IMPACT OF INCREASED REGULATORY FOCUS ON CEO PAY AND BANK RISK

Hengguo Da[a], Christopher James [b], and Darius Palia [c]

September 2025

Abstract

Due to the financial crisis, this paper examines the **causal** impact of increased regulatory pressure on the structure of CEO bank pay and its impact on bank equity risk. According to the excellent survey by Edmans, Gabaix, and Jenter (2017), few studies have examined causal connections between compensation structures and firm outcomes. But in 2010, due to the financial crisis, politicians and regulators either explicitly or implicitly forced the compensation structure of banks to become more long-term oriented and less convex. Did these reforms have the desired effect? In a short answer, YES!

As our treated group, we use three different definitions for which banks' compensation structure were explicitly, or more likely to be, scrutinized by financial regulators. We then employ a diff-in-diff model to isolate the impact of increased regulatory focus at the end of the financial crisis on the impact of bank CEO compensation structure and equity risk. Comparing the differential impact between the treated and control banks, we find that performance-vesting restricted stock awards, LTIPs, and anti-hedging provisions increased after regulatory focus increased, and time-vesting options grants decreased. Instrumenting for these differences in compensation structure, we find that idiosyncratic risk and systemic risk went down when regulatory focus increased, and this reduction is driven by the treated group. These results suggest that regulatory focus to make bank compensation structure more long-term oriented and less convex did successfully cause banks' idiosyncratic and systemic risks to decrease. No significant effect is found for differences in bank equity performance.

JEL codes: G01, G21, G32, G38

---

[a] SWUFE, [b] University of Florida, and [c] Rutgers Business School, respectively, We thank Viral Acharya, Yakov Amihud, Allen Berger, Dick Berner, Ivan Brick, Valentin Dimitrov, Richard Engle, Priyank Gandhi, Yanrong Jia, Kose John, Simi Kedia, Sophia Li, Oded Palmon, George Pennacchi, Thomas Philippon, Robert Prilmeier, Leili Rostami, Avanidhar Subrahmanyam, David Yermack, and seminar participants at Baruch, Florida, Fordham, Oregon, Rutgers, NYU, Tulane, 2021 FMA (Denver) meetings, and 2023 CELS (U. Chicago) meetings for helpful discussions and comments. We thank Mustafa Emin for research assistance. Corresponding author: Darius Palia, dpalia@business.rutgers.edu. All errors remain our responsibility.

Impact of Increased Regulatory Focus on CEO Pay and Bank Risk

"Identifying the **causal effect** of compensation contracts on any interesting outcomes is extraordinarily difficult. … There are almost no instrumental variables or natural experiments that create as-good-as-random variation in compensation contracts. … **we strongly welcome any additions to this list** (emphasis added)."

Edmans, Gabaix and Jenter (p. 387)[1]

I. Introduction

Many politicians and regulators have argued that a major reason for the financial crisis of 2007-2008 was that the structure of bankers' pay packages **caused** banks to take excessive risks. The aggregate sentiment in their conclusions was that banker's compensation was too short-term oriented and not focused enough on risk taking -- what we academics call "too convex" or with "high-*vega"*. Due to the financial crisis, regulatory focus increased substantially. The first instance of increased regulatory scrutiny was the congressional committee hearings on bank compensation and risk taking in June 2009 – coincidentally the last month of the financial crisis -- ranking republican Representative Spencer Bachus states "I thank you for holding hearings on executive compensation , which is **the first of a series on regulatory reform** (emphasis added) in the future of our financial system."[2] Similarly, chairman of the committee, Representative Barney Frank (democrat) states "I believe that it is now clear, and I am reinforcing that by a number of authorities -- Paul Volcker for example, Chairman Bernanke, people in the British Financial Services Authority-- that the problem with compensation is that it has encouraged excessive risk-taking. …

[1] Edmans, A., Gabaix, X., Jenter, D., 2017, Executive compensation: A survey of theory and evidence. Chapter 7 in The Handbook of the Economics of Corporate Governance, Volume 1., 383-539 Elsevier.

[2] Compensation Structure and Systemic Risk, Hearing before the Committee on Financial Services, US House of Representatives, June 11, 2009, p.1. and 3.

We are not talking here about amounts. We are talking about the **structure of compensation** (emphasis added)."

The Financial Crisis Inquiry Commission (FCIC)[3] also concluded that "Compensation systems … too often rewarded the quick deal, the short-term gain - without proper consideration of long-term consequences. Often, those systems encouraged the big bet - where the payoff on the upside could be huge and the downside limited". Similarly, Sheila Blair,[4] Chair of the FDIC, said that "The crisis has shown that most financial institution compensation systems were not properly linked to risk management. Formula-driven compensation allows high short-term profits to be translated into generous bonus payments, without regard to any longer-term risks". SEC Chair Mary Schapiro[5] stated "Many major financial institutions created asymmetric compensation packages that paid employees enormous sums for short-term success, even if these same decisions result in significant long-term losses or failure for investors and taxpayers."

In late 2009, the Federal Reserve issued Proposed Guidelines[6] to help ensure that incentive compensation at banking organizations does not encourage excessive risk-taking. In June 2010, these guidelines were adopted by all the federal banking agencies, i.e., FDIC, Fed, OCC, and OTS, respectively. According to the 2011 Report on Incentive Practices for banks issued by the Federal

[3]The FCIC was created by the Fraud Enforcement and Recovery Act of May 2009. The FCIC consisted of six democrats and four republicans. Its first meeting was held on September 17, 2009, and it issued its final report in January 2011. The cited statements were from p. xix of the final report (Final Report in of the National Commission on the Causes and Consequences of the Financial Crisis in the United States).

[4] Sheila C. Bair, written testimony for the FCIC, First Public Hearing of the FCIC, day 2, panel 1: Current Investigations into the Financial Crisis—Federal Officials, January 14, 2010, p. 22.

[5] Mary L. Schapiro, written testimony for the FCIC, First Public Hearing of the FCIC, day 2, panel 1: Current Investigations into the Financial Crisis—Federal Officials, January 14, 2010, p.18.

[6] Federal Register, vol. 74, no. 206, October 27, 2009.

Reserve Board of Governors[7], "… our approach has been to **require** (emphasis added) each firm to develop, under our supervision, its own practices and governance mechanisms to ensure risk-appropriate incentive compensation that accords with the interagency guidance throughout the organization. **Supervisors assessed areas of weakness** *(*emphasis added) at the firms, in response to which the firms have developed comprehensive plans outlining how those weaknesses will be addressed.". Under the heading "Steps Taken by Firms" the report continues to say that "With the oversight of the Federal Reserve and other banking agencies, the firms in the horizontal review **have implemented** (emphasis added) new practices to make employees' incentive compensation sensitive to risk addressed." Additionally, Section 956 the Dodd-Frank Act of 2010 explicitly directed financial regulators to adopt rules to make CEO compensation less convex and tied to long-term performance measures.

Finally, the Federal Reserve's Commercial Bank Examination Manual[8] (effective date was October 2010) added a **dedicated section** 4000.8.1 for Sound Incentive Compensation Policies. Before the financial crisis, bank examinations manuals followed a narrow statute-anchored view of §39 of the Federal Deposit Insurance Act. The emphasis was on prohibiting "excessive compensation" and with no guidance detail on how to structure incentives, risk-adjust payouts, use deferrals, or apply board oversight beyond the general "reasonable/not excessive" standard. In October 2010, bank examiners had to **ensure incentive compensation balanced between risk and payouts**. In doing so, **regulators had to make sure** that incentive pay was not short-term oriented, had longer deferral periods, and longer performance periods.

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

[8] https://www.federalreserve.gov/boarddocs/supmanual/cbem/4000.pdf

In sum, the directive from politicians and financial regulators was that bank CEO pay structure should be made more long-term oriented and structured to reduce excessive risk-taking. Accordingly, this paper examines the **causal** effect of increased regulatory focus on the structure of CEO bank pay and its impact on a bank's risk.[9] In doing so, we use a standard diff-in-diff methodology. Based on the above paragraphs, it seems reasonable to assume that regulatory focus started to change in late 2009. Accordingly, we proxy for increased regulatory focus by a dummy variable that is set to unity for post-2009, and zero otherwise. We then use post-2009 as an exogenous shock to see how some banks changed their compensation structure (treated group), when compared to other banks (control group). In our main set of results, we define the pre-event period as 2000-2009, and the post-event period as 2010-2019, respectively.[10] We employ three different definitions of banks who faced increased regulatory focus (treated group) -- each definition with advantages and disadvantages. If we find consistent results across all three definitions/tests, we believe that our results are robust.

In the first test, we define as our treated group, those banks who **were more likely to be targeted by federal financial regulators based on their high pay-risk relationship before regulatory focus was intensified.** Given that the main goal of regulators was to fix bank compensation structure with respect to excessive risk taking, we make the reasonable assumption that the sensitivity of a CEO's compensation to risk before the crisis is what regulators focused on.

[9] While not focusing on banks, Hayes et. al (2012), and Shue and Townsend (2017), have also examined the causal impact of CEO pay on firm outcomes. Edmans, Gabaix and Jenter (2017) criticize Hayes et. al's (2012) exogenous shock variable FAS 123 -- which required that *all* firms expense stock options after 2005 or 2006. In other words, there is no treated versus control group analysis. Additionally, we are unable to use Shue and Townsend's (2017) clever instrumental variables, as only a small number of the banks in our sample have fixed number/value option plans.

[10] We also find consistent results if we define the pre-event period as 2000-2007, and the post-event period as 2010-2019, respectively. See our robustness test 6.

Consistent with the previous literature, we define pay-risk sensitivity as the change in the dollar value of CEO wealth for a .01 change in stock return volatility (*vega*). We then define treated banks as those who have a higher pay-risk relationship (high-*prevega*) before the change in regulatory focus, than the compensation at banks who had a lower pay-risk relationship (low-*prevega*) before the change in regulatory focus. This is the largest sample, and we consequently use it for our main analysis. The advantage of this test is that we have a large sample of treated banks which reduces the variance of the regression coefficients. The disadvantage of this test is that we are assuming that *prevega* is precisely what regulators use for increased regulatory focus, i.e., we might be misclassifying some banks which are not targeted by regulators.

In the second test, we define as our treated group, those banks that **were explicitly targeted by federal financial regulators.** The advantage of this test is that the treated group had their compensation structure unequivocally targeted by the regulator. In other words, this test could reduce the estimation bias in the first test, because it excludes banks which might not be targeted by regulators. However, its disadvantage is that the sample of treated banks is small, which increases the variance of the regression coefficients. That said, we are running a bank-level fixed effects model, which only uses time-series variation in the regression, and not any cross-sectional variation. Having a larger sample size increases cross-sectional variation, and not necessarily, time-series variation.

In the third test, we define as our treated group, those banks who **were likely to be targeted by federal financial regulators based on their high frequency shocks to the first-time regulators discussed bank executive compensation and risk**.[11] High frequency shocks are

[11] The high frequency identification approach has been used by Ottonello and Song (2022), Nakamura and Steinsson (2018), among others.

defined as the differential stock returns between 15 minutes after, and 15 minutes before, the closing time of the House Committee on Financial Services Hearing meetings of June 11, 2009. This was the first time bank compensation issues were discussed by politicians and regulators. The idea behind this is to sharply test if markets reacted to the increased regulatory focus, and the reaction was different between treated and control banks.

By using the above three definitions of banks whose compensation structure was either, explicitly, or more likely to be targeted, by financial regulators at the end of the financial crisis, we can address the important criticism by Edmans, Gabaix and Jenter (2017, stated at the top of Section I. First, we examine if there is a differential effect between banks whose compensation structure guidelines were **explicitly targeted** by financial regulators, and those who were not. Here the treated group is those who were explicitly targeted for regulatory focus, which makes regulatory focus the only reason for changes in compensation structure. Second, we examine the **high frequency stock return reaction** to the first congressional hearings on bank compensation and risk. Why should the stock market generate any differential excess returns to congressional hearings on bank compensation and risk at all, unless it is aware that regulatory focus is going to be differentially applied to some banks. If we find similar results for these two additional tests to our large sample test (that uses *prevega*), we believe that we have successfully examined whether increasing regulatory focus on compensation structure in the post-2009 period *caused* bank equity risk to change.

