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ABSTRACT

We study asset and debt characteristics of US bank holding companies. We show that financial institutions, especially large institutions, are not just about holding discrete assets. Services and going-concern values are important, and capital market debt against going-concern values accounts for 10% to 15% of total assets, comparable to the volume of capital market debt against discrete assets. We find that financial institutions' debt against going-concern values has weak monitoring, relative to similar debt among non-financial firms. We argue that weak monitoring prevails because creditors cannot easily punish or restructure these institutions should they violate covenants, which limits covenants' usefulness.

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1 Introduction

The funding of financial institutions has always garnered substantial interest in economics research. A key focus has been theories and evidence on the nature of deposits. Nonetheless, major deposit-taking financial institutions in the US also rely on a sizable amount of non-deposit debt contracts from capital markets. For example, roughly 35% of the total liabilities of JP Morgan and Bank of America are not deposits. What is the nature of the capital market debt contracts of financial firms? What are the similarities and differences relative to non-financial firms? We investigate these questions and draw comparisons with non-financial firms, to flesh out the unifying themes as well as the distinct features of debt contract enforcement among financial institutions.

Among non-financial firms, there are two common approaches to debt enforcement. One approach is to lend against the liquidation value of discrete, separable assets, such as fixed assets and working capital, where creditors rely on the intrinsic liquidation value of these well-defined assets. Another approach is to lend against the going-concern cash flow value of the firm, where creditors rely on the value of the business as a whole and the verifiability of cash flows. The prevalence of these two approaches is influenced by the nature of firms' assets and economic activities, and the latter often comes with strong creditor monitoring and control (Kermani and Ma, 2020b).

In this paper, we collect data on the asset and debt characteristics of financial intermediaries (in particular, bank holding companies), and analyze the extent to which a similar framework applies to the capital market debt of financial firms. We show that there are broad similarities, but also important twists. On the asset side, although intuitively financial firms have more liquid, separable assets than non-financial firms, other types of activities such as services are also important, especially for large institutions. Indeed, whereas the asset features of non-financial firms appear to be significantly shaped by the industry, the asset composition of financial firms varies much by size. On the debt side, although debt against going-concern values among financial firms is less prevalent than such debt among non-financial firms, its volume is still meaningful in aggregate. Notably, this type of debt among financial institutions appears to have much fewer covenants, relative to what we observe among non-financial firms. Thus financial institutions can be an interesting "out-of-sample" data point for analyses of covenants and creditor monitoring. To interpret our empirical findings, we develop a model in which limited effectiveness or limited threats from creditor control results in the absence of covenants and monitoring-intensive debt.

In the empirical analyses, we start with asset composition, then proceed to debt composition, and finally contract enforcement. First, on the asset side, we find that the pledgeable value of discrete assets (i.e., the amount of borrowing that discrete assets can support when pledged directly) accounts for about 60% of total assets in aggregate. By discrete assets, we mean assets that can be separated and repossessed on a standalone basis, such as securities, mortgages and other loans, and fixed assets in the case of financial intermediaries. This value is much larger compared to the case for non-financial firms, where the liquidation value of (non-cash) discrete assets is less than 25% of total assets in aggregate (Kermani and Ma, 2020b). Nonetheless, financial intermediaries do generate meaningful going-concern values from services (e.g., deposit franchise, commercial banking, underwriting, trading and market making, brokerage, etc.), which is not necessarily captured by the intrinsic value of discrete assets.

In addition, there is substantial heterogeneity in financial intermediaries' asset features. In general, the share of services revenue is higher among larger institutions, suggesting fixed costs or increasing returns to scale in the provision of services. We find that larger institutions and institutions with higher services revenue shares have a significantly smaller share of the pledgeable value of discrete assets in total assets. In particular, the size dependence of asset composition is much stronger among financial intermediaries than among non-financial firms, where asset features are largely tied to the industry. Financial intermediaries appear to have more scope for choice in asset composition.

Second, on the liability side, we find that the value of financial institutions' going-concern debt is about 10% to 15% of total assets in aggregate. This amount is meaningful and similar to the aggregate value of their asset-based debt.[1] By asset-based debt, we refer to capital market debt that has claims against discrete assets, analogous to creditors' use of the term among non-financial firms. For financial institutions, this type of debt includes repos and asset-backed securities, as well as borrowings against loans or fixed assets. By going-concern debt, we refer to capital market debt that has claims against *the firm as a whole*, rather than any well-defined discrete assets (e.g., a financial institution may derive value from its franchise, services, networks, which are not captured by discrete assets). This concept is analogous to what is often called cash flow-based debt among non-financial firms (Lian and Ma, 2020; Ivashina, Laeven, and Moral-Benito, 2020; Kermani and Ma, 2020b). Here we use the term "going-concern debt" instead, since the debt of financial intermediaries has less emphasis on borrowers' measurable cash flow value. While cash flow-based debt of non-financial firms includes both loans and bonds, as well as both secured and unsecured (or subordinated) debt, going-concern debt of financial intermediaries primarily takes the form of unsecured (or subordinated) bonds.

There is also substantial heterogeneity in the amount of going-concern debt among financial intermediaries. The amount (normalized by total assets) increases with size and

[1] As mentioned at the beginning, we treat deposits separately; their primary form of enforcement in the current US institutional environment is government regulation and deposit insurance.

services revenue share, and decreases with the share of the pledgeable value of discrete assets in total assets. The amount of asset-based debt shows the opposite pattern.

Finally, whereas cash flow-based debt of non-financial firms often emphasizes creditor monitoring of the borrower's financial performance and control in the borrower's actions, going-concern debt of financial institutions seems to have much weaker monitoring and control rights. Compared with non-financial firms of similar credit quality, there is a lower share in the form of loans, as well as a lower prevalence of financial covenants in both bonds and loans. Although in principle the possibility of government bailouts may substitute for creditor monitoring, and some research finds that bailouts reduce interest rates (Acharya, Anginer, and Warburton, 2016; Berndt, Duffie, and Zhu, 2019), we do not find that bailouts can fully explain the weak monitoring we observe (which is present among smaller intermediaries too, not just "too-big-to-fail" institutions). The composition of financial institutions' short-term debt in practice—mostly insured deposits and bankruptcy remote, largely nonrecourse repos—dampens the Diamond and Rajan (2001) mechanism where short-term debt monitors and monitoring by other creditors may not be necessary. Empirically we do not find that the amount of repos or deposits has explanatory power. Also, while standard measures among non-financial firms such as EBITDA (earnings before interest, taxes, depreciation, and amortization) are possibly less useful for evaluating financial intermediaries, the extensive use of measurable indicators in regulation suggests there are measurable and contractible signals which can be used for monitoring financial intermediaries. The most plausible explanation we find is the difficulty to reform or orderly restructure financial intermediaries. If borrowers were to violate covenants (e.g., due to managerial incompetence), creditors may not have good alternatives because these institutions are opaque and complicated, or because orderly restructuring such as Chapter 11 is difficult to implement given the nature of financial intermediaries. This lack of feasible creditor interventions would diminish the value of covenants and creditor control.

After presenting the empirical findings, we provide an equilibrium model to shed further light on the results. In the model, a financial intermediary can invest in two types of projects: 1) discrete, separable assets, and 2) other activities (which may generate services revenue etc.). It has an endowment of equity and deposits, and can finance the discrete assets with asset-based debt, or finance investments in general with going-concern debt. We find that the heterogeneity in asset composition and debt composition, such as the pronounced size dependence, cannot be easily delivered by risk aversion. It is more likely that large institutions have an advantage in investing in other assets (such as services). In addition, we use the model to show that if creditors do not have effective ways to restructure or reform the borrower institutions should they violate covenants, then covenants would not be very useful and would be less prevalent in contracts ex ante. The model also suggests that if there are higher private benefits from being in charge of financial institutions, and correspondingly management exerts great effort to stay under control, this could reduce the role for covenants as well.

Taken together, the data suggests that financial institutions, especially large institutions, are not just about holding discrete assets. Services and going-concern values are important. Correspondingly, debt against going-concern values is prevalent, especially among large institutions. However, the enforcement of going-concern debt is non-trivial, given the difficulty in reforming or restructuring complex institutions that engage in liquidity provision (Duffie, 2010; Scott, 2012; Oehmke, 2014). In this case, monitoring and control by creditors can be challenging to implement.

Literature Review. There is a large literature on the funding of financial institutions. A prominent strand of research since Diamond and Dybvig (1983) studies liquidity provision through financial intermediaries' deposit liabilities (Gorton and Pennacchi, 1990; Kashyap, Rajan, and Stein, 2002; Hanson, Shleifer, Stein, and Vishny, 2015; Donaldson and Piacentino, 2020; Ma, Xiao, and Zeng, 2020). Following the 2008 financial crisis, a number of papers examine the asset-based debt of financial intermediaries, such as repos and asset-backed commercial papers (Gorton and Metrick, 2012; Krishnamurthy, Nagel, and Orlov, 2014). We show that the going-concern debt of financial intermediaries is important as well, and its enforcement raises interesting questions. In addition, we provide a systematic comparison of financial intermediaries with non-financial firms in asset composition, debt composition, and monitoring intensity to demonstrate the similarities and differences, which to our knowledge has not been analyzed in the literature.

Many papers on financial intermediaries also examine the issue of debt maturity (Brunnermeier and Oehmke, 2013; Milbradt and Oehmke, 2015; Bai, Krishnamurthy, and Weymuller, 2018). Going-concern debt among financial intermediaries is generally long-term, perhaps in part because going-concern values largely derive from longer-term investments. Its maturity is not shorter than that of comparable debt among non-financial firms. Asset-based debt of financial intermediaries, on the other hand, is often very short-term (to enhance the provision of safety and liquidity). Nonetheless, some asset-based debt of financial intermediaries is not necessarily ultra short-term, like Federal Home Loan Bank (FHLB) advances against mortgages.

Finally, our work relates to empirical research on different approaches of debt enforcement, where many studies focus on non-financial firms. A long literature investigates the role of discrete or tangible assets (Benmelech, Garmaise, and Moskowitz, 2005; Benmelech and Bergman, 2009; Chaney, Sraer, and Thesmar, 2012; Rampini and Viswanathan, 2013). Another set of work analyzes the importance of creditors' monitoring and control of borrowers' actions (Roberts and Sufi, 2009; Nini, Smith, and Sufi, 2012; Matvos, 2013; Green, 2018; Kermani and Ma, 2020b). Our paper provides evidence from financial intermediaries and shows the connection with results among non-financial firms. We demonstrate that financial firms provide interesting "out-of-sample" data points for analyses of creditor monitoring and control. We document weak creditor control in this setting, examine the possible explanations, and highlight that this phenomenon provides valuable information for understanding the foundations of creditor control.

The rest of the paper proceeds as follows. Section 2 describes the data and definitions. Sections 3, 4, and 5 present results on asset composition, debt composition, and monitoring intensity, respectively. Section 6 outlines the model. Section 7 concludes.

2 Data and Definitions

In this section, we describe the data and the construction of the main variables.

2.1 Asset Composition

For asset composition of financial intermediaries, we collect data on bank holding companies from FR Y-9C reports. The reporting institutions mainly include commercial banks before 2009, and some broker dealers after 2009 (e.g., Goldman Sachs and Morgan Stanley).

For each institution, we define discrete assets as standardized, transferable assets that can be separated and repossessed on a standalone basis, denoted by α_x. The institution may also have additional assets that generate revenue (e.g., networks, organizational capital, etc.), denoted by α_y. The institution can directly pledge the discrete assets α_x and borrow based on their standalone resale values. We estimate the pledgeable value of the discrete assets, denoted by $\lambda\alpha_x$ (i.e., the amount of debt that discrete assets can support when pledged directly). Specifically, for each institution i in each year t, we construct $\lambda\alpha^i_{x,t} = \sum_j \lambda_j \alpha^i_{x,j,t}$, where λ_j is the liquidation recovery rate (one minus the haircut) of asset class j and $\alpha^i_{x,j,t}$ is the balance sheet amount of asset j held by institution i in year t. In our baseline analysis, we use a constant λ_j for each asset class. We also perform robustness checks that allow λ_j to vary over time, which show almost identical results. Our method for constructing $\lambda\alpha_x$ for banks is analogous to the procedure in Ma, Xiao, and Zeng (2020).[2]

In α_x, we include the following asset categories: a) securities (e.g., Treasuries, government and municipal securities, MBS, ABS, bonds, and equities); b) reverse repos (not including securities borrowed), which represent collateral received for repo loans that the lender may use to raise financing (through rehypothecation); c) mortgages and real estate loans; d) commercial and industrial loans; e) consumer loans; f) fixed assets (e.g., real estate).

For λ_j, we collect data for each asset class, summarized in Table 1: a) for securities, our baseline analyses use the average haircut reported by Bai, Krishnamurthy, and Weymuller (2018); b) for reverse repos, we assume an average λ of 80% as a proxy of the value allowed for rehypothecation; c) for mortgages, we follow Federal Home Loan Banks' advance rate guidelines for lending against mortgage assets: 80% for single family, 75% for multi family, 70% for commercial real estate, and 60% for other real estate loans (Federal Home Loan Banks System, 2018); d) for commercial and industrial (C&I) loans, we assume that 60% of the balance sheet value of large commercial loans and 20% of the small business loans can be pledged directly; in practice C&I loans held by banks

[2]In the US, financial institutions report the net amount of derivatives (rather than the gross amount). Given that derivatives in the US are also largely bankruptcy remote (Bolton and Oehmke, 2015), the US reporting format is what we need in the empirical analyses and in the model (rather than reporting gross amounts).

are not easy to pledge directly for borrowing, since the drawn amount on credit lines can be highly variable and banks may also need to play an active role in monitoring borrower firms (e.g., lead banks in syndicated loans need to collect information on borrowers and organize renegotiations), so our assumptions may overestimate the effective λ on C&I loans; e) for consumer loans, we assume a 60% advance rate; f) for real estate and fixed assets, we also use a 60% advance rate, assuming that most of these assets are commercial real estate (e.g., office buildings, branch offices). One can also include cash and reserves in α_x with $\lambda = 1$. Our main results are similar with or without cash holdings. For securities, we can also obtain the time series of λ_j using data on tri-party repo haircuts from Krishnamurthy, Nagel, and Orlov (2014) and from the New York Fed. Our results are the same using such time-varying estimates of λ_j because the haircut variations in these datasets are relatively small. In any case, our main analysis focuses on cross-sectional differences across institutions, and always controls for year fixed effects, so the measurement of time-varying λ is not central.

For comparisons with non-financial firms, we measure $\lambda\alpha_x$ of non-financial firms using the liquidation value of their discrete assets (which mainly include property, plant, and equipment, inventory, and receivable) constructed by Kermani and Ma (2020a). These liquidation values are estimated orderly liquidation recovery rates based on information from the liquidation analyses in Chapter 11 filings. Overall, discrete assets of financial institutions are much more generic, given they are more standardized, easier to transfer, and have large liquid markets. The level of λ correspondingly is much higher compared to that for non-financial firms.

2.2 Debt Composition

We also collect detailed data on the debt composition of financial intermediaries. In particular, we classify debt into three categories.

The first category consists of debt against discrete assets, including repos, asset-backed and securitized debt; FHB advances (generally collateralized by mortgages); other debt against receivables, equipment, real estate, etc. This category is analogous to "asset-based debt" among non-financial firms studied in several recent papers (Lian and Ma, 2020; Ivashina, Laeven, and Moral-Benito, 2020; Kermani and Ma, 2020b). Debt against discrete assets has high priority claims against the liquidation value of these particular assets, but not against the firm value in general. For financial institutions, such debt claims (e.g., repos) are often bankruptcy remote: they are separate from the bankruptcy estate and are paid based on the liquidation value of the particular assets pledged to them.

