IMPACT OF DODD-FRANK ON CEO PAY AND BANK RISK

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Abstract

In this paper we examine changes in the relationship between bank risk and the structure of bank CEO compensation following the enactment of the Dodd-Frank Act of 2010. Using a diff-in-diff methodology, we find significant differences between high and low pay-risk sensitivity banks. Specifically, we find differences in performance-vesting restricted stock awards, LTIPs, anti-hedging provisions and emphasis on non-financial measures of performance to increase after Dodd-Frank. Additionally, differences in time-vesting options grants and annual bonuses decreased. Instrumenting for these differences in compensation structure, we find that bank risk went down in the post-Dodd-Frank period. The risk reduction is driven by high pay-risk banks. No significant effect is found for differences in bank performance. The above results suggest that Dodd-Frank achieved its intended legislative intent of reducing excessive pay-risk without adversely impacting bank performance.

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Introduction

The financial crisis (2007-2009) represents a watershed in the regulation and supervision of financial institutions. Following the crisis, the Dodd-Frank Act of 2010 was passed which included provisions in bank regulations and supervision which were intended to mitigate bank risk taking and enhance the stability of the financial sector. While many of the regulatory changes have focused on measuring risk exposures and ensuring that capital and loss absorption capacity vary with bank risk, regulatory oversight has also focused on the structure of senior bank management compensation.[1]

In late 2009, the Federal Reserve began a review of incentive compensation practices at the largest banks to assess their compliance with incentive compensation guidance promulgated by all bank regulatory agencies. The regulatory focus on CEO compensation was motivated by the belief that compensation affects CEO risk taking incentives which, in turn, affects the bank's risk taking strategy. On July 16, 2009, the US Treasury proposed the Corporate and Financial Institution Compensation and Fairness Act (CFICA), which was subsumed by the larger Dodd-Frank Act and passed by the House on December 11, 2009. On May 5, the Senate passed the larger Dodd-Frank Act (with the CFICA provisions), which President Obama signs into law on July 21, 2010.[2] Figure 1 presents a summary of the timeline

Figure 1

[1] See Wall (2020) and the papers referenced for an excellent literature survey of studies that examine the relationship between bank CEO compensation and bank risk taking.

[2] See Section III for a detailed discussion of the relevant regulations of Dodd-Frank that impacts the structure of bank CEO compensation.

In this paper we examine changes in the changing relationship between bank risk and the structure of CEO compensation around the passage of Dodd-Frank.[3] The basic idea is that effect of greater regulatory scrutiny of compensation in the post-Dodd-Frank era is likely to vary with a bank's pre-Dodd-Frank pay-risk sensitivity. As a result, we expect to observe differences in the changes in bank executive compensation in the post Dodd-Frank era based on pre-Dodd-Frank differences in pay-risk sensitivities.

Studies of management compensation structure typically define pay-risk sensitivity (*vega*), as the change in the dollar value of CEO wealth for a .01 change in stock return volatility. While these rules were first proposed in 2010 and have yet to be fully implemented, they provide the basis for regulatory guidelines concerning compensation policies and are thus likely to influence the structure of bank compensation.[4] In order to examine the relationship between bank risk and the structure of CEO compensation following the passage of Dodd-Frank, we use the diff-in-diff methodology of Pierce and Schott (2016).[5] We expect that reliance on risk sensitive compensation to decreases more for high pre-Dodd-Frank *vega* banks than low pre-Dodd-Frank *vega* banks. We examine a number of components of the compensation structure such as bonus, long term incentive plans, performance and time vesting stock grants, time and performance vesting option grants, deferred compensation and anti-hedging provisions.

[3] Section 956 of the 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 institution.

[4] https://www.federalreserve.gov/publications/other-reports/files/incentive-compensation-practices-report-201110.pdf.

[5] See Section II for a detailed explanation of our empirical testing methodology.

We examine 216 unique banks over the sample period 2000 through 2019. We find the following results:

(1) Significant differences in how pre-Dodd-Frank high pay-risk and low pay-risk banks change the structure of their CEO compensation following Dodd-Frank. Specifically, we find that performance-vesting restricted stock awards, use of long-term incentive plans (LTIP) and anti-hedging provisions increased more at high pay-risk banks than at low pay-risk banks. Conversely, we find greater decreases in the use of time-vesting options and annual bonuses at high pre-Dodd-Frank pay-risk banks than at low pay-risk banks. There were no significant differences in changes to deferred compensation for these two sets of banks.

(2) In examining which banks have high pay-risk sensitivities before Dodd-Frank we find high pay-risk sensitivity banks are larger, have lower stock return volatility, and have higher growth rates and gross profit banks than low pay-risk sensitivity banks. We find no significant difference in the capital ratios between the two groups of banks.[6]

(3) Instrumenting for the significant differences in compensation structure that we find in (1), we find that differences between the two groups of banks' post-Dodd-Frank risk (namely, stock return volatility) decreased over the sample period. The risk reduction is driven by high pay-risk banks. We find no significant change in performance differences as measured by Tobin's Q or ROA. These findings suggest that greater regulatory scrutiny of compensation in the Post Dodd-Frank era has achieved its intended effect of reducing pay-risk without adversely impacting bank performance.

[6] Note that these cross-sectional differences are captured by the bank-level fixed effects.

An important empirical challenge in examining the relationship bank risk and compensation is that compensation policies are likely to be endogenous due to confounding factors. For example, the optimal CEO compensation structure is likely to vary with the bank's business model, risk culture and future growth opportunities.[7] Thus, the relationship between risk and compensation in the cross-section may reflect these confounding factors rather than reflecting any causal link between risk taking and compensation.

We address these endogeneity concerns in two ways. First, we include bank fixed effects. The findings of Fahlenbrach *et al.* (2012) suggest that the effects of bank culture and growth opportunities on risk taking, and compensation are time invariant, as a result focusing on 'within bank variation' in risk will control for these confounding factors. Second, we calculate the sensitivity of wealth to equity risk due to options by using the yearly mean of the annualized standard deviation of stock returns in all Black–Scholes computations, instead of using the equity risk specific to each bank (Guay 1999; Coles *et al.* 2006; Hayes *et al.* 2012).

We conduct two additional robustness tests. One, to minimize the impact of the crisis years (2008-09) on *prevega*¸ we redefine the pre-Dodd-Frank period as 2000-2007 instead of 2000-2009. None of our results change significantly. The second robustness test examines if the reduction in risk is due to pay-performance sensitivities (*delta*) rather than pay-risk sensitivities (*vega*). We generally find no significant impact on bank risk and performance between the two groups of *predelta* banks.

This paper proceeds as follows. Section II describes our methodology in detail and Section III provides an overview of the literature relating bank risk to compensation policy and a

[7] See, for example, Hubbard and Palia (1995), Fahlenbrach *et al.* (2012), and DeYoung *et al.* (2013).

conceptual framework for our empirical analysis. Section IV explains the Dodd-Frank Act and its ex-ante potential to change the relationship between a bank CEO's compensation structure and bank risk. We then relate these Dodd-Frank stipulations to testable hypotheses. Section V describes our data and the empirical variables constructed for our tests. Empirical results are reported in Section VI, and Section VII presents our conclusion.

II. Empirical Testing Methodology

Our empirical methodology uses the framework of the diff-in-diff model specification of Pierce and Schott (2016). In the period before Dodd-Frank (2000-2009), we classify banks into two groups. We define *prevega* to be the pay-risk sensitivities of banks in the pre-Dodd-Frank period. The first group *high_prevega* are those banks whose average pay-risk sensitivities are greater than the median pay-risk sensitivities of all banks in the pre-Dodd-Frank period. This is effectively the treated group of banks -- whose CEO compensation structure regulators are concerned about. The second group of banks are the control group wherein banks have pay-risk sensitivities that are equal to or less than the median pay-risk sensitivities of all banks in the pre-Dodd-Frank period. We then examine if the difference between the high and low pay-risk groups changed following the enactment of Dodd- Frank. For ease of convenience, we summarize our empirical strategy in Figure 2.

