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

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**Abstract**

We use supervisory data to investigate the ex-ante credit risk taken by different types of lenders in the U.S. syndicated loan market when longer-term interest rates are low. We find that insurance companies, pension funds, and, especially, structured-finance vehicles take higher risk when interest rates decrease. Banks accommodate other lenders' investment choices by originating riskier loans and subsequently divesting them partly. These results are consistent with "search for yield" by certain nonbanks and, if Federal Reserve policies affected longer-term rates, with a risk-taking channel of monetary policy. Longer-term interest rates appear to have a modest effect on loan spreads.

**JEL classification**: E43, E44, E52, E58, G11, G20.

**Keywords:** Syndicated loans; Shared National Credit Program; Shadow banking; Zero lower bound; Search for yield; Risk-taking channel of monetary policy.

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# 1. Introduction

In this paper, we study risk taking in the U.S. syndicated loan market in the aftermath of the 2009 financial crisis. We ask whether risk taking changes as longer-term interest rates decline, whether risk-taking patterns vary across different lender types, and whether the same risk-taking patterns can be found in the primary and secondary markets, and whether risk-taking patterns induce compression of loan spreads. Our questions are related to the literature on “search for yield” and to the possible existence of a risk-taking channel of unconventional monetary policy. While, as discussed below, increased risk taking can raise financial stability concerns, accommodative monetary policy can help “prompt a return to the productive risk taking that is essential to robust growth.”[1] In this regard, syndicated loans are a suitable asset class to study because they provide a large amount of credit, especially in the form of leveraged loans, to the productive sector.

We analyze recent risk-taking trends in the $900 billion market for U.S. syndicated term loans using a confidential supervisory national credit registry available at a quarterly frequency since the end of 2009. The registry—the Shared National Credits Program (SNC)—covers syndicated loans amounting to at least $20 million and in which three or more federally supervised banks participate as lenders. The database reports all lenders and their syndicate shares, even if they are not supervised banks. Given that nonbank lenders play a significant role in syndicated term loans (Ivashina and Sun, 2011), primarily in the leveraged-loan segment, we can analyze the risk-taking behavior of a rich cross section of intermediaries with distinct business models and subject to different environments. The vast majority of the loans in our database are extended to nonfinancial corporations.

[1] The quote is from Chairman Ben S. Bernanke’s speech “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.

We find that a number of nonbank financial institutions—like insurance companies, pension funds, and, in particular, collateralized loan/debt obligations (CLOs/CDOs)—increase the credit risk of their syndicated-loan investments when longer-term interest rates are low. CLOs and CDOs are structured-finance vehicles that purchase a pool of fixed-income assets like loans or bonds and issue notes of different seniority backed by these assets. Banks originate riskier loans that they tend to divest after origination, accommodating other lenders' investment choices. While banks may have an advantage in screening and monitoring risky borrowers, they may face supervisory pressures to sell riskier loans off, amid strong demand for such high-yielding loans by institutional investors.[2] That is, we find that changes in longer-term interest rates induce risk reallocation from banks to nonbanks, especially in the form of leveraged loans, through transactions in the secondary market.

As noted by Ivashina and Sun (2011), strong investor demand throughout the 2000s resulted in a compression of syndicated loan spreads, and a natural question is whether the risk-taking patterns we find are also reflected in loan spreads. Pricing information is not available in the SNC data, but we are able to match about one third of the syndicated loan originations for which default risk data are available in SNC with spreads from Thomson Reuters Loan Pricing Corporation's DealScan. Controlling for nonbank loan share, we find that lower Treasury rates result in marginally higher spreads, which is not consistent with the hypothesis that demand from a search for yield leads to spread compression in the primary syndicated term-loan market.

The results are consistent with search for yield by nonbank intermediaries and with the existence of a risk-taking channel of monetary policy during a period when the Federal Reserve

[2] Given that banks have a competitive advantage in screening and monitoring borrowers (Gorton and Pennacchi, 1995), they are well-suited to investing in higher-risk loans in times of economic uncertainty, when interest rates are likely to be low. However, Maddaloni and Peydró (2011) find a weaker relation between short-term rates and lending standards when supervisory standards are stronger, raising the possibility that the intense regulatory activity following the 2008 financial crisis may have counterbalanced any incentives that banks may have had to hold riskier assets.

implemented unconventional monetary policies to put downward pressure on interest rates, with policies like forward guidance and large scale asset purchases programs (LSAPs) (D'Amico, English, Lopez-Salido, and Nelson, 2012; Krishnamurthy and Vissing-Jorgensen, 2013).

We address the potential endogeneity of changes in longer-term interest rates and default risk of loans being acquired in several ways. First, the default probabilities provided in the SNC data measure long-run default risk, which dampens their sensitivity to business-cycle shocks that affect interest rates. Second, we remove the business cycle components from the 10-year interest rate along the lines of Dell'Ariccia, Laeven, and Suarez (2014). Third, the richness of our data allows us to contrast the riskiness of the loans being acquired with the riskiness of the loans already in lenders' portfolios and to partial out an omitted common factor that may also affect U.S. interest rates. Fourth, we evaluate the robustness of our findings to excluding loans made to U.S. borrowers. By doing so, we can focus on borrowers whose credit risk is less likely to be jointly determined with U.S. interest rates. This approach, which is also used by Lee, Liu, and Stebunovs (2015), is similar to that employed by Jimenez, Ongena, Peydró, and Saurina (2014) and Ioannidou, Ongena, and Peydró (2015), who study credit risk in countries where monetary policies are considered exogenous. Overall, our conclusions are robust to a number of business- and financial-cycle controls, to different measures for interest rate expectations, and, as discussed just above, to specifications that address the endogeneity of longer-term interest rates and ex ante credit risk of loans being acquired.

We should point out that, while the analysis identifies a time-series relation using only 16 quarterly observations, 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 environment we need to identify the effect in which we are interested in. Note that, while interest rates were generally low in the sample we study, they varied significantly: for instance, the 10-year Treasury rate ranged between 1.5% and 4%. We also use other interest rate measures that are better suited to capturing the forward guidance channel of monetary policy, and these measures also exhibit significant variation over the sample we study. For example, the expected number of quarters before a 25-basis point increase in the federal funds rate varied between zero and 8 quarters over the sample period.

The literature on the risk-taking channel of monetary policy looks primarily at banks as conduits. For example, studies such as Maddaloni and Peydró (2011); Paligorova and Santos (2013); Dell'Ariccia, Laeven, and Suarez (2014); Ioannidou, Ongena, and Peydró (2015); and Altunbas, Gambacorta, and Marques-Ibanez (forthcoming) 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 banking group with deep internal capital markets (Buch, Eickmeier, and Prieto, 2014; Jimenez, Ongena, Peydró, and Saurina, 2014; and Campello, 2002).[3] Given that institutional investors and other financial intermediaries have been playing an increasingly large role in the syndicated loan market, such a view of the risk-taking channel appears to be too limited.

Our analysis leverages the SNC data to contribute to the literature in several ways. First, we can track activity in the secondary as well as the primary syndicated loan markets, which is important because the effect of low interest rates on risk taking in the primary market may be dampened by the attempt by certain intermediaries to cater to existing lending relationships (see, for instance, Degryse and Ongena, 2007).[4] Second, we are able to measure the ex-ante credit risk of each loan with the default probability that the agent bank uses to determine regulatory capital.

[3] In addition, Chodorow-Reich (2014) finds that money market funds and some defined-benefits pension funds engaged in a search for yield between 2009 and 2011. Di Maggio and Kacperczyk (2015) also show that money market funds, especially those not affiliated with other large financial intermediaries, took more risk after policies meant to reduce interest rates were implemented. A related literature studies the effect of more specific policy interventions, like the Troubled Asset Relief Program. See, for instance, Black and Hazelwood (2013), Duchin and Sosyura (2012), and Li (2013).

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

Regulations require banks to use default probabilities that provide a long-run assessment of a loan's credit risk, which assuages concerns about the endogeneity of U.S. interest rates and default risk, because a long-run default probability should be insensitive to contemporaneous interest rate shocks.[5] Third, our analysis is novel because, while other researchers have studied a limited set of financial intermediaries, we compare the behavior of a diverse set of lenders who all operate in the syndicated loan market but face different incentives and capacities when adapting to an environment of persistently low interest rates.

Generally, various types of lenders have an incentive to rebalance their portfolios investing in riskier assets when returns on safer assets decline. Indeed, an objective of unconventional monetary policies was to promote a return to productive risk taking. Certain types of lenders may have characteristics that strenghten this incentive. For instance, several studies show that fund managers generally have an incentive to increase risk taking in order to out-rank their peers, which is typically attributed to a rapid increase in pecuniary or reputational benefits as performance relative to their peers improves.[6] Similar incentives may apply to the managers of structured finance vehicles, which are included in our analysis. For other lender types, the incentive to invest in riskier assets can come from the structure of their balance sheet. Becker and Ivashina (forthcoming) find that insurance companies with binding capital ratios are more likely to engage in search for yield. Our results also

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5 For details, see the "Risk-Based Capital Standard: Advanced Capital Adequacy Framework - Basel II" (Federal Register Vol.72, No.235, December 7, 2007), which defines the probability of default for a wholesale (non-retail) obligor as follows: "For a wholesale exposure to a nondefaulted obligor, the [bank]s empirically based best 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 economic downturn conditions) sufficient to provide a reasonable estimate of the average one-year default rate over the economic cycle for the rating grade."

6 Early studies attributed the incentive to out-rank peers to the convex relation between fund inflows and past performance, which implies that a fund would increase assets under management (AUM) if the higher risk translated into positive returns, but would not lose much AUM if the higher risk led to negative returns (see, for instance, Chevalier and Ellison, 1997). Spiegel and Zhang (2013) show that this convexity is an artifact of omitted heterogeneity in fund characteristics and suggest that the incentive to out-rank peers can originate from managerial career concerns, like termination risk or compensation. Qiu (2003) shows that the incentive is stronger for funds with performance just below the median, and for those trailing the top performers. Kempf, Ruenzi, and Thiele (2009) discuss a richer framework in which the effects of termination risk depend on the state of the economy.

suggest that finance companies engage in search for yield, possibly because, as discussed later, of cost pressures stemming from their fixed-interest liabilities.

While excessive risk taking can facilitate the build-up of imbalances that set the stage for future financial distress (Borio and Zhu, 2012), we should also emphasize that any increase in risk taking attributable to monetary policy must be evaluated against the benefits of an accommodative monetary policy. In general, a healthier economy implies lower credit risk. In addition, the literature on the syndicated loan market has highlighted the fact that loan supply is adversely affected by negative liquidity and capital shocks to lenders, which accommodative monetary policy can help alleviate. 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). Chodorow-Reich (2014) also finds broad benefits of monetary policy for banks and life insurance companies in the aftermath of the 2008 financial crisis.

## 2. Shared National Credits Program Data

The Shared National Credits Program 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. Before 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 in excess of $20 million 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 assess a borrower's credit risk independently, syndicate members typically provide an assessment similar to that of agent banks.

The SNC program offers two data outputs: one at an annual frequency, that has been covered widely in the literature, and one at a quarterly frequency, that has become available only recently and offers more loan-specific information which is not available from the first output. While we rely only on the quarterly output, we find it instructive to describe both in some detail.

Annual SNC reviews are conducted each 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 (in descending order: pass, special mention, and classified), and further characterize loans with a classified rating into three sub-categories: substandard, doubtful, and loss.

The SNC program publishes review summaries every year, and the results of the 2013 SNC review were publicly released on October 10, 2013.[7] The 2013 SNC database covered approximately 9,300 syndicated loans to 5,800 borrowers, for a total of $3 trillion in drawn credit and unused commitments (for a given loan, commitment is the maximum amount of credit lenders agree to provide; throughout the paper we refer to drawn credit as loan "utilization"). 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.

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

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, which account for about 90% of the market. These quarterly reporters also provide a detailed assessment of each loan's credit risk through the Basel II parameters used to calculate regulatory capital, such as the probability of default (PD), loss given default, and exposure at default. In our analysis, we use the quarterly SNC data over the sample period 2010:Q1–2013:Q4 because the calculation of our main dependent variable requires lagged holdings.

The reported PDs are estimated in compliance with the Basel II Advanced Internal Ratings-Based requirements. For a non-defaulted obligor, the PD is the bank's estimate of the through-the-cycle default rate over a one-year horizon for the rating grade that the bank assigns 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 PD is equal to 100%. In terms of PD comparability across banks, banks calculate PDs independently, but they all need to comply with the provisions of Basel II and the supervisory process.

Figure 2 compares commitments and utilizations in the annual SNC data with commitments and utilizations in the quarterly SNC data; it shows that the quarterly data are only slightly less comprehensive than the annual data. Requiring the availability of PDs reduces the sample by about 30% in terms of loan commitments, and by about 50% in terms of utilizations. The reason for the significant amount of loans with missing PDs is that only banks in the early stages of adopting Basel II regulations must report the Basel II parameters, while other banks simply have the option to report. Once banks begin providing PDs for a given loan, they must continue doing so.

We apply several filters to the data in order to minimize the impact of recording errors, which represent a small percentage of the observations. Some banks appear to have reported PDs of zero for some loans for which they did not have PD values, and we set zero PDs to "missing" unless we are able to match them with an expected default frequency (EDF) from Moody's that is lower than 50 basis points. Some banks also appear to have erroneously reported PDs of 100% for certain loans. We replace a 100% PD with a "missing" value 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 a missing PD differ by only 1 basis point, we fill in the missing PD value with the average of its lead and lag. We do so also when two consecutive values are missing and the neighboring non-missing PDs are at most 1 basis point apart. For some loans, PDs in a given quarter are materially different from the PDs in the previous and subsequent quarters. If PDs in the previous and subsequent quarters differ by only 1 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 1/5 their average), we replace those PDs with the average of the previous and subsequent PDs. Finally, a small number of loans have no PDs but do have information on expected credit loss (ECL), loss given default (LGD), and exposure at default (EAD). In these cases, we calculate PDs according to the following formula: $PD = ECL/(EAD \times LGD)$. We should note that our conclusions carry through in the absence of these filters.

Table 1 shows summary statistics for the default risk of term loans according to rating grades and lender types. About 80% of loans are classified as "pass," with a median PD of 78 basis points, while about 3.5% of the loans receive the two lowest grades, whose median PD is 100%. In order to reduce the impact of loans with high default probabilities on the estimation, we cap PDs at 35%, which is the largest value that Moody's assigns to EDFs (the statistical and economic significance of the results is slightly stronger without capping PDs). The rightmost column of Table 1 shows that this filter affects the median PD of only the riskiest loan categories, which is now 35% rather than 100%.

