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Bankers' compensation before and after the 2007-2008 crisis

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BEFORE AND AFTER THE 2007–2008 CRISIS

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BANKERS' COMPENSATION

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ABSTRACT

This paper examines the effect of recent regulations on executive incentive compensation contracting among US banks. Following regulations (the Guidance on Sound Incentive Compensation Policies and the Dodd-Frank Act Section 956) intended to prevent incentive compensation arrangements that encourage imprudent risk-taking, I test whether pay-for-performance is weaker and the penalty for downside tail risk is stronger in the post-crisis period as compared to the pre-crisis period. Specifically, I compare the impact of the regulations on large banks versus small banks, using the latter to control for concurrent events. Consistent with regulatory intent, I find evidence of weaker pay-for-performance and larger penalties for downside tail risk for CEOs of large banks in the post-crisis years, as compared to small banks. Together, the results provide evidence on the effectiveness of new regulations in curbing bank CEOs' incentives, as well as introduce downside tail risk as a determinant of compensation in the banking industry.

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LIST OF ABBREVIATIONS

CEO.....Chief Executive Officer

CFO.....Chief Financial Officer

FDIC .....Federal Deposit Insurance Corporation

FRS .....Federal Reserve System

MES .....Marginal Expected Shortfall

OCC ..... Office of the Comptroller of the Currency

OTS..... Office of Thrift Supervision

PPS.....Pay-Performance Sensitivity

TARP ..... Troubled Asset Relief Program

1. Introduction

Ever since the 2007-2008 financial crisis, an ongoing debate surrounds whether compensation incentives caused banking executives to take on excessive risk, which further contributed to the 2007-2008 financial crisis. Due to the severe negative externalities associated with the potential failure of large banks, the US government introduced regulations aimed at improving bank incentive compensation arrangements to maintain their safety and soundness.[1] The common theme of these regulatory interventions is to prohibit incentive compensation arrangements that encourage imprudent risk-taking. Although partially in the proposed rule stage, some of the regulations' changes have already occurred in the banking sector.[2] However, many criticize the proposed rules, indicating concerns that the regulations would harm the efficiency of the executive labor market, and make it difficult for the affected financial institutions to attract and retain top talent.[3] This has led to calls to repeal these regulations. Since 2017, the proposed rules have been deferred on regulators' rule-making agenda.

This paper investigates the effect of two key regulatory changes on executive

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[1] In particular, I analyze two new regulations that target banks only: the Guidance on Sound Incentive Compensation Policies and the Dodd-Frank Section 956. The former covers commercial banks; and the latter covers not only commercial banks but also investment banks, brokers and dealers. Throughout this study, I will loosely refer to the covered financial institutions as "banks". Other post-crisis regulations on compensation apply to all public firms, such as "say-on-pay". My use of the term "regulations" in this study specifically excludes "say-on-pay" and related initiatives.

[2] The Federal Reserve noted changes in a review of 25 large banks from 2009 to 2011. The review report can be found here: https://www.federalreserve.gov/publications/other-reports/files/incentive-compensation-practices-report-201110.pdf.

[3] See regulators' discussion of comments that they receive for the Guidance: https://www.occ.gov/news-issuances/federal-register/75fr36395.pdf.

incentive compensation contracting at banks: the Guidance on Sound Incentive Policies, and Section 956 of Dodd-Frank. Specifically, it focuses on changes in two characteristics of incentive design: the strength of pay-for-performance (or pay-performance sensitivity, abbreviated "PPS"), and the strength of penalty for downside tail risk. To avoid "excessive" incentive compensation, banks may grant lower levels of incentive pay for the same level of performance: i.e., decrease PPS in the post-crisis period. To discourage managerial activities that can lead to material financial losses, banks can make greater downward adjustments to compensation for certain risk metrics: i.e. imposing a greater penalty to executives for extremely bad risk outcomes, in the post-crisis period than in the pre-crisis period.[4]

However, it is unclear if these expected changes will occur. From the regulators' perspective, there is uncertainty on the effective enforcement of the new regulations. First, the provisions under Dodd-Frank Act Section 956 remain in proposed rule stage; thus, it is unclear how regulators would enforce them. Secondly, frictions such as information asymmetry (e.g., due to the complexity of executive compensation contracts) and limited resources (due to the number of firms under their jurisdiction) suggest that regulators may be unable to fully assess whether incentives from compensation actually violate the imposed regulations. Finally, regulators may be captured due to the "revolving door" between public-sector regulators and private-sector executives,

[4] The penalty for downside tail risk in this paper refers to a downward adjustment of compensation in correspondence to downside tail risk measures. It takes the implicit form of reduced compensation, and does not mean that CEOs need to pay explicit fines to their employer for downside tail risk.

compromising their ability to conduct effective supervision. From the banks' perspective, boards still retain significant discretion in designing compensation contracts, since the regulations are principle-based rather than rule-based. This suggests that banks can use indirect tools to change their incentive compensation contracting (such as longer vesting periods, more deferred compensation, or stricter clawback provisions), instead of explicitly decreasing PPS and increasing the penalty for downside tail risk. Because regulators have lower risk tolerance than shareholders, the changes desired by regulators can conflict with maximization of shareholder wealth. The regulations also force bank managers to have more "skin in the game." As a result, the resistance from shareholders and managers may prevent any meaningful changes from occurring.

One challenge to assess the effects of regulation on compensation is establishing causality between the new regulations and the observed changes due to other concurrent compensation regulation changes, such as "say-on-pay." Accordingly, I exploit a difference-in-differences design to disentangle the impact of the specific regulation targeting incentive compensation contracting in the financial sector relative to other potentially correlated contemporaneous regulatory and non-regulatory effects. Because the regulations explicitly place more stringent requirements on larger banks, I partition the sample into a treatment group (large banks) and a control group (small banks). In particular, I expect the regulatory changes to impact large banks more significantly than small banks.

In support of my expectations, I find strong evidence that PPS is weaker, and that the penalty for downside tail risk is stronger, in the post-crisis period among large banks

as compared to small banks. Further, falsification tests support a causal relation between the regulations and the observed changes by showing that: (1) the observed changes are unlikely driven by other factors, such as TARP constraints or the self-correction of large banks; and (2) the increased penalty occurs only to downside tail risk but not to other risk measures, such as total or systemic risk. As the regulations cover not only CEOs but also other employees who can expose their organization to significant risk, I also look at CFO compensation contracts.[5] The empirical results provide similar evidence of increased penalty for downside tail risk, and much weaker evidence of decreased PPS among bank CFOs; this can reflect that non-CEO executives typically receive a lower proportion of total pay in the form of incentive pay. Together, the empirical results suggest that recent regulations are effective in preventing compensation incentives that may lead managers to adopt imprudent risk-taking behavior.

The empirical analyses provide two additional observations. First, I find that downside tail risk is actually *rewarded* among large banks in the pre-crisis period, rather than penalized. This is consistent with the regulators' belief that incentive compensation contracting prior to the new regulation was not compatible with effective risk control. Second, I find no significant pay-for-performance among large banks in the post-crisis period. However, one should interpret this result with caution when drawing inferences on the overall level of CEO incentive because this study focuses on the design of flow compensation contracts. The literature has shown that a major portion of CEO's

[5] For example, the Guidance applies to senior officers, including "named officers" for publicly traded companies. See Footnote 10 of the Guidance for details.

incentives derives from the holdings of stock and options previously granted. This portfolio of stock and options may mitigate the problem of misaligned interests between bank shareholders and managers, but it does not resolve the conflicting interests between bank shareholders and regulators.

The findings in the paper provide important policy implications. In particular, they provide direct evidence for the effects of new regulations. The relation between compensation and downside tail risk also sheds light on the compatibility between incentive compensation contracts and the safety and soundness of banks in both the pre- and post-crisis period. Finally, the results are relevant to the debate around the more restrictive rules of Dodd-Frank Section 956 that were proposed in 2016.

Besides policy implications, this study contributes to the compensation contracting literature by considering the unique institutional setting of banks, as opposed to non-financial firms. Specifically, I examine how downside tail risk impacts compensation contracts, which has not been formally considered in prior research. In a classical principal-agent model, agents (managers) are assumed to be more risk-averse than principals (shareholders). Thus, the primary goal of incentive compensation is to motivate managers to take more risks. This association gets more complicated when considering the effects of debt: Jensen and Meckling (1976) argues that shareholders of levered firms may prefer firms to invest in risky projects to transfer wealth from debtholders to shareholders (i.e., engage in "risk-shifting"). These effects are exacerbated in the financial sector due to relatively high leverage ratios, and the potential for regulators to largely absorb the downside tail risk. Therefore, risk-taking by bank

managers when maximizing shareholder wealth can be seen as excessive from regulator's point of view. This suggests regulators may want boards to add some disincentives to bank managers to mitigate excessive risk-taking. In particular, regulators can prod boards to introduce penalties for downside tail risk, as a proxy for excessive risk-taking, into CEO compensation contracts for banks. Thus, this paper provides the first piece of evidence on the contracting role of downside tail risk, and builds upon prior research examining compensation contracts (Aggarwal and Samwick, 1999; Jin, 2002; Cheng, Hong, and Scheinkman, 2015).

Section 2 summarizes prior research. Section 3 introduces the regulations, and develops the hypotheses. Section 4 describes the empirical models. Section 5 presents the empirical analysis. Section 6 summarizes.

2. Related Literature

2.1 Pay, Performance and Risk

This paper relates to the broad area of literature on compensation contracting. Specifically, it relates to the literature on how the level of compensation adjusts based on various observable factors. Performance and risk as two main outcomes of managerial actions are discussed here. Given the intense regulatory oversight of the financial sector, there can be fundamental differences in compensation contracting between financial firms and non-financial firms, so a large body of compensation literature excludes

financial sector. In this paper, I only discuss the literature that applies to financial firms.[6]

Pay-for-performance has been extensively studied, where performance is usually measured by stock returns or (the change in) return on assets. John and John (1993) models the optimal compensation contract in the presence of debt and predicts that PPS should decrease with leverage when considering the agency cost of debt. John and Qian (2003) confirms this prediction by showing that PPS in banks is lower than that in manufacturing firms. Bennett, Gopalan, and Thakor (2016) finds that, compared to non-financial firms, financial firms (including banks and insurance firms) link a higher proportion of executive compensation to accounting performance and a lower proportion to stock returns.

How risk affects compensation contracting originates from the classical principal-agency theory. The theoretical and empirical results generally suggest that (exogenous) firm risk affects both the strength of incentive and the dollar value of compensation. Aggarwal and Samwick (1999) proposes and finds that executive pay-for-performance sensitivity decreases with firm total risk; Jin (2002) further decomposes total risk into idiosyncratic risk and systematic risk, and shows that the level of CEO's incentives (measured by the delta of her equity portfolio) decreases with firms' idiosyncratic risk but is not affected by systematic risk.[7] Cheng et al. (2015) argues that riskier firms need to provide higher levels of total compensation to attract risk-averse managers and finds

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[6] I focus on studies that either do not differentiate between financial firms from non-financial firms or that look exclusively within the financial sector. I exclude from my discussion studies on non-financial firms for the sake of brevity and relevance.

[7] According to the sample description, these two papers, Aggarwal and Samwick (1999) and Jin (2002), use data from ExecuComp for both financial firms and non-financial firms.

consistent results among US financial firms during 1992–2008. Guo, Jalal, and Khaksari (2015) also documents a similar positive association between CEO compensation and total firm risk. In contrast to these previous studies, Bennett et al. (2016) shows that bank managers' performance targets are not adjusted for risk during the period 2006-2014.

This study contributes to the prior literature by addressing two deficiencies in the literature on how risk affects compensation contracting. First, when measuring risk, the above empirical studies do not distinguish between upside and downside risk. The three mostly used measures of risk are total risk, systematic risk and idiosyncratic risk. Ignoring higher moments of the outcome distribution may be insufficient from the perspective of financial regulators, who clearly worry only about the downside risk, especially the downside tail risk. On the other hand, bank executives benefit from gains in banks but are largely protected from losses. They probably lack the incentive to put sufficient weight on downside risk when choosing risky projects, as argued by Bebchuk and Spamann (2010). Therefore, downside tail risk may be an additional determinant of compensation contracts in banks. A penalty for downside tail risk in compensation contract would force bank executives to internalize the negative externality from excessive risk-taking. The distinct incentives for downside tail risk cannot be determined using only traditional risk measures.

Second, the prior literature tends to focus on the exogenous component of risk and to study its impact on compensation contracting from the perspective of the participation constraint. This perspective ignores the fact that part of risk is also an outcome of managerial actions. Thus, risk can affect compensation contracting through the incentive

compatibility constraint as well. Though not the focus of this paper, a large stream of the literature focuses on how incentives affect risk. The strength of incentives can be measured by the slope and convexity of equity compensation or firm-related wealth to firm performance as well as the percentage of incentive compensation. These papers generally support the wealth transfer argument, that better alignment of interests between shareholders and managers induces managers to choose higher risk level to shift wealth from debtholders to shareholders (Saunders, Strock, and Travlos, 1990; Noe, Rebello, and Wall, 1996; Fahlenbrach and Stulz, 2011; Kuang and Qin, 2013; Chen et al., 2006; Mehran and Rosenberg, 2007; DeYoung et al., 2013; Balachandran et al., 2010; Guo, Jalal, and Khaksari, 2015; Bennett et al., 2016).[8] This study relies on the extension of the relationship between incentive and risk shown above. That is, risk, just like performance, should be at least partially controllable by CEO. If not, there is no need to design incentives for better risk outcomes. Therefore, this study assumes that a firm's risk is also a result of CEO's actions that should be contracted upon, just like performance.