Figure 2

We build our empirical model in two stages. In the first-stage we examine which compensation structures changed after Dodd-Frank. In doing so, we use the guidance of Dodd-

Frank and relate it to testable hypotheses to the various compensation structures described in detail in Section IV. The first-stage regression model is given by equation (1) below.

$$Comp_{it} = \beta \times high\_prevega_{\mathrm{i}} * DF + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t} \qquad (1)$$

where subscript *i* indicates the bank and subscript *t* indicates the year, respectively. $Comp_{it}$ are the different compensation variables that we examine. $high\_prevega_i$ is a dummy equal to one when the pay-risk sensitivities before Dodd-Frank (*prevega*) of banks is greater than median of our sample, and otherwise equal to zero. *DF* is a dummy variable indicating the post Dodd-Frank period (2010 to 2019). The interest of coefficient β is the average treatment effect and compares the difference between banks in the high-*prevega* group and banks in the low-*prevega* group during the post-Dodd-Frank period. *X* variables are the control variables *size* and *capital*, α is the bank fixed effect, which absorb unobserved and time-invariant confounding factors, and δ are year dummies which control for any macro time trend. All standard errors are robust and are clustered at the bank-level.

Two identification concerns might threat the validity of our specification. The first concern is that Dodd-Frank targets big banks more strongly. Including the control variable *size* in our regression rules out this concern. The second concern is that unobserved factor of bank risk policy or bank risk attitude can determine the change of compensation structure. This concern is minimized by using bank-level fixed effects.

In the second stage we use the fitted values from the above equation to examine the impact of the changes in compensation structure on bank risk and performance. For doing this, we correct the standard errors which are also robust and clustered at the bank-level. The second-stage is given by equation (2) below.

$$Bank\ risk\ or\ performance_{it} = \mu \times \widehat{compensation\ structure}_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it} \qquad (2)$$

where compensation structure is instrumented by high_$prevega_i * DF$. Bank risk is proxied by the annualized standard deviation of stock returns, and bank performance is proxied by Tobin's Q or ROA.

III. Conceptual Framework and Related Literature on Bank Compensation and Risk Taking

The relationship between bank risk taking incentives and compensation is ambiguous. Focusing first on the relationship between risk taking incentives and incentive pay; higher incentive pay should serve to align the interests of management and shareholders by linking CEO compensation to shareholder wealth. However, the effects of increasing incentive pay on risk taking are ambiguous. On the one hand, a high incentive pay may lead to a concentration of wealth in the shares of the banks leading to greater managerial risk aversion. This effect is likely to be increase if share grants are required to be held after vesting and are subject to claw backs. On the other hand, as John and John (1993) and Bolton *et al.* (2015) point out, a higher incentive pay may incentivize bank CEOs to shift risk to depositors and debt holders. The incentive to engage in risk shift, however, depends critically on the response of depositors and, more importantly, regulators attitudes to risk shifting activities. If deposits are repriced in response to risk shifting activity either explicitly or implicitly through greater regulatory pressure, then risk shifting incentives are reduced. Indeed, since the goal of regulating the structure of CEO compensation is to discourage risk shifting activities by imposing penalties on CEOs that engage in risk shifting, stricter regulatory guidelines are expected to lead to less risk shifting activity.

At first glance, option pricing theory (and the pricing of performance-based stock grants) suggests that increases in *vega* should provide greater incentives for risk taking. However, Core

and Guay (1999), Guay (1999), Lambert *et al.* (1991), Carpenter (2000), Ross (2004), and Lewellen (2006) point out that undiversified risk averse executives are unlikely to value their options according to Black-Scholes. If for example, CEOs value options in terms of certainty equivalence then the relationship between risk taking and *vega* is ambiguous. To see why, the CEO's certainty equivalent wealth can be written as:

$$CE = E(W) - risk\ premium \qquad (3)$$

Differentiating (1) with respect to (σ) yields

$$\frac{\partial CE}{\partial \sigma} = \frac{\partial E(W)}{\partial \sigma} - \frac{\partial risk\ premium}{\partial \sigma} \qquad (4)$$

As shown, the effect of an increase in CE consists of two components, the effect of volatility on expected wealth and the effect of volatility on the risk premium required to take on risk. In the context of Black-Scholes, and more generally for compensation structures with convex payoffs, the effect of volatility on the value of CEO option holdings is unambiguous since $\frac{\partial W}{\partial \sigma} > 0$. The second term will also be positive if managers are risk averse and are unable to totally hedge the components of the compensation package with convex payoffs. The net effect on equation (4) and the CEO's preference for volatility will therefore depend on the relative magnitude of wealth and their risk aversion. 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. The magnitude of the risk aversion effect is expected to vary with the diversification of the manager's portfolio of wealth, hedging opportunities and the availability of claw back provisions.

Given the ambiguity concerning the effect of incentive pay and *vega* on risk taking, it is perhaps not surprising that the empirical evidence concerning the relationship between bank risk

taking and incentive compensation is mixed. For example, Houston and James (1995) find a negative relation between bank CEO stock and option holdings measured as a percentage of ownership and stock return volatility. In addition, Fahlenbrach and Stulz (2011) find no consistent evidence of a relationship between *vega* and other incentive-based compensation measures and bank 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 *vega* and various risk measures and conclude that prior to the financial crisis the structure of CEO compensation promoted bank risk taking.

There are several potential reasons the conflicting findings concerning the incentive effects of CEO compensation. First, the sample period used in these studies are different and geographic and activity restrictions on banks have changed dramatically over the past three decades. The changes are likely to affect risk taking opportunities and the market for corporate control in banking, which in turn will affect the optimal compensation contract for bank CEO's (see, for example, Hubbard and Palia (1995)). Second, as Fahlenbrach *et al.* (2012) argue, compensation policies are likely to vary with bank culture and growth opportunities which leads to cross-sectional variation in both compensation policies and the relationship between compensation and risk taking. As a result, studies in which identification is based on cross-sectional variation in risk taking and compensation structure are likely to suffer from omitted variable bias. Third, most prior studies focus on two measures of the incentive effects of compensation on bank risk taking. However, as Edmans and Liu (2011) point out a significant portion of CEO compensation is in the form of inside debt (i.e., sum of pensions and deferred cash compensation). Bennett *et al.* (2015) and Van Bekkum (2016) find a significant negative relation between bank risk taking and the

amount of inside debt held by bank CEOs during the pre-crisis period.[8] Finally, *vega* is not likely to be exogenous. A bank's compensation committee and the board of directors have an incentive to use compensation to influence risk taking and more generally their investment and lending policies of the bank. As a result, Guay (1999) and Coles *et al.* (2006) argue that there are likely to be feedback effects through which the level of bank risk influences the choice of compensation policies. Failure to control for these feedback effects is likely to result in biased estimates of the true relationship between risk taking and compensation structure.

For all estimates we include bank-level fixed effects so that identification is through within bank variation in risk and compensation structure. Including bank-level fixed effects allows us to control for time invariant differences between banks in culture, investment opportunities and strategic focus.[9] We also further address endogeneity concerns using an alternative methodology. We use the approach employed by Guay (1999) and Core and Guay (1999) to calculate the sensitivity of wealth to performance and risk by using the yearly mean of annualized stock return volatility in all Black–Scholes computations, instead of using the equity risk specific to each firm.

IV. Dodd-Frank its Impact on the Bank CEO Compensation-Risk Relationship

In response to the financial crisis of 2007 to 2009, Congress enacted the comprehensive Dodd-Frank Wall Street Reform and Consumer Protection Act (commonly referred to as Dodd-Frank) in 2010. Dodd-Frank impacted almost every part of US financial industry by creating rules and regulations (such as the orderly liquidation authority of insurance companies and broker dealers to different regulatory agencies like the SEC, the Fed, and the Federal Insurance Office)

[8] van Bekkum (2016) finds that a bank's CEO inside debt holdings is positively correlated with *vega*.
[9] We report statistical significance based on robust standard errors clustered at the bank level (Petersen (2009)).

as well as creating new agencies such as Financial Stability Oversight Council and the Office of Financial Research. In this section we examine several key provisions of Dodd-Frank and their implications for the pay-risk relationship of compensation for banking firms. While the provisions of Dodd-Frank have yet to be fully implemented, Wall (2020) explains these provisions provide the framework used by bank regulators in their oversight of bank executive compensation in the post-Dodd-Frank era.