The second category consists of debt against the going-concern value of the institution as a whole, rather than any particular well-defined discrete assets. In the context of US financial intermediaries, it typically takes the form of bonds or convertible securities, and we include (non asset-backed) commercial papers as well; in certain cases, it may also take the form of loans (which are much more common among non-financial firms). This category is analogous to "cash flow-based debt" among non-financial firms (Lian and Ma, 2020; Kermani and Ma, 2020b). In the context of financial intermediaries, we refer to this type of debt as "going-concern debt" instead of "cash flow-based debt." The reason is this type of debt has a much stronger emphasis on the value of measurable cash flows among non-financial firms, whereas financial intermediaries' going-concern values may not always be well-captured by cash flows, as we discuss more later.

The third category is deposits. We think of deposits as products mainly for transaction and liquidity purposes, and debt enforcement relies on redemption or government deposit insurance. Thus we separate deposits from capital market debt which may utilize more contractual mechanisms for debt enforcement.

For the classification of capital market debt in the first two categories, we mainly rely on detailed debt-level data from CapitalIQ which is available starting in 2003 for most public firms. For deposits, we use information from FR Y-9C filings.

For both asset composition and debt composition, our primary measures are normalized by total book assets. Total book assets proxy for the total costs of investment, and we study how they can be funded in different ways.

2.3 Debt Covenants

Finally, we collect data on debt covenants. We obtain covenants in loans from DealScan and covenants in bonds from Mergent's Fixed Income Securities Database (FISD).

2.4 Sample Description

As mentioned above, our analyses investigate bank holding companies. We thus restrict to firms with SIC codes starting with 60 (depository institutions), 6211 (broker-dealers), and 6712 (other bank holding companies). After combining data on asset composition and debt composition, we have about 780 bank holding companies and 5,500 bank-year observations from 2003 to 2016. As we discuss further in Section 5, in December 2016, the Federal Reserve announced the total loss-absorbing capacity (TLAC) regulation that specifically requires global systematically important banks (GSIBs) to hold long-term unsecured and subordinated debt as loss absorption buffer. The regulation was implemented starting in January 2019. Our sample period precedes this regulation, so the results are not simply a reflection of TLAC regulatory requirements. Table 2 provides summary statistics of the sample.[3]

3 Asset Composition of Financial Intermediaries

In this section, we document the asset characteristics of financial intermediaries. We study the aggregate composition in Section 3.1, bank-level composition in Section 3.2, and summarize a comparison with non-financial firms in Section 3.3.

3.1 Aggregate Composition

In the aggregate, we find that the pledgeable value of (non-cash) discrete assets, namely the total value of $\lambda\alpha_x$, is about 60% of total book assets. Figure 1 Panel A shows a time series plot of the aggregate share of $\lambda\alpha_x$, for commercial banks (red solid line) and broker dealers (blue dotted line). Panel B additionally includes the value of all cash. The magnitudes are very similar if we instead divide $\lambda\alpha_x$ by the total market value, since the market-to-book ratio of banks is close to one. Figure 1 also includes a comparison with non-financial firms (green line with diamond). For non-financial firms, the pledgeable value of discrete assets ($\lambda\alpha_x$) is much lower, at less than 25% of total assets: non-financial firms' assets are highly specific and the liquidation value of discrete assets is generally limited (Kermani and Ma, 2020a).

Figure 2 shows a further decomposition of $\lambda\alpha_x$: Panel A shows that for financial institutions, roughly one half of the value comes from securities and another half from loans; other assets such as fixed assets contribute minimally. Panel B shows that among

[3] In the data, we observe book values of banks' assets and liabilities: the value α_x and the value of debt are book values rather than market values. Although banks are subject to fair value accounting, they do not always mark asset values to market (Laux and Leuz, 2010), so we may not be able to fully detect the cyclical variations in the market value of bank assets. In our main analyses below, we focus on cross-sectional variations (with time fixed effects) to analyze determinants of asset and debt composition.

non-financial firms, roughly one half of $\lambda\alpha_x$ comes from working capital, and another half from fixed assets (property, plant, and equipment).

Although financial intermediaries' assets are much more generic than non-financial firms' assets, there is still a sizable fraction of value in the aggregate beyond the pledgeable value of discrete assets. As we discuss below, institutions also generate value from services, networks, human capital, and organziational capital, which are not captured by the intrinsic value of discrete assets. For instance, institutions with a smaller share of $\lambda\alpha_x$ in total assets are associated with indications of stronger services functions: they have a larger share of non-interest income in total revenue, and a larger share of commercial lending to non-financial borrowers with high asset specificity.

3.2 Bank-Level Composition

Figure 3 plots the histogram of $\lambda\alpha_x$ as a share of total assets among the financial intermediaries in our sample. The data shows a fair bit of dispersion among different institutions. The median ratio is about 0.67, which is larger than the aggregate ratio shown above.

Figure 4 and Table 3 show the relationship between the share of $\lambda\alpha_x$ in total assets and several bank characteristics, including size and features of economic activities. Figure 4 Panel A and Table 3 column (1) show the ratio decreases significantly with size: for larger financial institutions, $\lambda\alpha_x$ is a smaller share of total assets. Figure 4 Panel A and Table 3 column (2) show the amount of $\lambda\alpha_x$ also decreases with the fraction of revenue from services (proxied by non-interest income). Table 3 column (3) shows that financial institutions with less $\lambda\alpha_x$ also tend to lend to non-financial borrowers with higher asset specificity (lower liquidation value), as reflected by the average borrower liquidation value in syndicated loans from DealScan data.[4] The idea is that loans to borrowers with higher asset specificity have more intensive monitoring by lenders (Kermani and Ma, 2020b), which is a form of services. Finally, columns (4) and (5) show that there is some overlap in these metrics. Size and the importance of services are positively correlated, and the coefficient on each variable decreases somewhat when they are both included. Nonetheless, they still remain statistically significant and both account for variations in $\lambda\alpha_x$.

3.3 Comparison with Non-Financial Firms

As shown in Figure 1, compared to non-financial firms, financial institutions' assets are much more generic: the pledgeable value of discrete assets, $\lambda\alpha_x$, is a much higher fraction of total assets. These differences mainly reflect the different nature of assets among non-financial firms and financial institutions. The separable assets α_x among non-financial firms primarily take the form of physical assets that can be costly to transport or custom designed, and therefore have low λ and limited liquidation values (see Kermani and Ma (2020a) for more analyses on determinants of λ among non-financial firms). In comparison, the separable assets α_x among financial firms primarily take the form of financial securities that are relatively standardized, and are tradable in large and liquid markets.

In addition, among non-financial firms, variations in the value of $\lambda\alpha_x$ is largely an industry characteristic. For instance, for variations in the amount of $\lambda\alpha_x$ (normalized by total assets), two-digit SIC fixed effects account for 40% of R^2, and four-digit SIC fixed effects account for 50% of R^2. The size effect, on the other hand, is very weak

[4]Specifically, we calculate the borrower liquidation value (normalized by borrower book assets) using the procedure in Kermani and Ma (2020a,b). Then for each lender in each year, we take all the loan facilities the lender participates in, and calculate the average borrower liquidation value weighted by facility amount.

compared to results in Table 3. Controlling for industry fixed effects, the coefficient on log book equity is about -0.001 and the incremental R^2 from size proxies is close to zero. Taken together, for non-financial firms, asset features are largely driven by the nature of production activities at the industry level (e.g., assets of transportation companies are much more generic than assets of electronic manufacturers). For financial intermediaries, the features of assets and economic activities have more variations within the commonly defined industry, and some institutions engage in more services-intensive activities (e.g., market making, derivatives trading, commercial lending) than others.

4 Debt Composition of Financial Intermediaries

In this section, we turn to the characteristics of financial intermediaries' capital market debt. In particular, we are interested in the role of debt against discrete assets versus debt against going-concern values, as defined in Section 2.2. We study the aggregate composition in Section 4.1, bank-level composition in Section 4.2, and summarize a comparison with non-financial firms in Section 4.3.

4.1 Aggregate Composition

Figure 5 shows that the value of going-concern debt is almost as large as that of asset-based debt in aggregate. Going-concern debt as a share of total assets is about 25% among broker dealers (blue dashed line with circles) and about 10% among commercial banks (red solid line with circles). In comparison, asset-based debt (sum of repos, securitized debt, FHLB advances, etc.) has about the same magnitude: its value is roughly 20% of total assets among broker dealers, which falls sharply to slightly above 10% after around 2013 (green dashed line with diamonds), and roughly 10% of total assets among commercial banks (purple solid line with diamonds). Overall, the aggregate quantity of going-concern debt is sizable.

4.2 Bank-Level Composition

Figure 6 plots the histogram of going-concern debt as a share of book assets among the financial intermediaries in our sample. The distribution is fairly skewed. At the bank level, the median share is about 2%, much smaller than the share in aggregate.

Figure 7 and Table 4 show the relationship between going-concern debt and several bank characteristics. We normalize going-concern debt by total assets to maintain the same denominator for balance sheet variables, but the results are similar if we alternatively normalize by book equity or by total capital market debt.

First, Figure 7 Panel A and Table 4 column (1) show there is a significant negative correlation between the amount of going-concern debt and the amount of $\lambda\alpha_x$: institutions with more generic, directly pledgeable discrete assets (higher $\lambda\alpha_x$) have less going-concern debt and vice versa. Second, Figure 7 Panel B and Table 4 column (2) show that there are again variations with size: larger institutions have more going-concern debt. Third, Figure 7 Panel C and Table 4 column (3) show that there are also variations with the role of services: institutions that have stronger services functions (larger share of revenue from non-interest income) have a larger amount of going-concern debt. Table 4 column (4) shows that there is overlap among these characteristics, so the coefficient on each variable decreases somewhat when the variables are included together, as would be expected based on findings in Section 3.2. Overall, the share of going-concern debt decreases with the amount of $\lambda\alpha_x$, but size still plays an additional role even controlling for $\lambda\alpha_x$. Finally, several recent studies suggest that the deposit franchise contributes to banks' going-concern values (Egan, Lewellen, and Sunderam, 2018; Drechsler, Savov, and Schnabl, 2020; Ma, Xiao, and Zeng, 2020). For instance, deposits may provide cheap and stable financing, and deposit-related services may generate fee revenue. In the data, we also observe that banks with more deposits have more going-concern debt as a share of total capital market debt.[5]

4.3 Comparison with Non-Financial Firms

For US non-financial firms, Lian and Ma (2020) document that in the aggregate cash flow-based debt is about four times the amount of asset-based debt. As shown above in Section 4.1, for financial intermediaries, in the aggregate going-concern debt has about the same value as asset-based debt. In other words, financial institutions do have a lower usage of debt based on going-concern in comparison. This is consistent with financial institutions having a larger amount of generic assets than non-financial firms, as discussed in Section 3. For both non-financial firms and financial intermediaries, the share of going-concern debt in total assets decreases with $\lambda\alpha_x$, and increases with size.

The seniority structure also appears somewhat different for cash flow-based debt of non-financial firms and going-concern debt of financial intermediaries. Among cash flow-based debt of non-financial firms, about 15% of debt outstanding by value is secured (e.g., blanket liens against the firm as a whole),[6] and around 5% is subordinated. Among going-concern debt of financial intermediaries, less than 1% of debt outstanding by value is secured, and around 20% is subordinated. For the cash flow-based debt of

[5]Here we need to use going-concern debt as a share of total capital market debt. If we instead normalize going-concern debt by total assets, then there would be a mechanical negative correlation between the deposit share in total assets and the share of other types of debt in total assets.

[6]The collateral value of this type of secured debt is the going-concern value of the firm, minus the liquidation value of discrete assets pledged separately. In other words, a debt contract secured by a blanket lien on the firm has a high priority claim against the going-concern value of the firm (i.e., in bankruptcy it obtains a senior claim up to the firm's going-concern value, minus the liquidation value of discrete assets pledged separately). On the other hand, a debt contract secured by discrete assets such as a piece of equipment (asset-based debt) has a high priority claim against the value of the equipment (i.e., in bankruptcy it obtains a senior claim up to the liquidation value of the equipment).

non-financial firms, taking seniority explicitly through having secured claims (against the firm as a whole) can be important for creditor control (Donaldson, Gromb, and Piacentino, 2019; Kermani and Ma, 2020b). Correspondingly, the absence of secured going-concern debt may be related to the weakness of creditor monitoring and control that we discuss below in Section 5.

Another noticeable difference with non-financial firms is the determinants of debt capacity. For non-financial firms with substantial cash flow-based debt, total debt of the firm is typically benchmarked to operating earnings (specifically EBITDA, i.e., earnings before interest, tax, depreciation, and amortization) (Lian and Ma, 2020). For instance, when non-financial firms seek to issue debt, total debt is commonly restricted to a multiple of earnings. In addition, they may need to comply with financial covenants that set bounds of total debt or debt payments relative to earnings. For financial firms, however, bounds of total debt relative to earnings are rare, for either debt issuance or maintenance. For instance, for financial institutions like JP Morgan, Goldman Sachs, and Morgan Stanley, the ratio of total debt (not including deposits) to earnings may exceed 10 or 20, which is much higher than the level permitted for non-financial firms (e.g., debt to EBITDA of 4 to 6). There are several possible reasons why the standard debt to earnings benchmarks among non-financial firms do not seem to apply to financial institutions. One possibility is that accounting earnings are less useful for assessing the performance of financial institutions. Most simply, EBITDA does not typically include capital gains and losses on assets. It also does not include interest expenses.[7] Another possibility is that government support creates value for financial institutions beyond their own earnings (Atkeson, d'Avernas, Eisfeldt, and Weill, 2019). For example, we find that the ratio

[7] For non-financial firms, non-operating income like capital gains and losses are excluded from EBITDA because they are not part of the core business. The aim of excluding interest expenses is to avoid the impact of the debt tax shield and to make earnings more comparable regardless of capital structure. For financial firms, however, interest expenses are part of the core financial intermediation activity.

of the market value of the firm to operating earnings is substantially higher among financial institutions, and significantly increasing in size (in line with the possibility that large institutions benefit more from government support). On the other hand, this ratio decreases with size among non-financial firms.

Finally, an evident difference between financial institutions and non-financial firms is the level of leverage. This difference is mainly driven by deposits: capital market debt (non-deposits) as a share of total assets, if anything, is smaller among financial institutions in our sample. Deposit-taking is a key function of financial intermediaries and may also offer subsidized funding (Drechsler, Savov, and Schnabl, 2020). Therefore, the higher level of leverage among financial institutions due to deposits is not surprising, and is not a primary focus of our study.

5 Enforcement of Going-Concern Debt

Among non-financial firms, enforcement of debt against firms' going-concern values is frequently associated with covenants, i.e., legally binding contractual provisions that restrict borrowers' behavior. These covenants provide creditors with contingent control rights (in the case of covenant violation) to influence firms' management and operations (Chava and Roberts, 2008; Roberts and Sufi, 2009; Nini, Smith, and Sufi, 2012). In this section, we analyze the usage of covenants in financial intermediaries' going-concern debt. We first show that financial intermediaries appear to have fewer covenants than comparable non-financial firms. Financial intermediaries also have a substantially smaller share of such debt in the form of loans, which are commonly considered to have stronger monitoring and stronger covenants. We then discuss potential explanations for these differences.