The bottom panel of Table 1 reports the average loan share of different lender types, where the average is weighted by loan amount (see Appendix for details on lender classification). Banks and bank holding companies (BHCs) domiciled in the United States hold a 22% loan share, on average, while foreign banks hold slightly more than 18%. The largest share is held by U.S. investment funds and other lenders, with about 30%, while the share of CLOs/CDOs is 17%. Insurance companies and pension funds are the smallest lenders, with 3.5% of each syndicate on average. The second column of Table 1 shows loan shares when focusing on loans with non-missing PDs. Banks and BHCs now hold about 55% on average, and the shares of all other lenders are somewhat smaller than when considering all loans, with CLOs/CDOs standing at 11% rather than 17%. In terms of risk taken by the various intermediaries, banks invest in loans with a weighted median PD of about 0.70%, while all the other lenders are more active in the leveraged-loan segment, as highlighted by the median PDs of about 4%. Investment funds and other lenders domiciled in the United States have the highest weighted median PD (8%).

In Table 2 we evaluate changes in the composition of the syndicate shortly after origination. Banks, in particular, may facilitate the functioning of the syndicated loan market by originating loans that they intend to sell to other intermediaries quickly afterward. In the table we focus on loans that are in our data at origination and one and two quarters later. We then calculate the average loan share for each intermediary type, weighted by syndicate amounts, at origination and after one and two quarters. Consistent with the hypothesis that banks originate some loans to facilitate market functioning rather than for investment, U.S. and foreign banks reduce their loan shares by 3.4 and 2.7 percentage points, respectively, which is a decline of about 14% of the share at origination. Conversely, all other intermediaries increase their shares. Most of the reallocation happens within the first quarter following origination, because share changes are quite similar when considering shares two quarters after origination. We should point out that the results in this table are likely a lower bound to changes in loan ownership after origination, because banks may, for instance, sell most of their participation before SNC reporting is due at the end of the quarter.

## 3. Research design

Our analysis focuses on how the default risk of investments in the syndicated term-loan market changes when investors expect that U.S. interest rates will remain lower for a longer period of time. We consider term loans because, unlike for credit lines, nonbank lenders play a significant role in the term-loan market. The key variable of interest is the loan PD provided by the banks that coordinate each syndicate. Given that we are interested in the credit risk that lenders add to their portfolios, we mostly study the weighted-average PD of portfolio additions, which we define as primary market originations, including renegotiations of existing facilities, and secondary market purchases. The weights are based on each loan's utilization level; for term loans, there is little difference commitment and utilization.

We discuss results for both unbalanced and balanced panels, with the latter only including larger and more sophisticated lenders that are active in the term-loan market in each quarter. Balancing the panel removes participants that add loans to their portfolios only sporadically, and lenders who are active in every time period may pursue different investment strategies than the rest. Finally, the SNC data allow us to identify the ultimate lender to which a certain immediate lender belongs, and we measure portfolio default risk at the level of the ultimate lender. As a consequence, the results are not driven by within-group risk transfers that leave the risk exposure unchanged at the highest decision-making level, where strategic investment decisions are made.

We study the period between late 2009 through 2013, when the Federal Reserve was actively conducting unconventional monetary policies—forward guidance and large-scale asset purchases of

U.S. Treasuries (LSAPs). During this period, the implied federal funds rate 10 quarters ahead ranged between 0.39% and 2.79% and the 10-year Treasury rate between 1.64% and 3.72% (these figures refer to quarterly averages). Several papers attribute movements in these rates, to a large extent, to the Federal Reserve's actions.[8] For example, D'Amico and King (2013) show that the first LSAP program as a whole resulted in a persistent downward shift in the Treasury yield curve of as much as 50 basis points (the stock effect), with the largest effect at the 10- to 15-year tenors. Our sample concludes with the Federal Reserve's decision to stop purchasing additional securities and to roll over the existing ones. In line with these findings, Lee, Liu, and Stebunovs (2015) find that, prior to the financial crisis, the 10-year Treasury rate has no effect on the default risk of syndicated loan originations going back to 1995.

In Figure 3, we show the Federal Reserve holdings of U.S. Treasury securities between 2007 and 2015, with the period we study highlighted by the shaded area. The vertical lines highlight policy announcements about the Large-Scale Asset Purchases of U.S. Treasury securities. The Federal Reserve first announced LSAPs in March 2009 and it subsequently announced increases in those purchases (not shown) followed by an announcement of purchases taper in December 2013, thus concluding its efforts to affect longer-term Treasury yields. Around the end of our sample, in addition, U.S. federal regulators issued leveraged lending guidance and subsequent clarification—in a way, they activated a new prudential tool—which has been shown to limit the risk-taking behavior of syndicated lending market participants starting from 2014 (Calem, Correa, and Lee, 2016).[9]

The dynamics of the 10-year Treasury rate and the three-year-forward 10-year Treasury rate after the last three recessions, shown in Figure 4, highlight the fact that interest rates have stayed low for longer in the aftermath of the recent financial crisis, when the Federal Reserve implemented

[8] Their findings limit the scope for endogeneity concerns stemming from a common economy-wide factor driving our results.

[9] See the March 21, 2013 Interagency Guidance on Leveraged Lending.

unconventional monetary policies (Krishnamurthy and Vissing-Jorgensen, 2013). In alternative specifications we measure the severity and expected duration of the zero-lower bound period with the spread between the expected federal funds rate 10 quarters ahead and the current federal funds rate, and with the number of quarters before the federal funds rate is expected to reach 25 basis points. Both exhibit significant variation, with the former ranging from nearly zero to 3%, and the latter from zero to eight quarters.

One issue is particularly important for the interpretation of our results, namely that interest rates and changes in portfolio default risk could be endogenous—for instance because of an unobserved credit risk factor that is not captured by the macroeconomic variables we use as controls. While we rely on through-the-cycle PDs that reflect long-run default risk of borrowers and, therefore, are less sensitive to business- and credit-cycle shocks, we conduct additional robustness checks. We address potential endogeneity concerns with a specification wherein the dependent variable is the ratio of the default risk of portfolio additions to the default risk of the existing portfolio, which eliminates the impact of an unobserved credit risk factor that linearly affects the PDs of both portfolio additions and the existing portfolio.

Most of our results are based on regressions like the following:

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

where $log(pd^A_{i,t})$ is the natural logarithm of the weighted-average PD for additions to the portfolio of the ultimate lender $i$ in quarter $t$ (we use log-PDs to reduce the effect of skewness). We classify each ultimate lender into seven lender types, indexed with $j$, using a methodology that we describe in Appendix A and that builds on identifiers from the National Information Center database. The seven categories are: U.S. banks and BHCs, non-U.S. banks and BHCs, insurance companies and pension funds, U.S. CLOs/CDOs, non-U.S. CLOs/CDOs, U.S. investment funds and other lenders, and non-U.S. investment funds and other lenders.[10]

The variable $T_t$ is the 10-year U.S. Treasury rate; $\mathbf{X}_t$ is a set of other macroeconomic and financial variables that includes the European sovereign yield spread (the difference between the Italian and German sovereign yields), a measure of credit risk for North American speculative-grade companies (the CDX North American High Yield spread, henceforth CDX HY), the variance risk premium (Bollerslev, Tauchen, and Zhou, 2009), and the University of Michigan index of expected inflation. $I(j)$ is an indicator for lender type $j$, which means that we estimate the sensitivity of risk taking to U.S. Treasury rates and to the other macroeconomic variables at the lender-type level. Each variable is an average of within-quarter values, rather than an end-of-quarter value. We also include lender fixed effects ($\alpha_i$) and lender-type/year fixed effects ($q_{j,y}$). The latter term is meant to account for unobserved common factors that affect risk-taking decisions by specific types of lenders, but the results carry through even without $q_{j,y}$.[11] Throughout the paper, we assess statistical significance on the basis of standard errors double-clustered by time and lender according to the methodology of Cameron, Gelbach, and Miller (2011).[12] In each regression, we require that each lender type covers at least 1% of the observations, with the exception of immediate-lender regressions, where we set the threshold at 0.5% to account for the fact that lenders are not aggregated at the ultimate-lender level.

We expect the $\beta_j$ coefficients to be negative for lender types that increase the riskiness of their syndicated loan portfolio additions when longer-term interest rates are low. We are also interested in the pattern of coefficients across lender types, in particular for CLOs/CDOs, insurance companies/pension funds, and investment funds. The reason is that previous studies have

[10] We thank Greg Nini for a discussion on the role of CLOs.
[11] In unreported results, the statistical significance is generally stronger without lender-type/year fixed effects.
[12] The results change very little if we estimate the regression for each lender type separately, where we still cluster the standard errors by time and lender.

highlighted how these intermediaries make portfolio choices that are suggestive of or directly in line with search-for-yield incentives. First, Ivashina and Sun (2011) find that the spreads at origination of syndicated loans to which CDOs participate as lenders are more susceptible to compression when institutional demand for syndicated loans is high. Second, Becker and Ivashina (forthcoming) show that certain insurance companies are more likely to seek riskier investments.

Third, mutual fund managers have an incentive to take higher risk when they experience poor performance relative to their peers (Kempf, Ruenzi, and Thiele, 2009). Our sample makes testing this hypothesis challenging, because we would need the first half of each year to rank the funds, leaving only two quarters of each year for testing. In addition, it is not clear that the incentive to take more risk to catch up with peers is stronger at times of low longer-term interest rates. Therefore, instead of differentiating mutual funds on the basis of performance in the first half of the year, we sort mutual funds based on the fees they charge to investors. The reason is that higher fees reduce net yield paid to investors (as a fraction of gross yield) by a higher amount when interest rates are lower, and the managers of high-fee mutual funds may try to compensate by investing in assets with higher risk and higher yield.

Fourth, as we show in the next section, finance companies greatly increased their funding through largely fixed-rate instruments just before the 10-year Treasury rate decreased to very low levels in 2012, which may have generated a gap between asset yields and funding costs because a significant fraction of the assets held by finance companies can be refinanced as interest rates decline. Finally, banks may facilitate the functioning of the market by originating riskier loans in order to accommodate the investment objectives of other lenders.

# 4. Results

We first illustrate the credit-risk dynamics of portfolio additions graphically. In Figure 5 we show median residual log-PDs, by lender type, against residual Treasury rates. Residual PDs are calculated with a regression like equation (1) but without the Treasury rate. Residual Treasury rates are calculated by regressing the Treasury rate on the control variables in equation (1).[13] Unlike the actual 10-year Treasury rate, the orthogonalized rate spikes in late 2011 due to large fluctuations in the European sovereign yield spread and in the CDX HY. We conclude this section with an analysis of the pricing of syndicated loans.

As shown in Figure 5, which is based on the unbalanced panel, the residual log-PD of banks' portfolio additions are not particularly responsive to residual interest rates. On the other hand, the risk taking of the other intermediaries increased as orthogonalized interest rates bottomed out in late 2012 and early 2013, especially in the case of CLOs/CDOs. Figure 6 reports the dollar amounts of additions by lender type over time; it indicates that the value of portfolio additions for nonbank intermediaries increased as interest rates started to decline in 2010, decreased through the second half of 2011 as the European crisis worsened, and started climbing rapidly in early 2012.

The key results of our regression analysis are shown in Table 3. The negative and statistically significant coefficient on the Treasury rate indicates that CLOs/CDOs invest in riskier syndicated loans when U.S. interest rates are lower, and the economic effect is substantial. For instance, U.S. CDOs/CLOs with a portfolio additions PD of 3.71% (which is the time series average of the quarterly median PDs) are expected to increase this PD by 1.93 percentage points to 5.64%, a

[13] Relying on the Frisch-Waugh theorem, we net out the effect of the macroeconomic control variables from both the log-PDs and the Treasury rate.

change that is about half as large as the initial PD.[14] In the unbalanced panel, we find similar results for investment funds and other lenders and for insurance companies and pension funds, although the statistical significance does not carry over to the balanced panel for the latter group. Banks also have a statistically significant negative coefficient in the balanced panel for additions and in both panels for originations, which we define as loans with an origination date within a given reporting quarter. Still focusing on originations, statistical significance is noticeably weaker for CLOs/CDOs and investment funds relative to portfolio additions, especially in the balanced panel, although both economic and statistical significance increase for insurance companies and pension funds in the balanced panel.

As shown in Table 2, banks reduce their loan share by 14%, on average, one quarter after origination; the sensitivity of risk taking to interest rates that we find for bank originations could be driven by loans that banks help arrange but expect to quickly sell to other intermediaries. In the two rightmost columns of Table 3, we investigate whether this is indeed the case. The two columns show regression results for originations in which the bank share declined within one quarter and for originations in which the bank share increased, respectively. The coefficients on Treasury rates for banks are negative and statistically significant only for originations in which banks reduce their share relatively quickly.

The overall picture that emerges from the discussion above is of a market where a class of shadow-banking lenders, which help finance a relatively small but significant fraction of loans, increases the riskiness of its investments when interest rates decline, especially through secondary-market purchases. Insurance companies and pension funds also invest in riskier loans,

[14] The predicted change is calculated by multiplying 3.71% by the expected percent change in PDs implied by the estimated balanced-panel coefficient on the Treasury rate, which is given by $e^{-0.5\cdot\beta_T} - 1$ (the regressions are in semi-log form). We base our calculations on a quarterly decrease of 0.5 percentage points in the 10-year Treasury rate because D'Amico and King (2013) find that medium- to long-dated yields fell by as much as 0.5 percentage points after large-scale Treasury purchases were announced by the Federal Reserve.

including on the primary market, but on average they hold a small fraction of each syndicate. Banks, which hold large loan shares, appear to facilitate the functioning of the market by accommodating other intermediaries' investment preferences and originating riskier loans that they tend to sell soon after origination.

Our results are subject to several caveats. First, they are not necessarily representative of overall risk taking by the intermediaries we consider, because we study only a portion of their portfolios and the increased risk could be hedged by taking positions in other financial instruments. However, our conclusions are not driven by within-group risk transfers that leave the exposure of the ultimate lender to syndicated loans unchanged, because we consolidate activity in the syndicated loan market at the ultimate-lender level. Second, while it is difficult to identify the individuals or institutions who invest in CLOs/CDOs, in aggregate nonbanks hold the majority of these products. For instance, a pension fund may be exposed to syndicated-loan risk through intermediate investment funds even if it does not participate in this market directly. To the extent that a wide range of financial intermediaries invest in such vehicles, the results would point to increased risk taking by the broader financial sector.

