post_t$ is an indicator of the reform year (2016) and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of 2015. *Industry* is measured by 2-digits KSIC (Korea Standard industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets					
Sample Firm:	Treated Firms					
	Low RE Ratio		High RE Ratio		All	
	(1)	(2)	(3)	(4)	(5)	(6)
Post×High Dispersion	-0.0212^{***}		-0.0052		-0.0043	
	(-4.72)		(-1.26)		(-1.03)	
Post×Dispersion		-0.0362^{***}		-0.0160^{*}		-0.0133^{*}
		(-4.97)		(-1.96)		(-1.66)
Post×Low RE Ratio ...						
... ×High Dispersion					-0.0169^{***}	
					(-2.77)	
... ×Dispersion						-0.0236^{**}
						(-2.18)
Fixed Effects:						
– Firm	✓	✓	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓	✓	✓
– Age×Year	✓	✓	✓	✓	✓	✓
Obs	24,429	24,429	28,235	28,235	52,664	52,664
Adj. R^2	0.85	0.85	0.82	0.82	0.84	0.84
Mean of Dep. Var.	0.33	0.33	0.42	0.42	0.38	0.38

Table 9: Convergence in Creditor Dispersion: Low vs. High Default Risk

The dependent variable is $\Delta Dispersion_i(\tau)$, which is the change in creditor dispersion in firm i from 2015 to year τ. *High Dispersion* is an indicator for firms of which *Dispersion* is above the median value as of 2015. *Low Risk* is an indicator for firms of which the KIS Credit Index category is either Excellent or Good as of 2015. See Table B1 for details of the KIS Credit Index. *Industry* is measured by 2-digits KSIC (Korea Standard Industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. Standard errors are clustered by industries. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	ΔDispersion				
Sample Firm:	Treated Firms				
	(1)	(2)	(3)	(4)	(5)
Year:	2016	2017	2018	2019	2020
High Dispersion	-0.0760^{***}	-0.1204^{***}	-0.1585^{***}	-0.1830^{***}	-0.2008^{***}
	(-12.92)	(-17.33)	(-23.62)	(-23.99)	(-24.82)
Low Risk ...					
... ×High Dispersion	-0.0290^{***}	-0.0502^{***}	-0.0470^{***}	-0.0595^{***}	-0.0558^{***}
	(-3.01)	(-3.58)	(-3.08)	(-3.96)	(-3.15)
Fixed Effects:					
– Industry	✓	✓	✓	✓	✓
– Size	✓	✓	✓	✓	✓
– Age	✓	✓	✓	✓	✓
Obs	6,510	6,212	5,981	5,860	5,667
Adj. R^2	0.06	0.10	0.12	0.14	0.16

Table 10: Convergence in Creditor Dispersion: Low vs. High RE Ratio

The dependent variable is $\Delta Dispersion_i(\tau)$, which is the change in creditor dispersion in firm i from 2015 to year τ. *High Dispersion* is an indicator for firms of which *Dispersion* is above the median value as of 2015. *Low RE Ratio* is an indicator for firms of which *RE Ratio* is above the median value as of 2015. *Industry* is measured by 2-digits KSIC (Korea Standard Industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. Standard errors are clustered by industries. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	ΔDispersion				
Sample Firm:	Treated Firms				
	(1)	(2)	(3)	(4)	(5)
Year:	2016	2017	2018	2019	2020
High Dispersion	−0.0641***	−0.1139***	−0.1525***	−0.1767***	−0.1997***
	(−13.79)	(−16.87)	(−19.70)	(−22.44)	(−22.63)
Low RE Ratio ...					
... ×High Dispersion	−0.0388***	−0.0383***	−0.0334**	−0.0406***	−0.0319**
	(−3.67)	(−3.20)	(−2.53)	(−3.54)	(−2.28)
Fixed Effects:					
– Industry	✓	✓	✓	✓	✓
– Size	✓	✓	✓	✓	✓
– Age	✓	✓	✓	✓	✓
Obs	6,510	6,212	5,981	5,860	5,667
Adj. R^2	0.07	0.10	0.12	0.14	0.16

Appendix

A Model of the Commitment Channel

A.1 Set-up

The model consists of three periods ($t = 0, 1, 2$). All players are risk-neutral. There is no time discounting. To provide key economic intuitions of the commitment channel, I first analyze a model without uncertainty. In the Internet Appendix, I present the general analysis with uncertainty and its proofs.

Consider a firm managed by an equity holder that has an investment opportunity at $t = 0$ and assets-in-place valued at $A\,(\geq 0)$. The firm does not have internal fund; therefore, the firm should borrow money from external creditors to invest in the project. The firm can enter into a debt contract $\{K, B\}$ with N equal creditor(s), in which it borrows K ($\frac{K}{N}$ for each creditor) at $t = 0$ and promises to repay B at $t = 1$. However, this B may not be credible, and in this case, the value of debt becomes lower than the promised value. The competitive creditors will agree to this contract if the amount of lending K is equal to the value of debt. I assume that establishing lending relationship(s) incurs transaction costs cN with $c > 0$.

At $t = 1$, the project yields RK, assuming constant returns to scale with $R > 1$. A key assumption in this setting is that the project outcome RK is not verifiable in court (Hart and Moore, 1994, 1998). Therefore, even if the firm defaults, the creditors are unable to seize those funds. This limited enforcement creates the firm's strategic incentive to default on the debt.

If the firm does not repay its debt, the creditors have two options. One is going to the bankruptcy court (in-court bankruptcy), where they seize the assets-in-place and liquidate them. However, in-court bankruptcy creates inefficiency: the liquidation value of the assets is only $(1 - \lambda)A$ with $\lambda \in (0, 1)$. In this event, the payoffs for the creditors (v^C) and the equity holder (v^E) are $(1 - \lambda)A - K$ and $RK - cN$, respectively.

Alternatively, the creditors can avoid this deadweight loss by agreeing on a debt restructuring, where the total repayment is adjusted to $\bar{B}$ instead of B. In this event, the terminal payoffs to the creditors (u^C) and the equity holder (u^E) are $\bar{B} - K$ and $A - \bar{B} + RK - cN$, respectively. $\bar{B} \in [(1 - \lambda)A, A]$ is determined in bargaining between the equity holder and the creditors, ensuring a mutually beneficial outcome.

However, even when this adjustment benefits all creditors involved, externalities in debt restructuring and the implied coordination problem can prevent the creditors from agreeing on this

collective action (Gertner and Scharfstein, 1991). To account for this coordination problem, I follow Davydenko and Strebulaev (2007) and Favara *et al.* (2012) and take a reduced-form approach. Specifically, I assume that the creditors collectively agree on the adjustment with probability p, which is a function of the number of creditors N with $p_N < 0$ and $p_{NN} > 0$. The first derivative captures the idea that dispersed creditors worsen the coordination problem (Bolton and Scharfstein, 1996; Diamond, 2004), while the second derivative indicates the convexity that the marginal effect becomes smaller as N increases.[13]

If the creditors fail to coordinate with probability $1-p$, they have to go to court. In this event, the creditors and the equity holders' payoffs are given by v^C and v^E as defined above. Therefore, the coordination problem can hinder the creditors from achieving ex-post gains in restructuring. However, this potential for failure in restructuring also serves as an ex-ante disciplinary mechanism for the equity holder. From the equity holder's point of view, the failure in restructuring leads to a reduction in her post-default payoff by $u^E - v^E = A - \bar{B}$. This decrease in payoff makes defaults more costly for the equity holder, thereby discouraging her from engaging in defaults.

A.2 Equilibrium

Consider a debt contract $\{K, B\}$ with N creditors. Anticipating the debt adjustment from B to $\bar{B}$, the equity holder has an incentive to engage in the strategic default if the payoff from strategic default is greater than that from debt repayment:

$$\underbrace{A - B}_{\text{repayment}} + RK - cN \;<\; p \cdot u^E + (1-p)v^E \;=\; \underbrace{p \cdot (A - \bar{B})}_{\text{strategic default}} + RK - cN$$

$$\Rightarrow B > B_\tau(p) \equiv A - p \cdot (A - \bar{B}). \tag{A.1}$$

This inequality implies that the equity holder will default if the promised amount of repayment B exceeds a certain threshold B_τ. Therefore, $B > B_\tau$ is *not* credible to the creditors: the creditors rationally expect to collect $p \cdot \bar{B} + (1-p)(1-\lambda)A$ instead of B. This credibility condition $B \leq B_\tau$ ultimately serves as a financial constraint for the firm.

Since the project has a positive NPV, the firm wants to borrow and invest as much as possible. In this setting, I show that $B = B_\tau(p)$ maximizes the amount of borrowing and is optimal for the equity holder for any chosen N. With this contract, the firm establishes a commitment to repayment, and the strategic default never happens. The borrowing capacity is given by:

$$K^* = A - p \cdot (A - \bar{B}). \tag{A.2}$$

[13] The convexity in p is for the interior solution of N. Otherwise, I can introduce a convexity in the cost function of N.