5.1 Monitoring Intensity

Figure 8 plots the fraction of bond issues (Panel A) and loan issues (Panel B) with financial covenants by issuer ratings, for non-financial firms and financial intermediaries in our sample. Bond financial covenants use data from FISD, which records covenants whenever the bond prospectus mentions covenants.[8] Loan financial covenants use data from DealScan. Because loans are rare among financial firms (as discussed below), their loan documentation and covenant information can be less comprehensive. With this caveat in mind, we treat the analysis using loan covenants as one of several tests on monitoring intensity. The shading of the bar color increases with the number of observations from financial intermediaries in each issuer ratings category. We see that financial intermediaries generally have a lower prevalence of covenants, except in some cases for low-rated issuers where there are few observations of financial intermediaries.

In addition, it is commonly observed that commercial loans have stronger covenants and more active monitoring compared to bonds (Diamond, 1984, 1991; Holmstrom and Tirole, 1997). Figures 9 shows that among financial intermediaries' going-concern debt, the share of loans is also much lower than comparable non-financial firms. This difference can further contribute to the weakness of covenants for financial intermediaries.

In all of the comparisons above, we condition on issuer ratings to control for credit quality. In other words, the observation that financial intermediaries have a lower prevalence of covenants is not driven by financial intermediaries having a higher credit quality. Even for the same issuer rating category, financial intermediaries have a lower prevalence of covenants than non-financial firms. Indeed, conditioning on issuer ratings is likely conservative, given that recent research indicates some financial intermediaries' ratings

[8] We exclude medium term notes (MTNs) to be conservative since the documentation of covenants in bond prospectus may be less clear for medium term notes. For the bond sample, we also exclude foreign currency bonds and asset-backed bonds. For loans, we similarly exclude asset-based loans.

could have been inflated pre-crisis (Berndt, Duffie, and Zhu, 2019). Correspondingly, in each issuer ratings bin, the financial intermediaries could have lower credit quality than the non-financial firms, and if anything should have more—not fewer—covenants.

Table 5 Panel A shows corresponding regression results controlling for basic firm characteristics. We combine and compare non-financial firms and financial intermediaries. In column (1), the outcome variable is a dummy variable of having at least one financial covenant in a given bond issue. In column (2), the outcome variable is a dummy variable of having at least one financial covenant in a given loan issue. In column (3), the outcome variable is the share of loans in going-concern debt (cash flow-based debt for non-financial firms).[9] We use a linear model, and control for year fixed effects and issuer ratings fixed effects similar to the comparisons in Figure 8. In all three columns, we see a negative and significant coefficient on the dummy for financial intermediaries. For financial intermediaries in our sample, the fraction of debt issues with financial covenants is about 10 to 20 percentage points lower than that for non-financial firms. The share of loans in going-concern debt is about 30 percentage points lower. Finally, although it is sometimes viewed that shorter maturity can compensate for the lack of covenants, we do not find shorter maturity for the going-concern debt of financial firms relative to comparable debt of non-financial firms. The results in our tests of covenant prevalence are also very similar if we additionally control for debt maturity.

5.2 Potential Explanations

Why are covenants and creditor control rights weaker among financial intermediaries? We discuss four classes of possible explanations.

The first set of explanations focuses on the role of government supervision in the case

[9] We focus on the presence of financial covenants, instead of the tightness, since covenant tightness can be challenging to compare across different covenant formulas and different types of firms.

of financial intermediaries: regulations and bailouts may substitute for monitoring by creditors. Specifically, creditors' expected losses are driven by the probability of default and loss given default. For financial intermediaries, there are extensive government regulations aimed at decreasing the probability of default. Government bailout may also decrease both the probability of default and loss given default for creditors. Acharya et al. (2016) find that bond spreads are sensitive to measures of risk for medium and small financial institutions, but much less so among large financial institutions. Berndt, Duffie, and Zhu (2019) find that prior to the financial crisis, bond yields of large financial institutions indicate significant bailout subsidies. Government interventions may thus decrease the necessity of creditor monitoring.

We assess the role of government interventions in explaining weak creditor monitoring by comparing covenant prevalence among globally systematically important banks (GSIBS), which are subject to particularly heavy government interventions (regulations or bailouts), with covenant prevalence among large non-GSIB banks (top 20 by size) and other banks. Table 6 Panel A analyzes the prevalence of covenants among financial intermediaries' loan issues and bond issues, and tests its relationship with a dummy for GSIBs and a dummy for large banks. It shows that large banks in general have slightly fewer covenants, but GSIBs do not necessarily have much fewer covenants than other large banks. In addition, Table 6 Panel B provides a placebo check using non-financial firms: large banks roughly correspond to top 2% firms by revenue and GSIBs roughly correspond to top 1% firms by revenue. If we add dummies for top 1% and top 2% by size (revenue), we also find a lower prevalence of covenants among these largest non-financial firms all else equal. Finally, even after excluding the largest institutions (GSIBs and top 1% non-financial firms), we still find lower covenant prevalence among financial firms compared to non-financial firms as shown in Table 5 Panel B. Overall, we have not found strong evidence that government intervention provides a full account of the lower prevalence of covenants among financial intermediaries. In other words, while government interventions may affect the pricing (Acharya, Anginer, and Warburton, 2016) and quantity of financial firms' going-concern debt, especially for the largest institutions, we do not find that they fully explain weaker creditor monitoring (which applies not just to the largest institutions).

The second set of explanations draws on the observation of Diamond and Rajan (2001) that short-term debt may provide monitoring of financial intermediaries, and substitute out monitoring by other creditors. For US financial intermediaries, short-term debt primarily takes the form of deposits and repos.[10] For deposits, insured deposits are not very likely to have strong incentive to monitor (Egan, Hortaçsu, and Matvos, 2017). Even uninsured deposits are unlikely to be as sophisticated as professional investors. For repos, most contracts are bankruptcy remote and largely nonrecourse (Roe, 2010; Duffie and Skeel, 2012; Bolton and Oehmke, 2015). Thus creditors' payoffs are primarily determined by the value of repo collateral, rather than the performance and governance of the institution. Correspondingly, their monitoring incentives could also be weak. Table 6 Panel A also shows that among financial intermediaries, we do not observe having more deposits or repos is associated with a lower prevalence of covenants.[11]

The third set of explanations is there may be fewer informative, contractible signals to use for covenants in the case of financial intermediaries. As discussed in Section 4.3, accounting earnings (such as EBITDA, the standard measure used among non-financial firms) may not be informative about financial institutions' performance, and do not ap-

[10] Another form is commercial papers: the total value of commercial paper liabilities reported by banks is less than 2% of total assets, and their monitoring role might also be limited.

[11] We normalize deposits and repos by bank size measured using book equity. Results are similar if we instead normalize using total assets (but this normalization could be subject to the concern that the shares of different types of liabilities need to add up to one).

pear to be used to assess debt capacity. In particular, some earnings metrics (such as EBTIDA) do not include capital gains and losses or charge-offs, which are central to financial firms. EBITDA also does not include interest expenses, which are more substantial for financial institutions. Other earnings metrics (such as net income) do take these items into account, but banks can have substantial discretion in estimating and reporting capital gains and losses (Laux and Leuz, 2010). Recent research also finds that major US banks delayed and under-estimated loan losses leading up to the crisis (Bischof, Laux, and Leuz, 2019). However, measurable metrics are used extensively in banking regulation, which suggests that there are at least some measurable and informative indicators. Therefore, even though covenants based on earnings may not be very useful among financial institutions, in principle covenants can utilize alternative metrics.

The fourth set of explanations is that creditors lack effective mechanisms to enforce covenants. Creditors may not have credible threats in the case of financial intermediaries. In particular, when covenants are violated, creditors have the legal power to accelerate payments (i.e., make the debt due immediately), which they can use as threats during the renegotiation process to influence borrowers' financial and real decisions and implement their requests (Nini, Smith, and Sufi, 2012). Such threats are credible if creditors can expect to get reasonable payoffs upon payment acceleration (which likely result in the borrower filing for bankruptcy). Correspondingly, Kermani and Ma (2020b) find a positive correlation between the average enterprise value in Chapter 11 restructuring in an industry (a proxy for firm value under creditor control) and indications of monitoring intensity, including both loan covenant tightness and the amount of cash flow-based loans. For financial intermediaries which engage in liquidity provision and can be subject to runs, orderly restructuring has been challenging. If creditors were to accelerate payments after covenant violation and trigger bankruptcy of the borrower, their payoffs could be very low, which limits the scope for creditor control. Relatedly, even if some form of restructuring can happen, it may be difficult to fix problems or find better management teams given that financial intermediaries can be complicated and opaque.

In addition, in part due to the challenges for private restructuring of financial intermediaries, it is common for the government to be actively involved in the distress resolution of financial intermediaries. The government may also restrict creditors' control rights. Most recently, total loss-absorbing capacity (TLAC) requirements announced by the Federal Reserve in December 2016 prohibit the going-concern debt of relevant financial intermediaries from having meaningful covenants and creditor control rights. Indeed, this could reflect the government's preference to be actively involved in the distress resolution of financial intermediaries: the government aims to be in control rather than relying on creditor control. If covenants in private contracting are difficult to enforce and less useful in any case, the requirement may not be a major issue. Nonetheless, if private orderly restructuring of financial institutions becomes feasible at some point, which may increase the enforceability of covenants, then the TLAC "covenant-free" requirements could weaken otherwise useful creditor monitoring. Overall, when creditors lack the ability to enforce effective monitoring and resolve under-performance (e.g., by replacing management, implement restructuring), there tends to be more government regulation. Government regulation could then make it even more difficult for creditors to implement monitoring and control rights.

6 Simple Model

In the following, we present a simple model to further understand the economic mechanisms that can give rise to the empirical results we observe among financial firms.

In Section 6.1, we analyze variations of asset and debt composition among financial firms, especially along the dimension of size, as discussed in Sections 3 and 4. In Section 6.2, we investigate the low prevalence of debt covenants among going-concern debt k of financial firms, as discussed in Section 5.[12]

In the model, a risk-averse entrepreneur (bank) has equity endowment e. The entrepreneur can invest in discrete assets α_x with random return x, or in other projects (e.g., services) α_y with random return y. We model the asset structure as a choice by the entrepreneur, which reflects the greater flexibility in selecting assets and business models among financial firms as suggested by Section 3. The entrepreneur can borrow against the pledgeable value of discrete assets $\lambda\alpha_x$ (through asset-based debt) with nonrecourse and rate of return r_p. The entrepreneur can also borrow against firm value in general (going-concern debt) of amount k with coupon c. We assume that lenders are willing to supply any amount of such debt demanded by the entrepreneur, provided the expected rate of return is at least a constant R. Finally, the entrepreneur can obtain deposits up to an amount D, with return r and guaranteed by the government. The government charges a deposit insurance premium (per unit of deposit) that equals the expected loss L.

The investment returns x and y in our model are observable and verifiable, so contracts can specify payments based on investment payoffs. Accordingly, the entrepreneur will not be able to repudiate payments when investment returns are high, or to steal output (unlike models where payoffs are not verifiable such as Hart and Moore (1994) and Hart and Moore (1998)). This assumption of payoff verifiability is natural in the US institutional environment, with generally strict financial auditing, SEC supervision, and

[12]As shown in Sections 3 and 4, financial firms also have more $\lambda\alpha_x$ and a higher prevalence of asset-based debt compared to non-financial firms. Since a key part of the higher value of $\lambda\alpha_x$ among financial firms arises from exogenous features of the types of assets they have, our model does not focus on addressing this difference between financial and non-financial firms.

effective courts, as well as additional government regulation in the case of financial institutions. The verifiability of payoffs is especially relevant for the value of going-concern debt k.[13] Because our focus is debt contracting, we also assume that the bank manager and shareholders are fully aligned, and the entrepreneur represents equity holders too.

6.1 Variation in Asset and Debt Composition

In Sections 3 and 4, we find that financial institutions' asset composition and debt composition varies substantially by size. In particular, unlike most non-financial firms where asset composition is driven largely by the industry, financial institutions' asset composition appears to be more of an endogenous choice that differs by size. Smaller institutions hold more discrete asset (α_x). They also borrow more asset-based debt. We start by studying what might explain the role of size in financial intuitions' asset and debt composition.

For simplicity of illustration and to obtain clear comparative statics, we consider an environment with four states, with probability π_i and returns x_i on α_x and y_i on α_y for each state $i \in \{1, 2, 3, 4\}$. In order to avoid the entrepreneur specializing in only one type of asset, we need enough variability on the relative returns of x and y across the different states. We thus assume that in state 1, α_y has low returns and the returns on α_x are also low enough, so the entrepreneur fully defaults on debt. In addition, to simplify the calculation of the deposit insurance premium, we assume that the cost of default is large enough so that the deposit insurer receives zero in state 1. In state 2, $y_2 \leq R$, but the returns on α_x and the presence of equity and deposits may compensate these

[13]There are two aspects of verifiability that could be relevant. First, when the entrepreneur has good performance, k will be paid accordingly, instead of repudiated. Second, when the entrepreneur has poor performance and defaults, the court will assign payments to k based on realizations of investment payoffs. The value of k in bankruptcy is important among non-financial firms (Lian and Ma, 2020; Kermani and Ma, 2020b), since Chapter 11 restructuring is reasonably streamlined and payments to creditors in Chapter 11 are largely based on the enterprise value of the reorganized firm. The value of k in bankruptcy can be more limited among financial institutions, given the challenges of orderly restructuring.

losses, so there is no default. In contrast, in state 3, the returns on discrete assets are low $x_3 < \lambda r_p$, but returns on α_y are sufficient to avoid default (in particular, $y_3 > \frac{R}{1-\pi_1}$). In state 4, both α_x and α_y yield relatively good returns, so that no investment subsidizes another ex-post. In particular, $x_4 > r_p$ and $y_4 > \frac{R}{1-\pi_1}$. We will impose parameter values such that, in equilibrium, defaults on debt or deposits only occur in state 1.

In Appendix A.2, we show it is straightforward to see that if the entrepreneur's utility follows CARA, namely $u(z) = 1 - \exp(-Az)$, then asset composition would be homogeneous among institutions with different characteristics. For example, there is no variation with respect to size (i.e., equity endowment): $\frac{\partial \alpha_x}{\partial e} = \frac{\partial \alpha_y}{\partial e} = 0$. In the data, on the other hand, we do observe size effects in asset composition as shown in Section 3. What can generate these empirical results we observe? Instead of assuming a different class of utility functions, we maintain CARA utilities but postulate that larger financial institutions (i.e., those with more equity endowments) have advantages in services projects. Specifically, $y_i(e) = y_i + \theta(e)$ for every $i > 1$, with $\theta'(e) > 0$. This can capture that some services activities require a sufficient scale (e.g., large corporate banking, capital market services, trading, asset management).

In Appendix A.2, we obtain that in the four-state model with CARA utility functions and $\theta(e) = \theta e$, given the parameter restrictions described above, the following properties hold:

Proposition 1.

