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The Economics of Legal Uncertainty

Law Working Paper N° 669/2022
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Abstract

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Keywords: Bankruptcy, law and economics, legal uncertainty, uncertainty.

JEL Classification: G32, G33, G38, K22

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The Economics of Legal Uncertainty*

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July 23, 2026

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1 Introduction

A fundamental link between law and economic development has been recognized at least since the 19th century. Max Weber famously attributed the rise of modern industrial capitalism to the rule of law, especially legal certainty (Trubek, 1972). Legal uncertainty, driven by factors such as judicial discretion and changes in the law, is a persistent feature of any legal system.[1] Despite the potential importance of legal uncertainty in economic development, surprisingly few attempts have been made to study the link between legal uncertainty and economic activity. The objective of this paper is to address this gap in the literature.

We begin our analysis by developing a theoretical framework to examine the relationship between legal uncertainty and economic activity.[2] Our model examines an economy where suppliers and producers engage in transactions that may lead to legal disputes after production. When disputes arise, the monetary transfers between these risk-averse parties are uncertain, creating what we term legal uncertainty. Our framework identifies three distinct types of legal uncertainty. First, assignment uncertainty arises when legal disputes are randomly assigned to judges. This form of uncertainty is idiosyncratic—parties involved in many disputes can diversify away this type of uncertainty. Second, type uncertainty reflects incomplete knowledge about individual judges' types, which determine their decision-making. Third, regime uncertainty arises from potential changes to the legal system, such as the replacement of judges or the enactment of new legislation. Type and regime uncertainty cannot typically be diversified as they systematically affect all legal disputes.

In the second part of the paper, we exploit a unique institutional setting in Korea using detailed micro-level data on bankruptcy judges' decisions in restructuring cases and corporate loans to test the empirical predictions from our theoretical framework. We first use differences in judges' interpretations of the law to compute judge types based on their debtor-friendliness. In the Korean court system, judges are considered generalists who rotate through different courts and court divisions throughout their careers. They are typically appointed as bankruptcy judges for a single two-year term and are subsequently replaced by new judges. As a result, their type is unknown at the beginning of their term. We follow a two-step approach to quantify a judge's type. First, we

[1] The tension between legal certainty and judicial discretion is a central antinomy of modern legal philosophy (e.g., Dworkin, 1963; Hart, 2013).

[2] In line with the literature, and as discussed in further detail in Section 2, we refer to a single concept of uncertainty throughout the paper capturing aspects of both risk and uncertainty (or ambiguity).

classify judges' decisions in restructuring cases as debtor- or creditor-friendly. Second, we compute a time-varying measure of a judge's type using a simple Bayesian learning model in which agents learn about a judge's type from their decisions over time. Starting with a common prior, which we calibrate to the distribution of all judges in our sample, this procedure puts more weight on the observed debtor-friendliness of a judge as agents observe more of the judge's decisions.

Exploiting our time-varying measures of judge types and the unique institutional setting, we compute the three time-varying court-level measures of legal uncertainty identified in our theoretical framework: assignment uncertainty, type uncertainty, and regime uncertainty. Assignment uncertainty arises because cases are randomly assigned to judges who may differ in their debtor-friendliness. To capture this, we compute the standard deviation of judges' types in a given court at a given point in time. Assignment uncertainty is idiosyncratic and diversifiable by a bank with a large number of borrowers. In contrast, a borrower cannot diversify this type of uncertainty since bankruptcy uniformly affects all of the borrower's loans. Type uncertainty arises from agents' uncertainty about individual judges' types, which declines as agents learn from judges' decisions over time. We capture this by computing the variance of judges' average type based on the decisions made by judges in a given court up to a given month. Regime uncertainty arises from the replacement of judges in a given court, thereby increasing legal uncertainty, as agents are less informed about the new judges. We measure this effect by calculating the fraction of the current judges' term in a given court that has passed up to a given month.[3] Type and regime uncertainty are systematic and non-diversifiable in our empirical setting.[4] Since firms are strictly and unambiguously assigned to specific bankruptcy courts in Korea, different firms are exposed to different variation in judges' types and legal uncertainty in the cross-section and over time.

We first show that judge types are highly persistent, indicating that debtor-friendliness is a persistent characteristic. Judge types are strongly correlated across the first and second halves of a given judge's term, even when comparing judges working at the same court at the same time, in which case the remaining variation in case assignment is random. The correlation remains high

[3] As judges approach the end of their term, one may conjecture that they exert less influence over the restructuring process. However, since early decisions, particularly the acceptance or dismissal of a restructuring filing, have significant weight and shape the case trajectory, judges significantly impact a case even if they do not oversee it in its entirety.

[4] As most courts replace bankruptcy judges every two years, approximately half of all bankruptcy judges are replaced in a given year.

when we exclude cases that span both halves of a judge's term and when we restrict attention to cases handled by more than one judge, for which we can compute judge types net of case fixed effects, ruling out that our measure of judge types is distorted by systematic differences in observable or unobservable case characteristics across judges.

Next, we assess the impact of legal uncertainty on credit markets. We find that loan volume at the firm-bank level is higher when assignment, type, and regime uncertainty are lower. Specifically, loan volume is higher when there is less dispersion in judge types (lower assignment uncertainty), when individual judges' types are less uncertain (lower type uncertainty), and when judge replacements occur further in the future (lower regime uncertainty). This suggests that both idiosyncratic and systematic sources of legal uncertainty negatively affect credit markets. When we split firms into high-, medium-, and low-default-risk firms, we find that the sensitivity of credit to all three sources of legal uncertainty is concentrated within high-risk firms. This strengthens the interpretation of our results as being driven by exposure to legal uncertainty in bankruptcy law. Importantly, the results are qualitatively identical for the subset of firms that are strictly assigned to a single court, ruling out that our findings are driven by court selection.

In terms of economic magnitudes, our estimates imply that a one-standard-deviation increase in assignment uncertainty reduces loan volume by 12.70 percent for a firm that enters bankruptcy proceedings with certainty. Similarly, a one-standard-deviation increase in type uncertainty reduces loan volume by 11.22 percent, and a one-standard-deviation increase in regime uncertainty reduces loan volume by 4.63 percent.

As predicted by our model, we also find that interest rates are lower when assignment uncertainty is higher. In contrast, higher type and regime uncertainty are associated with higher interest rates. These results are consistent with the idea that the supply of credit is relatively less affected by idiosyncratic sources of legal uncertainty (assignment uncertainty) than by systematic sources of legal uncertainty (type and regime uncertainty) compared with the demand for credit, since banks can diversify idiosyncratic legal uncertainty across borrowers. As further predicted by our model, interest rates are higher when the court is more debtor-friendly, as more debtor-friendly judges increase credit demand but reduce credit supply. These results are again primarily driven by high-risk firms.

We conduct several robustness tests to strengthen the validity of our empirical analysis. First,

we show that our results are not sensitive to our calibration of agents' prior beliefs about judge types. Second, we show that firms and banks do not incorporate additional information when estimating judge types. Specifically, when we separately include measures of debtor-friendliness and assignment uncertainty based on fully informed judge types in our estimation, these cannot explain our findings. Third, we establish that the results are not driven by differences in bank quality across different courts by including bank-time fixed effects. Fourth, we show that industry-specific shocks do not drive the results by including industry-time fixed effects. Fifth, we show that our measures are not correlated with local economic conditions. Sixth, we show that large firms do not drive our results. Finally, while our measures of assignment uncertainty fluctuate over time within a given court and term, they do not systematically vary within a term when aggregated across all judges' terms. Our legal uncertainty measures are also uncorrelated with case length, a standard proxy for effective case resolution. This suggests that our measures are not systematically related to changes in the quality of judges' decisions over time.

Given the richness of our institutional setting, data, and empirical tests, any confounding factor would need to satisfy multiple conditions to explain our results. Any such factor would need to simultaneously explain why loan volume increases when: (1) judge types show less dispersion, (2) individual judges' types are more predictable, and (3) judge replacement occurs further in the future. Additionally, it would need to explain the contrasting interest rate patterns—specifically, why interest rates rise when judge types are less predictable, and replacement occurs sooner, yet fall when judge types show greater dispersion. Our tests specifically rule out differences in case characteristics, macroeconomic shocks, industry-specific shocks, differential treatment of large firms, and differences across banks as confounding factors. The institutional setting also eliminates endogenous judge appointments and forum shopping as confounding factors, since these are absent in the Korean court system. Finally, even if our learning model only partially captured how firms and banks form beliefs about judge types, a resulting noisier proxy of perceived judge types would create attenuation bias, leading us to underestimate the effects of legal uncertainty on credit markets.

Our analysis has important economic and policy implications, which we discuss in detail in Section 7. Reforms to judicial or legal systems may reduce legal uncertainty by limiting judge rotations, judicial discretion, and random judge assignment, increasing transparency, and utiliz-

ing information technology to enhance the predictability of legal outcomes. Stricter adherence to precedent can also reduce legal uncertainty by making future decisions more predictable. However, adherence to precedent can also make legal uncertainty more systematic, as important decisions systematically affect legal outcomes going forward. While we primarily emphasize the positive impact of reducing legal uncertainty on credit markets and economic activity, we also highlight that policies aimed at reducing legal uncertainty may entail negative consequences. For instance, eliminating random judge assignment could undermine fairness in judicial processes, and limiting judicial discretion might prevent adaptations to case-specific circumstances. Our analysis provides a novel economic framework for evaluating legal and judicial reforms by highlighting the trade-offs between reducing uncertainty and other policy objectives, offering policymakers a more comprehensive basis for assessing institutional design choices. Our findings have further implications for the diversification of legal uncertainty through intermediaries like banks, insurance companies, or investment funds, and for the boundary of the firm.

A substantial body of research investigates how different sources of uncertainty affect the economy (e.g., Bloom, 2014), including regulatory uncertainty (e.g., Gissler et al., 2016; Agarwal et al., 2022) and tax uncertainty (e.g., Lee and Xu, 2019; Brok, 2019; Jacob et al., 2021). Despite an extensive theoretical literature on legal uncertainty (e.g., Posner, 1973; D'Amato, 1983; Bebchuk, 1984; Craswell and Calfee, 1986; Kaplow, 1990; Bebchuk and Kaplow, 1992; Kaplow and Shavell, 1992; Kaplow, 1994; Harel and Segal, 1999; Guthrie, 2002; Brooks and Schwartz, 2005; Mullally, 2009; Geistfeld, 2010; Lang, 2017), few attempts have been made to measure or examine it empirically.[5] In contemporaneous work, Giommoni et al. (2025) measure legal uncertainty in Italy by the probability of disagreement between the Supreme Court of Cassation and lower courts and show that this uncertainty is higher for cases involving poorly written laws. Exploiting a reform that reassigned firms to different courts, they find that legal uncertainty reduces firm growth and capital investment and increases precautionary provisions, and they estimate that aggregate output would be substantially higher if laws were drafted more clearly. Importantly, the legal uncertainty in Giommoni et al. (2025) originates in the ambiguity of the laws themselves and

[5]Exceptions in measuring aspects of legal uncertainty include Lefstin (2006) and Farnsworth et al. (2010). Additionally, the World Bank's Doing Business Project, which collects data on business law from 175 countries, includes indicators related to legal uncertainty (Davis and Kruse, 2007). However, these studies do not explore the economic consequences of legal uncertainty.

is measured across courts, whereas our measures capture uncertainty arising from heterogeneity in judges' decision-making within a court, exploiting the random assignment of cases to judges. Moreover, their analysis does not differentiate between idiosyncratic and systematic sources of legal uncertainty, a distinction that proves critical for understanding how legal uncertainty differentially affects economic agents with varying capacities to diversify. In our empirical context, this distinction is essential for explaining contrasting effects on credit supply versus demand.

Our contribution is to provide multiple direct measures of legal uncertainty and to investigate their economic implications. We first establish that legal uncertainty inhibits economic activity. Moreover, guided by a theoretical framework, we differentiate between idiosyncratic and systematic sources of legal uncertainty and provide measures of both in our empirical analysis. In our framework, the measure in Giommoni et al. (2025) would be classified as systematic legal uncertainty. We show, both theoretically and empirically, that the effects of idiosyncratic and systematic legal uncertainty differ depending on economic agents' ability to diversify legal uncertainty. Our framework, therefore, allows us to provide unique policy implications for the judicial system, the legal system, legislation, transparency, the boundaries of the firm, and intermediation. Collectively, our findings provide important insights into how the institutional architecture of the legal system influences economic outcomes by shaping legal uncertainty.

While the primary objective of our paper is to examine how legal uncertainty affects economic activity, the legal uncertainty measures we develop can also be useful in answering the broader question of how uncertainty impacts economic activity. An important advantage of our measures of uncertainty over other measures of uncertainty is that they are unrelated to economic conditions (e.g., Bloom, 2014). This is because the variation in our measures of uncertainty is driven by exogenous judge rotations and random assignment of cases to judges, both of which are unrelated to economic conditions. This feature enables us to more cleanly identify the effects of uncertainty, a significant advantage over the existing literature. Additionally, we differentiate between measures of idiosyncratic and systematic uncertainty and demonstrate that their effects may vary based on economic agents' capacity to diversify idiosyncratic uncertainty, an insight that extends to other uncertainty sources as well.

A related literature examines how litigation risk—the probability of being sued in securities class action lawsuits—affects corporate decisions (e.g., Kim and Skinner, 2012; Lowry and Shu,

2002; Huang et al., 2019; Cassella and Rizzo, 2023). This literature measures the *likelihood* of adverse legal outcomes. Our paper addresses a conceptually distinct question: conditional on a legal dispute arising, how does *uncertainty* about its resolution affect economic activity? This represents a fundamentally different source of uncertainty with distinct policy implications. Moreover, the litigation risk literature does not distinguish between idiosyncratic and systematic sources of uncertainty—a distinction that, as we show, is critical for understanding how legal uncertainty differentially affects agents with varying capacities to diversify, and consequently, both the price and quantity of transactions in affected markets. In our empirical context, for example, this distinction proves essential for understanding how legal uncertainty differentially impacts borrowers and lenders and, as a result, both interest rates and the volume of credit.

This paper also contributes to the law and finance literature by examining the impact of uncertainty regarding creditor protection in bankruptcy proceedings on the size of credit markets. Following the seminal work of La Porta et al. (1997, 1998), several studies have explored the relationship between creditor protection and the size of credit markets, with mixed results. Some studies find a positive relationship (e.g., Levine, 1998, 1999; Djankov et al., 2007; Qian and Strahan, 2007; Djankov et al., 2008; Haselmann et al., 2010; Campello and Larrain, 2016; Ponticelli and Alencar, 2016; Favara et al., 2021), while others find a negative one (Acharya and Subramanian, 2009; Acharya et al., 2011; Vig, 2013). See Schoenherr and Starmans (2022) for an analysis that helps reconcile these opposing views. While existing research focuses on the level of creditor protection, we add to the literature by documenting the independent effect of uncertainty about the level of creditor protection in bankruptcy proceedings.

Finally, our analysis contributes to the literature on the random assignment of judges and other decision-makers and the variation in their interpretation of the law and regulations. Previous studies have examined the influence of judge types ex post using random judge assignment as an instrument (e.g., Anderson et al., 1999; Kling, 2006; Anwar et al., 2012; Chang and Schoar, 2013; Galasso and Schankerman, 2014; Dobbie and Song, 2015; Bernstein et al., 2019a,b; Antill, 2022; Arnold et al., 2022; Grindaker et al., 2022). In contrast, we adopt an ex-ante approach using random judge assignments to measure legal uncertainty. Specifically, we quantify the legal uncertainty generated by random judge assignment and evaluate its impact on credit markets. Furthermore, we provide validation for the instrumental-variable approach used in the literature by demonstrating

the persistence of judges' types by comparing their decisions in the first and second halves of their terms.

2 Theoretical Framework

This section presents a stylized framework analyzing the relationship between suppliers and producers that rely on suppliers' inputs for their production. Supplier-producer relationships face legal uncertainty, leading to disputes with unpredictable outcomes. We formally identify and characterize different types of legal uncertainty that we will study in our empirical analysis and explore their impact on production.

