Risk Taking and Low Longer-term Interest Rates: Evidence from the U.S. Syndicated Loan Market

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Abstract

Using supervisory data, we investigate risk taking in the U.S. syndicated loan market during the zero lower bound period by contrasting ex ante credit risk taken by lenders of different types. We find that shadow bank lenders—primarily, investment banks and funds—acquire ex ante riskier loan portfolios in response to a decline in spot and forward ten-year U.S. Treasury rates, and in response to an increase in the expected severity of the zero lower bound period. We also find that, for a given loan at origination, a higher ex ante default risk and a lower spot U.S. Treasury rate are associated with a higher loan spread. Our findings are consistent with lower longer-term interest rates inducing substitution from safer to riskier portfolios in "search for yield' and contributing to a build-up of ex ante credit risk in the shadow banking system. To the extent that the Federal Reserve's unconventional monetary policies had an impact on spot and forward interest rates, our results illustrate a risk-taking channel of monetary policy.

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1 Introduction

The persistently low interest rate environment that characterized the aftermath of the 2008 financial crisis has spurred a discussion about the effect of low longer-term interest rates on safer assets on risk taking in other asset classes, a channel distinct from the improved risk appetite that typically characterizes economic recoveries. To the extent that the Federal Reserve's unconventional monetary policies had an impact on spot and forward interest rates, the discussion focused on a risk-taking channel of monetary policy. When safer investment opportunities provide low expected returns, some financial intermediaries may increase the risk profile of their investments to earn higher returns, in particular if these intermediaries have liabilities that have costs insensitive to interest rates (for example, insurance companies and pension funds), or if they have other strong incentives to seek absolute returns rather than risk-adjusted returns (for example, investment funds competing on returns to investors net of fixed fees). Evidence of such behavior may have important implications for financial stability and broader policy actions, because, as discussed in Borio and Zhu (2008), excessive risk taking can facilitate the build-up of imbalances that set the stage for future financial distress.

Our contribution leverages on confidential supervisory data to analyze recent risk-taking trends in the $800 billion market for U.S. syndicated term loans.[1] The data allow us to study banks and different types of nonbank financial lenders, which provides a cross-section of financial institutions with different risk-taking incentives in the face of persistently low longer-term rates. Pension funds, for example, must finance their outlays even with reduced investment income, while performance relative to their peers is especially important for asset managers, because a high ranking produces significant inflows of assets under management (Sirri and Tufano (1998), Kempf and Ruenzi (2008)). Banks can, to a significant extent, pass through lower returns on assets to their creditors (mostly, depositors), have a natural advantage at screening and monitoring riskier loans during periods of economic uncertainty (see, for example, Gorton and Pennacchi (1995)), but they have been subject to stricter

[1] Based on outstanding term loan volumes.

regulations in the aftermath of the financial crisis.

We use the quarterly Shared National Credits program (SNC) data, which include information on the structure of loan syndicates provided by large banks through regulatory filings. The quarterly SNC data is a new, additional take on the well-known annual SNC program and, to our knowledge, is being used for research for the first time. For a given syndicated loan, we can track the share held by each syndicate participant over a loan's lifetime, as well as risk parameters, like the probability of default, which are used to calculate capital requirements under Basel II regulations.[2] The probabilities of default available in the SNC database are so-called "through the cycle" probabilities, which provide a long-run assessment of a loan's credit risk. This feature of the default probabilities helps address concerns about the endogeneity of U.S. interest rates and our measure of default risk, because a "through-the-cycle" default probability should be insensitive contemporaneously to shocks affecting interest rates.

We focus on the syndicated term loan market, in which nonbank lenders are significant if not dominant participants, and we study both primary market originations and secondary market transactions (collectively denoted as gross portfolio additions or simply gross additions).[3] Note that secondary market purchases may be less affected by the need to preserve established customer relations, hence they should be more responsive to changes in a lender's investment strategy.

While we control for investor risk appetite, the European sovereign crisis, and inflation expectations, our primary explanatory variable is the spot and forward longer-term U.S. Treasury rate. Over the zero lower bound period this rate became a de facto policy rate and likely affected investment allocation across various asset classes. In fact, the Federal Reserve implemented unconventional monetary policies, such as large-scale asset purchases meant to affect spot longer-term interest rates, and the literature suggests that these policies have been successful in doing so. While longer-term interest rates moved up and down, short-term interest rates—funding costs of many types of lenders—changed little over the period,

[2] In contrast, the annual SNC data are more limited and do not provide any probabilities of default.
[3] Originations include renegotiations of existing loans.

ruling them out from the analysis. However, we check separately whether the expectations of the severity of the zero lower period—the expected duration of the zero lower bound and the the expected change in the effective federal funds rate—affected risk-taking choices.

By studying differential responses of banks and nonbank lenders, our research design allows to distinguish between two possible explanations for increased risk taking in a low longer-term interest rate environment.

On the one hand, persistently low longer-term interest rates may prompt financial intermediaries to originate and purchase risker loans. Studies such as Altunbas, Gambacorta, and Marques-Ibanez (2010), Maddaloni and Peydró (2011), Paligorova and Santos (2013), and Dell'Ariccia, Laeven, and Suarez (2013) find evidence of a risk-taking channel that associates accommodative monetary policy (measured by short-term rates) to the origination of riskier loans by banks. The effect is stronger in the case of smaller banks that are not part of a large corporate group with a deep internal capital markets (Buch, Eickmeier, and Prieto (2011), Jimenez, Ongena, Peydró, and Saurina (2008), and Campello (2002)).[4]

On the other hand, banks may originate riskier loans because their competitive advantage at screening and monitoring borrowers is especially valuable during periods of unusually high asymmetric information. In fact, the very conditions that warrant persistently loose monetary policy may also make it more difficult to assess the default risk of borrowers. Banks would take on the riskier loans, which would signal the creditworthiness of the borrower to other lenders (Gorton and Pennacchi (1995)), while nonbank intermediaries would focus on borrowers whose loans are less subject to asymmetric information.[5] Consistently with the hypothesis that information asymmetry affects lender decisions in the syndicated loan market, Giannetti and Laeven (2012) show that the preference of lenders for loans to domestic borrowers increases during financial crises.[6]

[4]A related literature studies the effect of more specific policy interventions, like the Troubled Assets Relief Program. See, for instance, Black and Hazelwood (forthcoming), Duchin and Sosyura (2012), Li (2012).

[5]As evidence of the central role banks play in reducing asymmetric information problems, Ivashina (2009) estimates that a 9 percent increase in the share of syndicated loans that is retained by the lead bank reduces the cost of providing credit by 4 percent. Sufi (2007) who finds that the share of lead banks is larger when thorough monitoring is necessary, and that lenders tend to be geographically closer to the borrower when asymmetric information is particularly acute.

[6]The broader asset pricing literature has also highlighted that investors tend to prefer to invest in the

The two competing explanations for the reported higher risk taking at banks— accommodative monetary policy or higher asymmetric information—have distinct implications for risk taking across different types of lenders. The second explanation, but not the first, would provide an incentive for nonbank lenders to invest in less risky loans. In contrast, we find that, in response to lower longer-term interest rates, some types of nonbank lenders take on riskier credits, while banks generally do not.

We also show that higher through-the-cycle probabilities of default are associated with higher loan spreads (that is, compensation for bearing ex ante credit risk), and that lower spot U.S. Treasury rates are associated with higher loan spreads. We show that through-the-cycle probabilities of loan default explaining about 40 percent of variation in loan spreads, but spot U.S. Treasury rates and other variables explain a small percentage of variation. To establish this finding, as a first step, we merged loan pricing data from DealScan for 25 percent of loans in our quarterly SNC sample. These matches are exact: we matched precisely borrower names and loan terms, such as amounts and originations and maturity dates. As a second step, we estimated loan pricing regressions. The results highlight a risk-taking channel of monetary policy which operates on shadow banking lenders through returns on safer assets, that is, through "search for yield" by shadow banking lenders, and does not result in loan spread compression.

These results are subject to some caveats. First, the results are not necessarily indicative of broader risk-taking behavior by the intermediaries we consider, because we only study a portion of their overall portfolios. However, within the syndicated loan market, because we aggregate loans acquired by participating lenders (immediate lenders) to portfolios of loans at their corresponding parent organizations (ultimate lenders), our conclusions are not affected by within-group transfers that leave the parent-organization-level risk exposure unchanged. Second, for investment funds, we do not observe their investors, hence we do not know where credit risk ultimately resides. For example, pension funds may not invest

equity and fixed income instruments of companies that are geographically closer to them – the companies for which asymmetric information is less of a problem, as in Grinblatt and Keloharju (2001), Coval and Moskowitz (2001), and Butler (2008).

into riskier syndicated term loans directly, but they may do so indirectly by investing into investment funds or by delegating their asset management to portfolio advisors or investment funds. But again, the literature has not much to say about risk taking but nonbank lenders even at this level of precision. Third, one may argue that lenders mitigate credit risk taken in the syndicated term loan market through the use other markets or through the use of risk mitigants, such as collateral requirements. While in case of a default hedging of credit risk may reduce losses of the lenders, the credit protection sellers will suffer losses, possibly undermining the financial stability of the system. While the quarterly SNC data provide some expected credit loss information, it is patchy and does not appear at the moment to be of quality sufficient for a broad analysis.

A necessary observation is that the any increase in risk taking that may be attributed to monetary policy must be evaluated against the benefits of accommodative monetary policy. The literature on the syndicated loan market has highlighted that loan supply is adversely affected by negative liquidity and capital shocks to lenders. Ivashina and Scharfstein (2010), for example, find that banks with more liquidity problems – those with larger potential drawdowns and those with less access to deposit financing and more reliance on short term debt – cut lending to large borrowers more significantly during the 2008 financial crisis. Interest rates on syndicated loans also increased in proportion with the losses that banks experienced from subprime loans, as discussed in Santos (2011). Overall, increased lending to riskier borrowers, if these loans are appropriately priced and provisioned for, may be a desirable outcome of accommodative monetary policy.

2 Shared National Credits Program Data

The Shared National Credits Program (SNC) was established in 1977 by the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency to provide an efficient and consistent review of large syndicated loans. Prior to 1999, information was gathered for loans with a committed or disbursed amount of at least $20 million, shared by two or more unaffiliated supervised institutions. Currently, the program covers any loan or loan commitment that is shared by three or more supervised institutions.

Bank regulators review a SNC loan based on information provided by a designated bank, usually an agent bank. One or more agent banks are generally responsible for recruiting a sufficient number of loan participants, negotiating the contractual details, preparing adequate loan documentation, and disseminating financial documents to potential participants. Once the loan is made, agent banks are also responsible for loan servicing, usually for a fee. While bank regulations require participants to be responsible for assessing their own credit risk analysis, syndicate members typically provide an assessment similar to that of agent banks.[7]

SNC program reviews are conducted annually in May using data provided by agent banks, typically as of December 31 of the prior year, and sometimes as of March 31 of the review year. SNC program examiners assign credit ratings to these loans: pass, special mention, and classified, and split classified loans further into three additional categories – substandard, doubtful, and loss.

The SNC program publishes review summaries every year. The results of the 2013 SNC review were publicly released on October 10, 2013.[8] The overall 2013 SNC portfolio, which includes unused commitments, totaled $3.01 trillion on roughly 9,300 credit facilities (syndicates) to approximately 5,800 borrowers. Figure 1 shows the evolution of loan commitments and loan utilizations over time. Revolving credits are the bulk of commitments, while term loans are the bulk of actual utilizations. Term loans stand at roughly $800 billion as of the end of 2012, with about 70 percent of the lending provided by U.S. financial firms, 20 percent by non-U.S. financial institutions, and the remainder by non-financial institutions.

Beginning in the fourth quarter of 2009, federal regulators began collecting syndicated loan data on a quarterly basis from the 18 banks with the most active syndicated loan businesses; activities of these banks account for about 90 percent of the market. These

[7] Jones, Lang, and Nigro (2005) document the determinants of the proportion of a SNC loan retained by an agent bank over time.

[8] The results are available at www.federalreserve.gov/newsevents/press/bcreg/20131010a.htm.

quarterly reporters provide more detailed assessments of the credit risk associated with syndicated loans at a higher-frequency, regardless of whether they meet the annual SNC review criteria of having at least three regulated institutions sharing the exposure. More specifically, the banks most active in the syndicated loan market are required to provide Basel II parameter estimates for each loan, such as probability of default (PD), loss given default, and exposure at default.