1. *If the returns on discrete assets (α_x) in the states where these returns exceed returns on asset-based debt (namely x_2 and x_4) are close enough, then both α_x and α_y increase with e.*

2. *If in addition and $y_3 < [\frac{\alpha_x}{\alpha - y}(1-\lambda) + 1]\frac{R}{1-\pi_1}$, then $\frac{\lambda \alpha_x}{\alpha_x + \alpha_y}$ decrease with e.*

Appendix Table A1 presents a numerical simulation, which yields variation of asset composition and debt composition to size that is similar to what we observe in the data.[14]

6.2 Prevalence of Covenants

In Section 5, we find that the prevalence of covenants is much lower among the going-concern debt of financial institutions. A possibility is that covenants are more challenging to enforce among financial institutions, because creditors have less powerful threat. For instance, restructuring financial institutions is more difficult, given the nature of their business (liquidity creation that involves many short-term contracts) or the opacity and complexity of these institutions. We investigate this issue in our model next.

We think of covenants as contractual provisions that allow for contingent creditor interventions. There are a few models in the literature studying the role of covenants, which analyze asymmetric information (Garleanu and Zwiebel, 2009), moral hazard of borrowers (Kermani and Ma, 2020b), or commitment problems of lenders (Rajan and Winton, 1995). To illustrate how ex post covenant enforceability affects the ex ante usage of covenants, we focus on a simple modeling framework without these additional frictions. In our model, the existing entrepreneur has an intrinsic ability that is uncertain initially. The entrepreneur can choose effort, and enjoys non-pecuniary benefits if she keeps control until output is produced. Covenants allow for contingent replacement of the current entrepreneur when signals of her ability emerge. Industries differ in whether high quality alternative management can be found, which affects the ex ante usefulness of covenants. In equilibrium, the entrepreneur would choose effort[15] taking into consideration the cost of effort, the amount of non-pecuniary benefits, and the net benefits

[14] The reason for assuming x_4 being close to x_2 is that if $x_4 >> x_2$, the correlation between payoffs to α_x and payoffs to α_y increases, and the motive for diversification can be too weak. In this case, an increase in the payoff of α_y may cause a decrease in the optimal α_x. On the other hand, if $x_4 << x_2$, the value of diversification can be too strong. In this case, an increase in the payoff of α_y may cause a increase in the optimal share of α_x.

[15] We can interpret this more broadly as variable performance of the institution that can be affected by managerial actions.

to borrowers of replacing the management. In equilibrium, covenants are less prevalent if good management replacement is more difficult to find, or if the entrepreneur enjoys larger non-pecuniary benefits.

We still use the four-state example above, and now we introduce that the entrepreneur can exert effort w which decreases the probability of the worst state 1. The effect of effort w depends on the realization of a random variable $\tilde{\mu}$ that takes values μ_1 (with probability q) or $\mu_2 > \mu_1$, and is independent of the realization of the state. In other words, some entrepreneurs are more capable at avoiding the worst state than others. More precisely, the states have base probabilities $\bar{\pi}_1, \bar{\pi}_2, \bar{\pi}_3$ and $\bar{\pi}_4$, and if an entrepreneur exerts effort w and μ_j obtains, $\pi_i(w, j) = \bar{\pi}_i(1 + \mu_j w)$ for $i = 2, 3, 4$ and consequently $\pi_1(w, j) = \bar{\pi}_1 - \mu_j w(1 - \bar{\pi}_1)$.

The entrepreneur's choices are made before μ_i is observed. The entrepreneur has a utility cost of exerting effort given by $\phi(w)$, which satisfies $\phi' > 0$, $\phi'' > 0$, and $\phi''' \geq 0$. We also assume $\phi'(0) = 0$ and that as $w \to \frac{\bar{\pi}_1}{(1-\bar{\pi}_1)\mu_2}$, $\phi(w) \to \infty$. This will guarantee a choice of w such that $0 < \pi_1(w, j) < \bar{\pi}_1$. We continue the parametric assumptions under which the entrepreneur only defaults in state 1. For simplicity, we take w as contractible—conditional on w, lenders expect that with probability q, they will receive the promised debt payments with probability $(1 + \mu_1 w)(1 - \bar{\pi}_1)$; with probability $(1 - q)$, they will get debt payments with probability $(1 + \mu_2 w)(1 - \bar{\pi}_1)$. As before, we assume that the entrepreneur has CARA utility function $u(z) = 1 - \exp(-Az)$ and maximizes:

$$\sum_i [q\pi_{i,1}(w) + (1 - q)\pi_{i,2}(w)][u(z_i(w))] - \phi(w). \tag{1}$$

In addition, the current entrepreneur has a non-pecuniary benefit of $b \geq 0$ units of utility if she holds control until output is produced and there is no default.

Finally, after asset and debt choices are made, and w is chosen, a signal with values in $\{\nu_1, \nu_2\}$ is observed. This signal is informative of the quality of management. The value of the signal is independent of the state i, and if ν_2 is observed, then one learns that μ_2 obtained. However, if ν_1 is realized, the probability that μ_1 obtains is $q' > q$, namely the ex-post probability of a weaker entrepreneur (i.e., one who has μ_1) is higher than the ex-ante probability q. Thus after observing the signal, the probability of state 1 becomes:

$$\pi_1(w, \nu_2) = \bar{\pi}_1 - \mu_2 w(1 - \bar{\pi}_1),$$

$$\pi_1(w, \nu_1) = \bar{\pi}_1 - \mu' w(1 - \bar{\pi}_1),$$

where $\mu' \equiv q'\mu_1 + (1 - q')\mu_2 < 1$. In particular, the ex-ante probability of observing ν_1 is $\frac{q}{q'}$.

We now introduce a role for covenants: if a covenant is present, lenders can intervene and replace management after observing the signal ν. Under new management, the probability of state 1 (where default occurs) instead becomes:

$$\pi_1(w, \nu_2) = \bar{\pi}_1 - \gamma^f(1 - \bar{\pi}_1), \tag{2}$$

$$\pi_1(w, \nu_1) = \bar{\pi}_1 - \gamma^f(1 - \bar{\pi}_1). \tag{3}$$

In particular, γ^f is a key parameter that indicates how easy it is to find a good new manager. It can be interpreted more generally as how easy it is to restructure the firm if signals suggest that current operations are weak.

The old entrepreneur keeps equity claims and will get compensated in states $i > 1$. However, she loses the non-monetary compensation b, which now goes to the new management. Gains to lenders are the gains from lowering the probability of the worst state.

The expected gain from changing management is: $(\gamma^f - \mu_2 w)(1 - \bar{\pi}_1)c$ when signal ν_2 is observed and $(\gamma^f - \mu' w)\,(1 - \bar{\pi}_1)c$ if ν_1 is observed. Assuming, for definiteness, that lenders do not replace managers if gains are zero, the following proposition holds:

Proposition 2. *: Let $w^1 := \frac{\gamma^f}{\mu_2}$ and $w^2 := \frac{\gamma^f}{\mu'}$. Then*

1. *Management is replaced for every signal if $w < w^1$;*

2. *Management is replaced if and only if $\nu = \nu_1$ for $w^1 \geq w < w^2$;*

3. *Management is never replaced if $w \geq w^2$.*

This proposition shows the settings where the old entrepreneur will be replaced. Specifically, if w is too low, then management is always replaced. If w is in an intermediate range, then management is replaced when the bad signal is obtained. If w is high enough, then management is never replaced. Furthermore, as we establish in Appendix A.4, the following result holds:

Proposition 3. *If γ^f is small enough then the entrepreneur will choose $w \geq w^2$, which makes covenants useless, even if the entrepreneur enjoys no private benefits. In addition, if private benefits are large enough, the entrepreneur will also choose $w \geq w^2$, making covenants useless.*

An important implication of this proposition is that if lenders cannot easily replace weak management, or more generally restructure weak operations, then covenants are not very useful and will be less prevalent. This result speaks to our observation in Section 5.2 about the possible reason for fewer covenants and weaker creditor control among financial intermediaries, compared to non-financial firms. A plausible explanation is that covenants are more difficult to enforce for financial intermediaries (small γ^f in the model). This can arise from the opacity and complexity of managing financial firms, which makes replacing weak management difficult. More generally, it can arise from the difficulty of punishing or restructuring financial firms should they violate covenants. Finally, Proposition 3 also suggests that when private benefits of staying as management are high, the entrepreneur may also exert high effort to avoid being replaced. In this case, the necessity for replacing management, and correspondingly for having covenants, would also be lower. This alternative possibility for having a lower prevalence of covenants may be difficult to test empirically, but the model shows that if having control rights of financial institutions is more valuable, this might reduce the role for "external intervention" through covenants.

7 Conclusion

We study asset and debt characteristics of US financial intermediaries, and compare them with results from non-financial firms. For asset composition of financial intermediaries, we find that the pledgeable value of discrete assets accounts for 50% to 60% of total assets in aggregate. The share decreases with size and increases with the importance of services functions. This share is substantially higher than non-financial firms (less than 25% as shown in Kermani and Ma (2020b)), given the generic nature of the financial assets that financial institutions have, but still indicates a significant role for other activities. For debt composition, we find that going-concern debt accounts for 10% to 15% of total assets in aggregate, about the same as asset-based debt. The share increases with size and the importance of services functions. While the aggregate ratio of going-concern debt to asset-based debt in financial intermediaries (about 1:1) is smaller than the aggregate ratio of cash flow-based debt to asset-based debt in non-financial firms (about 4:1 as Lian and Ma (2020) find), the quantity of going-concern debt in the financial sector is still sizable. Moreover, we find that going-concern debt of financial intermediaries has weak monitoring. The most likely explanation for the weakness of creditor control is the lack of credible threat and scope for creditor interventions, which limits the usefulness of covenants and monitoring-intensive debt.

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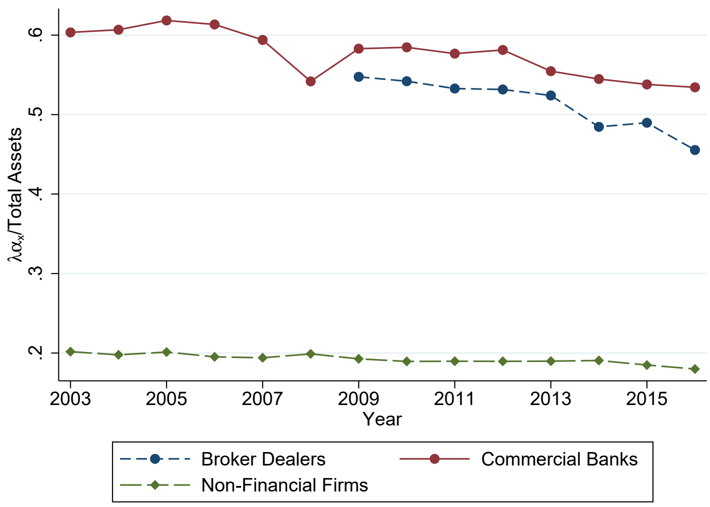
Figures and Tables

Figure 1: Aggregate $\lambda\alpha_x$/Assets

This figure shows aggregate total pledgeable value of discrete assets ($\lambda\alpha_x$), normalized by total book assets. The dashed line with circles represents broker dealers. The solid line with circles represents commercial banks. The dashed line with diamonds represents non-financial firms. Panel A shows $\lambda\alpha_x$ measured without cash holdings; Panel B shows the same plot using $\lambda\alpha_x$ plus cash holdings in the numerator.

Panel A. Total $\lambda\alpha_x$/Total Assets



Panel B. Total $\lambda\alpha_x$ (+ Cash)/Total Assets

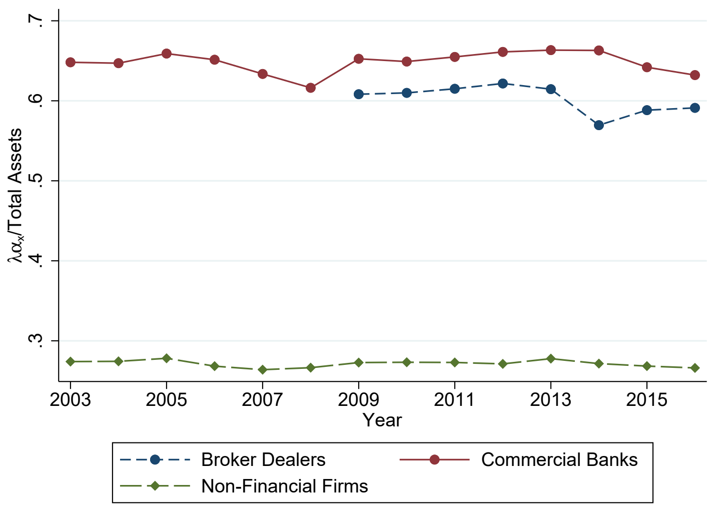
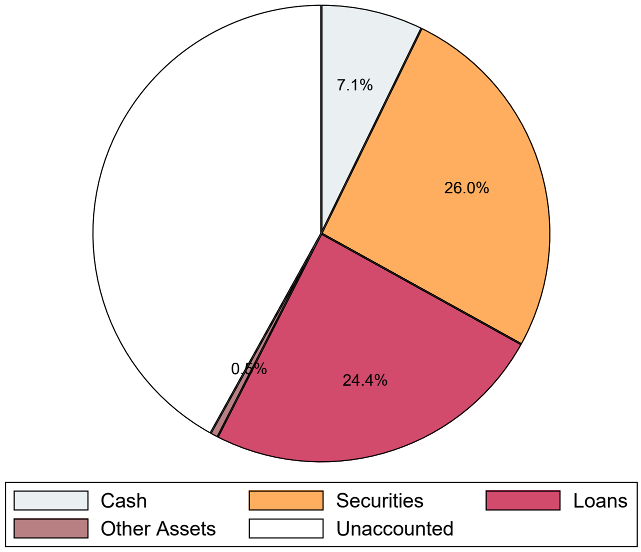


Figure 2: Composition of Aggregate $\lambda \alpha_x$

This figure shows a decomposition of aggregate $\lambda \alpha_x$ for the average year between 2003 and 2016. The total area of the pie represents aggregate book assets. Panel A shows financial firms in our sample. Panel B shows non-financial firms using data from Kermani and Ma (2020b).

Panel A. Financial Institutions



Panel B. Non-Financial Firms

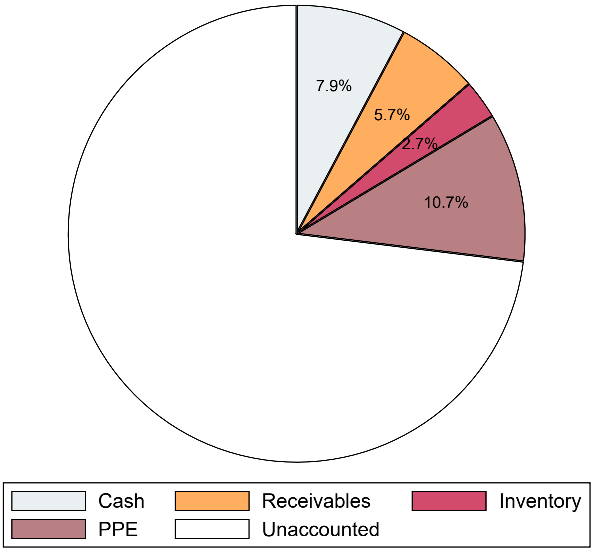


Figure 3: Distribution of $\lambda\alpha_x$/Assets

This figure shows the distribution of the bank-level pledgeable value of discrete assets ($\lambda\alpha_x$), normalized by book assets. All bank-years in our main financial intermediary sample are included.