Note that the diff-in-diff methodology helps us to isolate the impact of increased regulatory focus, i.e. our policy event, on bank executive compensation structure and bank equity risk. We examine several components of the compensation package such as bonus, long term incentive plans, performance and time vesting stock grants, time and performance vesting option grants, and

anti-hedging provisions.[12] Given that the policy event (post-2009) might have changed several regulations other than compensation structure, the first-stage regression helps us to isolate the impact of the policy event on differences in CEO compensation structure between the treated and control groups. If the policy event changed bank CEO compensation structure, then the first-stage results would show statistical significance -- which it does. We control other regulatory events such as TARP and stress tests by including them as control variables in both equations. We also make sure that the parallel trend assumption is met for the first-stage regression. For other confounding factors that might impact on the second-stage regression (e.g., changes in investor risk preferences post-crisis) we have conducted several robustness tests. We then use the predicted values of changes in compensation due to the policy event between the treated and control groups from the first-stage regression, to examine changes in the bank's equity and systemic risk in the second-stage regression.

Our sample consists of 216 unique banks over the sample period 2000 through 2019. In all three tests, we find significant differences in the change in the structure of CEO compensation between the treated and control groups of banks. Specifically, we find that performance-vesting restricted stock awards, use of long-term incentive plans (LTIP) and anti-hedging provisions increased more for treated banks when compared to the control group. Conversely, we find greater decreases in the use of time-vesting options for the treated banks than for the control group.

We hence examine the relation between changes in risk taking and changes in compensation structure between the treated and control banks. We ensure that the parallel trend assumption is not violated in the pre-2010 period using a dynamic diff-in-diff model.

[12] We do not examine compensation claw backs because the Sarbanes Oxley Act of 2002 was the reason that firms shifted to having compensation claw backs. We see this also in our data.

Instrumenting for differences in compensation structure between the two groups of banks, we find that bank risk (i.e., stock return volatility) decreased in the post-2009 era, with the risk reduction driven by the treated banks. We then examine if this result is driven by a bank's idiosyncratic risk or beta, and we find that that it is a bank's idiosyncratic bank risk that went down in the post-2009 period. Additionally, we find a similar result for systemic or tail risk. We find no change in the performance of the two sets of banks as measured by Tobin's Q.[13]

Additionally, we find that all but one of the explicitly federally targeted banks were in the high-*prevega* treated group of banks. We also find that *prevega i*s positively related to high frequency shocks. These findings indicate that the markets believed that banks with higher *prevega* faced stronger regulatory focus to restructure their compensation packages, leading to positive high frequency shocks. This suggests that regulatory focus from financial regulators on bank CEO compensation post-2009 is a reasonable explanation for why compensation differences changed between the treated and control samples. In sum, for all three tests described above, we find that both idiosyncratic risk and systemic risk decreased in the post-2009 era for treated banks.

An important empirical challenge in examining the relationship between 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, bank size and capital, whether it received TARP funds, whether it faced regulatory stress test constraints, bank culture, and future growth opportunities.[14] The relationship between risk and

[13] We also find similar results when we use stock returns and excess stock returns. Excess stock returns using the 4-factor model of Demsetz and Strahan (1999), wherein the 4-factors consist of: market returns, the change in the yield on the 3-month Treasury bill rate, the change in the spread between the 10-year Treasury note and the 3-month Treasury bill rate, and the change in the spread between Moody's Baa-rated corporate bonds and 30-year Treasury bonds. These results are not reported but are available from the authors.

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

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 the following ways.[15] First, we examine whether *prevega* is just a proxy for bank size. Note that our main tests have controlled bank size by using bank-level fixed effects (captures time-invariant bank characteristics) and a time varying proxy for bank size. Specifically, we only use 'within bank variation,' while including time-varying variables factors such as bank size, capital, whether the bank received TARP funds, and the distance between stress capital and regulatory capital that a bank faced in regulatory stress tests. To be sure that *prevega* is not a proxy for bank size, we repeat our entire analysis using our treatment group high-*prelarge* banks and finding statistically insignificant results (This is perhaps not surprising since we had controlled for bank size using bank-level fixed effects and including time-varying bank size as a control variable). Second, it is possible that changes in bank CEO compensation occurred not because of increased regulatory focus but rather due to investor risk preferences changing after the financial crisis. Using the variance risk premium of Rosenberg and Engle (2002) and Bollerslev, Gibson and Zhou (2012), we find that our results are not driven by changes in investor risk preferences. Third, Fahlenbrach *et al.* (2012) find that banks that did poorly in the 1998 Russia crisis also did poorly in 2007-2009 crisis, which they attribute to a bank's risk culture. Accordingly, we conduct additional tests to ensure that *prevega* is not capturing a bank's risk culture. We find no correlation between a bank's 1998 buy-and-hold returns and *prevega*. We also repeated our tests using the bank's 1998 buy-and-hold returns instead of *prevega* and find no significant differences.

[15] See Section VIIH of this paper for a detailed explanation of these robustness tests and results.

We conduct several additional robustness tests. First, to minimize the impact of the crisis years (2008-09) on *prevega*, we redefine the pre-event period as 2000-2007 instead of 2000-2009 and find similar results. Second, we examine a shorter six-year window before and after 2010, and find similar results.[16] Third, it is possible that the reduction in risk is due to changes in pay-performance sensitivities (*delta*) rather than pay-risk sensitivities (*vega*). We find no significant difference in the impact on bank risk and performance between the two groups of *predelta* banks which suggests that the primary channel is through the effect of compensation structure on *vega*.[17]

It is possible that without regulatory focus, some boards of directors endogenously changed the CEO's compensation structure due to excessive risk taking in the financial crisis. We find that compensation structure changes happened for banks that were explicitly targeted for regulatory focus, when compared to those that were not explicitly targeted. This makes increased regulatory focus the only reason for changes in compensation structure. We also find a larger high frequency stock return reaction to the first congressional hearings on bank compensation and risk for treated banks when compared to control banks. The only reason for a larger high frequency stock return reaction for treated banks is that the stock market is aware that certain banks are going to have their compensation structure change due to increased regulatory focus. Indeed we find that these treated banks changed their compensation structure like how banks that were explicitly targeted did. Consistent with our other results, we once again find that that these pay structure changes resulted in lower bank idiosyncratic and systemic risk. In sum, our results are strongly supportive

[16] Note that we are estimating a fixed effects model and therefore need time variation in our variables. Therefore, we picked six years rather than three or four years.

[17] To ensure that our results are not due to banks that failed in the financial crisis, we run another robustness test that focusing on banks that exist both in the pre-2010 and post-2009 period (140 banks). We re-estimate our main regressions and find similar results for this smaller sample. Accordingly, our main results are not due to the inclusion of failed banks. These results are not reported but are available from the authors.

of the argument that regulatory focus is an important *causal* reason for why compensation structure changed, which resulted in lower bank idiosyncratic and systemic risks.

This paper proceeds as follows. Section II describes our methodology. Section III provides an overview of the literature relating bank risk to compensation policy and provides a conceptual framework for our empirical analysis. Section IV explains our ex ante testable hypotheses on the relationship between increased regulatory focus, compensation structure, and bank equity risk. Section V describes our data, and the empirical variables constructed for our tests. We present our empirical findings in Section VI, and Section VII provides our conclusions.

II. Empirical Methodology

To isolate the impact of bank executive compensation structure on bank equity risk, we use a standard diff-in-diff methodology. As explained in Section I, we have three sets of tests which vary by how we define the treated bank. For ease of convenience, we summarize our empirical strategy in Figure 1.

Figure 1

We build our empirical model in two stages. In the first-stage we examine which elements of the compensation structure changed after 2009. In doing so, we use the ex ante predictions of Section IV to create testable hypotheses for examining the impact of increased regulatory focus on changes to various compensation structures. The first-stage regression model is given by equation (1) below.

$$Comp_{it} = \lambda \times treated_{\mathrm{i}} * IRF + \rho' X_{i,t} + \phi_i + \eta_t + \mu_{i,t} \qquad (1)$$

where subscript *i* indicates the bank, and subscript *t* indicates the year, respectively. $Comp_{it}$ are the different compensation variables that we examine. $treated_i$ is a dummy equal to one based on the three definitions of treated banks described in Section I.[18] *IRF* is a dummy variable for the period where regulator focus increased (2010 to 2019). Our coefficient of interest is λ, which is the average treatment effect of the treated (ATT), namely the differential impact of increased regulatory focus between treated and control banks. Vector *X* represents time-varying control variables bank size and capital, whether the bank received TARP funds that year, and the bank's stressed capital ratio distance from its regulatory threshold in that year. ϕ_i is the bank fixed effect, which absorbs unobserved and time-invariant confounding factors, and η_t are year dummies which control for any macro time trend. All standard errors are robust and are clustered at the bank level.

Our specification is designed to address two potential concerns regarding confounding factors. The first concern is that regulators in the post-2009 period might focus their attention on compensation policies of the largest banks. Using bank-level fixed effects and including the control variable *size* in our regression mitigates this concern. Additionally, robustness test 1 shows that this is not the case. The second concern is that other factors affecting bank risk can determine the change of compensation structure. Such factors might include risk reduction due to a bank receiving TARP funds and/or facing regulatory stress testing. Accordingly, we control these effects by using as independent variables, proxies for a bank receiving TARP funds in that year, and the bank's stressed capital ratio distance from its regulatory threshold in that year.

[18] Note that we do not use continuous treatment for tests 1 and 3, because Calloway et. al (2024) has shown that such a model does not accurately identify the average treatment effect under the standard parallel trend assumption.

In the second-stage regression we use the fitted values from the above equation to examine the impact of the changes in compensation structure on bank risk and performance. 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 $treated_i * IRF$. Bank risk is proxied by the annualized standard deviation of equity returns, or beta or idiosyncratic risk, whereas bank performance is proxied by Tobin's Q. We cluster robust standard errors at the bank level.

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, 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 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. Edmans and Liu (2011) show that managers with debt-based incentives manage their firms more conservatively, evidence for which has been found by Sundaram and Yermack (2007) in the general firm literature and by Bennett *et al.* (2015) and van Bekkum (2016) for banks.

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 volatility (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 additional 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 $\frac{\partial\, E(W)}{\partial \sigma} > 0$. The second term will also be positive if managers are risk-averse and are not able to completely 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.[19] 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 the value of a 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 for the conflicting findings concerning the incentive effects of CEO compensation. First, the sample period used in these studies is 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 only two measures of the incentive effects of

[19] Wall (2020) explains that these provisions provide the framework used by bank regulators in their oversight of bank executive compensation in the post-2009 era. Additionally, the paper provides a literature survey of studies that examine the relationship between bank CEO compensation and bank risk taking.

compensation on bank risk taking (stock and option grants). 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.[20] 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 these feedback effects is likely to result in biased estimates of the true relationship between risk taking and compensation structure.

In all regression specifications we include bank-level fixed effects so that identification is 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.[21] We 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.

[20] van Bekkum (2016) finds that a bank's CEO inside debt holdings is positively correlated with *vega*.

[21] We report statistical significance based on robust standard errors clustered at the bank level (Petersen (2009)).

IV. Testable Hypotheses for the Ex Ante Relationship Between Increased Regulatory Focus, Compensation Structure, and Equity Risk

As described in detail in Section I, congress and financial regulators clearly wanted to make banks' executive compensation structure to be less convex and tied to long-term performance measures. Accordingly, in this section we construct testable hypotheses how increased regulatory focus (IRF) could impact bank pay structure, which in turn impacts bank equity risk. Note that we are estimating a diff-in-diff model, so when we hypothesize that a certain pay structure increased (decreased), we mean differentially increased (decreased) for the treated group over the control group, respectively.

One way to reduce risk taking is by substituting 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. Given that options granted to the executive have convex payoffs, the substitution of restricted stock for options is expected to reduce *vega.*

Hypothesis 1: When regulatory focus increases, we expect a higher dollar value of restricted stock awards, and a lower dollar value of time vesting options granted.