2.2 Regulation and Compensation Contracting

This study is also closely related to a stream of literature examining how regulation affects compensation contracting. In the past, the US banking industry experienced waves of deregulations. Crawford, Ezzell, and Miles (1995) and Hubbard

[8] A similar positive association between convexity and (future) risk is documented in non-financial firms (Rajgopal and Shevlin, 2002; Coles et al., 2006, among others). Although Hayes et al. (2012) document that some part of convexity resulted from extracting the accounting benefits of option grants and does not seem to be associated with risk. On the other hand, Koharki, Ringgenberg, and Watson (2018) argue that convexity can also benefit creditors by motivating managers to take more positive-NPV projects.

and Palia (1995) both document an increase in PPS after bank deregulation in the 1980s. The deregulations in these two studies are about releasing constraints on bank operations, not directly about management compensation. Therefore, the authors interpret the change in PPS as a voluntary adjustment of compensation contracting to new investment opportunities. This is different from the regulations studied in this paper, which directly address compensation.

After the 2007–2008 crisis, many countries and other jurisdictions increased the regulation of compensation in banks, following the Guidelines on Sound Compensation proposed by the Financial Stability Board. The detailed implementation varies across countries. Two studies examine their effect on compensation contracting from different perspectives. Kleymenova and Tuna (2018) looks at the consequences of compensation regulations in the UK. They find that the capital market views some regulation positively (i.e., the UK Remuneration Code) and other regulation (i.e., the EU bonus cap) negatively, consistent with the view that regulating bankers' compensation is not always in the best interest of shareholders. The results also show that after the regulation on compensation, UK banks have more deferred bonuses, higher PPS and option use and that banks become less risky. Finally, their paper documents higher CEO turnover and increased complexity in bank CEO compensation contracts. Cerasi et al. (2017) examines banks from multiple jurisdictions, some that adopt the new regulations on compensation and others that do not. Using a difference-in-differences design, the paper finds that CEO compensation at banks in treated jurisdictions is less positively associated with profits and more negatively associated with total risk, i.e. a decreased PPS and an

increased penalty for total risk.

My study differs from these two papers in two substantive ways. First, I examine banks in the US, where the rule-making process is still ongoing and thus its effect more uncertain. This setting also addresses the power of regulators absent the effect of public comment, which could reinforce the captured nature of regulators. Second, and more importantly, I look at the penalty for downside tail risk, a characteristic that is arguably more straightforward in capturing the intent of the regulations to curb excessive risk-taking behavior.

3. Institutional Background and Hypotheses Development

3.1 Regulations to Align Reward and Risk among Banks

One crucial distinction between risk-taking by banks as opposed to non-financial firms is that the realizations of extreme negative outcomes for financial firms are protected by the federal safety net, such as deposit insurance from the FDIC, discount window lending from the FRS, and even government bailout during times of emergency. Therefore, one major goal of bank regulation is to maintain the safety and soundness of banks. Bank regulators typically use the CAMELS rating system to evaluate banks. It contains six aspects: capital adequacy, asset quality, management, earnings, liquidity, and sensitivity to market risk. Earnings is one consideration because theoretically any firm who can't create return for capital will eventually go bankrupt. Financial institutions are no exceptions. But pursuing earnings can sometimes conflict with other aspects. For example, some risky long-term loans may bring magnificent earnings for the short term,

while reducing capital adequacy, asset quality and liquidity, as well as increasing banks' sensitivity to market risk. In this sense, the goals of bank regulators and shareholders do not coincide with each other.

In addition, the protection provided by bank regulators effectively provides bank shareholders with inappropriate risk-taking incentives. The basic logic is as follows: if the risk outcome is positive, return primarily goes to shareholders; and if the risk outcome is extremely negative, the regulators may step in and absorbs the majority of the losses. As a result, the risk level that shareholders of an individual bank are willing to bear may exceed the level that regulators wish to be exposed to considering the macroeconomy. If bank managers' interests are perfectly aligned with shareholders, they may choose a risk level that is too high from the regulators' point of view. To correct this problem, regulatory invention is needed to better align bank managers' interests with those of regulators, even though this deviates from the optimum from the shareholders' perspective.

US regulators have started to oversee bank employee compensation since the early 1990s, as written in the Section 132 Standards for safety and soundness of the Federal Deposit Insurance Corporation Improvement Act of 1991 ("FDICIA"). Banks are prohibited from providing compensation that is excessive or that could lead to material financial losses. According to the standards, employee compensation is considered "excessive" when the amounts paid are either "unreasonable or disproportionate to the services actually performed" by considering several factors: the total compensation, the compensation history of the employee and peers, the financial

condition of the bank, the compensation practices at peer banks, the projected total post-employment benefits, whether the employee is involved in misconduct, and other factors that regulators consider to be relevant. Four federal bank regulators examine banks to determine whether they are in compliance with the safety and soundness standards or not.[9] However, there were no detailed standards guiding the compensation contracting practices as the regulators wanted to give banks flexibility and avoid micro-management.

In the wake of the 2007-2008 financial crisis, regulators believe that bankers' incentive pay is one of the contributing factors to the crisis. A series of government interventions have been launched, aiming to improve the "incentive" compensation practices within a broader range of banks to maintain the safety and soundness of the whole financial system. In the middle of 2010, four U.S. regulatory agencies jointly issued the Guidance on Sound Incentive Compensation Policies (the "Guidance") for banking organizations under their supervision.[10] The Guidance explicitly requires all banks under the supervision of any of the four agencies to design and implement their incentive compensation contracts to "appropriately balance risk and reward", to "be compatible with effective controls and risk management", and to "be supported by strong corporate governance." They require banks to have incentive compensation arrangements that are "consistent with safety and soundness, even when these practices go beyond those needed to align shareholder and employee interests." An example of

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[9] See for example, the discussion in the Guidance: https://www.occ.gov/news-issuances/federal-register/75fr36395.pdf.

[10] The agencies are the Federal Reserve System (FRS), The Office of the Comptroller of the Currency (OCC), the Federal Deposit Insurance Corporation (FDIC), and the Office of Thrift Supervision (OTS).

poorly designed compensation contract, as pointed out by the Guidance, is one that links compensation to short-term profits without considering the associated risk.

Later in 2010, the Dodd-Frank Wall Street Reform and Consumer Protection Act ("Dodd-Frank Act") was signed into law, bringing profound changes to the financial industry, broadening the regulated institutions from depository institutions to investment banks and other financial institutions. Building on the standards from the Federal Deposit Insurance Corporation Improvement Act of 1991 ("FDICIA") and the principles from the Guidance of 2010, Dodd-Frank Section 956 prescribed more details regulating incentive-based compensation among banks. According to the 2011 proposed rules, financial institutions with at least $1 billion of consolidated total assets are subject to Dodd-Frank Section 956, with financial institutions defined as the following: (1) a depository institution; (2) a broker-dealer; (3) a credit union; (4) an investment advisor; (5) Fannie Mae; (6) Freddie Mac; (7) any other financial institution designated by regulators. Although the 2011 rules under Dodd-Frank Section 956 were not effective immediately, many of the practices proposed were put in place by many large banks in 2011, according to a review report by the Federal Reserve System.[11] The report finds that banks use two major methods to prevent imprudent risk taking: risk adjustment of awards and deferral of payments.

Both the Guidance and Dodd-Frank Section 956 treat banks differently, depending primarily on their size. The Guidance requires larger banks to have

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

"systematic and formalized policies, procedures and processes" in place, while smaller banks can have "less extensive, formalized, and detailed" procedures in place.[12] Dodd-Frank Section 956 explicitly defines a covered bank as one with total assets larger than $1 billion. It further uses total assets of $50 billion as the cutoff point to classify a "larger covered financial institution" within each type of covered financial institutions based on total assets.[13] Under both regulations, larger banks must comply with more stringent rules.

3.2 Hypotheses Development

As a result of the 2007–2008 financial crisis, financial regulators issued rules to prohibit incentive compensation from being excessive or encouraging imprudent risk-taking. While the regulation does not provide explicit guidance on what "excessive" incentive compensation entails, one manifestation is to prevent abnormally high pay for performance. Moreover, prior literature has shown that stronger incentive is positively associated with bank risk-taking. For example, Noe et al. (1996) proposes a theoretical model in which linking bonus to performance may induce risk-seeking behaviors among bank managers. Saunders et al. (1990) documents that large commercial banks with higher managerial ownership exhibit higher capital market risk during the deregulation period of 1978-1985. Fahlenbrach and Stulz (2011) shows that bank CEOs' equity portfolio delta (the change in the value of equity portfolio to a 1% change in stock price)

[12] The "large banking organizations" (or LBOs) under the Guidance refer to a set of large and complex banks that are identified by the federal regulators for supervision purposes.

[13] The larger covered banks under Dodd-Frank Act generally refer to those with total assets larger than 50 billion dollars.

in 2006 is negatively associated with banks' performance during the crisis. Compensation incentives can interact with institutional factors in the financial sector to magnify firm risk.[14] Noe et al. (1996) demonstrates that shareholder-designed compensation contracts may further exacerbate the risk-taking incentives of managers of troubled banks. Therefore, weakening incentive compensation is a natural way to weaken excessive risk-taking. Weakening incentive can be achieved through various ways. Reducing the strength of incentive can be one. For example, less compensation can be granted for the same level of performance. Making performance targets more difficult to achieve is another way. On the other hand, it was noted by the Federal Reserve that some large banks defer more compensation to the future and use longer performance period after the crisis. Both practices can weaken the association between performance and compensation in the short term. Therefore, I expect to find a decrease in PPS under the new regulations, compared to the years before the regulations.

The regulations explicitly differentiate between large and small banks. According to the Guidance and Dodd-Frank Section 956, more stringent regulations apply to large banks for two reasons. First, large banks use incentive compensation more intensively than small ones; second, failure of large banks is more detrimental to the economy. Therefore, the expected changes are more likely to occur within large banks than small ones. This leads to my first hypothesis as follows:

[14] Some analytical studies have shown that deposit insurance alone can encourage risk-taking among banks (Kareken and Wallace, 1978; Merton, 1978; Sharpe, 1978, among others).

H1: PPS decreases more from the pre-crisis period to the post-crisis period among large banks than small banks.

The new regulations also aim to prevent incentives that can induce imprudent risk-taking, which is not equivalent to promote less risk-taking. While less risk-taking reduces imprudent negative outcomes, it may also excessively stifle regulators' attainment of its goal that financial institutions loan money to (risky) firms to expand the economy. As discussed in Section 2, commonly used risk measures, such as total risk and idiosyncratic risk, group volatility from the upside and downside together. Therefore, decreased total risk or idiosyncratic risk cannot be interpreted unambiguously as more prudent risk-taking, as it says nothing about whether the decreased risk is due to decreased upside or downside volatility.

Bolton, Mehran, and Shapiro (2015) models compensation incentives and bank risk-taking and suggests that introducing a CDS-based compensation component would improve bank managers' risk-taking incentives and prevent excessive risk-taking. The essence of their suggestion is to include some measure of downside tail risk in the compensation contracts. Compared to symmetric risk measures such as total risk and idiosyncratic risk, downside tail risk is more appropriate as a proxy for imprudent risk-taking, as it focuses on extreme losses. This is crucial in the bank setting because regulators, while representing depositors and taxpayers, can suffer from the consequences of extremely poor bank performance (for example, a government bailout to prevent bank failure) but do not benefit as much from extremely good performance. Therefore, looking at the relation between compensation and downside tail risk is suitable when

examining the effect of regulation on bank compensation contracts, although this distinction is not explicitly imposed by any rule in the regulations. Bolton, Mehran, and Shapiro (2015) also shows that when the deposit insurance premium does not adjust dynamically with bank risk, including a penalty for downside tail risk is not in the best interest of shareholders, and would unlikely be implemented voluntarily by shareholder themselves. If the new regulations are effective in correcting the imprudent risk-taking in compensation contracts designed by shareholders, I expect that banks start to penalize downside tail risk under the new regulations. This leads to my second hypothesis:

H2: The penalty for downside tail risk increases more from the pre-crisis period to the post-crisis period among large banks than small banks.

Nevertheless, there is uncertainty about whether these changes would occur. According to Agarwal et al. (2014), the actual impact of regulations relies on both the regulations themselves and how they are enforced by regulators. In the post-crisis period, the Guidance was effective, but Dodd-Frank Section 956 was not formally effective. Given this conflict and uncertainty about the final rules implementing Dodd-Frank Section 956, it is thus unclear how aggressively regulators would enforce the regulations on compensation contracts. Even with effective rules, the enforcement can be weak or ineffective. Weak enforcement may result from either regulators' inability or unwillingness to enforce the regulations. Executive compensation contracts are usually very complicate. Hence, regulators may have limited resources to review each contract. Regulators may be unwilling to enforce regulations because they are captured by regulated banks. The "revolving door" from Wall Street to Washington refers to the fact

that employees leave their jobs in regulatory agencies for executive positions in the banks being supervised and vice versa. The financial press warns that the revolving door may dampen the independence of regulators and, hence, the effectiveness of regulations.[15]

Three factors from banks' side also contribute to regulators' disadvantage in regulating compensation contracts. The first factor is the discretion banks utilize in designing executive compensation contracts. The regulations are generally principle-based, which maintains great flexibility for banks in their compliance with regulations. There is no consensus on the best compensation arrangement that can fit all banks, so it is usually legitimate and common for each bank to tailor the compensation package to their own executive and bank characteristics. This discretion exacerbates the friction of limited resources faced by regulators and prevent effective enforcement. The second factor is the resistance from banks to make changes that are desired by regulators. Shareholders are traditionally the main force that shapes the executive compensation arrangements. However, as discussed earlier, their goal of maximizing shareholder wealth does not necessarily align with regulators' broader policy making goals that emphasize the long-term health of an organization.[16] For example, Baron and Xiong (2016) documents the neglect of crash risk by bank shareholders in 20 developed countries during 1920-2012. Beyond shareholders, managers may resist changes in compensation contracts because the regulations prohibit excessive compensation and

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[15] Several empirical studies actually find evidence that is *inconsistent* with the massive criticism from the media that the revolving door leads to more lenient supervision (e.g., Agarwal et al., 2014; Lucca et al., 2014).