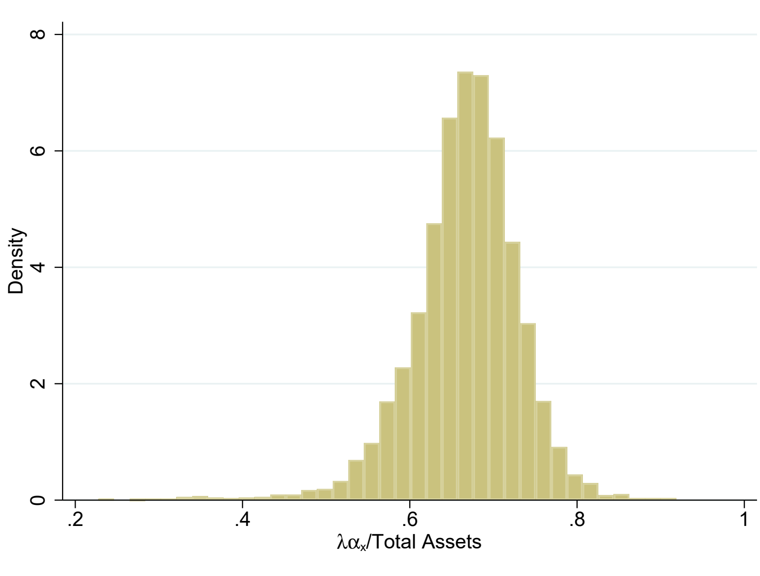
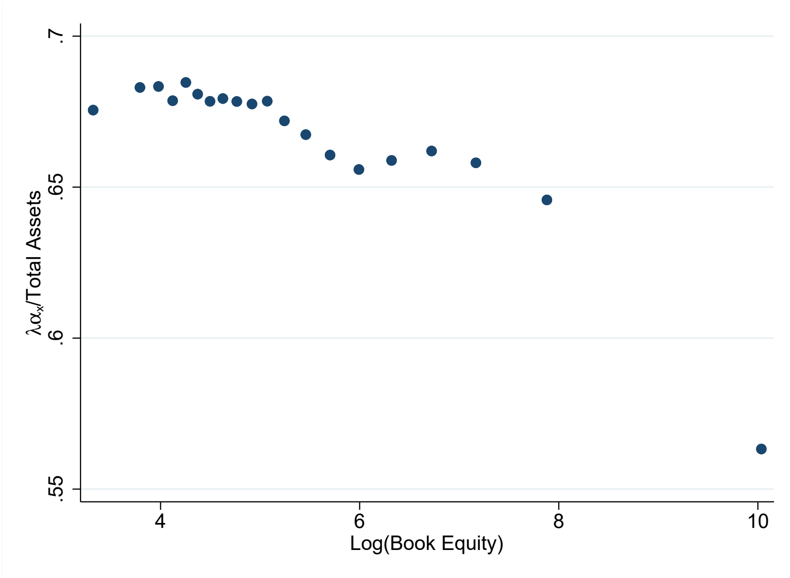


Figure 4: Variations of $\lambda\alpha_x$/Assets with Bank Characteristics

This figure shows binscatter plots of the relationship between the bank-level pledgeable value of discrete assets ($\lambda\alpha_x$) normalized by book assets (y-axis) and bank characteristics (x-axis). In Panel A, the bins are formed based on size (log book equity). In Panel B, the bins are formed based on the share of non-interest income in revenue. The average $\lambda\alpha_x$ in each bin is shown by the dots. The plots control for year fixed effects.

Panel A. Variations with Size



Panel B. Variations with Non-Interest Income

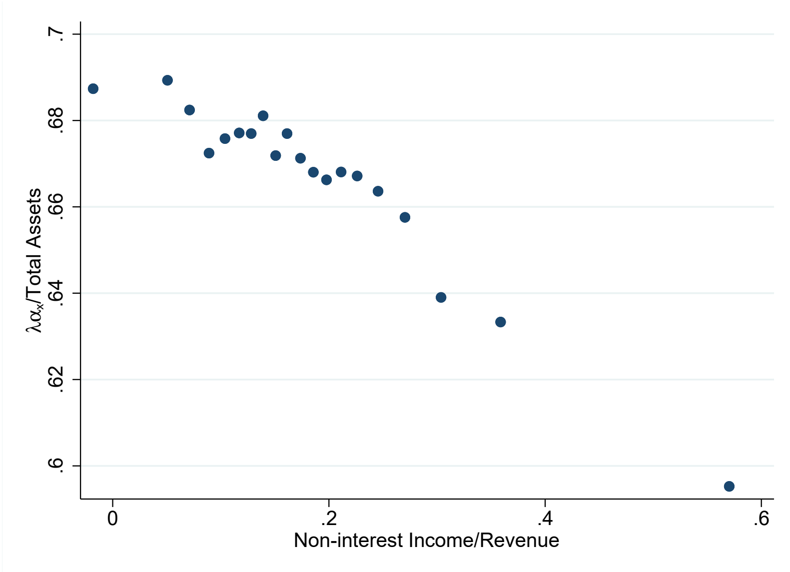


Figure 5: Aggregate Going-Concern Debt and Asset-Based Debt

This figure shows aggregate total going-concern debt (k) and asset-based debt (e.g., repos, securitized debt, FHB advances), normalized by total book assets. The dashed line with circles and diamonds represent going-concern debt and asset-based debt respectively for broker dealers. The solid line with circles and diamonds represent going-concern debt and asset-based debt respectively for commercial banks.

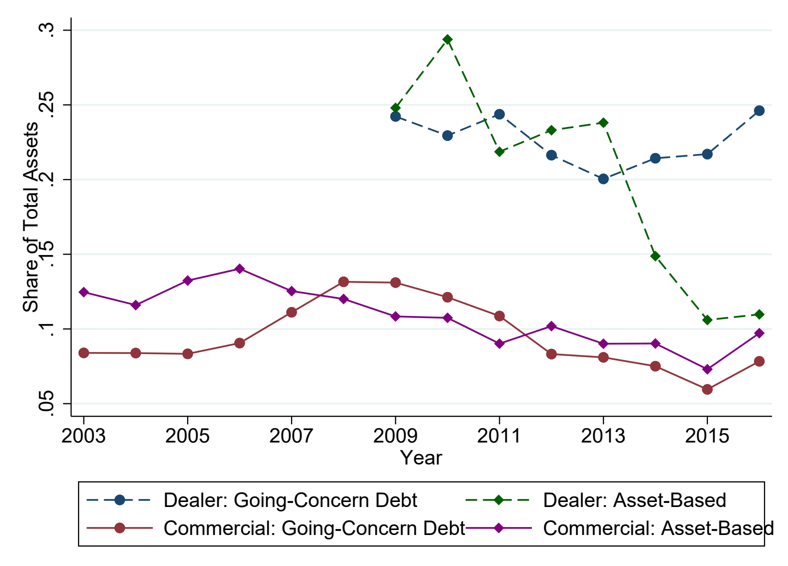


Figure 6: Distribution of Going-Concern Debt/Assets

This figure shows the distribution of the bank-level going-concern debt (k), normalized by book assets. All bank-years in our main financial intermediary sample are included.

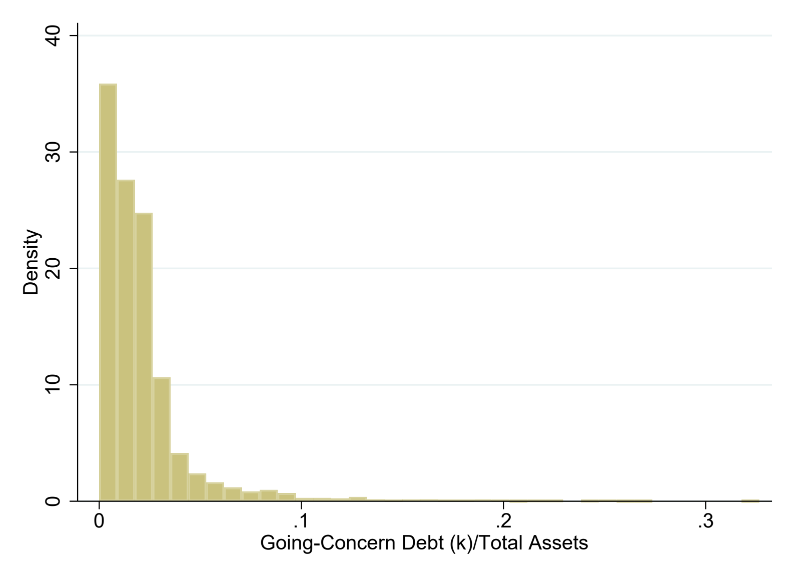
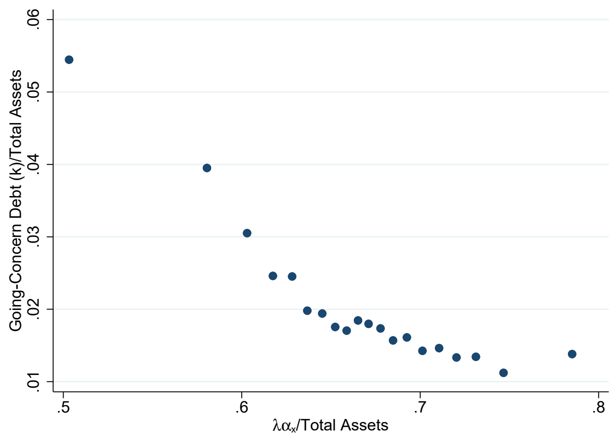


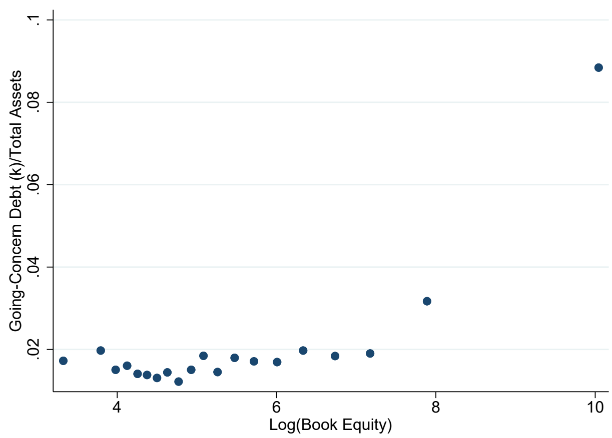
Figure 7: Variations of Going-Concern Debt with Bank Characteristics

This figure shows binscatter plots of the relationship between the bank-level going-concern debt (k) normalized by book assets (y-axis) and bank characteristics (x-axis). In Panel A, the bins are formed based on $\lambda\alpha_x$ in book assets. In Panel B, the bins are formed based on size (log book equity). In Panel C, the bins are formed based on the share of non-interest income in revenue. The average k in each bin is shown by the dots. The plots control for year fixed effects.

Panel A. Variations with $\lambda\alpha_x$



Panel B. Variations with Size



Panel C. Variations with Non-Interest Income

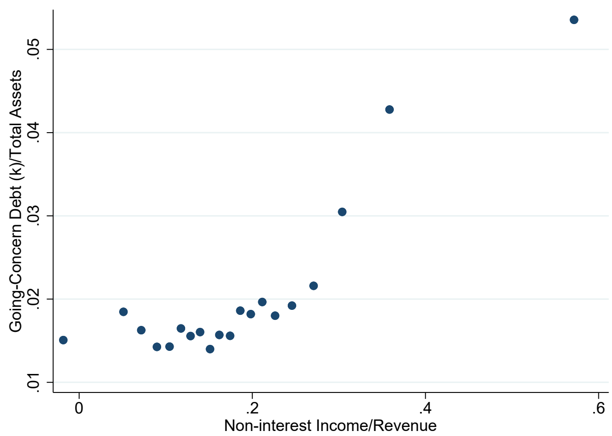
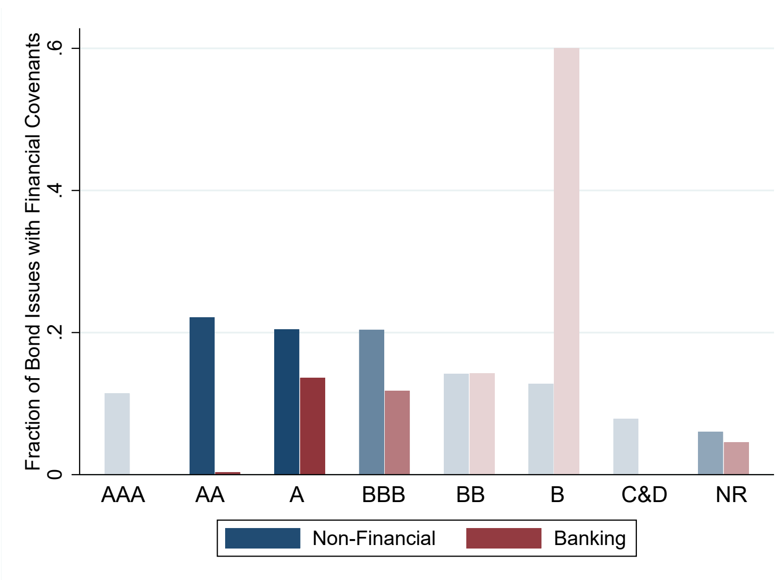


Figure 8: Prevalence of Financial Covenants among Financial Intermediaries' Going-Concern Debt

This figure shows the fraction of bond issues (Panel A) and loan issues (Panel B) that have financial covenants. The fractions are calculated for each issuer rating category. "Non-Financial" represents non-financial firms. "Banking" represents financial intermediaries in our main sample that are in the loan issue or bond issue datasets. Each observation is a debt issue. We exclude medium term notes in bond issues because their covenant information can be incomplete. The color intensity of the bars in each issuer rating category increases with the share of financial intermediary observations that belong to the given issuer rating category. The issues do not include debt that is collateralized by discrete assets (asset-based debt).

Panel A. Financial Covenants in Bond Issues



Panel B. Financial Covenants in Loan Issues

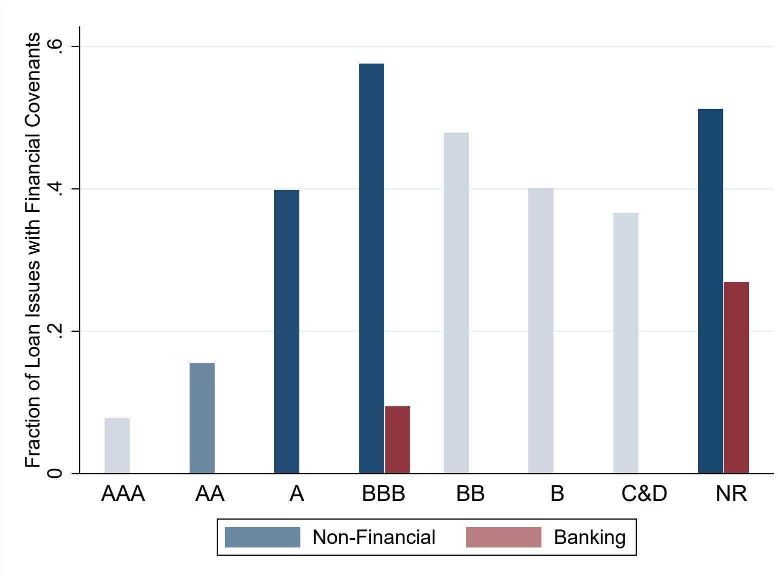


Figure 9: Prevalence of Loans among Financial Intermediaries' Going-Concern Debt

This figure shows the fraction of loans in going-concern debt for financial intermediaries. The fractions are calculated for each issuer rating category. "Non-Financial" represents non-financial firms. "Banking" represents financial intermediaries in our main sample. Each observation is a firm-year. The color intensity of the bars in each issuer rating category increases with the share of financial intermediary observations that belong to the given issuer rating category.