Knight (1921) differentiated between risk and uncertainty (or ambiguity). Risk is defined by a known probability distribution, while uncertainty occurs when agents cannot predict a specific probability distribution. Although our model focuses on the concept of risk as outlined by Knight, we recognize that, in reality, agents face both risk and uncertainty. Therefore, consistent with the literature (e.g., Bloom, 2014), we use the term "uncertainty" throughout this paper to encompass both risk and uncertainty.

2.1 Model Setup

We consider an economy with N producers and N suppliers. Each producer requires input from the suppliers for production, with each supplier providing $\frac{I}{N}$ of the total input I to each producer. Each supplier incurs a production cost of $C > 0$ per unit of input. When a producer receives a total of I units of input (i.e., $\frac{I}{N}$ units from each supplier), they generate I units of output, earning revenue RI, where $R > C$. At a price P per unit of input, each supplier receives revenue of $\frac{PI}{N}$ from each producer, totaling PI. The surplus from production is $(R-C)I > 0$, and its distribution between producers and suppliers is determined by the price P.

After production, a legal dispute arises between a producer and its suppliers. This dispute concerns an amount of DI of the producer's revenue, where $D > 0$. The share of the disputed amount DI retained by producer $i \in \{1,\ldots,N\}$ is represented by the random variable $\Lambda_i \in [0,1]$. Each supplier receives a share of $\frac{1-\Lambda_i}{N}$. Each Λ_i is governed by a distribution characterized by an unknown parameter $\theta \in \mathbb{R}^n$, with all agents sharing homogeneous beliefs about the distribution of

θ. Given θ, the random variables $(\Lambda_i)_{i\in N}$ are independent and identically distributed. We denote Λ as a random variable with the same conditional distribution as each Λ_i. We assume that legal uncertainty is strictly positive, $\text{Var}[\Lambda] > 0$.[6]

The payoff for producer i is given by $(R-(1-\Lambda_i)D-P)I$. The payoff for each supplier is given by

$$\left(P-C+\sum_{i=1}^{N}\frac{1-\Lambda_i}{N}D\right)I.$$

Suppliers select their input supply, while producers determine their input demand to maximize mean-variance utility with a risk aversion coefficient $\gamma > 0$. We assume producers and suppliers are price takers and normalize their reservation utility to zero.

While our empirical analysis examines legal uncertainty in the context of bankruptcy law and credit markets, the theoretical insights apply more broadly, and we therefore do not specify the market in which producers and suppliers interact. The model maps directly to our empirical setting: producers are firms seeking financing, and suppliers are banks providing loans. When a firm defaults, it enters bankruptcy proceedings, which lead to a legal dispute over the distribution of the firm's assets between the debtor and its creditors. Legal uncertainty arises because creditors face ex-ante uncertainty about their recovery in bankruptcy. The parameter θ captures characteristics of the legal environment, such as the relative orientation of courts toward debtors or creditors.

2.2 Demand, Supply, and Production

Producer i's expected payoff is $(R-(1-\mathbb{E}[\Lambda])D-P)I$ and their payoff variance is $(DI)^2\,\text{Var}[\Lambda]$. The variance of the producers' share, $\text{Var}[\Lambda]$, measures legal uncertainty in our model. When producer i purchases I units of the input at price P, their utility is:

$$(R-(1-\mathbb{E}[\Lambda])D-P)I-\frac{\gamma}{2}(DI)^2\,\text{Var}[\Lambda].$$

[6] Since $\text{Var}[\Lambda]=\mathbb{E}[\text{Var}[\Lambda|\theta]]+\text{Var}[\mathbb{E}[\Lambda|\theta]]$ and both components are nonnegative, this ensures that producers' and suppliers' optimization problems below are well defined.

Taking the first-order condition with respect to production scale I yields each producer's input demand:

$$I = \frac{R - (1 - \mathbb{E}[\Lambda])D - P}{\gamma D^2 \operatorname{Var}[\Lambda]}.$$

For suppliers, the expected payoff is $(P - C + (1 - \mathbb{E}[\Lambda])D)I$. The variance of a supplier's payoff is derived in the following lemma.[7]

Lemma 1. *The variance of a supplier's payoff is given by*

$$(DI)^2 \left(\frac{\mathbb{E}[\operatorname{Var}[\Lambda|\theta]]}{N} + \operatorname{Var}[\mathbb{E}[\Lambda|\theta]] \right).$$

Using the law of total variance, legal uncertainty $\operatorname{Var}[\Lambda]$ can be written as

$$\operatorname{Var}[\Lambda] = \mathbb{E}[\operatorname{Var}[\Lambda|\theta]] + \operatorname{Var}[\mathbb{E}[\Lambda|\theta]].$$

Lemma 1 demonstrates that suppliers can diversify idiosyncratic legal uncertainty, $\mathbb{E}[\operatorname{Var}[\Lambda|\theta]]$, but systematic legal uncertainty, $\operatorname{Var}[\mathbb{E}[\Lambda|\theta]]$, is non-diversifiable. Specifically, suppliers' exposure to idiosyncratic legal uncertainty decreases as the number of supplier-producer relationships N increases. Intuitively, legal disputes generate uncorrelated outcomes across producers, enabling suppliers with multiple relationships to mitigate this type of uncertainty. Conversely, systematic legal uncertainty cannot be mitigated because θ systematically influences the outcomes of legal disputes across all relationships. Systematic legal uncertainty emerges in our model due to the unknown nature of θ. If θ were known, we would have $\operatorname{Var}[\mathbb{E}[\Lambda|\theta]] = 0$, eliminating any systematic legal uncertainty.

The supplier's utility is:

$$(P - C + (1 - \mathbb{E}[\Lambda])D)I - \frac{\gamma}{2}(DI)^2 \left(\frac{\mathbb{E}[\operatorname{Var}[\Lambda|\theta]]}{N} + \operatorname{Var}[\mathbb{E}[\Lambda|\theta]] \right).$$

Taking the first-order condition with respect to I yields each supplier's input supply:

$$I = \frac{P - C + (1 - \mathbb{E}[\Lambda])D}{\gamma D^2 \left(\frac{\mathbb{E}[\operatorname{Var}[\Lambda|\theta]]}{N} + \operatorname{Var}[\mathbb{E}[\Lambda|\theta]] \right)}.$$

[7] Proofs not found in the text can be found in Appendix A.

Equating demand and supply yields the following equilibrium result:

Proposition 1. *In equilibrium, the input price is*

$$P = \frac{\beta R + C}{1+\beta} - (1 - \mathbb{E}[\Lambda])\, D,$$

where

$$\beta = \frac{\frac{\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]}{N} + \mathrm{Var}[\mathbb{E}[\Lambda|\theta]]}{\mathbb{E}[\mathrm{Var}[\Lambda|\theta]] + \mathrm{Var}[\mathbb{E}[\Lambda|\theta]]} \in (0,1],$$

and the equilibrium level of production is

$$I = \frac{R - C}{2\gamma D^2 \left(\mathbb{E}[\mathrm{Var}[\Lambda|\theta]] \frac{1}{2}\left(1 + \frac{1}{N}\right) + \mathrm{Var}[\mathbb{E}[\Lambda|\theta]]\right)}.$$

The equilibrium level of production decreases with risk aversion (γ), the size of legal disputes (D), and both idiosyncratic ($\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]$) and systematic ($\mathrm{Var}[\mathbb{E}[\Lambda|\theta]]$) legal uncertainty. As the number of producers and suppliers (N) increases, idiosyncratic legal uncertainty has a diminishing effect on diversified suppliers. However, systematic legal uncertainty impacts both suppliers and producers regardless of diversification. In particular, Proposition 1 illustrates how diversification can mitigate overall exposure to legal uncertainty and increase the equilibrium level of production.[8]

As demonstrated in Proposition 1, the input price rises with the producers' expected share in a legal dispute, $\mathbb{E}[\Lambda]$, due to opposing demand and supply effects. The impact of legal uncertainty on prices depends on whether it is idiosyncratic or systematic.

Corollary 1. *If $N = 1$, we have $\frac{\partial P}{\partial \mathbb{E}[\mathrm{Var}[\Lambda|\theta]]} = \frac{\partial P}{\partial \mathrm{Var}[\mathbb{E}[\Lambda|\theta]]} = 0$. If $N > 1$, we have $\frac{\partial P}{\partial \mathbb{E}[\mathrm{Var}[\Lambda|\theta]]} \leq 0$, with strict inequality if and only if $\mathrm{Var}[\mathbb{E}[\Lambda|\theta]] > 0$, and $\frac{\partial P}{\partial \mathrm{Var}[\mathbb{E}[\Lambda|\theta]]} \geq 0$, with strict inequality if and only if $\mathbb{E}[\mathrm{Var}[\Lambda|\theta]] > 0$.*

Corollary 1 demonstrates that without diversification ($N = 1$), the price remains unaffected by legal uncertainty since it symmetrically reduces demand and supply. In contrast, with diversification ($N > 1$) and both sources of legal uncertainty present, idiosyncratic legal uncertainty ($\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]$) leads to a decrease in the price, while systematic legal uncertainty ($\mathrm{Var}[\mathbb{E}[\Lambda|\theta]]$)

[8] Producer-specific legal uncertainty, as modeled here, allows suppliers to diversify across producer relationships. Conversely, supplier-specific uncertainty would enable producers to diversify across supplier relationships.

results in an increase. The price drops with idiosyncratic legal uncertainty because this form of uncertainty affects undiversified producers more severely than diversified suppliers, leading to a larger decline in demand compared to supply. Although suppliers and producers face similar exposure to systematic legal uncertainty, an increase in it reduces supply more than demand, as suppliers are generally less exposed to legal uncertainty. As a result, suppliers respond more significantly to the same unit change in legal uncertainty.[9]

Our model features diversified suppliers and undiversified producers. However, the key driver of demand, supply, and price responses is the relative exposure to idiosyncratic and systematic legal uncertainty. The model's predictions would hold in settings where both parties are diversified but to different degrees—for example, if suppliers can diversify across more relationships than producers, creating a relative difference in exposure to idiosyncratic legal uncertainty while maintaining equal exposure to systematic legal uncertainty.

2.3 Extensions

This section presents several model extensions that allow us to derive empirically measurable forms of idiosyncratic legal uncertainty, $\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]$, and systematic legal uncertainty, $\mathrm{Var}[\mathbb{E}[\Lambda|\theta]]$.

2.3.1 Random Judge Assignment

Many legal systems feature the random assignment of legal disputes to judges. We incorporate this by assuming disputes are randomly assigned to $J > 1$ judges. Let $\lambda_j \in [0,1]$ denote a producer's share when assigned to judge $j \in J := \{1,\ldots,J\}$, where the distribution of λ_j is characterized by a single parameter $\theta_j \in \mathbb{R}$. The random assignment is described by the random variable $\xi \in J$, with uniform assignment probability $\mathbb{P}(\xi = j) = \frac{1}{J}$ for each judge.

Producer i's share Λ_i is an independent draw from the random variable $\sum_{j\in J} \mathbb{1}_{\{\xi=j\}}\lambda_j$. The

[9]Note that this is a feature of any standard framework with risk-averse agents in which the demand for a risky asset is inversely related to its volatility (e.g., Grossman and Stiglitz, 1980). More generally, in a setting in which a firm's revenue is linear in scale, RI, and the cost of scale is convex, $\frac{\delta}{2}I^2$, the optimal scale of production is given by $I = \frac{R}{\delta}$. We have $\frac{\partial I}{\partial \delta} = -\frac{R}{\delta^2}$, implying that the reduction in the scale of production in response to a higher marginal cost is decreasing in the level of the marginal cost. In our context, exposure to legal uncertainty corresponds to the marginal cost of production scale, as a larger scale amplifies the volatility of shares by scaling up the disputed amount DI. Since suppliers are diversified and therefore less exposed to legal uncertainty, this implies a lower marginal cost of scale; a unit increase in legal uncertainty generates a larger response in input supply than demand.

parameter vector $\theta = (\theta_j)_{j\in J} \in \mathbb{R}^J$ governing its distribution is unknown, with all agents sharing identical beliefs about its distribution. We assume the components θ_j are independent across judges. Moreover, the random variables ξ and $(\lambda_j)_{j\in J}$ are independent conditional on θ, and ξ and θ are also independent. We denote by Λ a random variable with the same conditional distribution as each Λ_i.

Lemma 2. *In the presence of random judge assignment, we have*

$$\mathrm{Var}\left[\mathbb{E}\left[\Lambda|\theta\right]\right] = \frac{1}{J^2}\sum_{j\in J}\mathrm{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right].$$

Lemma 2 identifies systematic legal uncertainty under random judge assignment and shows that it is a weighted sum of uncertainty about each judge's type, $\mathrm{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right]$. We refer to this form of legal uncertainty as *type uncertainty* since it captures uncertainty about individual judges' "average" decision-making because their type θ_j is unknown. For example, agents may have limited information about judges' types, generating uncertainty that affects all legal disputes.

Lemma 3. *In the presence of random judge assignment, we have*

$$\mathbb{E}\left[\mathrm{Var}\left[\Lambda|\theta\right]\right] = \underbrace{\frac{1}{J}\sum_{j\in J}\left(\mathbb{E}\left[\lambda_j\right] - \frac{1}{J}\sum_{k\in J}\mathbb{E}\left[\lambda_k\right]\right)^2}_{\textit{Assignment uncertainty}} + \frac{1}{J}\sum_{j\in J}\mathrm{Var}\left[\lambda_j\right] - \frac{1}{J^2}\sum_{j\in J}\mathrm{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right]. \quad (1)$$

Lemma 3 identifies a second source of legal uncertainty: *assignment uncertainty*.[10] This arises because random case assignment creates uncertainty when judges differ in their expected types, measured by their expected producer's share $\mathbb{E}\left[\lambda_j\right]$. For example, even if agents are well informed about judges' types, the random assignment to judges with different types generates uncertainty. Assignment uncertainty represents idiosyncratic legal uncertainty that can be diversified across multiple legal cases since assignments to judges are independent.

[10]The second component of idiosyncratic legal uncertainty in equation (1) cannot be measured in a straightforward way in our empirical setting. Intuitively, it captures the fact that even after being allocated to a particular judge with expected type $\mathbb{E}\left[\lambda_j\right]$, the actual decision of the judge may still be uncertain.

2.3.2 Legal Regime Shift

The legal and institutional environment governing contractual relationships may change over time, affecting how disputes are resolved. Such changes could include shifts in legal doctrine, amendments to laws and regulations, or changes in judicial personnel.

To analyze such legal regime shifts, we assume that a producer's share under a "future" legal regime is determined by the parameter $\theta_f \in \mathbb{R}^n$, whereas under the "current" regime, it is determined by $\theta_c \in \mathbb{R}^n$. Both parameters are unknown to market participants and independent, and all agents share common beliefs about their probability distributions. In addition to the assumptions from the baseline model, we assume the random variables $\Lambda_i(\theta_c)$ and $\Lambda_i(\theta_f)$ are independent conditional on (θ_c, θ_f) and that their conditional distributions depend only on θ_c and θ_f, respectively. We denote by $\Lambda(\theta_c)$ and $\Lambda(\theta_f)$ the random variables with the same conditional distribution as each $\Lambda_i(\theta_c)$ and $\Lambda_i(\theta_f)$.

Whether a legal dispute is resolved under the current or the future legal regime is determined by the random variable $\nu \in \{0,1\}$, where $\nu = 1$ indicates resolution under the future regime and $\mathbb{P}(\nu = 1) = \eta \in [0,1]$. The regime realization is common to all disputes, and ν is independent of (θ_c, θ_f) and the random variables $(\Lambda_i(\theta_c), \Lambda_i(\theta_f))_i$ jointly. The producers' share is then given by $\Lambda_i = \nu\Lambda_i(\theta_f) + (1-\nu)\Lambda_i(\theta_c)$, and we redefine $\theta := (\theta_c, \theta_f, \nu)$ as the systematic state on which agents condition. The probability η captures the likelihood that a legal dispute will be resolved under the new regime. Consequently, a larger value of η captures a greater proximity to a change in the legal regime, such as the replacement of judges in a court.