The borrowing capacity depends on two factors. The first one is $u^E - v^E = A - \bar{B}$, which captures the equity holder's gain from restructuring following the strategic default. The second one is the restructuring probability p, which is a decreasing function of N. As p decreases, the gain from restructuring $(A - \bar{B})$ becomes less likely, thereby making the strategic default less attractive for the equity holder. This enhanced commitment increases the borrowing capacity by making a higher B credible. Therefore, the firm chooses the optimal N by considering the marginal benefit of additional financing and investment and the marginal transaction cost associated with additional creditors.

The marginal benefit of worsening the coordination problem ($N \uparrow$ and $p \downarrow$) is higher when the equity holder has a greater gain from restructuring, indicating a stronger need for the commitment. This benefit depends on the bargaining outcome in restructuring $\bar{B}$. I solve this bargaining outcome via the Nash bargaining solution and obtain $\bar{B} = A - \beta\lambda A$, where $\beta \in (0, 1)$ represents the equity holder's bargaining power relative to the creditors.

When β is low, $A - \bar{B}$ is also low, implying the creditors can rationally expect that the equity holder will find strategic default less attractive. Thus, low β effectively establishes the commitment, and I interpret β as (inversely) reflecting the firm's access to alternative commitment devices. In this context, I refer to β as the *value of commitment* achievable through dispersed creditors. For example, if the human capital of a manager is essential for the business, these firms would value this commitment more as their ability to threat to quit at an interim stage create a high bargaining power (Hart and Moore, 1994). Firms with low personal reputation would also value this commitment more since borrowers can use their personal reputation as an alternative commitment device (Belenzon *et al.*, 2017; Diep-Nguyen and Dang, 2022).

By substituting this bargaining outcome into Equation (A.2), we obtain

$$K^* = A - p \cdot \beta\lambda A \tag{A.3}$$

for any given N. Under the regularity conditions, I show that the optimal $N^* > 1$ satisfies the first-order condition

$$\underbrace{-p_N(N^*) \cdot (R-1)\beta\lambda A}_{\text{marginal NPV}} = c \tag{A.4}$$

if the value of commitment is sufficiently large such that

$$\beta > b(\lambda) \equiv \frac{c}{[-p_N(N=1) \cdot (R-1)\lambda A]}. \tag{A.5}$$

Otherwise, $N^* = 1$. Note that $b(\lambda)$ is decreasing in λ.

By taking the first derivative of N^* with respect to β, we have

$$\frac{\partial N^*}{\partial \beta} = \begin{cases} 0 & \text{if } \beta \leq b(\lambda) \\ \frac{1}{\beta}\left[-\frac{p_N}{p_{NN}}(N^*)\right] & \text{if } \beta > b(\lambda) \end{cases} \tag{A.6}$$

where $\frac{1}{\beta}\left[-\frac{p_N}{p_{NN}}(N^*)\right] > 0$ for any $\beta > b(\lambda)$.

These results provide two key empirical predictions. First, when $\beta > b(\lambda)$, firms with a higher value of commitment will choose more dispersed creditors, as the benefit of commitment is greater for these firms. However, directly measuring the value of commitment in real-world contexts is challenging. As discussed above, it requires detailed information about a manager's skill, its complementarity with the business, and her personal background. Instead, this result suggests one can indirectly measure the value of commitment by observing creditor dispersion.

Second, as $\frac{\partial b}{\partial \lambda} < 0$, the positive relationship between β and N becomes weaker when λ is low. In the extreme case of $\lambda = 0$, where the creditors would not agree to restructuring as they lose nothing in the liquidation event, no firm would require the commitment, regardless of their value of commitment. This result implies that creditor dispersion is more likely to reveal the value of commitment when the liquidation efficiency is low ($\lambda \uparrow$).

By taking the first derivative of K^* with respect to β, we have

$$\frac{\partial K^*}{\partial \beta} = -p(N^*) \cdot \lambda A - \frac{\partial N^*}{\partial \beta} p_N(N^*) \cdot \beta\lambda = \underbrace{-p(N^*) \cdot \lambda A}_{<0} + \underbrace{\frac{p_N^2}{p_{NN}}(N^*) \cdot \lambda A}_{>0} \tag{A.7}$$

for $\beta > b(\lambda)$. This derivative captures both the direct and indirect effects. The first term represents the direct effect: firms with limited access to alternative commitment devices ($\beta \uparrow$) are more constrained ($K \downarrow$), as they lack the commitment. The second term represents the indirect effect: firms with limited access to alternative commitment devices ($\beta \uparrow$) choose more dispersed creditors ($N \uparrow$) to enhance their commitment, which in turn increases their borrowing capacity ($K \uparrow$).

A.3 Predictions on the Reform

Now, consider a law reform that mitigates the coordination problem and reduces the effectiveness of dispersed creditors in worsening this problem. Specifically, I assume that after the reform, p changes to $\tilde{p}$, which satisfies

$$0 > \tilde{p}_N(N) > p_N(N), \quad \tilde{p}_{NN}(N) > 0, \quad \forall N \geq 1, \tag{A.8}$$

and

$$\tilde{p}(N=1) = p(N=1) = \overline{p}, \quad \lim_{N\to\infty} \tilde{p}(N) = \underline{\tilde{p}} \geq \underline{p} = \lim_{N\to\infty} p(N). \tag{A.9}$$

Note that these conditions imply $\tilde{p}(N) > p(N)$ for all $N > 1$. I further make assumptions on the curvature that (i) $0 > \frac{\tilde{p}_{NN}}{\tilde{p}_N}(N)$ is increasing in N and (ii) $0 > \frac{p_{NN}}{p_N}(N) \geq \frac{\tilde{p}_{NN}}{\tilde{p}_N}(N)$ for all N.

One example that satisfies the stated assumptions is a standard rational function $p(N;\alpha) = 1 - \alpha + \alpha N^{-1}$ with $\alpha \in (0,1)$. The reform can be modeled as a shock that decreases α to $\tilde{\alpha}$, which leads to $p_N(N;\tilde{\alpha}) > p_N(N;\alpha)$ and $\frac{p_{NN}}{p_N}(N;\tilde{\alpha}) = \frac{p_{NN}}{p_N}(N;\alpha)$.

I denote the equilibrium outcomes before and after the reform as $\{K^b, N^b\}$ and $\{K^a, N^a\}$, respectively. As creditor dispersion becomes less effective in worsening the coordination problem after the reform, we have a decrease in creditor dispersion and the borrowing capacity: $N^a - N^b \leq 0$ and $K^a - K^b \leq 0$. Furthermore, as high β firms are more reliant on this commitment device, we have stronger effects of the reform in those firms:

$$\frac{\partial(N^a - N^b)}{\partial\beta} < 0, \quad \frac{\partial(K^a - K^b)}{\partial\beta} < 0 \tag{A.10}$$

if $\beta > b(\lambda)$. Otherwise, there is no differential effect based on β:

$$\frac{\partial(N^a - N^b)}{\partial\beta} = 0, \quad \frac{\partial(K^a - K^b)}{\partial\beta} = 0. \tag{A.11}$$

Overall, these results predict a stronger decrease in (i) creditor dispersion and (ii) the leverage ratio of firms with high value of commitment after the reform. Again, as $\frac{\partial b}{\partial\lambda} < 0$, these differential effects should be more pronounced when the liquidation efficiency is low ($\lambda \uparrow$).

A.4 Extension: Liquidity Default Risk

In this section, I introduce a risk of project failure to the baseline model. Specifically, I assume that with probability $1-\theta$, the project fails and yields 0. The expected project outcome is RK.

If the project fails, the firm *cannot* make the payment as it lacks funds to repay its debt. I refer to this type of default as a *liquidity default*. Recall that in equilibrium, the firm never engages in strategic default. Therefore, the default risk is identical to the liquidity default risk.

In this event, the creditors expect to collect $p \cdot \bar{B} + (1-p)(1-\lambda)A$. Since $\bar{B} \geq (1-\lambda)A$, a decrease in the restructuring probability implies not only a stronger commitment but also a more costly liquidity default for the creditors: even when restructuring benefits all creditors, the creditors

have to go to court due to the coordination problem. Reflecting this additional implication of the coordination problem, the borrowing capacity in Equation (A.2) is modified to:

$$K^* = \bar{A} - p \cdot \left[\theta(A - \bar{B}) - (1-\theta)\big(\bar{B} - (1-\lambda)A\big)\right] \tag{A.12}$$

where $\bar{A} = \theta A + (1-\theta)(1-\lambda)A$. The newly added term $\bar{B} - (1-\lambda)A$ represents the increased cost of liquidity default as p decreases, which I refer to as the *liquidity channel*. The relative importance of the commitment channel and the liquidity channel depends on θ. If the firm has a high default risk, such that the liquidity channel outweighs the commitment channel, increasing N and decreasing p can impair the borrowing capacity rather than improve it. Therefore, having a sufficiently low default risk is a *necessary* condition for the benefits of worsening the coordination problem.