Section 956 of Dodd-Frank mandated six agencies (Fed, FDIC, OCC, SEC, NCUA, FHFA) draft rules regarding incentive compensation for financial institutions. The rules prohibit, for covered persons at covered institutions, incentive compensation that encourages inappropriate risks by providing excessive compensation or that could lead to material financial loss. Covered persons include senior executive officers (we study CEOs) and significant risk-takers (deemed to be any person who can put the bank at risk of a material financial loss). Covered institutions are based on a three-tiered approach with requirements increasing in stringency with asset size. Level 1 institutions are banks with assets over $250 billion, level 2 institutions are banks with assets between $50 and $250 billion, and level 3 institutions are banks with assets under $50 billion.[10] Most of our banks are level 1 institutions because they are traded S&P1500 companies whose CEO compensation data is provided by ExecuComp and Incentive Labs. Accordingly, we examine if Dodd-Frank is associated with reduced risk taking.

Dodd-Frank was intended to reduce excessive bank risk taking by making CEO compensation more performance-oriented, less convex and longer-term. We focus on changes in

[10] See Maag (2018) for a description of the proposed compensation rules under Dodd-Frank.

compensation in the post Dodd-Frank era since after passage of Dodd-Frank because there was an increase in bank regulatory scrutiny of compensation structure.

One way to reduce risk taking is a substitution of restricted stock awards for option grants. Restricted stock is stock that is nontransferable and generally becomes available to the recipient under a graded vesting schedule that lasts for several years that is often linked to performance. Given that options granted to the executive have convex payoffs the substitution of restricted stock for options is expected to reduce *vega* after Dodd-Frank.

Hypothesis 1: We expect a higher dollar value of restricted stock awards after Dodd-Frank, and a lower dollar value of time vesting options granted post Dodd-Frank.

Another potential way to reduce risk taking incentives, is to substitute performance-vesting requirements for time-based vesting. Performance-vesting provisions either initiate or accelerate vesting of stock and option grants to executives when they achieve accounting, stock-price, and/or some other target threshold.[11] However, unlike time vesting stock and option grants, performance-based grants are contingent on performance metrics (such as firm profitability and stock price performance. As a result, we expect the use of performance-vesting in banking to reduce the pay-risk relationship in banking.

Hypothesis 2: We expect the dollar amount in performance-based vesting for stocks and options to increase after Dodd-Frank, and the dollar amount in time-based vesting for stocks and options to decrease after Dodd-Frank, respectively.

[11] Recent empirical work by Bettis *et al.* (2018) finds that the trend towards a greater reliance on performance-vesting provisions has resulted in an increase in *vega* for non-financial firms.

As explained before, Dodd-Frank focused on making pay more long-term oriented and less short-term oriented. Accordingly, we examine if pay became more long-term oriented after Dodd-Frank.

Hypothesis 3: We expect the dollar amount in long-term incentive plans (LTIPs) to increase after Dodd-Frank

Dodd-Frank emphasized the role of non-financial measures in assessing the executive's performance when determining her compensation. Non-financial performance goals could include assessments of an executive's compliance with risk taking policies and procedures. Accordingly, we examine if the ratio of financial to non-financial metrics decreased after Dodd-Frank.

Hypothesis 4: We expect the ratio of financial to non-financial metrics to decrease after Dodd-Frank.

Dodd-Frank mandated for large banks[12] a four-year deferral of 60% of short-term CEO incentive compensation (less than three years), and a two-year deferral of 60% of long-term CEO incentive compensation (at least three years). Accordingly, we examine if the dollar amount of deferred incentive compensation increased after Dodd-Frank.

Hypothesis 5: We expect the dollar amount of deferred incentive compensation to increase after Dodd-Frank.

The SEC has sometimes forced executives to disgorge bonuses that were inflated on the basis of financial misstatements.[13] However, less extreme forms of misreporting often goes

[12] For banks whose asset size is greater than or equal to $250 billion. For level 2 banks, the deferral amount is 50%, and the deferral period is two years (one year) for short-term (long-term) incentive compensation, respectively.

[13] See SEC Report Pursuant to Section 308(c) of SOX that reviews enforcement actions over the five years preceding the enactment of SOX available at https://www.sec.gov/news/studies/sox308creport.pdf, and SEC v. Razmilovic, 738

unpunished because of the 'grey boundaries' between good-faith reporting and misreporting., Fried (2010) find that no-fault excess-pay claw backs do not deter executives from financial misreporting before Dodd-Frank was enacted. They find that nearly 50% of S&P 500 firms had no excess-pay claw back policies. Of those firms with clear policies, 81% did not require directors to recoup excess pay but gave directors discretion to allow executives to keep excess pay. Of the remaining firms, 86% did not permit directors to recoup excess pay without a finding of misconduct. As a result, less than 2% of S&P 500 firms required directors to recover excess pay from executives whether or not there was misconduct. Accordingly, we examine if CEO bonus declined after Dodd-Frank because of enhanced implementation of no-fault excess pay claw backs.

Hypothesis 6: We expect bonuses to decrease after Dodd-Frank.

Dodd-Frank aimed to minimize the adverse impact of any hedging activities by the CEO in purchasing any hedge or similar instrument to offset any decrease in the value of the executive's incentive compensation. CEOs were prohibited to purchase directly or through a third-party any such hedging instrument in order that CEOs do not take excessive risks. Accordingly, we examine if such anti-hedging provisions increased after Dodd-Frank.

Hypothesis 7: We expect anti-hedging provisions to increase after Dodd-Frank.

F.3d 14,32 (C.A.2, 2013) that held that it was not an abuse of discretion for the district court to order disgorgement of a culpable CEO's bonuses earned in relation to an accounting fraud.

IV. Data and Variable Construction

IV.A Data

We obtain information on the structure of bank CEO compensation from ExecuComp. We restrict our sample to bank holding companies (BHCs) by selecting firms with SIC codes between 6000 and 6199. Our data is from 2000 to 2019, which results in an initial sample of 249 unique BHCs comprising of 2,843 bank-year observations. We obtain stock return data from CRSP and the bank's financial statement data from Compustat. After excluding observations with missing values for bank size, bank capital, and the CEO's *vega*, we have 216 unique BHCs comprising of 2,367 bank-year observations. In July 2006, the SEC required companies to disclose information on executive deferred compensation from fiscal year 2006 onwards. Accordingly, our second sample covers the period 2006-2019 for which we have 172 unique BHCs comprising of 1,709 bank-year observations. A summary of our data collection methodology is given in Table 1.

Table 1

IV.B Variable Construction

Our main variables of interest are bank risk and bank performance. We define the variable *bank risk* as the annualized standard deviation of bank daily stock returns. We proxy for bank performance with Tobin's Q and ROA. We define the variable *Tobin's Q* as the ratio of book value of debt plus the market value of equity to total assets. We define the variable *ROA* as the ratio operating income to total assets expressed in percent. 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 annualized stock return volatility and $Z = [\text{In}(\text{S}/\text{X}) - T(\text{r} - \text{d} + \sigma^2/2)]/\sigma\text{T}^{(1/2)}$. We calculate the variable *prevega,* as the average CEO *vega* between 2000 and 2009 for each bank. If regulatory scrutiny in the post- Dodd-Frank era is focused on banks with the greatest pre-crisis pay-risk relationship, we expect the changes to impact these banks more. Accordingly, *high_prevega* is a dummy equal to one when the pay-risk sensitivities before Dodd-Frank (*prevega*) of banks is greater than median of our sample, and otherwise equal to zero. To examine changes in in regulatory scrutiny of bank CEO compensation in the post-Dodd-Frank era, we define a dummy variable, *DF*, which equals one for years 2010 to 2019, and zero otherwise.