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 thresholds.[22] However, unlike time vesting stock and option grants, performance-based grants are contingent on performance metrics (such as firm profitability and

[22] 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.

stock price performance). As a result, we expect the use of performance-vesting to reduce the pay-risk relationship.

Hypothesis 2: When regulatory focus increases, we expect the dollar amount in performance-based vesting for stocks and options to increase, and the dollar amount in time-based vesting for stocks and options to decrease, respectively.

As explained before, financial regulators were very focused on tying compensation to long-term performance. Accordingly, we examine if pay became more long-term oriented.

Hypothesis 3: When regulatory focus increases, we expect the dollar amount in long-term incentive plans (LTIPs) to increase.

The Dodd-Frank Act of 2010 explicitly mandated for large banks[23] 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 was higher after regulatory focus increased.

Hypothesis 4: When regulatory focus increases, we expect the dollar amount of deferred incentive compensation to increase.

The SEC has sometimes forced executives to disgorge bonuses that were inflated based on financial misstatements.[24] However, less extreme forms of misreporting often go unpunished because of the 'grey boundaries' between good faith reporting and misreporting. Fried (2010) finds

[23] 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.

[24] 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 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.

that no-fault excess-pay claw backs do not deter executives from financial misreporting before the Dodd-Frant Act 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 there was misconduct. Accordingly, we examine if CEO bonus declined after IRF A because of enhanced implementation of no-fault excess pay claw backs.

Hypothesis 5: When regulatory focus increases, we expect cash bonuses to decrease.

Increased regulatory focus 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 when regulatory focus increased.

Hypothesis 6: When regulatory focus increases, we expect anti-hedging provisions to increase.

IV. Data and Variable Construction

IV.A Data

We obtained 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 and pensions 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 *total risk* as the annualized standard deviation of bank daily equity stock returns, *beta* as the regression coefficient of banks' stock returns on the market portfolio, *idiosyncratic risk* as the bank's idiosyncratic risk from the one-factor model. We proxy for bank performance with Tobin's Q. We define the variable *Tobin's Q* as the ratio of book value of debt plus the market value of equity to total assets. 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 $Z=[\mathrm{In(S/X)}-T(\mathrm{r-d}+\sigma^2/2)]/\sigma\mathrm{T^{(1/2)}}$. We calculate *prevega,* as the average CEO *vega* between 2000 and 2009 for each bank. If regulatory scrutiny in the post-

2009 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 sensitivity pre-2010 (*prevega*) of banks is greater than median *prevega* of our sample, and otherwise equal to zero. To examine changes in regulatory scrutiny of bank CEO compensation in the post-2009 era, we define a dummy variable, *IRF*, which equals one for years 2010 to 2019, and zero otherwise.

We create and include four control variables in our model. The first control variable is bank size (*size*), defined as the natural logarithm of a bank's total assets. The second control variable is bank capital (*capital*), defined as the ratio of market value of equity to total assets. The third control variable captures whether a bank receives capital infusions from the federal government under the Troubles Asset Relief Program (TARP). We define a dummy variable, *TARP,* that is set to unity when the bank signed the agreement to receive TARP funds and remains unity until they repaid the TARP money, and zero otherwise. The fourth control variable captures the effect of stress tests on bank risk taking. As in Cortes, et al. (2020), we use the banks stressed capital ratio distance from their regulatory thresholds (*stress*). We use their preferred measure and update it for time-varying regulatory thresholds. Specifically, *stress* is defined as the minimum stress-test distance, which is equal to the minimum of (stressed Tier 1 capital less their regulatory Tier 1 capital ratio, stressed total risk-based capital less their regulatory total risk-based capital ratio, stressed leverage ratio less their regulatory leverage ratio). 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 when regulatory focus intensified post-2009.[25] 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 compensation structures designed to promote 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),* defined as the dollar value of newly awarded performance-vesting restricted stocks; (2) the dollar value of performance-vesting options (*pv option),* defined as the dollar value of newly granted performance-vesting options; (3) the dollar value of time-vesting restricted stock (*tv stock),* defined as the dollar value of newly awarded time-vesting restricted stocks; and (4) time-vesting options (*tv option),* defined as the dollar value of newly granted time-vesting options. In the sub-sample of banks where data is available from 2006-2019, we create two variables; the first is *deferred comp,* defined as the present value of deferred compensation, and the second is *pensions,* defined as the present value of accumulated pensions. We also manually collect from a bank's proxy statements, annual or quarterly reports when anti-hedging provisions were introduced during the sample period.

[25] We also examined if there are changes in CEO turnover before and after 2009 and find no significant differences. These results are not reported but are available from the authors.

Table 3 presents descriptive statistics for the variables of interest. 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 (for example, Coles, Daniel and Naveen (2006)). The average bank size is $14.50 billion, with a corresponding median value of $10.63 billion. The average (median) bank capital ratio is 12% (10%), suggesting that these banks are well capitalized. On average, the number of banks who receive TARP funds is 11%, with a median value of 0. This suggests that banks that received TARP money were few and they attempted to leave the program as soon as possible due to the compensation limits in the TARP agreement. In Figure 2, we find that the fraction of banks that received TARP funds started to be positive in 2007, peaked in 2009, after which it declined substantially till 2013. Our results are consistent with those in Bayatzitova and Shivdasani (2011) and Wilson and Wu (2012). We find that the average (median) minimum stress-test distance to be 0.14 (0), respectively. Every year, the Fed discloses names of banks participated in the stress test program. In Figure 3, we find that the fraction of banks that participated in the Fed's annual stress test program started to be positive in 2013, peaked in 2017, after which it declined.

Table 3

***Figures 2 and 3 ***

The mean (median) average annualized standard deviation of daily equity returns (*total risk*) is 35.5% (27.4%), which is consistent with studies in the general firm literature. The mean (median) beta of a bank is 1.25 (1.22), which suggests that banks have high systematic risk. Additionally, we find that the mean (median) of a bank's idiosyncratic risk is 28.83% (22.04%), and a bank's tail risk is 2.85 (2.24). Finally, the average Tobin's Q is 1.13, with median values of 1.05, respectively.

V. Empirical Results

VA. Compensation Structure Changes Due to Increased Regulatory Focus (IRF)

We begin our empirical analysis by examining how compensation structure changed when regulatory pressure increased in 2010, using the diff-in-diff framework of equation (1). The coefficient of interest is λ which is the average treatment effects of treated (ATT) that compares the difference between banks in the high-*prevega* group, and banks in the low-*prevega* group during the post-2009 period. Specifically, we examine changes in the various incentive-based components of CEO pay (namely, bonus, restricted stock awards, option grants, and LTIPs) and whether there is a difference in how these components changed for high versus low *prevega* banks. Estimates of equation (1) are presented in Table 4.

Table 4

The findings in Table 4 are generally consistent with the predictions of hypotheses 1 through 5. For example, in column (1), we examine if the value of bonuses changed with increased regulatory focus in 2010. As shown, the coefficient estimate of high-*prevega* is negative and significant at the one-percent level indicating that banks in the high-*prevega* group decreased bonuses by $0.323 million more than banks in the low-*prevega* group in the post-2009 period. The difference between high- and low-*prevega* banks is equal to 27.1% of the sample standard deviation of bonuses. These findings are consistent with the predictions of hypothesis 5.

Next, we examine changes in the reliance on restricted stock awards. 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 $1.139

million dollars higher than those in the low-*prevega* group (roughly equal to half sample standard deviation of restricted stock awards).

As shown in column 3 of Table 4, we find a significantly greater decrease in the use of option grants among the high-*prevega* group in the post-2009 era. The economic magnitude is equal to 63.5% of the standard deviation in option grants. These findings are consistent with the predictions of hypothesis 1. Similarly, in column (4), we find an increase in long-term incentive plans (LTIP).[26] This estimate suggests that banks in the high-*prevega* group raise their CEO's long-term incentive plans by $0.878 million compared with banks of low-*prevega* group. The estimate is equal to 40.6% of the standard deviation of LTIP. These findings are consistent with the predictions of hypothesis 3.

In summary, the above findings indicate that LTIP and restricted stock awards increased, and options granted, and bonus decreased, after 2009. We next examine if changes in restricted stock and options were driven by regulatory focus emphasizing incentive compensation that does not promote 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 suggests 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 $1.378 million more than banks in the low-*prevega* group. The coefficient of column (4) suggests that banks in the high-*prevega* group reduce time-vesting options by $1.286 million compared with banks in the low-*prevega* group; and the estimate's economic magnitude is equal to half of one standard

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

deviation of time-vesting options. We find no statistically significant changes in the use of performance-vesting option grants (column (2)), or time-vesting restricted stock awards (column (3)). These findings are consistent with hypothesis 2.

Table 5

Finally, we examine how other compensation structures[27] might have changed after 2009, the results of which are given in Table 6. In column (1), we find a statistically insignificant difference in deferred compensation between the high-*prevega* group and the low-*prevega* group in the post-2009 era. This is evidence against hypothesis 4. In column (2), we find a statistically insignificant difference in the present value of pensions between the high-*prevega* group and the low-*prevega* group in the post-2009 era. Given that both deferred compensation and pensions did not change, we find that inside debt (which is the sum of deferred compensation and pensions) did not change in the post-2009 era. In column (3) we find anti-hedging provisions to significantly increase, which is evidence in support of hypothesis 6. The coefficient of column (3) indicates that banks in the high-*prevega* group increased the probability of creating anti-hedging provisions by 16.1% than banks in the low-*prevega* group. This estimate is equal to 41.3% 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) and anti-hedging provisions. Conversely, we find decreases in bonuses and the use of time-vesting options.

[27] We also examined the vesting periods of restricted stock, options, and LTIPs and found no significant changes post-2009. These results are not reported but are available from the authors.

VB. Characteristics of High and Low Pay-Risk Sensitivities Banks in the Pre-2010 Period

While the findings in Tables 4 and 5 suggest differences in the impact of post-2009 regulatory scrutiny on the compensation structure for high- and low-*prevega* banks, the observed differences may arise from differences in the characteristics of the two sets of banks that is related to the intensity of regulatory scrutiny along some dimensions other than *prevega*. To address this question, we compare the characteristics of high pay-risk sensitivities and low pay-risk sensitivity banks in the pre-2010 era. For this analysis we use data on bank characteristics **for the last year prior to 2010**. As a result, we have only one observation for each bank, and this is a cross-sectional regression. We examine differences between high- and low-*prevega* banks along a number of pre-2010 dimensions including 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. We include MBS and real estate variables given that the financial crisis originated in the subprime sector which was securitized in the originate-to-distribute model of banking.[28] Additionally, we include non-interest income as a regressor given that Brunnermeier, Dong and Palia (2020) found it to be related to bank risk. We examine the relationship between these *prevega* and these bank characteristics by estimating a Probit regression where the dependent variable is one if the bank is in the high-*prevega* group, and zero otherwise. As shown in Table 6, we find only bank size to be significantly related to high-*prevega*. Panel B of Table 7 provides the names of banks ranked by *prevega.* As shown in the first column, high *prevega* banks are among the largest systemically important financial institutions (for example, JPMorgan Chase, Bank of America, Wells Fargo) and have

[28] We also included commercial and industrial loans and found it to be statistically insignificant. These results are not reported but are available from the authors.

high *prevega*. These results show that only bank size is correlated to *prevega* in a cross-sectional regression.

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 findings reported 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.

Is *prevega* a proxy for bank size? Given the above results, we examine if partitioning the pre-2010 sample by *prevega* is equivalent to partitioning it by bank size? In short, the answer is NO! There are three reasons why our results are due to *prevega* and not bank size. One, we include bank-level fixed effects which capture time-invariant cross-sectional differences between banks (which includes cross-sectional differences in variables such as bank size). Two, to capture time-varying 'within bank differences' in bank size, we have included *ln(bank assets*) as an independent variable. For robustness, we also included $ln(bankassets)^2$, and none of our results changed significantly.[29] Three, instead of partitioning the pre-2010 sample into two groups based on *prevega* and using *IRF * high-prevega*$_i$ as our instrumental variable in the first-stage regression, we partition our pre-2010 sample into two groups based on bank size. In robustness test 1 (Table 13) we find that our results are not driven by the size of the bank.