In the remainder of this section we explore the sensitivity of our results to omitting quarters of particular economic significance, to different ways of measuring credit risk and interest rate expectations, and to an alternative lender classification.

We start with Table 4, where we first exclude the second quarter of 2012 (as shown in Figure 6, U.S. CLOs/CDOs and other nonbank lenders added the lowest amount of loans to their portfolio during the quarter). In a separate set of regressions, we also exclude the second quarter of 2013, when interest rates increased rapidly in response to expectations of a more rapid normalization of the monetary policy stance. While the coefficients are generally somewhat smaller and statistical significance slightly weaker, the results carry through.

### 4.1 Alternative measures of interest rate expectations

So far we showed results that are consistent with search for yield by nonbank intermediaries and with the existence of a risk-taking channel of monetary policy in response to changes in spot long-term interest rates, which were likely driven by LSAPs (D'Amico, English, Lopez-Salido, and Nelson, 2012; Krishnamurthy and Vissing-Jorgensen, 2013). We now focus on another unconventional monetary policy tool—forward guidance—as a driver of risk taking.

We first consider the three-year-forward 10-year U.S. Treasury rate, which is the financial market's expectation of the 10-year rate in three years' time. The other two measures are built using the expected federal funds rates implied by overnight indexed swaps (OIS), which are derivative contracts of varying maturities whose payoff depends on the future evolution of short-term unsecured interest rates, in our case the federal funds rate. Using OIS quotes, we calculate the difference between the expected federal funds rate 10 quarters ahead and the current federal funds rate, as well as the number of quarters before the expected federal funds rate reaches 25 basis points. The Treasury rate forward is shown in the right chart of Figure 4, while the measures based on the federal funds rate expectations are shown in Figure 7. In all cases, the dynamics of the measures of interest rate expectations closely follow those of the 10-year Treasury rate.

We use each of these three measures in place of the 10-year Treasury rates in a set of regressions identical to equation (1). To be consistent with the results discussed so far, the coefficients on the three-year forward Treasury rate and on the difference between the expected and current federal funds rate should be negative, because both variables decline when investors expect interest rates to remain low for longer. On the other hand, the coefficients on the expected number of quarters before the federal funds rate reaches 25 basis points should be positive. The results shown in Table 5 are similar to those discussed so far, in terms of both statistical significance and relative magnitude. The only exception is that none of the bank coefficients are statistically significant when using the expected number of quarters until the federal funds rate reaches 25 basis points.

### 4.2 Robustness checks

Our sample of syndicated loan data begins in 2010; however, the time series of macroeconomic variables, which is constrained by the availability of the CDX HY spread, goes back to 2004. In the first two columns of Table 6, we obtain the sensitivity of risk taking to interest rates in two steps. We first orthogonalize the Treasury rate with respect to the other four macroeconomic variables over the 2004–2013 sample, and then we use the orhogonalized series ($T_t^{\perp}$) as the independent variable in a pooled regression similar to eq. (1):

$$log(pd^A_{i,t}) = \alpha_i + \sum_{j \subset J} I_j \beta_j T_t^{\perp} + q_{j,y} + \varepsilon_{i,t}. \tag{2}$$

Including Treasury rates that are already orthogonalized relative to macroeconomic state variables is econometrically similar to Dell'Ariccia, Laeven, and Suarez (2014)'s use of Taylor residuals to identify exogenous shocks to monetary policy. With the exception of banks, the coefficients are generally larger than in Table 3. Statistical significance is also stronger, especially for non-U.S. banks and BHCs. We should point out that the $t$-statistics in the second regression do not account for the fact that the orthogonalized Treasury rates series is estimated in the first step, with the consequence that the statistical significance of second-stage coefficients will be overstated to some extent.

We now address the endogeneity that could arise from the presence of an unobserved factor that affects both the default risk of additions and the Treasury rate, like an economy-wide default risk factor. For each lender, we study the logarithm of the ratio of gross addition PDs to the PDs of the existing portfolio. If the potentially omitted factor ($\Omega_t$) affects the PDs of additions ($pd^A_{i,t}$) and of the outstanding portfolio ($pd^O_{i,t}$) linearly, then taking the ratio simplifies the factor out and expresses the factor loading of newly acquired loans as a multiple of the factor loading of the existing portfolio. Similarly to a Taylor expansion of an unknown nonlinear function, the linear effect captured by the first order term of the possibly omitted factor dominates any higher order effects. We use the following ratio as the dependent variable:

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

where

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

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

As a result, the dependent variable can be interpreted as the change in the current investment strategy relative to the average investment strategy implied by the existing loan portfolio. We estimate the same regression as in equation (1), where the dependent variable is $\log(pd^A_{i,t}/pd^O_{i,t})$ and the probabilities of default are, as before, weighted by loan utilization. The results, reported in the third and fourth columns of Table 6, are similar to those shown in Table 3 for banks and CLOs/CDOs, but they are statistically insignificant for investment funds and others.

While our discussion so far has been centered on loan purchases, lenders can adjust the riskiness of their portfolios through sales as well as purchases. The fifth and sixth columns of Table 6 show results from regressions where the dependent variable is the log-ratio of addition PDs to disposition PDs, where dispositions are loans that disappear from a lender's portfolio in a given quarter, and their PDs are also weighted by loan participation amounts. The reported coefficients are in line with the results so far.

In the last two columns of Table 6, we study risk taking at the level of immediate lenders, that is, we do not consolidate loan portfolios at the ultimate-lender level. Given that finance companies are often the credit arm of a larger group rather than stand alone credit providers, only in this specification are we able to study them as a separate, albeit small, category. The coefficient shows that finance companies invest in riskier syndicated loans when interest rates decline. Finance companies increased their funding through (normally fixed-rate) bonds and intermediate notes substantially in the last quarter of 2010, after the 10-year Treasury rate dropped significantly through 2010, suggesting that finance companies may have tried to take advantage of then-historically low rates by issuing longer-term debt. However, the 10-year Treasury rate decreased further into 2012. This drop may have generated a gap between asset yields and interests on liabilities, because the assets held by finance companies can often be prepaid and borrowers have a stronger incentive to refinance after a significant decline in interest rates. As a consequence, finance companies may have attempted to reduce the gap by increasing the credit risk of newly acquired assets.[15]

In the two rightmost columns, we also focus on individual banks and exclude BHCs from the sample, which allows us to reduce the impact of subsidiaries not involved in core banking activities.

[15] Data from the Federal Reserve's G20 statistical release show that funding through bonds and intermediate notes at the end of 2010 increased to 59% from 45% in the previous quarter. The increase in the share of bonds and intermediate notes at the end of 2010 was nearly three times as large as the second-largest quarterly increase between 1995 and 2010. The 10-year Treasury rate decreased from 4% early in 2010 to 2.5% mid-year before bouncing back to 3.5% by the end of the year. The 10-year Treasury rate fell further through 2011 to reach 1.5% in 2012. Consumer loans held by finance companies were 45% of assets at the end of 2010.

The coefficient on banks is 40% lower than in Table 3 and is less statistically significant, indicating a weaker relation between risk taking and interest rates.

In the next robustness check, we present results based on a fully manual classification of the lenders in the balanced sample. The unbalanced sample includes a much larger cross-section of lenders, but many are private credit providers with nondescript names and it is difficult to obtain information on their activities from public sources. As discussed in Appendix A, we do not sort lenders on the basis of whether they are domiciled in the United States or not, and we use six categories: banks and BHCs, nonbank financials, insurance companies and pension funds, retail-oriented asset managers, CLOs/CDOs, and non-financials. We should highlight that a number of lenders classified as investment funds and other lenders in the main analysis are, in our assessment, tranched securitizations and should thus be considered CLOs/CDOs. This change likely explains why neither of the two categories derived from investment funds and other lenders has statistically significant coefficients in Table 7, where we present the results based on the new classification. These two categories are: nonbank financials, which mainly include private investment organizations and wealth management companies, and retail-oriented asset managers, which typically comprise funds available to retail or institutional investors and which are associated with asset managers with an established retail presence. The remainder of the results in Table 7 are similar to those presented previously for banks and BHCs, insurance companies and pension funds, and CLOs/CDOs.

Finally, we repeat our analysis using loans to borrowers domiciled outside the United States. The credit risk of these borrowers is less likely to be jointly determined with U.S. interest rates, which helps us address endogeneity concerns. This approach to addressing endogeneity, which is also used by Lee, Liu, and Stebunovs (2015), is similar to that of Jimenez, Ongena, Peydró, and Saurina (2014) and Ioannidou, Ongena, and Peydró (2015), who study credit risk in countries where monetary policies are considered exogenous. The first paper focuses on Spain, which ceded monetary policy to the European Central Bank, while the second studies Bolivia, which is a dollarized economy whose credit cycle is likely independent of the United States'. As shown in Table 8, the number of observations is about four times smaller than when using the full sample, yet the results are in line with those discussed so far.[16] The coefficients are typically larger in absolute value for all lenders and, in particular, they are nearly twice as large for U.S. CLOs/CDOs. Statistical significance is about the same as in the previous tables. Overall, these results provide further support that nonbank financial institutions acquire riskier loans when U.S. interest rates decrease.

### 4.3 Treasury rates and the pricing of syndicated loans

The discussion so far has focused on the credit risk of syndicated loans rather than their pricing, which is a more common theme in the literature. As noted by Ivashina and Sun (2011), strong institutional investor demand throughout the 2000s resulted in a compression of syndicated loan spreads, and a natural question is whether the risk-taking patterns we find are also reflected in loan spreads. Pricing information is not available in the SNC data, but we are able to manually match about one-third of the loan originations with PDs in SNC to spreads and fees from the commercial data set Thomson Reuters DealScan. We consider originations because Thomson Reuters DealScan only provides loan pricing at origination.

We define the all-in-drawn spread of a loan as the sum of the spread over U.S. dollar LIBOR, the annual fee, and the upfront fee prorated for the loan duration.[17] Table 9 shows summary statistics for the all-in-drawn spreads and PDs of the loans on which we focus in this section. Leveraged loans are a significant part of the market we study, as highlighted by the

[16] The SNC program focuses on loans originated or held by banks supervised by U.S. federal regulators, hence loans to U.S. borrowers constitute the bulk of the sample.

[17] Note that term loans are consistently drawn in full at origination. They have fewer built-in optionalities than credit lines and, hence, have fewer types of fees. As Berg, Saunders, and Steffen (2015) point out, the upfront fee is by far the most frequent of term loan fees, occurring nearly 30% of the time.

number of speculative and non-rated observations, both with median spreads much higher than for investment-grade loans.

We evaluate whether longer-term interest rates affect loan spreads with a set of regressions that relate log-spreads to selected loan characteristics and several macroeconomic variables, including 10-year Treasury rates. The full specification is:

$$log(ais_{i,t}) = \sum_{c \subset C} \beta_c L_{c,i} + \sum_{v \subset V} \gamma_m M_{m,t} + \delta S_i + \nu S_i \times T_t + q_{b,y} + q_{ab,y} + \varepsilon_i, \tag{3}$$

where $ais_{i,t}$ is loan $i$'s all-in-drawn spread; $L_{c,i}$ a set of loan characteristics that includes each loan's log PD; $M_{m,t}$ is a set of macro variables that includes the 10-year Treasury rate; $S_i$ is the loan share held by nonbank lenders at the end of the quarter of loan origination; and $q_{b,y}$ and $q_{ab,y}$ are borrower-industry/year and agent-bank/year fixed effects, respectively. The rationale for including nonbank loan share as a covariate is that the presence of certain nonbank intermediaries (for example, CDOs) makes spreads more sensitive to lenders' willingness to provide credit (Ivashina and Sun, 2011). To the extent that low Treasury rates increase this willingness to lend, their effects on spreads could be stronger for loans with a higher fraction of nonbank lenders.

As shown in Table 10, default risk and the fixed effects explain more than half of the variation in loan spreads, and, as expected, higher PDs are associated with higher spreads. Longer duration and smaller loan amounts also contribute to higher spreads, as does risk aversion, which is measured with the variance risk premium. The coefficient on the 10-year Treasury rate is not statistically significant, unless the nonbank loan share and its interaction with the Treasury rate are included, in which case the coefficient is negative. The economic effect is also relatively small, because a 0.5 percentage point quarter-on-quarter decrease in the Treasury rate would raise the median spread for investment-grade loans from 150 to 160 basis points.[18] The nonbank share enters with a positive and statistically significant coefficient, which may reflect the higher riskiness of loans held by nonbank intermediaries (we control for PDs, but loan spreads may also capture other dimensions of credit risk, like loss given default). The interaction between the Treasury rate and the nonbank share has a small and statistically insignificant coefficient.

While the relation between Treasury rates and PDs suggests that lenders increase their risk taking when interest rates are low, the relation between Treasury rates and loan spreads seems to imply that the appetite for riskier credits translates, if anything, into higher loan spreads. These two findings, however, are not necessarily at odds. As noted above, loan spreads may embed more accurate information about default risk than PDs do, for instance because they incorporate lenders' expected loss given default. In this case, higher spreads would reflect the same increased risk taking that we find when studying PDs. A second possibility is that the increase in risk taking that goes with low Treasury rates may be accompanied by a change in the characteristics of borrowers. For instance, lenders may be more willing to provide credit to companies for which, keeping default risk constant, information is more difficult to gather, and they may demand higher spreads to compensate for this additional business cost (see Easley and O'Hara, 2004, for the effect of information availability on the cost of capital).

## 4.4 Risk taking in the cross section of mutual funds

In order to provide cross-sectional evidence that low longer-term interest rates affect the risk taking of non-bank intermediaries, we now turn to a subset of mutual funds that invest in SNC loans. Researchers have found that mutual fund managers tend to take higher risk when they experience poor performance relative to their peers (see Kempf, Ruenzi, and Thiele, 2009 and references

[18] The regressions are in semi-log form, and the expected percent change in the loan spread for a decrease of the 10-year Treasury rate of 0.5 percentage point in a quarter is given by $e^{-0.5\cdot\beta_T} - 1$.

therein). As discussed in Section 3, it is not clear that the incentive to take more risk to catch up with peers is stronger at times of low longer-term interest rates, and indeed the literature finds an effect of relative performance on risk taking in samples that mostly exclude the recent low-interest rates environment. In addition, our sample makes tests of this hypothesis challenging, because we would need the first half of each year to rank the funds, leaving only two quarters of each year for testing.

Instead, we base our cross-sectional tests on the observation that funds which charge higher fees see a higher reduction in the net yield paid to investors (as a fraction of gross yield) when interest rates are lower. As a result, the managers of high-fee funds could have a stronger incentive to invest in assets with higher risk and higher yield.