By substituting $\bar{B}$ with the bargaining outcome, we obtain $K^* = \bar{A} - p \cdot (\beta + \theta - 1)\lambda A$. Under the regularity conditions, I show that the optimal $N^* > 1$ satisfies the first-order condition

$$-p_N(N^*) \cdot [(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A] = c \tag{A.13}$$

if the value of commitment is sufficiently large such that

$$\beta > b(\lambda, \theta) \equiv \frac{c}{[-p_N(N=1) \cdot (R-1)\lambda A]} + \frac{R}{R-1}(1-\theta). \tag{A.14}$$

Otherwise, $N^* = 1$. Note that $(1-\theta)\lambda A$ reflects the additional inefficiency in the liquidity default as p decreases.

By taking the first-order derivative of N^* with respect to β, we have $\frac{\partial N^*}{\partial \beta} > 0$ for $\beta > b(\lambda, \theta)$, suggesting the positive relationship between β and N. Otherwise, $\frac{\partial N^*}{\partial \beta} = 0$. As $\frac{\partial b}{\partial \theta} < 0$, the positive relationship should be stronger when firms have a low default risk ($\theta \uparrow$).

As in the baseline model, after the reform, we have a decrease in creditor dispersion and the borrowing capacity: $N^a - N^b \leq 0$ and $K^a - K^b \leq 0$. Furthermore, we have stronger effects of the reform in firms with high value of commitment:

$$\frac{\partial(N^a - N^b)}{\partial \beta} < 0, \quad \frac{\partial(K^a - K^b)}{\partial \beta} < 0 \tag{A.15}$$

if $\beta > b(\lambda, \theta)$. Otherwise, there is no differential effect based on β:

$$\frac{\partial(N^a - N^b)}{\partial \beta} = 0, \quad \frac{\partial(K^a - K^b)}{\partial \beta} = 0. \tag{A.16}$$

Overall, these results predict a stronger decrease in (i) creditor dispersion and (ii) the leverage

ratio of firms with high value of commitment after the reform. Again, as $\frac{\partial b}{\partial \theta} < 0$, these differential effects should be more pronounced when the default risk is low ($\theta \uparrow$).

B KIS Credit Index

Table B1 provides a description of the KIS Credit Index and its corresponding categories, as provided by NICE (https://www.niceinfo.co.kr).

Table B1: KIS Credit Index

Category	KIS Credit Index	Definition
Excellent	1	A company with an excellent creditworthiness for commercial transactions and capable of dealing with environmental changes.
	2	A company with a good creditworthiness for commercial transactions and capable of appropriate response to environmental changes.
	3	A company with a satisfactory creditworthiness for commercial transactions, but limited ability to cope with environmental changes.
Good	4	A company with a satisfactory creditworthiness for commercial transactions, but with a possibility of decreased transaction stability due to economic conditions and worsening environment.
Average	5	A company with an average creditworthiness for commercial transactions, and with concerns of decreased transaction stability due to economic conditions and worsening environment.
	6	A company with an average creditworthiness for commercial transactions, and with a high possibility of decreased transaction stability due to economic conditions and worsening environment.
Bad	7	A company with an average creditworthiness for commercial transactions, and with an expected decrease in transaction stability, requiring caution.
	8	A company with very low creditworthiness for commercial transactions, and with low transaction stability.
	9	A company with the lowest creditworthiness for commercial transactions, and with a very high possibility of transaction risks.
	10	A company that is currently experiencing actual credit risk or is in a state equivalent to credit risk.

C Additional Tables

Table C1: Robustness: Controlling for Exposures to the Liquidity Channel

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. This table presents regression results for low debt firms (i.e., firms of which financial debt is below 50 billion as of 2015). *Risk* is the KIS Credit Index (ranges from 1 to 10) as of 2015. See Table B for details regarding the KIS Credit index. *Industry* is measured by 2-digits KSIC (Korea Standard industry Code) codes. *Size* is decile of a firm's total assets within an industry as of 2015. *Age* is quintile of a firm's age as of 2015. $Post_t$ is an indicator of the reform year (2016) and years after. $High\ Dispersion_i$ is an indicator for firms of which $Dispersion_i$ is above the median value as of 2015. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:	Total Debt/Total Assets			
Sample Firm:	Treated Firms			
	(1)	(2)	(3)	(4)
Post×High Dispersion	-0.0110^{***}	-0.0099^{***}		
	(-3.62)	(-3.15)		
Post×Dispersion			-0.0241^{***}	-0.0220^{***}
			(-4.48)	(-3.83)
Fixed Effects:				
– Firm	✓	✓	✓	✓
– Industry×Year	✓	✓	✓	✓
– Size×Year	✓	✓	✓	✓
– Age×Year	✓	✓	✓	✓
– Risk×Year		✓		✓
Obs	52,664	52,664	52,664	52,664
Adj. R^2	0.84	0.84	0.84	0.84
Mean of Dep. Var.	0.38	0.38	0.38	0.38

Table C2: Benchmark: The Explanatory Power of Other Determinants

The dependent variable is $Total\ Debt_{it}/Total\ Assets_{it}$, which is total debt over total assets of firm i at year t. This table presents regression results for low debt firms (i.e., firms of which financial debt is below 50 billion as of 2015). *Industry* is measured by 2-digits KSIC (Korea Standard industry Code) codes. $Log(Sales)$ is a firm's total sales in log. $Profitability$ is measured by a firm's operating income over total assets. *RE Ratio* is calculated as the sum of land and building values divided by total assets. Standard errors are clustered by firms. t-values are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% respectively.

Dependent Variable:		Total Debt/Total Assets				
Sample Firm:		Small Firms				
	Std. Dev.	(1)	(2)	(3)	(4)	(5)
Log(Sales)	1.2063		-0.0834^{***}	-0.0754^{***}	-0.0640^{***}	-0.0064^{**}
			(-35.70)	(-31.47)	(-23.78)	(-2.32)
Profitability	0.0721			-0.4946^{***}	-0.5032^{***}	-0.4115^{***}
				(-19.29)	(-19.68)	(-26.27)
RE Ratio	0.2427				0.1665^{***}	0.1976^{***}
					(14.43)	(16.33)
Fixed Effects:						
– Firm						✓
– Industry×Year		✓	✓	✓	✓	✓
Obs		52,693	52,693	52,693	52,693	52,693
Adj. R^2		0.08	0.23	0.25	0.27	0.85
Mean of Dep. Var.		0.38	0.38	0.38	0.38	0.38

Internet Appendix

IA The General Analysis of the Commitment Channel

IA.1 Set-up

Figure IA1 illustrates the timeline of the model. The model consists of three periods ($t = 0, 1, 2$). There are two types of players in the model: a firm managed by an equity holder and competitive creditor(s). All players are risk-neutral, and there is no time discounting.

At $t = 0$, the firm has an investment opportunity and assets-in-place valued at $A\,(\geq 0)$. The firm does not have internal fund; therefore, the firm should borrow money from external creditors to invest in the project. The firm can agree with N equal creditor(s) on a debt contract $\{K, B\}$, in which $N\,(\geq 1)$ creditors lend $K\,(\geq 0)$ in total (K/N for each creditor) to the firm at $t = 0$ and the firm promises the creditors to repay $B\,(\geq 0)$ (B/N for each creditor) at $t = 1$. If the firm and the creditors do not reach an agreement on a debt contract, then the terminal payoffs to the equity holder and the creditors are given by A and 0, respectively. Following Detragiache *et al.* (2000), I assume that establishing lending relationship(s) incurs transactions costs $C = C(N)$:

$$C(N) = cN, \quad c > 0 \tag{IA.1}$$

Once a debt contract is agreed upon, the firm can use this external financing K to invest in the project. At $t = 1$, the project outcome is realized, assuming constant returns to scale. With probability θ, the project turns out to be successful and yields $Z(K)$. With probability $1 - \theta$, the project fails and yields 0. For brevity, I use s to represent the state of the project's success ($s = 1$) and failure ($s = 0$).

If the project succeeds ($s = 1$) and the firm repays their debt at $t = 1$, the terminal payoffs to the equity holder and the creditors are given by $A - B + Z - C$ and $B - K$, respectively.

If the project fails ($s = 0$), the firm *cannot* make the payment as it lacks funds to repay its debt. I refer to this type of default as a *liquidity default*. However, even when the project is successful ($s = 1$), the firm may still *choose not to* make the payment. I refer to this type of default as a *strategic default*.

If the firm does not repay their debt at $t = 1$, the creditors and the equity holder can reach an agreement of a restructuring plan, where the total repayment is adjusted to $\bar{B}_s$ instead of B.