[29] These results are not reported but are available from the authors.

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

In this section we examine how the endogenously chosen compensation structures changes are related to bank equity risk and performance in the post-2009 period. Note that we cannot include all the endogenously determined compensation variables in one regression specification, because each of them has the same instrumental variable high_$prevega_i * IRF$. We also do not examine compensation components that did not significantly change due to increased regulatory focus, because they would be weak instruments for the second-stage regressions.

Table 8 presents the 2SLS regression findings for total bank equity risk. We find that the differences between the two groups of banks' post-2009 stock return volatility is lower when time-vesting options grants decreased more for high-*prevega* banks. Conversely, the differences between the two groups of banks' post-2009 stock return volatility is lower when performance-vesting restricted stock, LTIPs and anti-hedging provisions increased. There is no impact of differences in bonuses due to increased regulatory focus, probably because the TARP program specifically targeted bonuses. The coefficient of LTIP is -4.58, which indicates that a one standard deviation increase in LTIP is associated with a 9.9% decrease in total bank equity volatility. The coefficient of performance-vesting stock is -3.73 which implies a one standard deviation increase in performance-vesting stock is associated with a 9.5% decrease in bank equity risk. The coefficient of time-vesting options is 4, which for a one standard deviation decrease in time-vesting options suggests a 12.28% decrease in total bank equity risk. The coefficient of anti-hedging provisions is 28.01, which for a one standard deviation increase in anti-hedging provisions suggests an 11% decrease in total bank equity risk. Therefore, the decreases in total bank equity

risk range from 9.5% (from changes in performance-vesting stock) to 12.28% (from changes in time-vesting options).[30]

***Table 8 ***

Testing the parallel trend assumption: The above results suggest that total bank equity risk went down post-2009, because of differences between the two groups of banks' (high and low-*prevega)* LTIPS, performance-vesting restricted stock, time-vesting options, and anti-hedging provisions. To ensure that these results are not driven by any pre-2010 trend, we estimate the following dynamic difference-in-difference regression that is given in equation (6) below.

$$Y_{t,i} = \alpha + \sum_{Year=2000}^{2019} \lambda_{year} \times high\_prevega_i * I(year \neq 2009) + \rho' X + \phi_i + \eta_t + \mu_{i,t} \qquad (5)$$

where $Y_{t,i}$ are the compensation variables, LTIPs, performance-vesting restricted stock, time-vesting options and anti-hedging provisions, respectively. As before, high_$prevega_i$ is our treatment variable, *X* the control variables, δ_t year dummies, and μ_i bank fixed effects. I() is an indicator function which is set to unity for each year from 2000 to 2019. Therefore β_{year} are the treatment effects of each year relative to the benchmark year 2009 (the year just before increased regulatory focus), and we set β of the benchmark year as zero, namely, $\beta_{2009} = 0$. For each year, we plot the mean $\beta's$ and its 90% percent confidence interval, the results of which are given in Figure 4. To satisfy the parallel trend assumption, we should find that in the pre-2010 period, an F-test for the joint effect of the $\beta's$ being equal to zero should be statistically accepted.

Figure 4

We begin by examining LTIPs in Panel A of Figure 4. We find that in the pre-2010 period, the difference in the LTIPs between the high- and low-*prevega* groups did not significantly change

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

compared to the benchmark period of 2009 -- as the F-statistic of 1.49 is statistically insignificant. This result confirms that there was not a pre-2010 trend in the difference in LTIPs between the high- and low-*prevega* groups, suggesting that the parallel trend assumption holds. We repeat such an analysis for performance-vesting restricted stock (Panel B), time-vesting options (Panel C), and anti-hedging provisions (Panel D), respectively. In all three panels, we find that in the pre-2010 period, the difference in between the high- and low-*prevega* groups did not significantly change compared to the benchmark period of 2009 (F-statistics of 0.84, 1.08, 0.96, respectively). These results are consistent with those for LTIPs, confirming that the parallel trend assumption holds also for performance-vesting restricted stock, time-vesting options, and anti-hedging provisions, respectively.

We next examine if the decreases in total bank equity risk after 2009 were due to changes in a bank's systematic risk (beta) or idiosyncratic risk. We estimate the CAPM to get a bank's beta and idiosyncratic risk and repeat the analysis wherein the dependent variable in 2SLS is a bank's beta or idiosyncratic risk. In Panel A of Table 9, we present the second-stage results when the dependent variable is a bank's beta, and in Panel B of Table 9, we present the second-stage results when the dependent variable is a bank's idiosyncratic risk. We find that a bank's beta is generally insignificantly related to the changes in the CEO's compensation due to increased regulatory focus. In contrast, we find that a bank's idiosyncratic risk is significantly related to the changes in a CEO's compensation due to increased regulatory focus. Once again, the coefficient on bonus is not statistically significant. The coefficient of LTIP is -4.55, which indicates that a one standard deviation increase in LTIP is associated with a 9.83% decrease in a bank's residual risk. The coefficient of performance-vesting stock is -3.35 which implies a one standard deviation increase in performance-vesting stock is associated with a 8.51% decrease in a bank's residual risk. The

coefficient of time-vesting options is 3.6, which for a one standard deviation decrease in time-vesting options suggests a 11.05% decrease in a bank's residual risk. The coefficient of anti-hedging provisions is -26.0 which for a one standard deviation increase in anti-hedging provisions suggests a 10.14% decrease in a bank's residual risk. Therefore, the decreases in total bank equity risk range from 8.51% (from changes in performance-vesting stock) to 11.5% (from changes in time-vesting options).

***Table 9 ***

Table 10 presents the 2SLS regression results for bank performance. We do not find any statistically significant relationship between bank performance and the compensation variables. The above results suggest that increased regulatory focus reduced excessive equity pay-risk in the banking industry, without adversely impacting bank equity performance. [31] The lack of association between risk and performance is not surprising because according to asset pricing theory, a firm's returns are only impacted by non-diversifiable market risk *beta*, and not by diversifiable idiosyncratic risk.

Table 10

The above results show that bank risk differences between the two groups of banks' post-2009 idiosyncratic risk (namely, idiosyncratic return volatility) decreased over the sample period. We hence examine which group of banks reduced their idiosyncratic risk due to increased regulatory focus. In other words, did the low-*vega* banks increase their idiosyncratic risk, and/or did the high-*vega* banks decrease their idiosyncratic risk?

[31] We also examine the impact of the level of pay (ln(TDC1)). Consistent with the results on the pay components, we find the level of pay to go down. These results are not reported but are available from the authors.

$$\text{idiosyncratic risk}_{it} = \gamma' X + \alpha_i + \delta_t + u_{it} \qquad (6)$$

Using equation (6) above, we calculate the average excess idiosyncratic risk, i.e., the variance of u_{it} across four groups: low-*vega* banks in the pre-2010 period, high-*vega* banks in the pre-2010 period, low-*vega* banks in the post-2009 period, and high-*vega* banks in the post-2009 period, respectively. For ease of analysis, we net out the excess idiosyncratic risk of the first group (i.e., low-*vega* banks in the pre-2010 period) from the idiosyncratic risks of the other three groups. The results of this analysis are given in Table 11. As shown in row (1) there was no significant difference in the average idiosyncratic risks between the low- and high-*prevega* groups in the pre-2010 period. This suggests that there is no time trend in idiosyncratic equity risks in the pre-2010 period. However, we find that idiosyncratic risk is significantly lower for high-*prevega* banks in the post-2009 period. These results suggest that the risk reduction that we found in Panel B of Table 9 is due to the lower idiosyncratic risks of high pay-risk banks in the post-2009 period.

Table 11

In Figure 5, we plot the excess idiosyncratic risk of both high- and low-*prevega* banks by year. For ease of interpretation, we normalize each year's excess idiosyncratic risk by excess idiosyncratic risk of the year 2000. Each red dot depicts the excess idiosyncratic risk of the high-*prevega* banks, and each blue triangle depicts the excess idiosyncratic risk of the low-*prevega* banks. We observe that before the financial crisis of 2007-09, the high-*prevega* banks have a similar trend to the low-*prevega* banks. But in the financial crisis, the excess idiosyncratic risk of the high-*prevega* banks increased substantially. Importantly, we find that the excess idiosyncratic risk of the high-*prevega* banks decreased significantly after 2009, whereas the excess idiosyncratic risk of the low-*prevega* banks did not change significantly.

Figure 5

VD. Interpretation of the Risk-Return Relationship

The above results suggest that the differences between the high- and low-*prevega* banks' idiosyncratic risk went down, but there was no such effect for systematic risk (betas) and bank equity performance (Tobin's Q). According to asset pricing theory, a firm's returns are only impacted by non-diversifiable market risk (beta), and not by diversifiable idiosyncratic risk. Therefore, finding results for diversifiable idiosyncratic risk and not firm performance is not surprising.

VE. Impact of Changes in Compensation Structures on Bank Systemic (Tail) Risk

The above results have shown that the idiosyncratic risks of the high-pay risk banks decreased post-2009, with no change in their bank performance. But regulators are concerned by a bank's systemic risk. Accordingly, we use a widely used measure of systemic risk, namely, the Marginal Expected Shortfall (MES) measure of Acharya, et al (2017). MES measures the impact of the tail risk of a bank and is defined as the expected loss on a bank's equity conditional on the worst 5% of daily market returns. This translates into equity returns of bank *i* conditional on the worst 5% of daily market returns. In Table 12, we repeat our analysis with our dependent variable being the systemic risk measure MES.

Table 12

In Panel A, we once again find that the coefficient on bonus is statistically insignificant. The coefficient of LTIP is -0.32, which indicates that a one standard deviation increase in LTIP is associated with a 0.69% decrease in systemic risk. The coefficient of performance-vesting restricted stock is -0.47 which implies a one standard deviation increase in performance-vesting restricted stock is associated with a 1.2% decrease in systemic risk. The coefficient of time-vesting options is 0.45, which for a one standard deviation decrease in time-vesting options suggests a

1.38% decrease in systemic risk. Therefore, the decreases in systemic risk range from 0.69% (from changes in LTIP) to 1.38% (from changes in time-vesting options).

In Panel B we examine which set of banks lowered their systemic risk. Consistent with the results for idiosyncratic risk, we find that the low-*vega* banks did not change their systemic risk, but the high-*vega* banks decreased their systemic risk.

VF. Treated Banks Redefined to be Those Whose Compensation Policies Were Explicitly Examined by Financial Regulators

We now redefine our treated group as those banks whose compensation practices were explicitly examined by the federal regulators in the 2011 Report on Incentive Practices.[32] Of the 25 banks that were targeted, nine were branches of foreign banks, two were investment banks (Morgan Stanley, Goldman Sachs) and one Ally Financial Inc. had a lot of missing data. This resulted in the explicitly targeted compensation practices of 13 unique US banks as the treated group. Specifically, they are: The American Express Co., Bank of America Corp., Bank of New York Mellon Corp., Capital One Financial Corp., Citigroup Inc., Discover Financial Services, JP Morgan Chase & Co., Northern Trust Corp., PNC Financial Services Group Inc., State Street Corp., Sun Trust Banks Inc., US Bancorp., and Wells Fargo & Co., respectively. In Table 13, we compare this smaller treated group versus two sets of control samples, namely, the original sample of low-*prevega* banks (Panel A), and all other banks that were not explicitly targeted by federal regulators. (Panel B), respectively. We find that our main results do not substantially change in these two tests for this much smaller sample of treated banks.[33] These results suggest that the explicit regulatory focus on bank compensation shows the same impact on bank risk and performance as

[32] For reference see footnote 6.

[33] Out of the 10 rows of results in Table 14, the only result that differs from our main results is that *anti-hedging* activities does not significantly impact idiosyncratic and systemic risk when the control sample is all banks that are not explicitly targeted by federal regulatory agencies (row 5 of Panel B).

the much larger sample of high-*prevega* banks. Additionally, we find that all but one, Discovery Financial Group, are federally targeted banks that were in the high-*prevega* treated group of banks (consisting of 106 unique high-*prevega* banks in our main tests). Therefore, regulatory focus from financial regulators on bank CEO compensation post-2009 is a reasonable explanation for why compensation differences changed between the treated and control samples, resulting in a decrease in idiosyncratic and systemic risk and an insignificant change in bank performance (our main sets of results).