[16] Frankel, Kothari, and Zuo (2018) discuss the results of the objective of shareholder wealth maximization.

generally aim to make compensation more sensitive to bad risk outcomes, which clearly acts against managers' self-interest. Managers could resist changes by influencing boards or the selection of board members. For both of these reasons, banks may abuse the flexibility allowed under the regulations and not make meaningful changes. The third factor is moral hazard arising from the possible government bail-out in times of extreme losses. Specifically, the "Too Big to Fail" doctrine may induce shareholders and boards of large banks to continue abusing the federal safety net. In this case, the expected changes may not occur among large banks.

Finally, even if banks indeed changed their incentive compensation arrangements in the post-crisis period, I may not necessarily find a decrease in PPS or an increase in the penalty for downside tail risk. Because the regulations do not implicitly dictate such changes, banks may use other ways to change their incentive compensation arrangements to comply with the regulations. For example, banks can defer a larger portion of compensation to the future periods. This can force bank managers to become creditors of banks and thus bear more costs for extremely bad risk outcomes. Banks can also adopt clawback provisions and require the return of compensation should extremely bad performance occurs. Both practices result in penalties for downside tail risk to the bank manager, but they cannot be detected by looking at the annual flow compensation. Due to data availability issues, I cannot examine these practices. But the existence of these alternative choices brings uncertainty to whether banks would change the pay for performance and penalty for downside tail risk in their CEO compensation contracts.

4. Empirical Models and Measurement of Variables

I use a difference-in-differences research design to test the hypotheses and control for the effects of other concurrent regulatory changes. Because large banks are the main group subject to the regulations, I partition the full bank sample into large banks and small banks, using the 2-digit SIC industry median total assets as the cutoff point.[17] The large bank group is considered to be the more regulated (treated) group, and the small bank group serves as the control group.

There are two typical models to test PPS in prior literature. According to Hall and Liebman (1998) and Baker and Hall (2004), they differ in the assumption of whether the marginal product of managerial effort varies with firm size. When the marginal product of managerial effort is proportionate to firm size, incentive should be measured by dollar value of equity ownership, and the firm performance should be stated as percentage change (e.g., stock returns). When the marginal product of managerial effort is constant across firms of different size, incentive should be measured by percentage of equity ownership, and the firm performance should be stated as dollar change of shareholder wealth. The former assumption is more appropriate for this study considering that large banks are generally the largest firms by book value of total assets in the US. From the theoretical point of view, managers of large banks tend to put more efforts into activities

[17] This method is simple and straightforward, but not precise. Because the identification of larger banks is different under the Guidance and Dodd-Frank Act, I use industry median total assets at the beginning of year as the cutoff point for my main results to avoid the complication. In addition, I use two other identification methods: the industry median total assets at the beginning of the post-crisis period and total assets of 50 billion dollars (threshold of larger banks under Dodd-Frank Act) as alternative cutoff points in the robustness tests and the results are similar to the main results.

that can have system-wide effect (proportionate to firm size) rather than fixed effect. From an empirical perspective, the assumption that the effect of managerial efforts varies with firm size is more consistent with practice. Bad managerial behavior in large banks is likely more detrimental to the economy than that in small banks, so large banks always get more scrutiny from regulators in reality. For these reasons, I choose the following specification:

$$\begin{aligned} LnPay_{i,t} \;=\; & \alpha_0 + \alpha_1 Post_t + \alpha_2 Treat_{i,t} * Post_t + \alpha_3 Return_{i,t} \\ & + \alpha_4 Post_t * Return_{i,t} \\ & + \alpha_5 Treat_{i,t} * Return_{i,t} + \alpha_6 Treat_{i,t} * Post_t * Return_{i,t} \\ & + \alpha_7 TailRisk_{i,t} + \alpha_8 Post_t * TailRisk_{i,t} + \alpha_9 Treat_{i,t} * TailRisk_{i,t} \\ & + \alpha_{10} Treat_{i,t} * Post_t * TailRisk_{i,t} + Controls + FixedEffect + \varepsilon_{i,t} \end{aligned} \quad \text{(Eq.1)}$$

Following prior studies, I use CEO total flow compensation as the main dependent variable instead of CEOs' firm-specific wealth (Kleymenova and Tuna, 2018; Cerasi et al., 2017). Because the relatively short post period for this study does not allow boards to significantly alter the stock of equity incentives built up over many annual contracts, it is more appropriate to look at the flow compensation, since it is a cleaner reflection of changes in the compensation contract.[18]

Post is an indicator variable equal to one for the post-crisis period (2011–2015)

[18] I focus on total compensation instead of individual pay components due to two considerations. First, it provides a comprehensive picture of compensation practices. Second, there seems to be a structural change (from stock options to restricted stocks) in executive compensation practices following the implementation of FAS 123R in 2006.

and zero for the pre-crisis period (2003–2007). I use stock returns as the performance measure. Albuquerque, Chen, Dong and Riedl (2019) suggests that stock returns are more informative than accounting earnings in reflecting the effect of managerial actions on future profitability.

I predict that $\alpha_6 < 0$, indicating that the decrease of PPS is greater for large (treated) banks than small (control) banks. Similarly, I expect $\alpha_{10} < 0$, suggesting a greater increase in the penalty for downside tail risk in the post-crisis period for large (treated) banks than small (control) banks.

I use three proxies for downside tail risk, $TailRisk$, in this study.[19] The first proxy is the probability of bankruptcy. Hillegeist et al. (2004) compare two accounting-based measures (the Altman Z-Score and the Ohlson O-Score) with a market-based measure based on the Black-Scholes-Merton model, *BSMProb*. This market-based measure essentially views equity as a European call option on firms' assets. Firms go bankrupt where the (estimated) market value of assets is lower than the face value of total liabilities.[20] The authors find that *BSMProb* is more informative than the two accounting-based measures. On the other hand, Hillegeist et al. (2004) find that *BSMProb* also suffers from some unrealistic model assumptions, resulting in upward biased estimation on the probability of bankruptcy compared to the real bankruptcy rate. Therefore, I also

[19] Measures of tail risk can be indicative of future stock returns, but the sign seems to depend on the exact return measures used. Chava and Purnanandam (2010) document a positive association between default risk and expected future returns; while prior studies, such as Dichev (1998), find a negative association when using realized stock returns.

[20] Using BSM model to estimate the probability of bankruptcy can apply to financial firms. For example, Bushman and Williams (2012) also use Black-Scholes-Merton model to calculate the fair value of the deposit insurance put option for banks.

use two other downside tail risk measures, *Tail5* and *MES* (*marginal expected shortfall)*, based on realized stock returns, following Bushman, Davidson, Dey, and Smith (2018). *Tail5* uses a firm's lowest 5% daily returns during a fiscal year; *MES* uses a firms' daily returns when the market experiences the worst 5% daily returns during a fiscal year. Thus, *Tail5* reflects the standalone tail risk, while *MES* measures a bank's tail risk exposure to market-wide downturns, similar to stress tests conducted in the banking sector. Bushman et al. (2018) finds that banks with materialistic CEOs have worse risk-management functions and higher tail risk exposure. One possible drawback of *Tail5* is that it may be correlated with contemporaneous stock return, so the tests of H2 may not be as powerful since (Eq 1) controls for contemporaneous returns. I multiply the raw measures of *Tail5* and *MES* by negative one so that higher values for all three downside tail risk measures, *BSMProb, Tail5,* and *MES,* indicate higher levels of tail risk.[21]

I follow prior literature and control for the major factors that affect the level of CEO compensation, including total risk, firm size, market-to-book ratio, CEO-board chair duality, and CEO tenure. I choose to use total risk instead of its idiosyncratic risk component for two reasons. First, the literature on pay for luck shows that systematic

[21] It should be noted that this study is distinct from the stream of literature examining the ex post settling up of cash compensation (Leone, Shuang, and Zimmerman, 2006; Shaw and Zhang, 2010; Albuquerque et al., 2019, among others). These studies generally test whether the PPS of cash compensation is asymmetric and whether cash compensation adjusts more for unrealized losses (proxied by negative returns) than for unrealized profits (proxied by positive returns). Unrealized losses and downside tail risk are two related but different concepts. According to Albuquerque et al. (2019), the tests of asymmetric PPS should be done within the incentive zone, excluding the two tails of performance distribution; while I specifically focus on the downside tail of the performance distribution in this study. To further distinguish between pay for performance and the penalty for downside tail risk, I always include both performance and downside tail risk in my regressions.

risk also matters for setting compensation in practice.[22] Second, the tail risk measures do not distinguish between idiosyncratic risk and systematic risk. Excluding the systematic risk component in the control would bring omitted variable bias to the estimates of tail risk. In addition to stock return-based total risk, I include leverage as it is normally viewed as a risk measure for banks. Also, leverage is found to be higher in larger banks than in smaller banks, and higher in financial firms than in non-financial firms, so controlling for leverage is necessary when comparing these groups. I use the logarithm of total book assets as the proxy for firm size, instead of the commonly used measure of market value of equity. Because banks usually have higher debt than equity, total assets may serve as a better proxy, because it includes both debt and equity.[23] Also, I include asset growth rate because it closely resembles loan growth rate, which can signal imprudent risk-taking and poor future performance (Fahlenbrach, Prilmeier, and Stulz, 2018).[24] Finally, I do not include some controls that are usually used in non-financial firms, such as the cash flow shortfall and an indicator for an operating loss, because they do not apply in the bank setting. See Appendix A for variable definitions.

Because the assignment of large and small banks is not random, the two groups are not comparable in many dimensions, such as size and CEO compensation level. To mitigate the concern that the small banks may not serve as a good control group for large banks, I test for the parallel trend between these two groups in the pre-crisis period.

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[22] The pay for luck literature generally suggests that executives are paid for good lucky events, but not penalized for bad luck. See for example, Garvey and Milbourn (2006).

[23] Cheng et al. (2015) use both the market value of equity and total assets as proxies for size and find similar results.

[24] Results are similar in terms of significance level without controlling for the asset growth rate.

Because many other factors could have impact on the compensation contracts in the banking sector, I run a few falsification tests to eliminate some possible treatment factors.

5. Empirical Analysis

5.1 Sample and Summary Statistics

Table 1 describes the sample selection process for the full bank sample. Following prior literature, firms with SIC code from 6000 to 6299 are classified as banks, including both commercial banks and investment banks. Both types of banks are subject to the regulation of Dodd-Frank Section 956 in the post-crisis period. The sample starts from 2003 so that firms have implemented the changes required by the Sarbanes-Oxley Act of 2002 (SOX). Also, the period of 2008–2010 is characterized by temporary turbulence and regulations in the banking sector, so this period is not included in my sample period.[25] The new compensation regulations started in 2010. Therefore, I rely on fiscal years from 2003 to 2007 as the pre-crisis period, and fiscal years from 2011 to 2015 as the post-crisis period.

<Table 1>

I get compensation, CEO tenure, and CEO-board chair duality data from ExecuComp, financial data from Compustat, and stock return data from CRSP.[26]

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[25] There are some dramatic (albeit temporary) changes to CEO compensation during this period. For example, CEO of Citigroup Inc., Mr Vikram Pandit, received $125,001 of salary (only 1/8 of his previous year salary) and no incentive compensation for 2009; in 2010 he received only $1 of salary and no other forms of compensation. The compensation of other named executives of Citigroup Inc have not experienced as dramatic changes in the same periods.

[26] Very few CEOs have missing tenure or negative tenure. One reason for reporting negative tenure can be that the same person became CEO for the same firm a second time, and

Following the literature, I require a firm to have at least 126 days of return data available during each fiscal year to calculate market-based risk measures. The Emergency Economic Stabilization Act of 2008 established the Troubled Assets Relief Program ("TARP"), which imposes constraints on executive compensation at the banks who received capital infusion from TARP ("TARP participants").[27] These constraints are temporary in nature, because they apply to TARP participants only when they have outstanding balance from TARP funds. I hand collect TARP fund data from the website https://projects.propublica.org/bailout/list. I first check whether a bank received funds from TARP that it needs to pay back.[28] TARP fund injection was typically made in the end of 2008 and beginning of 2009. I then collect data on when the TARP participants made their final TARP fund repayment. Most TARP participants fully repaid the TARP fund in 2009, but a few banks took longer time. I exclude bank-year observations for a TARP participant that has an outstanding TARP fund balance at the beginning of a fiscal year so that my dataset is not affected by the compensation regulations imposed by TARP.

Some banks filed for bankruptcy and disappeared, and other reorganize as new banks in the post-crisis period. To address the survivorship bias, I use balanced samples

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ExecuComp updates the "becameceo" data as the most recent date when the person became CEO, resulting in negative tenure for his or her previous years as CEO. I manually check and correct these tenure data by using information from firms' proxy statements.

[27] Core and Guay (2010) discusses typical constraints from TARP: prohibition of stock option awards and severance payment, limits on cash bonus and restricted stock awards for both the level and in proportion to annual total compensation. Also, see for example, the discussion of the TARP constraints in the 2013 proxy statement of Seacoast Banking Corp (ticker SBCF).

[28] Some assistance fund from TARP are subsidies that are not required to be paid back. Because these kinds of TARP fund do not put constraints on compensation, I do not consider the financial institutions who only received these funds to be TARP participants.

by requiring each bank to exist in both the pre- and post-crisis period. The final sample includes 116 unique banks and 940 bank-year observations.