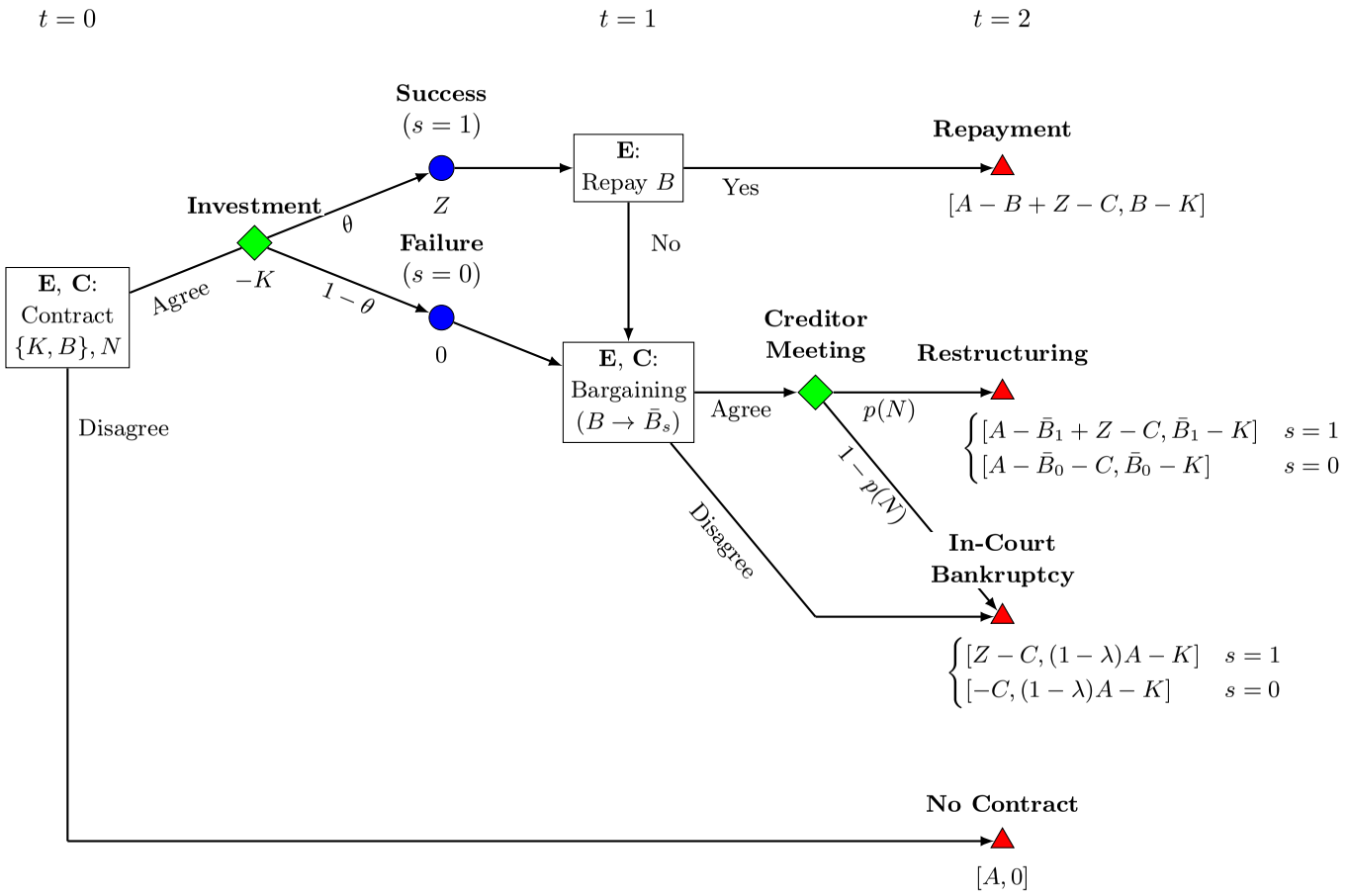


Figure IA1: Timeline of the Model

This figure illustrates the timeline of the model. Decision nodes are represented by rectangles. **E** and **C** denotes the equity holder and the creditors as a player in each decision node, respectively. Nature nodes are denoted by green diamonds. Each blue circle represents a state realized after the investment. A tuple $[u, v]$ at a terminal node (red triangle) represents the equity holder's payoff (u) and the creditors' payoff (v) at that node, respectively.

This approach is known as out-of-court debt restructuring or private workout. In this agreement event, the terminal payoffs to the creditors (u_s^C) and the equity holder (u_s^E) are given by:

$$\begin{cases} u_1^C = \bar{B}_1 - K, & u_1^E = A - \bar{B}_1 + Z - C \quad \text{if } s = 1 \\ u_0^C = \bar{B}_0 - K, & u_0^E = A - \bar{B}_0 - C \quad \text{if } s = 0 \end{cases} \tag{IA.2}$$

If the creditors and the equity holder fail to reach an agreement, they should go to court (in-court bankruptcy). In this case, the creditors seize the assets-in-place and try to recover the debt by either continuing the business or liquidating the assets. However, in-court bankruptcy creates an inefficiency: the second-hand or liquidation value of the assets decreases from A to $(1-\lambda)A$, where $\lambda \in (0,1)$ captures the direct and indirect cost of in-court bankruptcy. Because of this deadweight loss, reaching an agreement can be beneficial for both parties. In the disagreement event, the payoffs for the creditors (v_s^C) and the equity holder (v_s^E) are given by:

$$\begin{cases} v_1^C = (1-\lambda)A - K, & v_1^E = Z - C \quad \text{if } s = 1 \\ v_0^C = (1-\lambda)A - K, & v_0^E = -C \quad \text{if } s = 0 \end{cases} \tag{IA.3}$$

The key assumption in this setting is that the project outcome Z is not verifiable in court (Hart and Moore, 1994, 1998). Therefore, even if the firm diverts its cash flow, the creditors are unable to prove this in court and cannot seize those funds. Consequently, the creditors' payoff becomes $(1-\lambda)A - K$ regardless of the project outcome.

Assuming symmetric information, the amount of repayment after adjustment ($\bar{B}_s$) is determined in bargaining between the equity holder and the creditors, which satisfies $\left(u_s^C, u_s^E\right) \geq \left(v_s^C, v_s^E\right)$.

Following the bargaining with the equity holder, the creditors hold a creditor meeting. In the meeting, they should agree to accept the individual adjustments to $\bar{B}_s/N$ for each creditor. However, even when this adjustment benefits all creditors involved, externalities in debt restructuring and the implied coordination problem can prevent the creditors from agreeing on this collective action during the creditor meeting (Gertner and Scharfstein, 1991). To account for this coordination problem, I follow Davydenko and Strebulaev (2007) and Favara *et al.* (2012) and take a reduced-form approach.

Assumption 1. *In the creditor meeting, the creditors collectively agree on the adjustment with probability p, which is a function of the number of creditors N with*

$$\frac{\partial p}{\partial N} \equiv p_N < 0, \qquad \frac{\partial^2 p}{\partial N^2} \equiv p_{NN} > 0, \tag{IA.4}$$

and

$$p(N=1) = \overline{p} \leq 1, \qquad \lim_{N \to \infty} p(N) = \underline{p} \geq 0. \tag{IA.5}$$

The first derivative captures the idea that dispersed creditors worsen the coordination problem (Bolton and Scharfstein, 1996; Diamond, 2004), while the second derivative indicates the convexity that the marginal effect becomes smaller as N increases.[14]

If the creditors fail to coordinate with probability $1-p$, they have to go to court. In this event, the creditors and the equity holders' payoffs are given by v_s^C and v_s^E, as defined in Equation (IA.3). Therefore, the coordination problem can hinder the creditors from achieving ex-post gains in restructuring ($u_s^C - v_s^C = \bar{B}_s - (1-\lambda)A$). However, this potential for failure in restructuring also serves as an ex-ante disciplinary mechanism for the equity holder. From the equity holder's point of view, the failure in restructuring leads to a reduction in her post-default payoff by $u_s^E - v_s^E = A - \bar{B}_s$. This decrease in payoff makes defaults more costly for the equity holder, thereby discouraging her from engaging in defaults.

IA.2 Equilibrium

I use a subgame perfect equilibrium as the equilibrium concept. I employ a backward induction approach to solve the model. First, I determine the adjusted repayment after the bargaining between the firm and the creditors. Second, given this bargaining outcome, I analyze the equity holder's strategic incentive to default even when the investment is successful. Third, I examine the expected value of debt when the creditors form their expectation based on the equity holder's strategic incentive. This expected value of debt ultimately serves as a financial constraint for the firm. Lastly, I fully characterize the debt contract and the firm's investment decision, considering this financial constraint.