Lemma 4. *In the presence of a legal regime shift, we have*

$$\operatorname{Var}[\mathbb{E}[\Lambda|\theta]] = \eta \operatorname{Var}[\mathbb{E}[\Lambda(\theta_f)|\theta_f]] + (1-\eta)\operatorname{Var}[\mathbb{E}[\Lambda(\theta_c)|\theta_c]] + \eta(1-\eta)\left(\mathbb{E}[\Lambda(\theta_f)] - \mathbb{E}[\Lambda(\theta_c)]\right)^2,$$

and

$$\mathbb{E}[\operatorname{Var}[\Lambda|\theta]] = \eta\mathbb{E}[\operatorname{Var}[\Lambda(\theta_f)|\theta_f]] + (1-\eta)\mathbb{E}[\operatorname{Var}[\Lambda(\theta_c)|\theta_c]].$$

Lemma 4 shows how increasing η shifts weight from legal uncertainty under the current regime to legal uncertainty under the future regime. Summing the two components, total legal uncertainty

is given by

$$\text{Var}[\Lambda] = \eta \,\text{Var}[\Lambda(\theta_f)] + (1-\eta)\,\text{Var}[\Lambda(\theta_c)] + \eta(1-\eta)\left(\mathbb{E}[\Lambda(\theta_f)] - \mathbb{E}[\Lambda(\theta_c)]\right)^2,$$

which implies

$$\frac{\partial \,\text{Var}[\Lambda]}{\partial \eta} = \text{Var}[\Lambda(\theta_f)] - \text{Var}[\Lambda(\theta_c)] + (1-2\eta)\left(\mathbb{E}[\Lambda(\theta_f)] - \mathbb{E}[\Lambda(\theta_c)]\right)^2. \tag{2}$$

When expected legal outcomes are the same under both regimes, $\mathbb{E}[\Lambda(\theta_f)] = \mathbb{E}[\Lambda(\theta_c)]$, equation (2) shows that legal uncertainty is strictly increasing in η whenever legal uncertainty is higher under the future regime. This shift-induced legal uncertainty is referred to as *regime uncertainty*. For instance, legal uncertainty under the current regime may be lower because agents have accumulated more information about it. A higher η then raises overall legal uncertainty by placing more weight on the less-known future regime.

2.4 Empirical Implications

This section summarizes the key empirical implications of our model. Given that our empirical setting focuses on lender-borrower relationships and legal uncertainty in bankruptcy law, we discuss the implications of our model for this specific context. We describe the empirical measures of legal uncertainty we employ in Section 5.1.

Before discussing the model's predictions, it is important to emphasize its applicability to the bankruptcy context, given the stylized nature of the model. First, in the context of credit financing, corporate insiders such as owners and managers are residual claimants. As a result, one may be inclined to suppose that they could benefit from extreme outcomes that are more likely to increase the value of their equity claims. However, this effect would be offset by the resulting adjustment in the price of credit ex ante. Equity holders would have to compensate creditors for their higher expected value in bankruptcy states and would not benefit from increased legal uncertainty. Second, if there are non-priced private benefits for owners and managers (e.g., Schoenherr and Starmans, 2022), more legal uncertainty also increases uncertainty about these private benefits. As this type of uncertainty cannot be diversified, it is costly for corporate insiders.

The fundamental insight of our model is that higher legal uncertainty in bankruptcy law reduces economic activity by affecting credit markets.

Implication 1. *A higher level of legal uncertainty in bankruptcy law reduces the demand for and supply of credit, resulting in smaller credit markets.*

In addition to the quantity of credit, our framework also provides predictions regarding how interest rates respond to changes in legal uncertainty. This response depends on whether legal uncertainty is idiosyncratic or systematic. Assignment uncertainty arising from the random assignment of bankruptcy cases to judges represents idiosyncratic legal uncertainty, as it is uncorrelated across bankruptcy cases and can be diversified. In contrast, type uncertainty about bankruptcy judges affects all bankruptcy cases systematically and is non-diversifiable.

Regime uncertainty arises from judge rotations in our empirical setting, where judges are typically replaced jointly after a two-year term. In general, the effect of such regime shifts on the level of legal uncertainty depends on the relative levels of legal uncertainty under the current and future regimes. In our empirical setting, regime uncertainty increases as judge rotation approaches because agents have accumulated more information about current judges' decision-making than about incoming judges, who are unknown. This suggests that credit markets should contract as judge rotation approaches. In addition, since type uncertainty drives the difference between the current and new legal regime, regime uncertainty is systematic legal uncertainty in our empirical setting, even though, in general, it can capture aspects of both idiosyncratic and systematic legal uncertainty.

In the context of credit markets, banks can provide loans to multiple firms and face multiple bankruptcy cases, allowing them to diversify idiosyncratic legal uncertainty. However, all lending relationships of a given firm are systematically affected in bankruptcy, which means that firms are equally exposed to both idiosyncratic and systematic legal uncertainty. Consequently, credit demand is more sensitive to idiosyncratic legal uncertainty than credit supply.

Implication 2. *Interest rates decrease in idiosyncratic legal uncertainty, but increase in systematic legal uncertainty.*

The interest rate decreases with idiosyncratic legal uncertainty because an increase in idiosyncratic legal uncertainty reduces credit demand more than supply. On the other hand, an increase in

systematic legal uncertainty reduces supply more than demand because a bank is less affected by legal uncertainty overall due to diversification. As a result, a bank reacts more strongly to the same unit change in systematic legal uncertainty because the implied percentage change is greater for a bank than for a firm.

3 Institutional Background

This section provides an overview of the Korean bankruptcy code, the bankruptcy court system, and the role of judges in in-court restructuring proceedings.

3.1 Bankruptcy Courts in Korea

During our sample period, 14 District Courts were responsible for handling bankruptcy cases in Korea. Among these, nine courts had a separate division for bankruptcy cases (Busan, Changwon, Daegu, Daejeon, Gwangju, Incheon, Seoul, Suwon, and Uijeongbu), while four courts dealt with bankruptcy cases through their civil law division (Cheongju, Chuncheon, Jeonju, and Ulsan). One court initially handled bankruptcy cases through its criminal law division before establishing a separate bankruptcy division in February 2015 (Jeju). For simplicity, we refer to a court division that handles bankruptcy cases as the bankruptcy division or the bankruptcy court.

Of the 14 District Courts, nine exclusively handle cases in their local court district. The remaining five District Courts, located in cities with a High Court, have jurisdiction over cases from a broader region. As illustrated in Figure 1, the District Courts in Seoul, Daejeon, Daegu, Gwangju, and Busan have a wider jurisdiction that covers multiple court districts, whereas the District Courts in Changwon, Cheongju, Chuncheon, Incheon, Jeju, Jeonju, Suwon, Uijeongbu, and Ulsan only handle local cases.

Determination of Jurisdiction: The jurisdiction of a bankruptcy court for a given firm in Korea is determined by geography. According to Article 3 (Jurisdiction) of the Debtor Rehabilitation and Bankruptcy Act, every bankruptcy case is placed under the jurisdiction of the principal District Court that has jurisdiction over the location of the debtor's principal office or place of business. Moreover, firms can file an application for a bankruptcy case with a District Court in the city with a High Court that has jurisdiction over the location of the debtor's principal office or place of busi-

ness. This means that a firm can file for bankruptcy either with its local District Court or with the District Court in the city with the High Court covering their geographic location. For firms located in cities with a High Court, this implies that their only option is to file with the local District Court. Firms located elsewhere have two options: they may file with its local District Court or with the District Court in the city with the High Court covering their region. This procedure effectively divides Korea into five court zones for the purpose of bankruptcy jurisdiction (see Figure 1). Table 1 displays the filing options for firms located in different areas in Korea.

A firm's principal office/place of business is unambiguous. It is permanently recorded for every firm in Korea in the Supreme Court of Korea's Corporation Registration System. Jurisdiction is strictly enforced, and we do not observe any change of address of firms in the twelve months prior to a restructuring filing in our data.

Bankruptcy Judges: Unlike other countries, such as the United States, Korea did not have a system of specialized bankruptcy judges during our sample period. Instead, judges are considered generalists who rotate through different courts and court divisions throughout their careers. In particular, appointment to a bankruptcy division of a court does not require prior exposure to bankruptcy law. In fact, almost all judges start their term in a bankruptcy division with no prior experience in handling bankruptcy-related cases.

The rotation of judges through courts is a complex process that must satisfy a wide range of constraints. For example, judges rotate to specific geographic zones based on a combination of their tenure and the area in which they started their careers.[11] They remain in a geographic zone for a fixed number of years, also based on their tenure, after which they move to a different specialization and need to fill a court position according to their rank, also mainly determined by their tenure. Due to this complexity and the numerous constraints, software is used to allocate judges to different courts and divisions. Importantly, this procedure does not accommodate or involve any considerations relating to economic or financial market conditions and how these may interact with individual judge characteristics. In fact, intentionally assigning judges with specific economic or political preferences to particular courts or divisions would violate the political neutrality of the judiciary. Thus, the allocation of individual judges to bankruptcy courts across the country is orthogonal to economic and financial market conditions.

[11] For rotation purposes, Korea is divided into three main zones: Seoul, around Seoul, and elsewhere.

In most bankruptcy divisions, judges are appointed for a two-year term, after which they are all replaced by new judges. Since the rotation occurs in the same month across all courts and the typical term is two years, on average, about half of all bankruptcy judges are replaced in a given year.

Bankruptcy cases in a given bankruptcy court are randomly assigned to individual judges, with one exception that applies to only a small fraction of cases: If a debtor is related to a previous case, such as a subsidiary of a firm already in the bankruptcy process, or if the owner of the firm is involved in a personal bankruptcy case, the case is assigned to the judge who is already handling the related case.

3.2 Bankruptcy Law in Korea

The Debtor Rehabilitation and Bankruptcy Act, which took effect on April 1, 2006, is the relevant bankruptcy code for our sample period. The corporate restructuring procedure, known as "rehabilitation," resembles the Chapter 11 process in the U.S.[12] The reason for this similarity is that Korean bankruptcy law was revised under the supervision of the IMF and World Bank following the Asian Financial Crisis, with the objective of adhering to international best practices, which, in essence, meant closely following U.S. bankruptcy law. Consequently, Korean bankruptcy law, as of April 2006, features a bargaining process similar to Chapter 11, in which a court-appointed custodian takes control of the firm and proposes a restructuring plan. Typically, the court appoints the incumbent manager as the custodian, except in cases where financial distress can be attributed to fraudulent activity by incumbent management, creditors provide reasonable grounds for appointing a third-party custodian, or the court deems the appointment of a third-party custodian essential. In practice, incumbent management remains in control in most restructuring cases and negotiates a restructuring plan with the firm's creditors under court supervision (Ko, 2007).

In-court Restructuring Proceedings: The bankruptcy system is actively used across firms of all sizes in Korea, with its usage generally proportional to the representation of these firms in the economy (Kim, 2019). Medium-sized firms (with assets between 2 and 5 billion KRW, or approximately between 1.4 and 3.5 million USD at contemporaneous exchange rates) are slightly overrepresented in restructuring filings. This broad utilization reflects the importance of bankruptcy

[12] In contrast to Chapter 11, prepackaged bankruptcy was not part of the Korean bankruptcy system before 2015.

proceedings for financial planning across the Korean corporate landscape.

Figure 2 summarizes the steps involved in the in-court restructuring proceedings.[13] The process begins with a debtor filing for restructuring, and the filing is randomly assigned to a judge for review.[14] The first step in the review process is to determine whether the bankruptcy court where the case was filed has jurisdiction over the firm. If the judge determines that the case was filed under the wrong jurisdiction, the filing is dismissed. Next, the judge assesses whether the firm has a realistic chance of surviving as a going concern and whether its continuation value exceeds its liquidation value. This assessment must be made within ten days of the filing date, during which the judge mainly validates the plausibility of the estimates provided by the firm. During the review process, the judge may block the execution of collateral, the sale of assets, the issuance of debt, and the hiring of new employees. If the judge decides that the firm's continuation value exceeds its liquidation value, the case is accepted, and the restructuring proceedings commence. On the other hand, if the judge decides that the firm is not viable and that the liquidation value of the firm exceeds the continuation value, the case is dismissed, and the judge may order the liquidation of the firm. It is worth noting that even after the acceptance of a case, the judge has the authority to terminate the case and order the liquidation of the firm at any stage of the process.

Once a case is accepted, the judge sets a date for the first assembly of interested parties and establishes the period during which stakeholders can report their claims to the court. Additionally, the judge appoints a custodian who assumes control of the firm's operations during the restructuring process and is responsible for proposing the firm's first restructuring plan.

After the initial period for filing claims with the court ends, the custodian reviews the validity of the claims. External accountants are then consulted to value the claims and to update the liquidation and continuation value of the firm. At this stage, if the external accountants determine that the liquidation value of the firm exceeds its continuation value, the judge may terminate the case and order the liquidation of the firm. Otherwise, the first assembly of interested parties is held to share the custodian's report with all parties and to outline the timeline of the restructuring procedure.[15]

After the first assembly of interested parties, the court sets a deadline for the submission of the

[13] There are hardly any appeals in restructuring cases since appeal courts are hesitant to intervene, as it is difficult to reverse decisions that have been implemented.

[14] While creditors have the legal right to file for restructuring, this is not observed in practice since creditors prefer to enforce their claims outside of the bankruptcy system, where debtors are less protected against creditors' actions.

[15] As of 2015, the assembly has been abolished, and all relevant information is shared with all parties by mail.

restructuring plan.[16] The judge may extend the deadline if necessary. Once the custodian submits the restructuring plan, it is reviewed during the second assembly of interested parties, and a vote is taken. Although the judge may consider the vote, it is not binding, and it is ultimately up to the judge's discretion whether to approve or reject the plan. If the plan is rejected, the judge may order the liquidation of the firm. Alternatively, the judge may instruct the custodian to revise the plan, in which case another assembly of interested parties is held to repeat the same process until a decision is made to either accept and execute the plan or reject it.

Once a restructuring plan has been approved, it is implemented under court supervision. During this process, the judge assesses the firm's ability to implement all aspects of the restructuring plan and whether the firm is in good standing. At any point, the judge may determine that the firm failed to fully implement the plan, which would require the mandatory liquidation of the firm. It is also within the judge's discretion to determine when the firm has successfully implemented its commitments under the approved plan and is, therefore, allowed to graduate from the restructuring process. This is a crucial step for the firm, as it removes the threat of mandatory liquidation if the judge determines that the firm failed to fully implement the approved plan.

As the term of judges in a given court approaches its end, their influence on the restructuring process diminishes. When judges leave the court, they cease to be directly involved in ongoing cases. These cases are transferred to the incoming judges who replace them and who then take responsibility for handling the remaining proceedings. However, the initial decisions made during restructuring proceedings carry substantial weight, as they often establish the trajectory for the entire case. The decision of whether to accept or dismiss a restructuring filing, for example, represents one of the most consequential decisions in the proceedings. Consequently, even if current judges are expected to make only a few early decisions before their term concludes, their degree of debtor-friendliness can significantly impact the ultimate outcomes of these cases.

4 Data

In this section, we describe the data used for our empirical analysis. To ensure consistency of the law and court system, we focus on the period from April 2006 to December 2015. This is

[16] Since 2015, this deadline has been determined when the case is first accepted.

because in April 2006, Korea implemented a new bankruptcy system that changed the legal and institutional framework governing bankruptcy proceedings, and after 2015, the Korean bankruptcy court system underwent several institutional changes.

Court Data: We obtain bankruptcy filing data from the Court of Korea registry, which provides information on the year and type of the filing, the court where the case was filed, the case number, and the name of the filing firm.[17] To analyze the in-court process for each case, we use comprehensive data from the Court of Korea, which includes the filing date and court, case type, case number, name of the firm, court division and rank of the assigned judge, the date when the case ended, and detailed information on every step of the process, including the exact date for each step.[18] This allows us to observe all decisions made by each judge, including the time when decisions are made.