Stock return is a common performance metric in compensation contracts. But little is known about the extent to which risk is incorporated in compensation contracts. To examine this, I look into the detailed performance metrics information in CEO compensation contracts provided by IncentiveLab. This dataset includes only one half of the sample firms in ExecuComp, generally the larger ones. Nevertheless, looking into the explicit compensation contracts provides more direct evidence on the contracting role of risk int the compensation contracts. I search the key word "risk" in the performance metrics. Then I examine the percentage of firms with risk-related performance metrics for each year in the sample.

<Figure 1>

Figure 1 displays the time trend in banks and insurance firms, respectively. I use insurance firms as a comparison since risk is of similar importance to them. For banks, the usage of risk-related performance metrics demonstrates a general upward trend, especially in the post-crisis period. This provides direct evidence that more banks start to consider risk when designing their CEO's compensation contracts. On the other side, for insurance firms, the percentage of firms with risk-related performance metrics fluctuates and stays at a relatively low level in the post-crisis period. This is consistent with the regulations on compensation mostly focusing on (and thus affecting) banks.

I winsorize all continuous independent variables at the 1th and 99th percentiles within each 2-digit SIC code industry and fiscal year, except for the downside tail risk

measures and the logarithm of CEO tenure. Downside tail risk, by design, measures extreme events, so winsorization may severely reduce the information content of these proxies. Table 2 provides the descriptive statistics for the large bank and small bank group. The level of CEO compensation and total assets different a lot between these two groups. On the other hand, they share similar and similar changes to total risk, market-to-book ratio and asset growth rate.

<Figure 2>

The time trend of CEO compensation is presented in Figure 2. In general, total compensation of large banks fluctuates more than total compensation of small banks in both the pre-crisis period and the post-crisis period, primarily due to the fluctuations in the cash compensation component. The level of CEO compensation is higher for large banks than for small banks, though this difference appears smaller in the post-crisis period.

<Figure 3>

As for the time trend and level of stock return performance, large banks and small banks almost mimic each other during both the pre-crisis and the post-crisis period, as shown in Figure 3. For both groups, the stock market performance deteriorates in the pre-crisis period, recovers quick in the first half of the post-crisis period and deteriorates again thereafter. Correspondingly, all three downside risk measures demonstrate the opposite pattern, as shown in Figure 4.

<Figure 4>

Table 2 shows the summary statistics for the main variables used in the tests. Panel A looks at the large bank sample and tests for the changes in the variables in the post-crisis period. Total CEO compensation, leverage, market-to-book ratio, and the asset growth rate all decrease after the crisis. Risk, including total risk and downside tail risk, increases slightly, which is likely due to the high levels of risk at the beginning of the post-crisis period, as shown in Figure 4. Panel B looks at the small banks sample. Total compensation shows a slight increase, and CEO tenure becomes longer in the post crisis period. The other variables generally demonstrate similar changes among small banks as among large banks. Panel C compares the large banks and the small banks in both the pre-crisis period and the post-crisis period. Other than stock return, many of the variables exhibit significant differences: total compensation, total risk, size, leverage, market-to-book ratio, and CEO duality. The differences in downside tail risk are more significant in the post-crisis period. The last column shows the difference-in-differences of the variables. The differences between these two groups in total compensation, market-to-book ratio, assets growth rate, and CEO duality become smaller in the post-crisis period, whereas the differences in CEO tenure become larger. The differences in downside tail risk show mixed results.

<Table 2>

Table 3 reports the pairwise correlation between variables. Consistent with prior literature, CEO compensation is positively associated with contemporaneous returns, firm size and CEO-board chair duality. As for risk measures, compensation is negatively associated with total risk. The correlation between compensation and downside tail risk

is mixed, and the correlation between return and downside tail risk is negative and significant. Out of the three downside tail risk measures, *BSMProb* has relatively low correlation with the stock return and total risk; whereas *Tail5* has higher correlation with both of them, so part of the effect could be captured by return and total risk. Within risk measures, including total risk and downside tail risk, the correlation is always positive.

<Table 3>

5.2 Main Results

Table 4 tests H1 and H2 using the difference-in-differences regression design. Firm fixed effects are included in both regressions. I find strong evidence that the PPS for CEOs of large banks decreased more than that of small banks, supporting H1. Out of the three downside tail risk measures, two have shown evidence for greater increase in the penalty for downside tail risk for CEOs of large banks than for CEOs of small banks, consistent with the prediction in H2. The insignificant results for Tail5 may be attributed to the fact that *Tail5* is correlated with stock return and total risk, and thus it is more difficult to make precise estimations for the coefficient. In general, the results as a whole are consistent with the notion that the new regulations likely brought about changes to the incentive design of CEO compensation contracts among large banks. In addition, the coefficients for *Post* and the interaction between *Post* and *Treated* suggest a significant increase to the level of CEO compensation among both large banks and small banks, after controlling for other determinant factors.

<Table 4>

To confirm that the observed results are due to changes in compensation contracts at large banks but not at the small banks, I examine the changes in PPS and the penalty for downside tail risk within each subsample. Results are presented in Table 5. For the large bank sample, PPS is significantly weaker in the post-period while the penalty for downside tail risk is significantly stronger in the post-crisis period, as shown in columns (1), (3), and (5). Interestingly, the positive and significant coefficient on downside tail risk is consistent with large banks rewarding CEOs for downside tail risk in the pre-crisis period. This is clearly incompatible with effective risk control and supports regulators' concerns about inappropriate compensation practices within banks. It also helps bolster the legitimacy of the proposed regulations. F-tests (untabulated) among large banks show that PPS is not significantly different from zero in the post-crisis period; the penalty for downside tail risk in the post-crisis period, however, depends on the measure: it is statistically significant when using *BSMProb* but not when using *Tail5* and *MES*.

<Table 5>

None of the changes occur among small banks, as shown in columns (2), (4) and (6). Also note that there is no significant pay-for-performance among small banks in the pre-crisis period. On the other end, there is even weak evidence of penalty for downside tail risk among small banks in the pre-crisis period, as shown in column (2). This is consistent with regulators' view that small banks do not suffer from the same degree of incentive compensation problems as large banks, and, thus, not their focus. This may also suggest fundamental differences in compensation contracts between large and small banks.

To alleviate the concern that the small bank group may not serve as a good control for the large bank group, I test for the parallel trend of pay-for-performance and penalty for downside tail risk between large banks and small banks in the pre-crisis period. Due to the relatively small sample size and the exogenous shock of compensation disclosure in 2006, I conduct a falsification test to see whether the changes in pay-for-performance and penalty for downside tail risk around 2006 vary across the large bank and small bank groups. Results in Table 6 do not support divergent trend between these two groups in the pre-crisis period.

<Table 6>

Taken together, the results from Table 4, Table 5 and Table 6 suggest that the new regulations have been effective in correcting regulators' pre-crisis concerns about CEO incentive compensation arrangements. There is strong evidence that CEO compensation contracting in large banks shifted away from promoting performance and towards limiting downside tail risk as a result of the new regulations.

5.3 Falsification Tests

5.3.1 Other Possible Treatments

The new regulations clearly define regulated institutions and explicitly focus on large banks. This is why I use bank size to identify treated banks. However, the research design may omit variables correlated with pay, performance, and downside tail risk that are the real drivers of the changes documented in the Section 5.2. In the following tests, I try to rule out three alternative explanations for the observed changes in PPS and penalty for downside tail risk.

<Table 7>

First, TARP experience may be driving the results of both PPS and penalty for downside tail risk. TARP-participating banks are subject to executive compensation restrictions. Furthermore, the Office of the Special Master reviewed and approved their executive compensation payments to ensure the interests of shareholders and taxpayers. Although I exclude bank-year observations that fall directly under TARP constraints, influence from TARP experience may stay for a few more years. Because shareholders and directors could learn from the experience under TARP restrictions, compensation contracting in the post-crisis period may not become exactly as it was in the pre-crisis period. To address this concern, I partition the full bank sample based on TARP participation, classifying TARP participants as the treated group and non-TARP participants as the control group. I then test whether defining TARP participation as the treatment produces similar results in the difference-in-differences regressions. The results in the first three columns of Table 7 do not support this conjecture. TARP participants don't demonstrate higher changes in PPS or penalty for downside tail risk relative to non-TARP participants. Therefore, TARP participation does not seem to drive the changes observed in the main analysis.

Another possible cause of the changes in PPS may be self-correction in the post-crisis period initiated by shareholders and directors. For example, the implementation of say-on-pay practices may pressure directors to make changes to alleviate the agency problem in the years from 2011. Thus, the changes in compensation contracting in the post-crisis period may vary cross-sectionally with the magnitude of changes initiated by

shareholders and directors. When firm risk is realized in the concentrated period of crisis, banks with inferior stock market performance may be considered to be more problematic in their incentive contracting, given the direct link between compensation incentives and risk-taking. For their shareholders and directors, one solution at hand is to alter incentives from compensation contracts. As a result, these banks can demonstrate greater changes.[29] I use the buy-and-hold stock return during the crisis period as a proxy for the extent of risk taken. I then use the 2-digit SIC code industry median as the cutoff point to identify poorer performing banks, who presumably have greater agency problem in the pre-crisis period and more significant changes in the post crisis period. Column (4), (5) and (6) of Table 7 present the results. There is no evidence of greater changes in pay-for-performance; and only *BSMProb* shows weak result on greater penalty for downside tail risk in the poorer performing banks. The results reinforce the inference from Section 5.2 that regulations rather than market forces are associated with these changes in incentive compensation.

Lastly, Cerasi et al. (2017) examines a sample of the largest banks in several jurisdictions (including US) that are likely subject to similar compensation regulations in the post-crisis years. This paper finds that changes in bank CEOs' compensation contracts occur mostly among investment banks, as opposed to commercial banks. This can be true in the US setting because investment banks were very lightly regulated in the

[29] Another possibility can be boards' overreaction to the regulations. First, the principal-agency problem may cause boards and bank managers to not always act for the best interest of shareholders. Second, any sanction from regulators can cause magnificent damage to the firm and reputation of directors and managers. Therefore, the expected changes may be more likely to occur within firms of severe principal-agency problems.

pre-crisis period, but since 2008 the regulation of investment banks started to become stricter and converge to the regulation of commercial banks. Therefore, investment banks have experienced bigger regulatory shock than commercial banks, and the observed changes in PPS and penalty for downside tail risk may come from investment banks, rather than large banks. However, results from empirical tests in Column (5), (6) and (7) only provide weak evidence on greater changes in the penalty for downside tail risk and no evidence for greater changes in PPS. Thus, the more stringent regulation for investment banks does not seem to be driving the results documented in the Section 5.2.

5.3.2 Measures of Upside Tail Potential

The two tails of stock return distribution likely correlate with each other. That is, a firm with higher downside tail risk may well have higher upside tail potential. Thus, higher downside tail risk may actually proxy for higher upside tail potential, and the stronger penalty for downside tail risk may be a reflection of weaker reward for upside tail. To rule out this possibility, I use similar methods to construct two upside tail measures and replace the downside tail risk measures in Equation (1) with these upside tail measures. I then run both the difference-in-differences tests and the pre-post tests, similar to Table 4 and Table 5. The regression results are presented in Table 8. Panel A provides weak evidence of greater decrease in the pay for upside tail, as shown in Column (2). However, a further look at the large and small bank subsamples does not provide evidence of a decrease in the pay for upside tail among large banks, as shown in Column (2) and (4) of Panel B. Therefore, it is not likely that a decreased reward for upside tail potential is driving the results documented in Section 5.2.

<Table 8>

5.3.3 Other Risk Measures

Cerasi et al. (2017) finds a greater increase in the penalty associated with total risk for banks that are subject to similar post-crisis regulations, compared to unaffected banks. However, the interpretation of the coefficient on total risk is ambiguous. From a theoretical point of view, it makes more sense that regulations would treat upside and downside risk differently rather than equivalently, because regulators or governments have asymmetric payoffs from risk. They can suffer unlimited losses from extreme negative outcomes at banks, but only have limited gain from banks' profits after extreme positive outcomes. For example, FDIC collects a relatively constant premium from insured banks for providing deposit insurance. If a bank fails, FDIC have to recover the losses of depositors up to at least $250,000 per depositor, per bank, per ownership category. Further, total risk does not distinguish between normal risk-taking and imprudent risk-taking, so it is hard to argue that the effect of the regulations improves economic growth (limiting tail risk from the downside) or hinders it (forgoing risky positive NPV projects with huge upside potential).

Because all the downside tail risk measures are positively associated with total risk, as shown in Table 3, it is possible that there is penalty for total risk too. To make sure the observed results on penalty for downside tail risk are not driven by penalty for total risk, I control for lagged total risk in all the regressions. To further rule out the possibility that the results on increased penalty for downside tail is merely a reflection of increased penalty for total risk that is documented by Cerasi et al. (2017), I use

contemporaneous total risk to replace the proxies for downside tail risk and rerun the tests in (Eq 1). Column (1) of Table 9 provides the difference-in-differences results from this analysis. The insignificant coefficient for the three-way tail risk interaction does not support this conjecture.

<Table 9>

In addition to total risk, I try three other risk measures that can possibly be contracted upon. Similarly, I replace the downside tail with these different risk measures: leverage, crash risk and systemic risk. Leverage is very easy to monitor. Higher leverage indicates lower equity buffer to absorb losses, and thus losses are more easily transferred to creditors. Column (2) of Table 9 don't show differential changes in the penalty for leverage. Crash risk is usually related to managers hiding bad news. In the bank setting where financial reporting involves enormous management discretion, shareholders may want to put disincentive on bad news hoarding. Column (3) does not find supporting evidence. I also test whether there is more scrutiny over systemic risk, which refers to the harm to the whole financial sector from the distress of a single bank. Larger banks tend to have higher systemic risk. It is possible that the new regulations actually limit systemic risk rather than downside tail risk. Results are presented in column (4) of Table 9. There is no evidence of significantly larger penalties for systemic risk between large banks and small banks during the post-crisis period.