Table 13

VF. Treated Banks Redefined to be Whose <u>High Frequency Stock Returns</u> were Above the Median Value on the First Day of Congressional Hearings on Bank Compensation and Risk (June 11, 2009)

We now use the high frequency identification approach used by Ottonello and Song (2022), Nakamura and Steinsson (2018), among others. Consistent with these papers, we calculate high frequency excess returns by using a half-hour window before and after the event window. The high frequency excess returns reflect the information associated with the event and are high frequency identification shocks (*HFI_shocks*) defined as follows:

$$HFI\_shocks = log(P_{+15m}) - log(P_{-15M})$$

where P_{+15m} and P_{-15m} are one-minute equity prices with 15 minutes before and after the event time, respectively. For the event window we use the first-time bank compensation and risk was discussed by regulators in the House Committee of Financial Services Hearings on June 11, 2009. We use the closing time of 2:25 pm as the event time. Panel A of Table 14 shows that *prevega i*s positively and significantly associated with *HFI_shocks*, suggesting that banks with higher *prevega* experienced larger high frequency excess returns. These findings indicate that the market believed the banks with higher *prevega* were going to face increased regulatory focus on stronger

regulatory focus to restructure their compensation packages, leading to positive high frequency shocks.

*** Table 14***

We then use *HFI_shocks* to reclassify our treatment and control groups. Specifically, banks whose *HFI_shocks* are greater than the median of *HFI_shocks* is our treatment group, with the rest of the banks defined as our control group. Panel B of Table 14 shows that our main results hold. Why should the stock market generate any excess returns to congressional hearings on bank compensation at all, unless it is aware that regulatory focus is going to be differentially applied to some banks. In sum, our results are strongly supportive of the argument that regulatory focus is an important factor in why compensation structure changed, which caused both bank idiosyncratic and systemic risks to decrease.

VH. Robustness Tests

We conduct six sets of robustness tests. The first robustness test examines if the above results are due to bank size and not *prevega.* To test if bank size is driving our results, we create a large size variable, $prelarge_i$, defined as a dummy equal to one when the size of the bank before IRF A is greater than median size of pre-2010 banks, and zero otherwise. Then instead of using *IRF* * high-$prevega_i$ as our instrumental variable in the first-stage regression, we use *IRF* * high-$prelarge_i$ as our instrumental variable in the first-stage regression. In Table 15, the second stage results of using high-$prelarge_i$ show that total risk, idiosyncratic risk, and Tobin's Q is not statistically significant. This is not surprising given that our results using high-$prevega_i$ controlled for differences in bank size cross-sectionally (via bank-level fixed effects) and in time-series (using bank size as a control variable). Therefore, our results are not driven by the size of the bank, but by *prevega.*

Table 15

The second robustness test examines whether changes in bank CEO compensation occurred not because of increased regulatory focus but rather due to changes in investor risk preferences after the financial crisis. To examine this alternative mechanism, namely, changes in investor risk preferences, we use the variance risk premium (VAP) of Rosenberg and Engle (2002) and Bollerslev, Gibson and Zhou (2012)). VAP is defined as the difference between the implied volatility from S&P500 options and realized volatility from S&P500 intraday returns. In our second robustness test we use as our instrumental variable *prevega*VAP* instead of *prevega*IRF*. If it is indeed changing investor preferences driving our results, we should find the new instrumental variable to be significantly related to changes in compensation in the first-stage, and a lowering of idiosyncratic risk in the second-stage. In Table 16, we find insignificant results in both the first- and second-stage, indicating that it is not changes in investor risk preferences that is driving our results.[34]

Table 16

In the third robustness test, we examine if *prevega* is not capturing a bank's risk culture as in Fahlenbrach *et al.* (2012). They find that bank's that did poorly in the 1998 Russia crisis also did poorly in the 2007-2009 crisis, which they attribute to a bank's risk culture. In Figure 7, we find no correlation between a bank's 1998 buy-and-hold returns and *prevega*. In Table 17, we repeat our diff-in-diff model using the bank's 1998 buy-and-hold returns instead of *prevega* and find no significant results. These results suggest that our results are driven by changes in the sensitivity of CEO pay to risk, and not to a bank's general risk culture.

[34] We observe that VAP fell substantially in 2008 and recovered in 2009. These results are not reported but are available from the authors.

Figure 7

Table 17

In the fourth 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 18, we find that bank idiosyncratic and systemic risk generally does not significantly decrease (except LTIP). Consistent with our previous results bank performance does not change.

Table 18

The fifth 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 19. In the first-stage regressions we find consistent results with the results in Tables 4-12. Specifically, we once again find differences in performance-vesting restricted stock awards, LTIPs and anti-hedging provisions to go up after increased regulatory focus, and differences in time-vesting options grants go down. When we examine the second-stage regression results, we find once again that bank idiosyncratic and systemic risk goes down with changes in compensation. There are no corresponding changes in bank performance.

Table 19

In the sixth robustness test, we redefine the pre-2010 period to be 2000-2007 to calculate *prevega*, instead of 2000-2009. We run six regression models, the results of which are given in Panel A of Table 20. In the first-stage regressions we find consistent results with the results in Tables 4-12. Additionally, the second-stage regression results show that bank idiosyncratic and

systemic risk goes down with changes in compensation, but there is no corresponding change in bank performance.[35] In Panel B, we examine a shorter 6-year window around IRF A. Once again, we find consistent results.

Table 20

VI. Conclusions

This paper examines the *causal* impact of increased regulatory focus on the structure of bank CEO pay and equity risk. As our treated group, we use three different definitions for which banks' compensation structure were explicitly, or more likely to be, scrutinized by financial regulators. Specifically, banks whose compensation structure was (i) explicitly examined; (ii) more likely to be examined based on a high pre-2010 pay-risk sensitivity; and (iii) more likely to be examined based on the stock market's high frequency returns to the first congressional hearings on bank pay and risk; respectively.

Comparing the differential impact between the treated and control banks for all three definitions of treated banks, we consistently find that performance-vesting restricted stock awards, LTIPs, and anti-hedging provisions increased after regulatory focus increased, and time-vesting options grants decreased. Instrumenting for these differences in compensation structure, we find that idiosyncratic risk and systemic risk went down when regulatory focus intensified, and this

[35] 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. We also examined a sample of manufacturing firms (SIC codes between 2000 and 3999) to analyze if increased regulatory focus impacted these firms differently than banks. We find volatility to increase post-2009, in stark contrast to banks where we find volatility declines. These results are not reported but are available from the authors.

reduction is driven by the treated group. These results suggest that regulatory focus to make bank compensation structure more long term oriented and less convex did successfully reduce bank's idiosyncratic and systemic risks. No significant effect is found for differences in bank equity performance.

We conduct several tests to ensure that the above results are robust. Specifically, we show that (i) the parallel trend assumption holds between our treatment and control groups; (ii) our findings are not about large bank size, nor changing investor risk preferences due to the financial crisis, nor bank culture, nor pay-performance sensitivity (*delta*), respectively; (iii) there is no reverse causality from an individual bank's risk to its compensation structure; and (iv) to different time periods.

Future research might examine if the above compensation structure changes in treated banks also caused them to have lower interest rate risk when interest rates significantly increased in 2023.

References

Acharya, V.V., Pedersen, L.H., Philippon, T., Richardson, M., 2017. Measuring systemic risk. *Review of Financial Studies* 30, 2-47.

Bayazitova, D. and Shivdasani, A., 2012. Assessing TAR. *Review of Financial Studies* 25, 377-407.

Bennett, R.L., Güntay, L., Unal, H., 2015. Inside debt, bank default risk, and performance during the crisis. *Journal of Financial Intermediation* 24, 487-513.

Bettis, J.C., Bizjak, J., Coles, J.L., Kalpathy, S., 2018. Performance-vesting provisions in executive compensation. *Journal of Accounting and Economics* 66, 194-221.

Bollerslev, T., Gibson, M. and Zhou, H., 2011. Dynamic estimation of volatility risk premia and investor risk aversion from option-implied and realized volatilities. *Journal of econometrics* 160, 235-245.

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

Brunnermeier, M., Dong, G., Palia, D., 2020. Banks' non-interest income and systemic risk. *Review of Coroprate Finance Studies* 92, 229-255.

Calloway, B, Goodman-Bacon, A., Sant'Anna, P.H.C, 2024. Difference-in-differences with a continuous treatment. NBER 32117.

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

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.L., Daniel, N.D., Naveen, L., 2006. Managerial incentives and risk-taking. *Journal of Financial Economics* 79, 431-468.

Core, J., Guay, W., 1999. The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics* 28, 151-184

Cortés, K.R., Demyanyk, Y., Li, L., Loutskina, E., Strahan, P.E., 2020. Stress tests and small business lending. Journal of Financial Economics 136, 260-279.

Demsetz, R.S., Strahan, P.E., 1999. Diversification, size, and risk at bank holding companies, Journal of Money, Credit and Banking 29, 300-313.

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.

Edmans, A., Liu, Q., 2011. Inside debt. *Review of Finance* 15, 75-102.

Fahlenbrach, R., Prilmeier, R., Stulz, R.M., 2012. This time is the same: Using bank performance in 1998 to explain bank performance during the recent financial crisis. *Journal of Finance* 67, 2139-2185.

Fahlenbrach, R., Stulz, R.M., 2011. Bank CEO incentives and the credit crisis. *Journal of Financial Economics* 99, 11-26.

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.

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.

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.G., Palia, D., 1995. Executive pay and performance: Evidence from the U.S. banking industry. *Journal of Financial Economics* 39, 105-130.

John, T.A., John, K., 1993. Top-management compensation and capital structure. *Journal of Finance* 48, 949-974.

Lambert, R.A., Larcker, D.F., Verrecchia, R.E., 1991. Portfolio considerations in valuing executive compensation. *Journal of Accounting Research* 29, 129-149.

Lewellen, K., 2006. Financing decisions when managers are risk averse. *Journal of Financial Economics* 82, 551-589.

Maag, C.D., 2018. Flaw-Backs: Executive compensation clawbacks and their costly flaw. *Journal of*

Business Entrepreneurship and Law 11, 353-396.
Nakumura, E., Steinsson, J., High-frequency identification of monetary non-neutrality: the information effct. *Quarterly Journal of Economics* 133,1283-1330.
Ottonello, P., Song, W., 2022. Financial intermediaries and the macroeconomy: evidence from a high-frequency identification. *National Bureau of Economic Research*.
Pierce, J.R., Schott, P.K., 2016. The surprisingly swift decline of US manufacturing employment. *American Economic Review* 106, 1632-62.
Rosenberg, J.V. Engle, R.F., 2002. Empirical pricing kernels. *Journal of Financial Economics* 64, 341-372.
Ross, S.A., 2004. Compensation, incentives, and the duality of risk aversion and riskiness. *Journal of Finance* 59, 207-225.
Shue, K., Townsend, R., 2017. How do quasi-random option grants affect CEO risk-taking? *Journal of Finance* 72, 2551-2588.
Sundaram, R.K., Yermack, D.L., 2007. Pay me later: Inside debt and its role in managerial compensation. *Journal of Finance* 62, 1551-1588.
van Bekkum, S., 2016. Inside debt and bank risk. *Journal of Financial and Quantitative Analysis* 51, 359-385.
Wall, L.D., 2020. Is stricter regulation of incentive compensation the missing piece? *Journal of Banking Regulation* 21, 82-94.
Wei, C., Yermack, D., 2011. Investor reactions to CEOs' inside debt incentives. *Review of Financial Studies* 24, 3813-3840.
Wilson, L. and Wu, Y.W., 2012. Escaping TARP. *Journal of Financial Stability* 8, 32-42.