Using Compustat data we create controls for bank size and capital. *size* is defined as the natural logarithm of the bank's total assets, and *capital* is defined as the ratio of market value of equity to total assets. Table 2 summarizes the definitions of our variables and presents the data source.

Table 2

We also examine how each component of a CEO's pay changes around the passage of Dodd-Frank. We do so by examining how four components of the CEO package changes following 2009. Specifically, we examine the changes in cash bonus (*bonus*), restricted stock awards (*stock*), options (o*ptions*), and long-term performance-based compensation (*LTIP*).

As discussed earlier, if regulatory scrutiny of effects of compensation on bank risk taking increased following the financial crisis, we expect the components of equity-based compensation to change; with a decrease in reliance on time-based option grants and an increase in performance-based restricted stock grants. To examine changes in the components of equity-based

compensation, we decompose equity-based compensation into four components based on the type of vesting provisions. (1) the dollar value of performance-vesting restricted stock (*pv stock),* is defined as the dollar value of newly awarded performance-vesting restricted stocks; (2) the dollar value of performance-vesting options (*pv option),* is defined as the dollar value of newly granted performance-vesting options; (3) the dollar value of time-vesting restricted stock (*tv stock),* is defined as the dollar value of newly awarded time-vesting restricted stocks; and (4) time-vesting options (*tv option),* is defined as the dollar value of newly granted time-vesting options. Dodd-Frank emphasized that compensation increase its emphasis on non-financial performance metrics. We define the variable *finacc ratio* to be the ratio of financial and accounting metrics to total performance metrics. We manually collect from a bank's proxy statements, annual or quarterly report whether anti-hedging provisions were introduced in a sample year.

Table 3 presents the descriptive statistics of the different variables. The average *prevega* is 0.50, with a median value of 1. These estimates are similar to those reported for non-financial firms reported in other studies. There seems to be an equal number of observations in the pre- and post-Dodd-Frank period. The average bank size is 16.49, with a corresponding median value of 16.18. The average bank capital ratio is 12%, with a corresponding median value of 10%. The average annualized standard deviation of daily stock returns (*bank risk*) is 35.5%, with a corresponding median value of 27.4%. The average Tobin's Q (ROA) is 1.13 (3.22), with median value of 1.05 (2.36), respectively.

Table 3

V. Empirical Results

VA. Compensation Structure Changes in the Post Dodd-Frank Era

We begin our empirical analysis by examining which compensation variable changed more in the diff-in-diff framework of equation (1). The coefficient of interest is β which is the average treatment effect that compares the difference between banks in the high-*prevega* group and banks in the low-*prevega* group during the post-Dodd-Frank period. We begin by examining the various components of CEO pay (namely, bonus, restricted stock awards, option grants, and LTIPs). The results of these regressions are given in Table 4.

Table 4

In column (1), we examine if bonuses change due to Dodd-Frank. We find a negative relationship for *bonus* that is statistically significant at the five-percent level. Banks in the high-*prevega* group decline bonus by $0.385 million than banks in the low-*prevega* group after Dodd-Frank period relative to pre-Dodd-Frank period. The difference between high- and low-*prevega* banks is equal to 32.4% of the standard deviation of bonus. These results are consistent with the predictions of support hypothesis 6. Next, we analyze if restricted stock awards changed with Dodd-Frank. As shown in column (2) we find a strong positive relation between stock-based compensation and high-*prevega* indicating the high-*prevega* banks increased stock-based compensation more than other banks in our sample. The average restricted stock value for banks in the high-*prevega* group is $1.447 million dollars higher than those in the low-*prevega* group, and this estimate is half of restricted stock's one standard deviation. In column (3) we examine the relationship of options granted (*options*) and find a strong negative relationship. Banks in the high-*prevega* group reduce their CEO's options by $1.976 million. The economic magnitude of this estimate is equal to 77.5% of the standard deviation of options. These results support hypothesis

1. Similarly, in column (3), we find an increase in long-term incentive plans (LTIP).[14] This estimate suggests that banks of high-*prevega* group raise their CEO's long-term incentive plans by $1.419 million compared with banks of low-*prevega* group. The estimate is equal to 65.7% of the standard deviation of LTIP. These results support hypothesis 3.

In summary, the above results indicate that restricted stock awards increased, and options granted decreased, after Dodd-Frank. We next examine if the changes in restricted stock and options was driven by Dodd-Frank's emphasis of structuring bank CEO pay towards incentive compensation that does not lead to excessive risk taking. The results of this analysis are presented in Table 5. As shown in columns (1) and (4), we find a positive relationship for performance-vesting restricted stock awards and a negative relationship for time-vesting option grants. This indicates that there was a substitution of time-vesting option grants with performance-vesting restricted stock awards. The coefficient of column (1) shows that banks in the high-*prevega* group increase performance-vesting stocks by $1.812 million than banks in the low-*prevega* group in the post Dodd-Frank era; the economic magnitude of this estimate is equal to 71.3% of the standard deviation of performance-vesting restricted stock. The coefficient of column (4) suggests that banks in the high-*prevega* group reduce time-vesting options by $1.613 million compared with banks in the low-*prevega* group; and the estimate's economic magnitude is equal to half of one standard deviation of time-vesting options. No statistically significant changes are found for performance-vesting option grants (column (2)), or time-vesting restricted stock awards (column (3)), respectively. These results support hypothesis 2.

Table 5

[14] LTIP is defined in the reporting requirements as performance-based stock awards plus performance-based option grants.

Finally, we examine how other compensation structures[15] might have changed after Dodd-Frank, the results of which are given in Table 6. In column (1), we find that the emphasis on non-financial performance metrics significantly increased in the post Dodd-Frank era. The coefficient of column (1) shows that banks in the high-*prevega* group decline the finance performance metrics ratio by 10.4% than banks in the low-*prevega* group; and this estimate is equal to 43.3% of the standard deviation of financial performance metrics. This is evidence for hypothesis 4. In column (2), we find a statistically insignificant difference in deferred compensation between the high-*prevega* group and the low-*prevega* group in the post Dodd-Frank era. This is evidence against hypothesis 5. In column (3) we find anti-hedging provisions to significantly increase, which is evidence in support of hypothesis 7. The coefficient of column (2) indicates that banks in the high-*prevega* group increase the probability of creating anti-hedging provisions by 16.6% than banks in the low-*prevega* group. This estimate is equal to 42.6% of the standard deviation of anti-hedging provisions.

Table 6

In summary, we find that performance-vesting restricted stock awards went up, as did long-term incentive plans (LTIPs), anti-hedging provisions and emphasis on non-financial measures of performance. Conversely, we find decreases in the use of time-vesting options and bonuses.

VB. Who Are These High and Low Pay-Risk Sensitivities Banks in the Pre-Dodd-Frank Period and What Are Their Characteristics?

We now examine which banks have high pay-risk sensitivities before Dodd-Frank and which banks have low pay-risk sensitivities. In Panel A of Table 7, we estimate a Probit regression where the dependent variable is unity if the bank is in the high-*prevega* group, and zero otherwise.

[15] We also examined the present value of pensions and the vesting periods of restricted stock, options, and LTIPs and found no significant changes after Dodd-Frank. These results are not reported but are available from the authors.

The independent variables are as follows: bank size, capital, ratio of mortgage-backed securities (MBS) to assets, ratio of real estate loans to assets, and ratio of non-interest income to assets in the pre-Dodd-Frank period. We find only bank size to be statistically significant. Panel B of Table 7 provides the names of banks ranked by *prevega*. In the first column we observe that large banks (for example, JPMorgan Chase, Bank of America, Wells Fargo) have high *prevega*. In the second column we observe that smaller banks (for example, Pacwest Bancorp, First Republic Bank, AMRESCO Comm. Finl.) have low *prevega*. This pattern confirms our Probit regression results that the larger the bank the more likely it has a high *prevega* before Dodd-Frank.