5.4 Robustness Tests

To test for the robustness of the main results, I change a few parameters of the empirical model and rerun the tests.

5.4.1 Alternative Fixed Effects

I use firm fixed effects in all the previous regressions. To test whether the results in Table 4 hold under different fixed effects, I also test the hypotheses using industry fixed effects. Results are presented in Panel A of Table 10. They are similar to the results using firm fixed effects.

<Table 10>

SIC industry code may not well depict the businesses of banks, especially when a bank has multiple lines of business. Alternatively, the type of financial institutions may provide more information on their business and legal structure. When I control for institution type fixed effects, I find similar results too, as shown in Panel B.

In addition, the charter of a US financial institution determines which regulator is the primary regulator of the bank. The choice of bank charter should take into account many factors, regulation burden being one of them. One problem arising from the current US banking regulatory structure is "regulator shopping", a phenomenon that financial institutions choose and switch to the regulator that best suits their needs. When financial institutions switch to a more accommodating regulator, the enforcement of regulations is undermined. To address the concern arising from regulator shopping in the post-crisis period, I control for regulator fixed effects and rerun the tests. The results still hold, as evidenced in Panel C.[30]

[30] Rosen (2005) looks at the phenomena of US banks switching federal regulators from 1977–2003. 94% of the switches occurred among small banks (total assets < 1 billion). This would make the cross-sectional variation between larger banks versus smaller banks more prominent. I don't think this kind of arbitrage would be common in my sample, because my sample is comprised of the largest financial institutions, and the benefits from being a national bank or a

5.4.2 Alternative Control Group

Due to the significant differences between large banks and small banks, one may question whether the latter may serve as a good control group for what would have happened to PPS and penalty for downside tail risk among large banks if there were no regulatory interventions in the post-crisis period. Because insurance firms have similar business models but are not subject to the set of regulations examined, I use US insurance firms as an alternative control group for large banks. Panel A in Table 11 presents the difference-in-differences results. The results on PPS hold, and the results on penalty for downside tail risk are similar but weaker. Similar to Table 6, I also check the parallel trend between large banks and insurance firms in the pre-crisis period. The parallel trend assumption is violated when using *BSMProb* as a measure for downside tail risk. Thus, insurance firms may not serve as a good control at least for the test of penalty for downside tail risk, and one needs to interpret the results in Panel A with caution.

<Table 11>

5.4.3 Alternative Identification of Large Banks

In the main analysis, I use the beginning-of-year industry median total assets as the cutoff point to identify large banks to be more regulated relative to small banks. On one hand, this method has the advantage of simplicity, because the cutoff points per the Guidance and Dodd-Frank Act are not exactly the same, which brings a layer of complication to the identification of more regulated banks. On the other hand, this

holding company should be more attractive to them than changing charter to reduce regulation costs.

method is not accurate in identifying the more regulated banks. Because the median value of total assets is well below the cutoff point ($50 billion) in Dodd-Frank Act, it likely brings attenuation bias to the expected difference-in-difference results because it tends to misclassifies some less regulated banks as being subject to more regulations.[31] Hence the validity of the results is not harmed by choosing this method. Nevertheless, it may still be appealing to check the robustness of the results for alternative cutoff points. Therefore, I apply two different methods to classify large banks. First, I use the median of the bank's total assets at the beginning of the post-crisis period to identify a constant large bank group. Second, I use total assets of 50 billion dollars as an alternative cutoff point, according to the Dodd-Frank Act, to identify large banks. I rerun all the regressions in Table 4 and present the results in Table 12. The results still hold under these two alternative identification methods of large banks. Moreover, the penalty for downside tail risk results are stronger because all the three downside tail risk measures now show significant coefficients.

<Table 12>

5.4.4 Additional Controls

Risk management in banks receives much more attention since the 2007–2008 crisis. Accordingly, risk officer may be put in a more prominent position in the post-crisis period, compared to the pre-crisis period. Many banks have adopted formal procedures to involve risk officers in designing the executive compensation contracts. To examine

[31] This can be inferred from the fact that the median total assets for large banks in the post-crisis period (in Table 2) is about 42 billion dollars, which is below the 50 billion cutoff point for large banks under Dodd-Frank Act.

whether this explains the results documented earlier, I control for the existence of a risk officer among the five highest paid executives. The results still hold, as shown in Column (1), (3), and (5) of Table 13.

<Table 13>

Core and Guay (1999) demonstrates that among non-financial firms, CEO flow compensation is granted to bring the incentives from the CEOs' total portfolio back to the optimal level. Although there is no direct evidence showing a similar phenomenon occurs in the financial sector, there is also no evidence refuting such a possibility. As a result, I also control for lagged level of CEO incentives from the portfolio of all stock and option grants and rerun the tests in Table 4. I use the dollar change of executive wealth for one percentage change in firm value (Coles, Daniel, Naveen, 2006) as the measure of incentives.[32] Including this additional control decreases the sample size slightly. The results are similar to Table 4, as shown in column (2), (4) and (6) of Table 13.

5.4.5 Removing Mergers and Acquisitions

Mergers and acquisitions have always been very active in the US banking sector. Around the recent crisis, these likely occur more often. Announcement of merger and acquisitions typically would result in sudden and unusual fluctuations on the stock prices of acquirers. If a deal is completed, executive compensation may be adjusted accordingly to reflect the value of managing a larger and more complex organization. To rule out the

[32] Incentives can be expressed in different ways. According to Baker and Hall (2004), the sensitivity of CEOs' firm related wealth to percentage change in firm value corresponds to the regression model using stock return as the performance measure; while the sensitivity of wealth change to dollar change in firm value corresponds to the regression model using dollar change in firm value as the performance measure.

effect of mergers and acquisitions, I construct a balanced sample with no merger and acquisition announcements. The new sample is much smaller with only 559 firm-year observations. However, the results still hold within this restricted sample, suggesting that merger and acquisitions are not driving the main results.

<Table 14>

5.4.6 Restricted Sample

One way to make the large banks and small banks more comparable is to restrict the sample firms in a certain size range. Because Dodd-Frank Act provides total assets of $50 billion as the cutoff point for more stringent requirements, a natural choice would be to compare banks above and below $50 billion of total assets. Accordingly, I choose banks with total assets between $30 billion and $70 billion to balance between the similarity of the two groups of banks and the number of observations in the sample. The restricted sample has 115 firm-year observations. Due to the smaller sample size and greater comparability between treated and control banks, I run difference-in-differences tests excluding the control variables and report the results in Table 15. Throughout different measures of downside tail risk, no evidence is found for greater changes in PPS and penalty for downside tail risk among large banks.

<Table 15>

The small sample size may be one contributing factor for the null results. Another factor may be that banks actively manage the amount of total assets around the cutoff point. As bank managers know that exceeding the cutoff point will expose banks to more stringent regulatory requirements, bank managers may have incentives to manage

their assets downwards to avoid regulation. Figure 5 plots distributions of total assets for banks as well as for insurance firms around the $50 billion cutoff point in the pre- and the post-crisis periods. If banks anticipated and actively tried to manage total assets as a way to avoid regulation, then there should be an excess of banks with total assets just under the $50 billion cutoff in the post-crisis period. Figure 5 shows that for banks, the size distribution around $50 billion cutoff in the pre-crisis period is relatively smooth. There are 22 observations in the total assets range of $35–$50 billion, and 17 observations in the total assets range of $50–$65 billion. However, in the post-crisis period there are 30 observations in the $35–$50 billion range, and only 10 observations in the $50–$65 billion range. This suggests that a number of banks could have manipulated their total assets below $50 billion to avoid being subject to stricter regulations. The frequency change around the $50 billion total assets cutoff is not evidenced for insurance firms, suggesting that any potential downward size manipulation is more likely due to some unique factors in the banking sector, rather than common shocks to banks and insurance firms.

<Figure 5>

5.5 Additional Analysis

5.5.1 Compensation Components

As prior literature shows that different components of compensation can provide different incentives (Bennett et al., 2016; Guo et al., 2015), I look into two components of CEO compensation: cash compensation and equity compensation. I run similar tests as those in Table 4 to but replace the dependent variable of total CEO compensation with

cash compensation and equity compensation, respectively. Table 16 tabulates the difference-in-differences results. Panel A shows that the results on PPS and penalty for downside tail risk are present in cash compensation; Panel B shows results on PPS, but not on the penalty for downside tail risk. In other words, greater decrease in PPS among large banks is driven by both the cash compensation and equity compensation; while greater increase in the penalty for downside tail risk is driven by the cash compensation component only. This suggests that boards are more likely to cut cash bonus when extremely bad outcomes occur.

<Table 16>

5.5.2 CFO Compensation

Both the Guidance and the Dodd-Frank Section 956 require banks to identify employees who can expose the organization to significant amounts of risk. While there is some degree of ambiguity, the employees covered by the Guidance include, at a minimum, "named officers" subject to SEC compensation disclosure requirements for public firms.[33] Therefore, similar changes should occur among non-CEO executives. In the following additional analysis, I examine bank CFOs' compensation contracts. I rerun all the tests in Table 4 using the total compensation of bank CFOs as the dependent variable. The results in Table 17 show a similar pattern for CFOs regarding the penalty for downside tail risk. However, the results for PPS are much weaker for CFOs, though

[33] The covered persons under Dodd-Frank Act Section 956 (proposed rule 2011) also include executive officers, defined as persons who hold the titles or perform the function of at least one of the following positions: president, chief executive officer, executive chairman, chief operating officer, chief financial officer, chief investment officer, chief legal officer, chief lending officer, chief risk officer, or head of a major business line.

qualitatively similar. This may reflect that CFOs generally receive a lower proportion of incentive compensation than CEOs (Indjejikian and Matejka, 2009).

<Table 17>

6. Conclusion

The 2007–2008 financial crisis raised public concerns about the incentives of banks' executives. As a result, regulators started to pressure banks to improve their incentive compensation contracts as the crisis abated. In mid-2010, four federal bank regulators jointly issued the Guidance on Sound Incentive Compensation Policies (the "Guidance"). According to the Guidance, the incentive compensation arrangements should balance risk and reward, be compatible with effective control and risk management, and be supported by strong corporate governance. In early 2011, more detailed rules were proposed under Dodd-Frank Section 956, aiming to regulate employee incentive compensation so that the incentive compensation is not excessive and does not encourage imprudent risk-taking.

This paper studies whether the new compensation regulations affect the incentives provided by CEO compensation contracts. Specifically, it examines how the relation between pay and performance and the relation between pay and downside tail risk changes from the pre-crisis to the post-crisis period as a result of the regulatory changes introduced after the financial crisis. I find that there is a greater decrease in PPS and a greater increase in the penalty for downside tail risk among large banks in the post-crisis period, compared to small banks. I conduct a series of falsification tests to rule out

alternative explanations to my main findings. This includes different identification methods of treated banks and different risk measures. No supporting evidence is documented. I also run several robustness tests and the results always hold. A further look into the components of compensation shows that the greater decrease in PPS among large banks is driven by both the cash and equity components, whereas the greater increase in the penalty for downside tail risk is driven by cash compensation only. Lastly, I examine CFO compensation and find similar results on penalty for downside tail risk but much weaker results on PPS.

The results as a whole provide evidence for the effectiveness of new regulations on CEO compensation contracts in banks. In the pre-crisis period, CEOs of large banks appear to be rewarded for downside tail risk, a sign that compensation contracts encouraged CEOs to engage in imprudent risk-taking. This problem disappears after the new regulations, suggesting significant improvement in compensation contracts from regulators' perspective.

This study is also closely related to the ongoing debate on regulating compensation in the financial sector and the law-making process to implement it. In 2016, regulators proposed more detailed and stringent rules in Dodd-Frank Section 956, provoking much more virulent responses arguing the regulations are not appropriate. One of the criticisms of the new rules is that they may harm the ability of banks to attract and retain top employees.[34] According to the rule making agenda published by the

[34] Other studies offer comprehensive discussions about the impact of different regulations on compensation in the post-crisis period, for example, Core and Guay, 2010; Murphy and Jensen, 2018.

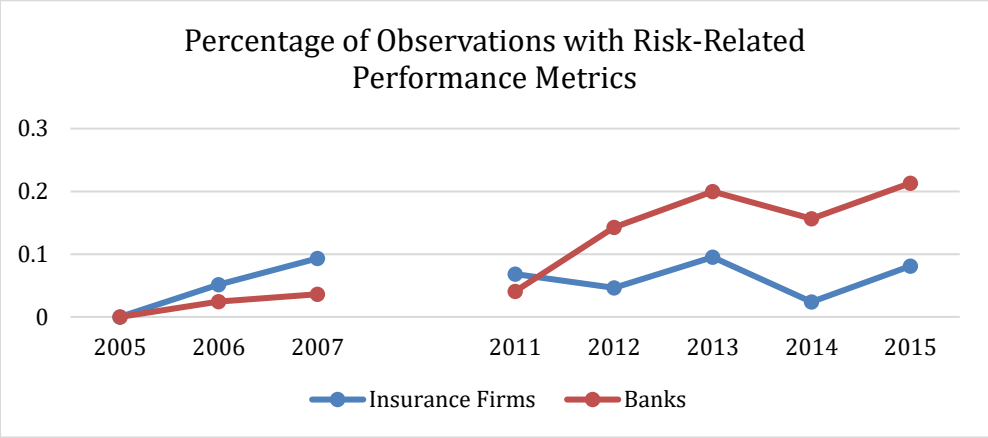
Federal Reserve, Dodd-Frank Section 956 did not enter into the final rule stage but was moved to the "Long-Term Actions" section during the fall of 2017 and has stayed there since then, indicating that there would not be further regulatory actions within the twelve months following the publication of the agenda. The decision to defer adopting a final rule is consistent with ongoing disagreement over whether the proposed rules should become law. This study informs this policy-making process by demonstrating changes in compensation contracting after the crisis but before the 2016 proposed rules. Policy makers and interested constituents can use the current environment to assess whether the desired changes have already been achieved and whether stricter rules are necessary.

