BANK CEO PAY-RISK SENSITIVITY AND LOAN CONTRACT TERMS

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Abstract

We analyze the impact of the bank CEO's pay-risk sensitivity ('*vega*') on four loan contract terms, loan spreads, existence of collateral, and the number and strictness of covenants. Using a bank-level fixed effects model to control for time-invariant bank characteristics, we find that increases in *vega* are correlated with lower loan spreads, lower probability of the loan being secured, and a lower number and strictness of covenants. This suggests that CEOs reduce the riskiness of their loan portfolios when their pay has a higher sensitivity to bank risk. We also find that bank stock return volatility is strongly positively correlated with the risk of the loan contract terms, which suggests that the stock market understands the riskiness of the bank loan portfolio. Finally, we find that longer borrower-bank relationships help borrowers get loans that are riskier in the presence of risk averse bank CEOs, and a larger distance between bank and borrower reduces the market power of the bank.

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1. Introduction

It is well known in the financial economic literature (see, for example, Diamond (1984, 1991), Ramakrishnan and Thakor (1984), Fama (1985)) that financial intermediaries such as banks[1] act as delegated monitors by reducing the investor's asymmetric information and moral hazard problems of finding good borrowers. Consistent with these arguments, many empirical papers[2] have examined the impact of borrower and lender characteristics on loan contract terms. For example, Petersen and Rajan (1994), Berger and Udell (1995) and Ivashina (2009) examine loan spreads; John, Lynch and Puri (2003), Bharath et. al (2009), and Cergueoro, Ongena and Rozbach (2016) examine collateral, and Demiroglu and James (2010), Murfin (2012), and Prilmeier (2012) examine covenants, respectively. However, none of these studies have examined the impact of a bank CEO's pay-risk sensitivity on loan contract terms.

Accordingly, this paper examines the impact of a bank CEO's pay-risk sensitivity or '*vega*' on loan contract terms. Consistent with the previous literature (for example, Core and Guay (2002), Coles, Daniel and Naveen (2006)), we define *vega* as the change in the dollar value of CEO wealth for a 0.01 unit change in stock return volatility. The importance of the relationship between a bank CEO's pay and her risk taking activities has been significantly emphasized by researchers, regulators and policy makers. In analyzing the causes of the financial crisis of 2007-2009, the U.S. Senate's Financial Crisis Inquiry Report [3] states "The Commission concludes … Executive and employee compensation at these institutions disproportionately rewarded short-term risk taking"; and Sheila Blair, FDIC Chairperson in the same report concludes with "The crisis has shown that most financial institution compensation systems were not properly linked to risk management.

[1] We use lender, bank and bank holding company interchangeably.
[2] See Section 3 for a detailed explanation of the literature that examines the impact of borrower and lender characteristics on loan contract terms.
[3] *The Financial Crisis Inquiry Report*, January 2011 (pages 64 and 279).

Formula-driven compensation allows short-term profits to be translated into generous bonus payments, without regard to long term risks." Similarly, Section 956 of the 2010 Dodd-Frank Act directed financial regulators to adopt rules discouraging incentive compensation arrangements that misalign manager's incentives with long-term firm value and might assist executives from taking inappropriate risks at their financial institutions.

The theoretical literature on the relationship between a bank CEO's pay and risk is ambiguous. The standard principal-agent model (Holmstrom (1979), Holmstrom and Milgrom (1987)) suggests that risk-averse bank CEOs will select lower-risk projects when they have high incentive pay. On the other hand, Carpenter (2000) and Ross (2004) show that depending upon the shape of CEO's utility function CEO risk aversion can result in a positive relationship. In other words, the convexity of the compensation plan (e.g., from options) can be offset by the concavity of the utility function of the risk-averse CEO. In the banking context, John and John (1993), and Bolton *et al.* (2015) argue that a higher incentive pay may incentivize bank CEOs to shift risk to depositors and debt holders.

The empirical literature in banking also shows mixed results.[4] For example, Houston and James (1995) find a negative relation between bank CEO stock and option holdings and stock return volatility. Fahlenbrach and Stulz (2011) find no consistent evidence of a relationship between bank pay-risk sensitivity and performance during the financial crisis. In contrast, Chen *et al.* (2006) finds a positive relation between value of manager's stock options and stock return volatility. DeYoung *et al.* (2013) also find a positive relationship between pay-risk sensitivity and

[4] See Wall (2020) for a survey of studies that examine the relationship between bank CEO compensation and risk.

various risk measures and conclude that prior to the financial crisis the structure of CEO compensation promoted bank risk taking.

We focus on the relationship between a bank CEO's pay and the risk of an important asset category, namely, bank loans. Specifically, we examine the relation between the pay-risk sensitivity (i.e., the sensitivity of pay to stock return volatility or '*vega*') and loan contract terms defined as loan spreads, existence of collateral or not, and the number and strictness of covenants. Consistent with the prior literature we find that the four loan contract terms are positively correlated -- suggesting that higher risk loans have higher loans spreads, a higher probability of having collateral, more covenants and stricter covenants.[5] When the board of directors prescribes a bank CEO's pay package for the year, we examine if the CEO reacts by setting a loan risk profile that is consistent with her incentive pay.[6]

We use a large sample of 19,737 loan facilities from 54 unique banks over the period 1992 to 2017. We only use revolver loans and term loans (consistent with Campello and Gao (2017)), and when the loan involves a lead bank (consistent with Schwert (2018)).

Using a bank-level fixed-effects model with year dummies, we find the following results.

(1) We find a strong negative relationship between the price of loans (i.e., loan spreads) and *vega*. We also find a strong negative relationship between the non-price loan variables (i.e., collateral, and the number and strictness of covenants) with *vega*. The above results are

[5] The fact that various loan contract terms are positively correlated with each other is consistent with Dennis, Nandy and Sharpe (2000), John, Lynch and Puri (2003), Gottesman and Roberts (2007), Brick and Palia (2007), Graham, Li, and Qiu (2008), Murfin (2012), Billett, et. al (2016), and Hollander and Verriest (2016). Also see Section 3.2 of this paper for correlations between the various loan contract terms in our sample.

[6] Strictly speaking loans are given by loan officers, whose pay packages are not publicly available. But it seems reasonable to assume that the CEO is involved in setting the overall loan risk tolerance of the bank, which the loan officer must respect.

strongly consistent with the hypothesis that CEOs reduce the riskiness of their loan portfolios when they have a higher pay-risk sensitivity.

(2) We then examine if the bank stock return volatility is related to the loan contract terms. We find that bank stock return volatility is strongly positively correlated with the risk of the loan contract terms, namely, volatility is higher when loan spreads, number and strictness of covenants, and probability of collateral is higher. This suggests that the stock market understands the riskiness of the bank loan portfolio.

(3) Many papers have found that that loan terms are better when there is a longer relationship between the borrower and the bank (see, for example, Berger and Udell (1995), Harhoff and Korting (1998), Brick and Palia (2007), Bharath et. al (2009), and Prilmeier (2017)). Consistent with this literature we find a negative relationship between the duration of the borrower-bank relationship and loan spreads, collateral, and the strictness of covenants. Additionally, we find evidence that the negative relationship between *vega* and loan spreads is reduced when there is a longer borrower-bank relationship.

(4) The extant literature has examined the impact of the distance between the borrower and bank on loan terms with conflicting results. On the one hand, Knyazeva and Knyazeva (2012) find that loan spreads are increasing in the distance between the borrower and bank. They argue that this is because delegated monitors such as banks have increasing costs of collecting soft information from distant borrowers. On the other hand, Petersen and Rajan (2002), DeGryse and Ongena (2005), Mistrulli and Casolato (2009) and Agarwal and Hauswald (2010) find that loan spreads are decreasing in the distance between the borrower and bank. They suggest that borrowers that are close to banks are charged higher loan spreads due to higher market power and spatial price discrimination. We find evidence

consistent with the market power hypothesis. However, we find that market power is driven by borrowers who are located close to the bank with a high-*vega* CEO.

(5) We conduct number of robustness tests. We have used OLS regressions to estimate the impact of *vega* on whether the loan is collateralized or not, and for the strictness of covenants. This is consistent with Angrist (2001). When we estimate a Logistic regression for whether the loan is collateralized or not, and a Tobit model for covenant strictness, we find consistent results with the OLS regressions. We also find that our results are not due to reverse causality from an individual bank's risk to compensation, to the endogenous selection of *vega*, and to estimating regressions at the loan-level rather than at the bank-level.