Table 7

In Panel B we list the top-15 banks in each group of high and low pay-risk sensitivity banks. Consistent with the results in Panel A, the top-15 high pay-risk sensitivity banks include large banks like Wells Fargo, JPMorgan Chase, and Bank of America. Conversely, the top-15 low pay-risk sensitivity banks include small banks like Pacwest Corp, MUFG Holdings Corp., and Signature Bank. Note by using bank-level fixed effects helps mitigate these cross-sectional differences.

VC. Impact of Changes in Compensation Structures on Bank Risk and Performance

In this section we examine how endogenously chosen compensation structures changes following Dodd-Frank are related to bank risk and performance in the post-Dodd-Frank period. The findings for this analysis are presented in Tables 8 and 9. Note that we cannot include all the endogenously determined compensation variables in one regression specification, because each of them has the same instrumental variable $\text{high\_}p\text{revega}_i * DF$. Table 8 presents the 2SLS regression findings for bank risk. We find that the differences between the two groups of banks' post-Dodd-Frank stock return volatility is lower when bonuses and time-vesting options grants,

decreased more for high-*prevega* banks. Conversely, the differences between the two groups of banks' post-Dodd-Frank stock return volatility is lower when performance-vesting restricted stock, LTIPs, emphasis on non-financial performance metrics and anti-hedging provisions increased. The coefficient of bonus is 12.24, which for a one standard deviation in decrease in bonus suggests a 14.6% decrease in bank risk. The coefficient of LTIP is -3.32, which for a one standard deviation increase in LTIP suggests a 7.2% decrease in bank risk. The coefficient of performance-vesting stock is -3.82 which for a one standard deviation increase in performance-vesting stock suggests a 9.7% decrease in bank risk. The coefficient of time-vesting options is 3.58, which for a one standard deviation decrease in time-vesting options suggests a 11.0% decrease in bank risk. The coefficient of *finacc ratio* is 60.20, which for a one standard deviation decrease in financial performance metrics suggests a 14.4% decrease in bank risk. The coefficient of anti-hedging provisions is 31.79, which for a one standard deviation increase in anti-hedging provisions suggests a 12.4% decrease in bank risk. Therefore, the decreases in bank risk range from 7.2% (from changes in LTIP) to 14.6% (from changes in bonus).[16]

Tables 8 & 9

Table 9 presents the 2SLS regression results for bank performance. Panel A presents the results for Tobin's Q, and Panel B presents the results for ROA. In both panels we do not find any statistically significant relationship between bank performance and the compensation variables. The above results suggest that Dodd-Frank seems to have achieved its intended legislative intent of reducing excessive pay-risk in the banking industry, without adversely impacting bank performance.

[16] We are unbale to calculate the *relative* importance of each component of compensation on bank risk because the compensation components are highly correlated with each other.

The above results show that bank risk differences between the two groups of banks' post-Dodd-Frank risk (namely, stock return volatility) decreased over the sample period. We hence examine which group of banks reduced their risk after Dodd-Frank? In other words, did the low-*vega* banks increase their risk, and/or did the high-*vega* banks decrease their risk? In order to do so, we begin by estimating for the full sample equation (5) below.

$$Bank\ risk_{i,t} = \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t} \qquad (5)$$

We then calculate the average excess risks (ε_{it}) across four groups: low-*vega* banks in the pre-Dodd-Frank period, high-*vega* banks in the pre-Dodd-Frank period, low-*vega* banks in the post-Dodd-Frank period, and high-*vega* banks in the post-Dodd-Frank period, respectively. For ease of analysis, we net out the excess risk of the first group (i.e., low-*vega* banks in the pre-Dodd-Frank period) from the excess risks of the other three groups. The results of such an analysis are given in Table 10. Row (1) shows that there was no significant difference in the average excess risks between the low- and high-*prevega* groups in the pre-Dodd-Frank period. This suggests that there is no time trend in excess risks in the pre-Dodd-Frank period. However, we find that excess risk is significantly lower for high-*prevega* banks in the post-Dodd-Frank period. These results suggest that the risk reduction we found in Panel A of Table 8 is due to the lower excess risks of high pay-risk banks in the post-Dodd-Frank period.

Table 10

VD. Robustness Tests

We conduct three sets of robustness tests. The first robustness test uses the average sample volatility to calculate *prevega* instead of using an individual bank's stock return volatility (Guay 1999; Coles *et al.* 2006; Hayes *et al.* 2012). By doing so, we control for reverse causality from an

individual bank's risk to compensation. We run six regression models, the results of which are given in Table 11. In the first-stage regressions we find consistent results with the results in Tables 4-7. Specifically, we once again find differences in performance-vesting restricted stock awards, LTIPs, anti-hedging provisions and emphasis on non-financial measures of performance to go up after Dodd-Frank, and differences in time-vesting options grants, and bonuses to go down. When we examine the second-stage regression results, we find once again that bank risk goes down with changes in compensation. There are no corresponding changes in bank performance.

Table 11

In the second robustness test, we redefine the pre-Dodd-Frank period as 2000-2007 to calculate *prevega* instead of 2000-2009. We run six regression models, the results of which are given in Table 12. In the first-stage regressions we find consistent results with the results in Tables 4-7. Additionally, the second-stage regression results show that bank risk goes down with changes in compensation, but there is no corresponding change in bank performance. [17]

Table 12

In the third robustness test, we repeat our analysis on the two groups of banks by classifying them by pay-performance sensitivities *(predelta*) instead of pay-risk sensitivities (*prevega*). In Table 13, we find that bank risk generally does not statistically significantly decrease (except LTIP). Consistent with our previous results bank performance does not change.

[17] We also examined bank performance defined as stock returns, and excess returns using the 4-factor model of Demsetz and Strahan (1999). The 4-factors consist of total market returns, the change in the yield on the 3-month Treasury Bill (short-term interest rate), the change in the spread between the 10-year and 3-month Treasury rates (term structure), and the change in the spread between rates on Moody's Baa-rated corporate bonds and 30-year Treasury Bonds (credit spread). We find stock returns and excess returns to be generally statistically insignificant and consistent with the results on Tobin's Q and ROA. We also examined a sample of manufacturing firms (SIC codes between 2000 and 3999) to analyze if Dodd-Frank impacted these firms differently than banks. We find volatility to go up after Dodd-Frank, in stark contrast to banks where we find volatility to go down. These results are not reported but are available from the authors.

Table 13

VI. Conclusions

In this paper we examine changes in the relationship between bank risk and the structure of CEO compensation following the enactment of the Dodd-Frank Act of 2010. The basic idea is that effect of greater regulatory scrutiny of compensation in the post-Dodd-Frank era is likely to vary with a bank's pre-Dodd- Frank pay-risk sensitivity. Using the diff-in-diff methodology, we find significant differences between high and low pay-risk sensitivity banks. We find significant increases in performance-vesting restricted stock awards, LTIPs, anti-hedging provisions and emphasis on non-financial measures of performance after Dodd-Frank. We also find significant decreases in time-vesting options grants and bonuses. Instrumenting for these significant differences in compensation structure, we find that bank risk goes down in the post-Dodd-Frank period. This is driven by reductions in the risk of high pay-risk banks after Dodd-Frank. Finally, we find no significant differences in bank performance. We conduct several robustness tests that show that the above results are robust.

Our results suggest that Dodd-Frank achieved its intended legislative intent of reducing excessive pay-risk without adversely impacting bank performance. Future research might conduct a similar analysis of bank risk and performance due to the Covid crisis.