APPENDIX A

Variable	Definition
Total pay	Total annual CEO compensation
Lnpay	The logarithm of total annual CEO compensation; when indicated, it is the logarithm of total CFO compensation. I follow Albuquerque, Franco, and Verdi (2013) in calculating compensation pre- and post-FAS 123R.
Cash pay	The sum of salary and cash bonus
Lncashpay	The logarithm of cash pay
Equity pay	The sum of grant date fair value of restricted stocks and options
Lneqpay	The logarithm of equity pay
Post	A dummy variable that equals 1 for fiscal years 2011-2015, and 0 for 2003-2006.
Treated	A dummy variable that can equal 1 for one of the following cases (depending on the test and sample):
1. Large bank	Bank whose total assets at the beginning of the fiscal year is above the annual median in each SIC 2-digit industry within the final bank sample. This is the main method to identify treated banks.
2. TARP participant	Bank who received assistance fund from TARP around the crisis.
3. Poorer performer during the crisis	Bank whose buy-and-hold return from July 2007 to December 2008 is below the median in each SIC 2-digit industry, following Fahlenbrach and Stulz (2011).
4. Investment Bank	Bank with SIC code between 6200(included) and 6299.
Return	The logarithm of 1 plus the compounded annual stock return using monthly returns.
BSMProb	The probability of bankruptcy estimated by using Black-Scholes-Merton model, following the method introduced in Hillegeist et al., (2004). The volatility is calculated using daily stock returns of each firm-fiscal year, requiring at least 126 available returns.

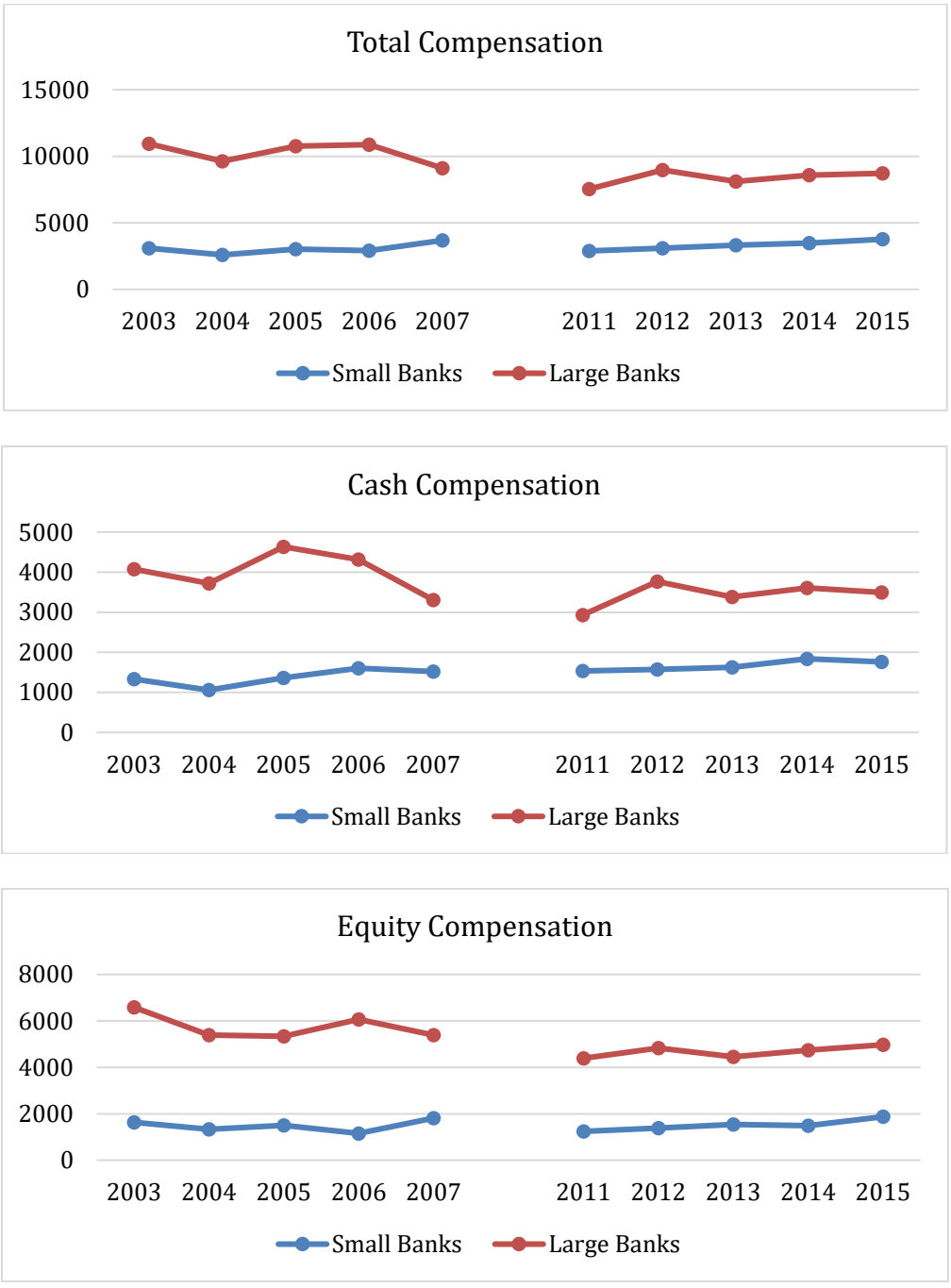
Tail5	The negative of average return of a firm during the 5% worst return days during one fiscal year, requiring at least 126 available returns.
MES	The marginal expected shortfall defined as the negative of the average daily returns of a firm during the 5% lowest market return days during one fiscal year, requiring at least 126 daily returns available for the fiscal year. I use S&P 500 index returns as the market returns.
Total risk	The annualized standard deviation of daily returns for a fiscal year.
Crash risk	The negative skewness of residual firm returns during each fiscal year. I require at least 26 weeks of data to calculate residual returns.
Upside tail – tail5	The average daily return of a firm during the 5% highest return days during one fiscal year, requiring at least 126 available returns.
Upside tail - MES	The average daily returns of a firm during the 5% highest market return days during one fiscal year, requiring at least 126 daily returns available for the fiscal year. I use S&P 500 index returns as the market returns.
Systemic risk	I following the method introduced by Adrian and Brunnermeier (2016) to calculate systemic risk. I require at least 200 weeks of return data for each firm in the pre-crisis period and post-crisis period respectively.
Size	The logarithm of total assets at the end of a fiscal year.
Leverage	The ratio of total liabilities to total assets at the end of a fiscal year.
Market-to-book	The ratio of market value of assets to the book value of assets at the end of a fiscal year. The market value of assets equals to the book value of total assets (at) minus book value of common shareholders' equity (ceq) plus market value of common shareholders' equity(prcc_f*csho).
Asset growth rate	The percentage change of total assets from the end of last fiscal year.
Lntenure	The logarithm of years since the CEO took office.

FIGURE 1. Time Trend of Risk-Related Performance Metrics



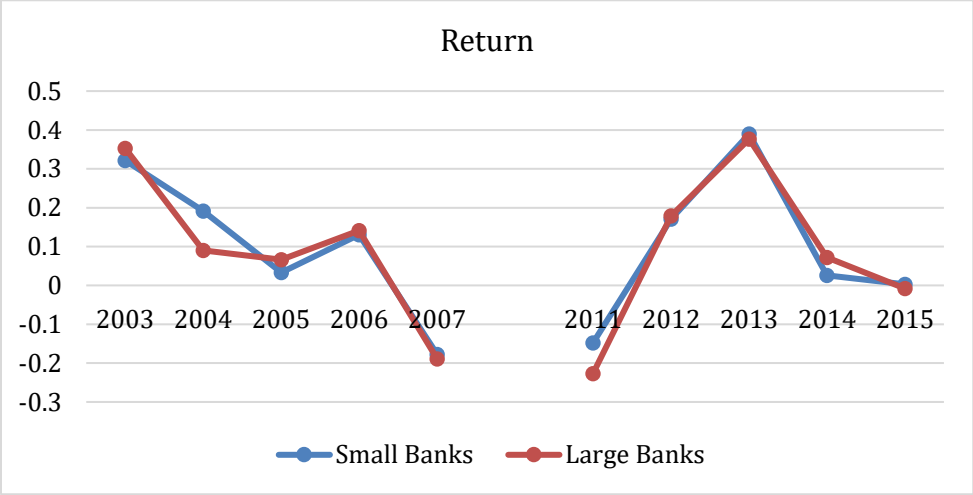
This figure displays the time trend of the percentage of firm-year observations with explicit risk-related performance metrics in their annual grant-based compensation plans.

FIGURE 2. Time Trend of Compensation and Compensation Components



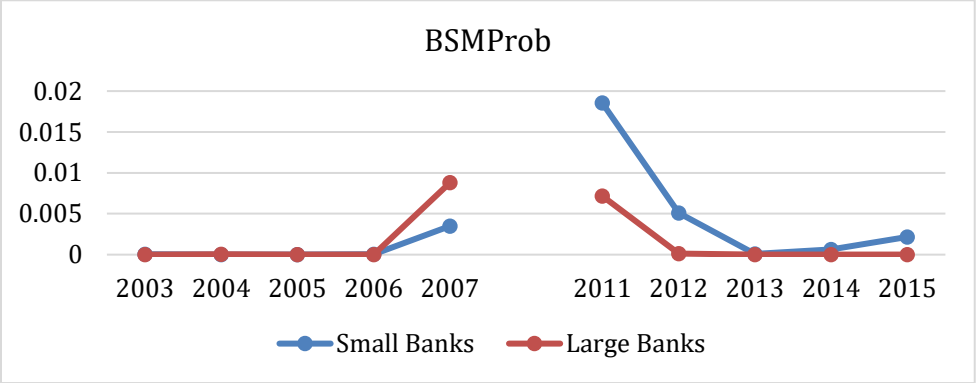
The figures here show the time trend of average CEO total compensation as well as two compensation components: the cash compensation and equity compensation, for small banks and large banks respectively.

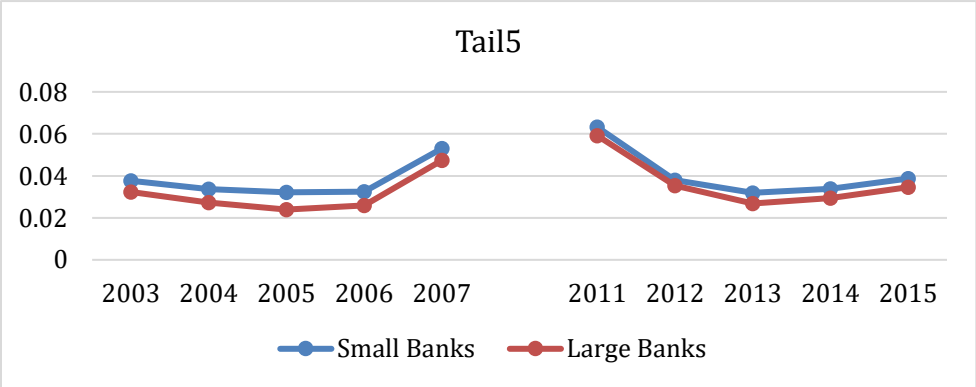
FIGURE 3. Time Trend of Stock Return

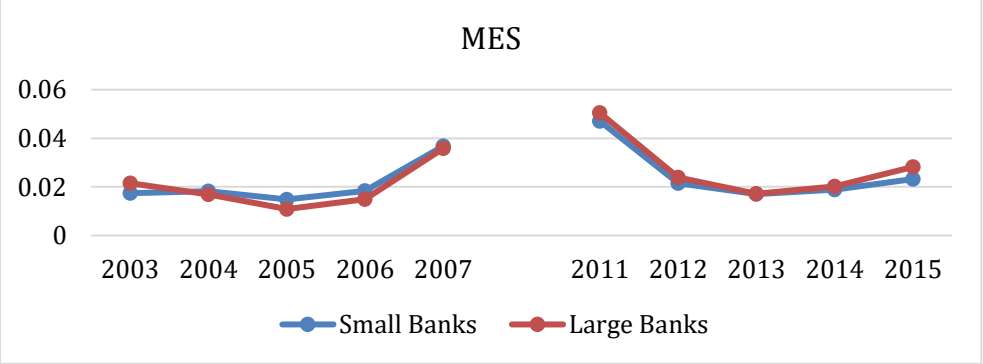


This figure shows the time trend of average stock return for small banks and large banks respectively.