Figure 2 compares commitments and utilizations from the annual SNC data with commitments and utilizations from the quarterly SNC data. The quarterly data is somewhat less comprehensive than the annual equivalent, but it still covers the majority of the annual universe. By focusing on loans for which PDs are available, we cover more than half of the annual universe for commitments, and somewhat less than half for utilizations. Once banks begin reporting PDs for a given credit, they have to continue doing so.[9] This, in addition to acquiring familiarity with the reporting process, explains the upward trend in the share of loans for which PDs are available.[10]

The reported PDs are Basel II Advanced internal rating-based parameter estimates. For a non-defaulted obligor, a Basel II PD is the bank's estimate of the long-run average one-year default rate for the rating grade assigned by the bank to the obligor, capturing the average default experience for obligors in the rating grade over a mix of economic conditions, including downturns. For a defaulted obligor, the bank assigns a PD of 100 percent.

The structure of the data allows us to track changes in syndicated loan portfolios at a lender level (that is, for agent banks and all other participants of the syndicated loan market) and at a lender's holding company (top holder) level. In particular, we can track the sum of loan originations and secondary market purchases.[11]

Tables 2 and 3 show summary statistics for term loans by rating grade and by lender

[9] Reporting is only required for banks that are in the early stages of adopting Basel II regulations (known as "parallel run") and it is optional for all others.

[10] The upward trend in the share is not correlated with the evolution of U.S. Treasury ten-year rates.

[11] Many syndicated loans are sold to nonbank lenders shortly after origination. Therefore, we cannot completely separate newly originated loans vs. those purchased on the secondary market, but can track the sum at a quarterly frequency. We also do not distinguish between loan originations and loan renegotiations—ultimately, both represent risk taking by lenders.

type. About 70 percent of loans receive a “pass” classification, with a median PD of about 60 basis points. Lenders who are subsidiaries of Bank Holding Companies or Financial Holding Companies (BHCs or FHDs) provide about 40 percent of the loans for which a PD is available, while more than one quarter of the loans are provided by funds, trusts, and other financial vehicles. Lenders in credit intermediation, which includes depository institutions and finance companies that are not subsidiaries of BHCs or FHDs provide a fifth of the loans for which PD is available. Finally, investment banks and securities dealing firms provide just under a tenth. Nonbank lenders typically assume significantly higher credit risk than banks, with a median PD about five times as large.

We apply several filters to the data in order to minimize the impact of recording inconsistencies. Because some banks appear to have reported PDs of zero for loans they did not have PD values for, we set them to missing unless we were able to match with an EDF from Moody’s (typically lower than 50 basis points). Some banks also appear to have erroneously reported PDs of 100 for certain loans. We replace a particular PD of 100 to missing if the loan is rated ”pass”, has no charge-off associated with it, is not past due, and did not have a legitimate PD of 100 in the prior quarter. If leads and lags of PD values are nearly identical (difference of one basis point) and the current PD is missing, we fill in the missing PD value with the average of the lead and lag PD value. We also do this when two consecutive values are missing as long as there are surrounding PD values that are the same. Some loans have PDs that are materially different from their PDs in the previous and subsequent quarters. If the previous and subsequent quarter PDs are nearly identical (difference of one basis point) and if the current reported PD is materially different from the previous and subsequent PDs (either greater than 5 times or less than 5 times their average), we replace those PDs with the average of the previous and subsequent PDs. Finally, there were a few credits with information on Expected Credit Loss (ECL), Loss Given Default (LGD), and Exposure at Default (EAD), which did not have PD information. In this case, we backed out PDs to replace them with missing values according to the following formula: $PD = ECL/(EAD \times LGD)$. We should note that estimating our benchmark models on the raw data produces quantitatively similar results.

We aggregate the data to the top holder level for most of our analysis. It might be the case that the syndicated market participants that belong to the same parent company engage in different, possibly not opposite, lending strategies. For example, one unit of a top holder might be loading on risky credits, while another unit adding the safest credits, leaving the net position at the top holder level unaffected. Hence, we choose PDs of additions to the portfolios of top holders rather than individual lenders as a unit of analysis. In unreported robustness checks, which are available upon request, we repeat our analysis at an individual lender level, and find quantitatively similar results.

3 Empirical Approach

Our analysis focuses on term loans, because the lines-of-credit segment of the syndicated loan market is overwhelmingly dominated by banks, while different types of lenders are active in the term loan segment. We use PDs provided by agent banks as a measure of the default risk of a syndicated loan.

Given that we are interested in incremental risk taking, we mostly focus on the weighted-average PD of gross additions (primary market originations, which also include renegotiations of existing facilities, and secondary market purchases) to the portfolio of lender i at time t.[12] The PDs are provided by agent-banks; typically, other lenders use these PDs instead of constructing their own estimates. The main results are based on a balanced panel tracking the same lenders over time. While balancing the panel removes participants that add loans to their portfolios only sporadically, like CLOs and CDOs, the aggregate volume declines only marginally. While it is possible that focusing on gross additions may bias the results (because lenders might be selling off riskier loans and replacing those with safer ones or they may be selling safer credits and buying riskier ones), using net additions as a dependent variable does not alter our conclusions.

[12] The weights are based on credit utilization rather than commitments; note that for term loans, there is little difference between the two.

The analysis identifies a time-series effect with only 16 quarters of data. While our data has a reduced time-series dimension, it is precisely the period we cover that is characterized by persistently low longer-term interest rates, and a longer sample would not necessarily provide the variation we need to identify the effect we are interested in. A comparison of ten-year Treasury yields and three-year-forward ten-year Treasury yields during the current and the two previous recessions (Figure 3) highlights that not only have rates stayed low for longer in the aftermath of the recent financial crisis, but that long term rates have actually kept falling after the end of the recession.

It is possible that an unobserved factor, like an adverse shock to the economy, drives changes in both PDs Treasury yields, although "through the cycle" default probabilities should be less sensitive to business cycle shocks. We address potential endogeneity concerns in alternative specifications that either regress gross additions' PDs on U.S. Treasury yields orthogonalized with respect to several macroeconomic variables, or that assume a latent credit risk factor common to both gross additions and outstanding portfolios.

4 Benchmark Models and Results

Based on the industry classification (using on NAICS codes) of either the syndicate lenders or the top holders of these lenders, the data suggests that there are some changes in risk taking among different types of lenders in the market during the exceptionally low interest-rate period. Figure 4 shows both the small decline in PDs for BHCs and FHDs' gross additions and the increase of PDs of other lender types' gross additions when interest rates were exceptionally low from mid-2011 to mid-2013. We note that funds and trusts are more active in the syndicated term-loan market than other nonbank lender such as investment banks, securities dealers, and other lenders (such as insurance carriers) at the top-holder level. Overall, this figure suggests that nonbank lenders have increased their risk taking in terms of syndicated term-loan originations or purchases relative to bank participants, especially after the first half of 2011. The amounts of gross additions are shown in Figure 5, which highlights how they are non-trivial with the exception of the amounts for other lenders.

4.1 Benchmark Model

To provide a formal analysis of the relationship between longer-term interest rates and risk taking, we begin with the following benchmark model:

$$log(pd^A_{i,t}) = \alpha_i + \sum_{j \subset J} I_j \beta_j T_t + \sum_{j \subset J} I_j X_t \gamma_j + q_{j,y} + \varepsilon_{i,t} \tag{1}$$

where i indexes a top holder (the lender) and j identifies its type (the lender type). We define five lender types at the top-holder level for lender participants – non-depository credit intermediation, investment banking and securities lending, funds/trusts/and other financial vehicles, BHCs and FHDs, and other lenders. According to three-digit NAICS codes, depository credit institutions are categorized as firms in credit intermediation, but we include them as part of BHCs and FHDs.[13,14] In the model, $log(pd^A_{i,t})$ is the log of weighted-average PDs (weighted by the utilization amounts) of gross additions of credits to the portfolio of lender i in quarter t.[15] These gross additions to the portfolios may be added through participating in the originations of a loan syndicate or purchasing an existing term loan credit. T_t is the U.S. Treasury ten-year rate, $\mathbf{X}_t$ is a vector of other macro and financial indicators such as the European sovereign yield spread (proxied by the spread between Italian and German sovereign yields), the high yield CDX index, the variance risk premium, and expected inflation (from the Michigan survey). The high yield CDX index proxies for the general credit or default risk in the economic environment for North American speculative-grade companies—this is a control for the state of the credit

[13] We classify lenders into five categories according to three digit NAICS codes based on the top-holder level. Lenders with top-holder NAICS 522 (with the exception of 5221, which are depository institutions) are classified as firms in non-depository credit intermediation, which includes finance companies. Lenders with top-holder NAICS 523 are classified as firms in investment banking and securities dealing. Lenders with top-holder NAICS 524 are classified as funds, trusts, and other financial vehicles, which include open-ended funds, pension funds, and structured finance vehicles. Lenders with top-holder NAICS 551 are typically BHCs and FHDs. We include lenders with top-holder NAICS of 5221 (depository intermediaries) in this category as well. The remaining lenders are classified as other lenders and include a diverse group including insurance carriers.

[14] We assume that $cov(T_t, \alpha_i) = 0$, $cov(T_t, \varepsilon_{i,t}) = 0$, and $cov(\mathbf{X}_t, \varepsilon_{i,t}) = 0$.

[15] We take logs due to the skewness of the weighted-average PD distribution.

cycle. The variance risk premium proxies for risk aversion and is used to help differentiate between an increase in risk appetite and a search for yield. $I(j)$ is an indicator for lender type j, so we estimate lender-type specific risk-taking sensitivity to U.S. Treasury ten-year rates and to all other macro and financial variables.

While for a given type of lender j the term β_j captures the sensitivity of $log(pd^A_{i,t})$ to T_t, and γ_j the sensitivity to all other macro and financial variables, and two fixed effects explain the level of risk taking. First, we include α_i, a lender i's time-invariant fixed effect. Second, we include $q_{j,y}$, the lender-type-year fixed effects. The presence of the $q_{j,y}$ should take care of unobserved common factors affecting lenders' behavior (or common behavior such as herding) for a particular year. To capture the lenders that are consistently active in the syndicated market, we focus our analysis on a balanced panel. We realize that lender entry and exit from the market might be informative about risk-taking behavior of these market participants. For example, persistently low longer-term interest rates may encourage entry of risk-seeking financial intermediaries, providing additional support to our story. Because of this point, we estimate the benchmark model on an unbalanced panel, as well as introduce an additional model in a later sections.

As βs capture the sensitivity of risk taking to changes in T_t, our first hypothesis is:

$$H_1 : H_0 : \beta_j < 0; \exists\, j,$$

that is, some of the betas might be negative, indicating that some types of lenders load on risk in response to a decline in U.S. Treasury ten-year rates.

Our second hypothesis is more complex. Generally, risk-taking sensitivity of some lender types might be higher than others'. For example, the sensitivity of nonbank lenders might be higher than that of banks or vice versa. By studying differential responses of banks and nonbank lenders, our research design allows to better distinguish between the two considered explanations for increased risk taking in a low longer-term interest rate environment. On the one hand, persistently low longer-term interest rates (or/and expectations of thereof) may induce financial intermediaries to originate risker loans. On the other hand, banks may originate riskier loans because their competitive advantage at screening and monitoring borrowers is especially valuable during periods of unusually high asymmetric information. In fact, the very conditions that warrant persistently loose monetary policy may also make it more difficult to assess the default risk of borrowers. Banks would take on the riskier loans, which would also signal the creditworthiness of the borrower to other lenders, while nonbank intermediaries would focus on borrowers whose loans are less subject to asymmetric information. The stylized fact that the importance of asymmetric information increases at times of economic stress might help us further with identification. The second hypothesis is:

$$H_2 : H_0 : \beta_j > \beta_{-j},$$

where some βs may be either positive or negative. In particular, if the hypothesis "banks' advantage at screening and monitoring borrowers" is true then we should find that $\beta_{nonbanks} > \beta_{banks}$.

Because we estimate a semi-log regression model, for a given lender i of type j, the marginal effect around a given level of gross additions' PD is:

$$\Delta(pd^A_{i,t}) = pd^A_{i,t}\beta_j \Delta T_t \; i \subset j.$$

For simplicity, when evaluating these effects, we hold other regressors fixed, and we ignore lender fixed effects and lender-type-time effects.