Figure 1: Impact of Changes in CEO Compensation Structure Due to Increasing Regulatory Focus on Bank Risk and Performance

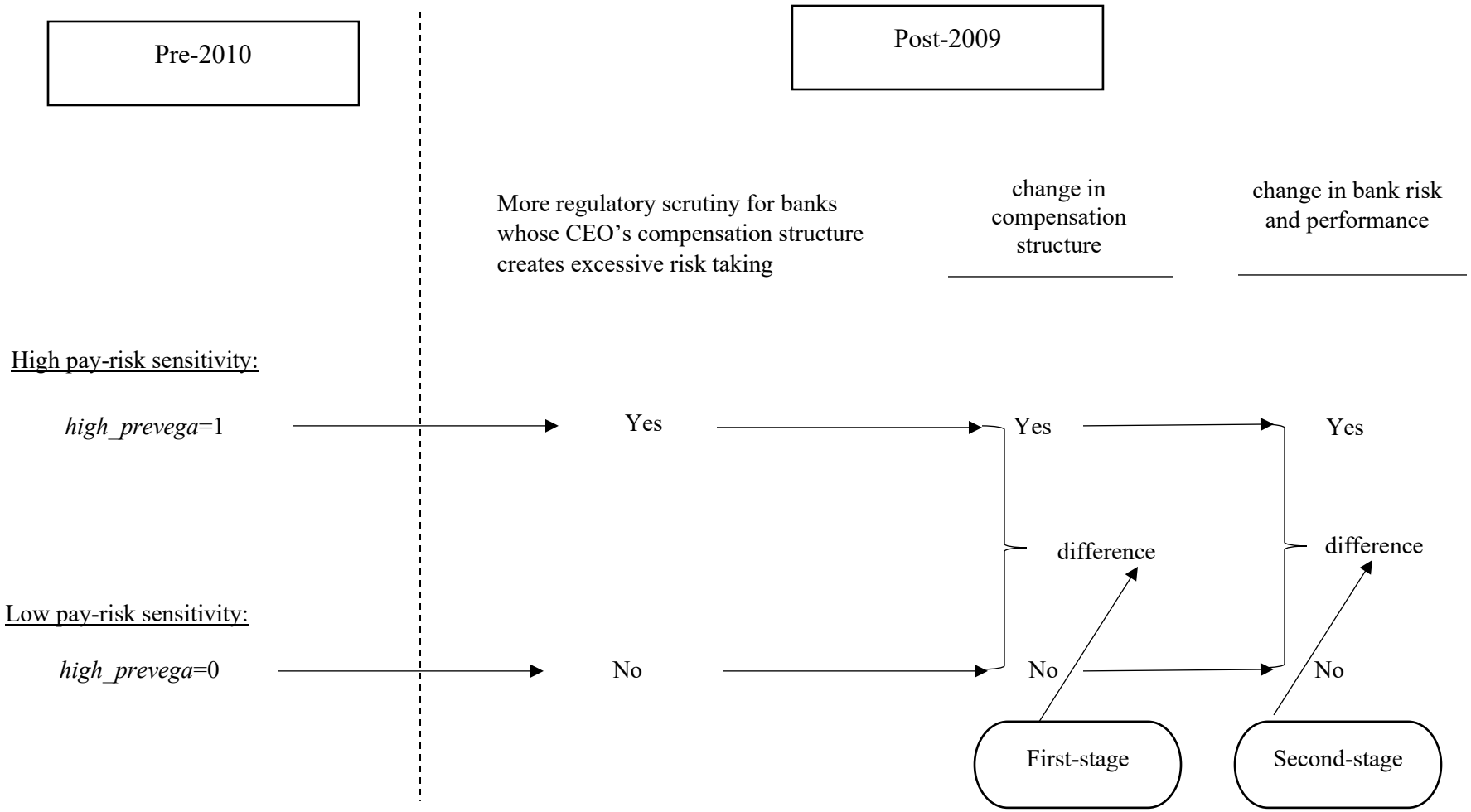

Figure 2: Fraction of Banks in the TARP Program

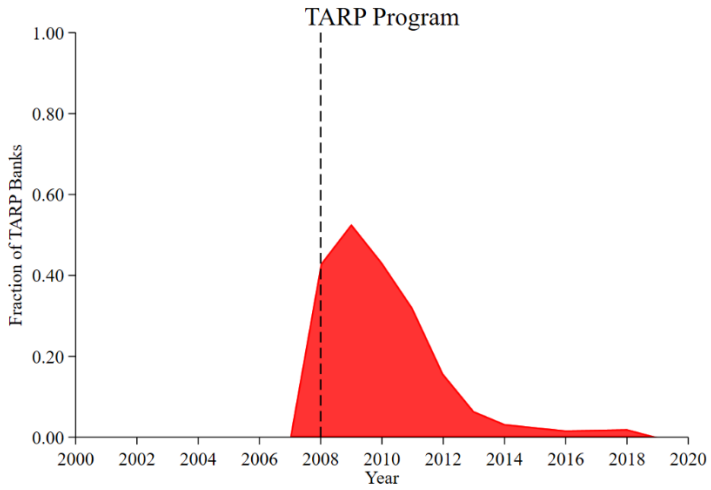

Figure 3: Fraction of Banks in the Stress Test Program

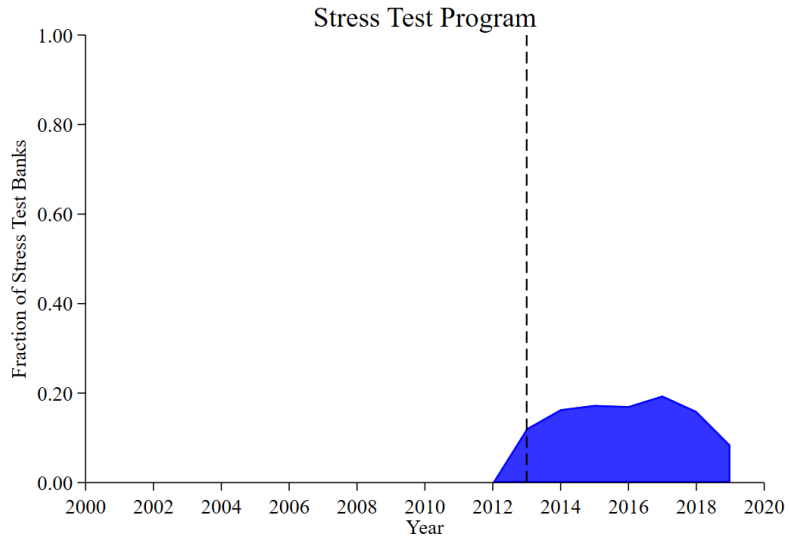

Figure 4: Dynamic Difference-in-Difference Model (Test of Parallel Trend Assumption)

$$Y_{t,i} = \alpha + \sum_{Year=2000}^{2019} \beta_{year} \times \text{high\_prevega}_i * I(\text{year} \neq 2009) + \rho' X + \phi_i + \eta_t + \mu_{i,t}$$

where $Y_{t,i}$ are the compensation variables LTIPs, performance-vesting restricted stock, time-vesting options and anti-hedging provisions, respectively. high_prevega_i is the treatment variable, *X* the control variables, δ_t year dummies, and μ_i bank fixed effects. I() is an indicator function which is set to unity for each year from 2000 to 2019. Therefore β_{year} are the treatment effects of each year relative to the benchmark year 2009 (the year just before increased regulatory focus), and we set $\beta_{2009} = 0$. We plot β_{year} for each fiscal year with their associated 90% confidence interval.

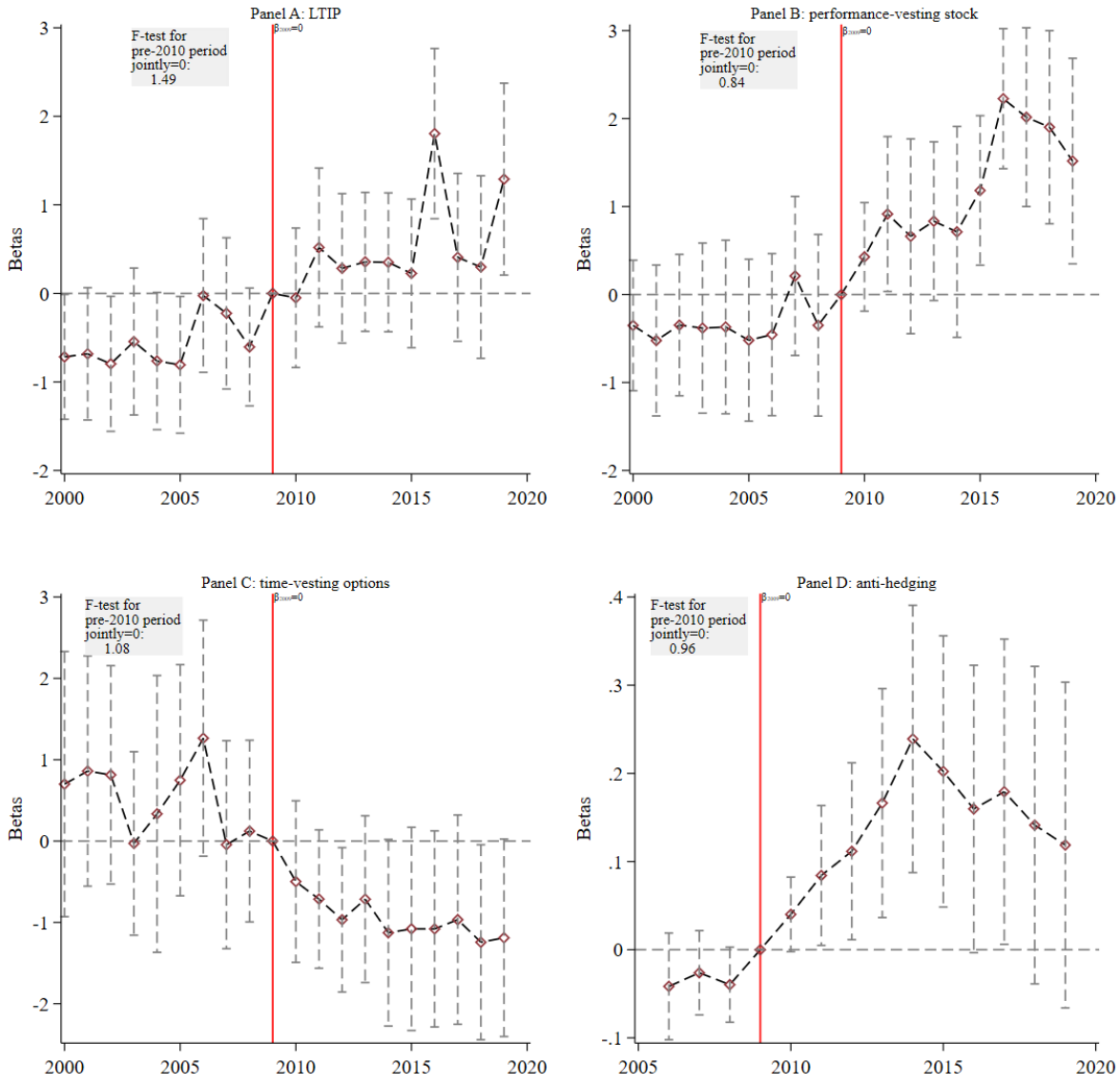

Figure 5: Time Series of Excess Idiosyncratic Risk Between High-*prevega* and Low-*prevega* Groups