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Figure 1: Timeline for the Passage of Dodd-Frank Act in US Congress

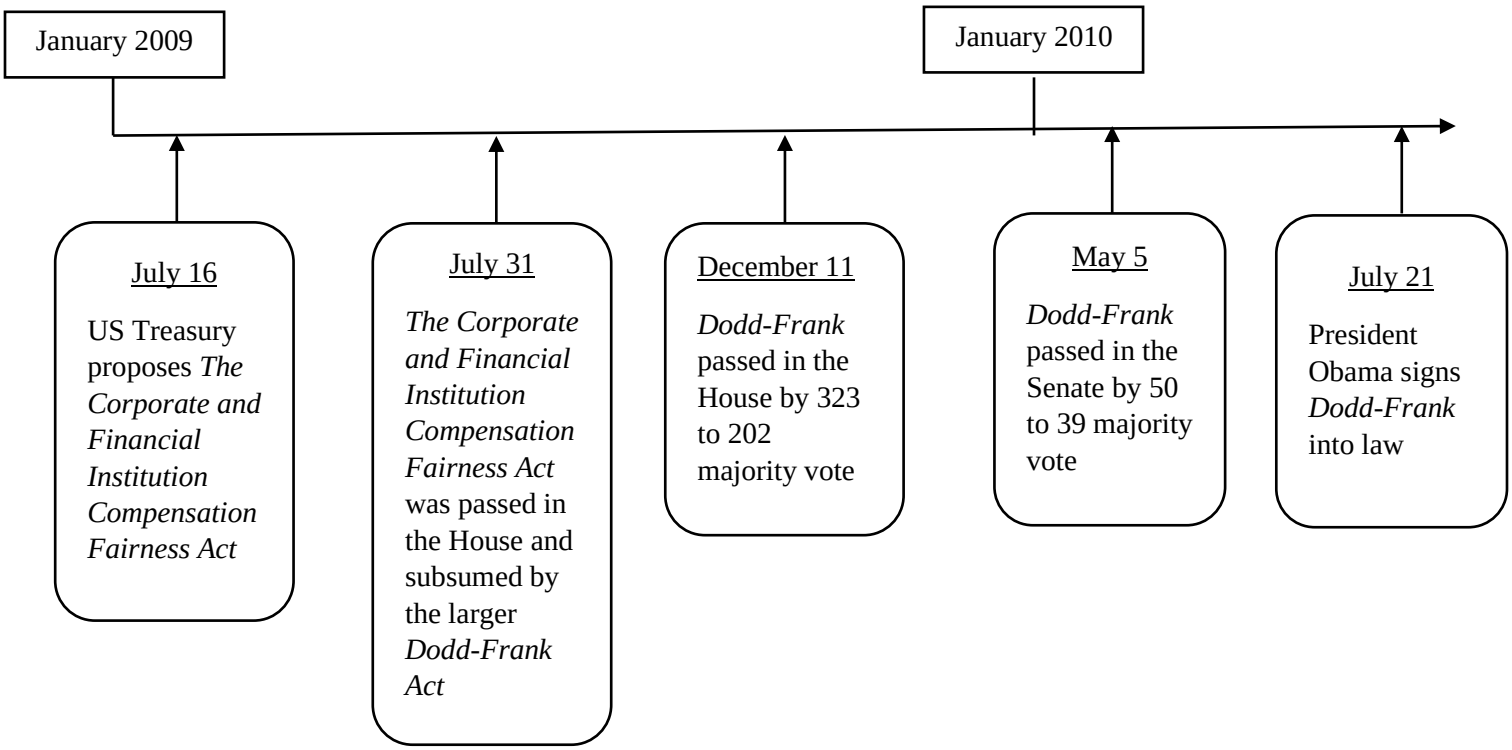

Figure 2: Impact of Changes in CEO Compensation Structure Due to More Severe Regulatory Scrutiny (i.e., Dodd-Frank) on Bank Risk and Performance

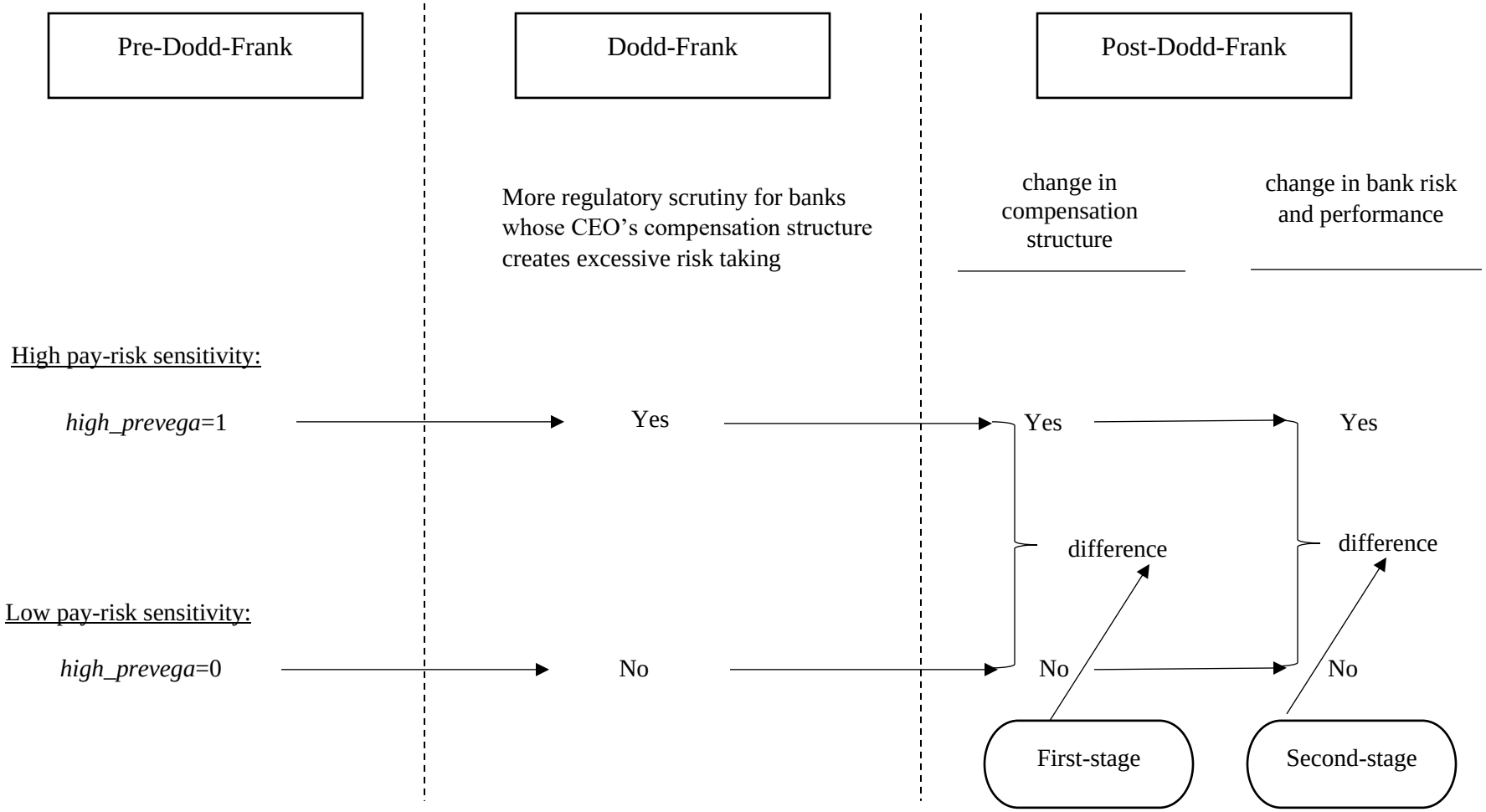

Table 1: Creation of Samples

Sample Selection Criteria	# of Unique Bank-Holding Companies	# of Observations
SIC between 6000 and 6199 in ExecuComp (2000-2019)	249	2,823
Delete missing values for *size*, *capital*, and *vega*	216	2,367
Sub-sample from 2006 to 2019 (when deferred compensation and anti-hedging data is available)	172	1,709