The results based on the benchmark model are shown in Table 4. The first two columns show the estimation results based on an unbalanced panel with errors clustered either by lender or time. The third and fourth columns show the estimation results based on a balanced panel with errors clustered either by lender or time. The models in all four columns include lender fixed effects, as well as lender-type-time fixed effects. Clustering by time is particularly important in our setup, because we are interested in the effect of a macroeconomic variable, which impact is correlated across lenders at a given point in time.

For the unbalanced panel, all the coefficients for the U.S. Treasury ten-year rate for different lender categories are negative and only for BHCs and FHDs are they statistically insignificant. The result that, in response to a decline in U.S. Treasury ten-year rates, non-BHC or FHD lenders acquire riskier credits in both the primary and secondary markets, speaks in favor of a risk-taking channel of monetary policy.[16] To the extent that the Federal Reserve's unconventional monetary policies had an impact on longer-term interest rates, our results illustrate such a risk-taking channel of monetary policy. In particular, the results point to the "search for yield" transmission mechanism. In the environment with little if at all movement in costs of funds for financial intermediaries, as the Federal Reserve's policies reduced returns on safer assets, some lender types were induced to invest into riskier ones.

For the balanced panel, which by constructions includes only lenders active in the market in every quarter of the sample period, the results are somewhat similar.[17] The coefficients for BHCs and FHDs continue to be statistically insignificant, while firms in non-depository credit intermediation and other lenders do not appear to significantly respond to a decline in U.S. Treasury ten-year rates, especially when clustered by time. Only firms in investment banking and securities lending and funds, trusts, and other financial vehicles appear to acquire riskier credits when interest rates are low. Such variation across lender-types supports the existence of a risk-taking channel of monetary policy.

Lender-type specific reactions to other types of macro and financial variables also differ substantially. For instance, bank and financial holding companies appear to be pretty sensitive to changes in the European sovereign spread, especially in the balanced panel.

Table 5 shows the marginal effects of longer-term interest rates for both the unbalanced and balanced panels. These marginal effects apply in the neighborhood of very low longer-term rates only. Because nonbank lenders have the highest median PD, and negative and the largest in absolute terms βs, their marginal effects are the largest in absolute terms. The

[16] In the appendix, we also break down lender-type by four-digit NAICS code, which reveals that stand-alone depository institutions (not part of a BHC or FHD), are also statistically insensitive to longer-term interest rates.

[17] Balancing the panel may introduce a sample selection bias but we show that it does not by comparing the results from the unbalanced and balanced panels.

economic significance of the marginal effects for these types of lenders appears to be large: their median PDs may increase substantially with a percentage point decline in the U.S. Treasury ten-year rate. The U.S. Treasury rates over the sample period ranged between 1.65 and 3.75 percent and averaged about 2.5 percent.

We estimate the benchmark model on the sample of loans to only foreign borrowers. In this regression (not shown), we address potential concerns about endogeneity of ex ante credit risk and the U.S. Treasury rates. It is less likely that U.S. Treasury rates and ex ante credit risk of loans to foreign borrowers respond to the same latent factors.

In the appendix, we explore variation of the benchmark model: the model estimated at the four-digit NAICS codes for the top-holders of the lenders, the model estimated for individual lenders, rather than their top holders as is done in the main text, the model estimated for just originations (or purchased prior to the end of the quarter of origination) of syndicated loans by top-holder lenders, and the model estimated for top-holder lenders broken out by both type and location.

5 Robustness Checks

We believe that concerns about endogeneity in our benchmark model are limited because of the usage of through-the-cycle probabilities to measure credit risk, the emphasis on intentional risk taking through secondary market purchases, and the variation in the risk sensitivities of various types of lenders. Nevertheless, to help push our results beyond their conditional correlation interpretation, we offer additional specifications to address possible endogeneity concerns. One model relies on orthogonalized U.S. Treasury ten-year rates, that is, the rates orthogonal to macroeconomic developments akin to the Taylor rule residuals. And another model takes advantage of the panel structure of our data to take possible latent factors into account.

5.1 Orthogonalized U.S. Treasury Rates

In a first robustness check we try to address the potential endogeneity that may arise from omitted variables that drive both interest rates and risk taking. Specifically, we use a two-stage approach describer below.

In the first stage, we explain U.S. Treasury ten-year rates by a set of macroeconomic variables over a longer period at a quarterly frequency over a period of about 38 quarters:

$$I:\ T_t = \alpha + \mathbf{X}_t\gamma + T_t^{\perp}$$

where T_t is the ten-year U.S. Treasury yield, $\mathbf{X}_t$ is a vector of the European sovereign yield spread, the variance risk premium, the high-yield CDX index, the unemployment rate, and expected inflation.[18] With this first step we account for some common factors that may be driving both the aggregate economy and risk taking by syndicated loan market participants.[19]

In the second stage, we use the residuals from the prior stage as a regressor capturing movement in U.S. Treasury ten-year rates orthogonal to macroeconomic developments:

$$II : \log(pd_{i,t}^{A}) = \alpha + \sum_{J} I(j)\beta_j T_t^{\perp} + \varepsilon_t \tag{2}$$

where $T_t^{\perp}$ is the residual from stage I.[20] We estimate this model both on the unbalanced and balanced panel and Table 6 shows the estimation results. BHCs and FHDs have a statistically insignificant coefficient when clustered by time, while other nonbank lenders have negative, statistically significant coefficients. The coefficient magnitudes are somewhat greater than those in the benchmark model's. The results further highlight the contrast between the risk taking by banks and nonbank lenders. The regression coefficients and marginal effects are similar to those of the benchmark model.

[18] We also estimated this stage model over a longer sample period with a more limited set of regressors. The results are similar.

[19] See, for example, Greenway-McGrevy, Han, and Sul (2012).

[20] Notice that in Stage II, we do not include lender-type×time fixed effects because $T_t^{\perp}$, the residual from Stage I and $\delta_{j,t}$s have the same information content.

5.2 Controls for Common Latent Factors [or for Broader Portfolios]

We now address concerns about potential endogeneity by exploiting the panel structure of our data. For each lender, we study a ratio of the (weighted average) PDs that are added to the portfolio and of the PDs of the existing loans in the portfolio. Taking the ratio can help control for fluctuations in broad latent risk factors, because such factors would affect both PDs of the new additions and the existing portfolio, and the ratio should highlight changes in the risk loadings on such factors. The risk loading for credits acquired in a given quarter (in particular, those acquired in the secondary market) is interpreted as picking intentional changes in risk taking.

Indicating gross additions with A and the outstanding portfolio with O for a given lender and time, we define the ratio as $\log(pd^A_{i,t}/pd^O_{i,t})$. (That is, $pd^O_{i,t}$ is the weighted average PD of the lender i's outstanding credit portfolio.) We assume that both the numerator and denominator are functions of a common latent risk or macroeconomic factor, that is, a driver for PDs, denoted by Ω_t, and this factor loadings for a given lender, $\theta^A_{i,t}$ and $\theta^O_{i,t}$. $\theta^A_{i,t}$ is a choice variable for lender i in the current quarter. The ratio, by construction, nets the effect of the common latent factor:

$$pd^A_{i,t} = \theta^A_{i,t} \times \Omega_t$$

$$pd^O_{i,t} = \theta^O_{i,t} \times \Omega_t$$

$$\frac{pd^A_{i,t}}{pd^O_{i,t}} = \frac{\theta^A_{i,t}}{\theta^O_{i,t}}$$

Deviations of $pd^A_{i,t}$ from $pd^O_{i,t}$ should indicate an intentional change in investment strategy of lender i. Table 1 elaborates on the interpretation of movement in the ratio. The economic interpretation of our econometric approach is appealing it is own right. One can think of this structure as capturing rebalancing of portfolios to meet some ex ante credit risk target.

Given these considerations, we estimate the following regression:

$$\log(pd^A_{i,t}/pd^O_{i,t}) = \alpha_i + \sum_{j \subset J} I_j \beta_j T_t + \sum_{j \subset J} I_j X_t \gamma_j + q_{j,y} + \varepsilon_{i,t} \tag{3}$$

We estimate this model on the balanced panel. The results are reported in Table 7, and support the hypothesis that many types of nonbank lenders increased their risk taking as longer-term interest rates decreased. The coefficients for BHCs/FHDs and other lenders, such as insurance companies, are not statistically significant. (Because of the new explained variable, the marginal effects for this model are not directly comparable with those for the benchmark or orthogonalized U.S. Treasury rate models.)

6 Net Additions: Risk Taking Through Both Purchases and Sales of Loans

In this section we consider the effect of loan dispositions—roll-offs of maturing loans and sales of loans—on our results. So far, we have focused on loan originations and purchases, which do not account for the fact that lenders can change the riskiness of their portfolio by both disposing existing loans and acquiring new ones. To address the limitations of the benchmark model, we consider PDs of "net additions", by accounting for the difference between loan originations/purchases and dispositions. The new dependent variable is

$$pd^N_{i,t} = \frac{\sum pd^A_{i,t} \times exposure^A_{i,t} - \sum pd^S_{i,t-1} \times exposure^S_{i,t-1}}{\sum exposure^A_{i,t} + \sum exposure^S_{i,t-1}}$$

where $pd^N_{i,t}$ is the weighted-average PD of the net additions to the portfolio in the current quarter. Net additions are measured by additions minus subtractions, which includes loans that matured, loans sold in the secondary market, or loans refinanced as indicated by $exposure^S_{i,t-1}$.[21] This allow us to use a sample that includes lenders who did not necessarily add to their portfolios, but possibly increased or decreased their risk taking by allowing

[21] The identification strategy of credits sold necessitates the $t-1$ timing.

loans to roll off their balance sheets.

The regression we estimate is:

$$pd^N_{i,t} = \alpha_i + \sum_{j \subset J} I_j \beta_j T_t + \sum_{j \subset J} I_j X_t \gamma_j + q_{j,y} + \varepsilon_{i,t} \tag{4}$$

If new additions have significantly higher volume than subtractions, $pd^N_{i,t}$ will be similar to $pd^A_{i,t}$. We estimate this model for lenders for which we can construct the left-hand side variable. The results are reported in Table 8, and support the hypothesis that nonbank lenders, such as investment banks and securities dealers increased their risk taking as longer-term interest rates decreased. The coefficient for BHCs and FHDs are negative, but much smaller in absolute terms than the that for investment banks and securities dealers.

One large caveat to this exercise is that the subtractions from the existing portfolios may be contaminated by refinancings into other sources of credit, such as bonds, or a shift in demand from other markets. This would be more of a credit demand driven phenomena and may be influencing our results. For example, the shift in refinancings of more credit-worthy borrowers may explain the statistically significant responses of BHCs and FHDs to longer-term interest rates. In addition, curiously, as the European sovereign spread increases, all types of lenders have positive coefficients on their risk taking behavior, which may have been caused by some pause in such refinancing behavior (to bonds) due to economic uncertainty that is not captured by some of our other financial variables. In any case, because our data has better coverage as time passes, the estimated riskiness of disposed credits may be less representative of the all the credits disposed of compared to gross additions, which contaminates our results.

6.1 Risk Taking in Response to Changes in Expected Stance of the U.S. Monetary Policy

The discussion so far has focused on whether some types of syndicated lenders—in particular, asset managers—add riskier credits to their portfolios in response to a decline in

U.S. Treasury spot ten-year rates. The results provide evidence that risk taking, at least, by some types of lenders may be guided by the current stance of the U.S. monetary policy. However, risk taking may also respond to expectations of a future stance of monetary policy. For example, risk taking in the syndicated market may pick up, if lenders expect risk free rates to stay low over a considerable period ("search for yield induces risk taking now because of low returns on safe assets going forward") or they were to expect the liftoff of the federal funds rate to occur in a more distant future ("low cost of funding going forward induces risk taking now"). To the extent that the Federal Reserve, through its forward guidance, affected market expectations of short- and longer-term interest rates, we are thinking of a risk-taking channel of monetary policy operational through the effect of forward guidance on expectations of interest rates going forward. We consider first the U.S. Treasury ten-year three-year forward rate, second the expected change in the federal funds rate ten-quarters from now (constructed using the implied federal funds rates derived from OIS quotes), and third the expected duration of the zero lower bound (constructed again using the implied federal funds rates derived from OIS quotes). The expected duration is measured as the number of quarters between the current quarter to the quarter when the federal funds rate is expected to rise above 25 basis points according to the OIS-quotes-implied federal funds rates.