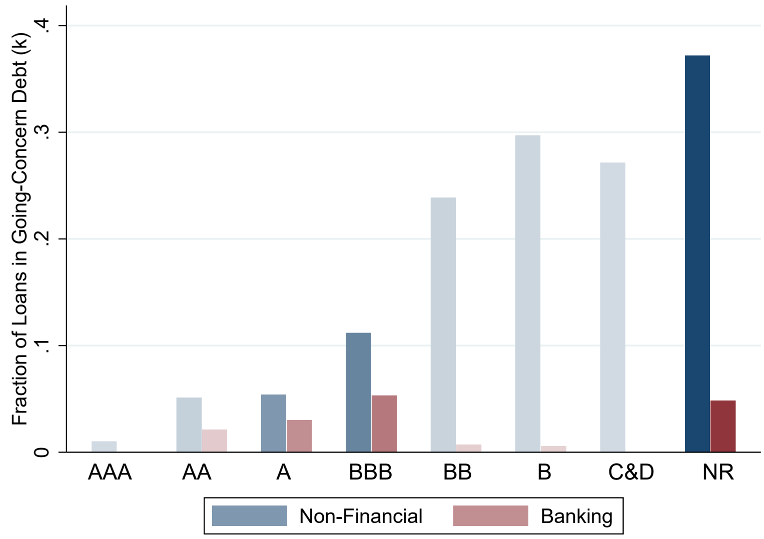


Table 1: Estimates of Pledgeable Value λ

This table summarizes the estimate of λ for each type of assets.

Securities
Treasuries: 0.98. Government obligations: 0.97. Agency MBS: 0.98. Non-agency MBS: 0.94. ABS: 0.94. Other debt securities: 0.95. Equities: 0.93. Reverse repo: 0.8.
Loans
Single family: 0.8. Multifamily: 0.75. Commercial real estate: 0.7. Other real estate: 0.6. Consumer: 0.6. C&I: 0.2.
Other Fixed Assets
Real estate and other fixed assets: 0.6.

Table 2: Summary Statistics

Summary statistics of financial institutions in the main sample. Mean, standard deviation, and selected percentiles are presented. Sample period is 2003 to 2016.

	Mean	SD	p10	p50	p90
Asset Composition					
Book assets	28,728.2	182,766.4	546.0	1,620.0	17,519.6
Enterprise value	31,550.6	189,887.7	566.4	1,872.4	20,122.9
Market value of equity	3,502.6	19,298.9	40.6	233.2	2,909.2
Enterprise value/book assets	1.04	0.07	0.96	1.03	1.12
Cash/assets	0.05	0.05	0.02	0.04	0.11
α_x/assets	0.88	0.07	0.81	0.90	0.95
$\lambda\alpha_x$/assets	0.67	0.07	0.59	0.67	0.74
Liability Composition					
Equity/assets	0.10	0.03	0.07	0.10	0.13
Deposits/assets	0.77	0.10	0.65	0.78	0.86
Asset-based debt/assets	0.10	0.08	0.02	0.09	0.20
Going-concern debt/assets	0.02	0.03	0.00	0.02	0.04

Table 3: Variations in Pledgeable Value of Discrete Assets $\lambda\alpha_x$

This table presents the relationship between $\lambda\alpha_x$ (normalized by book assets) and bank characteristics. Year fixed effects are included. R^2 does not include fixed effects. Standard errors are double-clustered by firm and time.

	$\lambda\alpha_x$/Assets				
	(1)	(2)	(3)	(4)	(5)
Size (log book equity)	-0.014***			-0.011***	-0.009***
	(0.002)			(0.001)	(0.003)
Noninterest income/revenue		-0.150***		-0.101***	-0.240***
		(0.034)		(0.028)	(0.059)
Liquidation value of C&I loan borrowers			0.155**		0.077*
			(0.068)		(0.041)
Observations	5,480	5,486	295	5,474	295
R^2	0.13	0.11	0.04	0.17	0.51
Fixed effects	Year				

Table 4: Variations in Going-Concern Debt k

This table presents the relationship between going-concern debt k (normalized by book assets) and bank characteristics. Year fixed effects are included. R^2 does not include fixed effects. Standard errors are double-clustered by firm and time.

	k/Assets			
	(1)	(2)	(3)	(4)
$\lambda\alpha_x$/assets	-0.137***			-0.063***
	(0.023)			(0.014)
Size (log book equity)		0.008***		0.007***
		(0.001)		(0.001)
Noninterest income/revenue			0.061***	0.021**
			(0.015)	(0.010)
Observations	5,422	5,411	5,416	5,405
R^2	0.11	0.24	0.10	0.28
Fixed effects	Year			

Table 5: Monitoring Intensity of Financial Intermediaries' Going-Concern Debt

In column (1), the outcome variable is a dummy that is equal to one if a bond issue has at least one financial covenant. In column (2), the outcome variable is a dummy that is equal to one if a loan issue has at least one financial covenant. In column (3), the outcome variable is the share of loans in going-concern debt. The debt issues do not include debt that is collateralized by discrete assets (asset-based debt). Bond issues also exclude medium term notes (MTNs). The sample includes both non-financial firms and financial intermediaries. The bank dummy is equal to one for financial intermediaries. Panel B excludes the largest firms (GSIBs and top 1% non-financial firms by revenue each year). Year and issuer ratings fixed effects are included. R^2 does not include fixed effects. Standard errors are double-clustered by firm and time.

Panel A. All Firms

	Has Fin Cov (Bonds) (1)	Has Fin Cov (Loans) (2)	% Loans in Going-Concern Debt (3)
Bank dummy	-0.097**	-0.203***	-0.303***
	(0.042)	(0.038)	(0.019)
Bond size (log face value)	0.005		
	(0.004)		
Senior bond dummy	-0.018		
	(0.013)		
Convertible bond dummy	-0.085***		
	(0.030)		
Loan size (log face value)		0.060***	
		(0.008)	
$\lambda\alpha_x$/assets	-0.001	-0.126**	0.010
	(0.037)	(0.059)	(0.046)
Firm size (log book equity)	-0.002	-0.047***	0.001
	(0.003)	(0.008)	(0.003)
EBITDA/l.assets	0.003	0.078**	0.031***
	(0.022)	(0.038)	(0.005)
Observations	13,383	13,124	31,291
R^2	0.02	0.03	0.07
Fixed effects		Year, issuer ratings	

Panel B. Excluding Largest Firms

	Has Fin Cov (Bonds) (1)	Has Fin Cov (Loans) (2)	% Loans in Going-Concern Debt (3)
Bank dummy	-0.091***	-0.238***	-0.307***
	(0.032)	(0.044)	(0.020)
Bond size (log face value)	0.008		
	(0.005)		
Senior bond dummy	-0.034***		
	(0.013)		
Convertible bond dummy	-0.091***		
	(0.030)		
Loan size (log face value)		0.057***	
		(0.008)	
$\lambda\alpha_x$/assets	-0.010	-0.134**	0.005
	(0.042)	(0.062)	(0.047)
Firm size (log book equity)	0.004	-0.039***	0.003
	(0.004)	(0.008)	(0.003)
EBITDA/l.assets	-0.007	0.075**	0.031***
	(0.019)	(0.037)	(0.005)
Observations	10,283	12,098	30,443
R^2	0.02	0.03	0.07
Fixed effects		Year, issuer ratings	

Table 6: Monitoring Intensity: Are Largest Institutions Special?

In column (1), the outcome variable is a dummy that is equal to one if a bond issue has at least one financial covenant. In column (2), the outcome variable is a dummy that is equal to one if a loan issue has at least one financial covenant. In column (3), the outcome variable is the share of loans in going-concern debt. The debt issues do not include debt that is collateralized by discrete assets (asset-based debt). Bond issues also exclude medium term notes (MTNs). In Panel A, the sample includes financial intermediaries. "GSIB" is a dummy for global systemically important banks. "Large non-GISB" is a dummy for top 20 US banks excluding GSIBs. In Panel B, the sample includes non-financial firms. "Top 1% (2%) non-financial" is a dummy for top 1% (2%) non-financial firms in a given year based on revenue. Year and issuer ratings fixed effects are included. R^2 does not include fixed effects. Standard errors are double-clustered by firm and time.

Panel A. Financial Intermediaries

	Has Fin Cov (Bonds) (1)	Has Fin Cov (Loans) (2)	% Loans in Going-Concern Debt (3)
GSIB	-0.015	-0.040	-0.068*
	(0.029)	(0.089)	(0.036)
Domestic large non-GSIB	-0.071**	-0.006	0.046
	(0.034)	(0.083)	(0.034)
Bond size (log face value)	0.013		
	(0.008)		
Senior bond dummy	0.134**		
	(0.061)		
Convertible bond dummy	-0.026		
	(0.031)		
Loan size (log face value)		-0.016	
		(0.025)	
Deposits/equity	0.011	0.017	-0.005
	(0.009)	(0.013)	(0.003)
Repo/equity	-0.024	0.051	0.022***
	(0.021)	(0.040)	(0.008)
$\lambda\alpha_x$/assets	0.230	-0.361	0.073
	(0.241)	(0.391)	(0.104)
Firm size (log book equity)	0.014	0.037	-0.012**
	(0.012)	(0.023)	(0.005)
EBITDA/l.assets	-2.262*	2.642	0.670
	(1.239)	(2.709)	(0.424)
Observations	1,079	203	4,215
R^2	0.12	0.04	0.01
GSIB+Large=0 (p-value)	0.02	0.51	0.27
Fixed effects		Year, issuer ratings	

Monitoring Intensity: Are Largest Institutions Special? (Cont.)

Panel B. Non-Financial Firms (Placebo)

	Has Fin Cov (Bonds) (1)	Has Fin Cov (Loans) (2)	% Loans in Going-Concern Debt (3)
Top 1% non-financials	-0.033**	-0.009	-0.005
	(0.015)	(0.030)	(0.012)
Top 2% non-financials	0.013	-0.110***	-0.074***
	(0.013)	(0.025)	(0.010)
Bond size (log face value)	0.006		
	(0.004)		
Senior bond dummy	-0.053***		
	(0.018)		
Convertible bond dummy	-0.092***		
	(0.032)		
Loan size (log face value)		0.063***	
		(0.008)	
$\lambda \alpha_x$/assets	-0.012	-0.124**	0.031
	(0.037)	(0.060)	(0.047)
Firm size (log book equity)	0.001	-0.036***	0.005*
	(0.004)	(0.008)	(0.003)
EBITDA/l.assets	-0.001	0.067*	0.031***
	(0.021)	(0.035)	(0.005)
Observations	12,304	12,920	27,019
R^2	0.01	0.03	0.01
Top 1%+2%=0 (p-value)	0.24	0.00	0.00
Fixed effects		Year, issuer ratings	

Internet Appendix

A Model

We provide more details about the model in this appendix.

A.1 Setup

A risk-averse entrepreneur (bank) has e dollars of equity, invests $\alpha_x \geq 0$ in discrete assets with random ex-post rate of return x, and invests $\alpha_y \geq 0$ in other projects with random ex-post rate of return y. The entrepreneur can obtain funding from the following sources. First, she can borrow against the liquidation value of the discrete assets (such as using repos). In this market, she pays $r_p > 1$ per dollar borrowed. If the entrepreneur has invested α_x in discrete assets, she can borrow any fraction $0 \leq \beta \leq 1$ of the maximum pledgeable value $\lambda\alpha_x$, where $0 < \lambda < 1$. The fraction $(1 - \lambda)$ is the haircut. $\beta\lambda\alpha_x$ maps into asset-based debt, which lends against the pledgeable value of discrete assets. Among financial institutions, borrowing against discrete assets (e.g., repos) is often bankruptcy remote and largely nonrecourse (Roe, 2010; Duffie and Skeel, 2012; Bolton and Oehmke, 2015); accordingly, if an entrepreneur borrows $\beta\lambda\alpha_x$, her liability is $\min\{r_p\beta\lambda\alpha_x, \beta\alpha_x x\}$. Second, the entrepreneur can also borrow k against income in general from risk-neutral lenders by paying a coupon c that produces an expected return to lenders that equals R, and we assume $R > r_p$. k maps into going-concern debt, which lends against firm value as a whole. Third, the entrepreneur also has access to deposits up to an amount D. Deposits get a return $r \geq 1$ and are guaranteed by the government. The government insures deposits but charges a premium per unit of deposit that equals the expected loss L. We assume that depositors and the government have first claims to revenues of the bank, except for the revenue of the discrete assets pledged (which can be bankruptcy remote). Then:

$$\alpha_x + \alpha_y \leq \beta\lambda\alpha_x + k + e + d, \tag{A1}$$

where $d \leq D$ is the amount of deposits the entrepreneur accepts.[16]

The payoff to the entrepreneur is:

$$\max\{0, \alpha_x\beta\max\{0, x - \lambda r_p\} + \alpha_x(1-\beta)x + \alpha_y y - ck - (r + L)d\}, \tag{A2}$$

[16] Since the entrepreneur is risk-averse, the optimal contract with risk-neutral lenders would entail equity participation. Our focus on debt leads us to concentrate on debt contracts. Alternatively one could use the framework of Hébert (2017) where entrepreneurs are risk-neutral but discount future payoffs by more than lenders do. Hébert (2017) deals with financing of a single project so one would to make several extensions of the model to accommodate the entrepreneur's choice of a portfolio of assets and the different sources of capital that we consider.

where $r_p > r$ is the return on debt against discrete assets, and c is the coupon promised to lenders of k. To simplify matters we assume there are no other claimants to output so lenders of k receive the minimum between what they were promised and the total value of the firm (minus payments to deposits and debt against discrete assets). The required rate of return R must thus satisfy:

$$E\left[\min\left\{ck, \max\{0, \alpha_x\beta\max\{0, x-\lambda r_p\} + \alpha_x(1-\beta)x + \alpha_y y - (r+L)d\}\right\}\right] = Rk. \quad \text{(A3)}$$

In particular this implies that $c \geq R$ and if we assume that the return on cash by the entrepreneur is not more than R, then inequality (A1) must hold with equality. Thus we get:

$$k = \alpha_x(1-\beta\lambda) + \alpha_y - e - d. \quad \text{(A4)}$$

If $r + L < R$, that is, deposits are cheaper than borrowing k even after taking into consideration the deposit insurance premium, then the payoff to the entrepreneur when d increases and k decreases would be higher in every state (x, y). This is because in states where the entrepreneur defaults on k her payoff is independent of the amount of deposits, whereas in other states she would benefit from cheaper financing. Accordingly, when $k > 0$ we may restrict ourselves to the case where $d = D$. Similarly, if $r_p < R$, we would obtain $\beta = 1$ when k is positive. In the data, β is close to 1 for liquid assets such as securities, especially for large financial institutions (for small institutions, there could be fixed costs of setting up repo networks). β is much smaller for illiquid assets such as commercial loans. This could come from over-estimation of λ for these assets, or from the illiquidity of these assets leading to an effectively higher r_p.