After merging the SNC data with Morningstar Direct and CRSP, we obtain a sample of 104 U.S. mutual funds. We estimate the panel regression shown in equation 1, where we include a set of fund-level characteristics often used as controls in studies of mutual-fund risk taking (Kempf, Ruenzi, and Thiele, 2009): the performance rank of fund relative to its peers in the same Lipper asset class code; fund turnover, the natural logarithm of net assets, the natural logarithm of the years since the introduction of the oldest share class of a mutual fund, and manager tenure (the natural logarithm of the average tenure in years of the mutual fund managers). We use the expense ratio, which is the amount of fees managers charge each year as a fraction of fund net assets, to identify high-expense and low-expense funds, with the cutoff being an expense ratio of 1% (the median and average expense ratios for the 104 funds over the 2010-2013 sample are about 0.98% and 0.92%, respectively). We measure the mutual fund characteristics at the end of the year preceding the quarterly observations. The regressions include lender fixed effects and, where indicated, year fixed effects.

The results we show in Table 11 are based on unbalanced samples where the dependent variable is the log-default probability of portfolio additions; as such, the results should be compared with the coefficients shown in the first column of Table 3.[19] While we study a subset of the intermediaries under the "Investment funds and others" category discussed throughout the paper, the coefficients in the two tables are fairly similar. The coefficient on "Investment funds and others" in the first column of Table 3 is -0.402 with a $t$-statistic equal to -2.03, and the coefficient on the 10-year Treasury rate for all the 104 funds is -0.452 without year fixed effects (column 1) and -0.426 with year fixed effects (column 4); the $t$-statistics are -2.25 and -2.07, respectively. Splitting the sample on the basis of the fees the mutual funds charge to investors, however, shows that the results are driven by funds that charge higher fees. The coefficients are smaller and statistically insignificant for low-expense funds, while they are -0.604 (column 3) and -0.678 (column 6) for high-expense funds, with $t$-statistics equal to -3.01 and -3.12. The fund-specific controls are generally not statistically significant, with the exception of manager tenure.

Overall, we find cross-sectional evidence consistent with an effect of low longer-term interest rates on the risk taking of mutual funds, where those funds that are ex-ante more likely to be sensitive to low interest rates because of the effect of low rates on the net yield they pay to investors do indeed invest in riskier syndicated loans when longer-term interest rates decline.

## 5. Conclusions

We use supervisory data to study the risk-taking behavior of banks and nonbank lenders in the primary and secondary U.S. syndicated loan market during the post-crisis period, when interest rates on longer-term, safe assets ranged between 1.5 and 4 percent and the expectations of a liftoff in the

[19] Table 11 does not show coefficients for the set of macroeconomic control variables we use throughout the paper.

federal funds rates varied between 0 and 8 quarters. We find that certain financial intermediaries—in particular, structured finance vehicles—increase the riskiness of their syndicated loan portfolios when longer-term interest rates are expected to remain low. We mainly focus on the 10-year Treasury rate as an explanatory variable, but the results are robust to using alternative measures for interest rate expectations. We also study the relation between Treasury rates and loan spreads for a sub-sample of loans for which we were able to source pricing information. We find that spreads increase modestly when interest rates decrease, which is not consistent with the hypothesis that demand from a search for yield leads to loan spread compression in the primary syndicated term loan market.

These results are consistent with a search for yield by nonbank lenders in the syndicated loan market. In light of the evidence that U.S. unconventional monetary policy put downward pressure on longer-term interest rates, our results are also consistent with the existence of a risk-taking channel of monetary policy.

Our findings 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 small relative to the overall portfolio, or the intermediary may be actively hedging the additional risk. Second, the dynamics of loan pricing and of recovery rates may be such that lenders are appropriately compensated for the additional risk or expected losses remain stable. 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 the fact that loan supply is adversely affected by negative liquidity and capital shocks to lenders (see Ivashina and Scharfstein, 2010, and Santos, 2011).

## A. Lender classification

We assign each lender to one of seven categories on the basis of the Entity Type code provided by the National Information Center database, which is made available in the SNC data.[20] We then refine the classification manually using lender names, as discussed below. The number of lenders in each category is shown in parentheses. Entity Type codes are shown in italics.

1) **U.S. banks and bank holding companies (20)**: *BHC* (Bank Holding Company), *FHD* (Financial Holding Company) if the lender is domiciled in the United States, *FCU* (Federal Credit Union), *FSB* (Federal Savings Bank), *NAT* (National Bank), *NMB* (Non-member Bank), *SAL* (Savings & Loan Association), *SMB* (State Member Bank), or *SSB* (State Savings Bank).

2) **Non-U.S. banks and bank holding companies (24)**: *FBH* (Foreign Banking Organization as a Bank Holding Company), *FHD* (Financial Holding Company) if the lender is domiciled outside the United States, *FBK* (Foreign Bank), *FBO* (Foreign Banking Organization), or *FHF* (Financial Holding Company/Foreign Banking Organization).

3) **Insurance companies and pension funds (14)**: the lender name includes "Insurance," "Reinsuarance," "Assurance," "Reassurance," "Retirement," "Pension," or "Pensioen," as long as the Entity Type is not *BHC* or *FHD* and the name does not contain "401" or "Superannuation." Note that we do not distinguish U.S./non-U.S. insurance companies or pension funds, and that 401k-style pension funds (including Australian superannuations) are considered investment funds because they are similar to tax-advantaged mutual funds. We also manually search lender names to ensure that the 25 largest U.S. insurance companies by

[20] See page 14 of the data dictionary at http://www.ffiec.gov/nicpubweb/nicweb/DataDownload.aspx for details on this variable.

assets as of the third quarter of 2014 (based on data from SNL Financial) are classified as insurance companies.

4) **U.S. CLOs/CDOs (80)**: the lender name includes "CDO" or "CLO," the Entity Type is not *BHC* or *FHD*, and the lender is domiciled in the United States.

5) **Non-U.S. CLOs/CDOs (29)**: the lender name includes "CDO" or "CLO," the Entity Type is not *FBH* or *FHD*, and the lender is domiciled outside the United States.

6) **U.S. investment funds and others (108)**: *DEO* (Domestic Entity Other); if, for lenders domiciled in the United States, the lender name contains "Fund" and the Entity Type is not *BHC* or *FHD*, and the lender is not classified as CLO/CDO or insurance company/pension fund; and if, for lenders domiciled in the United States, the lender name contains "401" and the Entity Type is not *BHC* or *FHD*, and the lender is not classified as CLO/CDO or insurance company/pension fund.

7) **Non-U.S. investment funds and others (24)**: *FEO* (Foreign Entity Other); if, for lenders domiciled outside the United States, the lender name contains "Fund" and the Entity Type is not *FBH* or *FHD*, and the lender is not classified as CLO/CDO or insurance company/pension fund; and if, for lenders domiciled outside the United States, the lender name contains "Superannuation" and the Entity Type is not *FBH* or *FHD*, and the lender is not classified as CLO/CDO or insurance company/pension fund.

The Entity Type variable can also take the value *SLCH* (Savings and Loan Holding Company), for which we classify lenders manually into one of the categories described above. As a rule, we do not reclassify lenders on the basis of their name if the entity type is *BHC*, *FBH*, or *FHD* because we have found these codes to reliably classify lenders. One specification in Table 6 includes an analysis at the immediate-lender level, rather than at the ultimate-lender level. In this case, we use the approach described previously to classify lenders, with the exception that we do not include U.S. bank holding companies in category 1. We also include finance companies (Entity Type *FNC*), whose classification we review manually on the basis of lender names.

In Table 7 we present results using a manual classification of the lenders in the balanced sample, in which we research information on each lender's activities. We construct one category each for "Banks and bank holding companies" and "CLOs/CDOs," irrespective of whether they are domiciled in the United States or not, and we reclassify U.S./non-U.S. investment funds and others into "Nonbank financials," "Retail-oriented asset managers," and "Non financials." Retail-oriented asset managers include companies with an established presence in the retail market, but their funds that participate in the syndicated-loan market are not necessarily plain-vanilla mutual funds. The six categories of the manual classification, highlighting the differences relative to the main classification, are the following:

A) **Banks and bank holding companies (44)**: The first two categories of the main classification are included in this category.

B) **Nonbank financials (18)**: These lenders appear to be private investment companies or wealth management companies, and were classified as 6 or 7.

C) **Insurance companies and pension funds (15)**: A small number of lenders previously classified as 6 are reclassified as insurance companies and pension funds, including insurance companies and investment funds for company pension plans. Public pension funds are now classified as non-financials lenders, because plan funding and investment choices can be affected by political considerations, and their sponsors have taxing power.

D) **Retail-oriented asset managers (63)**: All these lenders were previously classified as either 6 or 7, and include investment funds associated with asset managers with an established retail presence.

E) **CLOs/CDOs (142)**: All lenders in categories 4 and 5 are in this category. 33 lenders that were previously classified as investment funds and others are now classified as CLOs/CDOs. These are lenders whose names do not contain the keywords used in the main classification and that we judge to be tranched securitizations, normally using brief descriptions of the structure that are attached to notices of publicly available rating changes.

F) **Non financials (17)**: This category includes charitable foundations, private trusts, health insurance companies, and public treasury departments and pension plans. We consider health insurance companies non-financial lenders because premia tax deductability and employer plan sponsorship may provide these companies with different pricing power and investment incentives than life, property, and casualty insurers. As discussed above, we consider public pension funds non-financial lenders because their sponsors are directly exposed to political considerations and have taxing power. The large majority of lenders were classified as 6 or 7, and a small number were classified as 4.

# References


Altunbas, Y., L. Gambacorta, and D. Marques-Ibanez (forthcoming): "Does monetary policy affect bank risk-taking?," *International Journal of Central Banking.*

Becker, B., and V. Ivashina (forthcoming): "Reaching for yield in the bond market," *Journal of Finance.*

Berg, T., A. Saunders, and S. Steffen (2015): "The total cost of corporate borrowing in the loan market: Don't ignore the fees," *Journal of Finance, forthcoming.*

Black, L., and L. Hazelwood (2013): "The effect of TARP on bank risk-taking," *Journal of Financial Stability*, 9(4), 790–803.

Bollerslev, T., G. Tauchen, and H. Zhou (2009): "Expected stock returns and variance risk premia," *Review of Financial Studies*, 22(11), 4463–4492.

Borio, C., and H. Zhu (2012): "Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism?," *Journal of Financial Stability*, 8(4), 236–251.

Buch, C., S. Eickmeier, and E. Prieto (2014): "In search for yield? Survey-based evidence on bank risk taking," *Journal of Economic Dynamics and Control*, 43, 12–30.

Calem, P., R. Correa, and S. Lee (2016): "Prudential policies and their impact on credit in the United States," *Working paper.*

Cameron, A., J. Gelbach, and D. Miller (2011): "Robust inference with multiway clustering," *Journal of Business & Economic Statistics*, 29(2), 238–249.

Campello, M. (2002): "Internal capital markets in financial conglomerates: Evidence from small bank responses to monetary policy," *Journal of Finance*, 57(6), 2773–2805.

Chevalier, J., and G. Ellison (1997): "Risk taking by mutual funds as a response to incentives," *Journal of Political Economy*, 105(6), 1167–1200.

Chodorow-Reich, G. (2014): "Effects of unconventional monetary policy on financial institutions," *Brookings Papers on Economic Activity*, Spring, 155–204.

D'Amico, S., W. English, D. Lopez-Salido, and E. Nelson (2012): "The Federal Reserve's large-scale asset purchase programmes: Rationale and effects," *Economic Journal*, 122(564), F415–F446.

D'Amico, S., and T. King (2013): "Flow and stock effects of large-scale treasury purchases: Evidence on the importance of local supply," *Journal of Financial Economics*, 108(2), 425–448.

Degryse, H., and S. Ongena (2007): "The impact of competition on bank orientation," *Journal of Financial Intermediation*, 16(3), 399–424.

Dell'Ariccia, G., L. Laeven, and G. Suarez (2014): "Bank leverage and monetary policy's risk-taking channel: Evidence from the United States," *IMF Working Paper 13/143, International Monetary Fund.*

Di Maggio, M., and M. Kacperczyk (2015): "The unintended consequences of the zero lower bound policy," *Working paper, Columbia Business School.*

Duchin, R., and D. Sosyura (2012): "Safer ratios, riskier portfolios: Banks' response to government aid," *Working paper*.

Easley, D., and M. O'Hara (2004): "Information and the cost of capital," *Journal of Finance*, 59(4), 1553–1583.

Gorton, G., and G. Pennacchi (1995): "Banks and loan sales: Marketing nonmarketable assets," *Journal of Monetary Economics*, 35(3), 389–411.

Ioannidou, V., S. Ongena, and J. Peydró (2015): "Monetary policy, risk-taking and pricing: Evidence from a quasi-natural experiment," *Review of Finance*, 19(1), 95–144.

Ivashina, V., and D. Scharfstein (2010): "Bank lending during the financial crisis of 2008," *Journal of Financial Economics*, 97(3), 319–338.

Ivashina, V., and Z. Sun (2011): "Institutional demand presure and the cost of corporate loans," *Journal of Financial Economics*, 99(3), 500–522.

Jimenez, G., S. Ongena, J. Peydró, and J. Saurina (2014): "Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit-risk taking?," *Econometrica*, 82(2), 463–505.

Jones, J., W. Lang, and P. Nigro (2005): "Agent bank behavior in bank boan syndications," *Journal of Financial Research*, 28(3), 385–402.

Kempf, A., S. Ruenzi, and T. Thiele (2009): "Employment risk, compensation incentives, and managerial risk taking: Evidence from the mutual fund industry," *Journal of Financial Economics*, 92(1), 92–108.

Krishnamurthy, A., and A. Vissing-Jorgensen (2013): "The ins and outs of LSAPs," *Symposium on Global Dimensions of Unconventional Monetary Policy, Federal Reserve Bank of Kansas City*, pp. 57–111.

Lee, S., L. Liu, and V. Stebunovs (2015): "Risk taking and interest rates: Evidence from decades in the global syndicated loan markets," *Working paper*.

Li, L. (2013): "TARP funds distribution and bank loan supply," *Journal of Banking & Finance*, 37(12), 4777–4792.

Maddaloni, A., and J. Peydró (2011): "Bank risk-taking, securitization, supervision, and low interest rates: Evidence from the Euro-area and the U.S. lending standards," *Review of Financial Studies*, 24(6), 2121–2165.