FIGURE 4. Time Trend of Downside Tail Risk Measures

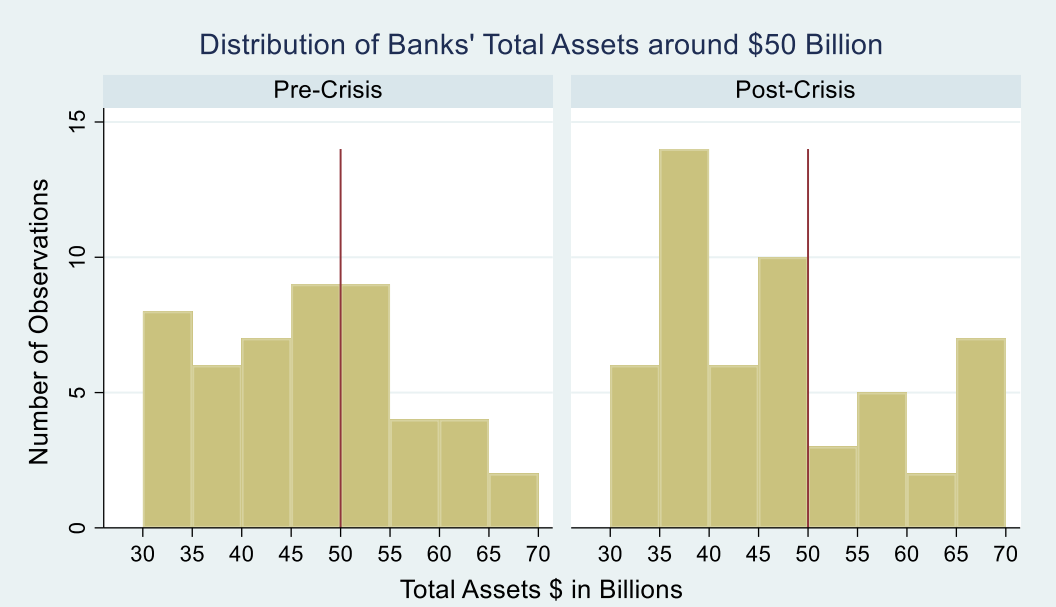


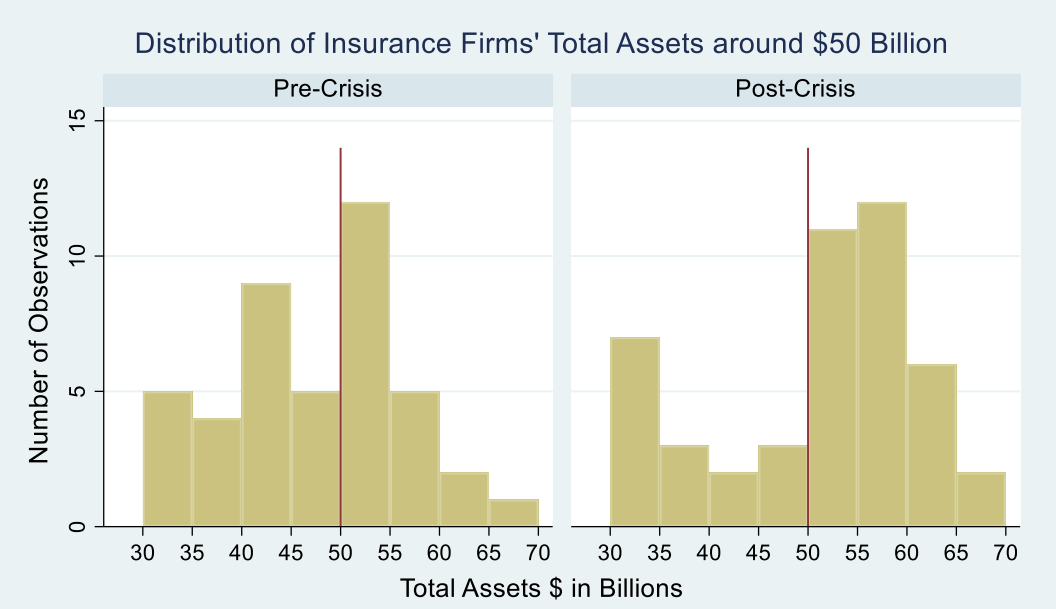




These figures show the time trend of average downside tail risk measures for small banks and large banks respectively.

FIGURE 5. Size Distribution of Observations Around $50 Billion





These figures display the distribution of total assets during the pre-crisis period and post-crisis period, for banks and insurance firms respectively.

TABLE 1. Sample Selection

	Firms	**Firm-year observations**
Initial data from ExecuComp with Compustat) SIC code 6000-6299 during fiscal years 2003-2007 (pre) and 2011-2015 (post)	267	1756
Less: missing CEO compensation and tenure	(13)	(54)
Less: missing control variables from Compustat	(8)	(79)
Less: missing return and risk measures from CRSP	(9)	(169)
Less: under constraints of TARP	0	(55)
Less: firms only existing in the pre- or post-crisis period	(121)	(459)
Final bank sample	**116**	**940**
Treatment group (large bank sample)	**67**	**463**

This table presents the sample selection process for the large bank sample, including banks whose total assets at the beginning of the fiscal year are above the median in each 2-digit SIC industry within the final bank sample.

TABLE 2. Summary Statistics

Panel A. Treatment Group - Large Bank Sample

	Pre-Crisis: N=208		Post-Crisis: N=255			
Variable	**Mean**	**Median**	**Mean**	**Median**	**Mean Difference**	**Median Difference**
Total pay	10,158	5,284	8,407	6,372	-1,751**	1,089
Return	0.06	0.10	0.09	0.08	0.03	-0.01
BSMProb	0.002	0.000	0.001	0.000	-0.001	0.000***
Tail5	0.033	0.029	0.036	0.033	0.004***	0.004***
MES	0.021	0.017	0.027	0.023	0.006***	0.006***
Lagged total risk	0.24	0.20	0.27	0.25	0.04***	0.05***
Lagged total assets	89,377	40,464	94,896	42,024	5,520	1,560
Lagged leverage	0.89	0.91	0.86	0.89	-0.03***	-0.02***
Lagged market-to-book ratio	1.18	1.10	1.06	1.02	-0.12***	-0.09***
Lagged assets growth rate	0.13	0.10	0.08	0.04	-0.05***	-0.05***
Duality	0.71	1.00	0.58	1.00	-0.12***	0.00
Tenure	8.33	6.00	9.29	7.00	0.96	1.00*

Panel B. Control Group - Small Bank Sample

	Pre-Crisis: N=217		Post-Crisis: N=260			
Variable	**Mean**	**Median**	**Mean**	**Median**	**Mean Difference**	**Median Difference**
Total pay	3,106	1,519	3,324	2,238	219	720***
Return	0.07	0.10	0.10	0.08	0.02	-0.03
BSMProb	0.001	0.000	0.005	0.000	0.004**	0.000
Tail5	0.039	0.034	0.040	0.035	0.001	0.001
MES	0.022	0.019	0.025	0.020	0.002**	0.001
Lagged total risk	0.29	0.26	0.32	0.28	0.03***	0.02*
Lagged total assets	6,815	3,431	5,826	4,850	-989	1,419***
Lagged leverage	0.78	0.90	0.76	0.88	-0.02	-0.02***
Lagged market-to-book ratio	1.73	1.15	1.40	1.05	-0.33***	-0.10***
Lagged assets growth rate	0.18	0.12	0.07	0.04	-0.10***	-0.08***
Duality	0.44	0	0.49	0	0.05	0.00
Tenure	7.93	6.67	10.77	8.379	2.84***	1.71***

Panel C. Large Banks vs. Small Banks

Variable	Pre			Post			Pre vs. Post Difference-in-Differences
	Large	Small	Difference	Large	Small	Difference	
Total pay	10,158	3,106	-7,052***	8,407	3,324	-5,083***	1,969**
Return	0.06	0.07	0.01	0.09	0.1	0.01	-0.00
BSMProb	0.002	0.001	-0.001	0.001	0.005	0.004**	0.005*
Tail5	0.033	0.039	0.006***	0.036	0.04	0.004***	--0.002
MES	0.021	0.022	0.001	0.027	0.025	-0.002**	-0.004**
Lagged total risk	0.24	0.29	0.05***	0.27	0.32	0.04***	-0.006
Lagged total assets	89,377	6,815	-82,561***	94,896	5,826	-89,070***	-6,509
Lagged leverage	0.89	0.78	-0.11***	0.86	0.76	-0.10***	0.01
Lagged market-to-book ratio	1.18	1.73	0.55***	1.06	1.4	0.34***	-0.21*
Lagged assets growth rate	0.13	0.18	0.04**	0.08	0.07	-0.01	-0.05**
Duality	0.71	0.44	-0.27***	0.58	0.49	-0.09**	0.18***
Tenure	8.33	7.93	-0.40	9.29	10.77	1.48**	1.89*

This table presents the descriptive statistics of the large bank and small bank groups. All the variables are defined in Appendix A. *, **, and *** indicate significance levels of 10%, 5%, and 1%, respectively. Mean differences are based on two-sided t-tests; median differences are based on nonparametric equality-of-medians tests.

Panel A presents descriptive statistics for the large bank sample, including bank-year observations with beginning-of-year total assets above the annual median value of each 2-digit SIC industry within the final bank sample.

Panel B presents descriptive statistics for the small bank sample, including bank-year observations with beginning-of-year total assets below the annual median value of each 2-digit SIC industry within the final bank sample.

Panel C presents the differences between the small and large banks in the pre-crisis and the post-crisis period respectively, as well as the difference-in-differences.

TABLE 3. Pairwise Correlation

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	Lnpay	1.00										
(2)	Return	0.10*	1.00									
(3)	BSMProb	-0.04	-0.27*	1.00								
(4)	Tail5	-0.13*	-0.48*	0.48*	1.00							
(5)	MES	0.09*	-0.45*	0.12*	0.73*	1.00						
(6)	Lagged total risk	-0.09*	0.19*	0.25*	0.46*	0.18*	1.00					
(7)	Lagged size	0.62*	0.02	-0.03	-0.18*	0.02	-0.17*	1.00				
(8)	Lagged leverage	-0.03	-0.07	0.06	-0.11*	-0.07	-0.13*	0.24*	1.00			
(9)	Lagged mtb ratio	-0.01	0.04	-0.04	0.06	0.04	0.05	-0.18*	-0.72*	1.00		
(10)	Lagged assets growth rate	-0.03	-0.03	-0.06	0.03	-0.05	-0.03	-0.04	-0.05	0.11*	1.00	
(11)	Duality	0.22*	0.02	-0.05	-0.17*	-0.05	-0.15*	0.21*	0.03	0.00	-0.09*	1.00
(12)	Lntenure	-0.12*	0.00	-0.01	-0.10*	-0.06	-0.12*	-0.16*	-0.10*	0.14*	-0.01	0.22*

This table shows the pairwise correlation of variables for the full bank sample (N=940). All the variables are defined in Appendix A. * corresponds to significance level at 0.05, based on two-sided tests.

TABLE 4. Difference-in-Differences of Pay-for-Performance and Penalty for Downside Tail Risk

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Post	0.24***	0.41**	0.31**
	(3.28)	(1.99)	(2.12)
Treated * Post	-0.07	-0.05	0.13
	(-0.87)	(-0.22)	(0.79)
Return	0.07	0.24**	0.24**
	(0.54)	(2.10)	(2.20)
Post * Return	0.29	0.15	0.21
	(1.59)	(0.89)	(1.17)
Treated * Return	0.76***	0.64***	0.61***
	(3.75)	(3.28)	(2.85)
Treated * Post * Return	**-1.15*** **	**-0.90*** **	**-1.05*** **
	(-4.83)	**(-3.57)**	**(-3.88)**
Tail risk	-7.23***	3.27	4.48
	(-5.14)	(1.09)	(1.32)
Post * Tail risk	5.01***	-3.69	-2.23
	(3.83)	(-0.84)	(-0.53)
Treated * Tail risk	11.36***	3.71	4.59
	(7.27)	(1.49)	(1.44)
Treated * Post * Tail risk	**-21.65*** **	**-3.84**	**-10.77** **
	(-4.51)	**(-0.76)**	**(-2.04)**
Lagged total risk	-0.47**	-0.61***	-0.60***
	(-2.48)	(-3.02)	(-3.09)
Lagged size	0.24***	0.23***	0.22***
	(3.27)	(2.86)	(2.88)
Lagged leverage	-0.41	-0.52	-0.48
	(-1.03)	(-1.22)	(-1.18)
Lagged market to book ratio	0.07	0.06	0.07
	(1.11)	(0.94)	(1.00)
Lagged assets growth rate	0.07	0.07	0.11
	(0.69)	(0.69)	(1.04)
Duality	-0.04	-0.04	-0.04
	(-0.74)	(-0.63)	(-0.65)
Lntenure	0.03	0.03	0.03
	(0.65)	(0.82)	(0.85)
Firm FE	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.168	0.155	0.159

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk, using three different downside tail risk measures respectively: BSMProb, Tail5, and MES. The dependent variable is the logarithm of total CEO compensation. Treated banks in this table are large banks with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011-2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 5. Changes in Pay-for-Performance and Penalty for Downside Tail Risk in Subsamples

Downside Tail Risk Measure	**BSMProb**		**Tail5**		**MES**	
	Large	**Small**	**Large**	**Small**	**Large**	**Small**
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.14**	0.26***	0.46***	0.26	0.45***	0.26**
	(1.98)	(3.83)	(2.74)	(1.60)	(3.14)	(2.00)
Return	0.83***	0.03	1.01***	0.08	0.87***	0.16
	(5.46)	(0.21)	(5.58)	(0.52)	(5.25)	(1.11)
Post * Return	**-0.85*** **	**0.32**	**-0.88*** **	**0.29**	**-0.88*** **	**0.28**
	(-4.26)	**(1.83)**	**(-3.96)**	**(1.49)**	**(-3.99)**	**(1.50)**
Tail risk	4.13***	-6.96*	11.35***	-1.09	10.70***	2.42
	(3.18)	(-1.67)	(3.44)	(-0.35)	(2.99)	(0.67)
Post * Tail risk	**-16.48*** **	**5.22**	**-11.41*** **	**0.14**	**-14.66*** **	**0.12**
	(-3.26)	**(1.24)**	**(-2.77)**	**(0.04)**	**(-3.23)**	**(0.03)**
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	463	477	463	477	463	477
Adj. R-sq	0.728	0.737	0.725	0.735	0.724	0.736

This table presents the changes in pay-for-performance and penalty for downside tail risk among the subsamples, using three different downside tail risk measures respectively: BSMProb, Tail5, and MES. The dependent variable is the logarithm of total CEO compensation. Large banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the interaction terms. Two sided tests are done for all the other variables *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 6. Parallel Trend in the Pre-Crisis Period

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-0.14	-0.15	-0.51
	(-0.44)	(-0.40)	(-1.25)
Treated * Post * Tail risk	-107.79	2.64	-1.36
	(-0.59)	(0.35)	(-0.15)
Other controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	425	425	425
Adj. R-sq	0.108	0.092	0.090

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk in the pre-crisis period. The dependent variable is the logarithm of total CEO compensation. Treated banks in this table are large banks with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2006–2007, and 0 for fiscal years 2003–2005. All the variables are defined in Appendix A. t-stats are reported in parentheses. Two sided tests are done for all the variables *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 7. Falsification Tests: Other Possible Treatments

Treated Group	TARP Banks			Poor-Performing Banks			Investment Banks		
Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**	**BSMProb**	**Tail5**	**MES**	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treated * Post * Return	-0.18	0.04	-0.22	0.15	0.10	0.24	-0.30	-0.27	-0.22
	(-0.70)	(0.16)	(-0.78)	(0.56)	(0.32)	(0.75)	(-1.00)	(-0.80)	(-0.65)
Treated * Post * Tail risk	0.21	13.45	8.51	-24.62*	-8.07	-6.49	-4.62	-10.98*	-11.59*
	(0.04)	(2.17)	(1.20)	(-1.49)	(-1.12)	(-0.88)	(-0.81)	(-1.41)	(-1.58)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	940	940	940	940	940	940	940	940	940
Adj. R-sq	0.141	0.140	0.141	0.141	0.134	0.137	0.154	0.143	0.143

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk.