Our paper is related to the literature that examines the relationship between compensation and firm-specific activities. In the general firm literature, May (1995) finds that CEOs with more stock ownership tend to diversify firm risk by acquisitions. Tufano (1996) finds that gold mining firms whose managers have more options manage less gold price risk, whereas those whose managers have more stock ownership manage more gold price risk. Mehran, Nogler and Schwartz (1998) find that CEOs with higher share ownership have a higher probability of voluntary liquidation. Coles, Daniel and Naveen (2006) find that CEOs with higher *vega* invest more in R&D, less in PP&E, are more focused and have higher leverage. In the banking literature, Hagendorff and Vallascas (2011) find that bank CEOs with high *vega* engage more in risk-reducing mergers. DeYoung, Peng and Yan (2013) find that high-*vega* banks have a higher proportion of net operating income from noninterest income, and a higher proportion of total assets in private mortgage securities.

This paper proceeds as follows. Section 2 explains the related literature, and Section 3 describes the data and empirical variables constructed for our tests. Empirical results are reported in Section 4, and Section 5 presents our conclusions.

2. Related literature

In this section, we present a detailed explanation of the related literature on loan prices and other non-price loan contract terms. Note that none of the papers has examined the relationship between a bank CEO's pay-risk sensitivity and loan contract terms.

2.1 Loan Spreads

Petersen and Rajan (1994), Berger and Udell (1995), Harhoff and Korting (1998), Degryse and Van Cayseele (2000), Brick and Palia (2007), and Bharath et. al (2009) have examined the impact of the duration of the borrower-lender relationship on loan spreads with mixed results. Petersen and Rajan (1994) find no significant relationship, Degryse and Van Cayseele (2000) find a positive relationship, whereas Berger and Udell (1995), Harhoff and Korting (1998), Brick and Palia (2007), and Bharath et. al (2009) find borrowers who have a longer relationship with their bank pay lower loan spreads. Using a system of equations, Dennis, Nandy and Sharpe (2000) find higher loan spreads when loan concentration is higher. Sapienza (2002) examines the impact of bank mergers in Italy on loan spreads. She finds lower spreads for banks operating in the same geographical area and if the target bank had small market share. Hubbard, Kuttner and Palia (2002) find higher loan spreads when borrowers with high switching costs borrow from low-capital banks. Guner (2006) finds that the loan spreads originated by active loan sellers is lower than loan spreads originated by moderate loan sellers. Graham, Li and Qiu (2008) finds that loans initiated after an accounting restatement have higher loan spreads, consistent the idea that banks use tighter loan contract terms to overcome financial restatements. Ivashina (2009) finds lower loan spreads when the lead bank's share in the syndicate is higher. Bae and Goyal (2009) examine differences in legal protection across different countries and finds that countries with poor enforceability of contracts have loans with higher loan spreads. Hertzel and Officer (2012) find loans spreads to be higher the two years surrounding bankruptcy filings by industry rivals. Chan, Chen and Chen (2013) find lower loan spreads after firm initiate claw back provisions due to accounting restatements. Rajan, Seru and Vig (2015) find that loan spreads are a worse predictor of default as securitization increases. Campello and Gao (2017) find higher loan spreads with higher customer concentration. Cerquiero, Ongena and Rozbach (2016) find that banks in Sweden increased loan spreads when the law was changed reducing the ability of the lender to seize the secured assets outside of bankruptcy and without court intervention. The new law insisted on a court declaration of bankruptcy. Demiroglu, James and Velioglu (2021) find loan spreads to be 'sticky' because banks engage in more intensive screening and monitoring of borrowers in economic downturns and/or when the borrower's financial performance declines.

2.2 Collateral

Berger and Udell (1990, 1995), Dennis, Nandy, and Sharpe (2000), Degryse and Van Cayseele (2000), Jimenez, Salas and Saurina (2006), Berger, Frame and Ionnidou (2011) find that collateral is more likely to be required for riskier borrowers. John, Lynch and Puri (2003) find that there is a positive yield differential between public bonds that are secured and those that are not. Additionally, they find this yield differential is higher for low credit rating, nonmortgage collateralized assets, longer maturity issues, and for new versus seasoned issues. Berger and Udell (1995), Brick and Palia (2007) and Gottesman and Roberts (2007) find that collateralized loans have higher loan spreads. Graham, Li and Qiu (2008) finds that loans initiated after an accounting restatement have a higher likelihood of collateral. Bharath, et. al (2009) find that relationships between the borrower and lender reduce the likelihood of collateral being required, and that collateralized loans earn higher loan spreads. Cerquiero, Ongena and Rozbach (2016) find that banks in Sweden increased the time interval to review borrower credit quality when the law was changed to allows lenders to seize secured assets only with a court order.

2.3 Covenants

John, Lynch and Puri (2003) find that the positive yield differential between public bonds that are secured and unsecured is lowered if there are covenants. Graham, Li and Qiu (2008) find that loans initiated after an accounting restatement have a higher number of covenants. Demiroglu and James (2010) find that riskier firms with fewer investment opportunities have tighter financial covenants. Murfin (2012) finds that banks write tighter covenants than their peers after suffering defaults on their own loan portfolios or when they have lower capital. Hollander and Verriest (2016) find the number of covenants and covenant intensity (defined as Debt/EBITDA covenant thresholds at the time of loan origination and the actual accounting variable) is lower when the distance between the borrower and lender is greater. Billet et. al (2016) that covenant-lite loans have higher loan spreads. Prilmeier (2017) finds that covenant tightness is reduced as the borrower-bank relationship grows.

3. Data and Variable Construction

3.1 Data

We begin by creating our sample of loan facilities and lenders. We obtain the loan sample from DealScan and retrieve 337,295 facilities from 1992 to 2017. These facilities are associated with 19,669 unique lender IDs. We obtain the IDs of banking holding companies (BHCs) in ExecuComp (SIC codes 6000-6199) and get 305 unique BHCs.

We then match lenders from DealScan with BHCs in ExecuComp. We search for the name of the BHC that owns each lender in DealScan using the National Information Center.[7] We manually match the lender's BHC in DealScan with the BHC in Execucomp, by BHC name and the location of its headquarters. For lenders in DealScan, we only keep independent commercial banks or commercial bank branches owned by the BHC. We exclude non-banking lenders such as securities, insurance, and asset management subsidiaries of the BHC. This procedure results in 555 lenders in DealScan which is matched to 184 BHCs in ExecuComp. We manually add the lenders GVKEY to the 555 lenders in DealScan.

We obtain the borrower's GVKEY from the linking table in Chava and Roberts (2008) and add it to the facilities data. Consistent with Campello and Gao (2017), we only use revolver loans and term loans resulting in 112,074 facilities. We also exclude 18,003 facilities involving regulated borrowers (namely, financials, utilities, and public administrative firms). Following Schwert (2018), we only keep facilities that have a lead bank; because the lead bank in the syndicate is responsible for setting loan terms and monitoring borrowers, while syndicate participants are passive investors. This results in 30,751 facilities. We also exclude 19,834 facilities that have missing values for any of our variables. Our final sample consists of 19,737 facilities with 161 lenders from DealScan, and 54 unique BHC incentive pay data from ExecuComp. A summary of our data collection methodology is given in Table 1.

*** Table 1 ***

[7] The National Information Center stores all organization and structure information of banks in the US. For details see https://www.ffiec.gov/NPW

We get loan contract information from DealScan, which provides the information on all syndicated loans originated in the US. Bank CEO compensation is obtained from ExecuComp, which provides compensation information for Standard & Poor 1500 companies. We calculate the physical distance in miles between the BHC and the borrower using the latitude and longitude geo coordinates obtained from Google API.[8] Financial and stock price information are from Compustat and CRSP.

3.2 Variable construction

In this sub-section we describe the construction of the various dependent variables used in our study. We examine five dependent variables. The first dependent variable is the price of the loan which is usually referred to as loan spreads. We define a variable *loan_spread* which is equal to the all-in-drawn spread over LIBOR in basis points. The second dependent variable is a dummy variable, *collateral,* which is set to unity if the loan is secured, and zero otherwise. The third dependent variable examines the number of covenants. We define a variable *#_covenant,* which counts the number of covenants attached to the loan, if any. The fourth dependent variable measures the strictness of covenants. As in Murfin (2012) and Prilmeier (2017), *covenant_strict* is defined as $p = 1 - \phi(\frac{r_t - \bar{r}}{\sigma})$, where ϕ is the standard normal cumulative distribution, r_t is the financial ratio, $\bar{r}$ is the minimum value[9] of the financial ratio, and σ is the standard deviation of the financial ratio estimated over the previous 12 quarters data. Therefore, p is the probability of covenant violation. The fifth, dependent variable is *volatility* and is defined as the annualized

[8] We use Google Maps geocoding API service to transform the bank headquarter address and firm headquarter address to the geo coordinates. For more details of Google geocoding, see https://developers.google.com/maps/documentation/geocoding/overview.