Paligorova, T., and J. Santos (2013): "Monetary Policy and Bank Risk-Taking: Evidence from the Corporate Loan Market," *Working paper*.

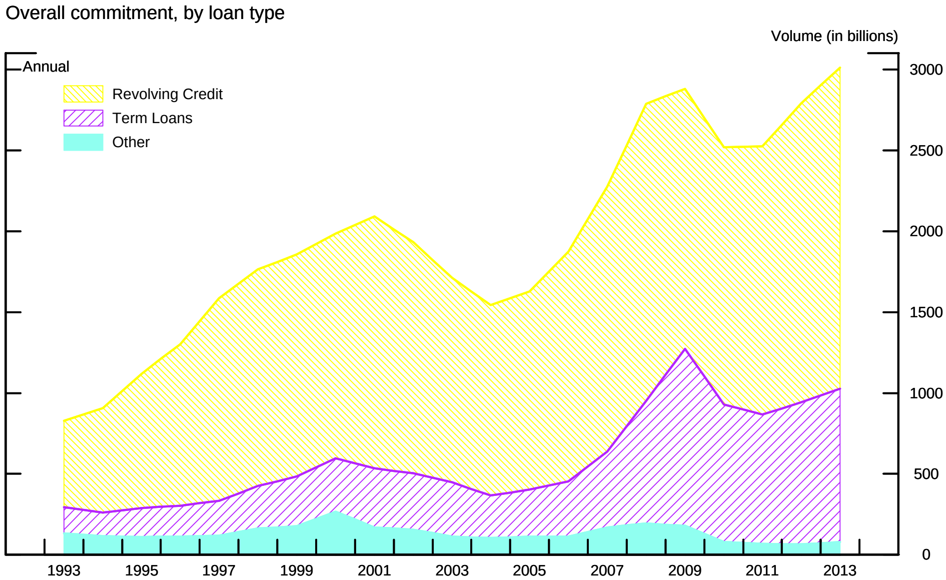
Qiu, J. (2003): "Termination risk, multiple managers and mutual fund tournaments," *European Finance Review*, 7(2), 161–190.

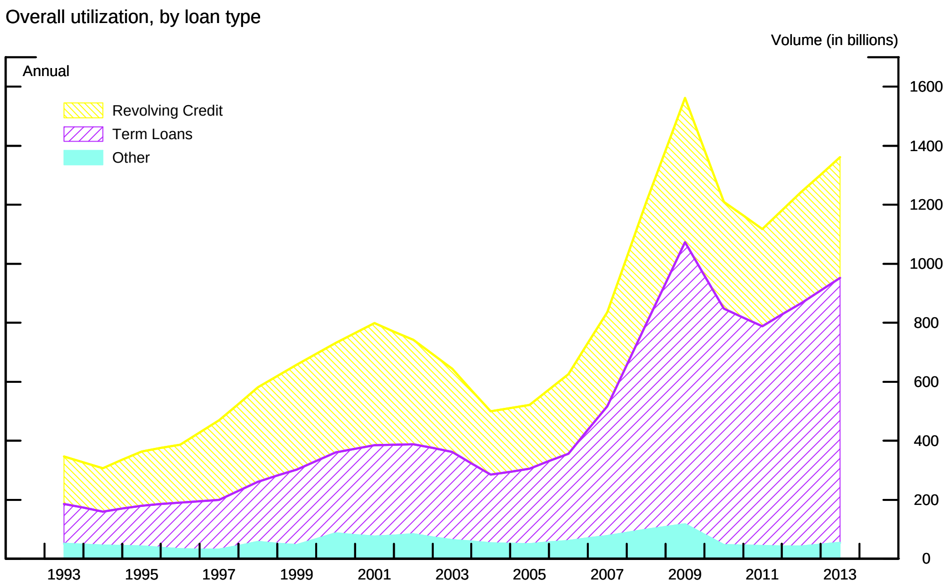
Santos, J. (2011): "Bank corporate loan pricing following the subprime crisis," *Review of Financial Studies*, 24(6), 1916–1943.

Spiegel, M., and H. Zhang (2013): "Mutual fund risk and market share-adjustes fund flows," *Journal of Financial Economics*, 108(2), 506–528.

Figure 1: Annual Shared National Credit: Commitment and utilization trends by loan type

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

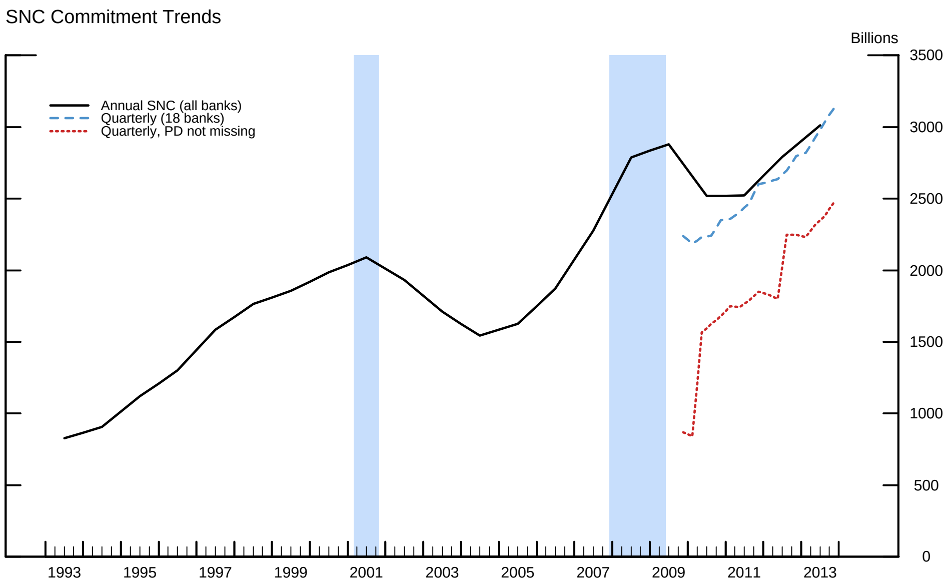


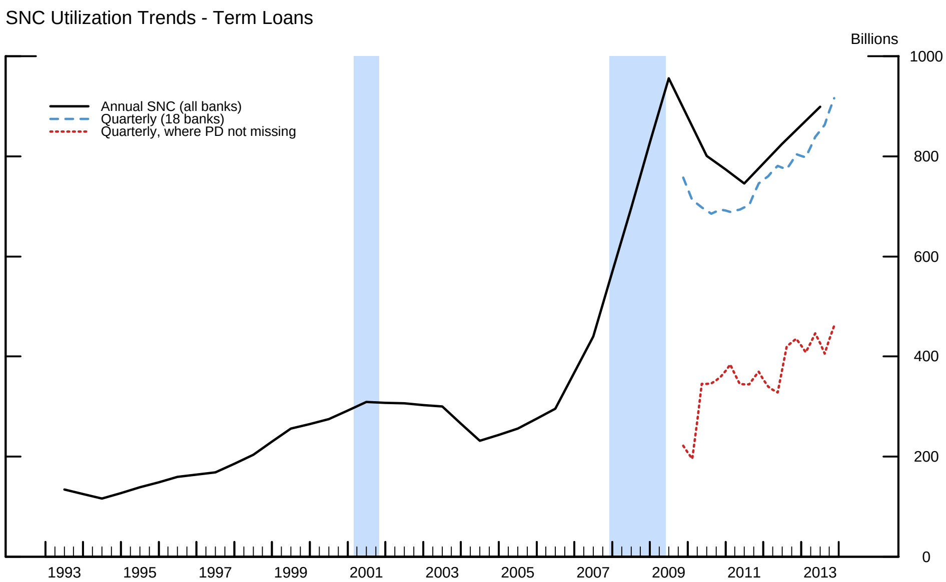




Note: SNC program reviews are conducted annually in May using data provided by agent banks, typically as of December 31 of the prior year, and sometimes as of March 31 of the review year.

Figure 2: Shared National Credit: Commitment and utilization trends, quarterly vs. annual data

The charts show the time series of annual and quarterly commitments and utilization by loan type. The charts also report volumes according to whether probabilities of default (PDs) are available.

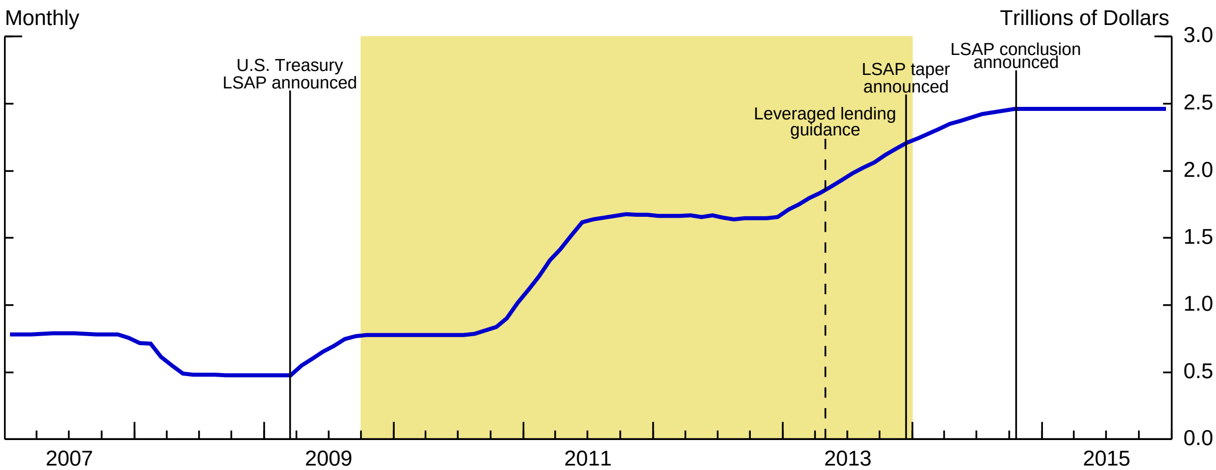



Note: SNC program reviews are conducted annually in May using data provided by agent banks, typically as of December 31 of the prior year, and sometimes as of March 31 of the review year.

Figure 3: Sample period and Federal Reserve holdings of U.S. Treasury securities

The chart shows the Federal Reserve holdings of U.S. Treasury securities between 2007 and 2015, with the period we study highlighted by the shaded area. The vertical lines highlight policy announcements about the Large-Scale Asset Purchases of U.S. Treasury securities and about the leveraged lending guidance designed to reinforce sound practices for leveraged finance activities (2013 Interagency Guidance on Leveraged Lending). The chart does not show announcements of increases in U.S. Treasury purchases between 2010 and 2013.




Source: Federal Reserve Statistical Release H.4.1.
Note. The shaded area represents the sample period.

Figure 4: Interest rates during the last three recessions

The charts report 10-year Treasury rates (left) and three-year-forward 10-year Treasury rates (right) through the three most recent recessions. The horizontal axes show quarters from the end of the recessions.

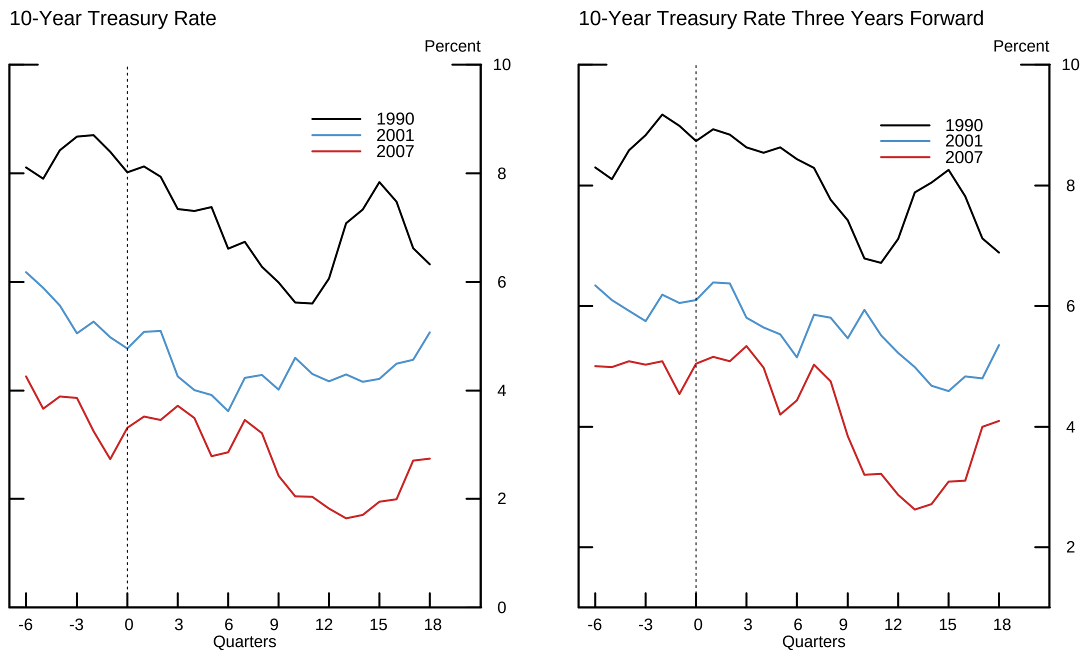


Figure 5: The default risk of gross portfolio additions by lender type

The charts show the time-series evolution of the residual log-probabilities of default of gross portfolio additions, by lender type, using the unbalanced panel. The orthogonalized Treasury rate is also shown in the chart. Residual PDs are calculated with a regression like equation (1) but without the Treasury rate. Residual Treasury rates are calculated by regressing the Treasury rate on the control variables in equation (1). Note that not all the left axes have the same scale.