Table 2: Variable Definitions and Sources

Variable Names	Definition (Units)	Source
Sample: 2000-2019		
high_prevega$_i$	Dummy equal to 1 if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, otherwise equal to 0	ExecuComp
DF	Dummy equal to 1 if year is from 2010 to 2019, otherwise equal to 0	Compustat
size	Natural logarithm of total assets	Compustat
capital	Ratio of market value of equity to total assets	Compustat
bonus	$ bonus (million)	ExecuComp
stock	$ newly granted restricted stock (million)	ExecuComp
options	$ newly granted options (million)	ExecuComp
LTIP	$ long-term incentive plan payouts (million)	ExecuComp
pv stock	$ newly granted performance-vesting restricted stock (million)	Incentive Lab
pv option	$ newly granted performance-vesting options (million)	Incentive Lab
tv stock	$ newly granted time-vesting stocks (million)	Incentive Lab
tv option	$ newly granted time-vesting options (million)	Incentive Lab
finacc ratio	Ratio of financial or accounting goals to total goals	Incentive Lab
deferred comp.[18]	Present value of deferred compensation (million)	ExecuComp
bank risk	Annualized standard deviation of daily stock returns	CRSP
Tobin's Q	Book value of debt plus market value of equity divided by total assets	Compustat
ROA	Ratio of operating income to total assets (percent)	Compustat
anti-hedging	Dummy equal to 1 if bank adopts an anti-hedging provision with respect to compensation, otherwise equal to 0	Manually collected from proxy statement, annual report, or quarterly report

[18] Sample period is 2006 to 2019 because proxy statements disclosed deferred compensation information after 2005, and banks generally adopted anti-hedging provisions after 2010.

Table 3: Summary Statistics

Variable	N	Mean	S.D	Min	25%	50%	75%	Max
Panel A: 2000-2009								
high_prevega	2,367	0.50	0.50	0.00	0.00	1.00	1.00	1.00
DF	2,505	0.52	0.50	0.00	0.00	1.00	1.00	1.00
size	2,505	16.49	1.63	13.06	15.42	16.18	17.33	21.36
capital	2,505	0.12	0.09	0.02	0.08	0.10	0.12	0.62
bonus	2,505	0.47	1.19	0.00	0.00	0.00	0.38	7.40
stock	2,505	1.48	2.79	0.00	0.00	0.30	1.57	14.67
options	2,494	0.94	2.55	0.00	0.00	0.00	0.53	17.00
LTIP	2,505	0.85	2.16	0.00	0.00	0.00	0.51	12.41
pv stock	1,157	1.37	2.54	0.00	0.00	0.00	1.81	12.81
pv option	1,157	0.02	0.17	0.00	0.00	0.00	0.00	1.50
tv stock	1,157	1.16	2.39	0.00	0.00	0.00	1.34	14.20
tv option	1,157	1.25	3.07	0.00	0.00	0.00	0.96	20.41
finacc ratio	937	0.84	0.24	0.00	0.75	1.00	1.00	1.00
deferred comp	847	3.84	6.90	0.00	0.29	1.09	4.31	36.54
bank risk	2,505	35.47	22.21	14.21	22.43	27.59	40.14	130.26
Tobin's Q	2,505	1.13	0.35	0.94	1.01	1.05	1.11	3.64
ROA	2,494	3.22	3.74	-1.30	1.92	2.36	3.00	22.88
anti-hedging	1,845	0.19	0.39	0.00	0.00	0.00	0.00	1.00

Table 4: Impact of Dodd-Frank on Components of CEO Compensation

$$Comp_{it} = \beta \times high\_prevega_{\mathrm{i}} * DF + \gamma^{'} X_{(i,t)} + \alpha_i + \delta_t + \epsilon_{(i,t)}$$

where *high_prevega*$_i$ is a dummy equal to unity if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, otherwise equal to 0, *DF* is a dummy variable equal to unity from 2010 onwards, α_i indicates the dummy variables for each individual bank *i*, δ_t indicates year dummies, ϵ_{it} are the error terms, and the model specification follows Pierce and Schott (2016). Column headings show the relevant compensation variables examined. The sample period is from 2000 to 2019 and the control variables in X_{it} are *size* and *capital*. Robust standard errors are given in parentheses and are clustered at the bank-level. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively All variables are defined in Table 2.

Compensation variable =	*bonus*	*stock*	*options*	*LTIP*
	(1)	(2)	(3)	(4)
high_prevega$_i$**DF*	-0.385**	1.447***	-1.976***	1.419***
	(0.178)	(0.396)	(0.372)	(0.376)
Observations	2,367	2,367	2,356	2,367
Adj.R^2	0.58	0.60	0.51	0.41
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes

Table 5: Impact of Dodd-Frank on Performance-Vesting v. Time-Vesting for Stock and Options

$$Comp_{it} = \beta \times high\_prevega_i * DF + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$

where *high_prevega*$_i$ is a dummy equal to unity if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, and otherwise equal to 0; *DF* is a dummy variable equal to unity from 2010 onwards; α_i indicates the dummy variables for each individual bank *i*; δ_t indicates year dummies; ϵ_{it} are the error terms; and the model specification follows Pierce and Schott (2016). Column headings show the relevant compensation variables examined. The sample period is from 2000 to 2019 and the control variables in X_{it} are *size* and *capital*. Robust standard errors are given in parentheses and are clustered at the bank-level. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively All variables are defined in Table 2.

Compensation variable =	*performance-vesting*		*time-vesting*	
	stock	*options*	*stock*	*options*
	(1)	(2)	(3)	(4)
high_prevega$_i$**DF*	1.812***	0.010	-0.264	-1.613***
	(0.485)	(0.022)	(0.312)	(0.470)
Observations	1,134	1,134	1,134	1,134
Adj.R^2	0.52	0.23	0.32	0.40
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes

Table 6: Impact of Dodd-Frank on Other Compensation Structures

$$Comp_{it} = \beta \times high\_prevega_i * DF + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{it}$$

where *high_prevega*$_i$ is a dummy equal to unity if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, and otherwise equal to 0; *DF* is a dummy variable equal to unity from 2010 onwards; α_i indicates the dummy variables for each individual bank *i*; δ_t indicates year dummies; ϵ_{it} are the error terms; and the model specification follows Pierce and Schott (2016). Column headings show the relevant compensation variables examined. The control variables in X_{it} are *size* and *capital*. Robust standard errors are given in parentheses and are clustered at the bank-level. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively All variables are defined in Table 2.

Compensation variable =	*finacc ratio*	*deferred comp*	*anti-hedging*
	(1)	(2)	(3)
high_prevega$_i$**DF*	-0.104***	-0.921	0.166***
	(0.052)	(1.430)	(0.058)
Observations	915	826	1,708
Sample period	2000-2019	2006-2019	2006-2019
Adj.R^2	0.38	0.57	0.54
Control Variables	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes

Table 7: Differences in Banks with High Pay-Risk Sensitivities and Banks with Low Pay-Risk Sensitivities before Dodd -Frank

For Panel A, we estimate a Probit regression where the dependent variable is unity if the bank is in the high-*prevega* group before Dodd-Frank, and zero otherwise. The independent variables are as follows: *size*, *capital*, ratio of mortgage-backed securities to assets (*MBS*), ratio of real estate loans to assets (*RE*), and ratio of non-interest income to assets (*NII*); all in in the pre-Dodd-Frank period. Robust standard errors are given in parentheses. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively

Panel A: Probit regression

Variable	*constant*	*size*	*capital*	*MBS*	*RE*	*NII*
Coefficient	-20.715***	1.212***	6.609	0.975	0.328	18.559
S.e	(3.382)	(0.214)	(5.970)	(1.647)	(1.180)	(16.148)

Panel B: Top-15 banks ranked by *prevega*

	Ranked highest to lowest		Ranked lowest to highest	
Rank	Name	*size*	Name	*size*
1	Capital One Financial	18.063	Pacwest Bancorp.	15.449
2	Wells Fargo	20.038	Popular Inc.	17.456
3	JPMorgan Chase & Co.	20.834	MUFG Americas	17.542
4	American Express Co.	18.795	AMRESCO Comm. Finl.	13.48
5	Washington Mutual Inc.	19.463	Signature Bank	15.685
6	MBNA	17.744	Legacy Tex Financial	14.538
7	US Bancorp	19.079	Intl. Bancshares Corp.	16.28
8	HSBC Finance Corp.	18.286	Southside Bancshares	14.706
9	Concord EFS Inc.	14.606	Columbia Banking Sys.	14.912
10	US Bancorp DE/old	18.285	PRA Group Inc.	13.279
11	Bank One Corp.	19.467	Bancfirst Corp-OK	15.152
12	Countrywide Financial	18.324	Park National	15.742
13	Bank of America	20.81	First Republic Bank	16.269
14	Navient Corp.	18.255	Capitol Federal Finl.	15.9
15	Wachovia Corp.	19.921	Finova Group Inc.	15.998