Table 2, Panel A, presents descriptive statistics for our legal data. We use data from 4,688 restructuring cases during our sample period. The average case length is 19 months, with a median of 10 months. Over the course of our sample period, judges made 11,777 decisions that we can classify as debtor- or creditor-friendly (see Section 5.1). Our data include 327 judges who serve in a bankruptcy court for an average of 24 months.

Loan Data: We combine data on loans from two different sources. First, we obtain monthly loan-level data from the Korea Information Service (KIS), which provides information on the borrower, lender, and loan amount. These data cover all firms in Korea and are available from December 2009. Each borrower and lender has a unique ID number, giving the data a panel structure. The data include information on the city where a firm's legal principal office is located, as well as basic accounting information. Second, we use annual loan data from Moon and Schoenherr (2022), who extract loan and interest rate information at annual frequency from firms' annual reports. The data include a firm's business ID number, an official ID number assigned to all firms in Korea.

Table 2, Panel B, provides descriptive statistics for the loan data. The average loan size is 189 million KRW, and the average monthly firm-level loan volume is 1,326 million KRW.[19] The average interest rate during our sample period is 4.19 percent.

[17] The data are available at `http://www.iros.go.kr/PMainJ.jsp`.

[18] The data are available at `https://www.scourt.go.kr/portal/information/events/search/search.jsp`.

[19] As a rule of thumb, 1 U.S. dollar is about 1,000 KRW during our sample period.

Accounting Data: We further obtain detailed accounting data from KIS. The data provide information on all balance sheet and income statement items, as well as two firm identifiers: an ID number used internally by KIS to identify firms and the official business ID number assigned to every firm in Korea.

Table 2, Panel C, presents descriptive statistics for the accounting data, which are available for 340,446 firms. The average firm has 30 employees, with a median of 9 employees. The average firm has total assets of 9,569 million KRW, sales of 9,643 million KRW, a return on assets of 4.88 percent, and a leverage ratio of 47.76 percent.

Local GDP Data: We obtain data on real local GDP from Statistics Korea. To compute GDP growth per capita for each court zone, we match province-level and county-level GDP data with the 14 District Court zones.[20] We compute real GDP per capita for each court zone by dividing real GDP by the population of the respective court zone, which is also available from Statistics Korea.

Data Merging: We match the restructuring filings and the data on case details using information on the court where the case was filed and a unique case number. This allows us to assign a precise filing date to each restructuring case. Additionally, information on the court and the judges' ranks enables us to link judges to specific bankruptcy cases.

The monthly loan data provide information on the location of firms' legal principal office, enabling us to assign firms to District Courts based on the court that has jurisdiction over their location. Since the monthly loan data are anonymized, we match them to the more comprehensive financial data using balance sheet and income statement items that are available in both databases. Specifically, we use time (year), total assets, and total cash and cash equivalents for matching. Since these variables jointly identify firms uniquely, we can match the data for all firms for which accounting data are available.[21] Annual loan and interest rate data can be matched to the merged data using a unique business ID number that is assigned to all Korean firms and is available in both the annual accounting data and in the annual loan and interest rate data.

[20] Due to a lack of disaggregated county-level GDP data for Gyeonggi-do from 2005 to 2009, we apply the county weights from 2010 to decompose local GDP into the three District Court zones of Incheon, Suwon, and Uijeongbu for this period.

[21] We lose about 20 percent of firms from the loan data for which the relevant accounting data are not available, which applies to very small firms. As a result, our analysis represents the majority of firms in the economy but not the very smallest ones.

5 Empirical Strategy and Results

This section provides an overview of our empirical methodology, including the measurement of courts' debtor-friendliness and legal uncertainty, the outline of our empirical strategy, and the presentation of the results.

5.1 Measurement

We start by describing how we classify judges' decisions as debtor- or creditor-friendly. Subsequently, we show how we utilize these data to generate monthly court-level measures of debtor-friendliness and legal uncertainty.

Judge Decisions: We classify the decisions made by judges during critical stages of the restructuring process as debtor- or creditor-friendly. During our sample period, we identify 11,777 decisions that can be categorized as debtor-friendly or creditor-friendly. Table 3 shows a list of these decisions.

The first decision in a restructuring case is whether the judge accepts or dismisses the case and potentially orders the firm to be liquidated. Restructuring offers firms the opportunity to overcome financial distress, reducing the risk of complete loss for shareholders. Conversely, at the time of filing, most creditors typically favor liquidation as a preferred outcome (e.g., Bergström et al., 2002; Ayotte and Morrison, 2009; Vig, 2013).[22] Therefore, we classify acceptance of a case as debtor-friendly, whereas dismissal is creditor-friendly.

During restructuring proceedings, the judge may side with the firm by preventing creditors from seizing its assets, approving an extension of the period for the firm's management to propose a restructuring plan, or approving the proposed restructuring plan or its modifications. We classify these decisions as debtor-friendly. Conversely, if the judge's rulings favor creditors by permitting the seizure of assets, denying an extension for the debtor's management to propose a restructuring plan, or rejecting the proposed restructuring plan or its modifications, we classify these decisions

[22] Conflicts of interest may arise between secured and unsecured creditors concerning the liquidation of the firm. However, it is important to note that expectations regarding the court's debtor-friendliness can significantly influence the supply of secured credit, which is a crucial source of funding for most firms. In addition, while their preferences regarding judges' decisions in bankruptcy may differ, all parties dislike uncertainty regarding these decisions, independent of their specific preference ordering. As such, our measures of legal uncertainty are robust to conflicts of interest between creditors.

as creditor-friendly.

The judge also plays a pivotal role in determining when a firm is permitted to graduate from restructuring proceedings. This decision carries substantial weight as failing to implement the restructuring plan during the proceedings leads to mandatory liquidation. In contrast, when a firm is allowed to graduate from the proceedings, the threat of automatic liquidation is removed. Therefore, we classify this decision as debtor-friendly. In contrast, if the judge determines that a firm has failed to graduate from restructuring proceedings, the firm is liquidated. As discussed previously, this decision is considered creditor-friendly due to the preference of secured creditors for liquidation.

We deliberately abstain from assigning weights to different decisions based on their potential importance, as our objective is to assess what agents in the economy learn about a judge's type in terms of their debtor-friendliness rather than how a decision affects a particular case. Intuitively, even if a specific decision is less crucial to the outcome of a case, it still allows agents to learn about the judge's type (e.g., Chang and Schoar, 2013).

Judge Types and Learning: To compute monthly court-level measures of debtor-friendliness and legal uncertainty, we exploit two aspects of Korea's legal and institutional environment. First, as discussed in Section 3, Korean judges rotate across various courts and court divisions throughout their careers. In particular, judges are assigned to bankruptcy courts without prior experience in handling bankruptcy cases and are replaced by new judges at the end of their two-year term. This implies that judges' types in terms of their debtor-friendliness are initially unknown. Therefore, debtors and creditors must rely on their prior beliefs during this stage. As time progresses, debtors and creditors gradually learn about judges' types from observing their decisions. Second, within a given court, bankruptcy cases are randomly assigned to judges. This random assignment generates assignment uncertainty, as discussed in Section 2.

To provide a theoretical foundation for our monthly court-level measures of debtor-friendliness and legal uncertainty, we extend our model of legal uncertainty with random judge assignment from Section 2.3.1 to incorporate agents' learning from judges' decisions. In this context, we refer to the supplier as the creditor and the producer as the debtor. Our objective is to develop a simple model that yields intuitive and robust formulas to capture the learning of agents in the economy.

To account for the binary nature of decisions in restructuring cases in our data, we assume that

the debtor's share, when assigned to judge $j \in J$, denoted by λ_j, follows a Bernoulli distribution. Thus, a judge's decision can favor the creditor or the debtor. The probability of a debtor-friendly decision is denoted by q_j. Importantly, the probabilities q_j are initially unknown to both debtors and creditors for all judges $j \in J$, and they hold homogeneous beliefs regarding their probability distributions. In particular, this implies that $\mathbb{E}\left[\lambda_j\right] = \mathbb{E}\left[\mathbb{E}\left[\lambda_j \middle| q_j\right]\right] = \mathbb{E}\left[q_j\right]$.[23]

To allow for closed-form solutions of the Bayesian updating formulas, we assume that agents' beliefs regarding q_j follow a beta distribution with parameters α and β. The agents' prior is characterized by a beta distribution with parameters α_0 and β_0. As agents observe a judge's decisions over time, they update their beliefs using Bayes' rule.

Let N_j denote the number of decisions agents observe for judge j up to a given month. Among these decisions, F_j represents the number of debtor-friendly decisions. We define $\bar{F}_j = \frac{F_j}{N_j}$. Consequently, the posterior distribution of q_j for judge j is given by a beta distribution with parameters $\alpha_j = \alpha_0 + F_j$ and $\beta_j = \beta_0 + N_j - F_j$. In particular, we can compute the judge's type after observing the N_j decisions as

$$\mathbb{E}\left[q_j\right] = \frac{\alpha_j}{\alpha_j + \beta_j} = \frac{\alpha_0 + F_j}{\alpha_0 + \beta_0 + N_j} = \frac{\alpha_0 + \beta_0}{\alpha_0 + \beta_0 + N_j} \frac{\alpha_0}{\alpha_0 + \beta_0} + \frac{N_j}{\alpha_0 + \beta_0 + N_j} \bar{F}_j. \tag{3}$$

By using data on judges' decisions, we can compute each judge's type $\mathbb{E}\left[q_j\right]$ in every month.[24] To compute these measures, we calibrate the parameters of the prior distribution, α_0 and β_0, to match the distribution of judge types in our sample based on the simple average of all decisions made by all judges in our sample. This average judge type is 0.643, with a variance of 0.026. By calibrating the parameters α_0 and β_0 using the formulas for the mean and variance of the beta distribution, we determine that $\alpha_0 + \beta_0 = 7.834$, which we employ in our main analysis. Figure 3 depicts the histogram and calibrated beta distribution for our sample. We investigate the robustness of our results concerning the choice of α_0 and β_0 in Section 6.1.

The parameters α_0 and β_0 of the prior distribution have a straightforward interpretation. The selection of these values can be understood as endowing agents with prior beliefs with mean $\frac{\alpha_0}{\alpha_0+\beta_0}$

[23] Note that we have $\theta_j = q_j$ such that $\mathbb{E}[\lambda_j] = \mathbb{E}\left[\mathbb{E}[\lambda_j|\theta_j]\right] = \mathbb{E}\left[\mathbb{E}[\lambda_j|q_j]\right] = \mathbb{E}[q_j]$.

[24] The Bayesian updating formula in equation (3) is conceptually identical to the case of a legal dispute involving a normally distributed transfer and an unknown mean. Consequently, our measures of judge types do not strictly depend on the assumption of a beta distribution.

based on $\alpha_0 + \beta_0$ observations. To illustrate this, consider the scenario where agents hold prior beliefs given by $\alpha_0 = \beta_0 = 5$, and they observe five decisions of a judge, one of them being debtor-friendly. Applying equation (3), this yields a posterior expectation of $\mathbb{E}\left[q_j\right] = \frac{5+1}{10+5} = \frac{10}{10+5}0.5 + \frac{5}{10+5}0.2 = 0.4$. If, instead, the prior belief is given by $\alpha_0 = \beta_0 = 10$, indicating an increased weight on the prior from ten to 20, then we obtain $\mathbb{E}\left[q_j\right] = \frac{10+1}{20+5} = \frac{20}{20+5}0.5 + \frac{5}{20+5}0.2 = 0.44$. Intuitively, assigning a higher weight to the prior reduces the rate at which agents in the economy update their beliefs based on information derived from observed judge decisions.

To assess whether our judge type measure captures persistent characteristics of judges, we examine whether we can predict judges' types based only on their decisions in the second half of their terms, using their types based only on decisions in the first half of their terms, by estimating

$$\mu_{j,t>T/2} = \alpha + \nu \cdot \mu_{j,t\leq T/2} + \varepsilon_j. \tag{4}$$

Here, $\mu_{j,t>T/2}$ and $\mu_{j,t\leq T/2}$ represent the fully informed judge type of judge j based on their decisions in the second and first halves of their term, respectively, each computed using a simple average.

Table 4 presents the results. We find that a 10 percentage-point increase in judges' debtor-friendliness during the first half of a judge's term corresponds to a 6.71 percentage-point increase in their debtor-friendliness during the second half of the term (column I). The estimates remain consistent even after accounting for court fixed effects (column II) and court-cycle fixed effects (column III).

To eliminate the possibility that judge types could be affected by systematic differences in the type of cases allocated to different judges within a court, we additionally control for observable and unobservable case characteristics in column IV by removing case fixed effects when computing judge types. This exploits the fact that many cases are handled by more than one judge. We find almost identical results after controlling for case characteristics. A final concern with this analysis could be that some cases overlap with the first and second halves of a judge's term, in which case consistency in decisions within a case could explain why judges' types in the first and second halves of the term appear similar. To address this concern, in columns V and VI, we exclude all cases that overlap with both halves of a judge's term. We find that the results are qualitatively

identical and quantitatively very similar, both without (column V) and with (column VI) case fixed effects. This evidence strongly suggests that judge types capture persistent characteristics of individual judges that shape their decision-making and rules out that differences in judge types are driven by case characteristics.

In addition to judges' types, we can compute the uncertainty about a given judge's type as[25]

$$\text{Var}\left[q_j\right] = \frac{\alpha_j \beta_j}{(\alpha_j+\beta_j)^2(\alpha_j+\beta_j+1)} = \frac{(\alpha_0+F_j)(\beta_0+N_j-F_j)}{(\alpha_0+\beta_0+N_j)^2(\alpha_0+\beta_0+N_j+1)}. \tag{5}$$

Intuitively, the more judge decisions agents observe, the more certain they become about the judge's type.

Court-level Measures: We proceed by employing the monthly judge-type measures to compute court-level measures of debtor-friendliness and legal uncertainty. First, we determine the expected value of the debtor's share in a legal dispute within a given court, where the judges are denoted by $j \in J$. This measure serves as a measure of the court's debtor-friendliness, which is defined as the average judge type within the court:

$$\frac{1}{J}\sum_{j\in J}\mathbb{E}\left[q_j\right]. \tag{6}$$

To compute this measure, we use the judge type measures $\mathbb{E}\left[q_j\right]$ from equation (3).

Second, the variance of the debtor's share in a legal dispute, denoted by $\text{Var}[\Lambda]$, serves as the measure of legal uncertainty in our model. As discussed in Section 2.3.1, the first component contributing to legal uncertainty is assignment uncertainty, which is given by

$$\frac{1}{J}\sum_{j\in J}\left(\mathbb{E}\left[q_j\right] - \frac{1}{J}\sum_{k\in J}\mathbb{E}\left[q_k\right]\right)^2. \tag{7}$$

To compute this measure, we again use the judge type measures $\mathbb{E}\left[q_j\right]$ from equation (3). In our empirical analysis, we use the square root of this expression, the standard deviation of judge types, so that the measure is in the same units as the judge types themselves.

Third, as discussed in Section 2.3.1, type uncertainty is a second component of legal uncer-

[25] Note that we have $\theta_j = q_j$ such that $\text{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right] = \text{Var}\left[\mathbb{E}\left[\lambda_j\middle|q_j\right]\right] = \text{Var}\left[q_j\right]$.

tainty, which is given by

$$\frac{1}{J^2}\sum_{j\in J}\text{Var}\left[q_j\right]. \tag{8}$$

Since judges' types are independent under agents' beliefs, this measure equals the variance of judges' average type at court c. To compute it, we use the judge type uncertainty measures $\text{Var}\left[q_j\right]$ from equation (5).