We use the three measures in a model similar to the benchmark model, where F is one of the measures:

$$log(pd_{i,t}^{A}) = \alpha_i + \sum_{J} I(j)\beta_j F_t + \sum_{j \subset J} I_j X_t \gamma_j + q_{j,y} + \varepsilon_t \tag{5}$$

We hypothesize that in regressions with the U.S. Treasury ten-year three-year forward rate, β_js may be negative for some types of lenders. As returns on safe assets are expected to remain low, some types of lenders may be induced to acquire riskier assets. Similarly, in regressions with the expected change in the federal funds rate ten-quarters from now some β_js may be negative. As funding costs for financial intermediaries are expected to stay low ten quarters from now, some types of lenders may be induced to acquire riskier credits. However, in regressions with the expected duration of the zero lower bound, βs for some types of lenders may be positive—the longer the duration of the zero lower bound, that is the more distant is the liftoff in the federal funds rate, the stronger may be incentive to acquire riskier credits.

The bottom half of Figure 3 shows the time series of the ten-year thee-year forward interest rate, while Figure 6 shows the OIS-quotes-based measures. All three measures suggest that market participants expected monetary tightening in the near future through early 2011, and then expected monetary policy to remain accommodative in the near term through late 2012.

Tables 9 to 11 report the estimated sensitivities βs for the balanced panel. The results are similar to those for the U.S. Treasury spot rates, and they show that, while BHC/FHDs' risk taking, is generally insensitive to changes in the F measures, certain nonbank lenders—in particular, investment banks, securities dealers, funds, trusts, and other financial vehicles—acquire riskier credits in the primary and secondary market in anticipation of loose monetary policy over the medium term. Note again that β_js are expected to be positive in Table 11, and, indeed, they are.

7 Risk Taking and Syndicated Loan Pricing

So far, we have discussed the existence and significance of a risk taking channel of the U.S. monetary policy operation through nonbank lenders (shadow banks). Next we highlight that our results are consistent with "search for yield". To do so, we merge additional loan-specific information–such as loan spreads and borrower debt and loan ratings–from DealScan by hand. Because DealScan captures loan characteristics around the time of origination, in what follows, we consider only probabilities of loan default around the time of origination. There is direct mapping of loans from one data set to another, we match a significant fraction of loans in SNC with those in DealScan (25 percent of the loans in our SNC sample). We leave the discussion of adequate risk compensation (and a more complete match of SNC and DealScan loans that this topic requires) to future research. At this point, we just want to illustrate that higher PDs correspond to worse borrower debt and loan ratings and to higher loan spreads.

Figure 7 shows that ex ante riskier loans command higher loan spreads and that the relationship between the two is highly nonlinear (note that both PDs and loan spreads on the axis are logged). Ratings appear to play a significant role in pricing of loans.[22] Borrowers with outstanding debt rated as investment grade generally pay significantly lower loan spreads than borrowers with either not rated or speculative grade debt. Figure 8 shows that the timing of origination does not appear to play a significant role in pricing of loans.[23]

Tables 12 and 13 shows some distribution statistics for the data presented in the figure. These statistics suggest that ex ante riskier loans command higher loan spreads (that is, are costlier to borrowers) and that loans to borrowers with non-rated or speculative-grade outstanding debt command higher loan spreads as well.

We estimate this baseline model:

$$log(ais_i) = \alpha + \beta log(pd_i) + \varepsilon_i, \tag{6}$$

where ais_i is a loan i's loan spread.

For pricing loans PDs play the most important role, they explain 40 percent of variation in loan spreads (see Table 14). Including additional variables makes little difference: inclusion of log(duration) adds about 2 percentage points to the R-sq, as does inclusion of quarter fixed effects capturing the effects of macroeconomic and regulatory environments. These effects are negative, in -0.10 to -0.30 range, many of them are statistical significant, and they are jointly statistically significant. This may give hope that macroeconomic variables such as the ten-year Treasury rate are important to pricing of loans. And the results in column (3) suggest just. The regression coefficient on the Treasury rate is estimated to

[22] Ratings are based on Moody's senior debt ratings at the moment of origination as reported in DealScan.

[23] Conditional correlations (not shown) suggest that too.

be negative and statistically significant. However, the explanatory power of this and other macroeconomic variables is low.

The U.S. Treasury rate may be an important factor in pricing of loans for borrowers with certain ratings of outstanding debt but not others. Consider this regression model to address this question:

$$log(ais_{i,t}) = \sum_J I(j)\alpha_j + \sum_J I(j)\beta_j log(T_t) + \sum_J I(j)\gamma_j log(pd_i) + ... + \varepsilon_i, \quad (7)$$

where $j \subset J = \{IG, SG, not-rated\}$–that is a set of dummy variables capturing whether a borrower of a loan i has senior debt outstanding rated IG or SG or not rated at all. As shown in Table 15, prices of loans to borrowers with not-rated and speculative-grade outstanding debt are affected by the safer, longer-term interest rates, but those to borrowers with investment-grade debt are not.

To summarize, declines in the U.S. Treasury rate appear to result in nonbank lenders acquiring riskier loan portfolios and an increase in loan spreads for loans to borrowers with below investment-grade debt. To the extent that the Federal Reserve's policies affected longer-term rates, these policies did encourage more risk taking in the syndicated loan market and contributed to a build-up of ex ante credit risk in the shadow banking system without apparent adverse effects on pricing of some types of syndicated loans.

8 Conclusions

We use supervisory data to study the risk-taking behavior of bank and nonbank lenders in the U.S. syndicated loan market during the recent period of low interest rates. We find that certain financial intermediaries increase the riskiness of their syndicated loan portfolios in both the primary and secondary markets when longer-term interest rates are expected to remain low. While we mainly focus on spot Treasury rates as an explanatory variable, we come to the same conclusion when using expectations of longer-term interest rates or the expected duration of the zero lower bound period.

These results are consistent with the notion that monetary policy can operate through a risk-taking channel that induces certain investors to acquire riskier portfolios. There are reasons to expect that low interest rates affect risk-taking differently for different intermediaries, depending on their business model. For example, asset managers need to take into account that the growth of their assets under management depends on the returns they are able to achieve. Similarly, the liabilities of defined-benefit pension plans are not related to the level of interest rates, even though the returns on their investments may be.

While we find statistically robust evidence that many nonbank lenders add riskier credits to their portfolios, we do not find such evidence for lenders in BHCs or FHDs (this result can be driven, in part, by the stricter regulations to which banks have been subjected in the aftermath of the financial crisis). This pattern of responses in the cross-section of lenders supports the hypothesis that the changes in risk-taking that we document are not due to potentially higher uncertainty about the economic recovery, because, in this case, banks should have invested in risker loans, in light of their ability to better screen and monitor borrowers.

Our results should be interpreted in light of several caveats. First, we focus only on part of an intermediary's portfolio—syndicated term loans—and the additional risk may be immaterial for the overall portfolio, or the intermediary may be actively hedging the additional risk. Second, loan pricing or recovery rates may be moving in ways that make the increased risk sufficiently profitable or dampen the increase in default risk. Finally, any effect of monetary policy on risk taking must be evaluated against the broader benefits of accommodative monetary policy. The syndicated loan literature, for instance, has highlighted that loan supply is adversely affected by negative liquidity and capital shocks to lenders (see, for instance, Ivashina and Scharfstein (2010) and Santos (2011)).

In a March 1, 2013 speech, Chairman Bernanke said: "One purpose of this support (for the economy with low interest rates) is to prompt a return to the productive risk taking that is essential to robust growth and to getting the unemployed back to work. On the other hand, we must be mindful of the possibility that sustained periods of low interest rates and highly accommodative policy could lead to excessive risk-taking in some financial markets. The balance here is not an easy one to strike."[24] While we do not show whether risk taking has been productive or not, we show that low spot and forward longer-term interest rates indeed have encouraged risk taking. From a financial stability point, a prospective build-up in ex ante credit risk on the books of shadow bank lenders is a negative, but policy makers may take some solace in the apparent absence of loan spread compression.

[24] "Long-Term Interest Rates" at the Annual Monetary/Macroeconomics Conference: The Past and Future of Monetary Policy, sponsored by Federal Reserve Bank of San Francisco, San Francisco, California, March 1, 2013.

Appendix. Additional checks

In this appendix, we show the results for the benchmark model estimated for four digit top-holder lender classification based on NAICS codes (Table A1), originations only (Table A2), the results for the benchmark model estimated for gross additions of individual lenders (rather than their top holders) (Table A3), and the results for the benchmark model estimated with lenders broken out by their type and location (Table A4 and Table A5).

The four digit lender classification reveals that stand-alone depository institutions are insensitive to changes in longer-term treasury yields, while BHCs and FHDs are now sensitive to such changes. However, many of these, especially large, BHCs and FHDs have many nonbank subsidiaries that are active in the market. To get a better sense which types of lenders their increase risk taking in response to a decline in U.S. Treasury rates directly, we study the PDs of additions for individual lenders, rather than their top holders as done in the regression in the main text. We classify individual lenders on the basis of several groups according to their NAICS codes, and we estimate a version of the benchmark model. The results based on the balanced panel are shown in Table A3.

In order to provide an international perspective on the relationship between low longer-term interest rates and risk taking in the U.S. syndicated loan market, we now classify lenders on the basis of both type and geographical location. In terms of volume of gross additions, non-U.S. participants tend to be relatively small, but there is a significant number of them, and they operate in a different environment from domestic institutions. In particular, it is possible that asset managers with a particulary high tolerance for risk incorporate in jurisdictions with less strong regulation.

In the quarterly SNC data, the classification of top-holders is limited to just three types: non-U.S. banks, U.S. banks, and nonbank lenders, which are the categories we use in the top-holder estimation. The results for Model 1 are shown in Table A4. The coefficient on the U.S. Treasury ten-year rate is positive but not statistically significant for foreign banks for both the unbalanced and balanced panels and U.S. banks for the unbalanced panel. Similar coefficients are negative and statistically significant for other lenders in both the unbalanced and balanced panels and for U.S. banks for the balanced panel. However, the large U.S. banks that are the most active in this market, as mentioned above, have many nonbank subsidiaries that are active in this market. The results are broadly similar when lenders are broken out more finely, as shown in Table A5. Investment banks, securities dealers, and other funds, trusts, and financial vehicles in both the United States and in offshore financial centers (OFCs) appear to increase their risk taking in response to a decline in U.S. Treasury ten-year rates.[25] In addition, U.S. bank and financial holding companies also tend to be risk taking, but at a smaller degree than the other nonbank lenders.

[25]The offshore international centers are jurisdictions such as the Cayman Islands.

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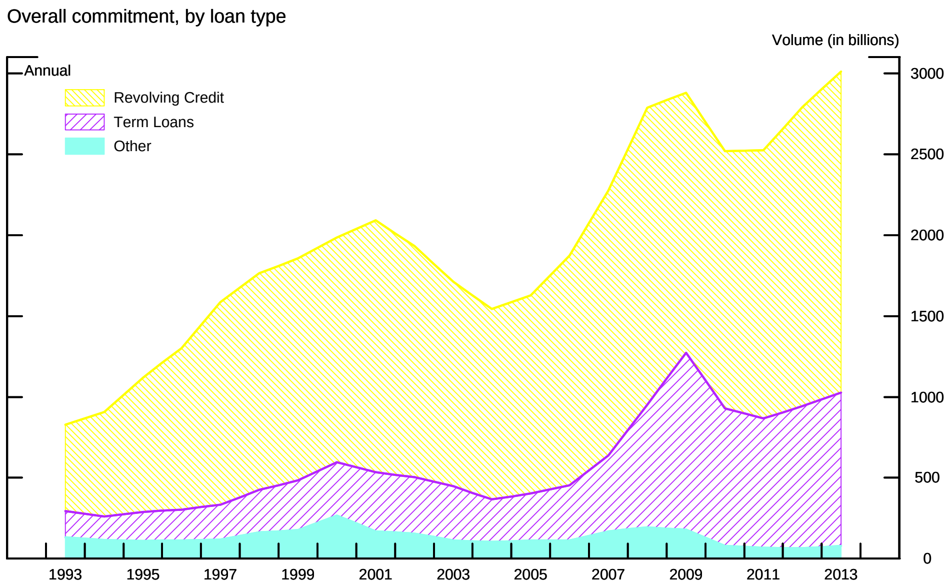
Figure 1: **Annual Shared National Credit, commitments and utilization trends by loan type**

The charts show the time series of commitments and utilization, by loan type, using the annual SNC data.