Column (1), (2), and (3) classify TARP participants to be treated banks; Column (4), (5), and (6) classify banks with poorer performance during crisis period (July 1st 2007 to Dec 31st 2008) to be treated banks; Column (7), (8), and (9) classify investment banks (i.e., SIC code between 6200 and 6299) to be treated banks.

The dependent variable is the logarithm of total CEO compensation. Post is an indicator variable equal to 1 for fiscal years 2011-2015, and 0 for fiscal years 2003-2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 8. Falsification Tests: Upside Tail Potential Measures

Panel A. Difference-in-Differences of Pay-for-Performance and Pay for Upside Tail Potential

Upside Tail Potential Measure	**Upside Tail – Tail5**	**Upside Tail - MES**
	(1)	(2)
Treated * Post * Return	-0.83***	-0.88***
	(-3.07)	(-3.26)
Treated * Post * Tail risk	-3.97	-7.83*
	(-0.93)	(-1.61)
Other controls	Yes	Yes
Firm fixed effects	Yes	Yes
N	940	910
Adj. R-sq	0.153	0.158

Panel B. Changes in Pay-for-Performance and Pay for Upside Tail Potential in Subsamples

Upside Tail Potential Measure	**Upside Tail - Tail5**		**Upside Tail - MES**	
	Large	**Small**	**Large**	**Small**
	(1)	(2)	(3)	(4)
Post	0.24	-0.06	0.22	-0.21
	(1.42)	(-0.34)	(1.44)	(-1.32)
Return	0.81***	-0.08	0.84***	-0.10
	(2.75)	(-0.35)	(2.94)	(-0.47)
Post * Return	**-0.46***	**0.46**	**-0.48***	**0.51**
	(-1.48)	**(1.90)**	**(-1.56)**	**(2.21)**
Tail risk	8.14	-2.43	10.64	-9.38
	(1.37)	(-0.54)	(1.31)	(-1.39)
Post * Tail risk	**-5.74**	**2.37**	**-7.85**	**11.17**
	(-1.01)	**(0.54)**	**(-0.98)**	**(1.61)**
Other controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
N	463	477	463	477
Adj. R-sq	0.717	0.727	0.717	0.729

This table presents the results using two upside tail potential measures, constructed similarly to the method used to construct the two return-based downside tail risk measures: Tail5 and MES. The dependent variable is the logarithm of total CEO compensation. Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the other variables are defined in Appendix A. t-stats are reported in parentheses. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

Panel A shows the difference-in-differences results on the strength of pay-for-performance and pay for upside tail potential. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables.

Panel B shows the changes in pay-for-performance and pay for upside tail potential among the subsamples. One-sided tests are done for the interaction terms. Two sided tests are done for all the other variables.

TABLE 9. Falsification Tests: Other Risk Measures

Downside Tail Risk Measure	Total Risk	Leverage	Crash Risk	Systemic Risk
	(1)	(2)	(3)	(4)
Treated * Post * Return	-0.84***	-0.75***	-0.55**	-0.89***
	(-3.28)	(-2.73)	(-2.24)	(-3.16)
Treated * Post * Tail risk	-0.39	0.10	-0.03	-5.08
	(-0.54)	(0.24)	(-0.28)	(-0.54)
Other controls	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
N	940	940	884	940
Adj. R-sq	0.157	0.149	0.147	0.155

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for different risk measures.

Column (1) replaces downside tail with total risk; Column (2) replaces downside tail with leverage ratio; Column (3) replaces downside tail risk with crash risk; Column (4) replaces downside tail risk with systemic risk.

The dependent variable is the logarithm of total CEO compensation. Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011-2015, and 0 for fiscal years 2003-2007. All the other variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 10. Robustness Check: Alternative Fixed Effects

Panel A. 4-digit SIC Code Industry Fixed Effects

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-1.07***	-0.86***	-0.97***
	(-4.53)	(-3.51)	(-3.73)
Treated * Post * Tail risk	-19.48***	-4.59	-11.10**
	(-4.28)	(-0.98)	(-2.33)
Fixed Effect	SIC Industry	SIC Industry	SIC Industry
Other controls	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.178	0.165	0.168

Panel B. Institution Type Fixed Effects

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-1.08***	-0.86***	-0.97***
	(-4.52)	(-3.51)	(-3.70)
Treated * Post * Tail risk	-19.97***	-4.93	-11.22**
	(-4.37)	(-1.05)	(-2.28)
Fixed Effect	Institution Type	Institution Type	Institution Type
Other controls	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.175	0.162	0.164

Panel C. Primary Federal Regulator Fixed Effects

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-1.08***	-0.87***	-0.96***
	(-4.41)	(-3.50)	(-3.57)
Treated * Post * Tail risk	-19.57***	-5.17	-11.38**
	(-4.30)	(-1.12)	(-2.31)
Fixed Effect	Regulator	Regulator	Regulator
Other controls	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.165	0.154	0.156

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty including different fixed effects.

Panel A uses 4-digit SIC industry fixed effects; Panel B uses institution type fixed effects; Penal C uses primary federal regulator fixed effects.

The dependent variable is the logarithm of total CEO compensation. Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 11. Robustness Check: Alternative Control Group

Panel A. Difference-in-differences results using insurance firms as the control

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-0.71***	-0.53**	-0.54**
	(-2.75)	(-1.99)	(-1.82)
Treated * Post * Tail risk	-14.36***	-5.78	-4.30
	(-3.09)	(-1.14)	(-0.76)
Firm fixed Effect	Yes	Yes	Yes
Other controls	Yes	Yes	Yes
N	998	998	998
Adj. R-sq	0.127	0.123	0.128

Panel B. Parallel Trend in the Pre-Crisis Period

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-0.38	-0.39	-0.56
	(-0.97)	(-0.78)	(-1.27)
Treated * Post * Tail risk	432.07***	-9.84	2.92
	(2.99)	(-1.19)	(0.28)
Industry fixed Effect	Yes	Yes	Yes
Other controls	Yes	Yes	Yes
N	472	472	472
Adj. R-sq			

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk, using insurance firms as the control. Treated banks in this table are large banks with beginning-of-year total assets above the annual median of each 2-digit SIC industry. The dependent variable is the logarithm of total CEO compensation. All the variables are defined in Appendix A. t-stats are reported in parentheses. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

Panel A presents results using both the pre-crisis and post-crisis period; and Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables

Panel B presents results using only the pre-crisis period; and Post is an indicator variable equal to 1 for fiscal years 2006–2007, and 0 for fiscal years 2003–2005. Two-sided tests are done for all the variables.

TABLE 12. Robustness Check: Alternative Identification Methods for Large Banks

Cutoff for Large Banks	**Median of Beginning Total Assets**			**Total Assets of $50B**		
Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)	(4)	(5)	(6)
Treated * Post * Return	-0.43*	-0.46*	-0.56**	-0.35*	-0.68**	-0.65**
	(-1.64)	(-1.55)	(-1.89)	(-1.31)	(-2.30)	(-2.00)
Treated * Post * Tail risk	-14.75***	-11.40**	-15.55**	-10.71***	-12.18**	-17.20***
	(-3.56)	(-1.75)	(-2.26)	(-3.24)	(-2.14)	(-2.80)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	940	940	940	940	940	940
Adj. R-sq	0.143	0.139	0.143	0.162	0.175	0.173

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk.

Column (1), (2), and (3) use the median value of the beginning total assets for the post-crisis period as the cutoff point to classify large banks; Column (4), (5), and (6) use the $50 billion threshold of Dodd-Frank Act Section 956 to classify large banks.

The dependent variable is the logarithm of total CEO compensation. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 13. Robustness Check: Additional Control Variables

Downside Tail Risk Measure	BSMProb		Tail5		MES	
	(1)	(2)	(3)	(4)	(5)	(6)
Treated * Post * Return	-1.16***	-1.15***	-0.91***	-0.95***	-1.06***	-1.04***
	(-4.94)	(-4.70)	(-3.67)	(-3.62)	(-3.98)	(-3.90)
Treated * Post * Tail risk	-21.94***	-21.52***	-3.65	-4.84	-10.58**	-8.86*
	(-4.52)	(-4.16)	(-0.72)	(-0.99)	(-2.01)	(-1.63)
Risk Executive	-0.09	-0.08	-0.08	-0.07	-0.09	-0.08
	(-1.40)	(-1.30)	(-1.26)	(-1.09)	(-1.35)	(-1.23)
Lagged Equity Incentive		0.03		0.03		0.04
		(0.58)		(0.74)		(0.86)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	940	889	940	889	940	889
Adj. R-sq	0.170	0.171	0.157	0.158	0.161	0.163

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk, adding additional controls. The dependent variable is the logarithm of total CEO compensation. Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 14. Robustness Check: Removing Firm-Years with Merger and Acquisition Activities

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-1.28***	-0.85**	-0.88**
	(-4.92)	(-2.23)	(-2.20)
Treated * Post * Tail risk	-46.70***	-9.06*	-14.14**
	(-2.43)	(-1.48)	(-1.93)
Other controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	559	559	559
Adj. R-sq	0.223	0.199	0.193

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk using a sample without merger and acquisition activities. The dependent variable is the logarithm of total CEO compensation. Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 15. Additional Analysis: Restricted Bank Sample

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	1.32	-0.08	-0.17
	(2.77)	(-0.11)	(-0.18)
Treated * Post * Tail risk	-276.78	-1.12	-9.32
	(-0.64)	(-0.09)	(-0.50)
Other controls	No	No	No
Firm fixed effects	Yes	Yes	Yes
N	115	115	115
Adj. R-sq	0.158	0.114	0.114

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk, using a restricted bank sample with bank total assets between $30 billion and $70 billion. Treated banks are those with total assets above $50 billion at the beginning of each year. The dependent variable is the logarithm of total CEO compensation. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 16. Additional Analysis: Compensation Components

Panel A. Cash compensation

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-1.29***	-1.37***	-1.43***
	(-2.61)	(-2.56)	(-2.60)
Treated * Post * Tail risk	-19.98***	-14.36**	-20.14**
	(-2.66)	(-1.81)	(-2.19)
Other controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.141	0.149	0.148

Panel B. Equity compensation

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-2.68***	-1.62*	-2.54**
	(-2.39)	(-1.42)	(-2.32)
Treated * Post * Tail risk	-13.00	33.38	-4.53
	(-0.73)	(1.54)	(-0.22)
Other controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	940	940	940
Adj. R-sq	0.070	0.069	0.064

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk within two compensation components.

Panel A presents results using the logarithm of total cash compensation as the dependent variable; Penal B presents results using the logarithm of total equity compensation as the dependent variable.

Treated banks are those with beginning-of-year total assets above the annual median of each 2-digit SIC industry. Post is an indicator variable equal to 1 for fiscal years 2011–2015, and 0 for fiscal years 2003–2007. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

TABLE 17. Additional Analysis: CFO Compensation

Downside Tail Risk Measure	**BSMProb**	**Tail5**	**MES**
	(1)	(2)	(3)
Treated * Post * Return	-0.22	-0.32	-0.36*
	(-0.78)	(-1.11)	(-1.32)
Treated * Post * Tail risk	-8.47**	-5.49	-7.89*
	(-2.30)	(-1.17)	(-1.62)
Other controls	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
N	843	843	843
Adj. R-sq	0.199	0.200	0.203

This table presents the difference-in-differences results on the strength of pay-for-performance and penalty for downside tail risk. The dependent variable is the logarithm of total compensation of CFOs. Treated banks in this table are large banks with higher than industry median total assets. All the variables are defined in Appendix A. t-stats are reported in parentheses. One-sided tests are done for the three-way interaction terms. Two sided tests are done for all the other terms and variables. *, **, and *** indicate significance levels of 10%, 5%, and 1%. Standard errors are robust and clustered at firm level.

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