Fourth, as discussed in Section 2.3.2, regime uncertainty is a third component of legal uncertainty, which arises due to the replacement of judges. As the replacement in a given court draws closer, legal uncertainty increases as agents put more weight on the future legal regime with new judges, about which they have less information. This time-varying effect of regime uncertainty at the court level is measured by the fraction of the judges' term completed up to a given month, which captures the probability η that a case is resolved under the future legal regime in our theoretical framework.[26]

We provide descriptive statistics of the measures for the data used in our empirical analysis in Table 5, including their mean, median, standard deviation, and the 25th and 75th percentiles.

5.2 Empirical Predictions

This section summarizes the empirical predictions based on our theoretical framework regarding our monthly court-level measures of legal uncertainty.

First, our model predicts that an increase in assignment uncertainty, as defined in equation (7), has a negative impact on credit demand and supply, leading to a negative effect on borrowing. We classify assignment uncertainty as idiosyncratic legal uncertainty, as lenders who provide loans to multiple firms and encounter multiple bankruptcy cases within the same court or across different courts can mitigate this type of uncertainty through diversification.

Second, an increase in type uncertainty, as defined in equation (8), has a negative impact on credit demand and supply, leading to a negative effect on borrowing. We classify type uncertainty as a form of systematic legal uncertainty, as all bankruptcy cases handled by a given court are systematically affected by this type of uncertainty.

[26] At any given point in time, there is more variation in the number of judge decisions across courts, whereas judge replacement cycles are more correlated across courts.

Third, our model predicts that an increase in the fraction of the judges' term at a court that has already passed, capturing higher regime uncertainty, negatively impacts borrowing. As discussed in Section 2.3.2, as the replacement of judges draws closer, debtors and creditors become more exposed to the new legal regime. Since agents possess more information about the legal regime under current judges than the future legal regime under new and unknown judges, this effect increases legal uncertainty. We classify regime uncertainty as a form of systematic legal uncertainty since it is driven by type uncertainty, which is systematic in nature.

Our model predicts that interest rates decrease with assignment uncertainty because an increase in idiosyncratic legal uncertainty reduces credit demand more than supply, leading to a decrease in interest rates. On the other hand, an increase in systematic legal uncertainty—type or regime uncertainty—reduces credit supply more than demand because a bank is less affected by legal uncertainty overall due to diversification. As a result, a bank reacts more strongly to the same unit change in systematic legal uncertainty because the implied percentage change in legal uncertainty is higher for the bank than for the firm.

The empirical prediction regarding the impact of courts' debtor-friendliness, as presented in equation (6), on borrowing is ambiguous. As demonstrated in Section 2, credit demand depends positively on the expectation of the debtor's share in a legal dispute, whereas credit supply depends negatively on the debtor's share. In our model, the opposing demand and supply effects offset each other. In a more general model that incorporates downward-sloping aggregate demand or additional frictions, either the demand or supply effect may dominate (e.g., Schoenherr and Starmans, 2022). Thus, which effect dominates in our setting is an empirical question.

5.3 Empirical Analysis

In our empirical analysis, we test the model's empirical predictions using the monthly court-level measures of assignment uncertainty, type uncertainty, and regime uncertainty.

Our empirical design exploits the fact that judge allocations to different bankruptcy courts are orthogonal to economic conditions, the assignment of cases to judges within a given court is random, and the timing and duration of judges' tenure across courts are exogenous and predictable. Together, this implies that the sources of variation in our uncertainty measures are independent of

economic and credit market conditions. This allows us to estimate the effects of different sources of legal uncertainty on several outcome variables. We provide additional analysis and discussion in Section 6 to address remaining concerns.

5.3.1 Legal Uncertainty and Credit Markets

We first examine the impact of courts' debtor-friendliness and legal uncertainty on credit markets by estimating

$$\log(L_{ib,t}) = \alpha_i + \alpha_b + \alpha_{z,t} + \delta \cdot \mu_{c,t-1} + \theta_1 \cdot \sigma_{c,t-1} + \theta_2 \cdot \phi_{c,t-1} + \theta_3 \cdot \tau_{c,t-1} + \varepsilon_{ib,t}, \tag{9}$$

where $\log(L_{ib,t})$ represents the logarithm of total loan volume from bank b to firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness at the end of month $t-1$, $\sigma_{c,t-1}$ denotes the level of assignment uncertainty at court c at the end of month $t-1$, $\phi_{c,t-1}$ denotes type uncertainty in court c at the end of month $t-1$, and $\tau_{c,t-1}$ denotes regime uncertainty at court c at the end of month $t-1$. As discussed in Section 3, some firms have the option to choose between two courts when filing for restructuring. Since firms file for bankruptcy in Korea, we assign the debtor-friendliness and uncertainty measures from the more debtor-friendly court to those firms. In Section 6.1, we show that the results are qualitatively identical when we limit the sample to firms that cannot choose between two courts. To control for time-invariant firm- and bank-specific differences in loan volume, we incorporate firm fixed effects (α_i) and bank fixed effects (α_b). Furthermore, court zone-month fixed effects ($\alpha_{z,t}$) control for shocks specific to a court zone. We cluster standard errors at the court-cycle level. Judge types and the derived uncertainty measures are correlated within a cycle but not across cycles within a court due to the rotation of judges after each cycle.

Importantly, our court-level measures of debtor-friendliness and legal uncertainty are not generated regressors: they are exact, closed-form functions of observed judge decisions under the Bayesian learning model outlined above. As a result, they carry no sampling error that would require adjustment of the standard errors of our estimates.

Based on the empirical predictions from the model, we anticipate negative values for θ_1, θ_2, and θ_3. The prediction for δ is ambiguous, reflecting the opposing effects of debtor-friendliness

on demand and supply. The results are reported in Table 6, column I. We find that all measures of legal uncertainty have a negative effect on loan volumes for the average firm-bank relationship (column I).

Firm Risk: To sharpen the interpretation of the results, we estimate equation (9) separately for firms with different exposure to bankruptcy risk. Specifically, we divide firms into three groups: high-risk firms with an interest coverage ratio below two, medium-risk firms with an interest coverage ratio from two to five, and low-risk firms with an interest coverage ratio above five. We find that the negative relationship between legal uncertainty and loan volume is mostly driven by high-risk firms (Table 6, column II), whereas the effects are economically and statistically weaker for medium-risk (column III) and low-risk firms (column IV).

Economic Magnitudes: Our estimates of the effect of legal uncertainty based on current judges' types underestimate the pure effect of legal uncertainty on credit outcomes. This is because even risky firms do not expect to inevitably end up in bankruptcy under current judges. To translate the economic magnitudes implied by our estimates into the actual effect of legal uncertainty, we need to divide them by the expected probability of default during the current judges' term. For the average firm-bank relationship, the default probability during the current judges' term is 0.2355 among risky firms.[27] Thus, a one-standard-deviation increase in assignment uncertainty (0.1863) implies a decrease in loan volume by 12.70 percent for the average firm-bank relationship for risky firms. Put differently, if firms and banks assumed that a firm was certain to go through bankruptcy proceedings, a one-standard-deviation increase in assignment uncertainty would reduce loan volume at the firm-bank relationship by 12.70 percent: $\frac{0.1863 \times 0.1605}{0.2355}$. Moving from the 25th to the 75th percentile in assignment uncertainty would similarly lead to a 21.75 percent decline in loan volume if a firm were assumed to end up in bankruptcy proceedings under current judges with certainty. Our estimates further imply that a one-standard-deviation increase in type uncertainty reduces loan volume by 11.22 percent, and moving from the 25th to the 75th percentile in type uncertainty reduces loan volume by 8.50 percent. For regime uncertainty, we find that a one-standard-deviation increase implies a decline in loan volume by 4.63 percent, and moving from the 25th to the 75th percentile reduces loan volume by 8.24 percent.[28]

[27] We translate the interest coverage ratios into ratings and then use mappings between ratings and predicted probabilities of default at different horizons based on historical data (Moody's, 2009).

[28] It should be noted that this quantification of regime uncertainty requires some caution, as variation in regime

Credit Demand and Supply: The results from estimating equation (9) capture both the demand and supply responses to legal uncertainty and debtor-friendliness. To assess the relative importance of the demand and supply effects, we examine interest rates. Since interest rate data are only available at an annual frequency, we collapse the data at the annual level. Specifically, we estimate

$$R_{i,t} = \alpha_i + \alpha_{z,t} + \delta \cdot \overline{\mu}_{c,t} + \theta_1 \cdot \overline{\sigma}_{c,t} + \theta_2 \cdot \overline{\phi}_{c,t} + \theta_3 \cdot \overline{\tau}_{c,t} + \varepsilon_{i,t}, \tag{10}$$

where $R_{i,t}$ represents the average interest rate on loans to firm i in year t. The remaining variables, $\overline{\mu}_{c,t}$, $\overline{\sigma}_{c,t}$, $\overline{\phi}_{c,t}$, and $\overline{\tau}_{c,t}$, are the annual averages of the monthly measures of debtor-friendliness, assignment uncertainty, type uncertainty, and regime uncertainty, respectively.[29]

The empirical predictions from the model imply the following relationships. First, we expect a positive value for δ since a higher level of debtor-friendliness increases credit demand but reduces credit supply, both of which contribute to an increase in interest rates. Second, the prediction for θ_1 is negative, as credit demand is more sensitive to idiosyncratic legal uncertainty compared to credit supply. The predictions for θ_2 and θ_3 are positive, as credit supply is relatively more sensitive to systematic legal uncertainty compared to credit demand.

The results are reported in Table 7. In column I, we find that interest rates are higher for the average firm when courts are more debtor-friendly. This effect is driven by high-risk firms (column II). For high-risk firms, a one-standard-deviation increase in courts' debtor-friendliness implies an increase in interest rates by 11 basis points. This aligns with our theory, as the prediction for δ in the context of interest rates is unambiguously positive.

In addition, we find that higher assignment uncertainty is associated with lower interest rates for high-risk firms. Specifically, a one-standard-deviation increase in assignment uncertainty implies a reduction in interest rates by 13 basis points. This combination of lower loan quantities and lower interest rates is indicative of the negative relationship between assignment uncertainty and loan volume being primarily driven by lower demand for credit.

In contrast, higher levels of type and regime uncertainty are associated with higher interest

uncertainty involves more complex dynamics, including the expected default probabilities under both current and future judges, as well as the difference in expected legal uncertainty between the two regimes.

[29] Given the annual nature of the interest rate data, for the purpose of clustering standard errors at the court-cycle level, we implicitly define judge cycles from January in year t to December in year $t+1$, instead of from February in year t to January in year $t+2$. Given that this implies a shift by only one out of 24 months, it is immaterial for our estimation. Excluding January values does not have any meaningful impact on the results.

rates. Specifically, a one-standard-deviation increase in type uncertainty results in a 7 basis point higher interest rate for high-risk firms. A one-standard-deviation increase in regime uncertainty is associated with a 12 basis point increase in interest rates for high-risk firms.[30] This suggests that systematic legal uncertainty, as captured by the amount of information available about current judges and the completion of their terms, has a relatively stronger impact on credit supply.

6 Alternative Interpretations and Robustness Tests

In this section, we discuss alternative interpretations of the results and provide additional empirical analysis to reinforce and validate our interpretation of the results.

6.1 Agents' Prior and Learning

To begin with, we assess the sensitivity of the results to assumptions about the learning model and agents' prior beliefs.

Strength of Agents' Prior: First, we assess the sensitivity of our results to the strength of agents' prior by varying the parameters α_0 and β_0 in the beta distribution. These parameters determine the weight assigned to the prior information in agents' beliefs about judge types in the economy. In our baseline calibration, we set $\alpha_0 + \beta_0 = 7.834$, which corresponds to treating the prior as if it were based on observing 7.834 decisions.

In Table 8, we assess the implications of different choices of $\alpha_0 + \beta_0$. In Panel A, we reduce the weight assigned to the prior by setting $\alpha_0 + \beta_0 = 5$. In Panel B, we increase the weight assigned to the prior by setting $\alpha_0 + \beta_0 = 10$. We find qualitatively identical results with similar magnitudes in both panels compared with the main results in Table 6. This suggests that the results are not highly sensitive to the strength of agents' prior.

Informed Priors and Alternative Learning Models: We assume that firms and banks start with the same prior for all judges at the beginning of their term. However, judges' types may be predictable based on judges' characteristics or expectations about economic conditions in ways that we are not able to observe.

[30] Adjusting the estimates for the estimated probability of entering bankruptcy while the current judges are serving increases the economic magnitude of the interest rate effects about fourfold.

To formally test whether firms or banks use more informed priors, we include measures of courts' debtor-friendliness ($\hat{\mu}_{c,t}$) and assignment uncertainty ($\hat{\sigma}_{c,t}$) based on all judge decisions during their term in equation (9). These measures, referred to as fully informed judge types computed using a simple average, incorporate all available information about judges and provide the most precise estimates of judge types. If firms or banks possess a superior ability to anticipate judges' decisions, the fully informed judge types should have additional predictive power for credit outcomes.

The results in Table 9 provide no clear evidence that firms' or banks' decisions reflect more informed priors. Significant estimates in the same direction as the main results occur only for the fully informed debtor-friendliness measure and only in the subset of the riskiest firms in column II, but not for assignment uncertainty. Thus, the results do not support the notion that firms or banks possess superior information about judges that could explain the main results.

Learning Model Specification: Most applications in economics and finance that employ judge fixed effects use them as an instrument for variation in legal decisions. The idea is that when judges' biases drive differences in legal decisions, the resulting variation is unrelated to case characteristics that may be correlated with the outcome of interest. In this case, it is crucial to estimate the underlying judge types purged of factors related to case characteristics.

This is not the case in our application. We examine the ex-ante effects of legal uncertainty rather than the ex-post effects of legal decisions. Thus, we need a measure of perceived judge types that accurately reflects how firms and banks in Korea measure judge types during our sample period. Our model choice, described in Section 5.1, is based on conversations with practitioners and takes into account the available technology and the scope of access to data in real time during our sample period. It is important to note that market participants did not use advanced econometric or complex machine learning models that take into account case-specific variables during our sample period, and professional third-party services offering such analyses only emerged after the end of our sample period.

While the model we use is consistent with anecdotal evidence and technological and data constraints, we validate our approach using several pieces of empirical evidence documented in the paper. First, as shown in Section 5.1, when we estimate judges' types separately for the first and second halves of their terms, the independently estimated judge types are highly correlated.

Specifically, a 10 percentage-point higher debtor-friendliness during the first half of a judge's term corresponds to a 6.71 percentage-point higher debtor-friendliness during the second half of the term (Table 4, column I). This strongly suggests that the judge types we estimate reflect persistent characteristics of individual judges that influence their decision-making. Therefore, our measures of judge types accurately capture judge-specific determinants of legal decisions. If firms and banks used a more sophisticated model that accounts for additional factors, their estimated judge types should converge towards the fully informed types more quickly than the model of perceived judge types we use. However, as discussed earlier, we show that when we include measures of courts' debtor-friendliness and assignment uncertainty based on fully informed judge types, they do not separately explain our results. This suggests that firms and banks do not employ a model that accounts for additional factors when estimating judge types.

Finally, the random assignment of cases to judges implies that even if firms and banks used a more sophisticated model, our simpler approach would introduce noise and attenuation bias in our estimates but would not generate systematic biases. In fact, when cases are randomly assigned to judges and the number of cases is large, even estimates of judge types from a simple model that does not account for other factors converge to judge types from the correctly specified model.

Case Characteristics: Judges' decisions can also be affected by case-specific features. Our institutional setting provides us with unique variation to control for observable and unobservable case characteristics. As discussed in detail in Section 5.1, since a large fraction of cases are handled by more than one judge, we can include case fixed effects in our computation of judge types.

As shown in Table 4, columns IV and VI, adding case fixed effects does not materially affect variation in judge types across judges. This confirms that our measures of judge types are driven by judge-specific characteristics rather than case-specific characteristics. In addition, since in the first half of their term, judges tend to be the second judge on an existing case, whereas in the second half of their term judges tend to be the first judge on a new case, the strong persistence in judge types between the first and second half of their terms even for non-overlapping cases and after controlling for case fixed effects (column VI) suggests that judge biases affect their decisions consistently in earlier and later parts of a case.