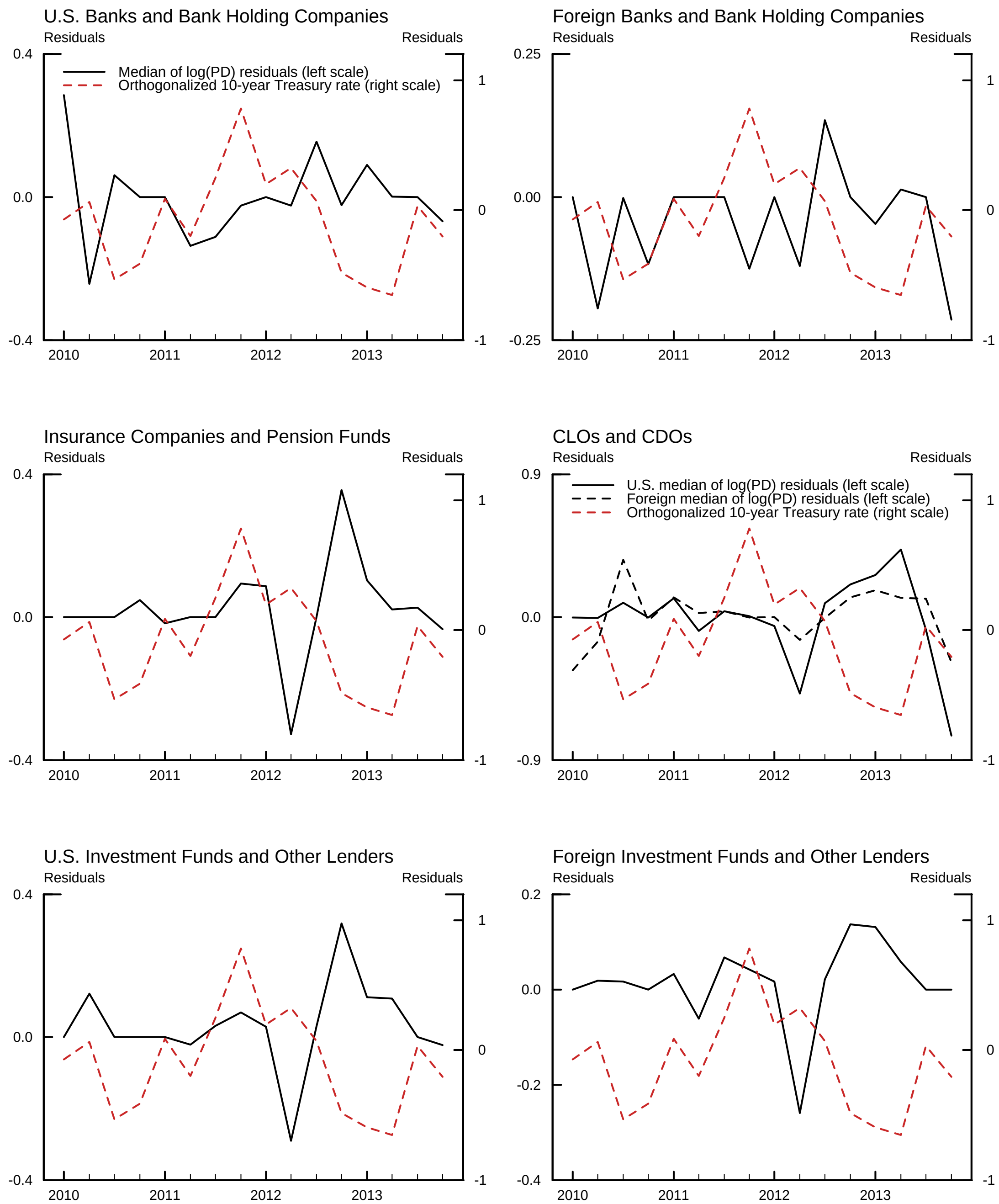


Figure 6: Portfolio additions by lender type

The charts show the amount of portfolio additions (in $ billion) by lender type, using the unbalanced panel.

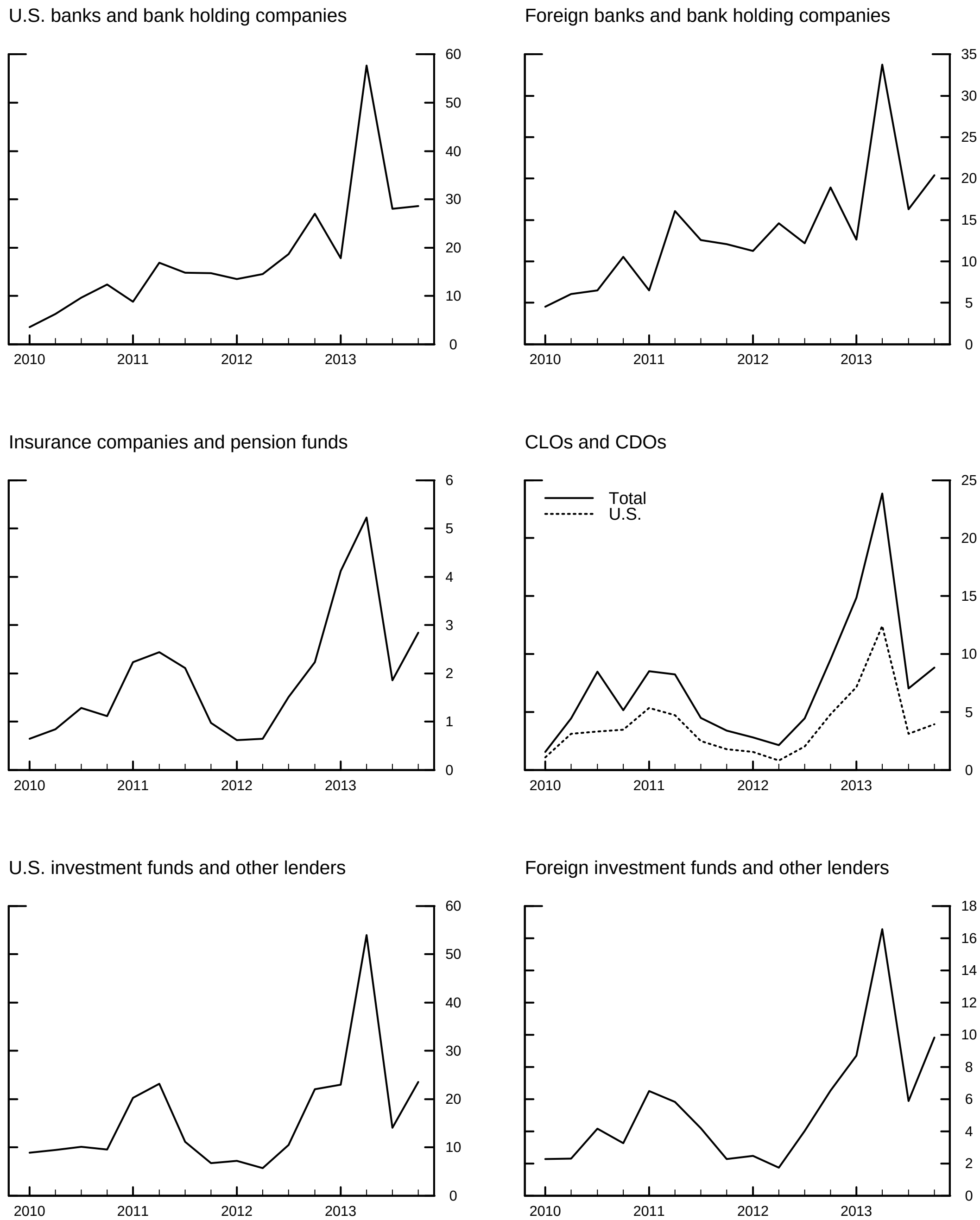


Figure 7: Monetary policy expectations from OIS quotes

The left chart shows the spread between the expected federal funds rate 10 quarters ahead and the current federal funds rate. The right chart shows, at a given point in time, the number of quarters before the federal funds rate is expected to reach 25 basis points. Expected federal funds rates at various time horizons are obtained from overnight indexed swaps (OIS) quotes.

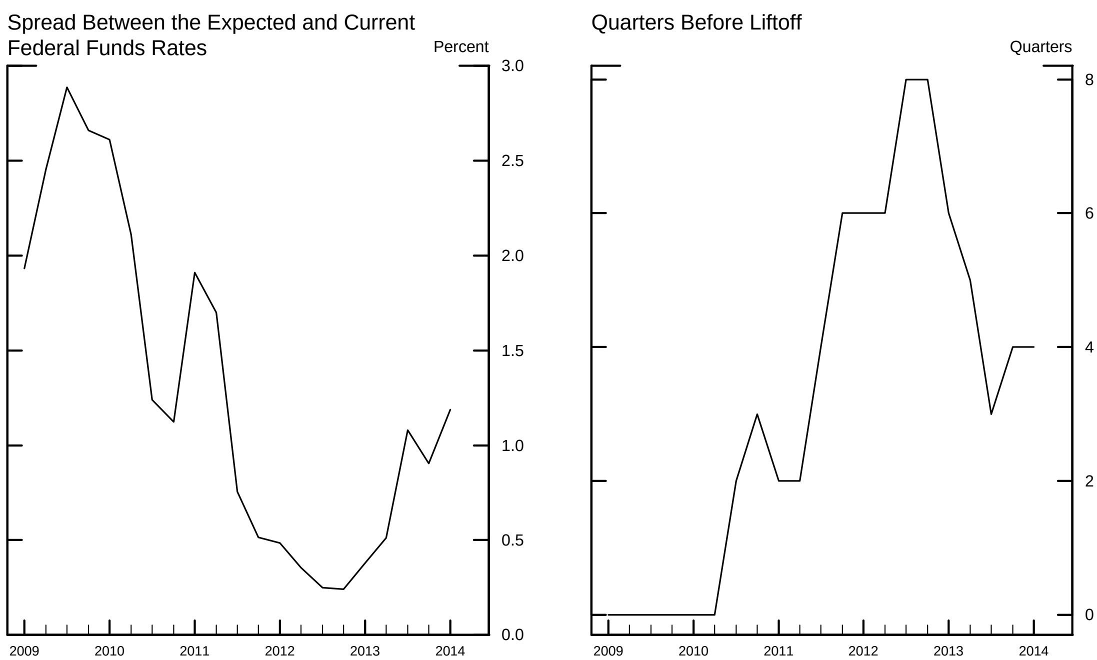


Table 1: Loan summary statistics by rating grade and lender type

The top panel shows the percent of loans that have been assigned a given rating grade by SNC examiners, the percent of loans with a given rating grade that have a probability of default (PD), and the median PD by rating grade. The bottom panel shows the weighted average lender share in a syndicated loan, weighted by loan amount, according to whether the loan has a PD or not. The table also shows the weighted median PD, with the weight given by the participation amount.

| Loan Rating Grade | Percent of Loans | Percent of Loans (with PD) | Median PD | 35% ceiling |
|---|---|---|---|---|
| Pass | 76.2 | 79.5 | 0.78 | 0.78 |
| Special Mention | 9.5 | 8.0 | 5.58 | 5.58 |
| Substandard | 11.2 | 9.1 | 29.41 | 29.41 |
| Doubtful | 2.0 | 2.0 | 100 | 35 |
| Loss | 1.1 | 1.4 | 100 | 35 |
| **Lender type** | **Av. loan share** | **Av. loan share (with PD)** | **Weighted median PD** | **35% ceiling** |
| U.S. banks and BHCs | 22.4 | 29.9 | 0.71 | 0.71 |
| Non-U.S. banks and BHCs | 18.3 | 26.3 | 0.65 | 0.65 |
| Insurance cos./Pension funds | 3.5 | 2.3 | 4.26 | 4.26 |
| U.S. CLOs/CDOs | 10.3 | 6.7 | 3.25 | 3.25 |
| Non-U.S. CLOs/CDOs | 6.7 | 4.4 | 4.50 | 4.50 |
| U.S. inv. funds and others | 30.3 | 24.4 | 7.95 | 7.95 |
| Non-U.S. inv. funds and others | 8.7 | 5.9 | 4.82 | 4.82 |

Table 2: Lender market share at origination and one or two quarters after origination

The table reports the market share of each lender type at origination and after one or two quarters. The sample includes loans whose origination date is within the reporting quarter.

| | Share held by lender type (in %) | | | | Share held by lender type (in %) | | | |
|---|---|---|---|---|---|---|---|---|
| | At orig. | +1 qrt | Δ | Δ% | At orig. | +2 qrts | Δ | Δ% |
| U.S. banks and BHCs | 25.7 | 22.3 | -3.4 | -13.2% | 25.7 | 22.2 | -3.5 | -13.5% |
| Non-U.S. banks and BHCs | 18.1 | 15.4 | -2.7 | -14.7% | 18.1 | 15.1 | -2.9 | -16.3% |
| Insurance cos./Pension funds | 3.6 | 3.9 | 0.4 | 10.4% | 3.6 | 3.9 | 0.3 | 9.5% |
| U.S. CLOs/CDOs | 8.3 | 9.2 | 0.9 | 11.1% | 8.7 | 9.7 | 1.1 | 12.3% |
| Non-U.S. CLOs/CDOs | 5.8 | 6.7 | 0.9 | 15.4% | 5.8 | 7.1 | 1.2 | 21.3% |
| U.S. inv. funds and others | 30.3 | 32.7 | 2.4 | 8.0% | 30.1 | 32.3 | 2.2 | 7.2% |
| Non-U.S. inv. funds and others | 8.3 | 9.8 | 1.5 | 17.4% | 8.1 | 9.7 | 1.6 | 19.5% |

Table 3: Risk taking in the syndicated loan market: Main results

The table shows the sensitivity of portfolio credit risk to the 10-year Treasury rate, by lender type, estimated using the panel regression discussed in Section 3. The dependent variable is the log PD of loan portfolios at the ultimate-lender level. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. $\overline{\text{PD}}^A$ is the time-series average of the PDs shown in each of Figure 5's charts, which we report for lender types with a statistically significant coefficient on the Treasury rate in the balanced panel. $\Delta\overline{\text{PD}}^A$ is the predicted change in PDs for a quarterly decrease in the Treasury rate of 0.5 percentage points. $\Delta\overline{\text{PD}}^A$ is calculated by multiplying $\overline{\text{PD}}^A$ by the expected percent change in the PD, which is given by $e^{-0.5\cdot\beta_T} - 1$ (the regressions are in semi-log form). The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013.