A.2 Four States

As mentioned in Section 6.1, for simplicity of illustration and to obtain clear comparative statics, we consider an environment with four states, with probability π_i and returns x_i on α_x and y_i on α_y for each state $i \in \{1, 2, 3, 4\}$. In order to avoid the entrepreneur specializing in only one type of asset, we need enough variability in the relative returns of assets across the different states. We thus assume that in state 1, α_y has low returns and the returns on α_x are low enough, so the entrepreneur defaults on debt. In addition, to simplify the calculation of the deposit insurance premium, we assume that the cost of default is large enough, so that the deposit insurer receives zero in state 1. In state 2, $y_2 \leq R$, but the returns on α_x is large enough so that together with equity and deposits it compensates the losses on α_y, so there is no default. In contrast, in state 3, the returns on discrete assets are low $x_3 < \lambda r_p$, but returns on α_y are enough to avoid default (in particular, $y_3 > \frac{R}{1-\pi_1}$). In state 4, both α_x and α_y yield relatively good returns, so that no asset need to subsidize another ex-post—in particular, $x_4 > \lambda r_p + (1-\lambda)\frac{R}{1-\pi_1}$ and

$y_4 > \frac{R}{1-\pi_1}$.

Since default only occurs in state 1 and is full in this state, competitive lenders of k will charge a coupon c such that:

$$(1-\pi_1)ck = Rk, \tag{A5}$$

where $k = \alpha_y + \alpha_x(1-\lambda) - e - D$. In addition the deposit insurance L would solve:

$$(r+L) = \frac{r}{1-\pi_1}.$$

The payoff of the entrepreneur in states $i = \{2,3,4\}$ is therefore:

$$\begin{aligned} z_i &= \alpha_y y_i + \alpha_x \max\{x_i - \lambda r_p, 0\} - \frac{r}{1-\pi_1} D - ck \\ &= \alpha_y y_i + \alpha_x \max\{x_i - \lambda r_p, 0\} - \frac{r}{1-\pi_1} D - \frac{R}{1-\pi_1} k. \end{aligned}$$

In an interior maximum, the FOCs are are:

$$\begin{aligned} \pi_2 u'(z_2)\left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right) + \pi_3 u'(z_3)\left(-(1-\lambda)\frac{R}{1-\pi_1}\right) \\ + \pi_4 u'(z_4)\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right) = 0, \\ \pi_2 u'(z_2)\left(y_2 - \frac{R}{1-\pi_1}\right) + \pi_3 u'(z_3)\left(y_3 - \frac{R}{1-\pi_1}\right) \\ + \pi_4 u'(z_4)\left(y_4 - \frac{R}{1-\pi_1}\right) = 0. \end{aligned}$$

It is obvious from these FOCs that if the entrepreneur has CARA utility, namely

$$u(z) = 1 - \exp(-Az),$$

then asset composition would be homogeneous among institutions. For example, there is no variation with respect to size of equity endowment:

$$\frac{\partial \alpha_x}{\partial e} = \frac{\partial \alpha_y}{\partial e} = 0.$$

In the data, on the other hand, we do observe size effects in asset composition as shown in Section 3.

Instead of assuming another class of utility functions, we maintain CARA utilities but postulate that firms with more equity have better projects: more precisely, $y_i(e) = y_i + \theta(e)$ for every $i > 1$, with $\theta'(e) > 0$. The example discussed below shows that we may choose $\theta(e) = \theta e$, so that the assumptions about default in different states hold for

e in an interval $[\underline{e}, \bar{e}]$. Then for $i > 1$

$$\frac{\partial z_i}{\partial e} = \alpha_y \theta'(e) + \frac{R}{1-\pi_1} > 0.$$

If we write F_{α_x} for the FOC with respect to α_x, and F_{α_y} for the FOC with respect to α_y, then for CARA utility functions,

$$F_{\alpha_x,e} = 0, \tag{A6}$$

$$F_{\alpha_y,e} = \alpha_y \theta'(e)[\pi_2 u'(z_2(e)) + \pi_3 u'(z_3(e)) + \pi_4 u'(z_4(e))] > 0. \tag{A7}$$

.

Thus:

$$\frac{\partial \alpha_x}{\partial e} = \frac{1}{|\mathcal{H}_F|} F_{\alpha_y,\alpha_x} F_{\alpha_y,e}, \tag{A8}$$

$$\frac{\partial \alpha_y}{\partial e} = -\frac{1}{|\mathcal{H}_F|} F_{\alpha_x,\alpha_x} F_{\alpha_y,e}, \tag{A9}$$

where $|\mathcal{H}_F| > 0$ denotes the determinant of the Hessian matrix of F. In the data, $\frac{\partial \alpha_x}{\partial e} > 0$ and $\frac{\partial \frac{\alpha_x}{\alpha_y}}{\partial e} < 0$.

In addition,

$$\begin{aligned} F_{\alpha_y,\alpha_x} &= \pi_2 u''(z_2(e)) \left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1} \right) \left(y_2(e) - \frac{R}{1-\pi_1} \right) \\ &+ \pi_3 u''(z_3(e)) \left(-(1-\lambda)\frac{R}{1-\pi_1} \right) \left(y_3(e) - \frac{R}{1-\pi_1} \right) \\ &+ \pi_4 u''(z_4(e)) \left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1} \right) \left(y_4(e) - \frac{R}{1-\pi_1} \right). \end{aligned}$$

Using the FOC with respect to α_x we obtain

$$\begin{aligned} F_{\alpha_y,\alpha_x} &= \pi_2 u''(z_2(e))(x_2 - \lambda r_p) \left(y_2(e) - \frac{R}{1-\pi_1} \right) + \pi_4 u''(z_4(e))(x_4 - \lambda r_p) \left(y_4(e) - \frac{R}{1-\pi_1} \right) \\ &= A\left(x_2 - \lambda r_p\right) \pi_3 u'(z_3(e)) \left(y_3 - \frac{R}{1-\pi_1} \right) - A(x_4 - x_2)\pi_4 u'(z_4(e)) \left(y_4(e) - \frac{R}{1-\pi_1} \right), \end{aligned} \tag{A10}$$

where in the last line we used the FOC with respect to α_y. Notice that the first term in the last line is always positive but the second term is negative if $x_4 > x_2$. As x_4 increases relative to x_2 the correlation between the payoffs of the two kinds assets increases and the motive for diversification decreases. In this case an increase in the payoff of α_y may cause a decrease in investments in α_x. To guarantee that $\frac{\partial \alpha_x}{\partial e} > 0$ we need to assume that x_4 is not much larger than x_2.

On the other hand, since $F_{\alpha_x,\alpha_x} \leq 0$, $\frac{\partial \alpha_y}{\partial e} \geq 0$. Furthermore,

$$
\begin{aligned}
-F_{\alpha_x,\alpha_x} &= A\Bigg[\pi_2 u'(z_2(e))\left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)^2 \\
&+ \pi_3 u'(z_3(e))\left((1-\lambda)\frac{R}{1-\pi_1}\right)^2 \\
&+ \pi_4 u'(z_4(e))\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)^2\Bigg] \\
&= A\Bigg[\pi_2 u'(z_2(e))\left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)^2 \\
&+ \pi_3 u'(z_3(e))\left((1-\lambda)\frac{R}{1-\pi_1}\right)\left((1-\lambda)\frac{R}{1-\pi_1} - (x_2 - \lambda r_p) + (x_2 - \lambda r_p)\right) \\
&+ \pi_4 u'(z_4(e))\left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1} + x_4 - x_2\right)\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)\Bigg] \\
&= A\Bigg[\pi_3 u'(z_3(e))(1-\lambda)\frac{R}{1-\pi_1}(x_2 - \lambda r_p) \\
&+ \pi_4 u'(z_4(e))(x_4 - x_2)\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)\Bigg]. \qquad \text{(A11)}
\end{aligned}
$$

If we write:

$$\Gamma(z_3) := \pi_3 u'(z_3(e))(x_2 - \lambda r_p) > 0,$$

and then $\frac{\partial \frac{\alpha_x}{\alpha_y}}{\partial e} < 0$ if and only if

$$\frac{\alpha_x}{\alpha_y} > \frac{\Gamma(z_3(e))\left(y_3(e) - \frac{R}{1-\pi_1}\right) - \pi_4(x_4 - x_2)u'(z_4(e))\left(y_4(e) - \frac{R}{1-\pi_1}\right)}{\Gamma(z_3(e))\left((1-\lambda)\frac{R}{1-\pi_1}\right) + \pi_4(x_4 - x_2)u'(z_4(e))\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1}\right)}. \qquad \text{(A12)}$$

Notice that if $x_4 \geq x_2$ then the RHS is dominated by

$$\frac{y_3 - \frac{R}{1-\pi_1}}{(1-\lambda)\frac{R}{1-\pi_1}}.$$

Thus $\frac{\partial \frac{\alpha_x}{\alpha_y}}{\partial e} < 0$ if

$$y_3 < \left[\frac{\alpha_x}{\alpha_y}(1-\lambda) + 1\right]\frac{R}{1-\pi_1}$$

or, provided $\lambda \frac{\alpha_x}{\alpha_y} < 1$,

$$y_3 < \frac{\alpha_x}{\alpha_y}\frac{R}{1-\pi_1}.$$

Hence for the case $x_4 \geq x_2$ it suffices to assume that rates of return on y-projects do not exceed $\frac{\alpha_x}{\alpha_y}$ times the coupon on firm's unsecured borrowing.[17]

Notice that if x_4 is much smaller than x_2, the inequality (A12) is no longer guaranteed even when $y_3 < \frac{\alpha_x}{\alpha_y}\frac{R}{1-\pi_1}$. This is because if $x_4 << x_2$ the correlation between the payoffs of the two kinds assets decreases and the value of diversification increases. In this case, an increase in the payoff of α_y may cause an increase in the share of α_x.

To summarize, we have shown that if x_2 and x_4 are not too different, and $y_3 < \left[\frac{\alpha_x}{\alpha_y}(1-\lambda)+1\right]\frac{R}{1-\pi_1}$, then $\frac{\partial \alpha_x}{\partial e} > 0$ and $\frac{\partial \frac{\alpha_x}{\alpha_y}}{\partial e} < 0$.

A.3 Variable Effort

To set the stage for studying covenants, we further extend the model to allow for variable effort of the entrepreneur. We continue with the four-state example in the above, and we specify that the entrepreneur can exert effort w which decreases the probability of the bad state 1. The effect of effort w depends on the realization of a random variable $\tilde{\mu}$ that takes values μ_1 (with probability q) or $\mu_2 > \mu_1$, and is independent of the realization of the state. More precisely, the states have base probabilities $\bar{\pi}_1, \bar{\pi}_2, \bar{\pi}_3$ and $\bar{\pi}_4$, and if an entrepreneur exerts effort w and μ_j obtains, $\pi_i(w,j) = \bar{\pi}_i(1+\mu_j w)$ for $i = 2,3,4$ and consequently, $\pi_1(w,j) = \bar{\pi}_1 - \mu_j w(1-\bar{\pi}_1)$.

The entrepreneur's choices are made before μ_i is observed. There is a utility cost of exerting effort given by $\phi(w)$, which satisfies $\phi' > 0$, $\phi'' > 0$, and $\phi''' \geq 0$. We assume $\phi'(0) = 0$, and that as $w \to \frac{\bar{\pi}_1}{(1-\bar{\pi}_1)\mu_2}$, $\phi(w) \to \infty$. This will guarantee a choice of w such that $0 < \pi_1(w,j) < \bar{\pi}_1$. We will continue to make parametric assumptions such that the entrepreneur only defaults on loans in state 1. We assume that w is contractible: conditional on w lenders expect that with probability q, they will get the agreed coupon c with probability $(1+\mu_1 w)(1-\bar{\pi}_1)$; with probability $(1-q)$ they will get c with probability $(1+\mu_2 w)(1-\bar{\pi}_1)$. Independence and risk-neutrality imply that lenders would require a coupon that equals

$$c(w) = \frac{R}{1-\mathbb{E}\pi_1(w)} = \frac{R}{(1+\mu w)(1-\bar{\pi}_1)} = \frac{R}{(1+\mu w)(\bar{\pi}_2+\bar{\pi}_3+\bar{\pi}_4)},$$

where $\mu = q\mu_1 + (1-q)\mu_2$. There is no loss in generality of choosing units so that $\mu = 1$, which we do from now on.

Similarly, self-financed deposit insurance would imply that the entrepreneur will be charged

$$\frac{r}{1-\mathbb{E}\pi_1(w)} = \frac{r}{(1+w)(\bar{\pi}_2+\bar{\pi}_3+\bar{\pi}_4)}$$

per unit of deposits D. Again if we assume $r < R$ the entrepreneur would employ all the exogenously available D, before choosing $k > 0$.

[17] Since in the data $\alpha_x \sim 3\alpha_y$ it suffices to assume that $y_3 < 3\frac{R}{1-\pi_1}$.

We continue to assume that the entrepreneur has CARA utility function $u(z) = 1 - \exp(-Az)$ and maximizes:

$$\sum_i [q\pi_{i,1}(w) + (1-q)\pi_{i,2}(w)][u(z_i(w))] - \phi(w). \tag{A13}$$

Since $u(0) = 0$ and the realization of μ_j and the realization of the state i are independent, we may rewrite the objective as

$$\sum_i \bar{\pi}_i(1+w)[u(z_i(w))] - \phi(w), \tag{A14}$$

where z_i is the payoff to the entrepreneur in state $i > 1$. Notice that given $k = \alpha_y + \alpha_x(1-\lambda) - e - D$,

$$z_i(w) - z_i(0) = \left(\frac{1}{1-\pi_1(0)} - \frac{1}{1-\mathbb{E}\pi_1(w)}\right)(Rk + rD),$$

$$\frac{\partial z_i(w)}{\partial w} = \frac{(Rk+rD)}{(1+w)^2(\bar{\pi}_2 + \bar{\pi}_3 + \bar{\pi}_4)} > 0,$$

and that

$$\frac{\partial^2 z_i(w)}{\partial w^2} = -2\frac{(Rk+rD)}{(1+w)^3(\bar{\pi}_2 + \bar{\pi}_3 + \bar{\pi}_4)} < 0.$$

Under the assumptions of the example, the entrepreneur defaults on repo in state $i = 3$, and the FOCs are:

$$\begin{aligned}
F_{\alpha_x} &= \pi_2 u'(z_2(w))\left(x_2 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1(w)}\right) + \pi_3(w)u'(z_3(w))\left(-(1-\lambda)\frac{R}{1-\pi_1(w)}\right) \\
&+ \pi_4(w)u'(z_4(w))\left(x_4 - \lambda r_p - (1-\lambda)\frac{R}{1-\pi_1(w)}\right) = 0, \\
F_{\alpha_y} &= \pi_2(w)u'(z_2(w))\left(y_2 - \frac{R}{1-\pi_1(w)}\right) + \pi_3 u'(z_3(w))\left(y_3 - \frac{R}{1-\pi_1(w)}\right) \\
&+ \pi_4(w)u'(z_4)(w)\left(y_4 - \frac{R}{1-\pi_1(w)}\right) = 0, \\
F_w &= \sum_{i>1}\bar{\pi}_i\left(u(z_i) + u'(z_i)\frac{(Rk+rD)}{(1+w)(\bar{\pi}_2 + \bar{\pi}_3 + \bar{\pi}_4)}\right) - \phi'(w) = 0.
\end{aligned}$$

A.4 Covenants

To introduce covenants, we assume that the entrepreneur has a non-pecuniary benefit of b units of utility, if she holds control until output is produced and no default happens. We also assume that after asset and debt choices are made, and w is chosen, a signal with values in $\{\nu_1, \nu_2\}$ is observed. This signal is informative of the quality of the current entrepreneur. The value of the signal is independent of the state i, and if ν_2 is observed, then one learns that μ_2 obtained. However, if ν_1 is realized, the probability that μ_1 obtains is $q' > q$, that is the ex-post probability of a weaker manager (i.e. one for which μ_1 obtains) is higher than the ex-ante probability q. Thus after observing the signal, the probability of state 1 becomes:

$$\pi_1(w, \nu_2) = \bar{\pi}_1 - \mu_2 w(1 - \bar{\pi}_1),$$

$$\pi_1(w, \nu_1) = \bar{\pi}_1 - \mu' w(1 - \bar{\pi}_1),$$

where $\mu' \equiv q'\mu_1 + (1 - q')\mu_2 < 1$. In particular, the ex-ante probability of observing ν_1 is $\frac{q}{q'}$.