IA.2.1 Bargaining in Restructuring

Consider a debt contract $\{K, B\}$ in which the firm does not repay B. As a result, the equity holder and the creditors enter into a bargaining procedure to reach an agreement on a restructuring plan. I solve this bargaining procedure in restructuring via the Nash bargaining solution:

$$\max_{(u_s^C, u_s^E) \geq (v_s^C, v_s^E)} \left(p \cdot u_s^C + (1-p)v_s^C - v_s^C\right)^{1-\beta} \left(p \cdot u_s^E + (1-p)v_s^E - v_s^E\right)^{\beta} = p \cdot (u_s^C - v_s^C)^{1-\beta} (u_s^E - v_s^E)^{\beta}$$

$$\Rightarrow \max_{\bar{B}_s \in [(1-\lambda)A, A]} p \cdot \left(\bar{B}_s - (1-\lambda)A\right)^{1-\beta} (A - \bar{B}_s)^{\beta} \tag{IA.6}$$

[14] The convexity in p is for the interior solution of N. Otherwise, I can introduce a convexity in the cost function of N in Equation (IA.1).

for $s \in \{0,1\}$. $\beta \in (0,1)$ represents the creditors' bargaining power (relative to the equity holder). By taking the first-order condition with respect to $\bar{B}_s$, I obtain

$$\bar{B}_s = A - \beta\lambda A \tag{IA.7}$$

for $s \in \{0,1\}$. Since $\bar{B}_s$ is identical between the two states, I will use $\bar{B}$ without the subscript s hereafter.

As β decreases, $\bar{B}$ increases, resulting in an decrease in the equity holder's payoff from the restructuring ($u_s^E - v_s^E = A - \bar{B}$). This decrease makes defaults more costly for the equity holder. In this sense, I interpret that β reflects the firm's access to alternative commitment devices, such as the alienability of the manager's human capital (Hart and Moore, 1994) and the personal reputation (Belenzon *et al.*, 2017; Diep-Nguyen and Dang, 2022). When β is low, the creditors can rationally expect that the equity holder will find the strategic default less attractive, thus effectively establishing a commitment not to engage in strategic default. Therefore, firms with low β have a low value of commitment achievable through dispersed creditors. In this setting, I label β as the *value of commitment*.

Given this bargaining outcome, the creditors' expected post-default payoff is higher when they agree to restructuring compared to not doing so. This implies that regardless of the type of default (s), whenever the firm defaults, the creditors have an ex-post incentive to agree to restructuring.

IA.2.2 Strategic Default

Understanding the creditors will agree to adjust B to $\bar{B}$, the equity holder has an ex-ante incentive to engage in the strategic default (despite the success of the project) if the expected payoff from strategic default is greater than that from debt repayment:

$$\underbrace{A - B + Z - C}_{\text{repayment}} < p \cdot u_1^E + (1-p)v_1^E = \underbrace{p \cdot (A - \bar{B}) + Z - C}_{\text{strategic default}}$$

$$\Rightarrow B > B_\tau(p) \equiv A - p \cdot (A - \bar{B}). \tag{IA.8}$$

This inequality implies that the equity holder will default even when the project is successful if the promised amount of repayment (B) is high and exceeds a certain threshold, referred to as the strategic default threshold (B_τ). If $B \leq B_\tau$, a commitment not to engage in strategic default is established. Here, $p \cdot (A - \bar{B})$ represents the expected increase in the equity holder's payoff ($p \cdot (u_1^E - v_1^E)$) from the strategic default. As p increases, the gain from strategic default ($A - \bar{B}$) becomes more likely, thereby making the commitment more challenging ($B_\tau \downarrow$). This negative relationship between p and B_τ illustrates the commitment mechanism of worsening the coordination problem.

IA.2.3 Value of Debt

The creditors understand and consider the firm's strategic incentive when they form their expectation. Consequently, the (expected) value of debt V^C is determined as follows:

$$V^C(B,N) = \begin{cases} p \cdot \bar{B} + (1-p)(1-\lambda)A & \text{if } B > B_\tau \\ \theta B + (1-\theta)\big[p \cdot \bar{B} + (1-p)(1-\lambda)A\big] & \text{if } B \leq B_\tau \end{cases} \tag{IA.9}$$

If $B \leq B_\tau$, the firm defaults only when the investment fails, establishing the commitment. However, if $B > B_\tau$, the firm always defaults regardless of the investment outcome. In this case, the value of debt does not depend on the investment's success probability θ nor the promised repayment value B. The possibility of strategic default implies that the value of debt may not always increase with a higher promised amount of repayment B, as the creditors would not collect such B. In this setting, I demonstrate the value of debt can be maximized when the firm credibly commits to not engaging in strategic default.

Lemma 1. *For a given $N(\geq 1)$, the value of debt $V^C(B;N)$ is maximized at*

$$B = B_\tau(p) = A - p \cdot (A - \bar{B}). \tag{IA.10}$$

Proof. See Appendix IB.1. □

Figure IA2 illustrates the relationship between the promised repayment amount (B) and the value of debt (V^C), as derived in Lemma 1. Initially, as B increases, V^C also increases until B reaches B_τ. However, once B exceeds B_τ, the strategic default leads to a downward jump in V^C at B_τ by an additional deadweight loss:

$$\theta(1-p)\lambda A \tag{IA.11}$$

This term captures the efficiency loss in court (λA) resulting from the failure of the coordination ($1-p$) following the strategic default (θ). After this point, V^C remains constant at $p \cdot \bar{B} + (1-p)(1-\lambda)A$, regardless of the value of B. Therefore, V^C is maximized at $B = B_\tau$, where the commitment is established.

Under optimal contracting, increasing the value of debt can indeed benefit the equity holder, because V^C ultimately serves as a financial constraint for the firm. From Lemma 1, I derive the

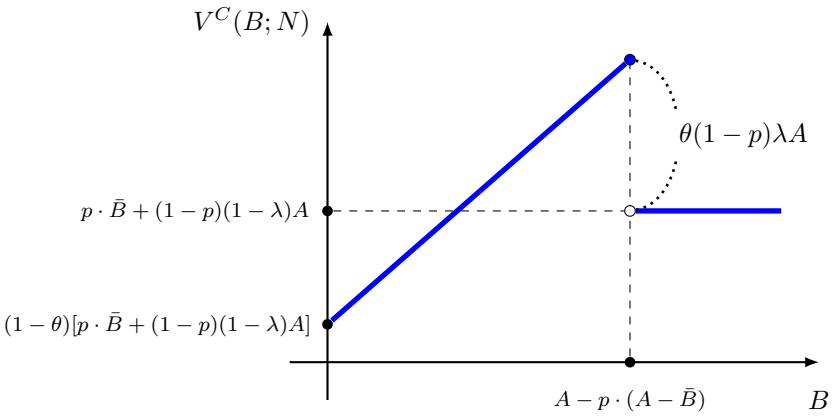


Figure IA2: Relationship between B and $V^C(B;N)$

maximal value of debt for a given N as:

$$\begin{aligned}\max_B V^C(B;N) &= V^C(B_\tau,N)\\ &= \theta\big[A-p\cdot(A-\bar{B})\big]+(1-\theta)\big[p\cdot\bar{B}+(1-p)(1-\lambda)A\big]\\ &= \theta A+(1-\theta)(1-\lambda)A\ -\ p\cdot\big[\theta\underbrace{(A-\bar{B})}_{\substack{\text{gain in}\\ \text{commitment}}}-(1-\theta)\underbrace{\big(\bar{B}-(1-\lambda)A\big)}_{\substack{\text{loss in}\\ \text{liquidity default}}}\big].\end{aligned}\tag{IA.12}$$

The number of creditors (N) affects the maximal value of debt throughout its effect on the coordination success probability (p). This relationship is determined by the relative importance of two mechanisms, weighted by θ and $1-\theta$: the commitment channel described in Equation (IA.8) and the liquidity channel, which represents the inefficiency in liquidity default. Therefore, when the coordination problem worsens ($p\downarrow$) due to an increase in the number of creditors ($N\uparrow$), the maximal value of debt can only increase if the expected commitment gain outweighs the expected loss in liquidity default.

Proposition 1. *The followings hold:*

1. *Increasing the number of creditors N leads to an increase in the maximal value of debt $V^C(B_\tau,N)$ if $1-\theta<\beta$*
2. *Furthermore, conditional on $1-\theta<\beta$, this positive relationship becomes stronger as the inefficiency in liquidation λ is higher.*

Proof. See Appendix IB.2. □

Proposition 1 characterizes the conditions under which increasing creditor dispersion can also increase the maximal value of debt. First, the value of commitment β should be high. In such

cases, $\bar{B}$ is low, leading to a significant reduction in the equity holder's payoff $A - \bar{B}$ if the restructuring fails. This amplifies the disciplinary effect of creditor dispersion. On the other hand, since $\bar{B}$ is low, the decrease in the creditors' payoff $\bar{B} - (1-\lambda)A$ is relatively small in the liquidity default. Taking into account the higher benefit and lower cost associated with creditor dispersion, increasing creditor dispersion can effectively increase the maximal value of debt when β is high.

Second, the (liquidity) default risk $1-\theta$ should be low. The trade-off in increasing creditor dispersion is characterized by the commitment gains in the success state and the efficiency losses in the failure state, weighted by their respective probabilities θ and $1-\theta$. Therefore, a low default risk ($\theta \uparrow$) suggests the gains are more probable than the losses, increasing the net benefit of creditor dispersion.