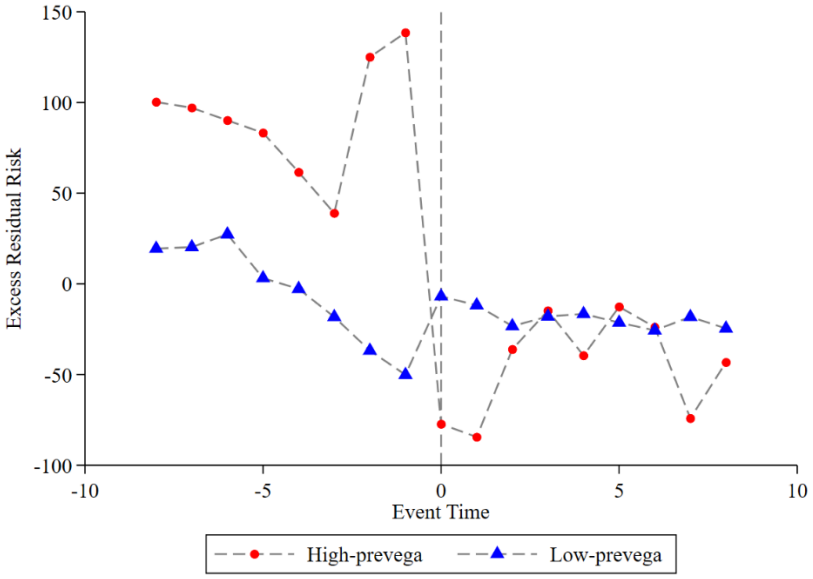

Figure 6: Scatterplot of *prevega* against Buy and Hold Returns in 1998 Russia Crisis

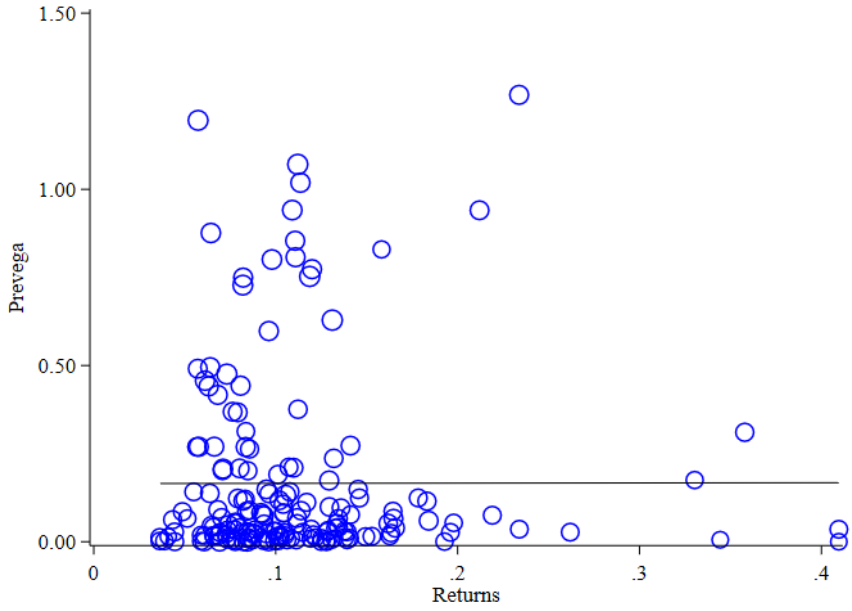

Table 1: Sample Creation

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
IRF	Dummy equal to 1 when regulatory focus significantly increased (2010-2019), otherwise equal to 0	Compustat
size	Natural logarithm of total assets	Compustat
capital	Ratio of market value of equity to total assets	Compustat
TARP	Dummy equal to1 when the bank signed the agreement to receive TARP funds and remains unity until they repaid the TARP money	Manually collected from the website of the treasury department
stress	the banks' stressed capital ratio distance from their regulatory thresholds	Compustat & manually collected from the Fed reserve
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
deferred comp[36]	Present value of deferred compensation (million)	ExecuComp
pensions	Present value of accumulated pensions (million)	ExecuComp

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

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
total risk	Annualized standard deviation of daily stock returns (percent)	CRSP
beta	The coefficient of market stock return on bank stock return, estimated from the CAPM model	CRSP
idiosyncratic risk	Annualized standard deviation of residual stock returns(percent), estimated from the CAPM[37]	CRSP
Systemic (tail) risk	Marginal Expected Shortfall (MES); Acharya, et al (2017)	CRSP
Tobin's Q	Book value of debt plus market value of equity divided by total assets	Compustat

[37] We estimated the beta and idiosyncratic risk from the CAPM model : $bank\ stock\ return_{byt} = \alpha_{by} + \beta_{by} \times market\ stock\ return_t + v_{byt}$ by using the daily stock return for each bank b at each fiscal year y.

Table 3: Summary Statistics

Variable	N	Mean	S.D	Min	25%	50%	75%	Max
high_prevega	2,367	0.50	0.50	0.00	0.00	1.00	1.00	1.00
IRF	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
TARP	2,367	0.11	0.31	0.00	0.00	0.00	0.00	1.00
stress	2,367	0.14	0.67	-0.80	0.00	0.00	0.00	7.80
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
deferred comp	847	3.84	6.90	0.00	0.29	1.09	4.31	36.54
pensions	1,076	4.94	7.20	0.00	0.40	1.93	6.65	35.76
anti-hedging	1,845	0.19	0.39	0.00	0.00	0.00	0.00	1.00
total risk	2,505	35.47	22.21	14.21	22.43	27.59	40.14	130.26
beta	2,505	1.25	0.44	0.23	0.98	1.22	1.50	2.6
idiosyncratic risk	2,505	28.83	19.07	11.88	17.80	22.04	32.65	118.68
systemic (tail) risk	2,352	2.85	2.05	0.33	1.57	2.24	3.37	11.18
Tobin's Q	2,505	1.13	0.35	0.94	1.01	1.05	1.11	3.64

Table 4: Impact of Increased Regulatory Focus on Components of CEO Compensation

$$\text{Comp}_{i,t} = \lambda \times h\text{igh\_prevega}_{\text{i}} * I\text{RF} + \rho' X_{i,t} + \phi_i + \eta_t + \mu_{i,t}$$

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, *IRF* 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, and ϵ_{it} are the error terms. 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*, *capital, TARP,* and *stress*. Robust standard errors are 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* (1)	*stock* (2)	*options* (3)	*LTIP* (4)
*high_prevega*IRF*	-0.323**	1.139***	-1.618***	0.878***
	(0.156)	(0.350)	(0.306)	(0.291)
Observations	2,367	2,367	2,356	2,367
Adj.R2	0.58	0.57	0.52	0.46
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes

Table 5: Impact of Increased Regulatory Focus on Performance-Vesting v. Time-Vesting for Stock and Options

$$Comp_{i,t} = \lambda \times high\_prevega_i * IRF + \rho' X_{i,t} + \phi_i + \eta_t + \mu_{i,t}$$

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; *IRF* 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 dummiesϵ_{it}; and ϵ_{it} are the error terms. 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*, *capital, TARP,* and *stress*. Robust standard errors are 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$_i$**IRF*	1.378***	-0.023	-0.120	-1.286***
	(0.401)	(0.018)	(0.318)	(0.429)
Observations	1,134	1,134	1,134	1,134
Adj. R^2	0.55	0.27	0.33	0.41
Control variables	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes

Table 6: Impact of Increased Regulatory Focus on Other Compensation Structures

$$Comp_{i,t} = \lambda \times h\text{igh\_prevega}_{\text{i}} * \ IRF + \rho' X_{i,t} + \phi_i + \eta_t + \mu_{i,t}$$

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; *IRF* 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; and ϵ_{it} are the error terms. Column headings show the relevant compensation variables examined. The control variables in X_{it} are *size*, *capital, TARP,* and *stress*. Robust standard errors are 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 =	*deferred comp* (1)	*pensions* (2)	*anti-hedging* (3)
high_prevega$_i$*IRF	-1.610	-1.257	0.161***
	(1.430)	(1.101)	(0.057)
Observations	826	1055	1,708
Sample period	2006-2019	2006-2019	2006-2019
Adj. R^2	0.58	0.60	0.54
Control variables	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes

Table 7: Cross-Sectional Probit Regression to Examine Differences in Banks with High Pay-Risk Sensitivities and Banks with Low Pay-Risk Sensitivities before 2010

Data is for the year just before the increased regulatory focus, where the year is defined by the year data is available for each bank. For Panel A, we estimate a Probit regression where the dependent variable is unity if the bank is in the high-*prevega* group before increased regulatry focus (pre-2010), 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*). Robust standard errors are 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 Increased Regulatory Focus on Bank Equity Risk

$$total\ risk_{i,t} = \mu \times \widehat{compensation\ structure}_{i,t} + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$

where compensation structure is instrumented by high_prevega$_i$ $*$ *IRF*. *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; *IRF* 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; and ϵ_{it} are the error t terms. *total risk* is the annualized standard deviation of stock returns. The control variables in X_{it} are *size*, *capital, TARP,* and *stress*. Robust standard errors are 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.

	(1)	(2)	(3)	(4)	(5)
bonus	12.468				
	(7.844)				
LTIP		-4.584**			
		(2.303)			
performance-vesting stock			-3.732**		
			(1.810)		
time-vesting options				3.999*	
				(2.093)	
anti-hedging					-28.008*
					(15.476)
Observations	2,367	2,367	1,134	1,134	1,708
Adj. R^2	0.54	0.68	0.73	0.58	0.70
Control variables	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Table 9: 2SLS Impact of Changes in Compensation Due to Increased Regulatory Focus on Bank Beta or Idiosyncratic Risk

$$beta\ or\ idiosyncratic\ risk_{i,t} = \mu \times \widehat{compensation\ structure}_{i,t} + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$

where compensation structure is instrumented by high_prevega$_i * IRF$. *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; *IRF* 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; and ϵ_{it} are the error terms. In Panel A, the dependent variable is *beta* estimated from the CAPM model, and in Panel B the dependent variable is *idiosyncratic risk*, the standard deviation of the residual value, estimated from the CAPM model, respectively. The control variables in X_{it} are *size*, *capital, TARP,* and *stress*. Robust standard errors are 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: Beta					
	(1)	(2)	(3)	(4)	(5)
bonus	-0.089				
	(0.142)				
LTIP		0.033			
		(0.054)			
performance-vesting stock			-0.060		
			(0.046)		
time-vesting options				0.064	
				(0.049)	
anti-hedging					0.100
					(0.272)
Observations	2,367	2,367	1,134	1,134	1,708
Adj. R^2	0.54	0.53	0.61	0.52	0.46
Control variables	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Panel B: Idiosyncratic Risk					
	(1)	(2)	(3)	(4)	(5)
bonus	12.377				
	(7.602)				
LTIP		-4.551**			
		(2.255)			
performance-vesting stock			-3.355**		
			(1.604)		
time-vesting options				3.595*	
				(1.844)	
anti-hedging					-26.004*
					(14.559)
Observations	2,367	2,367	1,134	1,134	1,708
Adj. R^2	0.43	0.59	0.67	0.50	0.63
Control variables	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Table 10: 2SLS Impact of Changes in Compensation Due to Increased Regulatory Focus on Bank Equity Performance

$$\text{Performance}_{i,t} = \mu \times \widehat{compensation\ structure}_{i,t} + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$

where compensation structure is instrumented by high_prevega$_i * IRF$. *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; *IRF* 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; and ϵ_{it} are the error terms.The dependent variable is Tobin's Q. The control variables in X_{it} are *size*, *capital, TARP,* and *stress*. Robust standard errors are 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.

	(1)	(2)	(3)	(4)	(5)
bonus	0.088				
	(0.098)				
LTIP		-0.032			
		(0.034)			
performance-vesting stock			-0.021		
			(0.028)		
time-vesting options				0.023	
				(0.030)	
anti-hedging					-0.168
					(0.225)
Observations	2,367	2,367	1,134	1,134	1,708
Adj. R^2	0.78	0.79	0.90	0.89	0.81
Control variables	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Table 11: Average Excess Idiosyncratic Risk

This table presents bank excess risk for four groups, high- and low-*prevega*, and pre-2010 and post-2009, respectively. We estimate bank excess risk $u_{i,t}$ by estimating the equation idiosyncratic $risk_{it} = \gamma' X_{i,t} + \alpha_i + \delta_t + u_{i,t}$ from 2000 to 2019. X_{it} are *size*, *capital, TARP,* and *stress*, 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-2010 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-2010 (2000-2009)	0.000%	2.778%	(-2.919)***
Post-2009 (2010-2019)	-1.644%	-1.004%	(-1.032)
t-statistic for differences in means	(1.797)*	(5.619)***	

Table 12:

Panel A: 2SLS Impact of Changes in Compensation Due to Increased Regulatory Focus on Bank Systemic (Tail) Risk

$$tail\ risk_{i,t} = \mu \times \widehat{compensation\ structure}_{i,t} + \gamma' X_{i,t} + \alpha_i + \delta_t + \epsilon_{i,t}$$

where compensation structure is instrumented by high_prevega$_i$ $*$ IRF. *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; *IRF* 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; and ϵ_{it} are the error terms. *tail risk* is the marginal expected shortfall (MES) measure of Acharya, et al (2017). The control variables in X_{it} are *size*, *capital, TARP,* and *stress*. Robust standard errors are 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.