Court Choice: In our analysis, we assume that firms that have the option to choose between two courts will select the more debtor-friendly court. To assess the impact of the option to choose

between two courts on our estimates, we limit our analysis to firms that do not have the choice between two courts. Within each court zone, firms that cannot choose between two courts are assigned to a single court, the District Court in the city with a High Court. Restricting the sample to these firms thus leaves only one court per court zone, so that court zone-month fixed effects would absorb all variation in our court-level measures. We therefore replace court zone-month fixed effects with month fixed effects to control for time-specific factors.

The results are presented in Table 10. In column I, we estimate the regression from Table 6, column I, with month fixed effects instead of court zone-month fixed effects to allow for a comparison of the results. The results for firms that do not have the option to choose between two courts (columns II to V) reproduce the patterns from the main sample and exhibit similar magnitudes. In particular, the effects remain concentrated among high-risk firms, for which all uncertainty measures are highly significant (column III). This suggests that our definition of the relevant court for a firm having a choice between two courts does not distort the estimates.

6.2 Macroeconomic Shocks

Next, we assess whether our measures of legal uncertainty and debtor-friendliness are correlated with macroeconomic shocks, in which case economic conditions may constitute a confounding factor biasing our estimates, a concern that applies to many other measures of uncertainty (e.g., Bloom, 2014).

Macroeconomic Conditions and Legal Uncertainty: While judge rotations in Korea adhere to institutional rules that are orthogonal to economic considerations, judges' decisions and their dispersion may be influenced by macroeconomic conditions. For instance, during economic booms, judges may exhibit greater optimism regarding the prospects of distressed firms, resulting in more favorable rulings and lower variability in their decisions. Consequently, judges could appear more debtor-friendly, and assignment uncertainty may decrease precisely when economic conditions are more favorable. Given that favorable economic conditions also tend to stimulate credit demand and supply, a correlation between economic conditions and the debtor-friendliness of courts, as well as assignment uncertainty, could drive a positive relationship between courts' debtor-friendliness and loan volume, and a negative relationship between assignment uncertainty

and loan volume.

To examine the relationship between our measures and economic conditions, we calculate correlations between local GDP growth and our measures. We aggregate city- and county-level GDP measures at the court-district level to compute court-specific measures of GDP growth. We find weak correlations between local economic growth and our measures. Specifically, the correlation between economic growth and debtor-friendliness is 0.06, the correlation between assignment uncertainty and economic growth is -0.09, the correlation between type uncertainty and economic growth is 0.19, and the correlation between regime uncertainty and economic growth is 0.04. These findings suggest that our measures are not related to economic conditions, supporting the notion that our results are not driven by macroeconomic shocks. For the only statistically significant measure, type uncertainty, the positive correlation with local GDP growth would imply a positive association between type uncertainty and loan volume, which is the opposite of what we find.

Industry-level Shocks and Legal Uncertainty: To address the potential influence of industry-specific shocks on our estimates, we incorporate industry-time fixed effects into equation (9). The results are reported in Table 11. We find that adding industry-time fixed effects does not alter the qualitative findings and maintains similar economic magnitudes.

6.3 Remaining Concerns

Finally, we address the remaining concerns regarding the interpretation of the results.

Bank Quality: Differences in bank quality across courts could potentially influence case outcomes and loan volume, leading to a correlation between courts' debtor-friendliness or legal uncertainty and loan volume. For example, lower bank quality might result in smaller credit markets and more unpredictable outcomes in restructuring cases. To mitigate concerns about differences in bank quality affecting the results, we saturate equation (9) by adding bank-month fixed effects. This approach leverages the fact that the same bank lends to firms assigned to different courts, effectively holding bank quality constant by comparing firms assigned to different courts but borrowing from the same bank. The results are reported in Table 12. We find that the results are qualitatively unaffected and quantitatively similar after controlling for bank-month fixed effects. This suggests that differences in bank quality across courts do not affect the results.

Endogenous Judge Allocation to Courts: While the rules governing the allocation of judges to different courts and divisions are orthogonal to economic considerations and taking into account judge-specific characteristics is explicitly illegal to guarantee the judiciary's political neutrality, we entertain the possibility that unintentional informal rules or preferences in the appointment process could introduce a correlation between judge types, legal uncertainty, and loan levels. For instance, if younger judges are more likely to be assigned to courts in economically prosperous regions, and if younger judges also tend to be more debtor-friendly and exhibit greater decision uniformity, it could create a scenario where higher loan volume is associated with higher debtor-friendliness or lower assignment uncertainty due to the judge allocation process.

Two findings from our analysis provide evidence against the presence of systematic and endogenous allocation of judges that could explain our results. First, if there were a systematic allocation of judges based on characteristics such as age or experience, we would expect banks and firms to be able to predict judge types and adjust their expectations accordingly. However, the results in Table 9 indicate that firms and banks do not possess superior predictive abilities compared to our model. Second, as detailed in Section 6.2, our analysis does not reveal any correlation between courts' debtor-friendliness or legal uncertainty and the business cycle. The absence of such a correlation further supports the notion that endogenous judge appointments do not generate a systematic relationship between our measures of debtor-friendliness, legal uncertainty, and loan volume.

Judge Learning and Quality: Bankruptcy judges are appointed without prior exposure to bankruptcy cases, which raises the possibility that they may improve their decision-making abilities over time as they gain experience in handling bankruptcy cases. In this case, judges may exhibit lower decision quality and greater inconsistency at the beginning of their term, which may lead to higher assignment uncertainty and may negatively impact credit markets.

To assess whether this is the case, we examine whether there are systematic trends in the time-series evolution of the average debtor-friendliness and average assignment uncertainty over the duration of judges' terms. Figure 4 depicts the average level of debtor-friendliness and assignment uncertainty across all courts based on the tenure of judges at a given court. We find that, in aggregate, debtor-friendliness and assignment uncertainty are remarkably stable over the course of judges' terms. Thus, it appears that there is no discernible correlation between learning on the job

and the courts' average debtor-friendliness or average assignment uncertainty.

Even without learning on the job, differences in judge quality may generate heterogeneity that could potentially correlate with our measures of judge types and legal uncertainty. For instance, highly skilled judges who are more effective at handling bankruptcy proceedings may also render more consistent decisions. Consequently, our measure of assignment uncertainty may be confounded by the underlying quality of judges. In other words, it may be difficult to disentangle the effects of judge types and legal uncertainty from those of judge quality.

Assessing the quality of judges in bankruptcy cases is a challenging task. One commonly used measure of judge quality and efficiency in bankruptcy cases is the duration it takes to resolve them (e.g., Nunn, 2007; Dou et al., 2021; Iverson et al., 2023). Our analysis of the data indicates that there is virtually no correlation between judges' debtor-friendliness, assignment uncertainty, type uncertainty, or regime uncertainty and the length of a case. Specifically, the correlation between judges' debtor-friendliness and case length is only 0.09, and similarly, the correlation between assignment uncertainty and case length is also 0.09. The correlation between type uncertainty and case length is -0.12, while the correlation between regime uncertainty and case length is 0.08.

These weak correlations suggest that our measures do not exhibit strong relationships with judge quality, at least when proxied by case length. In particular, judges do not appear to become sufficiently more efficient or competent over their two-year term at the bankruptcy court to make an observable difference, as indicated by regime uncertainty not being correlated with case length. This evidence indicates that judge quality is unlikely to be driving our results. While we acknowledge that case length may not capture all dimensions of judicial expertise, prior evidence suggests that the time it takes judges to make decisions and end cases is a key mechanism in explaining inefficiencies in bankruptcy cases (Iverson et al., 2023), thereby aggregating different aspects of judge quality and expertise.

Furthermore, as previously discussed, the evidence presented in Figure 4 supports the notion that, on average, judges' debtor-friendliness and assignment uncertainty exhibit no clear systematic trend throughout judges' terms. This observation suggests that estimates concerning these measures are unaffected by any potential improvements in judge quality that could arise from learning over time.

Large Firms: The composition of our sample primarily consists of small and medium-sized

firms. Large firms are sometimes considered to have some flexibility in engaging in forum shopping, and there may be non-random elements in the assignment of their cases to judges (Hüther and Kleiner, 2022). While there is no evidence of such effects in the context of Korea, to address this concern, we re-estimate our main analysis excluding firms with assets of 10 billion KRW or higher. The results are presented in Table 13. We find that the results remain qualitatively unchanged when considering only firms with assets below 10 billion KRW, and the magnitudes of the effects are very similar to those obtained in our original analysis, which includes all firms. This indicates that the inclusion of large firms does not significantly affect our results.

7 Discussion and Implications

In this section, we discuss the economic and legal implications of our analysis. Although our empirical analysis examines the ramifications of legal uncertainty within the realm of bankruptcy law, the implications of our findings extend to the broader domain of legal uncertainty. For example, as emphasized in our theoretical framework, the random assignment of legal cases to judges, a characteristic of numerous legal systems, generates assignment uncertainty within any legal setting.

While we primarily emphasize the positive impact of reducing legal uncertainty on credit markets and economic activity, we also highlight that policies aimed at reducing legal uncertainty may entail negative consequences.

Judicial System: There are various approaches to reducing legal uncertainty through reform of the judicial system. Given that judges' decision-making may be subject to biases (e.g., Frank, 1931), the random assignment of cases to individual judges serves to enhance fairness and instill confidence in judicial processes (e.g., Shayo and Zussman, 2011; Abrams et al., 2012). Our analysis draws attention to a potential drawback associated with random judge assignments, namely, assignment uncertainty. Since assignment uncertainty can be mitigated through diversification, the cost of random judge assignment is reduced when plaintiffs and defendants have the ability to diversify this particular form of uncertainty.

In contrast to a judicial system where judges specialize and remain in the same court for extended periods, implementing regular rotations of judges across different courts and divisions can have certain advantages. Rotations can broaden judges' expertise by exposing them to diverse

areas of law and help mitigate the risk of cronyism. However, it is important to note that frequent changes in judicial appointments also give rise to increased type and regime uncertainty. Unlike other forms of uncertainty, type and regime uncertainty are challenging to diversify and consequently impact a broader set of plaintiffs and defendants.

Legal System: There is a significant body of literature that examines the economic implications of legal systems, particularly legal origins (e.g., La Porta et al., 1998; La Porta et al., 1999; Djankov et al., 2007). Our analysis contributes to this field by highlighting the potential implications of legal traditions for legal uncertainty. For instance, within the common law system, a stronger adherence to precedent has a dual effect on legal uncertainty. While it can decrease legal uncertainty by enhancing the predictability of future decisions, it also implies that individual decisions may systematically influence legal disputes going forward, thereby making legal uncertainty more systematic and difficult to diversify. In contrast, in a civil law system, individual decisions by judges have less influence on legal disputes going forward.

Legislation: Reducing the frequency and magnitude of legislative changes can effectively mitigate regime uncertainty, which represents a form of systematic legal uncertainty that cannot be diversified. Several approaches can be employed to achieve this objective. Extending the duration of election cycles can help minimize the disruptions caused by frequent changes in legislation. Additionally, political systems that incorporate a greater number of checks and balances contribute to stability and reduce regime uncertainty. Parliamentary rules and systems that foster consensus, such as filibuster rules and multiple-party systems, can also play a role in curtailing drastic changes in legislation and promoting a more stable legal regime.

Transparency and Predictability: In recent years, a lively debate has emerged among academics, industry practitioners, and policymakers regarding the predictability of judge assignments and decisions (e.g., Hüther and Kleiner, 2022).[31] Our analysis sheds light on a trade-off that arises when considering the advantages of establishing predictable patterns in the judicial process at both the institutional level (case assignments to judges) and the individual judge level, and the concerns related to data protection, privacy, fairness, and equity. Specifically, increased transparency of legal proceedings and decisions can enable market participants to make more accurate predictions

[31] For the recent debate on the use of judicial analytics see, for example, "Big Data: Legal Firms Play 'Moneyball'," Financial Times, February 6, 2019, and "France's Judicial Analytics Ban Unlikely to Catch On in U.S.," Bloomberg Law, June 5, 2019.

about legal outcomes, thereby reducing both idiosyncratic and systematic legal uncertainty. In particular, the use of algorithmic recommendations may be able to reduce noise arising from judicial discretion (e.g., Kleinberg et al., 2017; Angelova et al., 2022). However, it is important to carefully balance this transparency with considerations of data protection, privacy concerns, and ensuring a fair and equitable legal system.

In addition, our findings contribute to the ongoing discourse surrounding the open justice movement, which advocates for increased transparency and accessibility in legal proceedings (e.g., Cunliffe, 2012). The movement's goals of enhancing public trust, improving judicial accountability, and fostering a more informed citizenry align with the advantages of reducing legal uncertainty we identify.

Firm Boundaries: Our analysis offers broader implications for the boundary of the firm. Legal disputes and uncertainty arise when two parties enter a contract. Transactions that occur within a firm's boundaries are typically less susceptible to contractual incompleteness. Consequently, one strategy to mitigate the impact of legal uncertainty is to consolidate transactions within the firm through vertical or horizontal integration.

Furthermore, vertical or horizontal integration enables firms to achieve economies of scale and expand their size by diversifying their business relationships. This diversification allows firms to reduce their exposure to idiosyncratic legal uncertainty, providing an additional rationale for pursuing mergers and acquisitions.

Intermediation: Similar to other forms of idiosyncratic uncertainty, idiosyncratic legal uncertainty can be diversified by large institutions, including conglomerates, insurance companies, or banks. For instance, in the context of bankruptcy law, specialized firms such as hedge funds play a crucial role. These firms acquire and consolidate distressed debt (e.g., Jiang et al., 2012; Lim, 2015; Ivashina et al., 2016), effectively serving as intermediaries that diversify legal uncertainty.

In the legal industry, it is common for law firms to structure their compensation arrangements based on a percentage of the proceeds obtained from a case rather than charging a flat fee. This payment structure helps align the incentives of the law firm with those of its clients. Importantly, this payment arrangement also reduces clients' exposure to legal uncertainty. By tying their fees to the success of a case, law firms essentially take on and diversify some of the idiosyncratic legal uncertainty associated with the outcome.

Other institutions also possess the capability to effectively diversify legal uncertainty. An illustrative example is the emergence of litigation funding in recent years, enabling the financing of lawsuits by third parties like investment funds (e.g., Martin, 2004). By providing funding for a portfolio of lawsuits, investment funds can effectively diversify legal uncertainty. Moreover, a dedicated market for insurance has developed to address variations in the outcomes of legal cases, thereby absorbing idiosyncratic legal uncertainty. Insurance companies offer a range of products that cater to different aspects of legal uncertainty, including traditional legal insurance as well as newer forms like litigation risk insurance. These insurance products enable individuals, businesses, and institutions to transfer the potential financial risks associated with legal uncertainty to insurance providers.

8 Concluding Remarks

In this paper, we examine the impact of legal uncertainty on credit markets. Our model demonstrates that legal uncertainty has a detrimental effect on economic activity. Furthermore, we distinguish between two types of legal uncertainty: idiosyncratic (and thus diversifiable) and systematic (and thus non-diversifiable). To validate the predictions of our model, we employ micro-level data on bankruptcy judges, bankruptcy cases, and corporate loans from Korea. Our empirical findings support the predictions made by the model, reinforcing the notion that legal uncertainty has significant implications for economic outcomes.

We view our paper as an initial step toward understanding the implications of legal uncertainty for economic outcomes. Despite the simplicity of our model, it holds significant economic and policy implications. This suggests that delving further into the economic consequences of legal uncertainty has the potential to yield novel insights and policy implications. One promising avenue for future research is to explore how individuals and firms mitigate their exposure to legal uncertainty. Additionally, while we focus on legal uncertainty in the context of bankruptcy law to analyze its effects on economic activity, it is important to acknowledge that legal uncertainty permeates various areas of the law, impacting a wide range of economic activities and markets. Investigating other sources of legal uncertainty arising from different legal domains can shed light on their specific implications for economic outcomes.