Table 8: 2SLS Impact of Changes in Compensation Due to Dodd-Frank on Bank Risk

$$Bank\ risk_{it} = \mu \times \widehat{compensation\ structure}_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it}$$

where compensation structure is instrumented by high_prevega$_i$ $*$ DF. *high_prevega*$_i$ is a dummy equal to unity if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, and otherwise equal to 0; *DF* is a dummy variable equal to unity from 2010 onwards; α_i indicates the dummy variables for each individual bank *i*; δ_t indicates year dummies; ϵ_{it} are the error terms; and the model specification follows Pierce and Schott (2016). *Bank risk* is the annualized standard deviation of stock returns. The control variables in X_{it} are *size* and *capital*. Robust standard errors are given in parentheses and are clustered at the bank-level. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively. All variables are defined in Table 2.

Bank risk	(1)	(2)	(3)	(4)	(5)	(6)
bonus	12.239*					
	(7.128)					
LTIP		-3.322**				
		(1.318)				
performance-vesting stock			-3.189**			
			(1.324)			
time-vesting options				3.583**		
				(1.533)		
finacc ratio					60.202**	
					(30.170)	
anti-hedging						-31.794**
						(16.174)
Observations	2,367	2,367	1,134	1,134	915	1,708
Adj.R^2	0.54	0.71	0.74	0.61	0.50	0.66
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 9: 2SLS Impact of Changes in Compensation Due to Dodd-Frank on Bank Performance

$$\text{Bank Performance}_{it} = \mu \times \widehat{compensation\ structure}_{it} + \gamma' X_{it} + \alpha_i + \delta_t + \epsilon_{it}$$

where compensation structure is instrumented by high_prevega$_i$ $*$ *DF*. *high_prevega*$_i$ is a dummy equal to unity if average *vega* of bank *i* from 2000 to 2009 is greater than median value of *vega* from 2000 to 2009, and otherwise equal to 0; *DF* is a dummy variable equal to unity from 2010 onwards; α_i indicates the dummy variables for each individual bank *i*; δ_t indicates year dummies; ϵ_{it} are the error terms; and the model specification follows Pierce and Schott (2016). In Panel A, the dependent variable is Tobin's Q, and in Panel B the dependent variable is ROA, respectively. The control variables in X_{it} are *size* and *capital*. Robust standard errors are given in parentheses and are clustered at bank level. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively. All variables are defined in Table 2.

Panel A: Tobin's Q						
	(1)	(2)	(3)	(4)	(5)	(6)
bonus	0.072					
	(0.077)					
LTIP		-0.020				
		(0.019)				
performance-vesting stock			-0.015			
			(0.019)			
time-vesting options				0.017		
				(0.022)		
finacc ratio					0.225	
					(0.377)	
anti-hedging						-0.165
						(0.206)
Observations	2,367	2,367	1,134	1,134	915	1,708
Adj.R^2	0.80	0.81	0.90	0.89	0.90	0.81
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: ROA						
	(1)	(2)	(3)	(4)	(5)	(6)
bonus	-0.173					
	(0.790)					
LTIP		0.045				
		(0.208)				
performance-vesting stock			-0.058			
			(0.146)			
time-vesting options				0.071		
				(0.177)		
finacc ratio					0.515	
					(2.901)	
anti-hedging						1.293
						(2.365)
Observations	2,356	2,356	1,123	1,123	904	1,700
Adj.R^2	0.84	0.84	0.92	0.92	0.92	0.83
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 10: Average Excess Risk

This table presents bank excess risk for four groups, high- and low-*prevega*, and pre- and post-Dodd-Frank, respectively. We estimate bank excess risk $\epsilon_{i,t}$ by estimating the equation $Bank\ risk_{i,t} = \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$ from 2000 to 2019. X_{it} are *size* and *capital*, α_i indicates dummy variables for each individual bank i, and δ_t indicates year dummies. Each cell shows the average of bank excess risk, normalized by subtracting the average of bank excess risk in the low-*prevega* group in the pre-Dodd-Frank period. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; and * denotes statistical significance at the 10% level, respectively. All variables are defined in Table 2.

Period	low-*prevega*	high-*prevega*	*t*-statistic for differences in means
Pre-Dodd-Frank period (2000-2009)	0.000%	0.500%	(-0.488)
Post-Dodd-Frank period (2010-2019)	-1.592%	-3.563%	(3.108)***
t-statistic for differences in means	(1.638)	(5.688)***	

Table 11 (Robustness Test 1) : Using Sample Mean Volatility Rather than Individual Bank Volatility in Defining *prevega*

		First-Stage	Second-Stage		
Regression	Compensation	Compensation	Bank Risk	Tobin's Q	ROA
(1)	*Bonus*	-0.380**	12.870*	0.076	-0.170
		(0.185)	(7.581)	(0.081)	(0.832)
(2)	*LTIP*	1.428***	-3.423**	-0.020	0.044
		(0.381)	(1.335)	(0.020)	(0.214)
(3)	*performance-vesting stock*	1.797***	-3.188***	-0.014	-0.042
		(0.472)	(1.180)	(0.019)	(0.143)
(4)	*time-vesting options*	-1.714***	3.343**	0.015	0.049
		(0.467)	(1.289)	(0.020)	(0.164)
(5)	*finacc ratio*	-0.113**	53.921**	0.183	0.318
		(0.050)	(24.022)	(0.342)	(2.609)
(6)	*anti-hedging*	0.163***	-33.420*	-0.177	1.359
		(0.059)	(17.097)	(0.218)	(2.557)

Table 12 (Robustness Test 2) : Redefining the Pre-Dodd-Frank Period as 2000-2007 Instead of 2000-2009

		First-Stage	Second-Stage		
Regression	Compensation	Compensation	Bank Risk	Tobin's Q	ROA
(1)	*Bonus*	-0.405**	14.048*	0.059	0.845
		(0.191)	(7.780)	(0.066)	(0.719)
(2)	*LTIP*	1.365***	-4.174***	-0.018	-0.242
		(0.391)	(1.531)	(0.018)	(0.174)
(3)	*performance-vesting stock*	1.708***	-3.567**	-0.034	-0.261
		(0.506)	(1.442)	(0.021)	(0.183)
(4)	*time-vesting options*	-1.780***	3.425**	0.033*	0.271
		(0.485)	(1.335)	(0.020)	(0.170)
(5)	*finacc ratio*	-0.106**	62.516**	0.558	4.535
		(0.050)	(30.653)	(0.437)	(3.696)
(6)	*anti-hedging*	0.137**	-45.205*	-0.164	-2.279
		(0.061)	(24.173)	(0.240)	(2.297)

Table 13 (Robustness Test 3) : Using *predelta* Rather Than *prevega* to Classify Banks Before Dodd-Frank

	Bonus	*LTIP*	*performance-vesting stock*	*time-vesting options*	*finacc ratio*	*anti-hedging*
	(1)	(2)	(3)	(4)	(5)	(6)
Bank Risk	14.593	-3.132**	-2.662	2.830	34.084	-30.756
	(10.256)	(1.429)	(2.006)	(2.436)	(25.671)	(18.783)
Tobin's Q	0.117	-0.025	-0.013	0.014	0.194	-0.225
	(0.120)	(0.022)	(0.022)	(0.024)	(0.341)	(0.254)
ROA	0.236	-0.049	-0.225	0.277	2.780	0.448
	(1.136)	(0.232)	(0.231)	(0.303)	(3.431)	(2.841)