[9] In the cases when the covenant ratio (for example, debt to equity) is defined as max rather than min, we take the negative of the actual ratio less the max covenant ratio.

standard deviation of daily stock returns. Table 2 summarizes the definitions of the dependent and independent variables used in our regressions.

*** Table 2 ***

Our main variable of interest is the bank CEO's pay-risk sensitivity (*vega*). As in Core and Guay (2002), we define the pay-risk variable *vega* as the change in the dollar value of CEO wealth for a 0.01 unit change in stock return volatility. Specifically, *vega* is defined as $e^{-dT}\ \mathrm{N(Z)\,ST^{(1/2)}} \times 0.01$ where d is the natural logarithm of dividend yield, T is time to maturity, N is the density function of the normal distribution, S is stock price, X is the exercise price of the option, r is the natural logarithm of the risk-free interest rate, σ is the annualized stock price volatility and $Z = [\mathrm{In(S/\,X)} - T(\mathrm{r} - \mathrm{d} + \sigma^2 / 2)] / \sigma \mathrm{T}^{(1/2)}$.

We also include a number of control variables. The first category of control variables are loan characteristics. We define the variable *loan_amount*, which is equal to the natural logarithm of the loan amount borrowed. We also include the variable *loan_maturity*, which is equal to the natural logarithm of loan maturity in months. Finally, we include a dummy variable *term_loan*, that is set to unity if the facility is a term loan, and zero otherwise.

We then include bank-borrower relationship variables. Specifically, we define a variable *relation_duration* which is defined as the number of years the borrower has been with the bank. We also define a variable *relation_distance* which is defined as the physical distance in thousands of miles between the headquarters of the borrower and the headquarters of the bank.

We also include a set of borrower characteristic variables. The first borrower variable is *firm_size* which is equal to the natural logarithm of the borrowing firm's total assets. We control for the borrower's leverage by including *firm_leverage*, defined as the ratio of total debt to total assets. We define the variable *firm_tangibility* as the ratio of a firm's property, plant, and equipment to total assets. We also include the variable *firm_profitability*, defined as the firm's ratio of operating profits to total assets. We include the variable *firm_mb* defined as the firm's market value of equity plus book value of debt divided by book value of total assets.

Finally, we include a set of bank characteristics. The first bank variable is *bank_size*, which is equal to the natural logarithm of the bank's total assets. The second bank variable is *bank_capital*, defined as the ratio of capital to total assets. The third bank variable is *num_banks*, which is equal to the number of banks in the syndicate.

Panel A of Table 3 presents the summary statistics of the different variables. The mean *loan spread* is 187.6 bps, with a standard deviation of 102.7 bps, a minimum value of 30 bps and a maximum value of 400 bps. This shows a large variation in loan pricing in the US syndicated loan market. We find that approximately half our sample (52%) are secured loans and the remaining 48% are unsecured loans. The median value of the number of covenants (*#_covenant*) is 1, with 75% of our sample having less than 2 covenants in a loan facility. The mean of *covenant_strict* is 0.10, which suggests that most loans face less strict covenants. The mean annual stock return volatility is 27.5%, with a minimum value of 12.8% and a maximum value of 57.9%. We now examine the banks CEOs *vega* which is the $ pay increase for a 0.01 standard deviation increase in the bank's stock return volatility. We find that the average *vega* is 0.58 million dollars, with a standard deviation of 0.54 million dollars. This suggests that the average bank CEO in our sample is very sensitive to increases in the volatility of their stock price

*** Table 3 ***

We find that the average (median) loan amount is $47.4M ($25.01M), and the average (median) loan has a maturity of 4.52 (5.00) years. 32% of our sample are term loans and the remaining 68% are revolving lines of credit. The average (median) borrower-bank relationship is 4.93 (3) years, which varies from a new loan with zero maturity to a term loan with maturity of 17.1 years. The average (median) distance between the borrower and the bank's headquarters is 1.12 (0.76) thousand miles. We find that the average (median) borrower firm's size is $20.43B (20.84B), and the average (median) borrower's leverage ratio is 0.34 (0,32). The borrower firm has on average 30% of its assets in tangible assets, a profitability ratio of 0.13, and a market-to-book ratio of 1.66.

When we examine the lending bank's characteristics, we find the average (median) asset size to be $1.1Tr ($1.2Tr), and that average bank holds 9% of its assets in capital. Finally, we find that the average (median) number of banks in a loan syndicate to be 3.25 (3) banks.

Panel B of Table 4 shows that all loan contract terms are positively correlated. Loan spreads have: a 0.51 correlation with the existence of collateral, and a lower 0.11 (0.19) correlation with the number of covenants (strictness of covenants), respectively. Collateral has a 0.31 correlation with the number of covenants, and a 0.27 correlation with covenant strictness. The number of covenants has a 0.48 correlation with covenant strictness. These results suggest that high-risk loans have higher loan spreads, are more likely to be secured, and have covenants that are strict. These results are consistent with those in Dennis, Nandy and Sharpe (2000), John, Lynch and Puri (2003), Gottesman and Roberts (2007), Brick and Palia (2007), Graham, Li and Qi (2008), Murfin (2012), Billett, et. al (2016), and Hollander and Verriest (2016).

4. Empirical Results

4.1 Methodology

In this sub-section, we begin by describing the empirical model we estimate, and is consistent with models used in the prior literature (see, for example, Graham, Li and Qiu (2008), Campello and Gao (2017)).

$$Y_{ijbt} = \beta_1 \times CEO\ vega_{bt} + \mathrm{loan}'_{it}\beta_2 + \mathrm{relation}'_{bjt}\beta_3 + borrower'_{jt}\beta_4 + \mathrm{bank}'_{bt}\beta_5 + \gamma_b + \delta_t + \epsilon_{ijbt} \quad (1)$$

In the model, *i* refers to the loan contract, *j* the borrower, *b* the bank, and *t* time in years. *Y* represents our five dependent variables: *loan_spread*, *collateral*, *#_covenant*, *covenant_ strict*, and *volatility*. The bank CEOs incentive pay variable is *vega*. We do not include *vega* and *delta* together as they are highly positively correlated (0.60). Loan is a vector of loan characteristics; relation is a vector of relationship variables between the bank and the borrower; borrower is a vector of borrower characteristics; bank is a vector of bank characteristics; γ_b is a vector of bank dummy variables which capture unobservable time invariant bank-level factors; δ_t is year dummies to control for time trends; and ϵ_{ijbt} is the error term. The standard errors are robust to heteroskedasticity.

4.2 Loan contract terms and *vega*

Table 4 reports the results of the fixed-effects regression of *loan_spreads* on a bank CEO's pay-risk variable *vega*. The first column shows regressions of loan spreads on *vega* without any control variables, the second column includes the loan and relationship variables. The third column also includes the borrower variables, and finally the fourth column is the most comprehensive regression specification that includes bank variables. The regression coefficient on *vega* is statistically significant at the one-percent level, and goes from -6.842 in column (1) to -5.654 in column (4). In terms of economic magnitude, using the regression coefficient of column (4), an increase from the 25th percentile to the 75th percentile in *vega* correlates with a -2.89% change in loan spreads when evaluated at its mean. A significant negative relationship between *vega* and loan spreads indicates that the CEO compensation package makes a bank CEO become more risk averse.