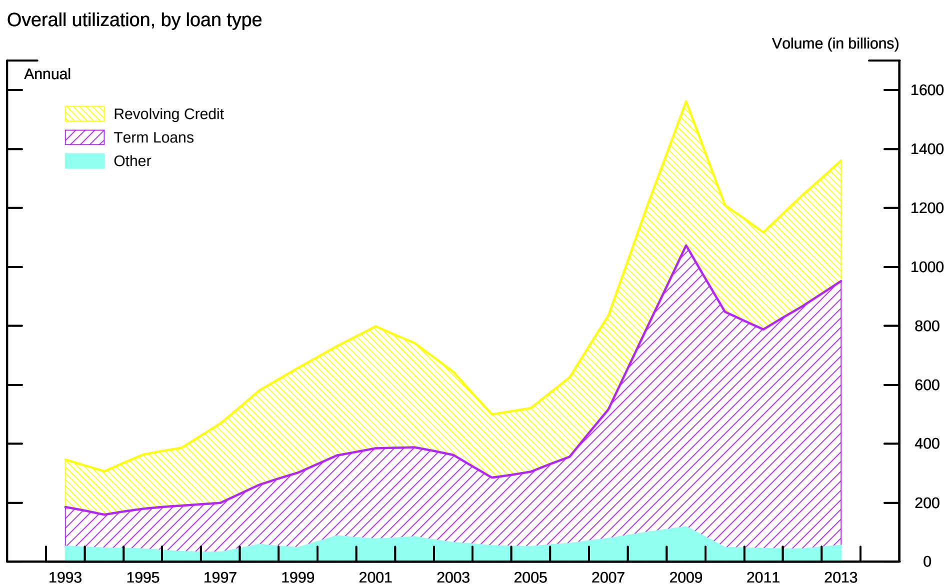


Figure 2: **Shared National Credit data: commitments and utilization trends - quarterly vs. annual**

The charts show the time series of annual and quarterly commitments and utilization, by loan type and uses both the annual and quarterly SNC data. The charts also shows the volumes for which we have different types of default risk indicators (PD and EDF), and for which we have usable credit identifiers and default probabilities.

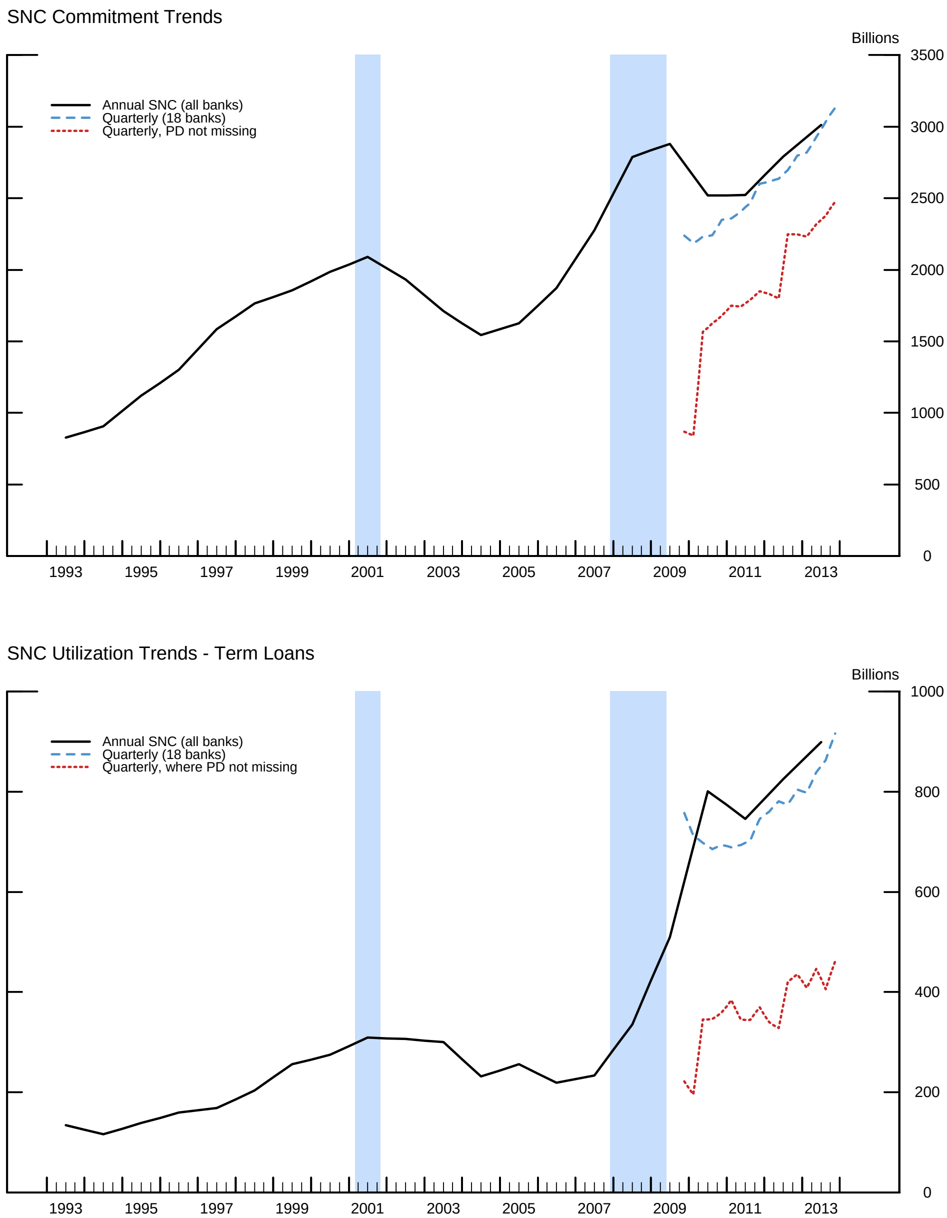


Figure 3: **Interest rates during the last three recessions**
The charts show ten-year Treasury rates through the three most recent recessions (left) and three-year-forward ten-year Treasury rates (right).

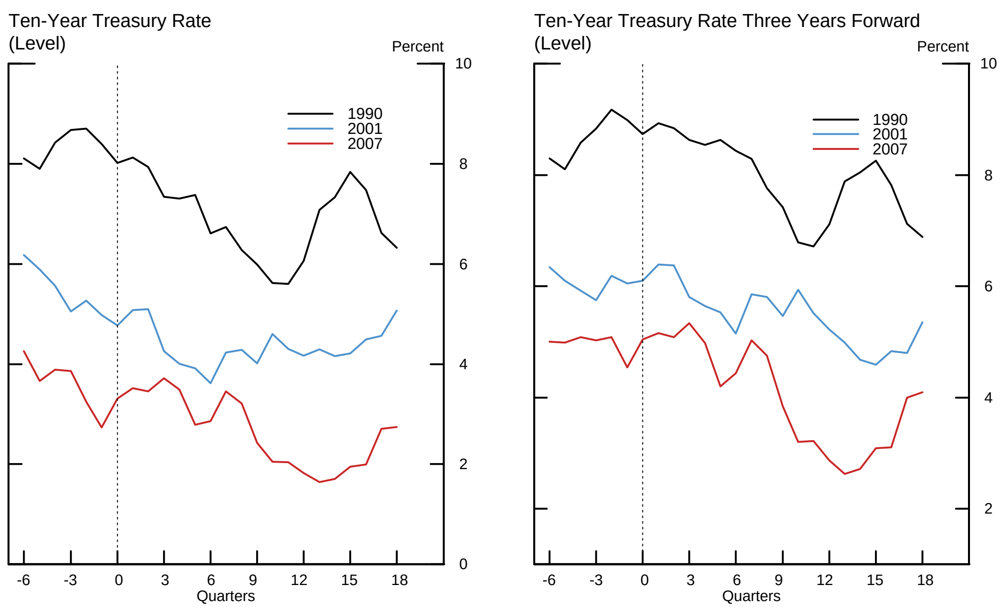


Figure 4: **Risk Taking by Lender Type: PDs of Gross Additions**

The chart shows PDs of portfolio additions (in percent) by lender type based on the unbalanced panel.

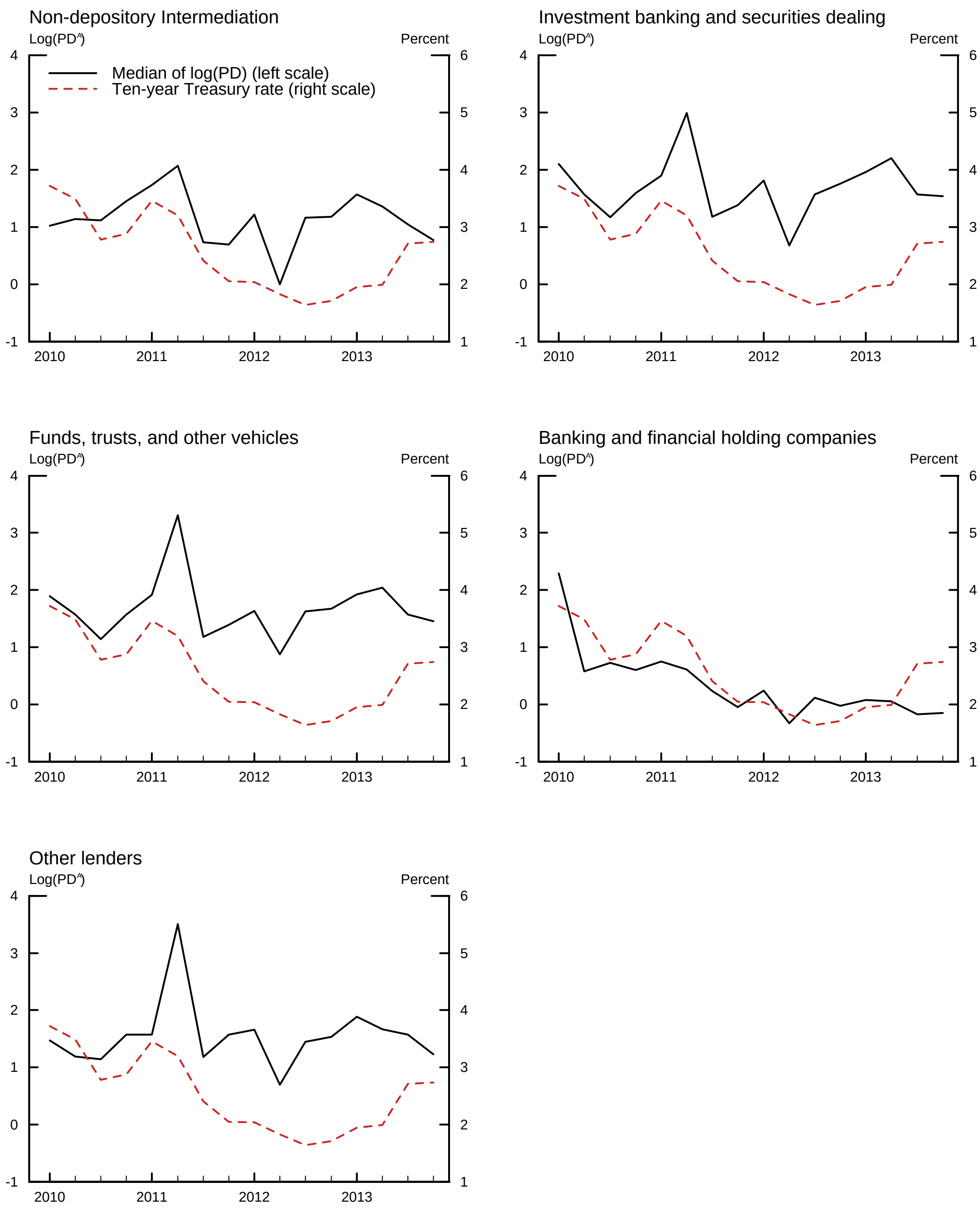


Figure 5: **Gross Additions by Lender Type**

The chart shows portfolio additions by lender type based on the unbalanced panel (in $billions).