The role of covenants is as follows: if a covenant is present, lenders can replace management after observing the signal ν. Under new management, the probability of state 1 (where default occurs) becomes instead,

$$\pi_1(w, \nu_2) = \bar{\pi}_1 - \gamma^f(1 - \bar{\pi}_1), \tag{A15}$$
$$\pi_1(w, \nu_1) = \bar{\pi}_1 - \gamma^f(1 - \bar{\pi}_1). \tag{A16}$$

The parameter γ^f denotes the quality of the new management, or more broadly, the ability for lenders to intervene and restructure the firm. The old entrepreneur keeps her equity claims, and will get compensated in states $i > 1$. However, the old entrepreneur loses non-monetary compensation b, which now goes to the new management. Gains to lenders are the gains from lowering the probability of the worst state. The expected gain from changing managers is: $(\gamma^f - \mu_2 w)(1 - \bar{\pi}_1)c$ when signal ν_2 is observed and $(\gamma^f - \mu' w)(1 - \bar{\pi}_1)c$ if ν_1 is observed.

The proof of Proposition 2 is straightforward. Proposition 2.1 implies that[18]

$$c(w) = \begin{cases} c_1(w) = \frac{R}{(1-\bar{\pi}_1)(1+\gamma^f)} & \text{if } w < w^1 \\ c_2(w) = \frac{q}{q'}\left(\frac{R}{(1-\bar{\pi}_1)(1+\gamma^f)}\right) + \left(1 - \frac{q}{q'}\right)\frac{R}{(1-\bar{\pi}_1)(1+\mu_2 w)} & \text{if } w^1 \leq w < w^2 \\ c_3(w) = \frac{R}{(1-\bar{\pi}_1)(1+w)} & \text{if } w \geq w^2. \end{cases}$$

The coupon function is continuous on w. Conditional on a choice of w, a manager

[18]When $w \geq w_2$ priors are updated after observing the signal, but the ex-ante expected ability, by the law of iterated expectations, is still μ.

would achieve utility,

$$U(w) = \begin{cases} U_1(w) = (1+\gamma^f)\sup_{\{\alpha_x,\alpha y\}}\left\{\bar{\pi}_2 u(z_2(c_1(w))) + \bar{\pi}_3 u(z_3(c_1(w))) + \bar{\pi}_4 u(z_4(c_1(w)))\right\} \\ -\phi(w) \text{ if } w < w^1 \\ U_2(w) = \left[1 + \frac{q}{q'}\gamma^f + \left(1 - \frac{q}{q'}\right)\mu_2 w\right]\sup_{\{\alpha_x,\alpha y\}}\left\{\bar{\pi}_2 u(z_2(c_2(w))) + \bar{\pi}_3 u(z_3(c_2(w)))\right. \\ \left. + \bar{\pi}_4 u(z_4(c_2(w)))\right\} + \left(1 - \frac{q}{q'}\right) b - \phi(w) \text{ if } w^1 \le w < w^2 \\ U_3(w) = (1+w)\sup_{\{\alpha_x,\alpha y\}}\left\{(\bar{\pi}_2 u(z_2(c_3(w))) + \bar{\pi}_3 u(z_3(c_3(w))) + \bar{\pi}_4 u(z_4(c_3(w)))\right\} \\ +b - \phi(w) \text{ if } w \ge w^2, \end{cases}$$

where (α_x, α_y) satisfy for each state $i = 2, 3, 4$,

$$\alpha_x \beta \max\{0, x_i - \lambda r_p\} + \alpha_x(1-\beta)x_i + \alpha_y y_i \ge c(w)[(1-\beta\lambda)\alpha_x + \alpha_y - e].$$

That is, the entrepreneur does not default on debt in these states. Notice that since $w^1 = \frac{\gamma^f}{\mu_2}$, then $\frac{q}{q'}(1+\gamma^f) + \left(1 - \frac{q}{q'}\right)(1 + \mu_2 w^1) = (1+\gamma^f)$. Since the coupon function is continuous in w, this implies that the expected utility is continuous at w^1 if $b = 0$. Similarly, since $w^2 = \frac{\gamma^f}{\mu'}$ in this case, then:

$$\begin{aligned} \frac{q}{q'}(1+\gamma^f) + \left(1 - \frac{q}{q'}\right)(1+\mu_2 w^2) &= \frac{q}{q'}(1+\gamma^f) + \left(1 - \frac{q}{q'}\right)(1 + \mu_2 \frac{\gamma^f}{\mu'}) \\ &= 1 + \gamma^f\left(\frac{q}{q'} + \frac{q'-q}{q'}\mu_2\right) \\ &= 1 + \frac{\gamma^f}{\mu' q'}(q\mu' + (q'-q)\mu_2) \\ &= 1 + \frac{\gamma^f}{\mu' q'}[q'(q\mu_1 + (1-q)\mu_2)] \\ &= 1 + \gamma^f \frac{1}{\mu'} \\ &= 1 + w^2. \end{aligned}$$

Hence U is also continuous w^2 when $b = 0$, and the jumps at w^1 and w^2 are positive if $b > 0$. Since $c_1(w)$ is independent of w, U_1 is maximized by setting $w = 0$. The entrepreneur exerts no effort and is always replaced. If $\bar{U}_2 := \sup_{\{w_1 \le w < w_2\}} U_2(w)$ and $\bar{U}_3 := \sup_{\{w_2 \le w\}} U_3(w)$ then,

1. $\bar{U}_2$ and $\bar{U}_3$ increase with b and so does $\bar{U}_3 - \bar{U}_2$. In particular, when private benefits b are large, the entrepreneur will work hard and not be replaced.

2. A decrease in γ^f decreases w_1 and w_2 but the effect on w_2 is larger.

For Proposition 3, we observe that since $z'(0) > 0$ and $\phi'(0) = 0$, there exist $\epsilon > 0$ such that $U_3'(w)$ is increasing for $w \in [0, \epsilon]$, and consequently $U_3(\epsilon) > \frac{\mu_2}{\mu'}(1+\gamma)U_3(0)$, for some $\gamma > 0$, and we may always choose $\gamma < \mu'\epsilon$. Hence for $\gamma^f < \gamma$, $b \geq 0$,

$$U_1(w) < U_1(0) = (1+\gamma^f)(U_3(0) - b) < U_3(\epsilon) - b \leq \sup_{\{w \geq w^2(\gamma^f)\}} U_3(w), \text{ and}$$

$$\begin{aligned} U_2(w) &\leq \frac{\mu_2}{\mu'} U_1(w) + (1 - \frac{q}{q'})b < \frac{\mu_2}{\mu'}(1+\gamma^f)(U_3(0) - b) + (1 - \frac{q}{q'})b \\ &< U_3(\epsilon) - b + (1 - \frac{q}{q'})b \leq \sup_{\{w \geq w^2(\gamma^f)\}} U_3(w). \end{aligned}$$

A.5 Simulation

We provide some simple numerical simulation examples below. We use the utility function: $u(z) = 1 - e^{-\gamma \cdot z}$ (CARA).

For the analysis of asset composition and debt composition, we use the following parameters:

- $\gamma = 3$.
- $\lambda = 0.9$. $r_p = 1.03$.
- $D = 3.5$. $r = 1.03$.
- $x_2 = x_4 = 1.05$.
- $\theta = 0.01$. $y_2 = 1.055 + 0.01e$; $y_3 = 1.135 + 0.01e$; $y_4 = 1.185 + 0.01e$.
- $\pi_1 = 0.03$; $\pi_2 = 0.38$; $\pi_3 = 0.01$; $\pi_4 = 0.58$.
- $R = 1.06$. $c = \frac{R}{1-\pi_1} \approx 1.093$.

We obtain the following results. As shown in Table A1, Panel B, the slope of the share of $\lambda\alpha_x$ in total assets with respect to $\log(e)$ is close to the findings in Table 3 column (1); the slope of k normalized by total assets with respect to $\log(e)$ is close to the findings in Table 4 column (2).

Table A1: Asset and Liability Composition for Different Levels of e

This table shows simulation results for different levels of e. In Panel A, we use four example values of e (listed in column (1)). Columns (2) and (3) show the corresponding amount of assets α_x and α_y. Column (4) shows the amount of going-concern debt k. Columns (5) to (8) show the ratio of the pledgeable value of discrete assets ($\lambda\alpha_x$), other assets (α_y), going-concern debt k, and deposits D as a fraction of total assets, respectively. Column (9) shows the ratio of deposits to equity. In Panel B, we show the slope of asset and debt composition with respect to $\log(e)$.

Panel A. Examples

e (1)	α_x (2)	α_y (3)	k (4)	$\frac{\lambda\alpha_x}{\alpha_x+\alpha_y}$ (5)	$\frac{\alpha_y}{\alpha_x+\alpha_y}$ (6)	$\frac{k}{\alpha_x+\alpha_y}$ (7)	$\frac{D}{\alpha_x+\alpha_y}$ (8)	$\frac{D}{e}$ (9)
0.5	7.25	4.38	1.21	0.5611	0.3765	0.1041	0.3007	7
0.6	7.31	4.51	1.25	0.5565	0.3815	0.1054	0.2960	5.8
0.7	7.37	4.64	1.29	0.5521	0.3865	0.1070	0.2913	5
0.8	7.43	4.78	1.33	0.5476	0.3915	0.1089	0.2865	4.3

Panel B. Slope against $\log(e)$

e (1)	$\log(e)$ (2)	$\frac{\lambda\alpha_x}{\alpha_x+\alpha_y}$ (3)	$\frac{k}{\alpha_x+\alpha_y}$ (4)
0.5	-0.6931	0.5611	0.1041
0.8	-0.2231	0.5476	0.1089
Δ	0.47	-0.0135	0.0048
Slope		**-0.029**	**0.01**
Data		-0.014	0.008

We also provide a simple example of the model incorporating covenants. We set the effort cost function $\phi(w) = 100w^2$ and use the following parameters:

- $\gamma = 3$.
- $\lambda = 0.9$. $r_p = 1.03$.
- $D = 0$ (for simplicity). $r = 1.03$.
- $x_2 = x_4 = 1.05$.
- $\theta = 0.01$. $y_2 = 1.055 + 0.01e$; $y_3 = 1.135 + 0.01e$; $y_4 = 1.185 + 0.01e$.
- $\bar{\pi}_1 = 0.03$; $\bar{\pi}_2 = 0.38$; $\bar{\pi}_3 = 0.01$; $\bar{\pi}_4 = 0.58$.
- $R = 1.06$.
- $\mu_1 = 0.5$; $\mu_2 = 1.6$; $q \approx 0.545$; $m = 0$.

We obtain the following results (where U^{*i} denotes maximum utility for the expected utility in region i and similar for other variables), where we evaluate the sensitivity of the solution to parameters γ_f and b:

Table A2: Optimal effort and Allocation Choices for Difference Values of γ_f and b

This table shows outcomes for example values of γ_f, which indicates whether creditors can find good replacement for management. Bold text denotes the optimal choice (i.e., the choice that generates highest utility).

Panel A. $b = 0$

γ_f (1)	w_1 (2)	w_2 (3)	U^{*1} (4)	w^{*1} (5)	U^{*2} (6)	w^{*2} (7)	U^{*3} (8)	w^{*3} (9)
0.005	0.003	0.009	0.858	0	0.862	0.0104	**0.867**	**0.017**
0.007	0.004	0.012	0.864	0	0.865	0.0106	**0.867**	**0.017**
0.008	0.005	0.014	0.867	0	**0.867**	**0.0107**	0.867	0.017
0.01	0.006	0.018	**0.873**	**0**	0.871	0.0108	0.867	0.017
0.012	0.007	0.021	**0.879**	**0**	0.875	0.0110	0.867	0.017

Panel B. $b = 0.006$

γ_f (1)	w_1 (2)	w_2 (3)	U^{*1} (4)	w^{*1} (5)	U^{*2} (6)	w^{*2} (7)	U^{*3} (8)	w^{*3} (9)
0.005	0.003	0.009	0.858	0	0.864	0.0104	**0.873**	**0.017**
0.007	0.004	0.012	5.549	0	0.868	0.0106	**0.873**	**0.017**
0.008	0.005	0.014	0.867	0	0.870	0.0107	**0.873**	**0.017**
0.01	0.006	0.018	0.873	0	**0.874**	**0.0108**	0.873	0.017
0.012	0.007	0.021	**0.879**	**0**	0.877	0.0110	0.873	0.017

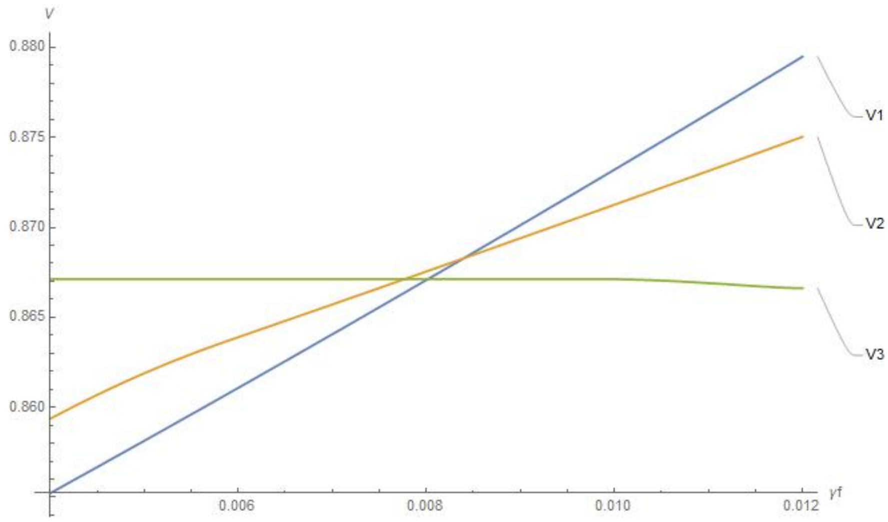
From Table A2, we see that as γ_f increases, the utility becomes higher in regions where management replacement occurs. For low values of γ_f, never replacing current management tends to dominate (therefore covenants are not useful). Similarly, by changing the non-pecuniary benefits b, we can also change the optimal effort choice. In particular, for higher values of b, it is less likely that the manager will chose zero effort (given by region 1).

We also visualize the results more directly in Figure A1. Panel A shows the case for $b = 0$ and we vary γ_f (x-axis). Panel B shows a higher level of b in dashed lines.

Figure A1: Optimal Effort and Allocation Choices for Different Values of γ_f and b

This figure shows the utility obtained under different arrangements, for each level of γ_f (x-axis). Panel A shows the case for $b = 0$ and Panel B shows the case for $b = 0.006$. The blue line (V1) is the value for case 1 in Proposition 2 (always replacing management), the yellow line (V2) is the value for case 2 in Proposition 2 (conditionally replacing management), and the green line (V3) is the value for case 3 in Proposition 2 (never replacing management).

Panel A. $b = 0$



Panel B. $b = 0.006$