*** Table 4 ***

We also find that smaller loans and term loans earn higher loan spreads, whereas loan maturity has no statistically significant relationship with loan spreads. We also find that loan spreads are lower when bank-borrowers have a longer relationship. This suggests that a longer bank-borrower relationship ameliorates asymmetric information problems between the bank and the borrower. These results are consistent with those found in Berger and Udell (1995), Harhoff and Korting (1998), Brick and Palia (2007), Bharath et. al (2009), and Prilmeier (2017). We also find that borrowers whose headquarters is closer to the bank's headquarters are charged higher loan spreads due to higher market power and spatial price discrimination. This result is consistent with the arguments and results of Petersen and Rajan (2002), DeGryse and Ongena (2005), Mistrulli and Casolato (2009) and Agarwal and Hauswald (2010). When we examine borrower characteristics, we find that higher risk borrowers are charged higher loan spreads. Specifically, borrowers who are smaller, with more intangible assets, who are less profitable, with higher leverage ratios, and with a lower market-to-book ratio are charged higher loan spreads. When we examine the bank characteristics, we find smaller banks charge higher loan spreads as do banks that have higher capital ratios and are in smaller syndicates.

Table 5 reports the results of the fixed-effects regression of *collateral* on the bank CEO's *vega*. Once again, the first column shows regressions on *vega* without any control variables, the second column includes the loan and relationship variables, the third column includes the borrower variables, and the fourth column includes the bank variables. The regression coefficient on *vega* is statistically significant at the one-percent level in all four models. In terms of economic magnitude, using the regression coefficient of column (4), an increase from the 25^{th} percentile to the 75^{th} percentile in *vega* correlates with a -5% change in collateral when evaluated at its mean.

*** Table 5 ***

In terms of the control variables, we find similar results to those found in Table 4. Smaller loans and term loans have a higher probability of being secured. However, unlike Table 4 wherein loan maturity was not related to loan spreads, we find longer maturity loans have a higher likelihood of having collateral. The bank-borrower duration relationship variables once again shows that it reduces the asymmetric information problems between the borrower and the bank as it is significantly negatively correlated with the probability of the loan having collateral. Further, the *relation_distance* variable once again shows evidence of a bank's market power with its closest borrowers. Consistent with the results of Table 4, we find that loans to higher risk borrower firms (smaller, higher leverage, more intangible assets, lower firm profitability, and a lower market-to-book ratio) have a higher probability of being collateralized. Examining bank characteristics, we find similar results to those for loan spreads. Specifically, smaller banks, banks with higher capital ratios, and smaller loan syndicates have loans with a higher probability of being collateralized.

Table 6 reports the fixed-effects regression of the number of loan covenants on a bank CEO's *vega*. All four columns show that *vega* is negatively correlated to *#_covenants* at the one-percent level of statistical significance. In terms of economic magnitude, using the regression coefficient of column (4), an increase from the 25^{th} percentile to the 75^{th} percentile in *vega* correlates with a -6.5% change in the number of covenants when evaluated at its mean. The results on the control variables remain generally consistent with those in Tables 4 and 5.

Table 6

In Table 7, we present the results of fixed-effects regressions of the strictness of loan covenants on a bank CEO's *vega* and *delta*. We find that *vega* is negatively correlated to *covenant_strict* at the one-percent level of statistical significance. Using the regression coefficient of column (4), an increase from the 25th percentile to the 75th percentile in *vega* correlates with a -11.5% change in the strictness of the covenants when evaluated at its mean. The results on the control variables remain generally consistent with those in Tables 4 to 6.

Table 7

In summary, we find that higher risk loans (as captured by higher loan spreads, higher probability of being collateralized, more covenants and a higher probability of loan covenant strictness) are negatively correlated with a bank CEO's *vega.* These results are strongly consistent with bank CEOs reducing the risk of the bank's loan portfolio because of the increasing risk in their compensation package.

Table 8 tests whether the borrower-bank relationship variables interact with *vega* in impacting loan spreads. The first column presents the regression of loan spread on *vega* interacted with *relation_duration*. The interaction term is positively related at the one-percent level of statistical significance. This suggests that longer borrower-bank relationships help borrowers get loans that are riskier (higher loan spreads) when banks have a risk averse CEO. Column (2) presents the regression of loan spreads on *vega* interacted with *relation_ distance*. The interaction term is negatively related at the five-percent level of statistical significance. This suggests that a longer distance between bank and borrower reduces the market power of the bank.

Table 8

4.3 Relationship between stock return volatility and loan contract terms

In Table 9, we present the results of fixed-effects regressions of a bank's annual stock return volatility on the loan contract terms. The first column presents the regression of bank stock return volatility on loan spreads. The second column presents the regression of bank stock return volatility on collateral. Column (3) presents the regression of bank stock return volatility on the number of covenants, and column (4) presents the regression of bank stock return volatility on the strictness of covenants. All four columns show that loan contract terms have a statistically significant positive correlation with the bank's stock return volatility. In other words, banks with higher risk loans (higher loan spreads, secured, larger number of covenants, and more strict covenants) have higher annual stock return volatility. This suggests that the stock market understands the riskiness of the bank loan portfolio.

*** Table 9 ***

4.4 Robustness Tests

We used an OLS regression model in Table 5 to examine the relationship between loan collateral and the bank CEO's *vega*. But the dependent variable *collateral* is a binary variable with values of one or zero. Accordingly, we redo the regressions using a Logistic regression model, the results of which are given in Table 10. Column (2) shows that the marginal effect of *vega* on loan collateral to be -0.023, and it is statistically significant at the one-percent level. This estimate is very similar to the -0.027 regression coefficient of *vega* using the OLS model. Therefore, our results on collateral are independent of the regression model used.

*** Table 10***

We also used an OLS regression model in Table 7 to examine the relationship between the strictness of loan covenants and the bank CEO's *vega*. But the dependent variable *covenant_strict* lies in the interval 0 to 1. When the dependent variable is censored, many studies have used a Tobit model. In the second robustness test, we redo the regressions using a Tobit model, the results of which are given in Table 11. Column (2) shows that the marginal effect of *vega* on *covenant_strict* to be -0.026, and it is statistically significant at the one-percent level. This estimate is similar to the -0.012 regression coefficient of *vega* using the OLS model. Therefore, our results on the strictness of covenants are independent of the regression model used.

*** Table 11 ***

It is possible that the negative relationship that we find between *vega* and the loan contract terms is due to reverse causality. In other words, higher bank risk generates lower CEO pay-risk sensitivities, rather than the other way round (which is our interpretation). In the third robustness test, we use the average sample volatility to calculate *vega* instead of using an individual bank's stock return volatility (Guay 1999; Coles, Daniel and Naveen 2006; Hayes, Lemmon and Qiu 2012). By doing so, we control for reverse causality from an individual bank's risk to compensation. The results of this regression are given in Table 12. Once again, we find all four loan contract terms to be negatively correlated with *vega.* This suggests that our results are not due to reverse causality from an individual bank's risk to compensation.

*** Table 12 ***

In our fourth robustness test we endogenize for *vega*, while including as a control variable the CEO's pay-performance sensitivity variable *delta*. The variables *vega* and *delta* are highly correlated (correlation coefficient of 0.60), so we do not use their first moments as valid instrumental variables (ivs). In empirical macroeconomics, Rigobon (2003) showed that we can use the second moments as valid ivs for equation identification. Accordingly, we use the standard deviation of the pay-risk variable of the bank's four non-CEO senior executives (*vega_std*) as a valid iv. It seems reasonable that the second moment of the non-CEO senior executives pay-risk sensitivities is not related independently to loan contract terms, making *vega_std* a valid iv. In Table 13 we present our results. Column (1) shows that *vega_std* is strongly correlated with *vega* at the one-percent level. This suggests that *vega_std* is a strong iv for *vega.* Columns (2)-(5) show the second-stage results. Once again, we find that the loan contract terms are negatively correlated with *vega,* although the coefficient on *loan_spreads* has the right sign and is statistically insignificant. We also note that *delta* does not impact the negative relationship between the loan contract terms and *vega* and is statistically insignificantly related to the loan contract terms in 3 out of 4 regressions.

*** Table 13 ***

In our fifth robustness test we estimate regressions at the bank-level rather than at the loan-level. In doing so, we calculate for each bank the average of each loan contract term by year. In Table 14 we present our results. Panel A shows that *vega* is negatively correlated to all four loan contract terms, although covenant strictness is statistically insignificant. Panel B shows that banks with higher risk loans (higher loan spreads, secured, larger number of covenants, and more strict covenants) have higher annual stock return volatility. The results of Table 15 show CEO risk aversion effects in loans being made when we use bank-level data.