| | Additions | | | | Originations | | Originations, by future change in bank loan share (unbalanced panel) | |
|---|---|---|---|---|---|---|---|---|
| | Unbal. | Bal. | $\overline{\text{PD}}^A$ | $\Delta\overline{\text{PD}}^A$ | Unbal. | Balanced | Decrease | Increase |
| U.S. banks and BHCs | -0.102 | -0.607$^{**}$ | 1.37 | 0.48 | -0.373$^{**}$ | -0.688$^{**}$ | -0.444$^{*}$ | 0.048 |
| | (-0.77)$^{3.5}$ | (-2.64)$^{6.7}$ | | | (-2.20)$^{3.7}$ | (-2.47)$^{12.8}$ | (-2.03)$^{4.4}$ | (0.14)$^{3.6}$ |
| Non-U.S. banks and BHCs | -0.037 | 0.075 | | | -0.310$^{**}$ | -0.263 | -0.498$^{**}$ | 0.512 |
| | (-0.20)$^{3.6}$ | (0.51)$^{8.0}$ | | | (-2.14)$^{3.8}$ | (-1.46)$^{17.4}$ | (-2.89)$^{3.9}$ | (1.21)$^{4.1}$ |
| Insurance cos./Pension funds | -0.420$^{**}$ | -0.440 | | | -1.033$^{*}$ | -1.041$^{**}$ | -1.375$^{*}$ | -0.571 |
| | (-2.23)$^{10.5}$ | (-1.63)$^{4.7}$ | | | (-1.78)$^{10.6}$ | (-2.45)$^{2.3}$ | (-1.91)$^{9.8}$ | (-0.94)$^{9.6}$ |
| U.S. CLOs/CDOs | -0.696$^{**}$ | -0.832$^{***}$ | 3.71 | 1.93 | -0.548 | -0.868 | -0.585 | 0.585 |
| | (-2.87)$^{12.6}$ | (-4.64)$^{26.8}$ | | | (-1.26)$^{13.7}$ | (-1.74)$^{23.3}$ | (-1.21)$^{15.0}$ | (1.28)$^{17.7}$ |
| Non-U.S. CLOs/CDOs | -0.667$^{***}$ | -0.725$^{***}$ | 3.48 | 1.53 | -0.719$^{*}$ | -0.579 | -0.730 | -0.276 |
| | (-3.65)$^{9.5}$ | (-3.89)$^{9.7}$ | | | (-1.91)$^{10.8}$ | (-0.90)$^{7}$ | (-1.35)$^{11.7}$ | (-0.64)$^{12.6}$ |
| U.S. inv. funds and others | -0.402$^{*}$ | -0.268 | | | -0.869$^{*}$ | -0.533 | -1.056$^{*}$ | -0.376 |
| | (-2.03)$^{43.7}$ | (-1.07)$^{36.1}$ | | | (-1.85)$^{41.4}$ | (-1.11)$^{31.4}$ | (-1.86)$^{40.2}$ | (-0.54)$^{37.8}$ |
| Non-U.S. inv. funds and others | -0.385$^{***}$ | -0.636$^{**}$ | 5.55 | 2.05 | -0.873$^{**}$ | -1.507* | -1.052$^{*}$ | -0.769 |
| | (-3.11)$^{16.6}$ | (-2.17)$^{8.0}$ | | | (-2.21)$^{15.9}$ | (-1.77)$^{5.8}$ | (-1.90)$^{15.1}$ | (-1.50)$^{14.8}$ |
| Observations | 39,987 | 4,784 | | | 28,207 | 1,376 | 20,343 | 12,158 |
| Adj. $R^2$ | 0.40 | 0.37 | | | 0.41 | 0.45 | 0.42 | 0.53 |

Table 4: Risk taking in the syndicated loan market: The effect of the "taper tantrum"

The table shows the sensitivity of portfolio credit risk to the 10-year Treasury rate, by lender type, estimated using the panel regression discussed in Section 3. The dependent variable is the log probability of default of loan portfolios at the ultimate-lender level. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013.

| | Excluding 2012:Q2 | | | | Excluding 2013:Q2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Additions | | Originations, by bank share change (unbalanced panel) | | Additions | | Originations, by bank share change (unbalanced panel) | |
| | Unbal. | Bal. | Decrease | Increase | Unbal. | Bal. | Decrease | Increase |
| U.S. banks and BHCs | -0.093 | -0.615$^{**}$ | -0.420$^{*}$ | -0.041 | -0.084 | -0.619$^{**}$ | -0.462$^{*}$ | 0.111 |
| | (-0.68)$^{3.4}$ | (-2.72)$^{5.8}$ | (-1.88)$^{4.2}$ | (-0.14)$^{3.5}$ | (-0.57)$^{3.4}$ | (-2.33)$^{6.7}$ | (-1.84)$^{4.4}$ | (0.32)$^{3.9}$ |
| Non-U.S. banks BHCs | 0.020 | 0.160 | -0.436$^{**}$ | 0.319 | 0.049 | 0.212 | -0.482$^{**}$ | 0.581 |
| | (0.10)$^{3.6}$ | (0.94)$^{7.2}$ | (-2.66)$^{3.8}$ | (0.86)$^{3.9}$ | (0.26)$^{3.7}$ | (1.39)$^{8.0}$ | (-2.57)$^{4.0}$ | (1.43)$^{4.4}$ |
| Insurance cos./Pension funds | -0.271$^{**}$ | -0.064 | -0.494$^{***}$ | -0.571 | -0.416$^{*}$ | -0.481$^{*}$ | -1.497$^{*}$ | -0.224 |
| | (-2.28)$^{10.4}$ | (-0.34)$^{4.9}$ | (-3.05)$^{9.8}$ | (-0.94)$^{9.6}$ | (-1.90)$^{10.3}$ | (-1.63)$^{4.7}$ | (-1.65)$^{9.7}$ | (1.63)$^{9.2}$ |
| U.S. CLOs/CDOs | -0.612$^{**}$ | -0.770$^{***}$ | -0.242 | 0.585 | -0.559$^{**}$ | -0.780$^{***}$ | -0.736 | 0.643 |
| | (-2.62)$^{12.7}$ | (-4.57)$^{27.7}$ | (-0.93)$^{15.2}$ | (1.28)$^{17.7}$ | (-2.38)$^{12.9}$ | (-3.97)$^{26.8}$ | (-1.98)$^{15.4}$ | (1.75)$^{18.5}$ |
| Non-U.S. CLOs/CDOs | -0.613$^{***}$ | -0.725$^{***}$ | -0.237 | -0.276 | -0.676$^{***}$ | -0.725$^{***}$ | -0.843 | -0.112 |
| | (-3.22)$^{9.6}$ | (-4.08)$^{11.5}$ | (-1.09)$^{11.8}$ | (-0.64)$^{12.6}$ | (-3.71)$^{9.6}$ | (-3.52)$^{9.7}$ | (-1.63)$^{11.7}$ | (-0.38)$^{12.6}$ |
| U.S. inv. funds and others | -0.256$^{*}$ | -0.134 | -0.428$^{*}$ | -0.414 | -0.353 | -0.230 | -1.159$^{*}$ | -0.028 |
| | (-1.81)$^{43.7}$ | (-0.71)$^{34.9}$ | (-1.95)$^{40.0}$ | (-0.59)$^{37.8}$ | (-1.56)$^{43.6}$ | (-0.80)$^{36.1}$ | (-2.04)$^{39.9}$ | (-0.05)$^{37.2}$ |
| Non-U.S. inv. funds and others | -0.289$^{***}$ | -0.424 | -0.452$^{*}$ | -0.806 | -0.358$^{**}$ | -0.619$^{*}$ | -1.141$^{*}$ | -0.521 |
| | (-3.11)$^{16.7}$ | (-1.54)$^{8.1}$ | (-2.15)$^{15.3}$ | (-1.52)$^{14.8}$ | (-2.37)$^{16.6}$ | (-1.85)$^{8.0}$ | (-2.14)$^{15.0}$ | (-1.24)$^{14.2}$ |
| Observations | 38,250 | 5,205 | 19,516 | 12,116 | 36,145 | 4,485 | 17,886 | 10,429 |
| Adj. $R^2$ | 0.42 | 0.39 | 0.46 | 0.53 | 0.39 | 0.35 | 0.45 | 0.54 |

Table 5: Risk taking in the syndicated loan market: Alternative measures of interest rate expectations

The table shows the sensitivity of portfolio credit risk to the indicated measure of interest rate expectations, by lender type, estimated using the panel regression discussed in Section 3. The dependent variable is the log probability of default of loan portfolios at the level of the ultimate lender. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013. *Forward Treasury rate* is the three-year-forward 10-year Treasury rate. The spread between the 10-quarters ahead and current federal funds rate and the number of quarters until the expected federal funds rate reaches 25 basis points are based on expected federal funds rates obtained from overnight indexed swaps quotes.

| | Forward Treasury rate | | Expected/current federal funds spread | | Quarters to rates liftoff | |
|---|---|---|---|---|---|---|
| | Unbal. | Bal. | Unbal. | Bal. | Unbal. | Bal. |
| U.S. banks and BHCs | -0.069 | $-0.426^{**}$ | -0.005 | $-0.482^{*}$ | 0.010 | 0.150 |
| | $(-0.63)^{3.5}$ | $(-2.21)^{6.7}$ | $(-0.03)^{3.5}$ | $(-2.08)^{6.7}$ | $(0.26)^{3.5}$ | $(1.58)^{6.7}$ |
| Non-U.S. banks and BHCs | -0.032 | 0.048 | 0.151 | 0.193 | 0.015 | -0.014 |
| | $(-0.20)^{3.6}$ | $(0.36)^{8.0}$ | $(0.89)^{3.6}$ | $(1.48)^{8.0}$ | $(0.31)^{3.6}$ | $(-0.28)^{8.0}$ |
| Insurance cos./Pension funds | $-0.356^{**}$ | $-0.457^{*}$ | $-0.305^{*}$ | -0.130 | $0.168^{**}$ | $0.234^{*}$ |
| | $(-2.23)^{10.5}$ | $(-1.97)^{4.7}$ | $(-1.79)^{10.5}$ | $(-0.59)^{4.7}$ | $(2.50)^{10.5}$ | $(1.93)^{4.7}$ |
| U.S. CLOs/CDOs | $-0.650^{***}$ | $-0.735^{***}$ | $-0.327^{*}$ | $-0.540^{***}$ | $0.206^{***}$ | $0.258^{***}$ |
| | $(-3.20)^{12.6}$ | $(-5.33)^{26.8}$ | $(-2.12)^{12.6}$ | $(-3.52)^{26.8}$ | $(3.56)^{12.6}$ | $(6.63)^{26.8}$ |
| Non-U.S. CLOs/CDOs | $-0.578^{***}$ | $-0.662^{***}$ | $-0.491^{***}$ | $-0.494^{**}$ | $0.150^{***}$ | $0.247^{***}$ |
| | $(-4.05)^{9.5}$ | $(-5.11)^{9.7}$ | $(-3.13)^{9.5}$ | $(-2.78)^{9.7}$ | $(3.27)^{9.5}$ | $(5.60)^{9.7}$ |
| U.S. inv. funds and others | $-0.378^{**}$ | -0.297 | -0.174 | -0.002 | $0.168^{**}$ | $0.165^{**}$ |
| | $(-2.29)^{43.7}$ | $(-1.39)^{36.1}$ | $(-1.03)^{43.7}$ | $(-0.01)^{36.1}$ | $(2.55)^{43.7}$ | $(2.26)^{36.1}$ |
| Non-U.S. inv. funds and others | $-0.337^{***}$ | $-0.630^{**}$ | $-0.233^{*}$ | -0.249 | $0.140^{***}$ | $0.283^{***}$ |
| | $(-3.22)^{16.6}$ | $(-2.69)^{8.0}$ | $(-1.76)^{16.6}$ | $(-0.93)^{8.0}$ | $(3.77)^{16.6}$ | $(3.73)^{8.0}$ |
| Observations | 39,987 | 4,784 | 39,987 | 4,784 | 39,987 | 4,784 |
| Adj. $R^2$ | 0.40 | 0.37 | 0.40 | 0.36 | 0.40 | 0.38 |

Table 6: Risk taking in the syndicated loan market: Robustness checks

The table shows the sensitivity of portfolio credit risk to the 10-year Treasury rate, by lender type, estimated using the panel regression discussed in Section 3. The dependent variable is the log probability of default of loan portfolios at the level of the ultimate lender, with the exception of the last two columns. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013. In the two-stage estimation, standard errors in the second stage are not adjusted to reflect that the Treasury rate residuals are an estimated variable. Dispositions are loans that, in a given quarter, leave the portfolio of an intermediary.

| | Additions, two-stage estimation | | Additions PDs scaled by outst. port. PDs | | Additions PDs scaled by dispositions PDs | | Additions, immediate-lender level | |
|---|---|---|---|---|---|---|---|---|
| | Unbal. | Bal. | Unbal. | Bal. | Unbal. | Bal. | Unbal. | Bal. |
| U.S. banks and BHCs | $-0.076$ | $-0.592^{**}$ | $-0.040$ | $-0.553^{**}$ | $-0.475$ | $-0.853^{**}$ | $-0.094$ | $-0.387^{*}$ |
| (banks only at immediate-lender level) | $(-0.53)^{3.5}$ | $(-2.44)^{6.7}$ | $(-0.23)^{3.5}$ | $(-2.45)^{6.9}$ | $(-1.48)^{3.5}$ | $(-2.54)^{6.8}$ | $(-0.60)^{4.1}$ | $(-2.06)^{7.7}$ |
| Non-U.S. banks and BHCs | $-0.392^{*}$ | $-0.394^{**}$ | $0.037$ | $0.093$ | $-0.742^{***}$ | $-0.638^{***}$ | $-0.367$ | $-0.046$ |
| | $(-2.00)^{3.6}$ | $(-2.17)^{8.0}$ | $(0.15)^{3.9}$ | $(0.56)^{8.3}$ | $(-3.01)^{3.7}$ | $(-3.54)^{8.1}$ | $(-1.57)^{2.3}$ | $(-0.07)^{1.3}$ |
| Insurance cos./Pension funds | $-0.634^{***}$ | $-0.835^{**}$ | $-0.154$ | $-0.332$ | $-0.940^{***}$ | $-0.343$ | $-0.407^{**}$ | $-0.499^{*}$ |
| | $(-3.18)^{10.5}$ | $(-2.84)^{4.7}$ | $(-0.59)^{10.3}$ | $(-0.89)^{4.2}$ | $(-3.50)^{10.4}$ | $(-0.60)^{4.4}$ | $(-2.20)^{10.1}$ | $(-2.00)^{5.3}$ |
| U.S. CLOs/CDOs | $-0.894^{***}$ | $-1.033^{***}$ | $-0.670^{***}$ | $-0.706^{***}$ | $-0.783^{**}$ | $-1.172^{**}$ | $-0.691^{**}$ | $-0.832^{***}$ |
| | $(-3.88)^{12.6}$ | $(-4.89)^{26.8}$ | $(-3.29)^{15.0}$ | $(-4.48)^{27.7}$ | $(-2.49)^{14.0}$ | $(-2.82)^{27.1}$ | $(-2.86)^{12.1}$ | $(-4.28)^{26.7}$ |
| Non-U.S. CLOs/CDOs | $-0.959^{***}$ | $-1.055^{***}$ | $-0.651^{***}$ | $-0.441^{**}$ | $-0.971^{**}$ | $-1.103^{**}$ | $-0.680^{***}$ | $-0.809^{***}$ |
| | $(-5.37)^{9.5}$ | $(-5.69)^{9.7}$ | $(-3.38)^{10.4}$ | $(-2.71)^{10.0}$ | $(-2.67)^{10.2}$ | $(-2.35)^{9.8}$ | $(-3.79)^{9.5}$ | $(-4.31)^{11.0}$ |
| U.S. inv. funds and others | $-0.575^{***}$ | $-0.590^{**}$ | $-0.293$ | $-0.069$ | $-0.730^{**}$ | $-0.886^{**}$ | $-0.386^{*}$ | $-0.302$ |
| | $(-3.05)^{43.7}$ | $(-2.52)^{36.1}$ | $(-1.18)^{41.8}$ | $(-0.26)^{36.0}$ | $(-2.70)^{42.4}$ | $(-2.50)^{36.3}$ | $(-1.95)^{44.6}$ | $(-1.20)^{40.0}$ |
| Non-U.S. inv. funds and others | $-0.559^{***}$ | $-0.842^{***}$ | $-0.273$ | $-0.374$ | $-0.449$ | $-0.638$ | $-0.392^{***}$ | $-0.636^{**}$ |
| | $(-4.42)^{16.6}$ | $(-3.07)^{8.0}$ | $(-1.60)^{15.0}$ | $(-1.05)^{6.9}$ | $(-1.62)^{15.6}$ | $(-1.46)^{7.5}$ | $(-3.18)^{16.3}$ | $(-2.17)^{8.0}$ |
| Finance companies | | | | | | | $-0.732^{**}$ | |
| (immediate-lender level only) | | | | | | | $(-2.41)^{1.0}$ | |
| Observations | 39,987 | 4,784 | 31,978 | 4,624 | 29,222 | 4,641 | 41,747 | 4,800 |
| Adj. $R^2$ | 0.38 | 0.31 | 0.20 | 0.20 | 0.07 | 0.16 | 0.40 | 0.33 |