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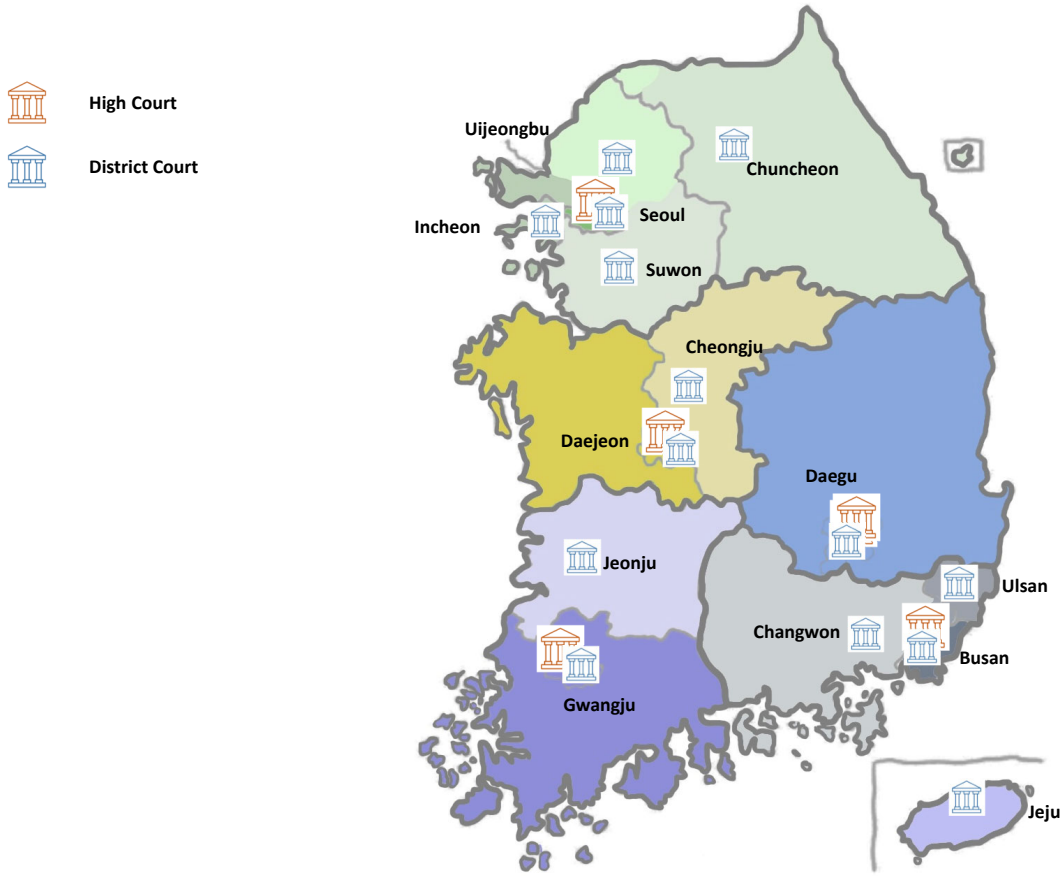
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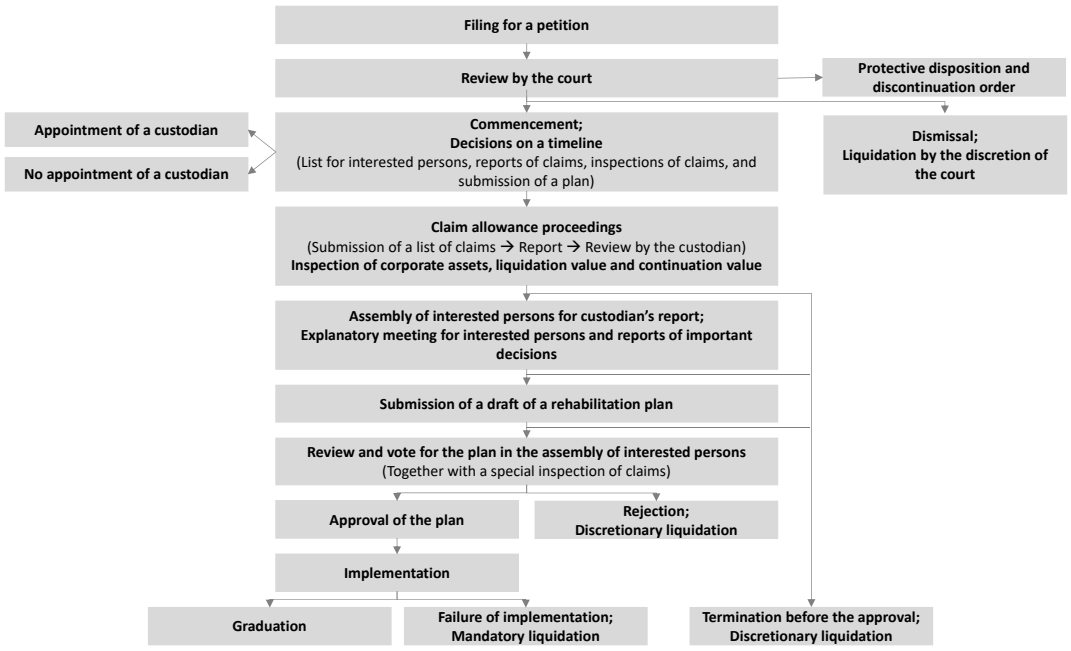
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Figure 1: Court Zones



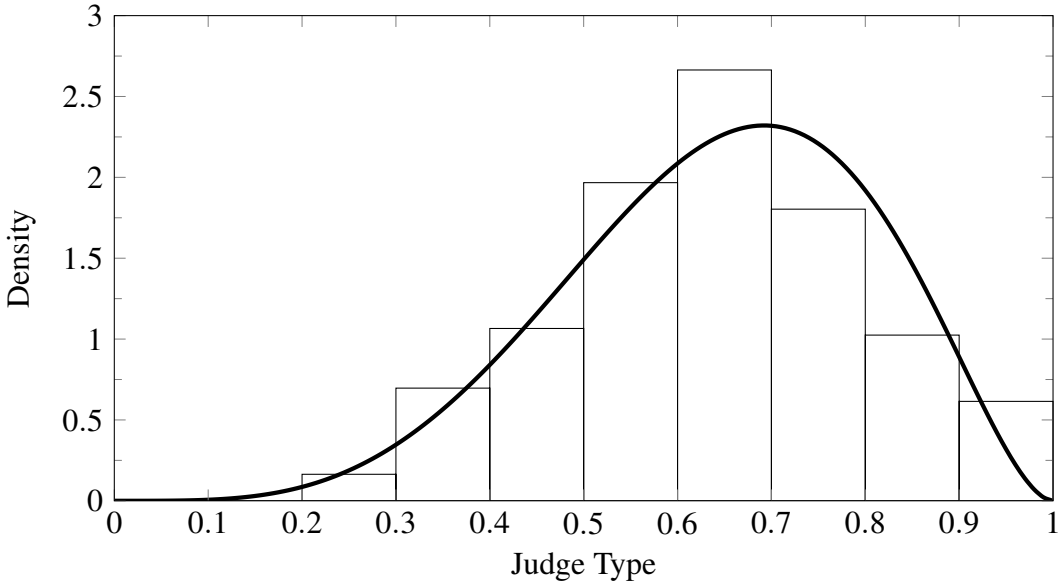
This figure depicts the location of District Courts and High Courts in Korea during our sample period. Each court zone is represented by a distinct color: green corresponds to Zone 1 (Seoul), yellow to Zone 2 (Daejeon), blue to Zone 3 (Daegu), gray to Zone 4 (Busan), and purple to Zone 5 (Gwangju).

Figure 2: In-court Restructuring Process



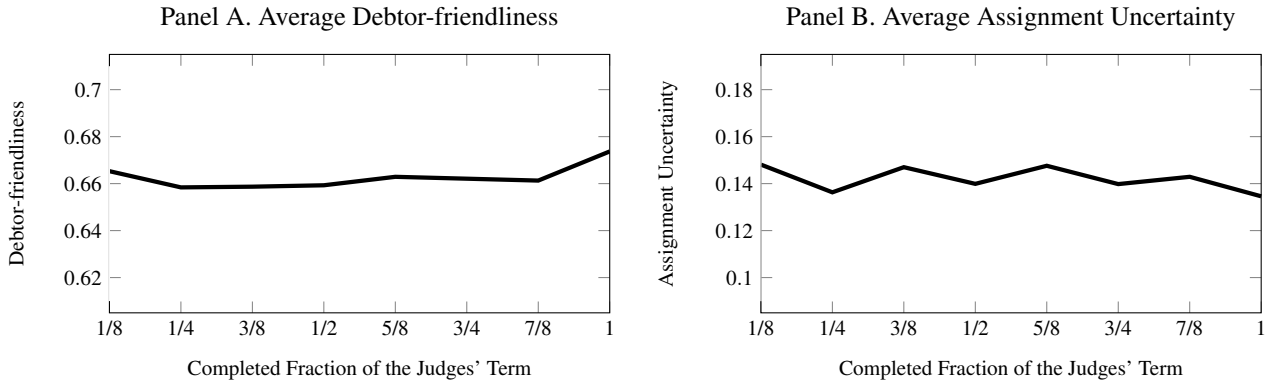
This figure illustrates the steps involved in the in-court restructuring process in Korea.

Figure 3: Judge Type Distribution



This figure shows a histogram displaying the empirical distribution of fully informed judge types across all courts and terms in the data. Additionally, it overlays a beta distribution that corresponds to the calibrated parameters $\alpha_0 = 5.038$ and $\beta_0 = 2.796$. On the x-axis, the value 0 represents a judge who is completely creditor-friendly, while the value 1 represents a judge who is completely debtor-friendly.

Figure 4: Average Debtor-friendliness and Assignment Uncertainty over Judges' Terms



This figure shows the average debtor-friendliness (Panel A) and the average assignment uncertainty (Panel B) over judges' terms at a court as a function of the fraction of the judges' term that has been completed.

Table 1: Court Zones

Administrative region	Local District Court	Court Zone District Court
	Zone 1: Seoul	
Gangwon-do	Chuncheon	Seoul
Incheon	Incheon	Seoul
West Gyeonggi-do	Incheon	Seoul
Seoul	Seoul	Seoul
South Gyeonggi-do	Suwon	Seoul
Cheorwon-gun	Uijeongbu	Seoul
North Gyeonggi-do	Uijeongbu	Seoul
	Zone 2: Daejeon	
Chungcheongbuk-do	Cheongju	Daejeon
Chungcheongnam-do	Daejeon	Daejeon
Daejeon	Daejeon	Daejeon
Sejong	Daejeon	Daejeon
	Zone 3: Daegu	
Daegu	Daegu	Daegu
Gyeongsangbuk-do	Daegu	Daegu
	Zone 4: Busan	
Busan	Busan	Busan
Gyeongsangnam-do	Changwon	Busan
Ulsan	Ulsan	Busan
Yangsan	Ulsan	Busan
	Zone 5: Gwangju	
Gwangju	Gwangju	Gwangju
Jeollanam-do	Gwangju	Gwangju
Jeju-do	Jeju	Gwangju
Jeollabuk-do	Jeonju	Gwangju

This table lists the District Courts that handle bankruptcy cases based on the location of firms' headquarters. Some firms have the option to choose between two courts, whereas other firms must file at a specific court. While Cheorwon-gun is part of Gangwon-do, it is assigned to a different court for geographical considerations.

Table 2: Descriptive Statistics

Panel A: Legal data	
Number of cases	4,688
Case length	19.39 months
Number of decisions	11,777
Number of judges	327
Term length	23.57 months
Panel B: Loan data	
Number of firms	125,663
Individual loan volume	189 million KRW
Firm-level loan volume	1,326 million KRW
Interest rates (annual)	0.0419
Panel C: Accounting data	
Number of firms	340,446
Employees	30
Total assets	9,569 million KRW
Total sales	9,643 million KRW
Return on assets	0.0488
Leverage	0.4776

The table presents descriptive statistics. Panel A provides descriptive statistics for legal data, Panel B for loan data, and Panel C for accounting data.

Table 3: Judge Decisions

Decision	Coding
Accept case	Debtor-friendly
Prohibit seizure of assets	Debtor-friendly
Extension of plan submission period	Debtor-friendly
Approve debtor's plan	Debtor-friendly
Grant debtor request for modification of plan	Debtor-friendly
Successful graduation from procedure	Debtor-friendly
Dismissal of case	Creditor-friendly
Allow seizure of assets	Creditor-friendly
Reject extension of plan submission period	Creditor-friendly
Reject debtor's plan	Creditor-friendly
Reject debtor request for modification of plan	Creditor-friendly
Failed graduation from procedure	Creditor-friendly

This table lists the debtor-friendly and creditor-friendly decisions of judges in the data.

Table 4: Predicting Judge Types

Dep. var.: $\mu_{j,t>T/2}$	I	II	III	IV	V	VI
Computation:	base case			case FE	base case	case FE
Sample:	all cases				non-overlapping cases	
$\mu_{j,t\leq T/2}$	0.6705***	0.6715***	0.6797***	0.6099***	0.5269***	0.5770***
	[0.0871]	[0.0780]	[0.1029]	[0.0526]	[0.1172]	[0.0631]
Court FE	no	yes	-	-	-	-
Court-Cycle FE	no	no	yes	yes	yes	yes
Observations	327	327	327	327	310	310
R-squared	0.186	0.237	0.485	0.630	0.462	0.553

This table presents the results of estimating equation (4). The dependent variable, $\mu_{j,t>T/2}$, represents the type of judge j based on their decisions in the second half of their term, while $\mu_{j,t\leq T/2}$ represents judge j's type based on their decisions in the first half of their term. In columns IV and VI, we apply case fixed effects when computing judge types. In columns V and VI, cases that span both the first and the second halves of a judge's term are excluded from computing judge types. The bottom section of the table provides information on fixed effects. *** denotes statistical significance at the 1% level with robust standard errors.

Table 5: Court-Level Measures

Variable	Mean	25 pct	Median	75 pct	Std
Debtor-friendliness ($\mu_{c,t}$)	0.6742	0.6386	0.6755	0.7026	0.0539
Assignment Uncertainty ($\sigma_{c,t}$)	0.2353	0.0860	0.1679	0.4051	0.1863
Type Uncertainty ($\phi_{c,t}$)	0.0034	0.0014	0.0023	0.0039	0.0033
Regime Uncertainty ($\tau_{c,t}$)	0.5132	0.2500	0.5000	0.7500	0.2809

This table provides descriptive statistics for the court-level measures of judges' debtor-friendliness and legal uncertainty.