Lastly, conditional on $1-\theta < \beta$, λ should be high. This is because as λ increases, the disciplinary benefit of creditor dispersion $A - \bar{B}$ also increases.[15] In the extreme case of $\lambda = 0$, there is neither benefit nor cost associated with creditor dispersion, rendering it irrelevant.

IA.2.4 Debt Contract

Conditional on the existence of a debt contract, I obtain the (expected) value of the assets-in-place as:

$$V^A(B,N) = \begin{cases} p \cdot A + (1-p)(1-\lambda)A & \text{if } B > B_\tau \\ \big[\theta + (1-\theta)p\big]A + (1-\theta)(1-p)(1-\lambda)A & \text{if } B \leq B_\tau \end{cases} \tag{IA.13}$$

Denote $\mathbf{1}_{\text{debt}}$ as an indicator for the existence of a debt contract. The (expected) value of equity is given by

$$V^E(\mathbf{1}_{\text{debt}}, K, B, N) = \begin{cases} V^A(B,N) + RK - V^C(B,N) - C(N) & \text{if } \mathbf{1}_{\text{debt}} = 1 \\ A & \text{if } \mathbf{1}_{\text{debt}} = 0 \end{cases} \tag{IA.14}$$

Here, $V^A(B,N)$ denotes the value of the assets-in-place in Equation (IA.13), RK denotes the expected investment outcome,[16] $V^C(B,N)$ denotes the value of debt in Equation (IA.9), and $C(N)$ denotes the transaction costs of establishing lending relationships in Equation (IA.1).

When a debt contract is introduced, default risk is associated with the assets-in-place. Consequently, the equity holder may choose not to borrow and pursue the investment opportunity if

[15] The cost of creditor dispersion also increases, but conditional on $\beta < \theta$, the increase in benefit outweighs the increase in cost.

[16] I introduce R to separate the profitability of the project from the default risk $1-\theta$.

the expected cost associated with this risk exceeds the net present value (NPV) of the project. To simplify the analysis, I assume that the NPV is sufficiently large, ruling out scenarios where the cost of risk outweighs the NPV.

Assumption 2. *The NPV per unit of investment satisfies the following condition:*

$$R - 1 \geq \frac{(1-\overline{p})(1-\lambda)A + c}{V^C\big(B_\tau(1), N = 1\big)}.$$

The equity holder is subject to a financial constraint imposed by the competitive creditors. This constraint requires that the value of debt is equal to the amount of lending:

$$V^C(B, N) = K \tag{IA.15}$$

The equity holder maximizes V^E by solving

$$\max_{\{1_{\text{debt}}, K, B, N\}} V^E(\mathbf{1}_{\text{debt}}, K, B, N) \tag{IA.16}$$

subject to the financial constraint in Equation (IA.15), $K \geq 0$, $B \geq 0$, and $N \geq 1$ if $\mathbf{1}_{\text{debt}} = 1$.

Proposition 2. *An equilibrium always exists and is unique. In equilibrium, we have*

1. *A debt contract is agreed upon. The strategic default is off-equilibrium path, and the promised repayment is equal to the strategic default threshold:*

$$B^* = B_\tau\big(p(N^*)\big) = A - p(N^*) \cdot (A - \bar{B}). \tag{IA.17}$$

2. *If*

$$-p_N(N = 1) \cdot \Big[(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A\Big] > c, \tag{IA.18}$$

then $N^* > 1$ and it satisfies

$$-p_N(N^*) \cdot \Big[(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A\Big] = c. \tag{IA.19}$$

Otherwise, $N^* = 1$.

Proof. See Appendix IB.3. □

Proposition 2 fully characterizes the debt contract. The equity holder maximizes the value of debt, because the creditors' participation constraint serves as a financial constraint. To maximize

the borrowing capacity, the promised repayment is set equal to the strategic default threshold, where the strategic default becomes off-equilibrium path. If $\beta > 1-\theta$, the equity holder can further increase her borrowing capacity by increasing creditor dispersion. The benefit of creditor dispersion exists if the NPV resulting from this additional financing and investment exceeds the loss arising from the increased inefficiency in the liquidity default:

$$\underbrace{(R-1)(\beta+\theta-1)\lambda A}_{\text{NPV}} - \underbrace{(1-\theta)\lambda A}_{\text{inefficiency}} > 0. \tag{IA.20}$$

If the benefit of creditor dispersion is large enough to cover the additional transaction costs, then the equity holder chooses dispersed creditors.

To derive comparative statistics with respect to β, I rewrite Equation (IA.18) as

$$\beta > b(\lambda,\theta) \equiv \frac{c}{[-p_N(N=1)\cdot(R-1)\lambda A]} + \frac{R}{R-1}(1-\theta). \tag{IA.21}$$

By taking the first-order derivative of N^* with respect to β, we have

$$\frac{\partial N^*}{\partial \beta} = \begin{cases} 0 & \text{if } \beta \le b(\lambda,\theta) \\ \frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\left[-\frac{p_N}{p_{NN}}(N^*)\right] & \text{if } \beta > b(\lambda,\theta) \end{cases} \tag{IA.22}$$

where $\frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\left[-\frac{p_N}{p_{NN}}(N^*)\right] > 0$ for any $\beta > b(\lambda,\theta)$.

These results provide three key empirical predictions. First, when $\beta > b(\lambda,\theta)$, firms with a higher value of commitment will choose more dispersed creditors, as the benefit of commitment is greater for these firms.

Second, as $\partial b/\partial\lambda < 0$, the positive relationship between β and N becomes weaker when λ is low. In the extreme case of $\lambda = 0$, where the creditors would not agree to restructuring as they lose nothing in the liquidation event, no firm would need the commitment, regardless of their value of commitment. This result implies that creditor dispersion is more likely to reveal the value of commitment when the liquidation efficiency is low ($\lambda \uparrow$).

Third, as $\partial b/\partial\theta < 0$, the positive relationship between β and N becomes weaker when θ is low. In the extreme case of $\theta = 0$, where the equity holder will always engage in liquidity default and never engage in strategic default, no firm would need the commitment, regardless of their value of commitment. This result implies that creditor dispersion is more likely to reveal the value of commitment when the default risk is low ($\theta \uparrow$).

IA.3 Predictions on the Reform

Based on the analysis, I derive empirical predictions regarding a reform that mitigates the coordination problem. Consider a law reform that mitigates the coordination problem and reduces the effectiveness of dispersed creditors in worsening this problem. Specifically, I assume that after the reform, p changes to $\tilde{p}$, which satisfies

$$0 > \tilde{p}_N(N) > p_N(N), \quad \tilde{p}_{NN}(N) > 0, \quad \forall N \geq 1, \tag{IA.23}$$

and

$$\tilde{p}(N=1) = p(N=1) = \overline{p}, \quad \lim_{N\to\infty} \tilde{p}(N) = \underline{\tilde{p}} \geq \underline{p} = \lim_{N\to\infty} p(N). \tag{IA.24}$$

Note that these conditions imply $\tilde{p}(N) > p(N)$ for all $N > 1$, as

$$\tilde{p}(N) = \tilde{p}(N=1) + \int_{n=1}^{N} \tilde{p}_N(n)dn > p(N=1) + \int_{n=1}^{N} p_N(n)dn = p(N). \tag{IA.25}$$

I further make assumptions on the curvature that (i) $0 > (\tilde{p}_{NN}/\tilde{p}_N)(N)$ is increasing in N and (ii) $0 > (p_{NN}/p_N)(N) \geq (\tilde{p}_{NN}/\tilde{p}_N)(N)$ for all N.

One example that satisfies the stated assumptions is a standard rational function $p(N;\alpha) = 1 - \alpha + \alpha N^{-1}$ for some $\alpha \in (0,1)$, as

$$p(N=1;\alpha) = 1, \quad \lim_{N\to\infty} p(N;\alpha) = 1-\alpha, \tag{IA.26}$$

$$p_N(N;\alpha) = -\alpha N^{-2} < 0, \quad p_{NN}(N;\alpha) = 2\alpha N^{-3} > 0, \tag{IA.27}$$

and

$$(p_{NN}/p_N)(N;\alpha) = -2N^{-1}. \tag{IA.28}$$

The reform can be modeled as a shock that decreases α to $\tilde{\alpha}$, which leads to

$$p_N(N;\tilde{\alpha}) = -\tilde{\alpha}N^{-2} > -\alpha N^{-2} = p_N(N;\alpha) \tag{IA.29}$$

and

$$(p_{NN}/p_N)(N;\tilde{\alpha}) = -2N^{-1} = (p_{NN}/p_N)(N;\alpha). \tag{IA.30}$$

I denote the equilibrium outcomes before and after the reform as $\{K^b, B^b, N^b\}$ and $\{K^a, B^a, N^a\}$, respectively.