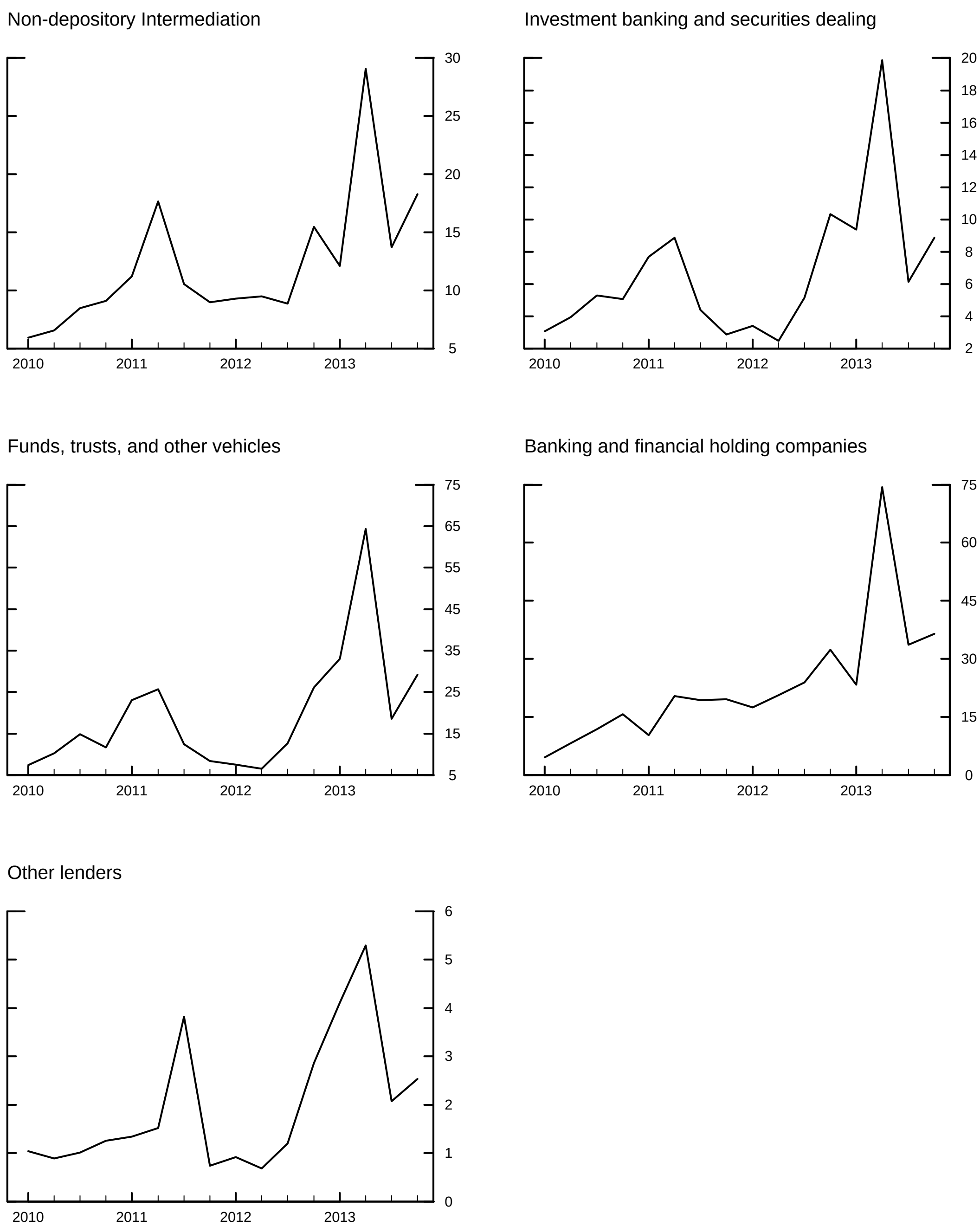


Figure 6: **Monetary policy expectations from OIS quotes**

The charts show the number of quarters until the federal funds rate liftoff and the spread between the federal funds rate 10 quarters ahead and the current federal funds rate.

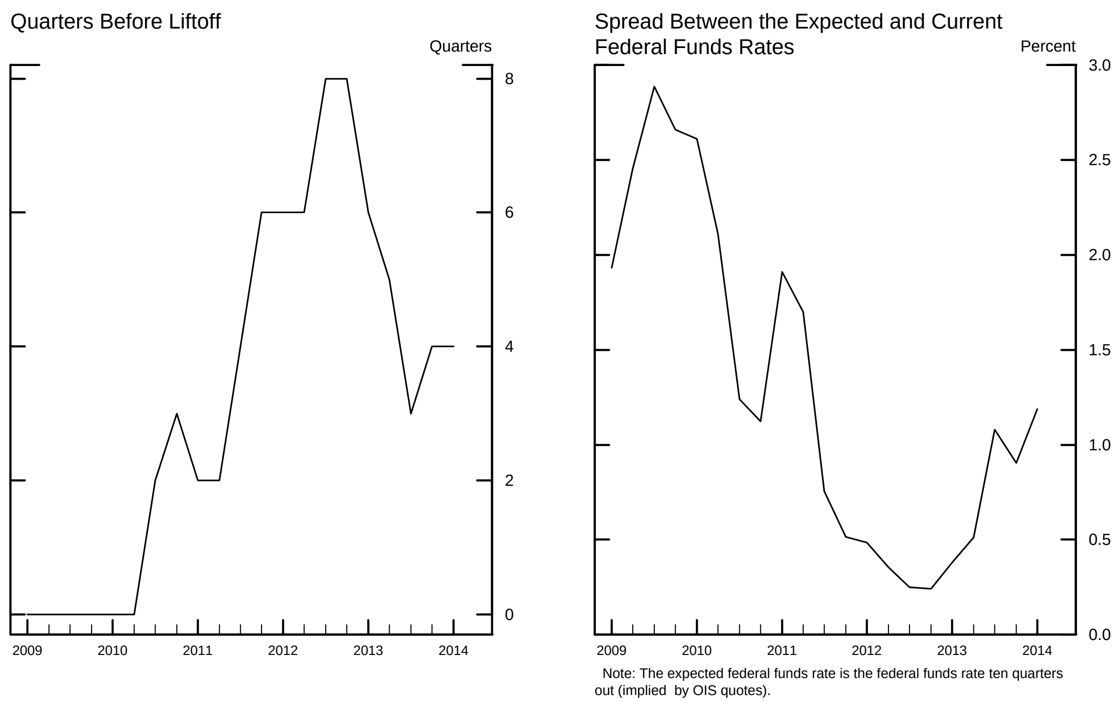


Figure 7: **PDs and loan spreads**

The chart shows that ex ante riskier loans command higher loan spreads and that the relationship between the two is highly nonlinear (the chart reports logged values for both variables). Ratings are based on Moody's senior debt ratings at the moment of origination as reported in Dealscan. Ratings appear to play a significant role in pricing of loans.

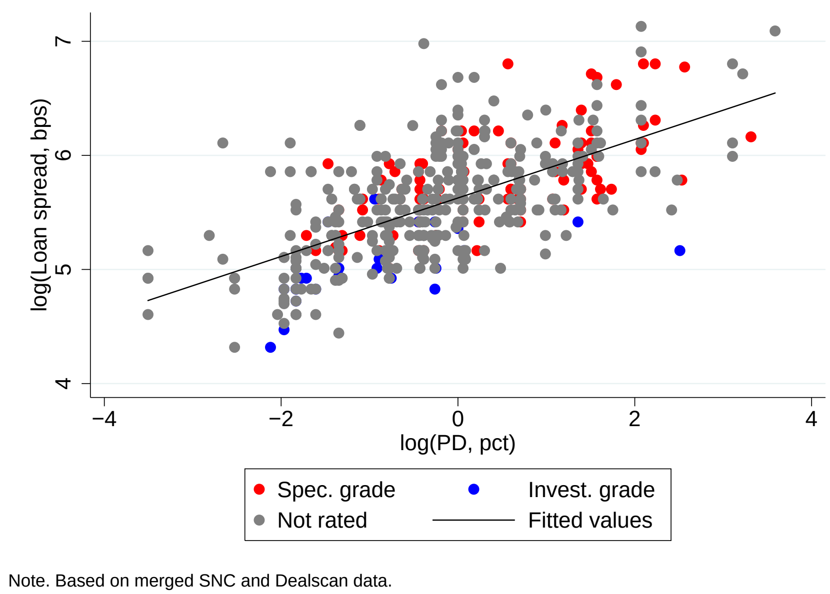
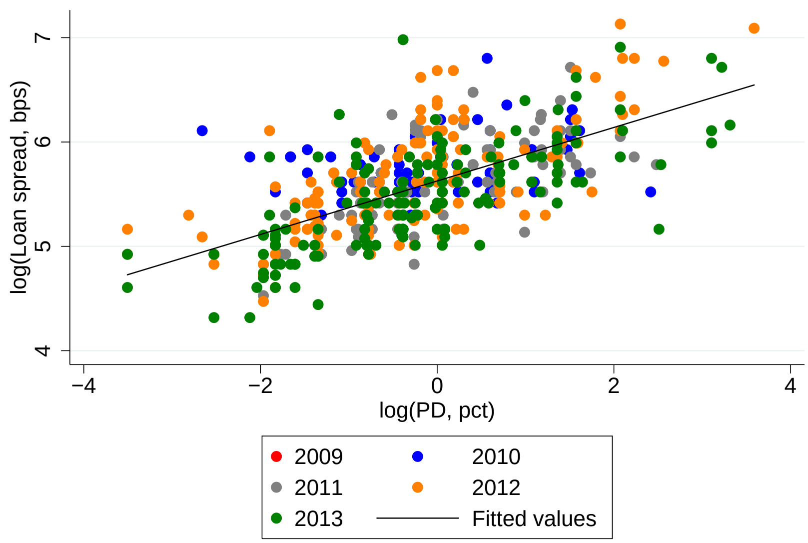


Table 1: **The interpretation of changes in the ratio** $\frac{pd^A_{i,t}}{pd^O_{i,t}}$

Case	$pd^A_{i,t}$	$pd^O_{i,t}$	Interpretation
1	up	up	risk neutral
2	up	down	risk seeking
3	down	up	risk aversion
4	down	down	risk neutral

Figure 8: **PDs and loan spreads**

The chart shows that ex ante riskier loans command higher loan spreads and that the relationship between the two is highly nonlinear. The timing of origination does not appear to play a significant role in pricing of loans.



Note. Based on merged SNC and Dealscan data.

Table 2: **Summary Statistics for Term Loans by Rating Grade**

Rating Grade	Percent of Loans	Percent of Loans with PDs	Median PD
Pass	70.3	66.3	0.64
Special Mention	11.6	12.5	5.58
Substandard	13.2	12.6	25.1
Doubtful	4.2	7.3	100
Loss	0.8	1.2	100

Table 3: **Summary Statistics for Term Loans by Lender Type**

Lender Type	Count	Percent of Loans	Percent of Loans with PDs	Median PD
Non-depository intermediation	765	8.6	7.5	3.89
Investment banking and securities dealing	2537	12.7	9.4	4.52
Funds, trusts, and other vehicles	6930	36.5	26.4	4.04
Bank and financial holding companies	1169	38.6	54.0	1.00
Other lenders	928	3.5	2.6	3.89

Table 4: **Benchmark model with gross additions PDs**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	-0.581^{***}	-0.581^{**}	-0.493^{**}	-0.493
	(-4.914)	(-2.854)	(-2.114)	(-1.557)
Investment banking / securities dealing	-0.642^{***}	-0.642^{***}	-0.917^{***}	-0.917^{***}
	(-10.363)	(-3.180)	(-5.652)	(-3.743)
Funds, trusts, and other vehicles	-0.533^{***}	-0.533^{***}	-0.678^{***}	-0.678^{***}
	(-14.891)	(-3.444)	(-8.790)	(-3.302)
Bank and financial holding companies	-0.057	-0.057	-0.165	-0.165
	(-0.658)	(-0.373)	(-1.079)	(-0.835)
Other lenders	-0.490^{***}	-0.490^{**}	-0.349	-0.349
	(-4.907)	(-2.618)	(-1.572)	(-1.449)
European sovereign spread, pct				
Non-depository intermediation	-0.345^{***}	-0.345^{*}	-0.082	-0.082
	(-3.125)	(-1.988)	(-0.448)	(-0.281)
Investment banking / securities dealing	-0.440^{***}	-0.440^{***}	-0.651^{***}	-0.651^{**}
	(-6.980)	(-3.167)	(-4.602)	(-2.816)
Funds, trusts, and other vehicles	-0.431^{***}	-0.431^{***}	-0.396^{***}	-0.396^{**}
	(-12.066)	(-3.611)	(-5.868)	(-2.247)
Bank and financial holding companies	-0.362^{***}	-0.362^{**}	-0.621^{***}	-0.621^{***}
	(-4.239)	(-2.783)	(-4.662)	(-3.574)
Other lenders	-0.531^{***}	-0.531^{***}	-0.495^{**}	-0.495^{***}
	(-7.228)	(-4.117)	(-2.282)	(-3.321)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.53	0.53	0.41	0.41

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: **Marginal effects of one percentage point increase in T_t**

Lender type	Median PD	Unbalanced panel		Balanced panel	
		β	marg. effect	β	marg. effect
Non-depository intermediation	3.89	-0.581	-2.260	—	—
Investment banking / securities dealing	4.52	-0.642	-2.902	-0.917	-4.145
Funds, trusts, and other vehicles	4.04	-0.533	-2.153	-0.678	-2.739
Bank and financial holding companies	1.00	—	—	—	—
Other lenders	3.89	-0.490	-1.906	—	—

Note. Only statistically significant βs with and marginal effects shown. Statistical significance of βs based on the regression with errors clustered by time. Calculations apply in the range of U.S. Treasury ten-year rates between 1.65 and 3.75 percent around the median PDs for outstanding loans.