Table 6: Credit

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\mu_{c,t-1}$	0.1622***	0.6187***	0.0276	0.0495
	[0.0375]	[0.0784]	[0.0263]	[0.0372]
$\sigma_{c,t-1}$	-0.0736***	-0.1605***	-0.0314***	-0.0255**
	[0.0104]	[0.0198]	[0.0081]	[0.0119]
$\phi_{c,t-1}$	-5.0149***	-8.0064***	-3.4925***	-4.0848***
	[0.7130]	[2.1579]	[0.4896]	[0.6822]
$\tau_{c,t-1}$	-0.0123**	-0.0388**	-0.0059*	-0.0021
	[0.0052]	[0.0182]	[0.0033]	[0.0036]
Firm FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.540	0.578	0.563	0.518

This table presents the results of estimating equation (9). Column I displays the results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7: Interest Rates

Dep. var.: $R_{i,t}$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\overline{\mu}_{c,t}$	0.0129***	0.0209***	0.0106	-0.0019
	[0.0048]	[0.0077]	[0.0094]	[0.0089]
$\overline{\sigma}_{c,t}$	-0.0043***	-0.0070***	-0.0031	0.0011
	[0.0013]	[0.0021]	[0.0025]	[0.0023]
$\overline{\phi}_{c,t}$	0.0887	0.2009**	0.1530	-0.1873
	[0.0621]	[0.0792]	[0.1175]	[0.1105]
$\overline{\tau}_{c,t}$	0.0026***	0.0042**	0.0022	-0.0019
	[0.0009]	[0.0017]	[0.0019]	[0.0018]
Firm FE	yes	yes	yes	yes
Court Zone-Year FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	39,982	21,217	7,152	11,613
R-squared	0.721	0.752	0.697	0.661

This table presents the results of estimating equation (10). Column I shows results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $R_{i,t}$, represents the average interest rate of all loans of firm i in year t. The variables $\overline{\mu}_{c,t}$, $\overline{\sigma}_{c,t}$, $\overline{\phi}_{c,t}$, and $\overline{\tau}_{c,t}$, are the annual averages of the monthly measures of debtor-friendliness, assignment uncertainty, type uncertainty, and regime uncertainty, respectively. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8: Different Prior Beliefs

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
Panel A: $\alpha_0+\beta_0=5$				
$\mu_{c,t-1}$	0.1370***	0.5506***	0.0210	0.0342
	[0.0323]	[0.0667]	[0.0232]	[0.0324]
$\sigma_{c,t-1}$	-0.0652***	-0.1366***	-0.0295***	-0.0262**
	[0.0083]	[0.0154]	[0.0065]	[0.0098]
$\phi_{c,t-1}$	-4.2422***	-7.4797***	-2.7195***	-3.3466***
	[0.6215]	[1.8079]	[0.4654]	[0.5465]
$\tau_{c,t-1}$	-0.0132***	-0.0369**	-0.0061*	-0.0038
	[0.0051]	[0.0178]	[0.0033]	[0.0038]
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.540	0.578	0.563	0.518
Panel B: $\alpha_0+\beta_0=10$				
$\mu_{c,t-1}$	0.1788***	0.6596***	0.0373	0.0586
	[0.0405]	[0.0840]	[0.0289]	[0.0407]
$\sigma_{c,t-1}$	-0.0798***	-0.1790***	-0.0313***	-0.0255*
	[0.0126]	[0.0236]	[0.0098]	[0.0140]
$\phi_{c,t-1}$	-5.1276***	-7.5571***	-3.7327***	-4.3184***
	[0.7714]	[2.2612]	[0.5296]	[0.7948]
$\tau_{c,t-1}$	-0.0125**	-0.0393**	-0.0060*	-0.0024
	[0.0053]	[0.0185]	[0.0034]	[0.0037]
Firm FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.540	0.578	0.563	0.518

The table presents the results of estimating equation (9). Panel A sets the strength of the prior belief to $\alpha_0+\beta_0=5$, while Panel B sets it to $\alpha_0+\beta_0=10$. Column I shows results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 9: Informed Priors

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\mu_{c,t-1}$	0.1525***	0.3777***	0.0516*	0.1218***
	[0.0408]	[0.0827]	[0.0268]	[0.0421]
$\sigma_{c,t-1}$	-0.0711***	-0.2318***	-0.0505***	-0.0005
	[0.0182]	[0.0382]	[0.0157]	[0.0196]
$\hat{\mu}_{c,t}$	0.0096	0.2539***	-0.0226*	-0.0758***
	[0.0167]	[0.0382]	[0.0122]	[0.0169]
$\hat{\sigma}_{c,t}$	-0.0018	0.0316*	0.0121*	-0.0122
	[0.0074]	[0.0167]	[0.0073]	[0.0091]
$\phi_{c,t-1}$	-5.0466***	-8.2123***	-3.3246***	-4.1535***
	[0.7126]	[1.9609]	[0.5002]	[0.6757]
$\tau_{c,t-1}$	-0.0123**	-0.0331**	-0.0055*	-0.0042
	[0.0050]	[0.0168]	[0.0033]	[0.0038]
Firm FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.540	0.578	0.563	0.518

This table presents the results of estimating equation (9) including courts' debtor-friendliness and assignment uncertainty based on fully informed judge types. Column I shows results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The variables $\hat{\mu}_{c,t}$ and $\hat{\sigma}_{c,t}$ represent courts' debtor-friendliness and assignment uncertainty, respectively, based on all observed judge decisions during the judges' term. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 10: Firms without Choice of Court

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV	V
Sample	all		high risk	med risk	low risk
$\mu_{c,t-1}$	0.1791***	0.2511***	0.7293***	-0.0549**	0.1333***
	[0.0347]	[0.0399]	[0.0848]	[0.0242]	[0.0407]
$\sigma_{c,t-1}$	-0.0168**	-0.0134	-0.1108**	-0.1393***	0.0325
	[0.0083]	[0.0198]	[0.0511]	[0.0167]	[0.0196]
$\phi_{c,t-1}$	-1.1243***	-0.1677	-4.0914***	-0.1952	1.0665
	[0.4316]	[0.6343]	[1.5334]	[0.3578]	[0.6541]
$\tau_{c,t-1}$	-0.0129*	-0.0144	-0.0757**	0.0008	0.0015
	[0.0071]	[0.0109]	[0.0293]	[0.0053]	[0.0097]
Firm FE	yes	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes	yes
Month FE	yes	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	19,607,867	3,130,963	6,686,989	9,789,915
R-squared	0.540	0.549	0.580	0.575	0.529

This table shows the results of estimating equation (9) for the full sample in column I and for firms that cannot choose between two courts in columns II to V. Column III shows results for firms with an interest coverage ratio below 2, column IV for firms with an interest coverage ratio between 2 and 5, and column V for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 11: Industry Shocks

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\mu_{c,t-1}$	0.1295***	0.6791***	0.0575**	0.0135
	[0.0327]	[0.0792]	[0.0241]	[0.0352]
$\sigma_{c,t-1}$	-0.0532***	-0.1685***	-0.0369***	-0.0080
	[0.0087]	[0.0193]	[0.0069]	[0.0104]
$\phi_{c,t-1}$	-4.4482***	-6.6604***	-3.3373***	-3.6522***
	[0.5306]	[2.0065]	[0.4155]	[0.6793]
$\tau_{c,t-1}$	-0.0108***	-0.0394**	-0.0063**	0.0001
	[0.0038]	[0.0170]	[0.0029]	[0.0034]
Firm FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Industry-Month FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.541	0.579	0.564	0.519

This table presents the results of estimating equation (9). Column I shows results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 12: Bank Quality

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\mu_{c,t-1}$	0.1223***	0.6058***	-0.0158	0.0149
	[0.0361]	[0.0782]	[0.0267]	[0.0351]
$\sigma_{c,t-1}$	-0.0497***	-0.1506***	-0.0072	-0.0005
	[0.0098]	[0.0195]	[0.0081]	[0.0109]
$\phi_{c,t-1}$	-3.9399***	-7.6451***	-2.4999***	-2.3664***
	[0.7447]	[2.2458]	[0.6011]	[0.6854]
$\tau_{c,t-1}$	-0.0135***	-0.0421**	-0.0064*	-0.0037
	[0.0051]	[0.0184]	[0.0034]	[0.0036]
Firm FE	yes	yes	yes	yes
Bank-Month FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	37,333,079	6,331,954	13,098,991	17,902,134
R-squared	0.546	0.583	0.568	0.528

This table presents the results of estimating equation (9). Column I shows results for the full sample, column II for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 13: Excluding Large Firms

Dep. var.: $\log(L_{ib,t})$	I	II	III	IV
Sample	all	high risk	med risk	low risk
$\mu_{c,t-1}$	0.1305***	0.5726***	0.0329	-0.0098
	[0.0392]	[0.0792]	[0.0284]	[0.0382]
$\sigma_{c,t-1}$	-0.0795***	-0.1750***	-0.0369***	-0.0227*
	[0.0108]	[0.0203]	[0.0085]	[0.0117]
$\phi_{c,t-1}$	-5.1554***	-9.5335***	-3.2437***	-3.9260***
	[0.7353]	[2.0819]	[0.5593]	[0.7030]
$\tau_{c,t-1}$	-0.0125**	-0.0350**	-0.0082**	0.0021
	[0.0054]	[0.0172]	[0.0040]	[0.0038]
Firm FE	yes	yes	yes	yes
Bank FE	yes	yes	yes	yes
Court Zone-Month FE	yes	yes	yes	yes
Clustered SE	court-cycle	court-cycle	court-cycle	court-cycle
Observations	33,487,810	5,494,205	11,856,798	16,136,807
R-squared	0.491	0.529	0.516	0.468

This table presents the results of estimating equation (9) for firms with assets below 10 billion KRW. Column II shows results for firms with an interest coverage ratio below 2, column III for firms with an interest coverage ratio between 2 and 5, and column IV for firms with an interest coverage ratio above 5. The dependent variable, $\log(L_{ib,t})$, represents the logarithm of total loan volume between bank b and firm i in month t. The variable $\mu_{c,t-1}$ denotes court c's debtor-friendliness, measured by the average judge type at court c at the end of month $t-1$ (equation (6)). $\sigma_{c,t-1}$ denotes the level of assignment uncertainty, measured by the standard deviation between judge types at court c at the end of month $t-1$ (equation (7)). $\phi_{c,t-1}$ captures type uncertainty, measured by the variance of judges' average type at court c at the end of month $t-1$ (equation (8)). $\tau_{c,t-1}$ denotes regime uncertainty, measured by the fraction of the judges' term at court c completed at the end of month $t-1$. The bottom section provides information on fixed effects and the clustering of standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

A Proofs

Proof of Lemma 1. We have

$$\mathbb{E}\left[\left(P-C+\sum_{i=1}^{N}\frac{1-\Lambda_i}{N}D\right)I\right]=\left(P-C+\sum_{i=1}^{N}\frac{1-\mathbb{E}[\Lambda]}{N}D\right)I=(P-C+(1-\mathbb{E}[\Lambda])D)I,$$

and

$$\begin{aligned}\mathrm{Var}\left[\left(P-C+\sum_{i=1}^{N}\frac{1-\Lambda_i}{N}D\right)I\right]&=\frac{(DI)^2}{N^2}\left(\mathbb{E}\left[\mathrm{Var}\left[\sum_{i=1}^{N}\Lambda_i\middle|\theta\right]\right]+\mathrm{Var}\left[\mathbb{E}\left[\sum_{i=1}^{N}\Lambda_i\middle|\theta\right]\right]\right)\\&=\frac{(DI)^2}{N^2}\left(\mathbb{E}\left[\sum_{i=1}^{N}\mathrm{Var}[\Lambda_i|\theta]\right]+\mathrm{Var}\left[\sum_{i=1}^{N}\mathbb{E}[\Lambda_i|\theta]\right]\right)\\&=\frac{(DI)^2}{N^2}\left(\mathbb{E}[N\,\mathrm{Var}[\Lambda|\theta]]+\mathrm{Var}[N\mathbb{E}[\Lambda|\theta]]\right)\\&=(DI)^2\left(\frac{\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]}{N}+\mathrm{Var}[\mathbb{E}[\Lambda|\theta]]\right),\end{aligned}$$

which completes the proof. ■

Proof of Proposition 1. The result follows directly from equating demand and supply and solving for P and I. ■

Proof of Corollary 1. Write $A:=\mathbb{E}[\mathrm{Var}[\Lambda|\theta]]$ and $B:=\mathrm{Var}[\mathbb{E}[\Lambda|\theta]]$, where $A+B=\mathrm{Var}[\Lambda]>0$. From Proposition 1, we have

$$\frac{\partial P}{\partial A}=-\frac{(N-1)NB(R-C)}{((N+1)A+2NB)^2},\qquad\frac{\partial P}{\partial B}=\frac{(N-1)NA(R-C)}{((N+1)A+2NB)^2}.$$

Since $R>C$ and $A+B>0$, the denominator is strictly positive. If $N=1$, both derivatives are zero. If $N>1$, then $\frac{\partial P}{\partial A}\leq 0$, with equality if and only if $B=0$, and $\frac{\partial P}{\partial B}\geq 0$, with equality if and only if $A=0$, which completes the proof. ■

Proof of Lemmas 2 and 3. We have the expression:

$$\mathbb{E}[\Lambda|\theta]=\frac{1}{J}\sum_{j\in J}\mathbb{E}\left[\lambda_j\middle|\theta_j\right],$$

which implies:

$$\mathrm{Var}\left[\mathbb{E}\left[\Lambda|\theta\right]\right] = \frac{1}{J^2}\mathrm{Var}\left[\sum_{j\in J}\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right] = \frac{1}{J^2}\sum_{j\in J}\mathrm{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right].$$

Further derivations lead to:

$$\mathrm{Var}\left[\Lambda|\theta\right] = \frac{1}{J}\sum_{j\in J}\mathrm{Var}\left[\lambda_j|\theta_j\right] + \frac{1}{J}\sum_{j\in J}\left(\mathbb{E}\left[\lambda_j\middle|\theta_j\right] - \frac{1}{J}\sum_{k\in J}\mathbb{E}\left[\lambda_k|\theta_k\right]\right)^2,$$

and

$$\mathbb{E}\left[\mathrm{Var}\left[\Lambda|\theta\right]\right] = \frac{1}{J}\sum_{j\in J}\left(\mathbb{E}\left[\lambda_j\right] - \frac{1}{J}\sum_{k\in J}\mathbb{E}\left[\lambda_k\right]\right)^2 + \frac{1}{J}\sum_{j\in J}\mathrm{Var}\left[\lambda_j\right] - \frac{1}{J^2}\sum_{j\in J}\mathrm{Var}\left[\mathbb{E}\left[\lambda_j\middle|\theta_j\right]\right],$$

which completes the proof. ■

Proof of Lemma 4. Since ν is measurable with respect to θ and takes values in $\{0,1\}$, and since the distributions of $\Lambda(\theta_f)$ and $\Lambda(\theta_c)$ conditional on θ depend only on θ_f and θ_c, respectively, we have

$$\mathbb{E}\left[\Lambda|\theta\right] = \nu\mathbb{E}\left[\Lambda(\theta_f)|\theta_f\right] + (1-\nu)\mathbb{E}\left[\Lambda(\theta_c)|\theta_c\right].$$

Applying the law of total variance conditional on ν, and using the independence of ν and (θ_c,θ_f), we obtain

$$\begin{aligned}\mathrm{Var}\left[\mathbb{E}\left[\Lambda|\theta\right]\right] &= \mathbb{E}\left[\mathrm{Var}\left[\mathbb{E}\left[\Lambda|\theta\right]|\nu\right]\right] + \mathrm{Var}\left[\mathbb{E}\left[\mathbb{E}\left[\Lambda|\theta\right]|\nu\right]\right] \\ &= \eta\,\mathrm{Var}[\mathbb{E}[\Lambda(\theta_f)|\theta_f]] + (1-\eta)\,\mathrm{Var}[\mathbb{E}[\Lambda(\theta_c)|\theta_c]] + \mathrm{Var}\left[\nu\mathbb{E}[\Lambda(\theta_f)] + (1-\nu)\mathbb{E}[\Lambda(\theta_c)]\right] \\ &= \eta\,\mathrm{Var}[\mathbb{E}[\Lambda(\theta_f)|\theta_f]] + (1-\eta)\,\mathrm{Var}[\mathbb{E}[\Lambda(\theta_c)|\theta_c]] + \eta(1-\eta)\left(\mathbb{E}[\Lambda(\theta_f)] - \mathbb{E}[\Lambda(\theta_c)]\right)^2.\end{aligned}$$

Moreover, conditional on θ, we have $\Lambda = \Lambda(\theta_f)$ if $\nu = 1$ and $\Lambda = \Lambda(\theta_c)$ if $\nu = 0$, such that $\mathrm{Var}\left[\Lambda|\theta\right] = \nu\,\mathrm{Var}[\Lambda(\theta_f)|\theta_f] + (1-\nu)\,\mathrm{Var}[\Lambda(\theta_c)|\theta_c]$. Taking expectations and using the indepen-

dence of ν and (θ_c, θ_f) yields

$$\mathbb{E}\left[\mathrm{Var}\left[\Lambda|\theta\right]\right] = \eta\mathbb{E}[\mathrm{Var}[\Lambda(\theta_f)|\theta_f]] + (1-\eta)\mathbb{E}[\mathrm{Var}[\Lambda(\theta_c)|\theta_c]],$$

which completes the proof. ■

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