Table 7: Risk taking in the syndicated loan market: Alternative lender classification

The table shows the sensitivity of portfolio credit risk to the 10-year Treasury rate, by lender type, estimated using the panel regression discussed in Section 3. The dependent variable is the log probability of default of loan portfolios at the level of the ultimate lender. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013. The alternative classification is based on the manual lender assignments discussed in Appendix A.

| | Full sample | No 2012 Q2 | No 2013 Q2 | Forward rate | Fed fund spread | Rates liftoff |
|---|---|---|---|---|---|---|
| Banks and BHCs | $-0.301^{*}$ | $-0.292$ | $-0.277$ | $-0.223$ | $-0.150$ | $0.108^{*}$ |
| | $(-1.83)^{14.7}$ | $(-1.71)^{14.6}$ | $(-1.65)^{14.7}$ | $(-1.73)^{14.7}$ | $(-0.79)^{14.7}$ | $(1.87)^{14.7}$ |
| Nonbank financials | $-0.251$ | $-0.167$ | $-0.232$ | $-0.330$ | $0.109$ | $0.098$ |
| | $(-0.75)^{6.0}$ | $(-0.54)^{6.0}$ | $(-0.71)^{6.0}$ | $(-1.12)^{6.0}$ | $(0.46)^{6.0}$ | $(0.89)^{6.0}$ |
| Insurance cos./Pension funds | $-0.394^{*}$ | $-0.251^{*}$ | $-0.422^{*}$ | $-0.408^{**}$ | $-0.168$ | $0.193^{**}$ |
| | $(-1.94)^{5.0}$ | $(-1.88)^{5.0}$ | $(-1.85)^{5.0}$ | $(-2.38)^{5.0}$ | $(-0.96)^{5.0}$ | $(2.40)^{5.0}$ |
| Retail-oriented asset managers | $-0.169$ | $-0.025$ | $-0.153$ | $-0.190$ | $0.029$ | $0.151^{**}$ |
| | $(-0.76)^{21.1}$ | $(-0.15)^{20.9}$ | $(-0.59)^{21.1}$ | $(-1.00)^{21.1}$ | $(0.15)^{21.1}$ | $(2.34)^{21.1}$ |
| CLOs/CDOs | $-0.816^{***}$ | $-0.719^{***}$ | $-0.766^{***}$ | $-0.741^{***}$ | $-0.499^{**}$ | $0.269^{***}$ |
| | $(-4.16)^{47.5}$ | $(-3.90)^{47.8}$ | $(-3.48)^{47.5}$ | $(-5.05)^{47.5}$ | $(-2.92)^{47.5}$ | $(6.20)^{47.5}$ |
| Non financials | $-0.058$ | $0.225$ | $-0.051$ | $-0.136$ | $0.239$ | $0.189$ |
| | $(-0.15)^{5.7}$ | $(0.81)^{5.6}$ | $(-0.11)^{5.7}$ | $(-0.39)^{5.7}$ | $(0.79)^{5.7}$ | $(1.28)^{5.7}$ |
| Observations | 4,784 | 4,515 | 4,485 | 4,784 | 4,784 | 4,784 |
| Adj. $R^2$ | 0.37 | 0.40 | 0.35 | 0.37 | 0.36 | 0.38 |

Table 8: Risk taking in the syndicated loan market: Loans to borrowers domiciled outside the United States

The table shows the sensitivity of portfolio credit risk to the indicated measure of interest rate expectations, by lender type, estimated using the panel regression discussed in Section 3. The sample includes borrowers domiciled outside the United States. Each specification shows results from unbalanced-panel regressions, where the dependent variable is the log probability of default of loan portfolios at the level of the ultimate lender. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender and lender-type/year fixed effects. $t$-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols $^{***}$, $^{**}$, $^{*}$ indicate statistical significance at the 1, 5, and 10% levels, respectively. Superscripts to the $t$-statistics show the percent of observations classified as the indicated lender type. The sample includes 2010 to 2013. *Forward Treasury rate* is the three-year-forward 10-year Treasury rate. The spread between the 10-quarters ahead and current federal funds rate and the number of quarters until the expected federal funds rate reaches 25 basis points are based on expected federal funds rates obtained from overnight indexed swaps quotes.

| | 10-year Treasury rate | Forward Treasury rate | Expected/current federal funds spread | Quarters to rates liftoff |
|---|---|---|---|---|
| U.S. banks and BHCs | -0.376 | -0.239 | -0.138 | 0.192 |
| | $(-0.68)^{2.7}$ | $(-0.55)^{2.7}$ | $(-0.19)^{2.7}$ | $(1.07)^{2.7}$ |
| Non-U.S. banks and BHCs | -0.295 | -0.220 | -0.165 | 0.006 |
| | $(-0.78)^{7.9}$ | $(-0.70)^{7.9}$ | $(-0.45)^{7.9}$ | $(0.07)^{7.9}$ |
| Insurance cos./Pension funds | -0.652** | -0.573** | -0.483 | 0.095 |
| | $(-2.43)^{8.8}$ | $(-2.88)^{8.8}$ | $(-1.67)^{8.8}$ | $(1.37)^{8.8}$ |
| U.S. CLOs/CDOs | -1.242** | -1.071*** | -1.056** | 0.401*** |
| | $(-2.71)^{14.0}$ | $(-3.15)^{14.0}$ | $(-2.18)^{14.0}$ | $(4.59)^{14.0}$ |
| Non-U.S. CLOs/CDOs | -0.630** | -0.521** | -0.569* | 0.134** |
| | $(-2.36)^{14.7}$ | $(-2.60)^{14.7}$ | $(-2.06)^{14.7}$ | $(2.18)^{14.7}$ |
| U.S. inv. funds and others | -1.222*** | -0.999*** | -1.136*** | 0.291*** |
| | $(-4.26)^{34.8}$ | $(-5.00)^{14.7}$ | $(-3.54)^{14.7}$ | $(4.08)^{14.7}$ |
| Non-U.S. inv. funds and others | -0.690** | -0.589** | -0.522* | 0.116** |
| | $(-2.44)^{17.1}$ | $(-2.76)^{14.7}$ | $(-2.02)^{14.7}$ | $(2.14)^{14.7}$ |
| Observations | 9,583 | 9,583 | 9,583 | 9,583 |
| Adj. $R^2$ | 0.34 | 0.34 | 0.33 | 0.33 |

Table 9: Probabilities of default and all-in-drawn spreads at origination by borrower rating

The table shows summary statistics for the distribution of default probabilities and all-in-drawn spreads at origination, by loan rating. Loan spreads are in basis points. The sample includes loan originations with PDs in the SNC database that we were able to match with Thomson Reuters DealScan data.

| | Default prob. percentile | | | All-in-drawn spread percentile | | | Obs |
|---|---|---|---|---|---|---|---|
| Borrower rating | 10 | 50 | 90 | 10 | 50 | 90 | |
| Investment | 0.14 | 0.26 | 1.00 | 100 | 150 | 275 | 37 |
| Speculative | 0.33 | 1.82 | 7.95 | 200 | 325 | 600 | 145 |
| Not rated | 0.16 | 0.80 | 3.89 | 150 | 275 | 475 | 527 |

Table 10: Determinants of all-in-drawn spreads at origination

The table shows regressions of all-in-drawn spreads at origination on PDs, selected loan characteristics, and on several macroeconomic variables. Loan spreads are in basis points. The sample include SNC loans we were able to match to Thomson Reuters DealScan loans. Duration is measured in days, *LBO* indicates whether the loan is issued to primarily finance a leveraged buyout, *No CUSIP* is a dummy for loans that have no CUSIP in SNC, *Public* is a dummy equal to one if the borrower is a listed company, and *Nonbank share* is the share of the loan held by nonbank intermediaries. Standard errors are clustered by time. Regressions include borrower-industry/year and agent-bank/year fixed effects.

| | dependent variable: log all-in-drawn spread | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| log(PD) | $0.200^{***}$ | $0.177^{***}$ | $0.138^{***}$ |
| | (10.20) | (9.40) | (9.11) |
| log(duration) | | $0.109^{***}$ | 0.033 |
| | | (3.41) | (1.06) |
| log(loan amount) | | $-0.030^{**}$ | $-0.077^{***}$ |
| | | (-2.93) | (-7.42) |
| LBO | | 0.154 | 0.094 |
| | | (1.27) | (1.18) |
| No CUSIP | | $-0.096^{***}$ | -0.045 |
| | | (-3.61) | (-1.57) |
| Public | | $-0.197^{***}$ | $-0.169^{***}$ |
| | | (-5.51) | (-5.91) |
| Default spread | | -0.012 | -0.075 |
| | | (-0.09) | (-0.61) |
| Variance risk premium | | $0.005^{**}$ | $0.006^{*}$ |
| | | (2.26) | (2.07) |
| CDX HY spread | | -0.000 | 0.001 |
| | | (-0.17) | (0.84) |
| European sovereign spread | | -0.038 | $-0.078^{**}$ |
| | | (-1.24) | (-2.31) |
| Expected inflation | | 0.067 | 0.059 |
| | | (1.26) | (1.33) |
| Treasury rate | | -0.073 | $-0.130^{***}$ |
| | | (-1.32) | (-3.04) |
| Nonbank share | | | $0.543^{***}$ |
| | | | (2.99) |
| Nonbank share $\times$ Treas. rate | | | 0.016 |
| | | | (0.23) |
| Observations | 709 | 709 | 709 |
| Adj. $R^2$ | 0.53 | 0.59 | 0.67 |

Table 11: Risk taking in the syndicated loan market: Selected mutual funds

The table shows the sensitivity of portfolio credit risk to the 10-year Treasury rate for a sample of 104 U.S. mutual funds, for which we were able to obtain mutual-fund characteristics from Morningstar Direct and CRSP. We estimated the panel regression discussed in Section 3, with the inclusion of the following mutual-fund characteristics: fund rank (an index between 0 and 1 indicating the rank of a mutual fund's returns relative to funds with the same Lipper asset class code in a certain year), fund turnover (which measures what fraction of the portfolio is bought and sold each year, relative to net assets), fund assets (the natural logarithm of net assets), fund age (the natural logarithm of the years since the introduction of the oldest share class of a mutual fund), and manager tenure (the natural logarithm of the average tenure in years of the mutual fund managers). The expense ratio is the amount of fees managers collect each year as a fraction of fund net assets. Mutual funds with expense ratios below 1% are classified as "low expense," funds with expense ratio higher than 1% are classified as "high expense." The median and average expense ratios for the 104 funds over the 2010-2013 sample are about 0.98% and 0.92%, respectively. The mutual fund characteristics are measured yearly at the end of the prior year. Each specification shows results from unbalanced-panel regressions, where the dependent variable is the log probability of default of loan portfolios at the immediate-level lender. Regressors with unreported coefficients are the European sovereign spread, the CDX HY spread, the variance risk premium, and the University of Michigan index of expected inflation. The regressions include lender fixed effects and, where indicated, year fixed effects. *t*-statistics in parentheses. Standard errors are double-clustered by quarter and lender. The symbols ***, **, * indicate statistical significance at the 1, 5, and 10% levels, respectively. The sample includes 2010 to 2013.

| | No year effects | | | With year effects | | |
|---|---|---|---|---|---|---|
| | All funds | Low expenses | High expenses | All funds | Low expenses | High expenses |
| 10-year Tr. rate | -0.452** | -0.309 | -0.604*** | -0.426* | -0.172 | -0.678*** |
| | (-2.25) | (-0.92) | (-3.01) | (-2.07) | (-0.61) | (-3.12) |
| Fund rank | -0.006 | -0.281 | 0.101 | 0.005 | -0.229 | 0.108 |
| | (-0.02) | (-0.56) | (0.26) | (0.02) | (-0.51) | (0.27) |
| Fund turnover | 0.059 | 0.177* | -0.106 | 0.058 | 0.161* | -0.111 |
| | (0.77) | (2.10) | (-0.76) | (0.78) | (1.99) | (-0.72) |
| Fund assets | -0.099 | -0.261 | 0.171 | -0.100 | -0.245 | 0.215 |
| | (-0.97) | (-1.14) | (0.61) | (-0.97) | (-1.07) | (0.70) |
| Fund age | -0.405 | -0.002 | -0.428 | -0.344 | -0.093 | -0.284 |
| | (-0.79) | (-0.00) | (-0.73) | (-0.65) | (-0.12) | (-0.42) |
| Manager tenure | -0.419*** | -0.444** | -0.447** | -0.420*** | -0.449** | -0.457** |
| | (-3.17) | (-2.42) | (-2.60) | (-3.13) | (-2.44) | (-2.53) |
| Observations | 712 | 366 | 346 | 712 | 366 | 346 |
| Adj. $R^2$ | 0.31 | 0.32 | 0.28 | 0.31 | 0.33 | 0.28 |