5. Conclusions

The importance of the relationship between a bank CEO's pay and her risk taking activities has been significantly emphasized by researchers, regulators and policy makers when addressing the causes of the recent financial crisis. This paper examines the relationship between a bank CEO's pay-risk sensitivity ('*vega*') on loan contract terms. The prior literature on loan contract terms (namely, loan spreads, existence of collateral, and the number and strictness of covenants) has not examined the impact of the bank CEO's pay-risk sensitivity. Using a bank-level fixed effects model to control for time-invariant bank characteristics, we find that increases in *vega* are correlated with lower loan spreads, lower probability of the loan being secured, and a lower number and strictness of covenants. These results suggest that CEOs reduce the riskiness of their loan portfolios when they have a higher pay-risk sensitivity. We also find that bank stock return volatility is strongly positively correlated with the risk of the loan contract terms, which suggests that the stock market understands the riskiness of the bank loan portfolio. Finally, we find that longer borrower-bank relationships help borrowers get loans that are riskier in the presence of risk averse bank CEOs. Similarly, a longer distance between bank and borrower reduces the market power of the bank who can charge nearby borrowers higher loan spreads.

References

Agarwal, S., Hauswald, R., 2010. Distance and private information in lending. *Review of Financial Studies* 23, 2757-2788.

Angrist, J.D., 2001. Estimation of limited dependent variable models with dummy endogenous regressors. *Journal of Business & Economic Statistics* 19, 2-28

Bae, K.-H., Goyal, V.K., 2009. Creditor rights, enforcement, and bank loans. *Journal of Finance* 64, 823-860.

Berger, A.N., Scott Frame, W., Ioannidou, V., 2011. Tests of ex ante versus ex post theories of collateral using private and public information. *Journal of Financial Economics* 100, 85-97.

Berger, A.N., Udell, G.F., 1990. Collateral, loan quality and bank risk. *Journal of Monetary Economics* 25, 21-42.

Berger, A.N., Udell, G.F., 1995. Relationship lending and lines of credit in small firm finance. *Journal of Business* 68, 351-381.

Bharath, S.T., Dahiya, S., Saunders, A., Srinivasan, A., 2011. Lending relationships and loan contract terms. *Review of Financial Studies* 24, 1141-1203.

Billett, M.T., Elkamhi, R., Popov, L., Pungaliya, R.S., 2016. Bank skin in the game and loan contract design: Evidence from covenant-lite loans. *Journal of Financial and Quantitative Analysis* 51, 839-873.

Bolton, P., Mehran, H., Shapiro, J., 2015. Executive compensation and risk taking. *Review of Finance* 19, 2139-2181.

Brick, I.E., Palia, D., 2007. Evidence of jointness in the terms of relationship lending. *Journal of Financial Intermediation* 16, 452-476.

Campello, M., Gao, J., 2017. Customer concentration and loan contract terms. *Journal of Financial Economics* 123, 108-136.

Carpenter, J.N., 2000. Does option compensation increase managerial risk appetite? *Journal of Finance* 55, 2311-2331.

Cerqueiro, G., Ongena, S., Roszbach, K., 2016. Collateralization, bank loan rates, and monitoring. *Journal of Finance* 71, 1295-1322.

Chan, L.H., Chen, K.C.W., Chen, T.-Y., 2013. The effects of firm-initiated clawback provisions on bank loan contracting. *Journal of Financial Economics* 110, 659-679.

Chava, S., Roberts, M.R., 2008. How does financing impact investment? The role of debt covenants. *Journal of Finance* 63, 2085-2121.

Chen, C.R., Steiner, T.L., Whyte, A.M., 2006. Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry. *Journal of Banking and Finance* 30, 915-945.

Coles, J., Daniel, N., Naveen, L., 2006. Managerial incentives and risk-taking. *Journal of Financial Economics* 79, 432-468.

Core, J., Guay, W., 2002. Estimating the value of employee stock option portfolios and their sensitivities to price and volatility. *Journal of Accounting Research* 40, 613-630.

Degryse, H., Ongena, S., 2005. Distance, lending relationships, and competition. *Journal of Finance* 60, 231-266.

Degryse, H., Van Cayseele, P., 2000. Relationship lending within a bank-based system: Evidence from European small business data. *Journal of Financial Intermediation* 9, 90-109.

Demiroglu, C., James, C., Velioglu, G., 2021. Why are commercial loan rates so sticky? The effect of private information on loan spreads. *Journal of Financial Economics*, forthcoming.

Demiroglu, C., James, C.M., 2010. The information content of bank loan covenants. *Review of Financial Studies* 23, 3700-3737.
Dennis, S., Nandy, D., Sharpe, L.G., 2009. The determinants of contract terms in bank revolving credit agreements. *Journal of Financial and Quantitative Analysis* 35, 87-110.
DeYoung, R., Peng, E.Y., Yan, M., 2013. Executive compensation and business policy choices at U.S. commercial banks. *Journal of Financial and Quantitative Analysis* 48, 165-196.
Diamond, D.W., 1984. Financial intermediation and delegated monitoring. *Review of Economic Studies* 51, 393-414.
Diamond, D.W., 1991. Monitoring and reputation: The choice between bank loans and directly placed debt. *Journal of Political Economy* 99, 689-721.
Fahlenbrach, R., Stulz, R.M., 2011. Bank CEO incentives and the credit crisis. *Journal of Financial Economics* 99, 11-26.
Fama, E.F., 1985. What's different about banks? *Journal of Monetary Economics* 15, 29-39.
Gottesman, A.A., Roberts, G.S., 2007. Loan rates and collateral. *Financial Review* 42, 401-427.
Graham, J.R., Li, S., Qiu, J., 2008. Corporate misreporting and bank loan contracting. *Journal of Financial Economics* 89, 44-61.
Guay, W.R., 1999. The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants. *Journal of Financial Economics* 53, 43-71
Güner, A.B., 2006. Loan sales and the cost of corporate borrowing. *Review of Financial Studies* 19, 687-716.
Hagendorff, J., Vallascas, F., 2011. CEO pay incentives and risk-taking: Evidence form bank acquisitions. *Journal of Corporate Finance* 17, 1078-1095.
Harhoff, D., Körting, T., 1998. Lending relationships in Germany - Empirical evidence from survey data. *Journal of Banking and Finance* 22, 1317-1353.
Hayes, R.M., Lemmon, M., Qiu, M., 2012. Stock options and managerial incentives for risk taking: Evidence from FAS 123R. *Journal of Financial Economics* 105, 174-190
Hertzel, M.G., Officer, M.S., 2012. Industry contagion in loan spreads. *Journal of Financial Economics* 103, 493-506.
Hollander, S., Verriest, A., 2016. Bridging the gap: the design of bank loan contracts and distance. *Journal of Financial Economics* 119, 399-419.
Holmstrom, B., 1979. Moral hazard and observability, *Bell Journal of Economics* 10, 74-91.
Holmstrom, B., Milgrom, P., 1987. Aggregation and linarity in the provision of intertemporal incentivesy, *Econometrica* 55, 303-328.
Houston, J.F., James, C., 1995. CEO compensation and bank risk: Is compensation in banking structured to promote risk taking? *Journal of Monetary Economics* 36, 405-431.
Hubbard, R., Kuttner, K., Palia, D., 2002. Are there bank effects in borrower's costs of funds? Evidence from a matched sample of brrowers and banks. *Journal of Business* 75, 559-581.
Ivashina, V., 2009. Asymmetric information effects on loan spreads. *Journal of Financial Economics* 92, 300-319.
Jiménez, G., Salas, V., Saurina, J., 2006. Determinants of collateral. *Journal of Financial Economics* 81, 255-281.
John, T.A., John, K., 1993. Top-management compensation and capital structure. *Journal of Finance* 48, 949-974.
Knyazeva, A., Knyazeva, D., 2012. Does being your bank's neighbor matter? *Journal of Banking and Finance* 36, 1194-1209.
May. D., 1995. Do managerial motives influence firm risk reduction strategies? *Journal of Finance*