Proposition 3 (The Differential Effects)**.** *After the reform,*

$$\begin{cases} N^a - N^b = 0, \quad K^a - K^b = 0 & \text{if } \beta \leq b(\lambda,\theta), \\ N^a - N^b < 0, \quad K^a - K^b < 0 & \text{if } \beta > b(\lambda,\theta). \end{cases}$$

Furthermore, we have

$$\begin{cases} \frac{\partial\left(N^a-N^b\right)}{\partial\beta}=0, & \frac{\partial\left(K^a-K^b\right)}{\partial\beta}=0 \quad \textit{if } \beta \leq b(\lambda,\theta), \\ \frac{\partial\left(N^a-N^b\right)}{\partial\beta}<0, & \frac{\partial\left(K^a-K^b\right)}{\partial\beta}<0 \quad \textit{if } \beta > b(\lambda,\theta). \end{cases}$$

Proof. See Appendix IB.4. □

As creditor dispersion becomes less effective in worsening the coordination problem after the reform, we have a decrease in creditor dispersion and the borrowing capacity: $N^a - N^b \leq 0$ and $K^a - K^b \leq 0$. Furthermore, as high β firms are more reliant on this commitment device, we have stronger effects of the reform in those firms.

Overall, these results predict a stronger decrease in (i) creditor dispersion and (ii) the leverage ratio of firms with high value of commitment after the reform. Again, as $\partial b/\partial\lambda < 0$ and $\partial b/\partial\theta < 0$, these differential effects should be more pronounced when the liquidation efficiency is low ($\lambda \uparrow$) or default risk is low ($\theta \uparrow$).

IB Proofs

IB.1 Proof of Lemma 1

Proof. Suppose $B > B_\tau(p) = A - p \cdot (A - \bar{B})$. Then, the firm does not repay debt even when the investment is successful. Therefore, the expected value of debt is given by

$$p \cdot \bar{B} + (1-p)(1-\lambda)A \tag{IB.31}$$

regardless of the value of B.

Now, suppose $B \leq B_\tau(p) = A - p \cdot (A - \bar{B})$. Then, the firm has no incentive to engage in the strategic default and the expected value of debt is given by

$$\theta B + (1-\theta)\big[p \cdot \bar{B} + (1-p)(1-\lambda)A\big] \tag{IB.32}$$

which is increasing in B. When $B = B_\tau(p) = A - p \cdot (A - \bar{B})$,

$$\begin{aligned}
\theta B_\tau + (1-\theta)\big[p \cdot \bar{B} + (1-p)(1-\lambda)A\big] &= p \cdot \bar{B} + (1-p)(1-\lambda)A + \theta\big[B_\tau - p\bar{B} - (1-p)(1-\lambda)A\big] \\
&= p \cdot \bar{B} + (1-p)(1-\lambda)A + \theta\big[A - p \cdot (A - \bar{B}) - p \cdot \bar{B} - (1-p)(1-\lambda)A\big] \\
&= p \cdot \bar{B} + (1-p)(1-\lambda)A + \underbrace{\theta(1-p)\lambda A}_{>0} \\
&> p \cdot \bar{B} + (1-p)(1-\lambda)A
\end{aligned} \tag{IB.33}$$

suggesting that the expected value of debt is maximized at $B = B_\tau(p) = A - p \cdot (A - \bar{B})$. □

IB.2 Proof of Proposition 1

Proof. By taking the first-order derivative of $V^C(B_\tau, N)$ with respect to N, I obtain

$$\begin{aligned}
\frac{\partial}{\partial N} V^C(B_\tau, N) &= \frac{\partial p}{\partial N}\frac{\partial V^C}{\partial p} \\
&= -p_N(N) \cdot \big[\theta(A - \bar{B}) - (1-\theta)\big(\bar{B} - (1-\lambda)A\big)\big] \\
&= \underbrace{-p_N(N)}_{(+)} \cdot \underbrace{(\beta + \theta - 1)}_{(+) \text{ or } (-)} \underbrace{\lambda A}_{(+)}
\end{aligned} \tag{IB.34}$$

where the last equality is from Equation (IA.7). □

IB.3 Proof of Proposition 2

Proof. Using $K = V^C(B, N)$, we can rewrite the problem as:

$$\max_{\{1_{\text{debt}}, B, N\}} V^E(1_{\text{debt}}, B, N) = V^A(B, N) + (R-1)V^C(B, N) - C(N) \tag{IB.35}$$

subject to $V^C(B, N) \geq 0$, $B \geq 0$, and $N \geq 1$. From Equations (IA.7) and (IA.9), we have $V^C(B, N) \geq (1-\theta)(1-\lambda)A > 0$ for any $B \geq 0$ and $N \geq 1$. Furthermore, we have $1^*_{\text{debt}} = 1$ from

$$\begin{aligned}\max_{B,N} V^E(1_{\text{debt}} = 1, B, N) &\geq V^E(1_{\text{debt}} = 1, B = B_\tau(1), N = 1) \\ &= A - \overline{p}(1-\theta)(1-\lambda)A + (R-1)V^C(B_\tau(1), N = 1) - c \\ &\geq A \end{aligned} \tag{IB.36}$$

where the last inequality is from Assumption 2.

Denote Karush-Kuhn-Tucker (KKT) multipliers for $B \geq 0$, and $N \geq 1$ as $\mu_B \geq 0$ and $\mu_N \geq 0$, respectively. From the first-order condition with respect to B, we have

$$\begin{aligned}\frac{\partial}{\partial B} V^E(1^*_{\text{debt}} = 1, B, N^*) + \mu^*_B &= \frac{\partial}{\partial B} V^A(B, N^*) + (\theta R - 1)\frac{\partial}{\partial B} V^C(B, N^*) + \mu^*_B \\ &= \underbrace{(R-1)}_{>0} \frac{\partial}{\partial B} V^C(B, N^*) + \mu^*_B \\ &= 0 \end{aligned} \tag{IB.37}$$

On the one hand, for all $B \leq B_\tau$, we have $\partial V^C / \partial B > 0$ from Equation (IA.9). Therefore, if $B^* \leq B_\tau$, we have

$$B^* = \arg \max_{B \in [0, B_\tau]} V^E(1^*_{\text{debt}} = 1, B, N^*) = B_\tau > 0 \tag{IB.38}$$

with $\mu^*_B = 0$. On the other hand, for all $B > B_\tau$, we have $\partial V^C / \partial B = 0$ from Equation (IA.9). Therefore, if $B^* > B_\tau$, $\mu^*_B = 0$ and $\partial V^E / \partial B = 0$, suggesting a constant V^E. Furthermore, for all $B > B_\tau$, we have

$$\begin{aligned} V^E(1^*_{\text{debt}} = 1, B_\tau, N^*) - V^E(1^*_{\text{debt}} = 1, B, N^*) &= \underbrace{V^A(B_\tau, N^*) - V^A(B, N^*)}_{\geq 0} + \underbrace{(R-1)}_{>0} \underbrace{\left[V^C(B_\tau, N^*) - V^C(B, N^*)\right]}_{\geq 0} \\ &\geq 0 \end{aligned} \tag{IB.39}$$

where $V^A(B_\tau, N^*) - V^A(B, N^*) \geq 0$ is from

$$\underbrace{\big[\theta + (1-\theta)p\big]A + (1-\theta)(1-p)(1-\lambda)A}_{\text{if } B \leq B_\tau} = p \cdot A + (1-p)(1-\lambda)A + \underbrace{\theta(1-p)\lambda A}_{\substack{\text{additional} \\ \text{deadweight loss}}}$$
$$\geq \underbrace{p \cdot A + (1-p)(1-\lambda)A}_{\text{if } B_\tau < B}. \tag{IB.40}$$

$V^C(B_\tau, N^*) - V^C(B, N^*) \geq 0$ is from Lemma 1. This inequality suggests $B^* \leq B_\tau$. Therefore, $B^*(N^*) = A - p(N^*) \cdot (A - \bar{B})$.

Finally, from the first-order condition with respect to N, we have

$$\begin{aligned}
\frac{\partial}{\partial N} V^E(1^*_{\text{debt}} = 1, B^*, N) + \mu^*_N &= \frac{\partial}{\partial N} V^A(B^*, N) + (R-1)\frac{\partial}{\partial N} V^C(B^*, N) - \frac{\partial}{\partial N} C(N) + \mu^*_N \\
&= \frac{\partial p}{\partial N}\Big[\frac{\partial}{\partial p} V^A(B^*, N) + (R-1)\frac{\partial}{\partial p} V^C(B^*, N)\Big] - c + \mu^*_N \\
&= p_N(N) \cdot \Big[(1-\theta)\lambda A - (R-1)(\beta + \theta - 1)\lambda A\Big] - c + \mu^*_N \\
&= 0
\end{aligned} \tag{IB.41}$$

where the third equality is derived in Proposition 1. Suppose

$$-p_N(N=1) \cdot [(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A] > c. \tag{IB.42}$$

If $N^* = 1$, the KKT condition in Equation (IB.41) implies $\mu^*_N < 0$, which is a contradiction. If $N^* > 1$, from $p_N < 0$ and $p_{NN} > 0$, there exists N^* that satisfies the KKT condition

$$-p_N(N^*) \cdot [(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A] = c \tag{IB.43}$$

with $\mu^*_N = 0$. Therefore, we obtain $N^* > 1$ under the condition in Equation (IB.42).

Now, suppose

$$-p_N(N=1) \cdot [(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A] \leq c. \tag{IB.44}$$

If $N^* > 1$, from $p_N < 0$ and $p_{NN} > 0$, we have

$$-p_N(N^*) \cdot [(R-1)(\beta + \theta - 1)\lambda A - (1-\theta)\lambda A] < c. \tag{IB.45}$$

However, the KKT condition in Equation (IB.41) implies $\mu^*_N > 0$, which is a contradiction. If $N^* = 1$, we have $\mu^*_N \geq 0$ which satisfies the KKT condition in Equation (IB.41). Therefore, we obtain the corner solution $N^* = 1$ under the condition in Equation (IB.44). □

IB.4 Proof of Proposition 3

Proof. Equilibrium outcomes are characterized in Proposition 2. Denote

$$b(\lambda,\theta) \equiv \frac{c}{[-p_N(N=1)\cdot(R-1)\lambda A]} + \frac{R}{R-1}(1-\theta), \tag{IB.46}$$

$$\tilde{b}(\lambda,\theta) \equiv \frac{c}{[-\tilde{p}_N(N=1)\cdot(R-1)\lambda A]} + \frac{R}{R-1}(1-\theta). \tag{IB.47}$$

Note that $\tilde{p}_N(N=1) > p_N(N=1)$ implies $\tilde{b} > b$. Depending on the value of β, we have three cases for N^a and N^b:

1. If $\beta \leq b$,
$$N^a = N^b = 1. \tag{IB.48}$$
2. If $\beta \in (b, \tilde{b}]$,
$$N^a = 1 < N^b. \tag{IB.49}$$
3. If $\beta > \tilde{b}$,
$$1 < N^a < N^b \tag{IB.50}$$
as $p_N(N^b) = \tilde{p}_N(N^a) > p_N(N^a)$ and $p_{NN} > 0$.

By taking the first derivative of N^a and N^b with respect to β, we have

$$-\frac{\partial N^a}{\partial \beta}\cdot\tilde{p}_{NN}(N^a)\cdot[(R-1)(\beta+\theta-1)\lambda A-(1-\theta)\lambda A]-\tilde{p}_N(N^a)\cdot(R-1)\lambda A=0$$

$$\Rightarrow \frac{\partial N^a}{\partial \beta} = \frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\left[-\frac{\tilde{p}_N}{\tilde{p}_{NN}}(N^a)\right] \tag{IB.51}$$

for $\beta > \tilde{b}$ and

$$-\frac{\partial N^b}{\partial \beta}\cdot p_{NN}(N^b)\cdot[(R-1)(\beta+\theta-1)\lambda A-(1-\theta)\lambda A]-p_N(N^b)\cdot(R-1)\lambda A=0$$

$$\Rightarrow \frac{\partial N^b}{\partial \beta} = \frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\left[-\frac{p_N}{p_{NN}}(N^b)\right] \tag{IB.52}$$

for $\beta > b$. From the above results, we obtain

$$\frac{\partial\left(N^a-N^b\right)}{\partial\beta} = \begin{cases} 0 & \text{if } \beta \leq b, \\ \frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\frac{p_N}{p_{NN}}(N^b) & \text{if } \beta \in (b,\tilde{b}], \\ \frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)}\left[\frac{p_N}{p_{NN}}(N^b)-\frac{\tilde{p}_N}{\tilde{p}_{NN}}(N^a)\right] & \text{if } \beta > \tilde{b}. \end{cases} \tag{IB.53}$$

$b < \beta$ implies $\frac{R-1}{(R-1)(\beta+\theta-1)-(1-\theta)} > 0$. Therefore, $\frac{\partial(N^a-N^b)}{\partial\beta} < 0$ for $\beta \in (b, \tilde{b}]$. For $\beta > \tilde{b}$, we have

$$\begin{aligned}\left[\frac{p_N}{p_{NN}}(N^b) - \frac{\tilde{p}_N}{\tilde{p}_{NN}}(N^a)\right] &\leq \left[\frac{p_N}{p_{NN}}(N^b) - \frac{\tilde{p}_N}{\tilde{p}_{NN}}(N^b)\right] \\ &\leq 0 \end{aligned} \tag{IB.54}$$

where the first inequality is from $N^b > N^a$ and $0 > (\tilde{p}_{NN}/\tilde{p}_N)(N)$ is increasing in N, and the last inequality is from $(p_{NN}/p_N)(N) \geq (\tilde{p}_{NN}/\tilde{p}_N)(N)$ for all N. This inequality implies $\frac{\partial(N^a-N^b)}{\partial\beta} < 0$ for $\beta > \tilde{b}$.

Next, by taking the first derivative of $\tilde{p}(N^a)$ and $p(N^b)$ with respect to β, we have

$$\frac{\partial\tilde{p}}{\partial\beta} = \frac{\partial N^a}{\partial\beta}\tilde{p}_N(N^a) \tag{IB.55}$$

for $\beta > \tilde{b}$ and

$$\frac{\partial p}{\partial\beta} = \frac{\partial N^b}{\partial\beta}p_N(N^b) \tag{IB.56}$$

for $\beta > b$. Since $\tilde{p}_N(N^a) = p_N(N^b)$ for $\beta > \tilde{b}$ from the first order condition, we have

$$\frac{\partial\left(\tilde{p}(N^a) - p(N^b)\right)}{\partial\beta} = \begin{cases} 0 & \text{if } \beta \leq b, \\ -\frac{\partial N^b}{\partial\beta}p_N(N^b) & \text{if } \beta \in (b, \tilde{b}], \\ \frac{\partial\left(N^a-N^b\right)}{\partial\beta}p_N(N^b) & \text{if } \beta > \tilde{b}. \end{cases} \tag{IB.57}$$

These results imply $\frac{\partial\left(\tilde{p}(N^a)-p(N^b)\right)}{\partial\beta} > 0$ for $\beta > b$.

Lastly, I want to show $\frac{\partial\left(K^a-K^b\right)}{\partial\beta} < 0$ for $\beta > b$, and $\frac{\partial\left(K^a-K^b\right)}{\partial\beta} = 0$ for $\beta \leq b$. Note that

$$\begin{aligned} K^a - K^b &= V_C(B^a, N^a) - V_C(B^b, N^b) \\ &= \left[p(N^b) - \tilde{p}(N^a)\right](\beta + \theta - 1)\lambda A. \end{aligned} \tag{IB.58}$$

Since

$$\tilde{p}(N^a) > \tilde{p}(N^b) > p(N^b), \quad \beta + \theta - 1 > 0 \tag{IB.59}$$

for $\beta > b$, we also have $K^a - K^b < 0$. For $\beta \leq b$, we have $\tilde{p}(N^a) = p(N^b) = \overline{p}$ and $K^a - K^b = 0$.

By taking the first derivative with respect to β, we have

$$\frac{\partial\left(K^a - K^b\right)}{\partial\beta} = \frac{\partial\left(p(N^b) - \tilde{p}(N^a)\right)}{\partial\beta} \cdot (\beta + \theta - 1)\lambda A + \left[p(N^b) - \tilde{p}(N^a)\right]\lambda A. \tag{IB.60}$$

For $\beta > b$, we have $\frac{\partial\left(p(N^b)-\tilde{p}(N^a)\right)}{\partial\beta} < 0$, $(\beta+\theta-1)\lambda A > 0$, and $\left[p(N^b)-\tilde{p}(N^a)\right]\lambda A < 0$, suggesting $\frac{\partial\left(K^a-K^b\right)}{\partial\beta} < 0$. For $\beta \leq b$, we have $\frac{\partial\left(K^a-K^b\right)}{\partial\beta} = 0$.

Taken together, we have

$$\begin{cases} N^a - N^b = 0, & K^a - K^b = 0 \quad \text{if } \beta \leq b, \\ N^a - N^b < 0, & K^a - K^b < 0 \quad \text{if } \beta > b \end{cases} \tag{IB.61}$$

and

$$\begin{cases} \frac{\partial\left(N^a-N^b\right)}{\partial\beta} = 0, & \frac{\partial\left(K^a-K^b\right)}{\partial\beta} = 0 \quad \text{if } \beta \leq b, \\ \frac{\partial\left(N^a-N^b\right)}{\partial\beta} < 0, & \frac{\partial\left(K^a-K^b\right)}{\partial\beta} < 0 \quad \text{if } \beta > b. \end{cases} \tag{IB.62}$$

□