	(1)	(2)	(3)	(4)	(5)
bonus	0.831				
	(0.638)				
LTIP		-0.322*			
		(0.193)			
performance-vesting stock			-0.467**		
			(0.204)		
time-vesting options				0.451**	
				(0.208)	
anti-hedging					-2.324
					(1.431)
Observations	2,352	2,352	1,120	1,120	1,694
Adj. R^2	0.63	0.71	0.68	0.53	0.71
Control variables	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes

Panel B: Average Excess Systemic Risk (Tail Risk)

This table presents bank excess risk for four groups, high- and low-*prevega*, and pre-2010 and post-2009, respectively. We estimate bank excess risk $u_{i,t}$ by estimating the equation tail $risk_{it} = \gamma' X_{i,t} + \alpha_i + \delta_t + u_{i,t}$ from 2000 to 2019. X_{it} are *size*, *capital, TARP,* and *stress*, 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 lower regulatory focus 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-2010 (2000-2009)	0.000%	-0.652%	(7.357)***
Post-2009 (2010-2019)	-0.069%	-0.772%	(-13.598)***
t-statistic for differences in means	(0.865)	(1.869)*	

Table 13: Treated Group Defined as Banks Whose Compensation Policies Were Explicitly Examined by Federal Regulators

Panel A: Control group defined as the original sample of low-*prevega* banks

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*Bonus*	-1.083**	7.010*	5.417	0.007	0.013
		(0.534)	(4.205)	(3.326)	(0.004)	(0.014)
(2)	*LTIP*	3.369***	-2.254***	-1.742***	-0.002***	-0.004
		(0.829)	(0.709)	(0.622)	(0.001)	(0.005)
(3)	*performance-vesting stock*	3.442***	-2.361***	-1.724***	-0.003***	-0.006
		(0.832)	(0.725)	(0.565)	(0.001)	(0.006)
(4)	*time-vesting options*	-2.838***	2.864***	2.091***	0.003***	0.007
		(0.807)	(0.942)	(0.735)	(0.001)	(0.007)
(5)	*anti-hedging*	0.264**	-35.250**	-25.383**	-0.034*	-0.030
		(0.117)	(16.426)	(11.869)	(0.019)	(0.048)

Panel B: Control group defined as all banks that were not explicitly targeted by federal regulatory agencies

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*Bonus*	-0.993*	6.561	4.323	0.007	-0.001
		(0.519)	(4.044)	(2.809)	(0.005)	(0.016)
(2)	*LTIP*	3.561***	-1.828***	-1.205***	-0.002***	0.000
		(0.727)	(0.495)	(0.390)	(0.001)	(0.004)
(3)	*performance-vesting stock*	3.679***	-1.528***	-0.935**	-0.002***	0.002
		(0.667)	(0.453)	(0.366)	(0.001)	(0.006)
(4)	*time-vesting options*	-2.918***	1.926***	1.179**	0.002***	-0.002
		(0.800)	(0.614)	(0.484)	(0.001)	(0.008)
(5)	*anti-hedging*	0.195	-34.387	-19.157	-0.040	0.020
		(0.120)	(21.731)	(13.276)	(0.028)	(0.085)

Table 14: Treated Group Defined as Banks whose High Frequency Stock Returns were Above the Median Value on the First Day of Congressional Hearings on Bank Compensation and Risk (June 11, 2009)

Panel A: Relationship between prevega and high frequency shocks

	(1)	(2)
Prevega,00-09	0.356***	0.239**
	(0.084)	(0.118)
Mean Size,00-09		0.027
		(0.030)
Mean Capital,00-09		0.464
		(0.412)
Constant	-0.086**	-0.560
	(0.036)	(0.485)
Observations	216	216
R^2	0.04	0.04

Panel B: High frequency shocks, compensation, risk and Tobin's Q

		First-stage	Second-Stage				
Regression	Comps	Compensation	Total risk	Idiosyncratic risk	MES	CoVaR	Tobin's Q
(1)	*Bonus*	-0.258*	12.148	13.377	0.003	0.088	-0.016
		(0.153)	(9.028)	(9.290)	(0.007)	(0.136)	(0.114)
(2)	*LTIP*	1.158***	-2.709**	-2.983**	-0.001	-0.020	0.004
		(0.290)	(1.356)	(1.318)	(0.002)	(0.029)	(0.025)
(3)	*performance-vesting stock*	1.792***	-2.749**	-2.363**	-0.002**	-0.071**	-0.016
		(0.455)	(1.203)	(1.121)	(0.001)	(0.032)	(0.024)
(4)	*time-vesting options*	-1.498***	3.288**	2.825*	0.002**	0.077**	0.019
		(0.538)	(1.645)	(1.513)	(0.001)	(0.037)	(0.030)
(5)	*anti-hedging*	0.027	-161.830	-182.851	-0.013	0.596	0.734
		(0.058)	(327.805)	(368.916)	(0.126)	(3.111)	(2.044)

Table 15 (Robustness Test 1): Placebo Results by Partitioning the Pre-2010 Sample into Two Groups Based on Bank Size

	Bonus	*LTIP*	*performance-vesting stock*	*time-vesting options*	*anti-hedging*
	(1)	(2)	(3)	(4)	(5)
Total risk	7.971	-3.008	-5.220	2.288	-60.298
	(7.958)	(2.618)	(9.665)	(2.903)	(69.312)
Idiosyncratic risk	7.033	-2.654	-2.670	1.170	-49.667
	(7.343)	(2.509)	(6.664)	(2.521)	(59.328)
Systemic risk	0.807	-0.290	-0.542	0.383	-5.976
	(0.811)	(0.225)	(0.800)	(0.447)	(6.229)
Tobin's Q	-0.029	0.011	0.121	-0.053	0.358
	(0.102)	(0.039)	(0.369)	(0.126)	(0.714)

Table 16 (Robustness Test 2): Placebo Results by Using Investor Risk Preferences

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*Bonus*	0.001	-2.302	-3.431	-0.089	-0.060
		(0.002)	(75.230)	(71.091)	(0.298)	(0.698)
(2)	*LTIP*	-0.000	6.621	9.869	0.148	0.174
		(0.007)	(256.957)	(300.072)	(2.713)	(4.279)
(3)	*performance-vesting stock*	-0.012	-7.472	-9.531	-0.001	0.035
		(0.011)	(11.499)	(11.223)	(0.008)	(0.078)
(4)	*time-vesting options*	0.005	16.438	20.966	0.002	-0.077
		(0.013)	(44.050)	(50.758)	(0.017)	(0.243)
(5)	*anti-hedging*	0.000	332.266	641.585	-0.554	-5.393
		(0.001)	(6060.101)	(1.1e+04)	(2.674)	(96.502)

Table 17 (Robustness Test 3): Placebo Test Using Bank Performance in 1998 Russia Crisis as the Treatment Group

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*bonus*	0.087	0.181	-2.377	0.321	0.251
		(0.210)	(18.330)	(18.295)	(1.982)	(0.575)
(2)	*LTIP*	0.250	0.063	-0.826	0.112	0.087
		(0.385)	(6.374)	(6.185)	(0.665)	(0.135)
(3)	*performance-vesting stock*	0.581	1.031	1.362	0.123	0.045
		(0.697)	(3.471)	(3.273)	(0.357)	(0.056)
(4)	*time-vesting options*	-0.485	-1.235	-1.631	-0.148	-0.054
		(0.799)	(4.335)	(4.249)	(0.452)	(0.091)
(5)	*anti-hedging*	-0.010	62.219	101.716	-2.896	-1.141
		(0.067)	(441.145)	(656.245)	(25.436)	(6.775)

Table 18 (Robustness Test 4): Using *predelta* Rather Than *prevega* to Classify Banks Before 2010

	Bonus	*LTIP*	*performance-vesting stock*	*time-vesting options*	*anti-hedging*
	(1)	(2)	(3)	(4)	(5)
Total risk	16.941	-4.433*	-3.697	3.792	-28.061
	(13.366)	(2.414)	(2.729)	(3.396)	(18.434)
Idiosyncratic risk	17.084	-4.471*	-3.525	3.616	-26.284
	(13.054)	(2.348)	(2.557)	(3.181)	(17.176)
Systemic risk	0.977	-0.272	-0.244	0.215	-2.460
	(0.983)	(0.199)	(0.194)	(0.189)	(1.837)
Tobin's Q	0.157	-0.041	-0.019	0.019	-0.239
	(0.169)	(0.037)	(0.028)	(0.029)	(0.280)

Table 19 (Robustness Test 5): Using Sample Mean Volatility Rather than Individual Bank Volatility in Defining *prevega*

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*bonus*	-0.315*	13.139	13.208	0.920	0.094
		(0.162)	(8.429)	(8.253)	(0.693)	(0.105)
(2)	*LTIP*	0.864***	-4.785**	-4.810**	-0.355*	-0.034
		(0.296)	(2.398)	(2.367)	(0.201)	(0.035)
(3)	*performance-vesting stock*	1.313***	-3.861**	-3.582**	-0.452**	-0.021
		(0.382)	(1.693)	(1.516)	(0.193)	(0.029)
(4)	*time-vesting options*	-1.368***	3.706**	3.438**	0.395**	0.020
		(0.426)	(1.762)	(1.565)	(0.178)	(0.028)
(5)	*anti-hedging*	0.159***	-29.192*	-27.903*	-2.567*	-0.180
		(0.058)	(15.915)	(15.223)	(1.519)	(0.237)

Table 20 (Robustness Test 6): Different Definitions of Time Periods

Panel A: Redefining the pre-2010 period as 2000-2007 instead of 2000-2009

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin's Q
(1)	*bonus*	-0.342**	14.643*	14.188*	0.999	0.084
		(0.168)	(8.625)	(8.269)	(0.694)	(0.085)
(2)	*LTIP*	0.800***	-6.254**	-6.059**	-0.409*	-0.036
		(0.306)	(3.023)	(2.952)	(0.211)	(0.033)
(3)	*performance-vesting stock*	1.238***	-4.149**	-3.564*	-0.491**	-0.053*
		(0.426)	(2.076)	(1.824)	(0.205)	(0.032)
(4)	*time-vesting options*	-1.430***	3.591**	3.086**	0.491**	0.046*
		(0.443)	(1.753)	(1.541)	(0.221)	(0.027)
(5)	*anti-hedging*	0.130**	-41.147*	-37.741*	-3.097*	-0.208
		(0.059)	(23.545)	(21.966)	(1.833)	(0.271)

Panel B: Using a shorter (6-year) window for both pre-2010 and post-2009

		First-stage	Second-stage			
Regression	Compensation	Compensation	Total risk	Idiosyncratic risk	Systemic risk	Tobin’s Q
(1)	*Bonus*	-0.324***	13.830*	14.543**	0.548	0.068
		(0.122)	(7.152)	(7.195)	(0.540)	(0.098)
(2)	*LTIP*	0.787**	-5.697*	-5.991*	-0.240	-0.028
		(0.333)	(3.155)	(3.245)	(0.226)	(0.040)
(3)	*performance-vesting stock*	1.249***	-5.428**	-4.773**	-0.606**	-0.022
		(0.466)	(2.339)	(2.103)	(0.278)	(0.035)
(4)	*time-vesting options*	-1.602**	4.231**	3.721**	0.431**	0.017
		(0.633)	(2.006)	(1.773)	(0.197)	(0.028)
(5)	*anti-hedging*	0.157***	-28.945*	-27.568*	-2.105	-0.168
		(0.051)	(15.337)	(14.628)	(1.408)	(0.228)