50, 1291-1308.
Mehran, H, Nogler, G.E., Schwartz, K.B., 1998. CEO incentive plans and corporate liquidation policy. *Journal of Financial Economics* 50, 319-348.
Mistrulli, P.E., Casolaro, L., 2009. Distance, lending technologies and interest rates. Working paper. Bank of Italy.
Murfin, J., 2012. The supply-side determinants of loan contract strictness. *Journal of Finance* 67, 1565-1601.
Petersen, M.A., Rajan, R.G., 1994. The benefits of lending relationships: Evidence from small business data. *Journal of Finance* 49, 3-37.
Petersen, M.A., Rajan, R.G., 2002. Does distance still matter? The information revolution in small business lending. *Journal of Finance* 57, 2533-2570.
Prilmeier, R., 2017. Why do loans contain covenants? Evidence from lending relationships. *Journal of Financial Economics* 123, 558-579.
Rajan, U., Seru, A., Vig, V., 2015. The failure of models that predict failure: Distance, incentives, and defaults. *Journal of Financial Economics* 115, 237-260.
Ramakrishnan, R.T.S., Thakor, A.V., 1984. Information reliability and a theory of financial intermediation. *Review of Economic Studies* 51, 415-432.
Rigobon, R., 2003. Identification through heteroskedasticity. *Review of Economics and Statistics*, *85*, 777-792.
Ross, S., 2004. Compensation, incentives, and the duality of risk aversion and riskiness, oral hazard and observability, *Journal of Finance* 59, 207-295.
Sapienza, P., 2002. The effects of banking mergers on loan contracts. *Journal of Finance* 57, 329-367.
Schwert, M., 2018. Bank capital and lending relationships. *Journal of Finance* 73, 787-830.
Tufano, P., 1996. Who manages risk? An empirical investigation of risk managmnet practices in the gold mining industry. *Journal of Finance* 51, 1097-1137.
Wall, L.D., 2020. Is stricter regulation of incentive compensation the missing piece? *Journal of Banking Regulation* 21, 82-94.

Table 1: Sample Construction

This table shows the criterion and steps by which we created our final sample of 19,737 loan facilities for the years 1992 to 2017.

Sample Selection Criteria	# of Lenders	# of Facilities
Number of lenders and facilities in DealScan	19,669	337,295
Number of unique lenders from ExecuComp	305	
Lenders from DealScan	555	
Bank holding company CEO pay data from ExecuComp	184	
Manually add GVKEY for 555 merged lenders in DealScan		280,390
Manually add GVKEY to borrowers (using linked table of and Chava and Roberts (2008))		183,345
Keep facilities that are term loans and revolver loans		112,074
Exclude borrowers that are regulated (financials, utilities, and public administrative firms)		18,003
Keep facilities where we can identify the lead bank		30,571
Exclude facilities with missing values in any variable		19,834
Final sample	161	19,737
Number of unique banking holding company CEO pay data from ExecuComp	54	

Table 2: Variable Names, Definitions and Sources

This table presents the variable names, definitions, units, sources, and where applicable the study wherein a formula is used to create a specific variable.

Variables Names	Definition (units) (reference}	Source
Dependent variables:		
loan_spread	All-in-drawn loan spread over LIBOR (basis points)	DealScan
collateral	Dummy equal to unity if facility is secured, and zero otherwise	DealScan
#_covenant	Number of covenants in the facility	DealScan
covenant_strictness	Strictness of covenant in the facility {Murfin, 2002}	
volatility	Annualized standard deviation of daily stock returns	CRSP
Pay-risk variable		
vega	Bank CEO's pay-risk sensitivity (millions) {Core & Guay, 2002}	ExecuComp
Control variables:		
Loan Characteristics:		
loan_amount	Natural logarithm of loan amount	Dealscan
loan_maturity	Natural logarithm of loan maturity	Dealscan
term_loan	Dummy equal to unity if the facility is a term loan, and zero otherwise	Dealscan
Relationship:		
relation_duration	Number of years that firm has relationship with bank	Dealscan
relation_distance	Distance between headquarters of borrowers and lenders (thousands of miles)	Compustat Google Maps
Borrower characteristics:		
firm_size	Natural logarithm of firm's total assets	Compustat
firm_leverage	Ratio of firm's total debt to total assets	Compustat
firm_tangibility	Ratio of firm's property, plant, and equipment to total assets	Compustat
firm_profitability	Ratio of firm's operating income to total assets	Compustat
firm_mb	Firm's (market value of equity plus book debt)/ total assets	Compustat

Bank variables:		
bank_size	Natural logarithm of total assets	Compustat
bank_capital	Ratio of equity to total assets	Compustat
num_banks	Number of banks in this facility	Dealscan
Instrument variable:		
vega_std	Standard deviation of pay-risk sensitivities of four non-CEO senior executives	ExecuComp

Table 3: Summary Statistics and Correlations between Loan Contract Terms

This table reports summary statistics of all variables from 1992 to 2017. Loan variables are from DealScan, compensation variables are from ExecuComp, and the financial variables are from CRSP and Compustat. All variables are winsorized at the 5% level. All variables are defined in Table 2.

Panel A: Descriptive Statistics

Variable	N	Mean	S.D	Min	25%	50%	75%	Max
loan_spread	19,737	187.6	102.7	30.0	112.5	175.0	250.0	400.0
collateral	19,737	0.52	0.50	0.00	0.00	1.00	1.00	1.00
#_covenant	19,737	1.31	1.29	0.00	0.00	1.00	2.00	8.00
covenant_strict	19,737	0.10	0.18	0.00	0.00	0.00	0.11	0.58
volatility	19,737	27.5	12.2	12.8	17.8	24.3	34.3	57.9
vega	19,737	0.58	0.54	0.00	0.08	0.48	1.04	1.60
loan_amount	19,737	19.2	1.44	16.1	18.3	19.3	20.3	21.4
loan_maturity	19,737	3.95	0.37	2.94	3.78	4.11	4.11	4.44
term_loan	19,737	0.32	0.47	0.00	0.00	0.00	1.00	1.00
relation	19,737	4.93	5.30	0.00	0.00	3.00	8.33	17.1
distance	19,737	1.12	0.97	0.02	0.36	0.76	1.69	3.48
firm_size	19,737	14.53	1.66	11.43	13.37	14.55	15.78	17.41
firm_leverage	19,737	0.34	0.19	0.02	0.20	0.32	0.47	0.73
firm_tangibility	19,737	0.30	0.23	0.03	0.11	0.24	0.45	0.80
firm_profitability	19,737	0.13	0.06	0.02	0.09	0.12	0.17	0.26
firm_mb	19,737	1.66	0.67	0.90	1.16	1.46	1.94	3.43
bank_size	19,737	20.32	1.16	17.98	19.36	20.90	21.30	21.52
bank_capital	19,737	0.09	0.02	0.05	0.08	0.09	0.10	0.12
num_bank	19,737	3.25	2.05	1.00	2.00	3.00	5.00	8.00
vega_std	19,737	0.14	0.14	0.00	0.02	0.09	0.24	0.49

Panel B: Correlations between Loan Contract Terms

Variable	*loan_spread*	*collateral*	*#_covenant*	*covenant_strict*
loan_spread	1			
collateral	0.51	1		
#_covenant	0.11	0.31	1	
covenant_strict	0.19	0.27	0.48	1

Table 4: Fixed-Effects Regressions of Loan Spreads on CEO Pay-Risk Sensitivity

This table presents bank-level fixed-effects regressions of loan spreads on the bank CEO's pay-risk sensitivity for 19, 737 loan facilities for the period 1992 to 2017. Loan spreads are defined as the all-in-drawn spread over LIBOR, *vega* is the bank CEO's pay-risk sensitivity, defined as the change in the dollar value of bank CEO wealth for a 0.01 unit change in stock return volatility. Heteroskedasticity robust standard error is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
vega	-6.842***	-6.768***	-6.322***	-5.654***
	(2.244)	(1.945)	(1.728)	(1.721)
loan_amount		-23.544***	-17.770***	-14.039***
		(0.554)	(0.704)	(0.692)
loan_maturity		-0.801	-4.893**	-2.756
		(2.202)	(2.001)	(1.999)
term_loan		64.093***	49.091***	46.690***
		(1.402)	(1.311)	(1.276)
relation_duration		-2.055***	-1.217***	-1.177***
		(0.135)	(0.125)	(0.123)
relation_distance		-4.047***	-0.634	-1.789***
		(0.667)	(0.624)	(0.622)
firm_size			-11.488***	-10.190***
			(0.645)	(0.634)
firm_leverage			152.392***	149.289***
			(3.131)	(3.103)
firm_tangibility			-3.971*	-7.738***
			(2.398)	(2.369)
firm_profitability			-280.799***	-267.933***
			(11.516)	(11.466)
firm_mb			-10.669***	-11.185***
			(1.042)	(1.029)
bank_size				-20.218***
				(2.596)
bank_capital				158.683**
				(74.224)
num_banks				-6.350***
				(0.281)
Constant	307.230***	696.884***	767.040***	1,053.942***
	(9.331)	(14.228)	(13.171)	(50.191)
Observations	19,737	19,737	19,737	19,737
R^2	0.17	0.36	0.50	0.51
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 5: Fixed-Effects Regressions of Loan Collateral on CEO Pay-Risk Sensitivity