Table 6: **Model with gross additions PDs and orthogonalized U.S. Treasury ten-year rates**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
Non-depository intermediation	-0.846^{***}	-0.846^{***}	-0.909^{***}	-0.909^{**}
	(-8.269)	(-2.999)	(-5.036)	(-2.362)
Investment banking / securities dealing	-0.803^{***}	-0.803^{***}	-1.151^{***}	-1.151^{***}
	(-13.084)	(-3.106)	(-6.820)	(-3.367)
Funds, trusts, and other vehicles	-0.790^{***}	-0.790^{***}	-0.981^{***}	-0.981^{***}
	(-23.429)	(-3.354)	(-14.863)	(-3.030)
Bank and financial holding companies	-0.318^{***}	-0.318	-0.410^{***}	-0.410
	(-4.473)	(-1.372)	(-3.442)	(-1.211)
Other lenders	-0.220^{***}	-0.220	-0.413	-0.413^{*}
	(-2.778)	(-1.221)	(-1.398)	(-1.811)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.50	0.50	0.32	0.32

Note: The explained variable is $log(pd^A_{i,t})$. The explanatory variable is the U.S. Treasury ten-year rate orthogonalized with respect to a set of variables (akin to a Taylor rule residual), $T^{\perp}_t = T_t$ - (-5.146-0.571×(Euro. sov. spread)$_t$-0.001×(High yield CDX)$_t$+0.006×(Variance risk premium)$_t$+0.049×(Exp. inflation)$_t$-0.111×(Unempl. rate)$_t$), estimated on 37 quarters of data. Both models include lender fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: **Model with gross additions PDs relative to outstanding portfolios' PDs**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	-0.527^{***}	-0.527^{**}	-0.334	-0.334
	(-3.729)	(-2.138)	(-1.303)	(-1.021)
Investment banking / securities dealing	-0.663^{***}	-0.663^{**}	-0.824^{***}	-0.824^{***}
	(-7.767)	(-2.466)	(-4.074)	(-3.152)
Funds, trusts, and other vehicles	-0.581^{***}	-0.581^{***}	-0.655^{***}	-0.655^{***}
	(-12.079)	(-2.947)	(-7.102)	(-3.442)
Bank and financial holding companies	0.054	0.054	-0.121	-0.121
	(0.493)	(0.279)	(-0.691)	(-0.639)
Other lenders	-0.398^{***}	-0.398	-0.192	-0.192
	(-2.813)	(-1.591)	(-0.527)	(-0.696)
European sovereign spread, pct				
Non-depository intermediation	-0.313^{**}	-0.313	-0.003	-0.003
	(-2.179)	(-1.562)	(-0.017)	(-0.010)
Investment banking / securities dealing	-0.493^{***}	-0.493^{***}	-0.714^{***}	-0.714^{***}
	(-5.849)	(-3.009)	(-4.731)	(-3.184)
Funds, trusts, and other vehicles	-0.503^{***}	-0.503^{***}	-0.426^{***}	-0.426^{**}
	(-10.757)	(-3.830)	(-5.386)	(-2.546)
Bank and financial holding companies	-0.345^{***}	-0.345^{**}	-0.588^{***}	-0.588^{***}
	(-3.345)	(-2.652)	(-4.094)	(-3.546)
Other lenders	-0.603^{***}	-0.603^{***}	-0.542^{***}	-0.542^{***}
	(-5.757)	(-3.358)	(-2.879)	(-3.331)
Num. of observations	32486	32486	4640	4640
Errors clustered by	lenders	time	lenders	time
Num. of clusters	5586	16	290	16
R-sq. overall	0.35	0.35	0.24	0.24

Note: The explained variable is $log(pd^A_{i,t}/pd^O_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8: **Model with net additions PDs**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	2.739	2.739^{*}	0.918	0.918
	(1.638)	(2.071)	(0.274)	(0.516)
Investment banking / securities dealing	-2.597^{**}	-2.597^{**}	-8.455^{***}	-8.455^{**}
	(−2.170)	(−2.270)	(−4.386)	(−2.662)
Funds, trusts, and other vehicles	0.253	0.253	-3.424^{***}	−3.424
	(0.378)	(0.275)	(−3.194)	(−1.369)
Bank and financial holding companies	0.127	0.127	-4.249^{***}	-4.249^{***}
	(0.185)	(0.225)	(−2.647)	(−4.091)
Other lenders	−0.012	−0.012	-12.665^{***}	-12.665^{**}
	(−0.007)	(−0.009)	(−2.702)	(−2.574)
European sovereign spread, pct				
Non-depository intermediation	4.252^{***}	4.252^{***}	8.970^{***}	8.970^{***}
	(2.698)	(3.230)	(3.416)	(4.250)
Investment banking / securities dealing	2.311^{**}	2.311^{*}	5.818^{***}	5.818^{**}
	(2.198)	(2.102)	(3.071)	(2.230)
Funds, trusts, and other vehicles	3.778^{***}	3.778^{***}	8.348^{***}	8.348^{***}
	(5.974)	(5.117)	(8.444)	(4.149)
Bank and financial holding companies	2.044^{***}	2.044^{***}	0.366	0.366
	(3.390)	(7.140)	(0.318)	(0.259)
Other lenders	1.094	1.094	-4.726^{**}	-4.726^{*}
	(1.231)	(1.228)	(−2.177)	(−1.781)
Num. of observations	44507	44507	3480	3480
Errors clustered by	lenders	time	lenders	time
Num. of clusters	7614	16	232	16
R-sq. overall	0.53	0.53	0.41	0.41

Note: The explained variable is $log(pd^N_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9: **Benchmark model with the U.S. Treasury ten-year three-year forward rate**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	-0.534^{***}	-0.534^{***}	-0.496^{**}	-0.496^{*}
	(-5.307)	(-3.121)	(-2.485)	(-1.888)
Investment banking / securities dealing	-0.569^{***}	-0.569^{***}	-0.841^{***}	-0.841^{***}
	(-11.018)	(-3.311)	(-6.207)	(-4.225)
Funds, trusts, and other vehicles	-0.486^{***}	-0.486^{***}	-0.630^{***}	-0.630^{***}
	(-16.297)	(-3.837)	(-9.935)	(-3.860)
Bank and financial holding companies	-0.040	-0.040	-0.113	-0.113
	(-0.576)	(-0.305)	(-0.912)	(-0.640)
Other lenders	-0.400^{***}	-0.400^{**}	-0.260	-0.260
	(-5.241)	(-2.753)	(-1.601)	(-1.296)
European sovereign spread, pct				
Non-depository intermediation	-0.369^{***}	-0.369^{**}	-0.137	-0.137
	(-3.350)	(-2.304)	(-0.729)	(-0.487)
Investment banking / securities dealing	-0.451^{***}	-0.451^{***}	-0.694^{***}	-0.694^{***}
	(-7.204)	(-3.749)	(-4.948)	(-3.468)
Funds, trusts, and other vehicles	-0.452^{***}	-0.452^{***}	-0.433^{***}	-0.433^{**}
	(-12.726)	(-4.222)	(-6.484)	(-2.762)
Bank and financial holding companies	-0.352^{***}	-0.352^{**}	-0.600^{***}	-0.600^{***}
	(-4.183)	(-2.738)	(-4.716)	(-3.494)
Other lenders	-0.548^{***}	-0.548^{***}	-0.488^{**}	-0.488^{***}
	(-7.455)	(-4.362)	(-2.390)	(-3.220)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.53	0.53	0.41	0.41

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10: **Benchmark model with the expected increase in the federal funds rate**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	-0.342^{***}	-0.342^{**}	-0.275	-0.275
	(-3.437)	(-2.314)	(-1.293)	(-1.153)
Investment banking / securities dealing	-0.349^{***}	-0.349^{**}	-0.491^{***}	-0.491^{**}
	(-6.062)	(-2.298)	(-3.477)	(-2.395)
Funds, trusts, and other vehicles	-0.280^{***}	-0.280^{**}	-0.363^{***}	-0.363^{**}
	(-8.230)	(-2.380)	(-5.077)	(-2.171)
Bank and financial holding companies	0.087	0.087	-0.007	-0.007
	(0.963)	(0.515)	(-0.047)	(-0.042)
Other lenders	-0.330^{***}	-0.330^{*}	-0.349	-0.349^{*}
	(-3.057)	(-2.115)	(-1.629)	(-1.980)
European sovereign spread, pct				
Non-depository intermediation	-0.275^{**}	-0.275	-0.007	-0.007
	(-2.340)	(-1.398)	(-0.035)	(-0.024)
Investment banking / securities dealing	-0.338^{***}	-0.338^{**}	-0.495^{***}	-0.495^{*}
	(-4.964)	(-2.144)	(-3.265)	(-1.782)
Funds, trusts, and other vehicles	-0.338^{***}	-0.338^{**}	-0.281^{***}	-0.281
	(-8.781)	(-2.510)	(-3.756)	(-1.388)
Bank and financial holding companies	-0.280^{***}	-0.280^{**}	-0.524^{***}	-0.524^{**}
	(-3.102)	(-2.209)	(-3.562)	(-2.798)
Other lenders	-0.472^{***}	-0.472^{***}	-0.532^{**}	-0.532^{***}
	(-5.690)	(-3.734)	(-2.399)	(-3.177)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.52	0.52	0.40	0.40

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11: **Benchmark model with the expected duration of the zero lower bound period**

	Unbalanced panel (1)	Unbalanced panel (2)	Balanced panel (3)	Balanced panel (4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	0.217***	0.217**	0.187***	0.187
	(5.785)	(2.311)	(2.858)	(1.564)
Investment banking / securities dealing	0.213***	0.213**	0.324***	0.324***
	(11.195)	(2.924)	(6.394)	(4.326)
Funds, trusts, and other vehicles	0.153***	0.153***	0.237***	0.237***
	(14.159)	(3.037)	(10.764)	(4.781)
Bank and financial holding companies	0.041	0.041	0.040	0.040
	(1.521)	(1.015)	(1.030)	(0.666)
Other lenders	0.073**	0.073	0.121	0.121
	(2.444)	(1.655)	(1.631)	(1.701)
European sovereign spread, pct				
Non-depository intermediation	−0.535***	−0.535**	−0.259	−0.259
	(−4.374)	(−2.282)	(−1.253)	(−0.711)
Investment banking / securities dealing	−0.575***	−0.575***	−0.917***	−0.917***
	(−8.833)	(−3.679)	(−5.880)	(−4.274)
Funds, trusts, and other vehicles	−0.493***	−0.493***	−0.586***	−0.586***
	(−12.957)	(−3.944)	(−7.963)	(−4.025)
Bank and financial holding companies	−0.446***	−0.446**	−0.621***	−0.621**
	(−4.658)	(−2.653)	(−4.476)	(−2.931)
Other lenders	−0.415***	−0.415***	−0.545**	−0.545***
	(−5.367)	(−3.450)	(−2.413)	(−3.253)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.52	0.52	0.41	0.41

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specific responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 12: **PDs and loan spreads by Moody's senior debt rating at the moment of loan origination**

Moody's rating	PD, pct percentile of dist.			Loan Spread, bps percentile of dist.			Observ.
	5	50	95	5	50	95	
Investment	[0.01]	0.26	1.00	88	150	275	30
Speculative	[0.01]	1.43	8.15	175	338	800	106
Not Rated	[0.01]	0.71	4.61	138	275	650	267

Table 13: **PDs and loan spreads by Moody's bank loan rating at the moment of loan origination**

Moody's rating	PD, pct percentile of dist.			Loan Spread, bps percentile of dist.			Observ.
	5	50	95	5	50	95	
Investment	0.16	0.33	1.82	125	200	300	11
Speculative	[0.01]	1.82	13.00	175	400	900	74
Not Rated	[0.01]	0.65	4.00	138	250	575	309

Table 14: **Pricing models**

	(1) baseline	(2) additional vars.	(3) macroecon. vars.
log(PD, pct)	0.256***	0.239***	0.237***
	(12.676)	(11.239)	(11.492)
log(duration, days)		0.220***	0.223***
		(4.027)	(4.462)
log(Treasury rate, pct)			−0.474***
			(−5.336)
log(VRP, pct sq.)			0.242***
			(4.022)
log(CDX High Yield, pct)			−0.109
			(−1.137)
log(Sovereign spread, pct)			−0.288***
			(−4.110)
log(Expected inflation, pct)			0.563***
			(3.517)
Num. of observations	476	476	476
R-sq. adj.	0.41	0.47	0.47
RMSE	0.37	0.35	0.35

t statistics in parentheses
Note: Errors clustered by quarters. Quarter fixed effects in column (2) are not shown.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table 15: **Pricing models**

	(1) pd, dur, lmac
IG-rated senior debt, dummy	3.187^{***}
	(7.107)
SG-rated senior debt, dummy	3.799^{***}
	(7.560)
Not-rated senior debt, dummy	3.646^{***}
	(7.526)
IG-rated senior debt× log(PD)	0.126^{**}
	(2.735)
SG-rated senior debt× log(PD)	0.216^{***}
	(6.753)
Not-rated senior debt× log(PD)	0.240^{***}
	(9.945)
IG-rated senior debt× log(Treasury rate, pct)	−0.337
	(−1.231)
SG-rated senior debt× log(Treasury rate, pct)	-0.595^{***}
	(−3.858)
Not-rated senior debt× log(Treasury rate, pct)	-0.389^{***}
	(−3.693)
log(duration, days)	0.194^{***}
	(3.823)
log(VRP, pct sq.)	0.205^{***}
	(5.532)
log(Sovereign spread, pct)	-0.295^{***}
	(−5.099)
log(Expected inflation, pct)	0.550^{***}
	(4.517)
Num. of observations	476
R-sq. adj.	0.49
RMSE	0.34

t statistics in parentheses
Note: Errors clustered by quarters. Quarter fixed effects in column 3 are not shown.

* $p < .1$, ** $p < .05$, *** $p < .01$

Table A1: **Benchmark model with gross additions PDs and four-digit NAICS based lender classification**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Depository credit intermediation	0.091	0.091	0.264	0.264
	(0.544)	(0.491)	(1.046)	(1.068)
Non-depository credit intermediation	-0.577^{***}	-0.577^{***}	-0.564^{**}	-0.564^{*}
	(−4.481)	(−3.206)	(−2.068)	(−2.050)
Activities related to credit intermediation	-0.556^{*}	−0.556	−0.294	−0.294
	(−1.843)	(−1.443)	(−0.658)	(−0.610)
Investment banking / securities dealing	-0.498^{***}	-0.498^{**}	-0.935^{***}	-0.935^{***}
	(−5.108)	(−2.531)	(−3.634)	(−3.311)
Portfolio management, investment advice	-0.732^{***}	-0.732^{***}	-0.912^{***}	-0.912^{***}
	(−9.060)	(−3.317)	(−4.684)	(−3.441)
Insurance and employee benefit funds	−0.224	−0.224	0.059	0.059
	(−1.309)	(−0.662)	(0.122)	(0.104)
Other investment pools and funds	-0.551^{***}	-0.551^{***}	-0.699^{***}	-0.699^{***}
	(−15.053)	(−3.662)	(−8.987)	(−3.474)
Bank and financial holding companies	−0.146	−0.146	-0.430^{**}	-0.430^{**}
	(−1.450)	(−1.016)	(−2.461)	(−2.372)
Other lenders	-0.494^{***}	-0.494^{**}	−0.349	−0.349
	(−4.915)	(−2.663)	(−1.567)	(−1.444)
Num. of observations	40638	40638	4800	4800
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8161	16	300	16
R-sq. overall	0.53	0.53	0.41	0.41

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specfic responses to the EU sovereign risk premium, high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A2: **Benchmark model with originations′ PDs at a top-holder lender level**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation	-0.987^{***}	-0.987^{***}	-1.331^{***}	-1.331^{***}
	(-7.895)	(-3.630)	(-6.444)	(-5.579)
Investment banking / securities dealing	-1.289^{***}	-1.289^{***}	-1.540^{***}	-1.540^{***}
	(-19.923)	(-4.442)	(-10.617)	(-4.526)
Funds, trusts, and other vehicles	-1.099^{***}	-1.099^{***}	-1.138^{***}	-1.138^{***}
	(-31.999)	(-4.750)	(-14.005)	(-3.849)
Bank and financial holding companies	-0.218^{**}	-0.218	-0.265^{*}	-0.265
	(-2.456)	(-1.200)	(-1.876)	(-1.210)
Other lenders	-1.010^{***}	-1.010^{***}	-0.964^{***}	-0.964^{***}
	(-9.835)	(-4.372)	(-4.163)	(-3.512)
European sovereign spread, pct				
Non-depository intermediation	-0.493^{***}	-0.493^{*}	-0.717^{***}	-0.717^{***}
	(-3.916)	(-2.128)	(-3.424)	(-3.235)
Investment banking / securities dealing	-0.619^{***}	-0.619^{**}	-0.934^{***}	-0.934^{***}
	(-9.374)	(-2.773)	(-4.954)	(-2.958)
Funds, trusts, and other vehicles	-0.528^{***}	-0.528^{**}	-0.502^{***}	-0.502
	(-14.493)	(-2.352)	(-6.312)	(-1.684)
Bank and financial holding companies	-0.503^{***}	-0.503^{***}	-0.808^{***}	-0.808^{***}
	(-5.915)	(-3.103)	(-5.329)	(-3.769)
Other lenders	-0.840^{***}	-0.840^{***}	-1.079^{***}	-1.079^{***}
	(-10.490)	(-5.972)	(-6.192)	(-6.460)
Num. of observations	32488	32488	2576	2576
Errors clustered by	lenders	time	lenders	time
Num. of clusters	6998	16	161	16
R-sq. overall	0.55	0.55	0.51	0.51

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specfic responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: **Benchmark model with gross additions PDs at a participant-lender level**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Depository credit intermediation	-0.164^{*}	-0.164	-0.214	-0.214
	(-1.758)	(-1.110)	(-1.576)	(-0.811)
Nondepository credit intermediation	-0.517^{***}	-0.517^{***}	-0.655^{***}	-0.655^{**}
	(-4.858)	(-3.233)	(-3.671)	(-2.583)
Investment banking / securities dealing	-0.480^{***}	-0.480^{**}	-0.752^{***}	-0.752^{**}
	(-4.930)	(-2.632)	(-2.703)	(-2.181)
Portfolio management, investment advice	-0.662^{***}	-0.662^{***}	-0.867^{***}	-0.867^{***}
	(-8.465)	(-2.995)	(-4.867)	(-3.376)
Insurance and employee benefit funds	-0.214	-0.214	-0.005	-0.005
	(-1.252)	(-0.624)	(-0.010)	(-0.008)
Funds, trusts, other vehicles	-0.547^{***}	-0.547^{***}	-0.721^{***}	-0.721^{***}
	(-15.007)	(-3.699)	(-9.306)	(-3.584)
Other lenders	-0.425^{***}	-0.425^{***}	-0.458^{*}	-0.458^{*}
	(-5.454)	(-3.239)	(-1.742)	(-1.858)
Num. of observations	43443	43443	4912	4912
Errors clustered by	lenders	time	lenders	time
Num. of clusters	8810	16	307	16
R-sq. overall	0.53	0.53	0.38	0.38

Note: The explained variable is $log(pd^{A}_{i,t})$. Other regressors not shown are lender-type specfic responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4: **Model with gross additions PDs and international classification of top-holder lenders**

	Unbalanced panel		Balanced panel	
	(1)	(2)	(3)	(4)
U.S. Treasury spot ten-year rate, pct				
Foreign banks	−0.034	−0.034	−0.130	−0.130
	(−0.299)	(−0.190)	(−0.836)	(−0.490)
U.S. banks	−0.156	−0.156	-0.511^{***}	-0.511^{**}
	(−1.456)	(−1.307)	(−3.023)	(−2.347)
Other lenders	-0.559^{***}	-0.559^{***}	-0.690^{***}	-0.690^{***}
	(−19.159)	(−3.427)	(−10.463)	(−3.214)
European sovereign spread, pct				
Foreign banks	-0.570^{***}	-0.570^{***}	-0.692^{***}	-0.692^{***}
	(−7.921)	(−7.094)	(−7.041)	(−4.173)
U.S. banks	-0.542^{***}	-0.542^{***}	-0.936^{***}	-0.936^{***}
	(−4.958)	(−3.780)	(−5.335)	(−4.347)
Other lenders	-0.416^{***}	-0.416^{***}	-0.392^{***}	-0.392^{*}
	(−14.311)	(−3.346)	(−6.849)	(−2.049)
Num. of observations	40638	40638	4800	4800
Num. of clusters	8161	16	300	16
Num. of observations	4800	4800		
R-sq. overall	0.52	0.52	0.40	0.40

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specfic responses to the high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5: **Model with gross additions PDs and international classification of top-holder lenders**

	Balanced panel			
	(1)	(2)		
U.S. Treasury spot ten-year rate, pct				
Non-depository intermediation, foreign	-0.796^{***}	-0.796^{***}	-0.455	-0.455
	(-3.270)	(-4.325)	(-0.899)	(-1.596)
Non-depository intermediation, U.S.	-0.524^{***}	-0.524^{*}	-0.502^{*}	-0.502
	(-3.902)	(-1.991)	(-1.906)	(-1.515)
Investment banking and securities dealing, foreign	-0.367^{**}	-0.367^{*}	-0.485^{***}	-0.485
	(-2.285)	(-1.933)	(-2.770)	(-0.874)
Investment banking and securities dealing, U.S.	-0.617^{***}	-0.617^{**}	-0.974^{***}	-0.974^{***}
	(-8.367)	(-2.448)	(-4.882)	(-3.441)
Investment banking and securities dealing, OFC	-0.933^{***}	-0.933^{***}	-0.864^{**}	-0.864^{**}
	(-6.245)	(-6.057)	(-2.504)	(-2.861)
Funds, trusts, and other vehicles, foreign	-0.297^{***}	-0.297^{**}	-0.382	-0.382^{*}
	(-2.628)	(-2.263)	(-0.748)	(-1.929)
Funds, trusts, and other vehicles, U.S.	-0.537^{***}	-0.537^{**}	-0.637^{***}	-0.637^{**}
	(-12.523)	(-2.884)	(-7.586)	(-2.882)
Funds, trusts, and other vehicles, OFC	-0.634^{***}	-0.634^{***}	-0.922^{***}	-0.922^{***}
	(-8.314)	(-3.145)	(-4.541)	(-4.884)
Bank and financial holding companies, foreign	0.090	0.090	0.143	0.143
	(0.672)	(0.462)	(0.755)	(0.696)
Banking and financial holding companies, U.S.	-0.243^{**}	-0.243^{*}	-0.577^{***}	-0.577^{**}
	(-2.170)	(-2.048)	(-2.618)	(-2.193)
Other lenders	-0.472^{***}	-0.472^{**}	-0.349	-0.349
	(-4.674)	(-2.493)	(-1.564)	(-1.442)
Num. of observations	40638	40638	4800	4800
Num. of clusters	8161	16	300	16
R-sq. overall	0.00	0.00	0.08	0.08
R-sq. within	0.09	0.09	0.24	0.24
R-sq. between	0.00	0.00	0.05	0.05

Note: The explained variable is $log(pd^A_{i,t})$. Other regressors not shown are lender-type specfic responses to the EU sovereign risk premium, high yield CDX index, the variance risk premium, and inflation expectations. All models include lender, and lender-type-year fixed effects. t-statistics in parentheses; p-values denoted as * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.