This table presents bank-level fixed-effects regressions of loan collateral on the bank CEO's pay-risk sensitivity for 19,737 loan facilities for the period 1992 to 2017. Loan collateral is defined as unity if the loan is secured, and zero otherwise, *vega* is the bank CEO's pay-risk sensitivity, defined as the change in the dollar value of bank CEO wealth for a 0.01 unit change in stock return volatility. Heteroskedasticity robust standard errors is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
vega	-0.023**	-0.035***	-0.028***	-0.027***
	(0.011)	(0.010)	(0.009)	(0.009)
loan_amount		-0.076***	-0.025***	-0.016***
		(0.003)	(0.004)	(0.004)
loan_maturity		0.118***	0.097***	0.103***
		(0.010)	(0.010)	(0.010)
term_loan		0.188***	0.140***	0.135***
		(0.007)	(0.007)	(0.007)
relation_duration		-0.013***	-0.008***	-0.008***
		(0.001)	(0.001)	(0.001)
relation_distance		-0.035***	-0.014***	-0.017***
		(0.004)	(0.003)	(0.003)
firm_size			-0.087***	-0.084***
			(0.003)	(0.003)
firm_leverage			0.572***	0.564***
			(0.018)	(0.018)
firm_tangibility			-0.062***	-0.071***
			(0.015)	(0.015)
firm_profitability			-0.856***	-0.823***
			(0.063)	(0.064)
firm_mb			-0.049***	-0.050***
			(0.006)	(0.006)
bank_size				-0.044***
				(0.014)
bank_capital				0.749*
				(0.419)
num_banks				-0.016***
				(0.002)
Constant	0.167***	1.060***	1.324***	1.905***
	(0.042)	(0.071)	(0.068)	(0.270)
Observations	19,737	19,737	19,737	19,737
R^2	0.04	0.15	0.24	0.24
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 6: Fixed-Effects Regressions of the Number of Loan Covenants on CEO Pay-Risk Sensitivities

This table presents bank-level fixed-effects regressions of the number loan covenants on the bank CEO's pay-risk sensitivity for 19,727 loan facilities for the period 1992 to 2017. V*ega* is the bank CEO's pay-risk sensitivity, defined as the change in the dollar value of bank CEO wealth for 0.01 unit change in stock return volatility. Heteroskedasticity robust standard errors is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
vega	-0.063**	-0.080***	-0.047*	-0.089***
	(0.028)	(0.028)	(0.027)	(0.027)
loan_amount		-0.085***	0.091***	0.037***
		(0.007)	(0.009)	(0.009)
loan_maturity		0.203***	0.167***	0.136***
		(0.027)	(0.026)	(0.026)
term_loan		0.076***	0.086***	0.122***
		(0.019)	(0.019)	(0.019)
relation_duration		-0.003*	0.012***	0.011***
		(0.002)	(0.002)	(0.002)
relation_distance		-0.141***	-0.089***	-0.062***
		(0.009)	(0.009)	(0.009)
firm_size			-0.262***	-0.276***
			(0.008)	(0.008)
firm_leverage			0.397***	0.457***
			(0.049)	(0.049)
firm_tangibility			-0.260***	-0.199***
			(0.037)	(0.036)
firm_profitability			0.122	-0.103
			(0.173)	(0.171)
firm_mb			-0.045***	-0.036**
			(0.016)	(0.016)
bank_size				-0.231***
				(0.036)
bank_capital				2.643**
				(1.091)
num_banks				0.103***
				(0.004)
Constant	-0.861***	0.370**	0.531***	5.534***
	(0.061)	(0.166)	(0.166)	(0.711)
Observations	19,737	19,737	19,737	19,737
R^2	0.17	0.19	0.23	0.25
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 7: Fixed-Effects Regressions of the Strictness of Loan Covenants on CEO Pay-Risk Sensitivities

This table presents bank-level fixed-effects regressions of the strictness of loan covenants on the bank CEO's pay-risk sensitivity for 19,737 loan facilities for the period 1992 to 2017. Strictness of loan covenants is defined according to Murfin (2002). v*ega* is the bank CEO's pay-risk sensitivity, defined as the change in the dollar value of bank CEO wealth for 0.01 unit change in stock return volatility. Heteroskedasticity robust standard errors is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
vega	-0.008**	-0.010***	-0.009**	-0.012***
	(0.004)	(0.004)	(0.004)	(0.004)
loan_amount		-0.006***	0.006***	0.003**
		(0.001)	(0.001)	(0.001)
loan_maturity		0.008*	0.006	0.005
		(0.004)	(0.004)	(0.004)
term_loan		0.025***	0.011***	0.014***
		(0.003)	(0.003)	(0.003)
relation_duration		-0.002***	-0.001**	-0.001**
		(0.000)	(0.000)	(0.000)
relation_distance		-0.012***	-0.007***	-0.006***
		(0.001)	(0.001)	(0.001)
firm_size			-0.021***	-0.021***
			(0.001)	(0.001)
firm_leverage			0.147***	0.150***
			(0.007)	(0.007)
firm_tangibility			-0.002	0.001
			(0.006)	(0.006)
firm_profitability			-0.497***	-0.509***
			(0.025)	(0.025)
firm_mb			-0.000	0.000
			(0.002)	(0.002)
bank_size				-0.007
				(0.005)
bank_capital				0.568***
				(0.165)
num_banks				0.006***
				(0.001)
Constant	-0.068***	0.032	0.091***	0.242**
	(0.008)	(0.025)	(0.025)	(0.104)
Observations	19,737	19,737	19,737	19,737
R^2	0.06	0.08	0.14	0.14
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 8: Fixed-Effects Regressions of Loan Spreads on the Borrower-Bank Relationship

This table presents bank-level fixed-effects regressions of loan spreads on the borrower-bank relationship for 19, 737 loan facilities for the period 1992 to 2017. Loan spreads are defined as the all-in-drawn spread over LIBOR, *relation_duration* is defined as the number of years that firm has relationship with the bank and *relation_distance* is defined as the distance between headquarters of bank and firm. Definitions of all other control variables are in Table 2. Heteroskedasticity robust standard error is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
*vega*relation_duration*	0.689***	
	(0.213)	
*vega*relation_distance*		-2.521**
		(1.102)
relation_duration	-1.485***	
	(0.158)	
relation_distance		-0.301
		(0.903)
vega	-8.938***	-2.455
	(2.042)	(2.177)
Observations	19,737	19,737
R^2	0.51	0.51
Control variables	Yes	Yes
Bank fixed-effects	Yes	Yes
Year dummies	Yes	Yes

Table 9: Fixed-Effects Regressions of a Bank's Stock Return Volatility on Loan Contract terms (loan spreads, collateral, number and strictness of covenants)

This table presents bank-level fixed-effects regressions of a bank's annual stock return volatility on loan contract terms for 19,727 loan facilities for the period 1992 to 2017. Heteroskedasticity robust standard errors is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
loan_spread	0.001*			
	(0.000)			
collateral		0.212***		
		(0.058)		
covenant			0.044*	
			(0.023)	
covenant_strict				0.338**
				(0.158)
loan_amount	0.019	0.013	0.008	0.009
	(0.031)	(0.030)	(0.030)	(0.030)
loan_maturity	0.361***	0.338***	0.353***	0.358***
	(0.085)	(0.085)	(0.085)	(0.085)
term_loan	0.045	0.047	0.071	0.071
	(0.059)	(0.057)	(0.057)	(0.057)
relation_duration	-0.004	-0.003	-0.005	-0.004
	(0.006)	(0.006)	(0.006)	(0.006)
relation_distance	-0.074**	-0.071**	-0.072**	-0.073**
	(0.030)	(0.030)	(0.030)	(0.030)
firm_size	0.033	0.044	0.039	0.034
	(0.029)	(0.029)	(0.029)	(0.029)
firm_leverage	-0.122	-0.142	-0.043	-0.074
	(0.150)	(0.146)	(0.142)	(0.143)
firm_tangibility	0.062	0.072	0.065	0.056
	(0.117)	(0.117)	(0.117)	(0.117)
firm_profitability	-0.505	-0.509	-0.679	-0.511
	(0.520)	(0.509)	(0.507)	(0.515)
firm_mb	0.033	0.036	0.027	0.025
	(0.044)	(0.045)	(0.044)	(0.044)
bank_size	-2.407***	-2.411***	-2.411***	-2.418***
	(0.124)	(0.124)	(0.124)	(0.124)
bank_capital	-29.274***	-29.320***	-29.284***	-29.359***
	(4.224)	(4.223)	(4.229)	(4.231)
num_banks	0.045***	0.044***	0.036**	0.038***
	(0.015)	(0.014)	(0.015)	(0.014)
Constant	69.258***	69.557***	69.717***	69.879***
	(2.480)	(2.435)	(2.437)	(2.433)
Observations	19,737	19,737	19,737	19,737
R^2	0.92	0.92	0.92	0.92
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 10 (Robustness Test 1): Logistic Regressions of Loan Collateral on CEO Pay-Risk Sensitivity

This table presents logistic regressions of loan collateral on the bank CEO pay-risk sensitivity from 1992 to 2017. Loan collateral is defined as unity if the loan is secured, and zero otherwise *vega* is the bank CEO's pay-risk sensitivity, defined as the change in dollar value of bank CEO wealth for 0.01 unit change in stock return volatility. Definitions of all other control variables are at table 2. This table provides marginal effect for each variable. Heteroskedasticity robust standard error is in parentheses. Significance levels are indicated following: * $p<0.1$; ** $p<0.05$; *** $p<0.01$

	(1)	(2)
vega	-0.023**	-0.032***
	(0.011)	(0.010)
loan_amount		-0.015***
		(0.004)
loan_maturity		0.099***
		(0.010)
term_loan		0.129***
		(0.007)
relation_duration		-0.007***
		(0.001)
relation_distance		-0.015***
		(0.004)
firm_size		-0.082***
		(0.003)
firm_leverage		0.552***
		(0.017)
firm_tangibility		-0.071***
		(0.014)
firm_profitability		-0.825***
		(0.061)
firm_mb		-0.048***
		(0.006)
bank_size		-0.052***
		(0.014)
bank_capital		0.688
		(0.444)
num_banks		-0.015***
		(0.002)
Observations	19,701	19,701
Pseudo R^2	0.03	0.20
Bank fixed-effects	Yes	Yes
Year dummies	Yes	Yes

Table 11 (Robustness Test 2): Tobit Regressions of Loan Covenant Strictness on CEO Pay-Risk Sensitivity

This table presents Tobit regressions of the covenant strictness on bank CEO pay-risk sensitivity from 1992 to 2017. Left bound is 0 and right bound is 1. Covenant strictness is defined as the strictness of the covenant. *vega* is the bank CEO's pay-risk sensitivity, defined as the change in dollar value of bank CEO wealth for 0.01 unit change in stock return volatility. Definitions of all other control variables are in Table 2.

	(1)	(2)
vega	-0.017**	-0.026***
	(0.008)	(0.007)
loan_amount		0.018***
		(0.003)
loan_maturity		0.016**
		(0.008)
term_loan		0.024***
		(0.005)
relation_duration		0.000
		(0.001)
relation_distance		-0.019***
		(0.003)
firm_size		-0.066***
		(0.003)
firm_leverage		0.274***
		(0.014)
firm_tangibility		-0.028**
		(0.011)
firm_profitability		-0.693***
		(0.049)
firm_mb		-0.010**
		(0.004)
bank_size		-0.009
		(0.011)
bank_capital		1.384***
		(0.331)
num_banks		0.024***
		(0.001)
Constant	-2.243	-1.500***
		(0.177)
Observations	19,737	19,737
Pseudo R^2	0.13	0.23
Bank fixed-effects	Yes	Yes
Year dummies	Yes	Yes

Table 12 (Robustness Test 3): Using Sample Mean Volatility Rather than Individual Bank Volatility in Defining Bank CEO Pay-Risk Sensitivity

This table presents bank fixed effects regressions of loan contract terms (i.e., loan spreads, loan collateral, number of loan covenants, and covenant strictness) on the CEO pay-risk sensitivity. Loan spread is defined all in drawn loan spread over LIBOR, loan collateral is defined as the unity if the loan is secured, and zero otherwise, loan covenants is defined as the number of covenants in the facility, covenant strictness is defined as the strictness of covenants in the facility. *vega* is the bank CEO's pay-risk sensitivity, calculated using the sample mean volatility rather than individual bank volatility. Definitions of all other control variables are in Table 2. Heteroskedasticity robust standard error is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively.

	(1) *spread*	(2) *collateral*	(3) *covenant*	(4) *covenant strict*
vega	-5.766*** (1.805)	-0.028*** (0.010)	-0.100*** (0.028)	-0.014*** (0.004)
Observations	19,574	19,574	19,574	19,574
R^2	0.51	0.25	0.25	0.14
Control variables	Yes	Yes	Yes	Yes
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Table 13 (Robustness Test 4): 2SLS Fixed-Effects Regressions of Loan Contract Terms on CEO Pay-Risk Sensitivity

This table presents two-stage least square fixed effects regressions of loan contract terms (i.e., loan spreads, loan collateral, number of loan covenants, and covenant strictness) on the CEO pay-risk sensitivity. Loan spread is defined all in drawn loan spread over LIBOR, loan collateral is defined as the unity if the loan is secured, and zero otherwise, loan covenants is defined as the number of covenants in the facility, covenant strictness is defined as the strictness of covenants in the facility. In the spirit of Rigobon (2003), Vega is instrumented by the variable, *vega_std*, which is the standard deviation of pay-risk sensitivities of four non-CEO executives during the fiscal year. Definitions of all other control variables are in Table 2. Heteroskedasticity robust standard error is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively. In the first-stage regression, F-statistic is larger than the critical value of Stock-Yogo weak instrument test (16.38).

	First-Stage	Second-Stage			
	vega	*spread*	*collateral*	*covenant*	*covenant strict*
vega_std	1.021*** (0.024)				
vega		-5.705 (5.986)	-0.099*** (0.035)	-0.468*** (0.093)	-0.027** (0.014)
delta		-1.499 (1.244)	0.008 (0.007)	0.043** (0.019)	0.001 (0.003)
Observations	19,727	19,727	19,727	19,727	19,727
R^2	0.82	0.41	0.21	0.09	0.09
Control variables	Yes	Yes	Yes	Yes	Yes
Bank fixed-effects	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes

Table 14 (Robustness Test 5): Loan Contract Terms Test and Stock Volatility at the Bank-Level

This table presents loan contract terms test and stock volatility test at bank level and loan contract terms are aggregated at bank level by calculating the bank-year average of loan contract terms. Panel A shows bank-level regressions of loan contract terms (i.e., loan spreads, loan collateral, number of loan covenants, and covenant strictness) on the CEO pay-risk sensitivity. Loan spread is defined all in drawn loan spread over LIBOR, loan collateral is defined as the unity if the loan is secured, and zero otherwise, loan covenants is defined as the number of covenants in the facility, covenant strictness is defined as the strictness of covenants in the facility. v*ega* is the bank CEO's pay-risk sensitivity, defined as the change in the dollar value of bank CEO wealth for 0.01 unit change in stock return volatility. Control variables are bank size and bank capital. Heteroskedasticity robust standard error, clustered at bank level, is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively. Panel B shows bank-level regressions of bank stock volatility on loan contract terms. Bank stock volatility is the annualize standard deviation of daily stock return. Control variables are bank size and bank capital. Heteroskedasticity robust standard error, clustered at bank level, is in parentheses. All variables are defined in Table 2. *, **, and *** denotes statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Loan contract terms	(1) *spread*	(2) *collateral*	(3) *covenant*	(4) *covenant strict*
vega	-20.517**	-0.081***	-0.116**	-0.010
	(9.469)	(0.029)	(0.055)	(0.019)
Observations	389	389	389	389
R^2	0.65	0.51	0.64	0.42
Control Variables	Yes	Yes	Yes	Yes
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes

Panel B: Bank stock volatility	(1)	(2)	(3)	(4)
loan_spread	0.018**			
	(0.008)			
collateral		3.108**		
		(1.424)		
covenant			0.493	
			(0.481)	
covenant_strict				5.532*
				(2.843)
Observations	389	389	389	389
R^2	0.91	0.91	0.90	0.91
Control Variables	Yes	Yes	Yes	Yes
Bank fixed-effects	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes