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London Business School

The Role of Accounting Information in Understanding the Behavior of Financial Institutions

Anya Kleymenova

A thesis submitted to the London Business School for the degree of Doctor of Philosophy

June 2014

Declaration

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London Business School is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

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Abstract

This thesis consists of five chapters. The first chapter provides an introduction and ties the three research papers together under the main theme of the role of accounting information in understanding banks' behavior and the last chapter provides a brief conclusion. In the second chapter, I study the capital market consequences of unique and unexpected mandatory disclosures of banks' liquidity and the resulting changes in banks' behavior. I employ a hand-collected sample of the disclosures of banks' borrowing from the US Federal Reserve Discount Window (DW) during the financial crisis. I find that these disclosures contain positive incremental market information as they decrease banks' cost of capital. However, I also find evidence of endogenous costs associated with more disclosure. I document that banks respond to the DW disclosures by increasing their liquidity holdings and decreasing risky assets. In line with the theoretical predictions of Goldstein and Sapra (2013), this finding indicates that, following the DW disclosures, banks try to avoid accessing the DW facility, despite its cost of capital benefits.

The third chapter studies whether universal banks exhibit more risky behavior and require additional governance mechanisms compared to pure-play commercial banks. Using a unique setting of the repeal of the Glass-Steagall Act of 1933, which removed barriers to universal banking in the United States, I examine whether commercial banks that become universal exhibit more risky behavior following the deregulation and change their corporate governance mechanisms. I find no observable difference in risk characteristics between universal and pure-play commercial banks. Furthermore, CEO pay-structure and compensation do not appear to be driven by the choice of the universal banking model.

The fourth chapter examines the effect of compensation regulation on the banking sector. Using the UK as the setting, this chapter tests the changes in compensation practices in the UK after the passage of the Remuneration Code and examines the related changes in banks' behavior. We find that regulated firms exhibit less risk when they make changes to compensation contracts after the implementation of regulation. We also find lower turnover among the regulated firms after the introduction of the Remuneration Code, potentially due to decreased job opportunities in the financial services sector following the financial crisis. Although some of the above changes can be perceived as benefits of regulation, an event study we conduct on the day the European Union announced a bonus cap finds negative abnormal returns. This finding is suggestive of investors perceiving at least some costs from regulating executive compensation.

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1 Introduction

This thesis focuses on several areas of accounting and financial economics: 1) the role of accounting information and mandatory disclosure for financial institutions; 2) real effects of disclosure; and 3) effects of changes in regulation on risk taking and corporate governance. These areas reflect my overall interest in financial institutions and their behavior in response to regulatory interventions. The common theme of the three main chapters of the thesis is that they study the capital market effects of interventions as exogenous shocks. In particular, I attempt to identify quasi-experimental settings in which intervention is unanticipated in order to be able to draw causal conclusions and inform both academic and policy debates about the resulting consequences of such changes.

The second chapter of my thesis, "Consequences of Mandated Bank Liquidity Disclosures," studies the real effects of disclosure. Using a hand-collected dataset, I study the capital market consequences of unique and unexpected disclosures of banks' borrowing from the US Federal Reserved Discount Window (DW) liquidity facilities during the financial crisis. While increased disclosure improves price efficiency and leads to market discipline in a setting without frictions, as demonstrated analytically by Goldstein and Sapra (2013) and Thakor (2014), this might not necessarily be the case for banks. This is because, due to their interconnectedness, banks operate in the "second-best" environment, which is prone to externalities and informational and market frictions. Therefore, while more disclosure for banks might lead to price efficiency, it does not necessarily imply economic efficiency due to changes in banks' behavior in response to increased disclosure. I find that despite the positive capital market consequences of the DW disclosures, as measured in both equity and debt markets, banks change their behavior in anticipation of future disclosures. In line with

the theoretical predictions of Goldstein and Sapra (2013) that disclosure is a necessary but insufficient condition for economic efficiency, my findings indicate that banks try to avoid accessing the DW facility in the future despite the observed benefits with respect to their cost of capital.

In the third chapter, "Are Universal Banks More Risky?", I study the reintroduction of the universal banking system in the United States with the repeal of the Glass-Steagall Act. I examine whether universal banks (banks that combine commercial and investment banking activities under one umbrella) are more risky. Given the removal of a restriction on universal banking activities for the first time since 1933, I also study whether executive compensation for banks was redefined to reflect potential changes in risk-taking incentives. Using a propensity-score matched sample, I compare banks that became universal to those that remained pure-play commercial and find that both types of banks changed their executive compensation and increased risk-taking. In particular, while both types of banks significantly increased their compensation and took more risk, these changes were not significantly different between the two different banking models. This finding adds to the debate on whether the universal banking model is indeed more risky and requires different governance mechanisms and regulations.

The fourth chapter, entitled "Regulation of Compensation," examines specific changes in executive compensation regulation in the UK and the resulting consequences.[1] Following the passage of the new Remuneration Code in the UK, we study the consequences of the new rules on banks' risk-taking activities and executive turnover by comparing affected banks' to other unaffected financial and non-financial firms in the UK. We find evidence that these regulatory changes decrease risk-taking

[1] "Regulation of Compensation" is joint work with İrem Tuna (London Business School).

and no evidence of increased executive turnover. While some of these changes might be perceived as beneficial, we find that investors react negatively to the announcements of further changes in regulation of executive pay for financial institutions. Our findings suggest that from the investors' perspective, further changes in compensation regulation might results in negative consequences outweighing the positive benefits.

Finally, chapter five concludes this thesis.

2 Consequences of Mandated Bank Liquidity Disclosures[2]

2.1 Introduction

The health of a financial sector relies crucially on its liquidity, as evidenced by the recent events that triggered the financial crisis. Several regulatory proposals have been put forward with the aim of preventing a recurrence of these events, a number of which involve the disclosure of bank liquidity information. The reasoning is that greater transparency would allow market participants and bank counterparties to discipline banks (BIS 2013a, 2013b). Opponents of these proposals, however, argue that, in the presence of information asymmetry about banks' asset quality and a lack of credible communication, liquidity disclosures can be counterproductive because they might lead to decreased lending and avoidance of borrowing from the lender of last resort (Herzberg and Praet, 2008; Bernanke, 2009; and Thakor, 2014). This paper studies the capital market consequences of bank liquidity disclosures and the impact of these disclosures on banks' behavior.

I utilize information from the 2011 US Federal Reserve disclosures that reveal which banks accessed the Discount Window (DW) liquidity facilities.[3] During the

[2] I would like to thank Pat Akey, Brian Akins, Allen Berger, Christa Bouwman, Andrew Cohen, Maria Correia, Michael Crawley (discussant), Emmanuel De George, Alex Edmans, Atif Ellahie, Sapnoti Eswar, Elizabeth Klee, John Kuong, Christian Leuz, Yun Lou, Maria Loumioti, Xiumin Martin, Steven Monahan, Doron Nissim, Clemens Otto, Richard Rosen (discussant), Oded Rozenbaum, Oleg Rubanov, Tjomme Rusticus, Sasan Saiy (discussant), Haresh Sapra, Stephen Schaefer, Lakshmanan Shivakumar, Rhiannon Sowerbutts, Ahmed Tahoun, İrem Tuna, Oktay Urcan, Joana Valente, Florin Vasvari, Robert Verrecchia, Tomasz Wieladek, Stephen Zeff, Irina Zviadadze and seminar participants at the Bank of England, the 2013 Trans-Atlantic Doctoral Conference, the 2013 ABTA Doctoral Researcher Awards, the 2013 FIRS Conference, the 2013 IFABS Conference, the 2013 AAA Annual Meeting, the London Business School, the University of Toronto, Rice University, the University of Michigan, the University of Pennsylvania, Wharton, Washington University at St. Louis, the US Federal Reserve Board, McGill University, the University of Chicago, INSEAD, HEC Paris, Columbia Business School, Northwestern University, the 2014 BAFA Annual Meeting, the 2014 EAA Annual Congress and the London School of Economics for their helpful comments and suggestions. The views expressed in this paper are my own and are not necessarily the views of the Bank of England. All remaining errors are my own.

[3] The DW, established in 1913, is a facility that allows deposit-taking institutions in the United States to borrow funds from the US Federal Reserve System on an overnight basis when needed (also known as the "lender of last resort"). The DW extends credit to help alleviate liquidity strains in deposit institutions and

2007-2009 financial crisis, banks in the United States borrowed unprecedented amounts through the DW facilities. While weekly borrowing from the DW before the crisis averaged $170 million per week, this amount was close to $30.8 billion from August 2007 to December 2009. Banks borrowed more than 26,000 loans with a total par value of $11 trillion. More than 50% (20%) of large (small) banks used the DW between March 2008 and March 2010 to obtain additional liquidity (Berger et al., 2014). However, despite the sizeable amount of capital provided, information about individual bank borrowing from the DW was not made public until recently. On March 21, 2011, the Supreme Court denied the Federal Reserve and Clearing House Association's appeal and, on March 31, 2011, forced the Federal Reserve to reveal which banks accessed the DW facilities, when they did so, how much they borrowed and for how long.[4] This disclosure was an "information surprise" that can provide insight into how banks modify their behavior if liquidity disclosures were provided regularly. Using a propensity-score matched sample of banks that accessed the DW (treatment sample) and those that did not (control sample), along with a standard difference-in-differences methodology, I study two main research questions: (1) whether the DW disclosures had any consequences with respect to banks' cost of capital; and (2) whether these disclosures triggered changes in banks' borrowing and lending activities.

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ensure the basic stability of the payment system. Banks pre-pledge collateral and can access this facility on a "no-questions-asked" basis, provided they have sufficient collateral and remain sound. During the financial crisis, the US Federal Reserve increased the maturity of DW loans to the maximum maturity of 90 days.

[4] Bloomberg News and Fox News filed several lawsuits against the Federal Reserve under the Freedom of Information Act requesting access to the DW borrowing data during the financial crisis (please see Appendix 2.A for the timeline of the lawsuits). The Clearing House Association, which represents 17 largest global banks, joined one of the lawsuits in support of the Federal Reserve in September 2009. For the news coverage, see, for example, Torres, Craig (2011), "Fed Releases Discount-Window Loan Records During Crisis Under Court Order," *Bloomberg*, March 31, 2011, available at http://www.bloomberg.com/news/2011-03-31/federal-reserve-releases-discount-window-loan-records-under-court-order.html.

Previous research has documented the existence of a stigma associated with the usage of the DW by banks in the United States (Furfine, 2001 and 2003; Armantier et al., 2011; and Acharya, Gromb and Yorulmazer, 2012). Ennis and Weinberg (2013) show analytically that in the presence of information asymmetry about the quality of banks' assets, it is rational for banks to avoid using the DW facilities to prevent signaling that their need for funding might be an indicator of poor asset quality. While the DW borrowing rate should theoretically provide an upper-bound on banks' cost of short-term borrowing in the federal funds market (Acharya et al., 2012), banks are willing to pay higher rates on funds from other sources, such as interbank loans or the Term Auction Facility, TAF (Furfine, 2003).[5] Furthermore, despite the fact that funds provided through the DW and TAF had the same collateral and eligibility requirements, banks borrowed substantially higher amounts during the financial crisis through the more expensive TAF and thus paid substantially more because of the perceived DW stigma (Brunnermeier, 2009; and Haltom, 2011).[6] While the aforementioned studies all document the existence of the DW stigma by comparing banks' borrowing in the federal funds (or interbank) market to that of borrowing from the Federal Reserve, the unprecedented event of the full, public DW borrowing disclosure provides a unique opportunity to test whether the stigma exists in the public capital market as well. If the market penalizes banks when the information is revealed, then it is rational for banks to adjust their behavior pre-emptively to avoid the impact of future DW disclosures.

Prior analytical research on disclosure has mainly focused on studying the effects of mandatory and voluntary disclosures by management and the role disclosure plays in informing capital market investors about a firm's future profitability (e.g., Kim

[5] The Term Auction Facility (TAF) was a temporary facility in operation from December 2007 until March 2010.

[6] In particular, during the 28 months of TAF's operation, financial institutions borrowed more than $3.8 trillion of funds at an average premium of between 37 and 150 basis points above the DW rate (Haltom, 2011).

and Verrecchia, 1994; and Lambert, Leuz and Verrecchia, 2012). These studies find that disclosure improves price efficiency by decreasing information asymmetry. Less is known, however, about the cost of capital impact of specific firm disclosures provided by regulators. The notable exceptions are the recent studies of the capital market consequences of US and EU bank stress test disclosures on the information asymmetry and information uncertainty about the underlying soundness of financial institutions (Peristiani, Morgan and Savino, 2010; Bischof and Daske, 2013; and Ellahie, 2013). Regulators potentially have a different objective function than an individual firm. In particular, banking regulators aim to provide disclosures that enhance market discipline and, at the same time, improve financial stability of the banking sector (Morgan and Stiroh, 2001; Goldstein and Sapra, 2013). Furthermore, regulatory disclosures might be viewed by market participants as less strategic for an individual firm than an individual firm's disclosure, thus potentially increasing the credibility of disclosures. Finally, disclosures by regulators might provide further impetus for additional voluntary disclosures by firms wishing to signal their quality (Bischof and Daske, 2013).

While more disclosure improves price efficiency and leads to market discipline in a setting without frictions, Goldstein and Sapra (2013) demonstrate analytically that this may not necessarily be the case for banks. This is because banks operate in the "second-best" environment, due to their interconnected nature, the presence of externalities, and banks' exposure to informational and market frictions. Furthermore, they show that, in the second-best environment, the incentives of all market participants need to be taken into account—for example, the incentives of banks when they interact with each other in the interbank market. Therefore, Goldstein and Sapra (2013) argue that while more disclosure for banks might lead to better market discipline and price efficiency, it is a necessary but insufficient condition for economic efficiency because

of the endogenous costs of disclosure. Similarly, Thakor (2014) analytically predicts that mandatory financial disclosure for financial institutions might be inefficient and lead to banks' fragility. Overall, these two studies argue that, in response to increased mandatory disclosure, banks change their behavior to avoid further disclosures.

To study the first question about the effect of liquidity disclosure on banks' cost of capital, I first need to establish that the information released by the Federal Reserve was material. I assess the information content of DW disclosures using three measures: cumulative abnormal stock returns (Lo, 2003; and Larcker, Ormazabal and Taylor, 2011); abnormal stock return volatility (Landsman and Maydew, 2002); and abnormal trading volume (Beaver, 1968; and Kim and Verrecchia, 1997). I find that, following the disclosure of the DW information, banks that accessed the DW exhibit positive cumulative abnormal returns of 1.10% (measured over a four-day window, including the DW disclosure event) compared to banks that did not. I also find that banks that accessed the DW experience a 26% drop in abnormal trading volume. However, I do not find any significant abnormal return volatility following the DW event, suggesting that negative abnormal volumes are more likely to be the result of investors' consensus, as investors will trade less if there is no disagreement about the content of disclosure (Holthausen and Verrecchia, 1990). These initial information content tests suggest that investors see the DW disclosures as a positive material event. Furthermore, the significant results indicate that the DW disclosures provide incremental material information despite being released with a two-year lag.

Next, I directly investigate the cost of capital consequences of DW disclosures by studying changes in the equity bid-ask spread and the cost of debt. I find that the DW disclosures significantly decrease the information asymmetry component of the bid-ask spreads for banks that accessed the DW in the short-horizon of seven days around the

announcement date. However, I find that the information asymmetry component of the bid-ask spread increases for banks that accessed the DW over the longer horizon of two quarters after the event. Regarding the cost of debt, I find that following the DW disclosures, banks that accessed the DW receive significantly lower bond issuing yields, with an average significant reduction of 1.16 percentage points, compared to the matched control group of banks that did not access the DW facilities. Overall, these findings suggest that the DW disclosures result in a decrease in the banks' cost of capital as measured by short-term equity and debt prices. Furthermore, unlike in prior studies, which document the existence of the DW stigma in the interbank market, there seems to be no evidence suggesting the stigma's presence in the public capital markets.

Finally, I study the effects of the DW disclosures on banks' lending, liquidity, and borrowing to establish whether banks change their behavior in response to the DW disclosures. I document that, following the DW disclosures, banks increase liquidity and decrease asset risk, measured as a proportion of risk-weighted assets in total assets. Banks also decrease their borrowing from other sources of unsecured lending, given by the proportion of their pledged assets in total assets. Furthermore, banks that accessed the DW appear to borrow less from the interbank market and increase their balance sheet liquidity by closing the loan-to-deposit gap. In addition, banks that borrowed more or accessed the DW more frequently decrease their risky lending and increase liquidity. Therefore, banks appear to change the composition of their balance sheets and hold more liquidity following the DW disclosures. These results, taken together with the capital market tests, suggest that while the DW disclosures provide some incremental information and are perceived positively by equity and debt investors, they also create incentives for banks to avoid accessing the DW in the future, despite the capital market benefits. This seeming inefficiency is an example of the endogenous costs (or

unintended consequences) of disclosure discussed by Goldstein and Sapra (2013) and Gigler et al. (2014). In this setting, the endogenous cost of disclosure for banks is the potential increase in the cost of interbank borrowing due to the signal that DW disclosures provide about banks' liquidity needs and the quality of their assets.

This study contributes to the literature across several dimensions. First, it adds to the literature on the role and economic consequences of mandatory disclosure. There is ample literature on the capital market consequences of mandated changes of particular accounting standards, rules, or regulatory events.[7] These studies reveal that mandatory disclosure leads to a reduction in information asymmetry and firms' cost of capital. I add to this literature by documenting how *unexpected* mandatory liquidity disclosures by a *regulator*, at the time of disclosure, provide incremental information to the capital market and lead to changes in banks' cost of capital. Mandatory disclosure by a regulator is an interesting setting as it provides standardized information for all companies and is less likely to be influenced by the strategic behavior of a particular firm. The unexpected nature of this disclosure allows me to exploit the exogenous variation resulting from the information shock and hence to draw causal inferences. Furthermore, I also contribute to the studies which investigate mandatory disclosure by bank regulators during the recent financial crisis (e.g., Peristiani et al., 2010; Bischof and Daske, 2013; and Ellahie, 2013). I add to these studies by providing evidence that supplemental mandatory liquidity disclosures decrease cost of capital and lead to a decrease in banks' risk-taking behavior. Moreover, while these studies focus on the effect of disclosure during the financial crisis, I show corroborating evidence that DW disclosures provide incremental information to the capital markets even after the financial crisis.

[7] For example, see Watts and Zimmerman (1986); Fields, Lys and Vincent (2001); Kothari (2001); Leuz and Verrecchia (2000); Daske et al., (2008, 2013); Hail, Leuz and Wysoki (2010); DeFond et al., (2011); Zhang, (2007); and Petacchi (2014).

Second, this paper contributes to the literature on the role of disclosure as a disciplining device for financial institutions (Flannery, 1998; Flannery, Kwan and Nimalendran, 2010; and Bushman and Williams, 2012). One of the arguments in support of the DW disclosure is that it can improve market discipline by providing additional information about banks' asset quality and liquidity. As Beatty and Liao (2013) point out, it is important to study and understand the effects of new regulatory changes for banks and, in particular, the increased liquidity disclosure requirements. However, given that the regulation affects all banks, studying the impact of these changes empirically poses a challenge of constructing a counterfactual scenario. The setting of the unexpected liquidity disclosure enables me to construct a counterfactual scenario of the consequences of liquidity disclosure by comparing banks that were directly affected by these disclosures (banks accessing the DW) with those that were not. My findings show that liquidity disclosures provide incremental information to the capital market over and above that available in regulatory and financial filings and result in the reduction in banks' cost of capital.

Third, because banks operate in the second-best environment with informational and market frictions, my setting allows me to directly test the endogenous costs of disclosure. In line with the analytical predictions of Goldstein and Sapra (2013) and Thakor (2014), and in contrast to the work that shows more disclosure is always better (e.g., Blackwell, 1951), I find that banks change their behavior following the DW disclosures by decreasing asset risk and increasing liquidity holdings. This is consistent with banks' attempts to mitigate the effects of similar disclosures in the future. Furthermore, banks change their behavior despite the positive reaction in the public capital market, suggesting that they perceive these disclosures to increase their cost of funding in some other way, in particular, through the interbank market. This is an

example of price efficiency not directly translating into economic efficiency, as banks respond to disclosures by changing their *ex ante* behavior (Bond, Edmans and Goldstein, 2012; Goldstein and Sapra, 2013; and Gigler et al., 2014).

Finally, this paper provides new evidence on whether the DW stigma is reflected in the capital markets. Unlike the interbank markets, in which the existence of the stigma has been widely documented (Furfine 2001; 2003; Armantier et al., 2011; and Acharya et al., 2012), I find no supporting evidence for the existence of the DW stigma in the public capital markets (either debt or equity). My findings also corroborate those of Berger et al. (2014), who study which banks accessed the DW and TAF during the financial crisis and document changes in banks' lending behavior and balance sheet structure contemporaneously to their usage of TAF and DW. My study differs in that it focuses on the capital market consequences of the public disclosure of DW information and changes in banks' behavior following this disclosure. To the best of my knowledge, consequences of disclosing the DW information have not yet been documented.

The rest of this chapter is organized as follows: section 2.2 provides a brief history of the discount window and its role; section 2.3 reviews the literature and formulates the hypotheses; section 2.4 introduces data sources and discusses the research design; section 2.5 presents the empirical results; and section 2.6 summarizes the main findings.

2.2 Borrowing from the Federal Reserve

The Discount Window (DW) facility at the Federal Reserve functions as a safety valve for financial institutions. Through this facility, the Federal Reserve can act as a "lender of last resort" and provide access to liquidity for solvent banks with sufficient

collateral.[8] Since 2003, depository institutions have been allowed to borrow from the DW easily and without any questions asked.

While the function of the DW remained relatively constant, its administration has changed over time. Prior to the mid-1960s, the DW loans were extended at "penalty" rates equal to or higher than short-term market interest rates (Madigan and Nelson, 2002; and Klee, 2011). From the mid-1960s until January 2003, the rate paid on the discount window borrowing was pegged at 25 to 50 basis points below the target federal funds rate and, to reduce potential arbitrage opportunities, deposit institutions borrowing from the DW had to demonstrate that they were unable to obtain funding from any other sources and were subject to additional regulatory scrutiny. Accessing the DW, therefore, became associated with the inability to borrow funds from other sources, giving rise to a stigma (Brunnermeier, 2009; and Haltom, 2011). This regime changed in January 2003, when the Federal Reserve returned to the "penalty rate" framework and increased the discount rate to 100 to 150 basis points above the federal funds target rate. Two facilities were established: primary credit for institutions in sound condition and secondary credit for financial institutions that do not qualify for primary access funding. Primary access facility provides credit mainly overnight on a "no-questions-asked" basis with minimal administration and no restrictions on its use. Secondary credit is available to troubled financial institutions to meet overnight backup liquidity needs and is closely monitored by the Federal Reserve. These changes were implemented as an attempt to eliminate the stigma associated with the DW access; however, they were unsuccessful (Furfine, 2003; and Haltom, 2011). In this paper, I study banks that access the primary credit facility of the DW.

[8] All commercial banks, thrift institutions, and US branches and agencies of foreign banks have access to the DW. The range of acceptable collateral includes investment-grade certificates of deposit, AAA-rated commercial mortgage-backed securities, US Treasury securities, state and local government securities, collateralized mortgage obligations (AAA), consumer loans, commercial and agricultural loans, and certain mortgage notes on one-to-four family residences.

As the financial crises unfolded in the second half of 2007, borrowing from the DW remained low (Bernanke, 2009). In August 2007, the Federal Reserve reduced the spread between the discount rate and the federal funds rate to 50 basis points and increased the DW loan terms from overnight to 30 days. The Federal Reserve also introduced the Term Auction Facility (TAF) to overcome the stigma problem associated with the DW (Bernanke, 2009). The key difference between the DW and TAF was that TAF was administered through a series of fortnightly auctions: the Federal Reserve announced that it would auction a fixed amount of funds, and an unlimited number of banks could bid for up to 10% of that amount (the cap was imposed to ensure that funds were distributed evenly).[9] Funds were given to bidders providing the highest bid, which exhausted all available funds. Furthermore, bidders were only notified that their bid was successful three days after the auction had taken place. Hence, TAF guaranteed that multiple banks were able to borrow from the Federal Reserve and reduced the likelihood that any one borrower would be identified by the market as requiring immediate funding and hence penalized (Armantier et al., 2011; and Haltom, 2011).

On March 31, 2011, the Federal Reserve made an unprecedented release of the DW borrowing information after it had lost a series of lawsuits filed under the Freedom of Information Act. The Federal Reserve initially refused to reveal this information by arguing that such disclosure would dissuade banks from borrowing from the DW in the future and thus undermine financial stability; however, just a few days earlier, on March 21, 2011, the Supreme Court denied the Federal Reserve's petition to hear its appeal. This was the first time the DW information was made public since its inception

[9] Collateral requirements were exactly the same for DW and TAF funds.

in 1913.[10] In addition, as required by the Dodd-Frank Act, on December 1, 2010, the Federal Reserve released information about TAF borrowing.

In this paper, I focus on the DW disclosures event on March 31, 2011 (the DW disclosure event). In addition, in robustness tests, I also investigate the reaction to the TAF disclosure event (December 1, 2010) and the Supreme Court decision event (March 21, 2011).

2.3 Review of the literature and hypotheses development

As discussed briefly above, accessing the DW facility is associated with a stigma based on the notion that only a bank in financial trouble will borrow funds from the Federal Reserve over other sources of funds (e.g., Peristiani, 1998; and Armantier et al., 2011). Ennis and Weinberg (2013) provide a formal model showing the existence and rationality of the stigma as a result of information asymmetry and noisy signaling; while Furfine (2001; 2003) finds empirical evidence in support of the stigma. In addition, studies of banks' behavior during the recent financial crisis reveal further support that, even during times when liquidity needs are extreme, banks pay a substantial premium for other sources of funds instead of accessing the DW (Armantier et al., 2011; and Acharya et al., 2012). One factor that contributed to the existence of this stigma is information asymmetry about the quality of banks' assets (Artuc and Demiralp, 2010; and Furfine, 2001).

Information asymmetries create costs by introducing adverse selection into transactions between buyers and sellers of firm shares, which is typically manifested in reduced levels of liquidity for firm shares (e.g., Copeland and Galai, 1983; Kyle, 1985; and Glosten and Milgrom, 1985). In order to overcome the reluctance of potential

[10] The Dodd-Frank Act introduced a requirement for the Federal Reserve to release the DW access details with a two-year lag. The first release was on September 28, 2012. Going forward, this information will be released quarterly.

investors to hold firm shares in illiquid markets, firms issue capital at a discount. Discounting results in fewer proceeds to the firm and hence higher cost of capital. The disclosure theory for capital markets predicts that if informative disclosures are backed by commitment to increased levels of disclosure, the information asymmetry component of the equity bid-ask spread should decrease (Baiman and Verrecchia, 1996; Diamond and Verrecchia, 1991; and Verrecchia, 2001). However, if disclosure is partial, such as in the case of redacted disclosures, the equity bid-ask spread will increase (Verrecchia and Weber, 2006). If, on the one hand, the stigma associated with the DW also applies to the capital markets, the revelation of which banks accessed the DW during the financial crisis will lead to a negative market reaction. On the other hand, because banks accessing the DW are required to be in good standing and have enough high quality collateral, the reaction might be positive. Over a short horizon, the changes of investors' beliefs based on changes in information asymmetry will result in changes in the bid-ask spread and thus changes in the cost of equity capital.

One of the main arguments in support of the DW disclosure is that it provides additional information about banks' liquidity and asset quality and may increase market discipline. Bank supervisors are willing to disclose information about banks to share the role of policing bank risk with private investors, in particular, bondholders. Morgan and Stiroh (2001) find that banks' bondholders take into account the underlying risk of banks' portfolios of assets. However, the authors also find that investors appear to fail to incorporate all information or fully penalize large or more opaque banks, suggesting that the disciplinary mechanism partially fails for banks either considered to be "too big to fail" or "too difficult to understand" by the bond market. Prior studies on the role of disclosure in the credit markets have documented that while higher disclosure quality leads to a lower cost of debt (Sengupta, 1998; Yu, 2005), bond prices have high

sensitivity to negative news (Easton, Monahan and Vasvari, 2009). Therefore, if the DW disclosure increases transparency and hence reduces the adverse selection costs for bondholders, the DW disclosures will be viewed as positive news by bondholders as they will reduce the uncertainty associated with the quality of banks' assets (Duffie and Lando, 2001). However, if banks accessing the DW are instead perceived as having poor asset quality in line with the documented stigma, the reaction will be negative. Given that the DW disclosures are provided with a lag, I expect to find no significant effect on banks' cost of capital if the DW disclosures do not contain any new information for banks' investors.

The effects of the DW disclosures on cost of debt and equity are, therefore, unclear *a priori* and the net impact of the two opposing effects has to be assessed empirically. In my first hypothesis, I test whether the DW disclosures result in a change in the cost of banks' capital as measured by the information asymmetry component of the equity bid-ask spread and the offering bond yields:

H1: DW disclosures decrease (increase) banks' cost of capital as measured by the equity bid-ask spread and offering bond yields if they decrease information asymmetry (increase DW stigma).

The literature on real effects of accounting disclosure emphasizes the two-way impact between firm decisions and capital market pricing (e.g., Kanodia and Lee, 1998; Sapra, 2002; and Kanodia, Sapra and Venugopalan, 2004). If the DW disclosures provide additional information to banks' investors, they will result in changes in banks' cost of capital. Whether banks adjust their behavior accordingly, however, is unclear. Banks operate in the second-best environment with informational and market frictions and are prone to externalities. Therefore, increased disclosure, even if it results in price efficiency, might not necessarily lead to economic efficiency due to endogenous costs

(Bond et al., 2012; Goldstein and Sapra, 2013; and Gigler et al., 2014). Furthermore, in the second-best environment, it is important to take into account the effect of disclosure not only on market discipline but also on all market participants, for example, the effect of disclosure on bank's interactions with each other in the interbank market (Goldstein and Sapra, 2013).

Goldstein and Sapra (2013) present a theoretical model in which a banking regulator discloses the results of banks' stress tests. They show that market discipline is a necessary but insufficient condition for economic efficiency. This is because disclosure might induce suboptimal *ex post* market externalities that would lead to excessive and inefficient reaction to public news. This disclosure might also reduce traders' incentives to gather information and hence impose market discipline. Most importantly, this disclosure might lead banks to change their behavior *ex ante* in anticipation of future disclosures and thus make *ex post* inefficient decisions. The authors refer to these predicted outcomes as endogenous costs of disclosure. In addition, Thakor's (2014) theory of information disclosure with disagreement examines the implications of mandatory disclosure for financial and non-financial firms. He finds that banks optimally disclose less strategic information than non-financial firms and that mandatory disclosure may make banks more fragile. However, in a recent empirical study of the European banks' response to the regulator's disclosure of the EU banks' stress tests results, Bischof and Daske (2013) find that this mandatory disclosure causes banks to lower their risk-taking behavior.

When the information about the DW access is released, the market is already aware of the Dodd-Frank Act requirements to provide DW access disclosures from

September 2012, and that these DW disclosures apply to all banks accessing the DW.[11] The unexpected disclosure provides banks with a signal about how such disclosures will be viewed by banks' investors over and above that of the overall passage of the Dodd-Frank Act, to which investors had a mixed reaction (Gao, Liao and Wang, 2013). Hence, if banks perceive investors and counterparties to react negatively to the release of the DW information, they would adjust their behavior before the scheduled information is released. Such real changes in banks' behavior are likely to decrease their likelihood of accessing the DW in the future. In particular, if banks perceive that future DW disclosures will increase their cost of funding and ability to access the interbank market, they will seek to obtain short-term liquidity from other sources to avoid the impact of future disclosures. Furthermore, banks might change the riskiness of their assets to avoid short-term liquidity needs that might require them accessing the DW. Therefore, my second hypothesis tests whether banks alter the composition of their balance sheets in response to this release of the DW borrowing information:

> *H2: Disclosure of the DW information ex post affects banks' asset allocation, liquidity, and risk decisions ex ante.*

2.4 Data and empirical research design

2.4.1 Data and sample selection

The DW borrowing data for most of the financial crisis (March 2008 to March 2010) is obtained directly from Bloomberg in the form of PDF files it received from the Federal Reserve on March 31, 2011. DW data contains the name of the bank, the district Federal Reserve from which the funds were borrowed, the amount borrowed, and the loan terms (collateral and other identifying information is redacted). TAF data is obtained directly

[11] While many of the Dodd-Frank provisions specifically target the largest financial institutions with total assets in excess of $50 billion, the DW disclosure requirements affect all banks accessing the DW. For the timeline of events please see Appendix 2.A.

from the Federal Reserve, following the mandatory release under the Dodd-Frank Act on December 1, 2010. TAF data is available for the duration of the facility (December 2007 to March 2010) and, apart from the actual information on loans, also includes data on unencumbered collateral and its quality.

For accounting and regulatory data, I use the consolidated financial statements for bank holding companies (FR Y-9C reports), which are publicly available on the Federal Reserve Bank of Chicago website.[12] Since internal financing from the parent company is the cheapest form of funding, financial institutions are unlikely to access the DW unless they are unable to obtain funds from the parent company (Kashyap, Rajan and Stein, 2002; Gatev and Strahan, 2006; Ashcraft, 2008). Therefore, in my analysis, I focus on the top-level banks by manually matching the codes of banks accessing the DW to their top-level bank or bank holding company. The data is also complemented with the structural information from the FDIC Call Reports for commercial banks to identify the top-level BHC as well as a manual name match of the information revealed through the FDIC's National Information Center. Form FR Y-9C contains detailed information on the financial performance of BHCs, their consolidated financial statements, and accompanying details as well as exposures and regulatory capital details. This data is also supplemented with market data from CRSP, bond issuance data from Mergent Fixed Income Securities Database (FISD), and accounting data from Compustat.[13]

I also conduct an extensive news search using Factiva to ensure that no other market-sensitive events occurred contemporaneously with the DW disclosures. Appendix 2.C shows the news coverage for the US banking sector during the DW

[12] Data is available at http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm. BHCs are required to submit their regulatory filings within two months after the end of each calendar quarter.

[13] BHCs are manually matched to the identifying information on issuers based on CUSIP, location and name of the top-level BHC and issuer identifying information in Mergent FISD.

disclosure as well as on placebo dates the year before and after. As can be seen from the chart, DW news represented approximately one-half of all news articles on the US financial sector on March 31, 2011. DW did not feature at all in the news, either in the previous year or the year after.

I focus my study on public BHCs in order to establish the capital market response to the DW disclosures. My final dataset consists of 197 banks that accessed the DW and 76 banks that accessed TAF. In particular, 138 of these banks accessed the DW only and 17 banks accessed TAF only. 59 banks accessed both facilities.[14] The sample also includes banks that did not access either DW or TAF matched on their likelihood of accessing the DW facilities using propensity-score matching. These banks form the control sample in my analysis.

Table 2.1, Panel A presents the descriptive statistics for the main sample. Panel B presents variables used in the cost of equity tests, and Panel C shows the summary statistics for the variables used in the cost of debt issuance analysis. Panel D presents the variables used in the propensity-score matching before and after the match. It shows that, on average, banks accessing the DW are significantly larger and more profitable than banks which did not access the DW. The matched sample, however, shows that treatment and control banks are no longer different after the matching exercise. The matched sample is used in the remainder of the analysis. Untabulated univariate comparisons of the means show that DW banks have higher bid-ask spreads, smaller market size, and less volatile equity returns than the control banks. Also, on average, they receive lower offering yields than the control sample of banks.

[14] The starting sample consisted of 473 banks that accessed the DW and 123 that accessed TAF. In particular, 350 accessed the DW only, 20 accessed the TAF only, and 103 accessed both facilities. The sample attrition occurred due to matching on bank size, availability of public information, and the requirement for banks to exist in the sample during the matching period. The full sample was also analyzed for robustness.

2.4.2 Research design

The unexpected and unprecedented release of the DW information represents an exogenous information shock. However, since the DW information is disclosed with a lag, before testing the cost of capital consequences of these disclosures, I test whether these disclosures provide any material information. I focus on short four-day windows, which include the event date (0, +3), using three measures of information content: cumulative abnormal returns, abnormal trading volumes, and abnormal returns volatility. While price changes reflect the average change in investors' beliefs attributable to the disclosure of new information, trading volumes reflect idiosyncratic interpretation of new information (Beaver, 1968; Holthausen and Verrecchia, 1990; and Kim and Verrecchia, 1991, 1997). Since disclosure could be neutral in the sense of not changing the expectations of the market overall (i.e., resulting in no price reaction) and yet alter the expectations of individual investors (thus leading to trading), volume reactions might be more sensitive tests of the usefulness of public disclosures than price reactions (Beaver, 1968; Bamber et al., 2011; and Chae, 2005). Holthausen and Verrecchia (1990) show that trading volumes consist of two components: informedness and consensus, which may shift upward or downward depending on whether shifts in informedness and consensus are reinforcing or countervailing.[15] In order to identify which effect might dominate, I use abnormal return volatility as an alternative measure of information content (Landsman and Maydew, 2002; and DeFond et al., 2007).

I identify the information content of the DW disclosures using cross-sectional tests around the DW event date:

$$y_i = \gamma_0 + \gamma_1 Treated_i + \sum_k \gamma_k Controls_i + \theta_i \tag{2.1}$$

[15] Furthermore, Brochet, Naranjo and Yu (2013) demonstrate that, if complexity affects the usefulness of the information released, more complexity reduces the information content, leading to less trading volume and smaller price movements.

where y_i is one of the measures of cumulative abnormal returns, abnormal volume, or abnormal volatility estimated around a short window following the DW event; $Treated_i$ identifies whether bank i accessed the DW and captures the average treatment effect; and $Controls_i$ is a vector of control variables defined in more detail below. I define cumulative abnormal returns (*CAR*) and abnormal volatility (*AVAR*) using the market model and the CRSP value-weighted market index.[16] Since the unexpected DW disclosures on March 31, 2011, were preceded by the scheduled TAF disclosures on December 1, 2010, providing some information about banks that accessed both facilities, I measure the normal period as a one-year of trading activity six months before the TAF disclosure event to avoid creating overlapping windows. Consistent with prior studies, I measure abnormal volatility of stock returns as the ratio of event window return volatility to the return volatility in the non-event period (Beaver, 1968; Landsman and Maydew, 2002; and Landsman et al., 2012): $AVAR_i = ln\left(\overline{u_{it}^2}/\sigma_i^2\right)$, where $u_{it} = R_{it} - \left(\hat{\alpha}_i + \hat{\beta}_i R_{mt}\right)$, R_{it} is the firms' stock return, R_{mt} is the value-weighted US stock market return, and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are bank i's estimation-period market model parameter estimates. σ_i^2 is the variance of the market-model residuals in the non-event period defined before the TAF event on December 1, 2010. Abnormal volume is calculated as $AVOL_{it} = ln(\overline{V}_{it}/V_i)$, where $\overline{V}_{it}$ is the mean event-period volume for bank i and V_i is the mean estimation-period volume measured over a period of 30 trading days before the TAF disclosures event (DeFond et al., 2007).[17] Abnormal volumes are in natural logarithms to account for their high skewness (Landsman et al., 2012).

[16] Using all US stocks or S&P 500 as benchmarks instead does not alter inferences. I do not focus only on the SIC6000 because the analyzed disclosures affected all listed deposit-taking institutions, which represent a significant proportion of the SIC6000 firms.

[17] Inferences remain unchanged if I compute abnormal volumes using the market model or use longer non-event windows to estimate "normal" trading volumes.

I control for observable characteristics that might influence the underlying trading activities (for example, see Larcker et al., 2011; Landsman, et al. 2012). These are as follows: market value measured as the natural logarithm of market value of equity (*Size*); the ratio of book value of equity to market value of equity (*Book-to-Market*); the market-adjusted return over the prior six months (*Momentum*); and leverage, measured as a ratio of total liabilities scaled by the market value of equity (*Leverage*) (DeFond et al., 2007; and Landsman et al., 2012). Given that the amount and frequency of the DW borrowing represents incremental information not available to investors prior to the disclosure, I also control for the DW borrowing (*Average amount borrowed/Assets*) and the frequency of accessing this facility (*Total number of visits*).

Next, I test whether the release of the DW information results in a change in banks' cost of capital. I use the information asymmetry component of the equity bid-ask spread and bonds' offering yield as my measures of the cost of capital. In order to isolate the information asymmetry component of the equity bid-ask spread, I follow Stoll (1978; 1989) and estimate the adverse selection component of the bid-ask spread by considering small and fixed order processing and the larger inventory holding costs of the market-maker and estimate the following regression using a standard difference-in-differences design:

$$\begin{aligned} BA\,Spread_{it} = \beta_0 + \beta_1 Event_t + \beta_2 Treated_i + \beta_3 Event_t \times Treated_i + \beta_4 Size_{it} \\ + \beta_5 Volume_{it} + \beta_6 Volatility_{it} + \sum_n \beta_n Controls_{it} + \varepsilon_{it} \end{aligned} \quad (2.2)$$

where $BA\ Spread_{it}$ is the natural logarithm of the relative equity bid-ask spread for each bank deflated by the average price, $Event_t$ is the DW disclosure, $Treated_i$ takes the value of one for banks which have accessed the DW, $Event_t \times Treated_i$ is the interaction term which takes the value of one in the post-event window for banks that have accessed the DW; $Size_{it}$ is the natural logarithm of daily market capitalization of each bank to take

into account its size, $Volume_{it}$ is the volume of shares trading as a proportion of the shares outstanding, and $Volatility_{it}$ is the rolling standard deviation of daily stock returns in the previous trading year. In addition to the short-term tests using the above difference-in-differences methodology, I also test the long-run effect of the DW disclosure on banks that have accessed the discount window. In order to take into account unobserved heterogeneity at the bank-level and aggregate shocks over time, I use fixed effects at the levels of the bank holding company and time. The inclusion of fixed effects implies that only the difference-in-differences effect is identified. The estimated specification, therefore, takes the following form:

$$BA\ Spread_{it} = \beta_1 Event_t \times Treated_i + \beta_2 Size_{it} + \beta_3 Volume_{it} + \beta_4 Volatility_{it} + \sum_n \beta_n Controls_{it} + T_t + B_i + \varepsilon_{it} \quad (2.3)$$

where T_t and B_i refer to the time-level and bank-level fixed effects, respectively, and the rest of the variables are as defined above.

I estimate the effects on banks' cost of borrowing from the public market by using a difference-in-differences research design, heeding the effects of unobserved heterogeneity and aggregate shocks or shifts in debt-financing over time by including bank-level and quarterly fixed effects:[18]

$$Offering\ Yield_{it} = \alpha_1 Event_t \times Treated_i + \sum_l \alpha_l Controls_{it} + T_t + B_i + \nu_{it} \quad (2.4)$$

where $Offering\ Yield_{it}$ is the bond-offering yield-to-maturity of bank i's bond at time t, measured at the time of bond issuance; $Event_t \times Treated_i$ is the interaction term which takes the value of one for banks that have been identified as having accessed the DW in the post-DW disclosure period; and $Controls_{it}$ include the yield-to-maturity of a corresponding US Treasury bill or bond matched to each bond in the sample on

[18] Yu (2005) points out that, to the extent that security issues are often accompanied by additional disclosures, bond offering yields are more sensitive to perceived accounting transparency and disclosure quality than the secondary market bond yields.

maturity and coupon (*Benchmark Treasury Yield*) to control for changes in benchmark risk-free interest rates and controls for bond-specific characteristics. Other controls are as follows: the bond maturity in years (*Bond Life*); the total dollar amount of the face value of each bond at issuance (*Amount of Issue)*; and indicators for whether a bond is *Callable*.[19] I also control for bank-specific characteristics that might affect the cost of issuance (Morgan and Stiroh, 2001), such as bank size measured as the natural logarithm of total assets (*Log Assets*); the overall riskiness of bank's assets measured as the share of risk-weighted assets in total assets (*Asset Risk*); bank's capitalization measured as the share of Tier 1 regulatory capital in total assets (*Tier Ratio*); bank's need to rely on outside funding measured as the share of total deposits in total assets (*Deposits/Assets*); and, finally, bank's profitability measured as the return on assets (*ROA*).

Finally, to estimate the real effects of the DW disclosure on banks' subsequent risk-taking behavior, I once again use the difference-in-differences estimation to compare banks that have accessed the DW with those that did not. I include bank- and quarter-level fixed effects in all of the long-run specifications to account for unobserved heterogeneity and aggregate shocks. As a result, only the difference-in-differences effect is identified:

$$y_{it} = \delta_1 Event_t \times Treated_i + \sum_m \delta_m Controls_{it} + T_t + B_i + \upsilon_{it} \tag{2.5}$$

where y_{it} refers to the proxies of risk-taking behavior measured as idiosyncratic volatility; asset risk (proportion of risk-weighted assets in total assets); and risky proportion of the balance sheet activities (proxied as a proportion of commercial and industrial loans in total assets).

[19] I do not control for whether a bond is a putable or subordinated, as the majority of the sample has very few observations with these characteristics during the time period I study.

The potential endogenous costs of disclosure for banks can take several forms: in order to avoid accessing the DW in the future, banks might increase their overall balance sheet liquidity by holding more liquid assets, decreasing their pledged collateral and reducing their riskier lending. Furthermore, banks might change the overall liquidity needs by closing the gap between loans and deposits by either actively seeking to increase deposits or by decreasing lending (Acharya and Mora, 2014; Berger et al., 2014). In order to identify the effect of disclosure on banks' asset allocation and liquidity-holding, I use the same research design as above and investigate whether banks change the structure of their balance sheets to increase liquidity by increasing the proportion of liquid assets in total assets (*Liquid Assets*); decreasing the amount of pledged collateral, which typically consists of highly liquid assets (*Percentage Pledged*); change their net borrowing in the federal funds and repo market (*Fed Funds and Repo Borrowed*); and, finally, change their loan-deposit gap as a proxy for the overall balance sheet liquidity, measured as the difference between the levels of loans and deposits as a share of total assets (*Loan-Deposit Gap*).[20]

One of the endogenous costs of disclosure for banks is the potential increase in their cost of funding through the interbank market since the DW disclosures provide information about the quality of banks' balance sheets and their need for accessing liquidity. In the presence of information asymmetry and a lack of credible communication, banks that accessed the DW might experience an increase in their cost of interbank funding if their counterparties perceive the DW access to provide a

[20] Following the analysis of Cornett et al. (2011), I also estimate the effect on liquidity, loan growth, and credit growth to study whether banks changed their liquid asset holdings following the DW disclosure. The dependent variables of interest are the growth of liquid assets measured as the change in liquid assets (cash plus non-asset-backed securities) scaled by the beginning of quarter total assets ($\Delta Liquid\ Assets_t/Assets_{t-1}$); quarterly growth in lending measured as a change in loans scaled by the beginning of quarter total assets ($\Delta Loans_t/Assets_{t-1}$); and quarterly growth in credit (sum of loans plus undrawn commitments) scaled by the sum of the beginning of quarter total assets and undrawn commitments ($\Delta Credit_t/(Commit + Assets)_{t-1}$). Please see Appendix 2.B for variable definitions.

negative signal in line with the DW stigma. I therefore test whether banks' access to funding changes following the DW disclosures by testing whether banks experience any significant changes in the federal funds market ($\Delta Net\ Fed\ Funds\ and\ Repo_t\ /\ Assets_{t-1}$), with other sources of borrowing, which include borrowing from the DW ($\Delta Other\ Borrowed\ Funds_t\ /\ Assets_{t-1}$), and with the wholesale funding overall ($\Delta Wholesale\ Funding_t\ /\ Assets_{t-1}$). Finally, I also compute the implicit interest rate changes on large and core deposits to test whether banks that accessed the DW offered higher rates on deposits to increase their core funding in order to increase their overall liquidity (Acharya and Mora, 2014).

The cross-sectional and difference-in-differences research design assumes that the selection into treatment is random. However, in this setting there might be self-selection into treatment (accessing of the DW) by various banks. Therefore, I construct a matched sample by matching treated and control (untreated) banks using the propensity score matching methodology with one-to-one matching without replacement. The observable covariates on which the banks are matched are identified as the most likely determinants of liquidity needs and the likelihood of accessing the DW (Berger et al., 2014). These variables are total assets which proxy for banks' size (*Assets*); banks' capital adequacy position computed as a ratio of Tier 1 regulatory capital to total assets (*Tier Ratio*); portfolio risk measured as the standard deviation of the return on assets (*Std ROA*); commercial real estate normalized by total assets (*CRE/Assets*); mortgage-backed securities normalized by total assets (*MRE/Assets*); profitability measured as a return on equity (*ROE*); and, finally, liquidity computed as a ratio of liquid assets (cash and cash equivalents) to total assets (*Liquid Assets / Assets*). In order to proxy for credit

risk, I also include leverage (*Leverage*) in the set of matching variables.[21] The matching sample also excludes systemically important financial institutions, which are subject to the "too big to fail" biases and also had access to other sources of funding.[22]

2.5 Results

2.5.1 Information content

The first hypothesis tests whether the revelation of information about banks accessing the DW provides incremental material information to market participants and results in changes in banks' cost of capital. Since the DW disclosures contained information that was released with at least a one-year lag, I first need to establish whether these disclosures provide any new and material information to capital market participants.

Table 2.2, Panel A presents univariate tests of the difference in the market reaction during the event period using the matched sample. Banks accessing the DW saw positive and significant cumulative abnormal returns (CARs) of 1.05%, while banks that did not access the DW on average had 0.10% statistically insignificant CARs. The test of differences in means shows that on average banks that accessed the DW exhibit statistically significantly different (at the 10% level) CARs that are 0.95 percentage points greater than that of the control group. Panel A, Table 2.2 also shows that abnormal trading volumes (AVs) were significantly more negative for banks accessing the DW following the DW disclosure event (22% lower for the DW banks and statistically significant at the 5% level). Finally, both the DW and control banks had significantly higher abnormal volatility (AVAR) following the DW event; however, their AVARs were not statistically different. This suggests that investors agreed on the

[21] I test sensitivity of the matching exercise by including a proxy for the likelihood of default, estimated using a structural model of default risk, and measures of market leverage. The composition of the matched sample remains unchanged with the inclusion of these additional variables.

[22] These banks are: Bank of America, Bank of New York Mellon, Chase Manhattan Corporation, Citigroup, Goldman Sachs, Morgan Stanley Dean Witter & Co., State Street Corp., and Wells Fargo & Company.

impact of the content of disclosure for both banks that accessed the DW and those that did not. The univariate results, therefore, indicate that the DW disclosure provided some information content despite being released with a lag. However, this disclosure was also followed by a drop in trading volumes and an increase in abnormal volatility for all banks.

Table 2.2, Panel B presents multivariate results for CARs, AVs and AVARs for the matched sample controlling for size, book-to-market, returns momentum, and leverage as well as the information about the average amount borrowed as a proportion of total assets and the frequency of visits to the funding facilities. Columns (1) to (5) show the results for CARs following the DW disclosures; columns (6) to (7) show the results for the AVs; and columns (8) to (9) show the results for AVARs. The results indicate that the DW disclosure was followed by positive abnormal returns for banks that accessed the DW of between 0.96% and 1.10% over the four-day window (0, +3). This effect appears to arise from banks that accessed both facilities (TAF and DW), which experienced CARs between 1.57% and 2.00% on average following the DW disclosure (columns 4 and 5). In addition, both the average amount of borrowing from the DW and the frequency of accessing the DW exhibit negative and statistically significant coefficients, decreasing the CARs by 0.1% on average.

Table 2.2, Panel B, columns (6) to (7) present the results of multivariate tests of abnormal volumes following the DW disclosure. The DW disclosure led to negative abnormal trading volumes for banks that have accessed the DW (-0.2607 and highly statistically significant). Banks that did not access DW but have accessed TAF, however, did not see any abnormal trading activity. Furthermore, while the average amount borrowed from the DW has a weakly statistically significant negative effect on trading volumes, the number of visits to the DW actually increases the trading volume.

There are two potential explanations for this result: either investors reached consensus and therefore did not trade (Holthausen and Verrecchia, 1990), or they found the information too difficult to interpret (Brochet, et al., 2013).[23]

The final set of cross-sectional market tests studies the effect of the DW disclosure event on abnormal return volatility, which captures information content and investors' beliefs (Holthausen and Verrecchia, 1990).[24] Columns (8) and (9) of Table 2.3 show that the banks accessing the DW did not experience any abnormal return volatility.[25] Taken together with the low abnormal trading volumes, this finding implies investors' agreement on the content of disclosures. Overall, the information content tests suggest that the DW disclosures provide incremental material information that resulted in positive abnormal returns, low trading volumes, and no significant abnormal returns volatility.[26]

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[23] In untabulated tests of the abnormal trading volume following the TAF disclosure event and the SC event, I find statistically significant negative abnormal volumes for the SC event following the announcement of the impending DW disclosure. However, I find that only banks, for which information was available before (i.e., banks which have accessed TAF) saw positive abnormal trading volume compared to other banks. In addition, abnormal trading volumes significantly increased following the disclosure of TAF access for banks accessing TAF. These increases in abnormal trading volumes indicate that investors viewed TAF disclosures as informative and traded on their idiosyncratic interpretation of this information. This is not surprising, as TAF disclosures were scheduled and anticipated and were also provided in a user-friendly machine-readable format.

[24] Higher AVAR implies higher information content, as with greater content, investors' beliefs are more likely to change (Kim and Verrecchia, 1991; and Landsman et al., 2012).

[25] Untabulated AVAR results for TAF disclosures and the SC decision announcement are statistically significant. In particular, AVAR increases significantly for banks which have accessed TAF following the SC announcement about impending DW disclosure. In addition, only banks that had previously accessed TAF and for whom this information was already publicly available experienced higher abnormal returns volatility. DW banks did not experience any significant AVARs. Taken together, the results suggest that the SC announcement on March 21, 2011, resulted in a divergence of investors' opinions and changes in uncertainty.

[26] In this particular setting, three events are clustered in time and apply to all banks in the sample. As a result, cross-sectional correlation of returns could create serious inference problems—not addressing this will tend to overstate the significance of results (Bernard, 1987; and Lo, 2003). Therefore, following Lo (2003) and Larcker et al. (2011), I compute bootstrapped *p*-values for all coefficients using simulated non-event days in the sample. Inferences for all analysis remain unchanged if *p*-values are computed in this manner. I also test that the results are not driven by some spurious relationship arising on the day of the event. I use a random set of placebo dates and find insignificant results for these dates for all tests. I also conduct placebo analyses on randomly chosen dates, and compute abnormal returns, abnormal volumes, and abnormal volatility using other methodologies. The findings remain the same. Finally, I conduct an extensive news search and check whether any banks issued press releases or earnings

2.5.2 Cost of capital consequences

Having established that there is some evidence of the market reaction to the DW disclosures, I test my first hypothesis of whether this disclosure had any short- and long-run cost of capital consequences. Table 2.3 present univariate results for all control variables used in the cost of capital and real effects tests. It shows that univariately, short-run and long-run bid-ask spreads are lower for the banks that accessed the DW post-DW disclosure; however, this difference is not statistically significant. The lack of statistical significance in the comparison of the bid-ask spreads is likely to be driven by the fact that these difference reflect the overall difference in the bid-ask spreads rather than differences in the information asymmetry component of the bid-ask spreads. I find that post-DW disclosure the offering bond yields are 1.072 percentage points lower (highly statistically significant at the 1% level) for bonds issued by the DW banks. Table 2.3 also shows that banks that accessed the DW have significantly lower idiosyncratic risk in the post-DW disclosure period, lower proportion of federal funds and repo borrowing, higher proportion of liquid assets, and higher growth in net federal funds and repos as a percentage of total assets. The latter result indicates that the DW banks post-DW-disclosure on average lend more in the interbank market than they borrow. While in the pre-DW disclosure period these banks were net borrowers in the federal funds market, they appear to become net lenders post-DW disclosure. This could be interpreted as an indicator that either banks have more liquid assets and hence rely on the interbank market less or that they are less able to borrow in the interbank market.

Table 2.4 presents the results of the difference-in-difference estimation using a matched sample and short-run estimates of the information asymmetry component of

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announcements during the time of the DW disclosure event. I find that there were no other material events surrounding the event period.

the equity bid-ask spread.[27] Columns (1) and (2) show the impact of the DW disclosures on the short-run bid-ask spread around the same window as the market test (measured as -3, +3 days including the event day). The results show that the DW disclosure increased information asymmetry for all banks. However, banks that accessed the DW and both DW and TAF facilities saw statistically significant decreases in their cost of capital as measured by the information asymmetry component of the bid-ask spread. I conduct further cross-sectional tests to see whether the frequency and amount of borrowing from the DW affect the cost of capital. As column (4) shows, conditional on banks accessing the DW, borrowers that accessed only the DW (and not TAF) and were in the top quartile by the average amount borrowed as a percentage of total assets or the top quartile of the number of times they borrowed from the DW both saw a significant increase in their equity bid ask-spreads following the disclosures. However, banks that experienced negative CARs following the disclosures also saw a decrease in their short-run bid-ask spreads. This suggests that for some banks, accessing the DW was viewed negatively in content; however, it led to a decrease in information asymmetry and hence a lower bid-ask spread.

I also investigate the long-run effect on the equity bid-ask spreads using a difference-in-differences design over a horizon of 5 quarters which followed the passage of the Dodd-Frank Act in July 2011. In order to have an even number of quarters surrounding the event, I use 2010Q3 to 2011Q1 as my pre-event quarters and 2011Q2 to 2011Q3 as my post-event quarters. Table 2.5 presents the results of the long-run tests on the cost of equity capital as measured by monthly bid-ask spreads. Unlike with the short-run tests, I find that over a longer horizon, banks that accessed the DW

[27] Since bid-ask spreads available through CRSP are based on the end-of-day quotes, their usage might be problematic for event studies with events that might have occurred during the earlier part of the day. Therefore, I recomputed relative bid-ask spreads using daily tick data from TAQ. My results remain unchanged if I used bid-ask spreads computed from TAQ data instead.

only saw a weakly significant increase on average in their bid-ask spreads. I do not find any significant changes for the banks in the top quartile by the amount borrowed from the DW or the frequency of access to the DW. Taken together with the short-run tests, this finding suggests that, while in the short-run the DW disclosure significantly decreased information asymmetry for banks that accessed the DW window, the effect was not long-lived.[28] The DW disclosure seemed to have allowed resolution of at least some of this information asymmetry in the short-run and lowered banks' cost of capital.[29]

I next turn to the cost of debt component of banks' cost of capital and study the long-run effects of the DW disclosures on banks' funding costs as measured by bond offering yields at the time of issuance. I use the same time-horizon as for the long-run equity bid-ask spread analysis above. Table 2.6 presents the difference-in-difference results for bond offering yields (measured in percent) following the DW disclosures. Column (1) shows that following the DW disclosure, banks that accessed the DW were able to receive significantly lower yields on issued bonds, with an average significant reduction of 1.16 percentage points (a 9.6% reduction in the average spread or a $238,000-saving in interest expense, based on the average amount of bond offering amount of $20 million), compared to the matched control group of banks that did not access the DW. Column (2) shows that these results are mostly driven by banks that accessed the DW only, which saw a significant reduction in their offering yield post-DW disclosures of 1.89 percentage points (a 16% reduction in the average spread or a

[28] This is consistent with my untabulated findings that between the announcement of the Supreme Court decision on March 21, 2011, and the actual DW disclosures on March 31, 2011, banks experienced negative abnormal returns and the widening of the bid-ask spreads.

[29] In untabulated results, I also test the effect of the SC announcement and TAF disclosures on the short-run bid-ask spreads following the SC decision and TAF disclosure. I find that spreads increase significantly for all banks following the Supreme Court announcement and decrease for banks accessing the DW following the DW disclosure. Following TAF disclosures, however, there was a widening of the short-term bid-ask spreads for banks that accessed TAF.

$388,000-saving in interest expense).[30] Overall, the above suggests that the DW disclosures resulted in a lower cost of capital for banks by decreasing the cost of borrowing from the debt market and decreasing the information asymmetry component of the short-term bid-ask spread in the equity market.[31]

2.5.3 Changes in banks' liquidity, lending, and borrowing in response to the DW disclosures

My second hypothesis tests whether there are any real effects following the DW disclosures. Despite finding positive capital market consequences, if banks perceive *ex ante* that future disclosures will result in higher cost of funding from other sources, for example, in the interbank market because of the DW stigma, they will change their behavior following the unexpected DW disclosures ahead of the scheduled disclosures. I therefore test whether banks changed the composition of their balance sheets, their liquidity, and risk-taking and funding activities in response to the DW disclosures.

Table 2.7 presents tests of proxies for banks' risk-taking activities: idiosyncratic (bank-specific) risk, asset risk (measured as the proportion of risk-weighted assets in total assets), and risky lending (measured as a proportion of commercial and industrial loans in total assets). As can be seen from columns (1) and (2) in Table 2.7, the effect of the DW disclosure is negative and statistically significant for the idiosyncratic component of banks' risk. Column (3) in Table 2.7 shows that following the DW disclosures, asset risk also decreased significantly for banks that accessed the DW. Asset risk is measured as a proportion of risk-weighted assets to total assets; hence, the negative and significant coefficients imply that following the DW event, banks that

[30] In unreported results, I find that following TAF disclosures in December 2010, banks accessing TAF experienced an increase in the cost of borrowing from the bond market of 0.728 percentage points (statistically significant at the 5% level, 6% increase in the average spread or an increase of $148,000 in the interest expense).

[31] However, while the DW disclosures decreased information asymmetry and lowered banks' cost of capital, banks that accessed the more expensive facility, TAF, were penalized by a higher cost of capital through widened bid-ask spreads and higher cost of borrowing from the bond market.

accessed the DW see a decrease in the proportion of riskier assets on their balance sheets. Finally, columns (5) and (6) show the results for banks' risky lending activities measured as a proportion of commercial and industrial loans in total assets. While on average, banks that accessed the DW seem to have increased the proportion of their risky loans (coefficient of 0.0027 is statistically significant at the 5% level of significance), banks that only accessed the DW decreased this proportion (coefficient of -0.0102 is weakly statistically significant at the 10% level). The positive result appears to be driven by the category of banks that accessed both DW and TAF facilities. Overall, the results suggest that following the DW disclosures, DW banks decreased their risk and, in particular, banks that accessed the DW only achieved this through a decrease in risky lending.

In Table 2.8 and Table 2.9, I study the effects of DW disclosures on bank liquidity proxies. In particular, columns (1) and (2) of Table 2.8 present the results for the proportion of liquid assets in total assets, and columns (3) and (4) show the results for the proportion of pledged assets in total assets. Pledged assets are defined as assets used as collateral for secured borrowing. All else equal, a decrease in the proportion of pledged assets for a bank implies an increase in unsecured (without collateral) borrowing. Furthermore, it implies an increase in liquidity as pledged assets are highly liquid assets that cannot be used by a bank while they remain pledged. Columns (5) and (6) investigate the effect of the DW disclosures on the borrowing from the federal funds and repo markets. Finally, columns (7) and (8) show the results for a loan-deposit gap as a proxy for banks' liquidity needs. Column (1) shows that following the DW event, banks increased the proportion of liquid assets on their balance sheets. This effect is highly statistically significant and implies a 2.6% increase in the liquidity ratio (based on the average ratio of 0.2608 for DW banks). Columns (3) and (4) in Table 2.8 show

that the proportion of pledged assets following the DW disclosure decreased significantly for banks that accessed the DW (this suggests a 5% decrease in the proportion of assets pledged, using the average ratio of 0.1145 for DW banks). In addition, the percentage of pledged assets decreased significantly for banks that accessed the DW only (a decrease of 9.6% and highly statistically significant). This finding suggests that the DW banks decreased their level of secured borrowing and released some of the most liquid assets from being pledged as collateral.

I further investigate changes in banks' behavior following the DW disclosure event by testing whether banks change their liquidity over time and whether they achieve this through the reduction of lending and other credit. Following the approach of Cornett et al. (2011), Table 2.9 shows quarterly growth rates in liquid assets as a proportion of the beginning of quarter assets; lending rates as a proportion of the beginning of quarter assets; and changes in credit as a proportion of commitments and total assets. As can be seen from columns (1) and (2) in Table 2.9, banks that accessed the DW increase their holdings of liquid assets post-DW disclosure. However, this increase does not arise from changes in overall lending or credit grants, as shown in columns (3) to (6). In fact, banks appear to also increase lending and overall credit growth. This finding is consistent with that of Berger et al. (2014), who show that banks that accessed the DW and TAF facilities during the financial crisis did not curtail their lending. Overall, the results suggest that following the DW disclosure, banks appear to increase their holding of liquid assets. Furthermore, banks decrease riskier lending and increase borrowing from other sources of unsecured lending.[32]

[32] In untabulated results, I also investigate whether top-quartile borrowers (by the amount or frequency of accessing the DW) changed their behavior more significantly. I find that indeed these banks increased their liquidity and decreased their risky lending more significantly than the rest of the DW borrowing banks.

In the final step, using proxies for banks' funding and cost of deposit funding, I investigate whether banks' access to funding changes following the DW disclosures. Since I cannot directly observe the potential negative consequences of DW disclosures in the interbank market, I attempt to proxy them by studying banks' overall net borrowing in the interbank market, banks' reliance on wholesale funding as well as changes in the cost of deposits. Columns (1) to (4) of Table 2.10 show that there are no significant changes in the growth of net federal funds and repos or other borrowing for banks that accessed the DW post-DW disclosure. However, banks have been shown to window-dress their federal funds and repo balances at quarter-ends (Owens and Wu, 2014), which will bias against finding any result in these proxies. I find weak results that banks accessing the DW rely less on the wholesale funding. However, it appears that banks do not need to achieve this through a higher cost of deposits. This finding is consistent with Acharya and Mora (2014), who show that post-2008Q2, banks are perceived as "safe havens" and are able to attract deposits without incurring further costs. The results in this final analysis suggest that it is unclear whether banks that accessed the DW reduced their reliance on the interbank market following the DW disclosures.

In order to address this concern, I utilize the new DW disclosures which first became available on September 28, 2012. I collect the new DW disclosures released by the Federal Reserve Board of Governors on September 28, 2012; December 31, 2012; March 31, 2013; June 30, 2013; and September 30, 2013. The two latter releases correspond to DW borrowing after the DW disclosure event of March 31, 2011. While having accessed the DW in the past appears to be one of the determinants of accessing the DW in the future, I find from the two latest disclosures that the public banks analyzed in this paper no longer borrow from the DW following the DW disclosure.

However, a number of these banks still accessed the DW between July 22, 2010, and March 31, 2011. Since these banks still appear in the disclosures for the first three quarters after the Dodd-Frank disclosure requirement, the fact that they do not appear after the March 31, 2011, disclosures suggests, by revealed preference, that banks changed their behavior *ex ante* to avoid future DW disclosures. This is consistent with my main finding that, despite the positive capital market reaction, banks reduce or completely stop relying on the DW borrowing for short-term liquidity needs following the DW disclosures event. The potential confounding effect is that the latest data corresponds to the period after the end of the financial crisis, and hence, banks might not need as much liquidity. I address this issue by creating a matched sample based on the likelihood of accessing the DW in 2011 and still find the same result suggesting that the end of the financial crisis cannot fully explain this change in behavior.

These results, taken together with the market tests in the first half of the analysis, suggest that while the DW disclosures resulted in a positive market reaction and cost of capital benefits, banks responded to the disclosures by changing their behavior through changes in lending, borrowing, and liquidity-holding activities. This seeming inefficiency is an example of the endogenous costs of disclosure predicted by Goldstein and Sapra (2013), who suggest that in the presence of information asymmetry, externalities and frictions that banks are exposed to, mandated disclosures might lead to inefficient outcomes through changes in banks' behavior.

2.6 Conclusion

This chapter studies the capital market consequences of unique and unexpected mandatory bank liquidity disclosures and the resulting changes in banks' behavior. During the recent financial crisis of 2007-2009, banks in the United States accessed the DW facilities at the US Federal Reserve and borrowed unprecedented amounts.

However, until recently, the information about which banks borrowed from the Federal Reserve and how much they borrowed was not public. In this paper, I utilize the information from the Federal Reserve DW disclosures and investigate whether these disclosures had any capital market consequences for banks and whether banks changed their behavior in response. Using a hand-collected sample of disclosures revealing which banks accessed the DW liquidity facilities, I find that despite being released with a two-year lag, these disclosures contain incremental market information which decreases banks' cost of capital as measured by the short-term equity bid-ask spreads and cost of debt. However, despite these cost of capital benefits, I also find that banks appear to change their lending, borrowing, and liquidity holding behavior in response to these disclosures. These changes in banks' behavior suggest that, even though the DW disclosures provided capital market benefits, they also created incentives for banks to avoid accessing the DW in the future. This inefficient behavior is consistent with the theoretical predictions of Goldstein and Sapra (2013), who find that in the second-best environment, increased disclosure might lead to inefficient outcomes through changes in banks' behavior. This is due to externalities and the informational and market frictions to which banks are exposed.

This paper contributes to several strands of the literature. First, it adds to the literature concerning the role of supplemental mandatory disclosures by documenting that non-financial disclosure by a regulator contains incremental material information even if released with a lag. Second, it provides some evidence in support of the theory of endogenous costs of mandatory disclosure by showing that banks change their lending and borrowing behavior despite observing a positive capital market reaction; therefore, confirming that price efficiency might not necessarily imply economic efficiency. Third, this paper provides some evidence on the role of disclosure as a

disciplining device for financial institutions. Finally, this paper provides new evidence that, unlike in the interbank market in which the DW stigma has been widely documented, there appears to be no supporting evidence that this stigma exists in the public capital markets.

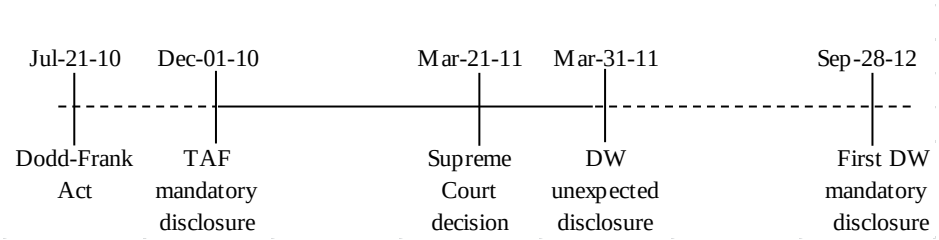
Appendix 2.A: Summary of the main events

This table summarizes the events that led to the disclosure of the TAF and DW access information. The paper focuses specifically on event 8 (DW event).

Panel A: Chronological order of the events leading up to and including the DW disclosure event.

Date	Event ID	Event Description
Oct-25-2008	1	Bloomberg News files FOIA request with the Federal Reserve Board in connection with $2 trillion in loans made to troubled banks.
Dec-12-2008	2	The Federal Reserve refuses Bloomberg's request
Jul-30-2009	3	Judge Alvin Hellerstein of the US District Court in Manhattan rules against FOX News and states that the Federal Reserve Board was within its rights to withhold documents.
Aug-24-2009	4	District Judge Loretta Preska of the Southern District of NY rules in favor of Bloomberg News.
Mar-19-2010	5	US District Court in Manhattan upholds its decision on appeal.
Dec-01-2010	6	Federal Reserve discloses TAF information as required by the Dodd-Frank Act (TAF event).
Mar-21-2011	7	Supreme Court rejects the Federal Reserve appeal and orders release of bank loan data (Supreme Court event).
Mar-31-2011	8	The Federal Reserve releases the Discount Window information (DW event).

Panel B: Timeline of the disclosure events.



Appendix 2.B: Variable definitions

Variable	Definition	Source	Code
Dependent variables			
Asset Risk	Ratio of Risk-Weighted Assets (RWA) to total assets	FR Y-9C	BHCKA223 / BHCK2170
AV	Abnormal volume computed using a market model (in natural logarithms)	CRSP	
AVAR	Abnormal return volatility computed as a ratio of the mean of the squared market-model- adjusted returns divided by the bank's market model residuals during the non-event period.	CRSP	
BA Spread	Relative equity bid-ask spread calculated as (Ask-Bid) / (Ask+Bid)/2	CRSP	
CAR	Cumulative Abnormal Return computed using a market model	CRSP	
ΔCredit$_t$ / (Commit + Assets)$_{t-1}$	Change in total loans plus undrawn commitments scaled by the sum of total assets and undrawn commitments	FR Y-9C	(BHCK2122 + BHCK3814 + BHCK3816 + BHCK3817 + BHCK6550 + BHCK3411) / BHCK2170
ΔImplicit Interest Rate on Core Deposits	Quarterly change in interest expense on core deposits divided by quarterly average of large time deposits	FR Y-9C	(BHCKA518 + BHCK6761) /(BHCB3187 + BHOD3187 + BHCB2389 + BHOD2389 + BHCB6648 + BHOD664)
ΔImplicit Interest Rate on Large Deposits	Quarterly change in interest expense on large term deposits divided by quarterly average of large term deposits	FR Y-9C	BHCKA517 / (BHCB6648 + BHCB2604)
ΔLiquid Assets$_t$ / Assets$_{t-1}$	Change in liquid assets scaled by total assets	FR Y-9C	(BHCK0081 + BHCK0395 + BHCK0397 + BHCK1754 + BHCK1773) / BHCK2170
ΔLoans $_t$ / Assets $_{t-1}$	Change in total loans scaled by total assets	FR Y-9C	BHCK2122 / BHCK2170
ΔNet Fed Funds and Repo$_t$ / Assets$_{t-1}$	Change in federal funds and repo lent net of federal funds and repo borrowed scaled by previous quarter total assets	FR Y-9C	(BHDMB987 + BHCKB989 - BHDMB993 - BHCKB995 - BHCK3190) / BHCK2170
ΔOther Borrowed Funds$_t$ / Assets$_{t-1}$	Quarterly change in the share of other borrowed funds in total assets from the start of the quarter	FR Y-9C	BHCK3190 / BHCK2170
ΔWholesale Funding$_t$ / (Assets)$_{t-1}$	Quarterly change in wholesale funds as a share of total assets in the previous quarter, where wholesale funds is a sum of large-time deposits, deposits booked in foreign offices, subordinated debt and debentures, gross federal funds purchased and repo, and other borrowed money.	FR Y-9C	(BHCB2604 + BHFN6631 + BHFN6636 + BHDMB993 + BHCK3190) / BHCK2170
Fed Funds and Repo Borrowed	Federal funds and report borrowed scaled by total assets	FR Y-9C	(BHDMB993 + BHCKB995 + BHCK3190) / BHCK2170
Idiosyncratic Risk	Idiosyncratic Risk is the standard deviation of the residuals from a market model estimated daily over previous year.	CRSP	
Liquid Assets / Assets	Liquid assets as a proportion of total assets	FR Y-9C	(BHCK0081 + BHCK0395 + BHCK0397 + BHCK1754 + BHCK1773) / BHCK2170
Loan - Deposit Gap	Change in loan/deposit gap scaled by previous quarter total assets	FR Y-9C	(BHCK2122 - BHCK2170) / BHCK2170
Offering Yield	Bond's yield to maturity at issuance	Mergent FISD	
Percentage Pledged	Share of pledged assets in total assets	FR Y-9C	BHCK0416 / BHCK2170
Risky Lending	Commercial and industrial loans as a proportion of total assets	FR Y-9C	(BHCK1763 + BHCK2011) / BHCK2170
Systematic Risk	Systematic volatility computed using the market model.	CRSP	
Control and matching variables			
Amount of issue	Total dollar face value of the bond issue	Mergent FISD	
Asset Quality	Provisions divided by average total assets	FR Y-9C	BHCK4230 / BHCK3368

Variable	Definition	Source	Code
Assets	Total assets of the bank (or natural log of total assets)	FR Y-9C	BHCK2170
Average amount borrowed / Assets	Average amount borrowed from DW facility as a proportion of total assets	DW disclosure	
Benchmark Treasury Yield	Benchmark treasury bond or bill yield closely matching the corresponding bond characteristics	Mergent FISD and CRSP	
Book-to-market	The ratio of book value of equity to market value of equity	FR Y-9C, CRSP	BHCP3210
Callable	Indicator variable identifying bonds that are callable	Mergent FISD	
CRE / Assets	Share of commercial real estate in total assets	FR Y-9C	(BHCKF159 + BHCKF160 + BHCKF161) /BHCK2170 Prior to 2007: (BHDM1415 + BHDM1480) / BHCK2170
Deposits / Assets	Total deposits as a proportion of total assets	FR Y-9C	(BHCB2210 + BHOD3189 + BHFN6636 + BHCB3187 + BHOD3187 + BHCB2389 + BHOD2389 + BHCB6648 + BHOD6648) / BHCK2170
DW Event	Indicator variable equal to 1 during the days of the discount window information release (March 31 2011)	DW disclosure	
Leverage	Total liabilities as a proportion of total assets	FR Y-9C	BHCK2948/ BHCK2170
Life of the Bond	Bond maturity in years	Mergent FISD	
Loans / Assets	Proportion of total loans in total assets	FR Y-9C	BHCK2122 / BHCK2170
MBS / Assets	Share of mortgage-backed securities in total assets	FR Y-9C	(BHCK1698 + BHCK1702 + BHCK1703 + BHCK1707 + BHCK1709 + BHCK1713 + + BHCK1714 + BHCK1717 + BHCK1718 + BHCK1732 + BHCK1733 + BHCK1736) / BHCK2170
Momentum	Market-adjusted return over the prior six months	CRSP	
NPL / Assets	Non-performing loans as a proportion of total assets	FR Y-9C	(BHCK5526 - BHCK3507 + BHCK1616 + BHCK5525 - BHCK3506) / BHCK2170
Off-balance sheet assets / Assets	Securitized off-balance sheet assets as a proportion of total assets	FR Y-9C	(BHCK3814 + BHCK3816 + BHCKJ455 + BHCKJ456 + BHCK6550 + BHCKJ457 + BHCKJ458 + BHCKJ459 + BHCK3411) / BHCK2170
ROA	Return on assets (Net Income divided by average total assets)	FR Y-9C	BHCK4340 / BHCK3368
ROE	Return on equity (Net Income divided by shareholders' equity)	FR Y-9C	BHCK4340 / BHCK3210
Size	Natural logarithm of the market value of equity or natural logarithm of total assets	CRSP and FR Y-9C	
Std ROA	Standard deviation of ROA (net income normalized by total Assets) over the prior 12 quarters	FR Y-9C	BHCK4340 / BHCK2170
Tier Ratio	Tier 1 Equity as a proportion of total assets	FR Y-9C	BHCK8274 / BHCK2170
Total number of visits	Number of visits to the discount window or TAF facility during the period of study	DW disclosure	
Treatment: Banks accessing both TAF and DW window	Indicator variable identifying banks that accessed both TAF and DW	DW and TAF disclosure	
Treatment: Banks accessing DW only	Indicator variable identifying banks that accessed DW only	DW and TAF disclosure	
Treatment: Banks accessing the TAF only	Indicator variable identifying banks that accessed the TAF only	DW and TAF disclosure	
Volatility	Standard deviation of stock returns over the prior 12 months estimated on a daily basis using rolling windows.	CRSP	

Variable	Definition	Source	Code
Volume Traded	Daily number of shares traded / Freefloat shares outstanding	CRSP	

Appendix 2.C: DW event coverage in the news

The table and figure below illustrate that the DW event was newsworthy. The entire universe of Factiva was searched for news and then filtered to the news on the banking sector and the DW.

	03/31/2011	03/31/2010	03/30/2012
Number of news stories on Factiva (no filters); global news	34,670	30,562	34,923
US news	8,050	8,188	3,678
US Banking sector	345	65	245
Discount window	164	0	0
Dow Jones News	862	809	690
US Banking sector	100	63	54
Discount window	80	0	0

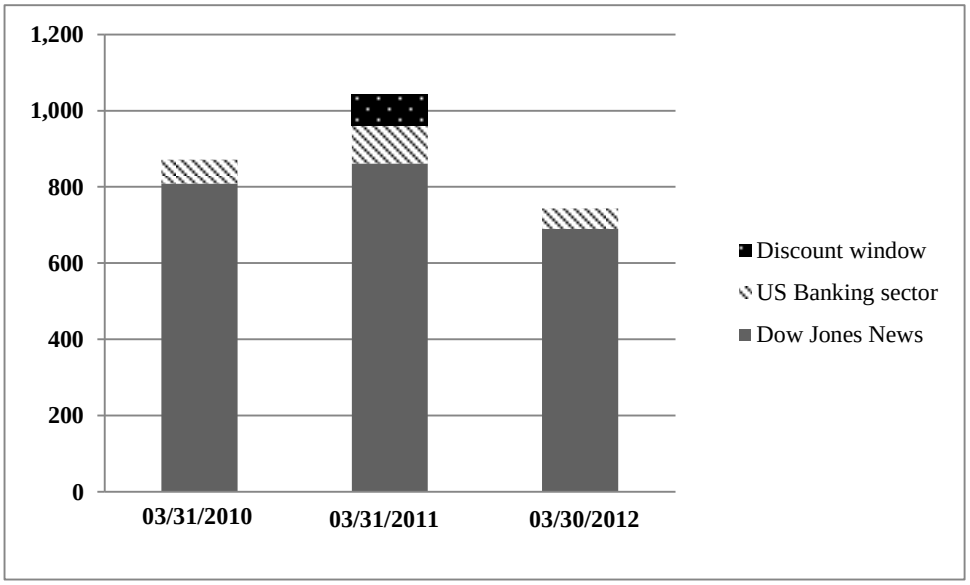


Table 2.1: Descriptive statistics

The tables below present summary statistics for the main dependent and control variables used in the analysis of the matched sample. Panel A presents quarterly variables computed using quarterly data for the period of 2009Q2 to 2012Q3. Panel B shows the main variables used for the equity bid-ask spread analysis over a shorter horizon of 2010Q3 to 2011Q3 (controls are in natural logarithms at a monthly frequency). Panel C presents variables used for debt issuance analysis using the time period of 2010Q3 to 2011Q3. Panel D presents the variables used in the propensity score estimation and the resulting matched sample using the data for the period of 2004Q1 to 2006Q4. All observations apart from equity returns, bid-ask spreads, abnormal volumes, and volatility are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. Variables are defined in Appendix 2.B. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are estimated using the differences in means test.

Panel A: Matched quarterly sample

Variable	N	Mean	SD	P25	P50	P75
Asset Quality	3,017	0.006	0.007	0.001	0.003	0.009
Asset Risk	3,017	0.714	0.101	0.647	0.722	0.782
CI Loans / Assets	3,017	0.102	0.066	0.054	0.087	0.136
ΔCredit t / (Commit + Assets) t-1	3,017	-0.002	0.041	-0.018	-0.005	0.008
ΔImplicit Interest Rate on Core Deposits	3,017	-0.703	1.961	-0.347	0.270	0.365
ΔImplicit Interest Rate on Large Deposits	3,017	-0.697	1.882	-0.173	0.263	0.362
ΔLiquid Assets t / Assets t-1	3,017	0.008	0.033	-0.010	0.005	0.022
ΔLoans t / Assets t-1	3,017	-0.001	0.039	-0.016	-0.004	0.007
ΔNet Fed Funds and Repo t / Assets t-1	3,017	-0.001	0.008	-0.002	0.000	0.001
ΔOther Borrowed Funds t / Assets t-1	3,017	-0.003	0.014	-0.006	0.000	0.000
ΔWholesale Funding t / (Assets) t-1	3,017	-0.011	0.035	-0.026	-0.009	0.008
Deposits / Assets	3,017	0.774	0.098	0.733	0.793	0.834
Idiosyncratic Risk	3,017	0.522	0.367	0.280	0.404	0.665
Liquid Assets / Assets	3,017	0.264	0.110	0.187	0.248	0.324
Loans / Assets	3,017	0.643	0.110	0.591	0.654	0.714
(Loans - Deposits) / Assets	3,017	-0.133	0.123	-0.207	-0.126	-0.057
Log (Assets)	3,017	14.877	1.379	13.834	14.564	15.663
Net Federal Funds and Repo / Assets	3,017	0.030	0.034	0.002	0.019	0.046
Net Wholesale Funding / Assets	3,017	-0.193	0.125	-0.262	-0.186	-0.110
NPL / Assets	3,017	0.002	0.004	0.000	0.000	0.002
Off-balance sheets Assets/Assets	3,017	0.122	0.067	0.070	0.112	0.165
Other Borrowed Funds / Assets	3,017	0.060	0.055	0.019	0.047	0.085
Percentage of Assets Pledged	3,017	0.112	0.076	0.060	0.100	0.149
ROA	3,017	0.001	0.008	0.000	0.002	0.005
Systematic Risk	3,017	0.225	0.172	0.081	0.210	0.316
Tier Ratio	3,017	0.092	0.025	0.080	0.092	0.106
Volatility	3,017	0.600	0.358	0.374	0.485	0.727

Panel B: Variables used in the equity bid-ask spread analysis

Variable	N	Mean	SD	P25	P50	P75
BA Spread	3,724	0.029	0.036	0.004	0.013	0.041
Size	3,724	12.386	2.052	10.833	12.190	13.693
Volume Traded	3,724	0.372	1.413	-0.571	0.519	1.464
Volatility $_{t-1}$	3,724	-0.407	0.447	-0.739	-0.378	-0.089

Panel C: Variables used in the cost of debt issuance analysis

Variable	N	Mean	SD	P25	P50	P75
Offering Yield (%)	1,077	12.064	5.189	9.000	11.950	15.200
Benchmark Treasury Yield (%)	1,077	0.621	1.008	0.169	0.264	0.354
Log (1+ Bond Life)	1,077	5.551	1.155	4.585	5.242	5.916
Log (Bond Amount of Issue)	1,077	6.944	2.025	5.665	6.597	8.085
Callable	1,077	0.023	0.148	0.000	0.000	0.000
Log (Assets)	1,077	20.522	1.440	18.137	21.474	21.511
Asset Risk (%)	1,077	52.931	5.137	49.578	53.353	54.640
Tier Ratio (%)	1,077	6.784	0.629	6.570	6.698	6.847
Deposits / Assets (%)	1,077	31.827	13.315	30.571	32.427	44.785
ROA (%)	1,077	0.333	0.286	0.035	0.253	0.585
Rating	1,077	5.219	0.660	5.000	5.000	5.000

Panel D: Variables used in propensity score matching (pre-matched and matched values)

Treatment: Banks accessing DW (full sample)

Variable	N	Mean	SD	P25	P50	P75	t-statistic
Assets (US$ bn)	197	8.5799	20.1000	0.6896	1.5667	4.5028	(2.1332) **
Tier Ratio	197	0.0876	0.0170	0.0757	0.0851	0.0961	(-0.9965)
Std ROA	197	0.0036	0.0014	0.0028	0.0034	0.0042	(0.6377)
CRE / Assets	197	0.2937	0.1377	0.1864	0.2794	0.3904	(0.5850)
MBS / Assets	197	0.1034	0.0822	0.0351	0.0893	0.1554	(0.4376)
ROE	197	0.0776	0.0295	0.0615	0.0784	0.0945	(5.7358) ***
Liquid Assets / Assets	197	0.2436	0.1159	0.1631	0.2263	0.2967	(-0.4322)
Leverage	197	0.9112	0.0188	0.9012	0.9136	0.9248	(1.5559)

Control Group: Banks that did not access DW (full sample)

Variable	N	Mean	SD	P25	P50	P75
Assets (US$ bn)	371	5.1389	14.3000	0.4455	0.8688	2.1518
Tier Ratio	371	0.0892	0.0187	0.0776	0.0861	0.0956
Std ROA	371	0.0035	0.0020	0.0025	0.0032	0.0039
CRE / Assets	371	0.2866	0.1354	0.1896	0.2741	0.3837
MBS / Assets	371	0.1002	0.0830	0.0343	0.0873	0.1433
ROE	371	0.0607	0.0394	0.0421	0.0663	0.0843
Liquid Assets / Assets	371	0.2480	0.1156	0.1637	0.2328	0.3181
Leverage	371	0.9083	0.0248	0.8969	0.9119	0.9255

Treatment: Banks accessing DW (matched sample)

Variable	N	Mean	SD	P25	P50	P75	t-statistic
Assets (US$ bn)	197	8.5799	20.1000	0.6896	1.5667	4.5028	(0.7319)
Tier Ratio	197	0.0876	0.0170	0.0757	0.0851	0.0961	(-0.4546)
Std ROA	197	0.0036	0.0014	0.0028	0.0034	0.0042	(-0.4739)
CRE / Assets	197	0.2937	0.1377	0.1864	0.2794	0.3904	(-0.1157)
MBS / Assets	197	0.1034	0.0822	0.0351	0.0893	0.1554	(0.1224)
ROE	197	0.0776	0.0295	0.0615	0.0784	0.0945	(0.0462)
Liquid Assets / Assets	197	0.2436	0.1159	0.1631	0.2263	0.2967	(-0.2308)
Leverage	197	0.9112	0.0188	0.9012	0.9136	0.9248	(-0.4693)

Control Group: Banks that did not access DW (matched sample)

Variable	N	Mean	SD	P25	P50	P75
Assets (US$ bn)	197	7.1902	17.5000	0.4934	1.0599	3.4572
Tier Ratio	197	0.0884	0.0184	0.0775	0.0855	0.0951
Std ROA	197	0.0037	0.0016	0.0028	0.0035	0.0041
CRE / Assets	197	0.2953	0.1485	0.1858	0.2817	0.4206
MBS / Assets	197	0.1024	0.0882	0.0318	0.0893	0.1432
ROE	197	0.0774	0.0293	0.0614	0.0802	0.0947
Liquid Assets / Assets	197	0.2464	0.1248	0.1597	0.2260	0.3118
Leverage	197	0.9121	0.0216	0.9022	0.9151	0.9281

Table 2.2: Event study results: Cumulative Abnormal Returns, Abnormal Volumes and Abnormal Returns Volatility (matched sample)

This table presents univariate and multivariate event study results using the matched sample. *Treatment* refers to banks that accessed the DW and *Control* refers to banks that did not access the DW. Panel A shows the univariate comparisons for cumulative abnormal returns (*CAR*), abnormal volumes (*AV*) and abnormal return volatility (*AVAR*) over a short (0, +3) window computed using the market model. The difference column shows the difference between control and sample banks. Panel B presents the short-window OLS estimation results of the cumulative abnormal returns (*CAR*), abnormal volumes (*AV*) and abnormal volatility (*AVAR*) following the DW disclosures on March 31, 2011. The estimation period for the market model is 125 trading days prior to the TAF event on December 1, 2010. Abnormal volume is calculated as $AVOL_{it} = ln(\overline{V}_{it}/V_i)$, where $\overline{V}_{it}$ is the mean event-period volume for bank *i* and V_i is the mean estimation-period volume measured over a period of 30 trading days before the TAF event. Abnormal return volatility is calculated as $AVAR_i = ln(\overline{u_{it}^2}/\sigma_i^2)$, where $u_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$, R_{it} is bank *i*'s stock return, R_{mt} is the value-weighted return for the US stock market and $\hat{\alpha}_i$ and $\hat{\beta}_i$ are bank *i*'s estimation-period market model parameter estimates. σ_i^2 is the variance of the market-model residuals in the non-event period. All variables are presented in decimals and are computed as mean values over a four-day period following the DW disclosure event on March 31, 2011, including the event date. Control banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All variables are defined in Appendix 2.B. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors. Inferences are similar with bootstrapped p-values.

Panel A: Univariate cross-sectional tests following the DW disclosures

		Control sample: Other banks		**Treatment sample: Banks accessing DW**		**Difference**	
Variable	**Days**	**Mean**	**t-statistic**	**Mean**	**t-statistic**	**Mean**	**t-statistic**
CAR	4	0.0010	(0.411)	0.0105***	(4.188)	0.0095*	(1.871)
AV	4	-0.2241**	(-2.578)	-0.4464***	(-6.752)	-0.2222**	(-2.037)
AVAR	4	-9.0894***	(-32.553)	-9.0885***	(-52.483)	0.0009	(0.003)

Panel B: Multivariate cross-sectional tests following the DW disclosures

This table presents the short-window (0, +3) OLS estimation results of the cumulative abnormal returns (*CAR*), abnormal volumes (*AV*) and abnormal volatility (*AVAR*) following the DW disclosures on March 31, 2011.

	CAR	**CAR**	**CAR**	**CAR**	**CAR**	**AV**	**AV**	**AVAR**	**AVAR**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treatment: Banks accessing DW	0.0095*	0.0096*	0.0110**			-0.2607**		0.0364	
	(1.873)	(1.829)	(2.041)			(-2.262)		(0.104)	
Treatment: Banks accessing DW only				0.0070	0.0079		-0.3495***		0.1155
				(1.239)	(1.398)		(-2.674)		(0.310)
Treatment: Banks accessing TAF only				-0.0017	-0.0016		-0.1959		-0.0613
				(-0.116)	(-0.109)		(-1.283)		(-0.070)
Treatment: Banks accessing both DW and TAF				0.0157**	0.0200***		-0.0514		-0.0137
				(2.191)	(2.648)		(-0.340)		(-0.026)
Size		-0.0002	-0.0000	-0.0009	-0.0011	-0.0260	-0.0507	-0.0502	-0.0356
		(-0.068)	(-0.017)	(-0.377)	(-0.469)	(-0.804)	(-1.491)	(-0.502)	(-0.318)
Book-to-Market		-0.0032	-0.0032	-0.0031	-0.0031	-0.0135	-0.0125	-0.0068	-0.0070
		(-1.396)	(-1.398)	(-1.454)	(-1.497)	(-0.391)	(-0.375)	(-0.079)	(-0.082)
Momentum		-1.2176	-1.2158	-1.1827	-1.1988	1.4795	2.5648	59.5014	58.5385
		(-0.804)	(-0.817)	(-0.784)	(-0.818)	(0.034)	(0.060)	(0.653)	(0.643)
Leverage		-0.0539	-0.0550	-0.0679	-0.0756	1.0119	0.4251	-5.2141	-5.1261
		(-0.373)	(-0.382)	(-0.469)	(-0.528)	(0.420)	(0.180)	(-0.840)	(-0.799)
Average amount borrowed / Assets		-0.0016*		-0.0016*		-0.0501*	-0.0354	-0.0219	0.0252
		(-1.967)		(-1.894)		(-1.874)	(-1.407)	(-0.849)	(0.352)
Total number of visits			-0.0001**		-0.0001***	0.0038*	0.0026		-0.0034
			(-2.524)		(-3.012)	(1.830)	(1.358)		(-0.584)
Intercept	0.0010	0.0562	0.0024	0.0782	0.0876	-0.8082	0.0376	-3.7567	-4.0048
	(0.216)	(0.385)	(0.098)	(0.528)	(0.598)	(-0.342)	(0.016)	(-0.607)	(-0.617)
Observations	250	250	250	250	250	250	250	250	250
Adjusted R-squared	0.012	0.027	0.030	0.026	0.037	0.010	0.018	-0.016	-0.026

Table 2.3: Univariate difference-in-difference tests of main dependent variables

This table presents univariate comparison between *Treated* banks (banks that accessed the DW) and *Control* banks (banks that did not access the DW) for all dependent variables used in this paper. The difference column shows the difference between control and sample banks. Control banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All variables are defined in Appendix 2.B. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors.

	Before DW Disclosures				After DW Disclosures				Difference - in - Differences	
	Control	**Treated**	**Difference**	**t-statistic**	**Control**	**Treated**	**Difference**	**t-statistic**		**t-statistic**
Variable	**(1)**	**(2)**	**(3) = (2) - (1)**	**(4)**	**(5)**	**(6)**	**(7) = (6) - (5)**	**(8)**	**(9) = (7) - (3)**	**(10)**
BA Spread (long horizon)	-4.047	-4.536	-0.489	(-7.56)***	-4.180	-4.678	-0.498	(-4.86)***	-0.009	(-0.09)
BA Spread (short horizon)	-4.312	-4.762	-0.450	(-3.89)***	-4.326	-4.806	-0.480	(-5.29)***	-0.030	(-0.2)
Offering bond yield	13.557	10.613	-2.944	(-12.75)***	10.466	6.450	-4.016	(11.2)***	-1.072	(3.04)***
Idiosyncratic Risk	0.602	0.641	0.039	(2.08)**	0.426	0.395	-0.031	(-3.52)***	-0.070	(-2.58)***
Systematic Risk	0.208	0.260	0.052	(5.72)***	0.180	0.218	0.038	(-2.38)***	-0.014	(-1.08)
Asset Risk	0.721	0.733	0.012	(2.4)***	0.681	0.704	0.023	(4.24)***	0.011	(1.49)
Risky Lending	0.094	0.106	0.012	(3.71)***	0.089	0.108	0.019	(3)***	0.007	(1.22)
Liquid Assets	0.252	0.245	-0.007	(-1.37)	0.292	0.277	-0.015	(-1.82)*	-0.008	(-0.88)
Pct. Pledged	0.104	0.115	0.011	(2.81)***	0.111	0.113	0.002	(-2.04)**	-0.009	(-1.48)
Fed Funds and Repo Borrowed	0.028	0.033	0.005	(3.35)***	0.028	0.029	0.001	(-2.33)***	-0.004	(-1.69)*
Loan - Deposit Gap	-0.121	-0.102	0.019	(3.02)***	-0.170	-0.148	0.022	(9.14)***	0.003	(0.26)
ΔLiquid Assets$_t$ / Assets$_{t-1}$	0.013	0.007	-0.006	(-3.43)***	0.007	0.007	0.000	(5.41)***	0.006	(2.27)**
ΔLoans$_t$ / Assets$_{t-1}$	-0.001	-0.005	-0.004	(-2.13)**	0.000	0.004	0.004	(3.83)***	0.008	(2.78)***
ΔCredit$_t$ / (Commit + Assets)$_{t-1}$	-0.003	-0.007	-0.004	(-2)**	0.000	0.004	0.004	(3.91)***	0.008	(2.83)***
ΔNet Fed Funds and Repo$_t$ / Assets$_{t-1}$	0.000	-0.001	-0.001	(-2.23)**	-0.001	0.000	0.001	(2.31)**	0.002	(1.67)*
ΔOther Borrowed Fund $_t$ / Assets$_{t-1}$	-0.003	-0.004	-0.001	(-1.09)	-0.002	-0.001	0.001	(1.58)	0.002	(1.14)
ΔWholesale Funding$_t$ /Assets$_{t-1}$	-0.016	-0.012	0.004	(2.35)***	-0.009	-0.008	0.001	(-1.76)*	-0.003	(-1.27)
ΔImplicit Interest Rate on Large Deposits	-0.514	-0.489	0.025	(0.26)	-0.869	-0.939	-0.070	(-0.92)	-0.095	(-0.68)
ΔImplicit Interest Rate on Core Deposits	-0.419	-0.397	0.022	(0.22)	-1.065	-1.011	0.054	(0.33)	0.032	(0.22)

Table 2.4: Cost of capital: daily equity bid-ask spreads (matched sample)

This table presents the difference-in-difference estimation results of the impact on the cost of capital as measured by the adverse selection component of the bid-ask spread using the matched sample.

$$BA\ Spread_{it} = \beta_0 + \beta_1 Event_t + \beta_2 Treated_i + \beta_3 Event_t \times Treated_i + \beta_4 Size_{it} + \beta_5 Volume_{it} + \beta_6 Volatility_{i,t-1} + \sum_n \beta_n Controls_{it} + \varepsilon_{it}$$

where $BA\ Spread_{it}$ is the natural logarithm of the relative equity bid-ask spread for each bank deflated by the average price, $Event_t$ is an indicator variable for the window following the disclosure of the DW information. $Treated_i$ refers to indicator variables for each category of banks accessing the DW or TAF (DW only access, TAF only access and DW and TAF). $Size_{i,t}$ is the natural logarithm of daily market capitalization of each bank to take into account the size of the bank, $Volume_{i,t}$ is the volume of shares trading as a proportion of the shares outstanding, and $Volatility_{i,t-1}$ is the rolling standard deviation of daily stock returns in the previous trading year. The treatment effect is captured by the coefficient β_3 on the difference-in-differences estimator. Columns (1) and (2) present the results for all banks in the matched sample. Columns (3) and (4) provide results for the banks in the top quartile of average DW borrowing as a proportion of total assets. Banks in columns (5) and (6) are in the top quartile of borrowers by frequency. Finally columns (7) and (8) show the results for banks with negative abnormal returns on the DW disclosure event. All other variables are defined in Appendix 2.B; ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level. Inferences remain unchanged using bootstrapped p-values. Control banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. The regression is estimated using daily values over a seven-day period around the DW disclosure event on March 31, 2011, to match the cross-section market tests on the (0,+3) window.

	All banks		**Top quartile DW Borrowers (by amount)**		**Top quartile DW Borrowers (by frequency)**		**Banks with negative CARs on DW Disclosure Event**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment: Banks accessing DW	-0.0661						-0.0118	
	(-0.858)						(-0.090)	
DW Event	0.1183**	0.1594***	0.0769	0.0890	0.0758	0.0132	0.1128	0.1404**
	(2.556)	(3.289)	(1.007)	(1.565)	(1.103)	(0.082)	(1.590)	(2.122)
Banks accessing DW * DW Event	-0.0522						-0.1493*	
	(-0.957)						(-1.668)	
Treatment: Banks accessing DW only		-0.0399		0.5115**		0.3605*		0.0838
		(-0.494)		(2.309)		(1.802)		(0.650)
Banks accessing DW only * DW Event		-0.1115*		-0.0542				-0.2123**
		(-1.748)		(-0.389)				(-2.218)
Treatment: Banks accessing TAF only		0.0184						-0.0375
		(0.123)						(-0.152)
Banks accessing TAF only * DW Event		-0.3691***						-0.3881
		(-2.817)						(-1.645)
Treatment: Banks accessing both DW and TAF		-0.1551						-0.7117**
		(-1.101)						(-2.297)
Banks accessing both DW and TAF * DW Event		-0.0575				0.0937		-0.0850
		(-1.003)				(0.565)		(-0.997)
$Size_t$	-0.4620***	-0.4491***	-0.5153***	-0.4724***	-0.4967***	-0.4677***	-0.4237***	-0.3723***
	(-10.203)	(-8.538)	(-8.506)	(-10.286)	(-11.206)	(-11.718)	(-6.754)	(-5.891)
Volume traded $_t$	-0.3610***	-0.3598***	-0.3541***	-0.3123***	-0.3505***	-0.3291***	-0.3131***	-0.2785***
	(-7.495)	(-7.153)	(-5.427)	(-4.248)	(-5.376)	(-4.725)	(-5.204)	(-5.465)

$Volatility_{t-1}$	0.5964***	0.6009***	0.5980***	0.6759***	0.5183***	0.5556***	0.7156***	0.8356***
	(5.362)	(5.717)	(3.096)	(3.424)	(2.781)	(3.027)	(4.417)	(4.862)
Average amount borrowed / Assets	0.0030	-0.0013	-0.0102	-0.0274*	-0.0043	-0.0136	0.0213	-0.0081
	(0.219)	(-0.091)	(-0.855)	(-2.013)	(-0.322)	(-0.947)	(0.924)	(-0.394)
Total number of visits	-0.0008	-0.0004	0.0002	0.0015	-0.0001	0.0005	-0.0028	-0.0005
	(-0.932)	(-0.456)	(0.227)	(1.494)	(-0.102)	(0.486)	(-1.405)	(-0.280)
Intercept	1.5541***	22.6046	2.0642***	1.2306**	1.8244***	1.2908**	1.1826*	0.6571
	(3.199)	(0.206)	(2.889)	(2.030)	(3.376)	(2.442)	(1.767)	(0.997)
Observations	1,682	1,682	254	254	275	275	621	621
Adjusted R-squared	0.808	0.809	0.822	0.840	0.859	0.866	0.786	0.800

Table 2.5: Cost of capital: monthly equity bid-ask spreads (matched sample)

This table presents the difference-in-difference estimation results of the impact on the cost of capital as measured by the adverse selection component of the bid-ask spread using the matched sample.

$$BA\ Spread_{it} = \beta_1 Event_t \times Treated_i + \beta_2 Size_{i,t-1} + \beta_3 Volume_{i,t-1} + \beta_4 Volatility_{i,t-1} + \sum_n \beta_n Controls_{it} + T_t + B_i + \varepsilon_{it}$$

where *BA Spread*$_{it}$ is the natural logarithm of the monthly median relative equity bid-ask spread for each bank deflated by the average price, *Event* is an indicator variable for the window following the disclosure of the DW information. *Event*$_t$ *x Treated*$_i$ refers to the interaction that takes the value of one for banks that access the DW and the effect of this information post-disclosure of March 31, 2011. This is the difference-in-difference estimator. *Size*$_{i,t-1}$ is the natural logarithm of the monthly median of the daily market capitalization of each bank lagged by one month to take into account the size of the bank, *Volume*$_{i,t-1}$ is the natural logarithm of the monthly median volume of shares trading as a proportion of the shares outstanding, and *Volatility*$_{i,t-1}$ is the rolling standard deviation of daily stock returns in the previous trading year. T_t reflects the year and month fixed effects and B_i refers to the holding company fixed effects. The treatment effect is captured by the coefficient β_1 on the difference-in-differences estimator. This analysis uses bank and time fixed effects and therefore only the difference-in-differences operator is identified. Columns (1) and (2) present the results for all banks in the matched sample. Columns (3) and (4) provide results for the banks in the top quartile of average DW borrowing as a proportion of total assets. Banks in columns (5) and (6) are in the top quartile of borrowers by frequency. Finally columns (7) and (8) show the results for banks with negative abnormal returns on the DW disclosure event. Variables are defined in Appendix 2.B; ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level. Inferences remain unchanged using bootstrapped p-values. Control banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. The regression is estimated using monthly medians of daily relative bid-ask spread values over a five-quarter period following the passage of the Dodd-Frank Act from 2010Q3 to 2011Q3.

	All banks		**Top quartile DW Borrowers (by amount)**		**Top quartile DW Borrowers (by frequency)**		**Banks with negative CARs on DW Disclosure Event**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banks accessing DW * DW Event	0.0677*		0.0125		0.0233		0.1250**	
	(1.804)		(0.092)		(0.153)		(2.042)	
Banks accessing DW only * DW Event		0.0805*		0.0588		0.0360		0.1636**
		(1.909)		(0.428)		(0.237)		(2.517)
Banks accessing TAF only * DW Event		-0.0001						0.1354
		(-0.001)						(1.535)
Banks accessing both DW and TAF * DW Event		0.0414		-0.0637		0.0002		0.0526
		(0.830)		(-0.476)		(0.001)		(0.491)
$Size_{t-1}$	-0.0375	-0.0389	0.0099	0.0076	-0.0097	-0.0104	-0.0196	-0.0236
	(-1.314)	(-1.388)	(0.190)	(0.148)	(-0.181)	(-0.195)	(-0.617)	(-0.795)
$Volume_{t-1}$	-0.1246***	-0.1247***	-0.1080***	-0.1035***	-0.1302***	-0.1289***	-0.1097***	-0.1082***
	(-6.694)	(-6.694)	(-3.008)	(-2.836)	(-3.277)	(-3.121)	(-3.916)	(-3.874)
$Volatility_{t-1}$	0.1260*	0.1145*	-0.0587	-0.0817	-0.0514	-0.0647	0.0230	-0.0021
	(1.912)	(1.679)	(-0.299)	(-0.429)	(-0.254)	(-0.306)	(0.219)	(-0.019)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,724	3,724	565	565	605	605	1,415	1,415
Adjusted R-squared	0.311	0.311	0.316	0.324	0.283	0.282	0.308	0.311

Table 2.6: Cost of capital: bond offering yields (matched sample)

This table presents the estimation results of the impact of the DW disclosures on banks' cost of borrowing in the bond market.

$$OfferingYield_{it} = \alpha_1 Event_t \times Treated_i + \sum_l \alpha_l Controls_{it} + T_t + B_i + v_{it}$$

The dependent variable is the bond-offering yield, which is measured as the bond's yield to maturity at the time of issuance. *Benchmark Treasury Yield* is the yield to maturity of a corresponding US Treasury bill or bond matched to each bond in the sample on maturity and coupon. *Bond Life* is the bond maturity in years. *Amount of Issue* is the total dollar amount of the face value of each bond at issuance. *Callable* is an indicator variable, which takes the value of one if the bond is callable and zero otherwise. *Assets* are the total assets of each bank. *Asset Risk* is the share of risk-weighted assets in total assets, which measures the overall riskiness of a bank's assets. *Tier Ratio* is the share of Tier 1 capital in total assets. *Deposits / Assets* is the ratio of banks' total deposits to total assets. *ROA* measures each bank's return on assets. $Event_t$ *x* $Treated_i$ takes the value of one for bonds issued after the DW disclosure event on March 31, 2011, by banks that have accessed the DW (or TAF and DW). *Rating* is a numerical credit rating for which the lowest value implies higher credit quality. Control banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. T_t captures the quarterly fixed effects and B_i captures the holding company fixed effects. This analysis uses bank- and time- fixed effects and therefore only the difference-in-differences operator is identified. All continuous variables are in percent and are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. The regression is estimated over a five-quarter period following the passage of the Dodd-Frank Act from 2010Q3 to 2011Q3. All other variables are defined in Appendix 2.B. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

	(1)	(2)
Banks accessing DW * DW Event	-1.1595*	
	(-1.869)	
Banks accessing DW only * DW Event		-1.8945**
		(-1.967)
Banks accessing both DW and TAF * DW Event		-0.1568
		(-0.133)
Benchmark Treasury Yield	2.1716***	2.1592***
	(8.816)	(8.755)
Log (1+ Bond Life)	-3.7870***	-3.7795***
	(-18.154)	(-18.106)
Log (Bond Amount of Issue)	-0.3889***	-0.3900***
	(-5.745)	(-5.760)
Callable	-1.4117**	-1.3909**
	(-2.551)	(-2.512)
Log (Assets)	-4.8050	0.6762
	(-0.307)	(0.041)
Asset Risk	-0.6619**	-0.4134
	(-2.392)	(-1.110)
Tier Ratio	-1.3991*	-3.0201*
	(-1.939)	(-1.699)
Deposits / Assets	0.3720	0.1456
	(1.469)	(0.428)
ROA	-1.3164	-0.8208
	(-1.167)	(-0.666)
Rating	-0.3967	-0.4169
	(-0.749)	(-0.786)
Time fixed effects	Yes	Yes
Bank fixed effects	Yes	Yes
Observations	1,077	1,077
Adjusted R-squared	0.636	0.636

Table 2.7: Real effects results: Risk (matched sample)

This table presents the estimation results of the DW disclosure on proxies of risk using the difference-in-difference methodology and a matched sample:

$$y_{it} = \delta_1 Event_t \times Treated_i + \sum_m \delta_m Controls_{it} + T_t + B_i + \upsilon_{it}$$

Event$_t$ x Treated$_i$ refers to the interaction that takes the value of one in the period following March 31, 2011, for banks that access the DW. This is the difference-in-difference estimator. T_t refers to the quarterly fixed effects and B_i captures the holding company fixed effects. This analysis uses bank and time fixed effects and therefore only the difference-in-differences operator is identified. Columns (1) and (2) present the effects of disclosure on banks' idiosyncratic risk following the DW event. Columns (3) and (4) focus on the balance sheet measure of risk computed as a proportion of risk-weighted assets in total assets. Finally, columns (5) and (6) show the results for risky lending proxied by the proportion of commercial and industrial loans in total assets. Control sample banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All continuous variables are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. All other variables are defined in Appendix 2.B. Control variables are computed using quarterly data for the period of 2009Q3 to 2012Q3. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

	Idiosyncratic risk		**Asset Risk**		**Risky Lending**	
	(1)	(2)	(3)	(4)	(5)	(6)
Banks accessing DW * DW Event	-0.0786***		-0.0051**		0.0027**	
	(-6.984)		(-2.310)		(2.058)	
Banks accessing DW only * DW Event		-0.0263		0.0033		-0.0102*
		(-1.113)		(0.837)		(-1.783)
Banks accessing TAF * DW Event		0.0431		-0.0087		-0.0010
		(1.024)		(-0.779)		(-0.293)
Banks accessing both DW and TAF * DW Event		-0.0524**		-0.0014		0.0084***
		(-1.992)		(-0.277)		(2.874)
Log (Assets)$_{t-1}$	-0.0890	-0.0797	-0.0053	-0.0052	0.0212**	0.0199**
	(-1.447)	(-1.276)	(-0.371)	(-0.372)	(2.234)	(2.203)
Tier Ratio$_{t-1}$	-0.4755**	0.4231**	-0.0719*	0.0185	-0.0103	-0.0015
	(-2.471)	(2.411)	(-1.731)	(0.470)	(-0.466)	(-0.065)
(Deposits / Assets)$_{t-1}$	0.5235***	-0.1634	0.5715***	0.4982***	0.1333***	0.1235***
	(3.046)	(-1.007)	(15.869)	(13.170)	(9.141)	(8.095)
(Loans / Assets)$_{t-1}$	-2.8885	-3.2643	-0.8390*	-0.8425*	-0.1625	-0.1712
	(-1.117)	(-1.368)	(-1.857)	(-1.739)	(-0.693)	(-0.731)
(NPL / Assets)$_{t-1}$	-3.3694***	-2.8096***	0.0402	0.0956	0.0352	0.0250
	(-8.537)	(-6.461)	(0.461)	(1.094)	(0.899)	(0.605)
(Off-balance Sheet Assets / Assets)$_{t-1}$	-1.3962***	-0.4627***	-0.0460**	0.0871**	-0.0018	0.0133
	(-10.932)	(-2.892)	(-2.248)	(2.559)	(-0.169)	(0.796)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,017	3,017	3,017	3,017	3,017	3,017
Adjusted R-squared	0.374	0.482	0.410	0.444	0.143	0.174

Table 2.8: Real effects results: Liquidity (matched sample)

This table presents the estimation results of the DW disclosure on proxies of liquidity using the difference-in-difference methodology and a matched sample:

$$y_{it} = \delta_1 Event_t \times Treated_i + \sum_m \delta_m Controls_{it} + T_t + B_i + \upsilon_{it}$$

Event$_t$ x Treated$_i$ refers to the interaction that takes the value of one in the period following March 31, 2011, for banks that access the DW. This is the difference-in-difference estimator. This analysis uses bank and time fixed effects and therefore only the difference-in-differences operator is identified. Columns (1) and (2) present the effects of disclosure on banks' balance sheet liquidity measured as a proportion of liquid assets in total assets. Columns (3) and (4) show the results for the proportion of pledged assets in total assets as a measure of collateralized borrowing. Columns (5) and (6) present the results for net borrowed Federal Funds and Repos as a proportion of total assets as a proxy for banks' access to the federal funds market. Columns (7) and (8) present the loan-deposit funding gap as a proportion of total assets as a proxy for a liquidity shortfall. T_t refers to the quarterly fixed effects and B_i is the holding company fixed effects. All other variables are defined in Appendix 2.B. Control variables are computed using quarterly data for the period of 2009Q3 to 2012Q3. Control sample banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All continuous variables are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

	Liquid Assets		**Pct. Pledged**		**Fed Funds and Repo Borrowed**		**Loan - Deposit Gap**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Banks accessing DW * DW Event	0.0068***		-0.0057***		-0.0021**		-0.0113***	
	(3.969)		(-3.063)		(-2.207)		(-5.346)	
Banks accessing DW only * DW Event		-0.0017		-0.0110***		-0.0031*		-0.0049
		(-0.567)		(-2.893)		(-1.864)		(-1.469)
Banks accessing TAF * DW Event		-0.0014		0.0001		-0.0065*		-0.0050
		(-0.135)		(0.008)		(-1.763)		(-0.405)
Banks accessing both DW and TAF * DW Event		-0.0038		-0.0023		-0.0029		0.0011
		(-1.121)		(-0.491)		(-1.351)		(0.259)
Log (Assets)$_{t-1}$	-0.0337***	-0.0378***	-0.0082	-0.0071	-0.0088**	-0.0080**	0.0440***	0.0465***
	(-4.240)	(-4.520)	(-1.005)	(-0.916)	(-2.428)	(-2.230)	(4.836)	(4.933)
Tier Ratio$_{t-1}$	0.0761	0.0334	0.0619	0.0743	-0.0270	-0.0223	-0.0980	-0.0537
	(1.202)	(0.498)	(0.772)	(0.946)	(-1.047)	(-0.911)	(-1.288)	(-0.659)
(Deposits / Assets)$_{t-1}$	0.0441*	0.0191	-0.1198***	-0.0941**	-0.1057***	-0.1032***	-0.6873***	-0.6333***
	(1.663)	(0.684)	(-3.497)	(-2.495)	(-5.471)	(-5.220)	(-17.935)	(-15.109)
(Loans / Assets)$_{t-1}$	-0.7041***	-0.6884***	-0.1354***	-0.1569***	-0.0111	-0.0111	0.6793***	0.6371***
	(-23.710)	(-22.390)	(-4.900)	(-5.310)	(-1.149)	(-1.084)	(16.766)	(14.757)
(NPL / Assets)$_{t-1}$	-1.2635***	-1.2041***	-0.4219	-0.4871*	-0.1916	-0.2017	0.7270	0.6937
	(-2.915)	(-2.722)	(-1.534)	(-1.755)	(-1.069)	(-1.158)	(1.029)	(0.959)
(Off-balance Sheet Assets / Assets)$_{t-1}$	-0.0053	-0.0155	-0.0086	0.0162	-0.0052	-0.0118	0.0032	0.0577**
	(-0.312)	(-0.598)	(-0.622)	(0.731)	(-0.707)	(-1.006)	(0.163)	(2.112)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017
Adjusted R-squared	0.556	0.568	0.070	0.089	0.118	0.123	0.557	0.571

Table 2.9: Real effects results: Changes in liquidity and lending (matched sample)

This table presents the estimation results of the DW disclosure on proxies of liquidity using the difference-in-difference methodology and a matched sample:

$$y_{it} = \delta_1 Event_t \times Treated_i + \sum_m \delta_m Controls_{it} + T_t + B_i + \upsilon_{it}$$

$Event_t$ x $Treated_i$ refers to the interaction that takes the value of one in the period following March 31, 2011, for banks that access the DW. This is the difference-in-difference estimator. This analysis uses bank and time fixed effects and therefore only the difference-in-differences operator is identified. *Tt* is the quarterly fixed effect and *Bi* is the holding company fixed effect. Columns (1) and (2) show quarterly growth in liquid assets as a proportion of total assets at the beginning of the quarter. Columns (3) an (4) show growth in loans as a percentage of total assets and columns (5) to (6) show growth in credit as a proportion of total committed assets. All variables are defined in Appendix 2.B. Control variables are computed using quarterly data for the period of 2009Q3 to 2012Q3. Control sample banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All continuous variables are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

	ΔLiquid Assets$_t$ / Assets$_{t-1}$		**ΔLoans$_t$ / Assets$_{t-1}$**		**ΔCredit$_t$ / (Commit + Assets)$_{t-1}$**	
	(1)	(2)	(3)	(4)	(5)	(6)
Banks accessing DW * DW Event	0.0058**		0.0047*		0.0060**	
	(2.429)		(1.658)		(1.979)	
Banks accessing DW only * DW Event		0.0051*		0.0018		0.0025
		(1.724)		(0.575)		(0.762)
Banks accessing TAF * DW Event		0.0093		-0.0053		-0.0050
		(0.803)		(-0.557)		(-0.514)
Banks accessing both DW and TAF * DW Event		0.0040		0.0089**		0.0114***
		(1.111)		(2.450)		(2.874)
Log (Assets)$_{t-1}$	-0.0645***	-0.0644***	-0.0937***	-0.0937***	-0.0987***	-0.0987***
	(-6.527)	(-6.544)	(-6.603)	(-6.640)	(-6.625)	(-6.681)
Tier Ratio$_{t-1}$	0.0348	0.0352	0.2548***	0.2504***	0.2792***	0.2735***
	(0.481)	(0.487)	(3.063)	(3.046)	(3.209)	(3.181)
(Deposits / Assets)$_{t-1}$	0.0329	0.0320	-0.0922***	-0.0925***	-0.0902***	-0.0908***
	(1.014)	(0.989)	(-3.114)	(-3.144)	(-2.924)	(-2.965)
(Loans / Assets)$_{t-1}$	0.2949***	0.2953***	-0.1188***	-0.1198***	-0.1413***	-0.1425***
	(10.288)	(10.298)	(-4.229)	(-4.290)	(-4.819)	(-4.913)
(NPL / Assets)$_{t-1}$	-0.5968	-0.5987	-1.0683	-1.0882	-1.0388	-1.0647
	(-1.295)	(-1.272)	(-1.517)	(-1.551)	(-1.406)	(-1.448)
(Off-balance Sheet Assets / Assets)$_{t-1}$	-0.0049	-0.0039	0.1733***	0.1663***	0.1478***	0.1390***
	(-0.219)	(-0.172)	(5.856)	(5.520)	(4.847)	(4.464)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,017	3,017	3,017	3,017	3,017	3,017
Adjusted R-squared	0.157	0.158	0.120	0.121	0.120	0.122

Table 2.10: Real effects results: Changes in access to funding and funding costs (matched sample)

This table presents the estimation results of the DW disclosure on proxies of liquidity using the difference-in-difference methodology and a matched sample:

$$y_{it} = \delta_1 Event_t \times Treated_i + \sum_m \delta_m Controls_{it} + T_t + B_i + \upsilon_{it}$$

Event$_t$ x Treated$_i$ refers to the interaction that takes the value of one in the period following March 31, 2011, for banks that access the DW. This is the difference-in-difference estimator. This analysis uses bank and time fixed effects and therefore only the difference-in-differences operator is identified. T_t refers to the quarterly fixed effects and B_i to the holding company fixed effects. Columns (1) and (2) show quarterly changes in net federal funds and repo borrowing as a proportion of total assets at the beginning of the quarter. Columns (3) and (4) show growth in other borrowed funds as a proportion of total assets. Columns (5) and (6) show growth in net wholesale funding as a proportion of total assets. Finally, columns (7) through (10) show the quarterly change in the implicit interest rate banks pay on large and core deposits. All other variables are defined in Appendix 2.B. Control variables are computed using quarterly data for the period of 2009Q3 to 2012Q3. Control sample banks are matched to the banks accessing the DW using propensity score matching based on the pre-crisis quarterly data for 2004Q1 to 2006Q4. All continuous variables are winsorized at the utmost 1% tails of their respective distributions to adjust for the effects of extreme observations. ***, **, * designate significance at 1%, 5% and 10% levels respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

	ΔNet Fed Funds and Repo$_t$ / Assets$_{t-1}$		**ΔOther Borrowed Funds$_t$ / Assets$_{t-1}$**		**ΔWholesale Funding$_t$ / Assets$_{t-1}$**		**ΔImplicit Interest Rate on Large Deposits**		**ΔImplicit Interest Rate on Core Deposits**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Banks accessing DW * DW Event	0.0006		0.0005		-0.0027		-0.0984**		-0.0236	
	(1.183)		(0.503)		(-0.937)		(-2.136)		(-0.584)	
Banks accessing DW only * DW Event		0.0002		-0.0004		-0.0049*		-0.1173**		0.0092
		(0.325)		(-0.432)		(-1.655)		(-2.260)		(0.202)
Banks accessing TAF * DW Event		-0.0013		0.0008		-0.0091		-0.1991***		0.1327
		(-0.709)		(0.409)		(-0.834)		(-2.709)		(1.365)
Banks accessing both DW and TAF * DW Event		0.0012		0.0025		-0.0007		-0.1164**		-0.0520
		(1.649)		(1.519)		(-0.183)		(-1.975)		(-0.988)
Log (Assets)$_{t-1}$	-0.0017	-0.0017	-0.0106***	-0.0106***	0.0550***	0.0550***	0.3880***	0.3873***	0.2713**	0.2714**
	(-1.234)	(-1.249)	(-2.762)	(-2.803)	(5.897)	(5.889)	(3.264)	(3.250)	(2.472)	(2.478)
Tier Ratio$_{t-1}$	0.0489***	0.0483***	0.1338***	0.1318***	0.1128	0.1104	2.8943**	2.9014**	0.2660	0.3012
	(3.869)	(3.821)	(4.047)	(3.984)	(1.570)	(1.535)	(2.250)	(2.249)	(0.240)	(0.270)
(Deposits / Assets)$_{t-1}$	0.0444***	0.0444***	0.1873***	0.1869***	0.2141***	0.2146***	2.4886***	2.5100***	0.8906*	0.8837*
	(4.987)	(5.016)	(10.718)	(10.758)	(5.238)	(5.269)	(3.723)	(3.752)	(1.773)	(1.739)
(Loans / Assets)$_{t-1}$	0.0004	0.0002	0.0045	0.0042	-0.3195***	-0.3202***	0.0678	0.0610	-0.0950	-0.0839
	(0.079)	(0.046)	(0.406)	(0.378)	(-10.241)	(-10.179)	(0.177)	(0.160)	(-0.285)	(-0.252)
(NPL / Assets)$_{t-1}$	0.0397	0.0373	-0.3549**	-0.3647**	0.1658	0.1575	1.9611	2.0725	10.5782*	10.7006*
	(0.578)	(0.536)	(-2.230)	(-2.344)	(0.369)	(0.342)	(0.326)	(0.347)	(1.692)	(1.693)
(Off-balance Sheet Assets/ Assets)$_{t-1}$	0.0052	0.0042	0.0330***	0.0301***	0.0547**	0.0507**	0.4939	0.4944	0.0147	0.0743
	(1.016)	(0.821)	(2.994)	(2.758)	(2.245)	(2.043)	(0.931)	(0.948)	(0.039)	(0.199)
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017	3,017
Adjusted R-squared	0.018	0.018	0.122	0.123	0.178	0.178	0.683	0.713	0.887	0.891

3 Are Universal Banks More Risky?[33]

3.1 Introduction

The recent financial crisis brought financial institutions' risk-taking behavior into focus and resulted in calls for more stringent financial regulation and break-up of universal banks.[34] While common in other developed countries such as Germany, Japan and the UK, universal banking was prohibited by law in the United States of America (US) until the end of 1999 under the Glass-Steagall Act (GSA) of 1933. GSA prevented deposit-taking institutions from engaging in investment banking activities and prevented bank holding companies from owning investment banking and insurance businesses. The repeal of the GSA in 1999 has paved the way for banks in the US to return to the universal banking model abandoned in 1933, allowing them to engage in both retail banking activities through their commercial banking arms and investment activities through their investment banking arms.

Proponents of universal banking argue that banks benefit from increased economies of scale and scope by offering multiple services as universal banks. Opponents, however, posit that universal banking is inherently more risky as it gives financial institutions access to a depositors' base, and hence explicit and implicit

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[34] It is important to clarify the differences between universal and commercial banks. Universal banks are financial institutions that engage in commercial, investment and broker-dealer banking. Commercial or retail banks primarily take deposits from customers and make loans to customers. Investment banks primarily help with securities issuance and corporate banking activities. There is also a third category, known as dealer banks. Dealer banks are similar to investment banks but primarily engage in secondary trading and derivatives transactions. In my analysis I refer to both investment banks and dealer banks as "investment banks." Prior to the repeal of the Glass-Steagall Act, commercial, investment and dealer banks were not allowed to engage in each other's activities.

government guarantees. These guarantees encourage moral hazard in the sense that banks engage in riskier activities knowing that governments can provide a backup if things go wrong. Some prior studies also find that the conflict of interest among managers, shareholders, depositors and regulators is unique to financial institutions due to the existence of government guarantees and the complexity of universal banks (Acharya et al., 2009; Sierra, Talmor and Wallace, 2006).

The issue of universal banking has recently come under scrutiny as banking regulators are contemplating whether universal banks should be broken up into commercial banks and investment banks to avoid these incentive problems.[35] In particular, some argue that repealing the GSA exacerbated frictions between the incentives of depositors, other creditors, bank shareholders and management and reduced monitoring of banks' management activities. However, whether the repeal of the GSA has indeed created incentives for banks to take greater risk remains unknown. Stiroh (2006) attempts to address this issue by studying the determinants and characteristics of bank risk through the lens of the information available in regulatory disclosure before and after the repeal of the GSA; however, his focus is on the additional items of disclosure, available from 2001, rather than changes in risk-taking incentives.

Furthermore, if the incentives to take more risk have changed as a result of the change from the commercial-banking-only model to a universal model, banks' shareholders and boards would have implemented measures to align the incentives of shareholders and management. For example, a recent study by Fahlenbrach and Stulz (2011) using a small sample of the largest financial institutions in the US finds that bank

[35] See, for example, "Obama takes on America's banks with new Glass-Steagall Act," *The Guardian*. January 21, 2010. Available at http://www.guardian.co.uk/business/2010/jan/21/obama-bank-reform-glass-steagall and Hirsh, Michael (2009), "An Odd Post-Crash Couple Spurning Obama, McCain and Cantwell propose resurrecting Glass-Steagall to break up Wall Street," *Newsweek*, December 15, 2009, available at http://www.newsweek.com/2009/12/14/an-odd-post-crash-couple.print.html.

CEOs' incentives were aligned with those of the shareholders before the recent financial crisis. This study, however, does not address the question of whether shareholders have indeed taken into account any changes in risk arising from the changes in banks' business models.

Therefore, using the unique quasi-experimental setting of this policy change, I study two questions: (i) whether the repeal of the Glass-Steagall Act has led to more risk-taking by universal banks and (ii) whether shareholders and boards have responded to this change by shifting the structure of executive compensation packages in order to address any changes in risk-taking incentives. The repeal of the Glass-Steagall Act is a particularly interesting setting for examining banks' risk-management decisions because the change in legislation provides a clear structural break in the way banks were allowed to structure their business and, hence, their exposure to risk.

In the first part of my analysis, I utilize the quasi-experimental nature of the policy change and study the differences between banks that became universal and those that continued to engage solely in commercial banking activities. Using propensity score matching, I construct a control group consisting of banks with similar *ex ante* characteristics to those that chose to become universal prior to the repeal of the GSA, and then test the effect of the policy change on risk proxies using a set of risk determinants and characteristics over the whole sample. My control group consists of pure-play commercial banks which closely resemble banks that became universal starting from the year 2000.[36] In the second part of this paper, I study whether compensation structures for CEOs of universal banks changed following the shift to the universal banking business model. Using the propensity score matching identification

[36] Ideally, as part of my analysis, I would construct two control groups: one with pure-play investment banks and another with pure-play commercial banks. Unfortunately, only a handful of investment banks in the United States remained as pure-play; therefore, I restrict my comparisons of universal banks to pure-play commercial banks only.

and a difference-in-difference analysis, I find that universal banks do not appear to exhibit different risk characteristics from those of pure-play commercial banks. Furthermore, when I test for differences in executive compensation incentives, I find no observable difference between universal and pure-play commercial banks, in particular, in the period after the repeal of the GSA.

This paper contributes to the existing stream of literature on the changes resulting from the repeal of the Glass-Steagall Act (Puri, 1999; Stiroh, 2006) and the role of governance mechanisms in mitigating conflicts of interest arising in financial institutions (Adams and Mehran, 2003; Clinch and Maglio, 1993; Fahlenbrach and Stulz, 2011; Hubbard and Palia, 1995; John and Qian, 2003; Sierra, et al., 2006). The repeal of the Glass-Steagall Act in 1999 provides a setting in which banks were given access to cheaper funding sources that were explicitly guaranteed by deposit insurance and at the same time were allowed to engage in potentially more risky investment-banking activities all under the same universal bank umbrella. Whether this change of policy has created a more risky financial sector remains an open question. While this is a very timely question, to the best of my knowledge, no specific studies investigate the changes in bank risk and governance in response to the repeal of the Glass-Steagall Act. By being unable to find any observable differences between universal and pure-play commercial banks, this paper potentially has a direct policy application by contributing to the ongoing debate on whether universal banks should be broken up and some aspects of the Glass-Steagall Act be reinstated.

The rest of this chapter is organized as follows. Section 3.2 describes some of the institutional details of the banking sector and the history of the Glass-Steagall Act and provides a brief literature review and the motivation for the paper. Section 3.3

presents the research design for this study, section 3.4 discusses empirical findings and section 3.5 concludes.

3.2 Motivation and literature review

The constellation of various financial activities under the umbrella of one holding company presents a potential array of costs and benefits. However, some researchers find no strong case for the net benefits of forming large, diversified universal banks (Boot, Milbourn and Thakor, 1999). In this paper, I do not focus on the benefits of universal banking but instead study the potential costs of weaker governance mechanisms arising as a result of banks changing from pure commercial or investment banking activities to universal banking.

3.2.1 Commercial, investment and universal banks

One could argue that combining commercial and investment banks under one umbrella could increase efficiencies through increased economies of scale and scope and reduced transaction costs resulting from lower information asymmetries. However, evidence on the benefits of one model over the other is mixed. On the one hand, some researchers find no support for the net benefits of forming universal banks (Boot, Milbourn and Thakor, 1999). On the other hand, studies using international data from other developed countries, such as Germany, find evidence of benefits of universal banking (Benston, 1994; Calomiris, 2000) such as greater efficiency and lower risk arising from diversification.

Moreover, theoretical models of banking structure which study the differences between the two banking models also show mixed results. Comparing the incentives of universal and commercial banks, for example, Boyd, Chang and Smith (1998) present a model of moral hazard and find that allowing commercial banks to hold equity positions

in other firms increases their risk-taking behavior and exacerbates problems of moral hazard. In particular, they find that incentives to take risky positions are stronger when moral hazard problems are the most severe. However, Saunders (1985), who identifies nine potential conflicts of interest (such as promotional role, economic tie-ins, director interlocks and misuse of security proceeds), finds that reputation concerns mitigate potential conflicts of interest that a commercial bank might experience if engaged in universal banking activities. He also suggests that external governance mechanisms, such as the market for corporate control, a competitive market for financial services and the regulatory oversight mitigate any potential risks.

Some studies, such as Puri (1999), for example, also explain the co-existence of commercial and investment banks alongside universal banks. She finds that when information costs are high, prior financial claims by banks can cause banks to obtain better prices for underwriting securities than investment banks. Others studies show pricing differences between overlapping financial products offered by commercial and investment banks with investment banks securities' being viewed as more risky, prior to the repeal of the Glass-Steagall Act (for example, see Ang and Richardson, 1994; Gande, Puri and Saunders, 1999; Puri, 1996). In general, most of the studies comparing the three types of banks suggest that conflicts of interest and other social costs arising from combining commercial and investment banks can be mitigated through outside governance forces or reputation effects.

3.2.2 Literature review

Shleifer and Vishny (1997) define corporate governance as dealing with "the ways that suppliers of finance to corporations assure themselves of getting a return on their investment." According to the agency theory, if managers behave independently, they may make financing, investment and payout decisions that are detrimental to

shareholders. In order to mitigate this conflict of interest, economic theory offers several mechanisms that address these failures, such as monitoring by the board of directors and institutional shareholders, compensation contracts and managerial equity investment. Jensen and Meckling (1976) argue that ownership structure, board structure and compensation structure are determined by one another along with a range of other variables, such as risk, cash flow, firm size and regulation. They also suggest that these variables influence firms' conduct and performance.

Interestingly, while governance concerns have been studied in depth in non-regulated sectors, only a few studies focus on governance issues in regulated sectors. As a heavily regulated sector, the governance of banks may be different from that of other unregulated sectors for a number of reasons. First, the increased number of stakeholders complicates the governance of financial institutions: in addition to managers and shareholders, depositors and regulators have a direct interest in banks' financial performance. Furthermore, regulators have an interest in how banks are governed from a more macro-level systemic stability perspective (Adams and Mehran, 2003).

At the same time, whether the regulatory oversight can be perceived as a substitute for corporate governance, especially in the case of complex financial institutions, is unclear. For example, Acharya et al. (2009) argue that in the lead up to the recent financial crisis, the over-reliance on the regulatory oversight provided bank managers with more incentives to take excessive risk. They also posit that this was in line with the interests of shareholders. Similarly, Fahlenbrach and Stulz (2011) find that banks whose CEOs' incentives were better aligned with the interests of shareholders performed worse than banks whose CEOs' incentives were less aligned during the recent financial crisis. This is likely to be in line with the hypothesis that while the

shareholders' and CEOs' incentives were aligned, the CEOs did not anticipate the financial crisis and its outcome.

The real issue is that, unlike industrial firms, financial firms can alter their risk profiles swiftly, almost instantaneously. Hence, some would argue that, as banks become more complex, monitoring of managers' incentives should come through the provision of appropriate incentives rather than direct monitoring or control (Acharya and Sundaram, 2009). In addition, the combination of short-term oriented compensation of management, implicit and explicit government guarantees through the FDIC insurance of deposits, and potential too-big-to-fail provisions lead to increased risk-taking by management and less monitoring from stakeholders (depositors, regulators and shareholders (Acharya et al., 2009)). However, boards still play an important role, and stronger boards result in better bank performance (Sierra et al., 2006). Therefore, it is important to study which governance mechanisms are effective and whether different governance mechanisms need to be in place within the banking sector for large and more complex financial institutions. In particular, universal banks may require governance mechanisms that might not be as necessary for pure-play commercial and investment banks because of potentially higher conflicts of interest in universal banks.

Some aspects of bank governance have been studied in the past, but most studies used the data before the repeal of the Glass-Steagall Act. These studies have focused on compensation mechanisms and board structures. For example, Clinch and Magliolo (1993) explore the relation between components of earnings and the cash compensation of CEOs of bank holding companies. They find that discretionary items with cash flow effects are reflected in the compensation function, while discretionary items with no cash flow implications do not appear to enter the compensation function.

In a related study, Hubbard and Palia (1995) investigate the changes in executive pay in the banking industry in response to the relaxation of interstate banking restrictions in the US. This setting is similar to the shock that occurred with the repeal of the Glass Steagall Act, as the relaxation of interstate laws allowed banks to acquire other banks across states, establish branches in more locations and potentially introduce more financial production. As a result, the financial sector saw an increase in size and complexity of financial institutions. Hubbard and Palia (1995) find that the relaxation of interstate banking laws resulted in higher levels of pay and stronger pay-performance relationship. They also find that CEO turnover increased substantially following the deregulation. A key element in Hubbard and Palia (1995) is the possibility that this deregulation increased the demand by banks for more talented managers. An increased demand for talent can lead to more scrutiny by boards to discern talent levels of incumbent managers, and thus lead to a change in the relative roles of accounting and stock price performance in determining managerial turnover. However, in an earlier study and prior to this change in regulation, Barro and Barro (1990) find no relationship between accounting-based measures and turnover for a sample of large bank CEOs; instead, they find an inverse relation between stock price performance and turnover.

In addition, it seems that being a publicly-held bank provides management with increased incentives to engage in earnings management. For example, Beatty, Ke, and Petroni (2002) find that publicly-held banks engage in more earnings management than privately-held banks. The reason for this could be that bank managers have myopic views exacerbated by their compensation contracts. This makes banks different from other institutions for which stock-based compensation provides incentives for management to engage in value-enhancing activities (Core, Guay and Larcker, 2003).

3.2.3 The Glass-Steagall Act of 1933

The Glass-Steagall Act of 1933 (also known as the Banking Act of 1933 and commonly referred to as "Glass-Steagall") came into force in response to the ongoing banking failures in the United States in the wake of the Great Depression. Prior to the enactment of the GSA, 2,000 banks on average failed in the US per year. The major contributions of the Glass-Steagall Act were to establish the Federal Deposit Insurance Corporation (FDIC) for ensuring deposits and separate commercial and investment banking activities.[37] The Act was heavily criticized during 1980s and was finally repealed in November 1999 with the establishment of the Gramm-Leach-Bliley Act (GLBA), which came into force on March 31, 2000. GLBA also repealed parts of the Banking Holding Company Act of 1956 that separated commercial banking from insurance activities. Thus, GLBA permits single holding companies to offer banking, securities and insurance, as they had before the Great Depression. As a result, GLBA has widened the range of activities that banks and their holding companies can conduct (Barth, Brumbaugh and Wilcox, 2000).[38]

Although Glass-Steagall appeared to maintain the barriers between "banking" and "commerce" for more than half a century, depository, financial, industrial and securities firms found ways to overcome these barriers. Furthermore, US banks with operations outside of the United States were able to engage in universal banking on foreign soil and, similarly, foreign deposit-taking institutions could invest in US investment banks. In 1987, the Congressional Research Service prepared a study listing

[37] The original motivation behind the Glass-Steagall Act was threefold: 1) maintaining the integrity of the banking system; 2) preventing self-dealing and other financial abuses and 3) limiting stock market speculation. The language of the act made it a felony for anyone (a banker, broker, dealer, or a savings institution) to engage in the deposit-taking and securities business at the same time (Jackson, 1987).

[38] It is my understanding that GLBA did not address directly any of these original concerns of the Glass-Steagall Act. However, there is limited legal evidence showing that certain provisions of the Glass-Steagall Act were left in place, such as activities of pure commercial banks and pure investment banks. For example, pure commercial banks that were not part of universal banks had limited ability to engage in security trading and investment activities (Wallison, 2009).

pros and cons of repealing the GSA (Jackson, 1987). This study listed moral hazard arising from the combination of granting and investing credit as well as the potential for excessive risk-taking through securities investment as the main reasons for preserving the GSA. The Congressional study also mentioned that the universal banking model had worked well in other parts of the world and allowed banks to internalize some of the benefits from the economies of scale and scope as well as network externalities.

A limited number of studies have specifically investigated the impact of the repeal of the GSA. Most of these papers study the value relevance and the market response to commercial banks' abilities to underwrite securities. For example, Cyree (2000) studies the market reaction to the repeal of the act and finds that banks that benefited the most (in terms of positive abnormal returns) are large commercial banks, which already had cross-state operations. To the best of my knowledge, there are no studies directly investigating risk and governance implications of the repeal of the Glass-Steagall Act in 1999 and the role of universal banks in the US financial sector during the decade that followed.

3.2.4 Hypotheses development

The repeal of the Glass-Steagall Act has allowed commercial banks to engage in investment banking and insurance underwriting activities and, similarly, has allowed investment banks to have access to commercial banking and its depositor base. The resulting universal banks are able to offer a wider range of products but also have access to cheaper funding through customer deposits. This has increased the number of bank stakeholders. Stakeholders in universal banks are depositors, other creditors, other financial institutions, borrowers, regulators and shareholders. Contract and governance theory predicts that, with the increase of banks' complexity and with the existence of government guarantees, monitoring of banks' management activities becomes more

difficult. The increase in size potentially decreases monitoring incentives due to the expectation that a bank is “too-big-to-fail” and hence will be bailed out in the case of need. In addition, the complexity of the bank structure makes standard monitoring through board and executive compensation more difficult. Moreover, given that customer deposits are subject to an explicit government guarantee, depositors have fewer incentives to monitor banks’ operating activities. Finally, because these banks are subject to banking regulation, regulators add another dimension to monitoring, potentially decreasing the incentives of other stakeholders to monitor managers’ activities (there is room for free-riding).

In comparison to universal banks, traditional commercial banks are simpler to analyze and monitor as they only engage in lending and deposit-taking activities. However, their depositor base is covered by similar types of deposit insurance guarantees as that of universal banks. Similarly, pure-play investment banks are not regulated and do not have explicit and implicit government guarantees. Hence, both types of pure-activity banks could be used as control groups to test the effect of the policy change on the banks that chose to become universal and combine the two sets of activities.

Since there appears to be a trade-off between the benefits of universal banking through diversification and economies of scale and scope on the one hand, and increased moral hazard and hence incentives to take greater risks on the other, it is important to first understand which of these two outcomes dominates. Therefore, in my analysis I first examine whether risk profiles have changed since the repeal of the GSA and whether any additional incentive and monitoring structures have been put into place to mitigate these concerns. My first hypothesis examines whether banks that elect the

universal banking model exhibit more risky behavior compared to their pure-play commercial bank counterparts.

H1: Banks adopting the universal banking model exhibit more risky behavior than pure-play commercial banks.

If the critics of the universal banking model are correct, then the first hypothesis predicts an increase in risk-taking behavior and hence an increase in the measures of risk for the banks adopting the universal banking model. This would be consistent with Stiroh's (2006) findings that the regulatory changes in the United States led to changes in the composition of the determinants of risk. In particular, he finds that as the regulatory and operating landscapes evolved, non-traditional banking activities such as insurance underwriting, securitization and other investment banking activities started to play a more prominent role in determining risk. However, if the universal banking model allows banks to diversify their risk profiles through the benefits of the economies of scale and scope, universal banks will see a decrease in risk compared to pure-play commercial banks.[39]

Finally, if the universal banking model has no economically significant role in determining the risk profile of the bank choosing to adopt it, there will be no incremental impact on the risk profile of banks adopting the universal banking model compared to their pure-play counterparts. Another potential alternative explanation might also be that the risk profiles of both types of banks have been affected in a similar way since the repeal of the GSA, and therefore there is no observable difference in their risk characteristics due to the policy change. One such potential alternative explanation

[39] One might also argue that the shift from one model to another has changed the long-run equilibrium outcome. In this case, if two steady-state equilibria exist, one will observe a permanent change in the risk-taking behaviour of banks that become universal. Alternatively, if GSA constrained optimal behaviour of banks that optimally should have used the universal banking model all along, the repeal of the GSA will lead to the choice of an efficient business model for such banks.

is the improvement of banks' monitoring, which results in the underlying risk profiles either remaining unchanged or improving.

Since corporate governance is one potential factor that might influence riskiness of banks, I consider changes in corporate governance and, in particular, executive and CEO compensation as my next hypothesis. If forming universal banks does indeed give rise to moral hazard, then shareholders and boards will need to provide incentives to mitigate such moral hazard problems. I hypothesize that if governance mechanisms fail to align the incentives of management with that of other stakeholders, universal banks will see an increase in their risk but not necessarily in their return on the underlying assets. Therefore, I expect that if governance mechanisms are not at work, universal banks will see an increase in their return on equity (ROE) but not return on assets (ROA) measures of profitability.

If differences in performance between universal and pure-play commercial banks exist, then it will be important to analyze the direct impact of governance mechanisms. In particular, if universal banking generates more complexity, this might result in universal banks exhibiting more complex executive compensation schemes, more complex boards, more active boards and more shareholder activism.[40]

Following the approach used by Aggarwal and Samwick (2006), I do not hypothesize that greater incentives lead to better firm performance but instead assume that every bank is different, and hence the amount of incentives it provides depends on the level appropriate to the bank. Therefore, my second hypothesis tests the differences between incentive plans as follows:

[40] Given my current data limitations for obtaining governance characteristics for publicly-held banks, in the current version of the paper I only focus on one aspect of corporate governance mechanisms, namely executive compensation. I am in the process of collecting more data to extend this analysis to more governance characteristics.

H2: Universal banks assign less weight to risk-based incentive plans than pure-play commercial banks.

Furthermore, given competitive labor markets and shortage of talent, managers of complex banks with more complex structures are also more likely to demand higher compensation (Himmelberg and Hubbard, 2000). Himmelberg and Hubbard use firm size as a proxy for managerial talent and find that larger firms tend to pay their CEOs more. Extending Himmelberg and Hubbard (2000) conclusions to the setting of the choice of the universal banking model, executives of universal banks are expected to receive higher compensation either because they are more talented or because they manage a more complex entity (or both).

3.3 Data and empirical research design

3.3.1 Research design

The repeal of the GSA represents an exogenous policy change, which allows for the implementation of quasi-experimental methods and identifies causal effects due to the change of policy (treatment effects). For both hypotheses, the effect of the GSA implementation can be estimated using a difference-in-differences methodology in a panel setting (Bertrand and Mullainathan, 2003):

$$y_{it} = \alpha_t + \gamma X_{it} + \delta GSA_Universal_{it} + \varepsilon_{it} \tag{3.1}$$

Where i indexes firms, t indexes time, y_{it} is the dependent variable of interest (risk characteristics or CEO compensation), α_t, is the year-fixed effect, X_{it} are the control variables, *GSA_Universal* is an indicator variable taking the value of one if a bank has become universal after the repeal of the GSA, and ε_{it} is the error term. Note that in this setting using firm-fixed effects will lead to non-identification due to collinearity, which could be mitigated by interacting year- and-firm fixed effects. With this model, the effect of becoming a universal bank is identified by δ.

However, the complication for identification in this setting arises from the fact that while the repeal of the GSA can be qualified as an exogenous shock, the effect of this shock will be different depending on banks' choice of whether to adopt the universal banking model.[41] Hence, in order to identify the treatment effects from the repeal of the GSA, I need to take into account banks' choice of the business model following the policy change (i.e., self-selection into the treatment). I address this concern by implementing a propensity score matching model. I rely on the propensity score match using pre-treatment observable information that predicts the treatment (covariates that predict the likelihood of banks choosing the universal model). The probability of treatment is called the propensity score, and the treatment effect is equal to the outcome for the treated firm minus the outcome for the untreated firm with equal treatment probability (pair-wise matching). The overall treatment effect is the average of these differences. This approach identifies a sample of banks that have similar characteristics before the repeal of the GSA. Having identified these pairs, I construct a panel of observations for these banks only and analyze them using standard difference-in-differences analysis and multivariate techniques.[42]

In order to compute propensity scores, I identify the characteristics of banks most likely to benefit from the repeal of the GSA based on the prior literature: existing large commercial customer base proxied by the proportion of commercial and industrial loans in the total loan portfolio (*CI Loans / Assets*), existence of investment banking relationships proxied by the share of trading assets in total assets (*Trading Assets / Assets*), importance of non-traditional banking activities to the business model of the bank proxied by the proportion of income from trading assets in total income (*Share of Trading Income*), sophistication proxied by the proportion of securitized off-balance

[41] This is sometimes referred to as an event-related self-selection (see Li and Prabhala, 2007).
[42] An alternative set of assumptions might identify the self-selection into the treatment as a selection bias. I test whether my model predicts different results when this approach is used and find similar results.

sheet assets to total assets (*Securitized Off-BS Assets / Assets*), overall profitability proxied by the return on asset and the return on equity ratios (*ROA* and *ROE*), and dependence on the traditional funding base proxied as a ratio of deposits to total assets (*Deposits / Assets*). Calomiris (2000) also identifies asset size (*Assets*) as one of the factors that might influence the choice of universal banking. In addition, I also add to the matching variables some proxies for bank performance: quality of the assets proxied as a proportion of non-performing loans in total assets (*NPL / Assets*), regulatory capital (*Tier 1 / Assets)*, and whether banks have publicly-listed equity (*Public*). Based on the obtained propensity score, I construct a sample of banks that have the same likelihood of becoming universal given these characteristics.

My first hypothesis tests whether the repeal of the GSA has resulted in universal banks becoming more risky than commercial banks. To test my prediction, I implement the following model using ordinary least squares on the propensity-score-matched sample:

$$y_{i,t}=\alpha_t+\delta_1 GSA_Universal_{i,t}+\delta_2 Public_{i,t}+\delta_3 Public_Universal_{i,t}+\gamma Controls_{i,t-1}+\varepsilon_{i,t} \quad (3.2)$$

where i indexes firms and t indexes time, y_{it} is the dependent variable for risk; measured as the standard deviation of annualized daily returns during the year (*Volatility*), proportion of risk-weighted assets to total assets (*Asset Risk*), share of trading revenue (*Trading Income*), and proportion of off-balance sheet securitized assets (*Securitized Off-BS Assets)*.

GSA_Universal is an indicator variable, which takes the value of one after the repeal of the GSA and firm switching its status from a commercial bank to a universal bank. *Public* and *Public_Universal* are indicator variables for whether the bank is publicly listed or not, where the latter is an interaction term between the listing status and the choice of the banking model. I include the interaction term between *Public* and

Universal indicators to identify any incremental effects on risk for banks that are both publicly-listed and universal.

To identify control variables, I follow the approach used by Stiroh (2006) and use the prior reporting period's balance sheet and income statement components that have been identified as potential risk determinants by prior literature. Specifically, I take into account the asset composition in the loan portfolio (*Trading Assets / Assets*), importance of trading revenues (*Share of Trading Income*), overall profitability (*ROA*), provisioning of capital (*Tier 1 / Assets*), quality of the loan book (*NPL / Loans*) and funding choice (*Deposits / Assets*). If banks choosing to become universal indeed exhibit more risky behavior, the coefficient on the indicator for universal banks is expected to be positive, $\delta_1>0$.

In order to test the second hypothesis, I rely on the CEO compensation data and follow Conyon, Core and Guay (2010) to specify the following determinants of CEO compensation: overall size of the firm (*Assets*), growth opportunities (*Book to market*), riskiness of assets (*Asset Risk*), standard deviation of stock returns (*Volatility*) and financial leverage (*Leverage*) measured as the ratio of equity to assets. All variables correspond to the previous period, and apart from the *Book to market* ratio are in natural logarithms.

CEO's compensation is influenced by the size of the firm, its growth opportunities and profitability as well as the CEO's own ability and tenure. Therefore, I estimate the following equation using ordinary least squares:

$$x_{i,t} = \alpha_t + \delta_1 GSA_Universal_{i,t} + \gamma Controls_{i,t-1} + \varepsilon_{i,t} \tag{3.3}$$

where x_{it} is a component of interest from a CEO's overall compensation. I break down the CEO's compensation into total compensation (*CEO Pay*), defined as the sum of salaries, bonuses, benefits and stock equity incentives; the CEO's equity incentives

(*CEO Equity Incentives*);[43] short-term (*Short-term direct compensation)* and long-term (*Long-term direct compensation*) direct compensation to capture cash incentives; and the CEO's compensation sensitivity to the performance of the firm's stock price and its volatility (*CEO's delta* and *CEO's vega*).[44]

Control variables consist of the determinants of CEO compensation lagged by one period, as identified by Conyon, Core and Guay (2011). I expect to find a positive coefficient on the indicator variable for universal banks if compensation is positively associated with the complexity of universal banking. Since my sample for executive compensation data only consists of public firms, I do not test the interaction effect of being a universal and a public bank.

3.3.2 Data and sample selection

My primary sample is comprised of bank holding companies which file FR 9-YC reports with the Federal Reserve. Given that the Glass-Steagall Act was repealed in November 1999 and took effect at the end of the first quarter of 2000 with the first 97 BHC already switching to the universal banking status by March 31, 2000, I use the data for the period prior to the repeal of GSA (Q1 1996 to Q4 1999) and after the repeal of GSA and before the onset of the current financial crisis (Q1 2000 to Q2 2007). This data is made publicly available by the Federal Reserve Bank of Chicago.[45]

The Federal Reserve is the federal supervisor and regulator of all US BHCs, including financial companies and state-chartered banks that are members of the Federal Reserve System. At the end of 2010, there were 5,464 BHCs in operation in the United States, of which 4,844 were top-tier BHCs. These organizations controlled 5,443

[43] Computed as Share price * Number of shares held + Share price * Option delta * Number of options held (Conyon, Core and Guay, 2011).

[44] I follow Core and Guay (1999) and Core and Guay (2002) to compute *CEO's delta* and *CEO's ve*ga using compensation data from ExecuComp and market data from CRSP.

[45] Data is available at http://www.chicagofed.org/webpages/banking/financial_institution_reports/bhc_data.cfm. BHCs are required to submit their regulatory filings within two months after the end of each calendar quarter.

insured commercial banks and held approximately 99% of all insured commercial bank assets in the United States.[46] Under the Federal Reserve Board Regulation Y and the Bank Holding Company Act of 1956, BHCs with total consolidated assets in excess of $500 million are required to file form FR Y-9C every quarter.

Many BHCs are complex companies; while all BHCs must file semi-annual forms Y-9SP, parent (top-tier) BHCs and stand-alone BHCs are required to file FR Y-9C on a quarterly basis if they have total consolidated assets in excess of $500 million ($150 million prior to 2006). I therefore identify BHCs at the top-tier level (*BHCK9802*=1) and BHCs without subsidiaries (*BHCK9802*=3) to use consolidated data and avoid any double-counting.

Prior to 2006, BHCs had to file a quarterly FR Y-9C if their total consolidated assets were in excess of $150 million. Starting from the first quarter of 2006, this threshold increased to $500 million. In my analysis, I use quarterly fixed effects, and therefore I do not control for this shift in reporting directly. As a robustness test, I also estimate my results using the subsample of banks which passed the threshold in 2006 (I use real first quarter of 2006 dollars for this analysis) and find similar results.

Form FR 9-YC contains detailed information on the financial performance of BHCs, their consolidated financial statements and accompanying details as well as exposures and regulatory capital details (the starting sample consists of 2,911 variables). Beginning in 2001, FR Y-9C also started to report more detailed information for bank performance; in particular, requiring banks to provide disaggregated income statement and balance sheet figures.

[46] Federal Reserve 97th Annual Report, 2010, p. 76.

To consider mergers and acquisitions activities as well as bank closures, I manually check the status of all BHCs during the sample period by reviewing each BHC's status and history on the Federal Reserve National Information Center.[47]

I obtain governance and directors' compensation data from Risk Metrics (IRRC) and ExecuComp databases available through the Wharton Research Data Service (WRDS). Out of an average of 2,000 BHCs in a given year, only 150 have compensation data, thus reducing the final sample substantially. For market data on stock prices and returns, I rely on the Center for Research in Securities Prices (CRSP) data.

I require that all banks from the FR Y-9C data have reported total assets, loans and book equity in each quarter. I also truncate the top and bottom 1% of all continuous variables used in my analyses to remove outliers and data errors. This yields my primary sample of 71,169 BHC-quarter observations. The CEO compensation sample is much smaller, with only 1,683 year-bank observations.

3.4 Results

Table 3.1 presents the descriptive statistics for variables used in my analyses as well as several other descriptive variables of interest. Panel A shows the sample used in the risk analysis while Panel B presents descriptive statistics for the data used in the CEO compensation analysis. Panel C shows the number of universal and public banks during the sample period. The descriptive statistics in Panel A and Panel B are split between the pre-repeal of the GSA (GSA) and post-repeal of the GSA (post-GSA) periods. One can see that on average 21% of banks in the sample are universal and 23% of firms are public. Total assets (measured in thousands of US dollars) are skewed with average total assets of 1.6 and 1.5 billion in the pre- and post-GSA periods respectively. One

[47] http://www.ffiec.gov/nicpubweb/nicweb/SearchForm.aspx

striking observation between the two periods is that, on average, the two subsamples are quite similar. However, *Asset Risk* (the proportion of risk-weighted assets in total assets) increased from an average of 65% to 71%, while the reliance on deposits decreased from 81% to 79% and liquidity decreased from 30% to 27%. Securitized off-balance sheet assets increased from 4.5% to 5.9%. Interestingly, volatility actually decreased from 38% to 31%.

Panel B presents a much smaller sample for the compensation analysis. Interesting differences between the two time periods are as follows: a large increase in the level of assets (note that the difference between Panel A and Panel B is due to the trimming of the 1% of the outliers in the first sample); a small increase in the *Book-to-market* ratio from 8% to 8.5%; more than doubling of CEO's equity incentives; more than doubling of CEO's vega (from 13% to 30%); and a significant decline in CEO's direct short-term and long-term compensation (from 3,075 to 1,944 thousand and 1,549 to 284 thousand, respectively).

Table 3.3 presents the univariate comparisons between universal and pure-play commercial banks using the difference-in-differences methodology to identify the effect of the treatment (the repeal of GSA) on banks that became universal (the treated). Panel A presents the difference-in-differences analysis utilizing the causal identification for the differences resulting due to the repeal of the Glass-Steagall Act. As can be seen from this table, in the risk sample, there is a significant increase in volatility (an average effect of 2%), asset risk (0.5%), securitized assets (0.4%) and a decrease in the Tier 1 ratio of 0.2%. These results should be interpreted with caution, however, as Panel B of Table 3.3, which presents the difference-in-differences analysis specifically for the immediate period before and after the repeal of the GSA, shows a statistically significant difference due to the repeal of Glass-Steagall only for the share of trading

assets and ROE.[48] From this, we can infer that the immediate effect of the repeal of the Glass-Steagall Act was insignificant. Panel C of Table 3.3 shows the variables used to construct the matched sample using the observations from 1999, the last year before the repeal of the GSA. Only the matched pairs that are both on the common support and have a weight of one are kept in the matched sample.

Table 3.4 presents the multivariate results of the analysis of the impact of the repeal of Glass-Steagall and banks' choice to switch to the universal banking model from equation (3.2) using the full sample in Panel A and the propensity-score-matched sample in Panel B. The first important point to note is that the indicator variable for whether banks have elected to become universal or not is not significant for all specifications of risk variables. BHC asset size is highly significant across all model specifications.

Column (1) of Table 3.4 measures the impact of the choice of the universal banking model on the volatility of stock returns. In this specification, only the asset size, $Ln(Assets)_{t-1}$ and profitability $(ROA)_{t-1}$ are significant. Both have negative signs and are significant at the 1% level of significance. Columns (2), (3) and (4) correspond to the specification that uses *Asset Risk* (the ratio of risk-weighted assets to total assets) as a proxy for riskiness of banks, and in this specification BHC size, the proportion of Tier 1 capital in total assets, proportion of deposits in total assets and profitability are all highly significant at the 1% level. Another interesting effect in this specification is that publicly-held banks appear to be more risky. The coefficients in columns (3) and (4) suggest that the ratio of risky assets to total assets increases by approximately 1% for publicly-held banks compared to privately-held banks.

[48] As a robustness test, I also extend the test window to two and three years on both ends (1998-1999 and 2000-2001 pre- and post-windows and 1997-1999 and 2000-2002 pre-post windows, respectively) and find similar results.

Columns (5) to (7) refer to the share of trading income in total income as a proxy for the riskiness of the underlying operating strategy. In this specification it appears that the share of trading income from the previous period drives most of the results, which is not surprising as the choice of focusing more operations on trading activities is likely to be persistent over time. Finally, columns (8) to (9) use the proportion of off-balance sheet securitized assets in total assets as a measure of the riskiness of the bank. In this specification, asset risk is higher for publicly-held BHC.

Panel B of Table 3.4 presents the results for the propensity-score matched sample. The findings are similar to those of Panel A, with the only exception of the coefficient on the universal bank indicator being significant for the specification in column (5). The effect, however, is not economically meaningful.

The above discussion suggests that there is insufficient evidence to conclude that universal banking increases risk for banks that choose to become universal. Furthermore, it is also possible to conclude that the impact of the repeal of the GSA is insignificant.

Next, I move to the analysis of the second hypothesis, which examines whether the universal banking model created different compensation and payment incentive structures. Table 3.5 presents the difference-in-difference analysis for banks that chose to become universal before and after the repeal of the GSA. Panel A presents the propensity-score matched sample for the whole period of study, while Panel B compares the immediate effects of the repeal of the GSA between the end of 1999 when the decision was first announced and the end of 2000, the first year when it came into force. Panel C presents the results of the matching procedure for the identifying covariates.

Panel A, column (9) shows that for the overall sample, the repeal of the GSA resulted in an overall increase of total compensation, increase of equity incentives and increase of the sensitivity of CEOs' pay to changes in stock prices and volatility of stock returns for CEOs of banks that became universal. One possible explanation for this change is that the complexity and scale of banks changed over the whole sample period. Panel B shows that the repeal of the GSA did not result in significant changes to CEOs' compensation in banks that became universal. However, column (3) and column (7) suggest that differences between these two types of banks existed even prior to the repeal of the GSA.

Finally, Table 3.6 presents the multivariate tests of the effect of the repeal of the GSA and banks' choice to become universal on their CEOs' compensation. Panel A presents the results for the whole sample. Panel B shows the results for the propensity-score-matched sample. In both panels, the coefficients on the *Universal* indicator variable are insignificant across all specifications. Panel A shows that, in line with prior literature, changes to CEOs' compensation are driven by asset size, *Book to Market* and *Leverage*.

Therefore, similar to the tests of the first hypothesis, I do not find conclusive evidence that the repeal of the GSA has led to changes in pay incentives for CEOs of banks that chose to become universal.

3.5 Conclusion

This chapter studies whether universal banks exhibit more risky behavior and implement additional corporate governance mechanisms compared to pure-play commercial banks. Using the unique setting of the repeal of the Glass-Steagall Act in the United States in 1999, this paper implements a combination of difference-in-difference analyses and propensity score matching. I construct treatment and control

groups matching banks that were similar in their size and other characteristics prior to the repeal of the Glass-Steagall Act and then compare the average treatment effects between these two groups. I utilize this methodology in order to disentangle the effect of the change of the policy (the repeal of the GSA), which is exogenous, and the choice of each bank to adopt the universal banking model, which is likely to be endogenous.

I hypothesize that there is a difference between universal and pure-focus banks due to the existence of explicit and implicit government guarantees and resulting differences in incentive structures. I find no significant differences in either the risk profile of banks or compensation structures of banks' CEOs which can be attributed to the repeal of the GSA. Furthermore, using the matched sample of universal and pure-play banks, I find no incremental effect from the choice of the universal banking model on either risk or structure of banks' CEOs' compensation.

My analysis and conclusions could potentially have some policy implications and contribute to the ongoing debate of whether the universal banking model can persist. In particular, my results seem to suggest that there is neither risk- nor governance-based justification for implementing drastic changes such as prohibiting universal banking in the future.

Appendix 3.A: Variable definitions

Variable	Definition	Source	Code
General			
Universal	Indicator variable for whether a bank is a universal bank or not	FR Y-9C	RSSD9346='FHD'
Public	Indicator variable for whether a bank is publicly-held or not	FR Y-9C, CRSP and Datastream	RSSD9161
Matching and control variables (Risk analysis)			
Asset Risk	Ratio of Risk-Weighted Assets (RWA) to total assets	FR Y-9C	BHCKA223 / BHCK2170
Assets	Total assets of the bank in '000s (or natural logarithm of total assets)	FR Y-9C	BHCK2170
CI Loans[49] / Assets	Commercial and industrial loans as a proportion of total assets	FR Y-9C	(BHCK1763 + BHCK2011) / BHCK2170
Deposits / Assets	Total deposits as a proportion of total assets	FR Y-9C	BHCB2210 + BHOD3189 + BHFN6636 + BHCB3187 + BHOD3187 + BHCB2389 + BHOD2389 + BHCB6648 + BHOD6648
Liquid Assets / Assets	Liquid assets as a proportion of total assets	FR Y-9C	(BHCK0081 + BHCK0395 + BHCK0397 + BHCK1754 + BHCK1773) / BHCK2170
NPL/Loans	Non-performing loans as a proportion of total loans	FR Y-9C	(BHCK5526 - BHCK3507 + BHCK1616 + BHCK5525 - BHCK3506) / BHCK2122
ROA	Return on assets (Net Income divided by average total assets)	FR Y-9C	BHCK4340 / BHCK3368
ROE	Return on equity (Net Income divided by shareholders' equity)	FR Y-9C	BHCK4340 / BHCK3210
Securitized Assets / Assets	Total securitized assets as a proportion of total assets	FR Y-9C	(BHCKB705 + BHCKB706 + BHCKB707 + BHCKB708 + BHCKB709 + BHCKB710 + BHCKB711) / BHCK2170
Securitized Off-BS Assets / Assets	Securitized off-balance sheet assets as a proportion of total assets	FR Y-9C	(BHCK3814 + BHCK3816 + BHCKJ455 + BHCKJ456 + BHCK6550 + BHCKJ457 + BHCKJ458 + BHCKJ459 + BHCK3411) / BHCK2170
Share of Trading Income	Share of income from trading activities in net income	FR Y-9C	BHCKA220 / BHCK4340
Tier 1 Leverage Ratio[50]	Tier 1 Leverage ratio (Tier 1 capital / Assets for leverage ratio calculations)	FR Y-9C	BHCK7204
Tier 1[51] Capital / Assets	Tier 1 Equity as a proportion of total assets	FR Y-9C	BHCK8274 / BHCK2170
Trading Assets / Assets	Net trading assets as a proportion of total assets	FR Y-9C	(BHCK3545 - BHCK3548) / BHCK2170
Volatility	Annualized standard	CRSP	

[49] Prior to 2001, BHCK2008 / BHCK2170.
[50] Prior to 2001, Tier 1 Capital / Assets for Leverage Calculation is based on the following (BHCK8274 / BHCKA224).
[51] Tier 1 equity is available from 2006.

Variable	Definition	Source	Code
	deviation of firm stock returns (using rolling window daily observations)		
Matching and control variables (Executive compensation analysis)			
Book to market	The ratio of book value of assets to the sum of book value of liabilities plus market value of equity.	FR Y-9C, CRSP	
CEO Equity Incentives	CEO Equity incentives are in equivalent stock value defined as Share price * Number of shares held + Share price * CEO delta * Options Held	ExecuComp, CRSP	
CEO Pay	CEO's total compensation	ExecuComp	TDC1
CEO-chair	Indicator variable for whether the CEO is also the chair of the board	RiskMetrics	EMPLOYMENT_CHAIRMAN
CEO's delta[52]	Sensitivity of CEO's compensation to stock price	ExecuComp, FR Y-9C, and CRSP	
CEO's vega	Sensitivity of CEO's compensation to stock return volatility	ExecuComp, FR Y-9C, and CRSP	
Closely held shares	Percentage of closely held shares	RiskMetrics	
Compensation proposal	Indicator variable equal one if compensation proposal is submitted in that year	RiskMetrics	
Interlocking	Indicator variable equal one if board is interlocked	RiskMetrics	
Long-term direct compensation	All other compensation	ExecuComp	TDC1 - salary - bonus
Restricted shares	Restricted shares held by the CEO	ExecuComp	
Shareholder return	One-year total return to the shareholders	CRSP	
Short-term direct compensation	Salary and bonus	ExecuComp	salary + bonus
Tenure	Number of years the CEO has held the position.	ExecuComp	Year (*t*)-Year(becameceo) if Date<=leftofc

[52] CEO's *delta* and *vega* are computed using Core and Guay (1999) and Core and Guay (2002) methodology.

Table 3.1: Descriptive statistics

This table contains descriptive statistics for the two samples used in the analysis for the period of 1996Q1-2007Q2. Panel A presents the sample used in the risk analysis, and Panel B presents the sample used in the executive compensation analysis. Panel C shows the number of universal and public banks in the sample (annually for the whole sample and quarterly from 1999Q4 to 2002Q1). Dependent variables are adjusted for the effect of the outliers by removing the top and bottom 1% of the distribution. Dependent variables presented in levels are in real 1999 dollars. Variables are defined in Appendix 3.A.

Panel A: Risk sample

	1996Q1-1999Q4 (GSA)						2000Q1-2007Q2 (post-GSA)					
Variable	**N**	**Std.**	**Min**	**Mean**	**Median**	**Max**	**N**	**Std.**	**Min**	**Mean**	**Median**	**Max**
Universal	18,076	0	0	0	0	0	53,093	0.4092	0.0000	0.2127	0.0000	1.0000
Public	18,076	0.3734	0.0000	0.1675	0.0000	1.0000	53,093	0.4230	0.0000	0.2335	0.0000	1.0000
Asset Risk	17,348	0.1029	0.3734	0.6547	0.6584	0.9632	51,942	0.1089	0.3733	0.7084	0.7152	0.9632
Assets	17,638	6,373,359	148,621	1,676,542	311,980	77,600,000	52,109	5,517,718	148,641	1,534,926	362,598	77,600,000
CI Loans / Assets	17,631	0.0633	0.0011	0.1080	0.0968	0.3553	52,115	0.0637	0.0011	0.1068	0.0954	0.3549
Deposits / Assets	17,598	0.1145	0.0290	0.8067	0.8414	0.9187	52,149	0.1054	0.0293	0.7929	0.8176	0.9187
Liquid Assets / Assets	17,809	0.1053	0.0515	0.3081	0.2971	0.6437	51,938	0.1174	0.0514	0.2664	0.2505	0.6438
NPL/Loans	17,906	0.0019	0.0000	0.0015	0.0009	0.0116	52,551	0.0018	0.0000	0.0012	0.0004	0.0116
ROA	17,364	0.0012	-0.0024	0.0029	0.0029	0.0077	51,301	0.0013	-0.0025	0.0027	0.0027	0.0077
ROE	17,372	0.0135	-0.0311	0.0326	0.0321	0.0888	51,266	0.0154	-0.0318	0.0314	0.0305	0.0887
Securitized Off-BS Assets / Assets	17,983	0.0379	0.0000	0.0445	0.0355	0.2369	52,474	0.0459	0.0000	0.0593	0.0490	0.2370
Share of Trading Income	17,079	0.0171	-0.0047	0.0028	0.0000	0.2461	50,115	0.0164	-0.0048	0.0023	0.0000	0.2463
Tier 1 Leverage Ratio	17,274	0.0000	0.0000	0.0000	0.0000	0.0000	52,012	3.6501	0.0000	0.0787	0.8360	0.1773
Tier1 Capital / Assets	16,743	0.0237	0.0443	0.0884	0.0855	0.1891	50,804	0.0230	0.0443	0.0889	0.0848	0.1896
Trading Assets / Assets	17,830	0.0018	0.0000	0.0003	0.0000	0.0232	52,398	0.0013	0.0000	0.0002	0.0000	0.0233
Volatility	4,744	0.1106	0.1375	0.3801	0.3639	0.7759	11,803	0.1103	0.1372	0.3114	0.2902	0.7749

Panel B: Compensation sample

	1996Q1-1999Q4 (GSA)						2000Q1-2007Q2 (post-GSA)					
Variable	**N**	**Std.**	**Min**	**Mean**	**Median**	**Max**	**N**	**Std.**	**Min**	**Mean**	**Median**	**Max**
Universal	336	0	0	0	0	0	766	0.4962151	0	0.5639687	1	1
Assets	315	95,600,0	405,03	49,300,00	16,200,00	717,000,00	682	278,000,00	899,06	97,500,00	16,800,00	2,740,000,00
Ln(Assets)	273	1.4068	12.869	16.8903	16.6959	21.3852	577	1.4658	12.866	16.6194	16.3094	21.5061
Book to market	273	0	0	0	0	0	568	0	0	0	0	0
Ln(Volatility)	273	0.3828	-2.0609	-1.3243	-1.3569	0.4773	574	0.5444	-2.1787	-1.1121	-1.1948	1.0673
Asset Risk	205	0.1428	0.3344	0.7551	0.7594	1.1387	534	0.1430	0.2774	0.7468	0.7542	1.2217
Equity to total assets	273	0.0185	0.0435	0.0834	0.0811	0.1722	571	0.0229	0.0225	0.0897	0.0880	0.2079
CEO Pay	313	6,737	322	4,734	2,552	84,825	678	12,539	77	6,944	3,187	238,619
CEO Equity Incentives	286	321,592	741	95,962	22,566	3,351,240	488	1,144,047	38	252,476	29,664	17,900,000
CEO's delta	302	0.4399	0.0000	0.3164	0.1727	3.8870	514	0.9216	0.0013	0.4661	0.1908	10.7948
CEO's vega	302	0.2179	0.0000	0.1293	0.0520	2.0723	514	0.5219	0.0000	0.3006	0.1151	5.3809
CEO Options Held	336	1,253	0	850	454	9,969	682	412	0	858	839	3,438
Salary	315	248	141	659	640	2,000	678	10,736	0	4,753	1,766	218,407
Long-term direct compensation	313	5,992	5	3,075	1,326	81,075	766	3,062	0	1,944	1,113	32,915
Short-term direct	336	1,517	0	1,549	1,105	10,402	490	1,209	0	284	0	13,407
LTIP	315	572	0	230	0	5,529	766	3,764	0	1,576	573	77,947
Tenure	257	6	0	7	6	24	604	6	0	7	5	32

Panel C: Composition of bank types in the whole sample

Year	Not-Universal	Universal	Private	Public	Total
1996	1,338	0	1,153	185	1,338
1997	1,438	0	1,224	214	1,438
1998	1,544	0	1,278	266	1,544
1999	1,647	0	1,317	330	1,647
2000	1,419	308	1,366	361	1,727
2001	1,443	399	1,437	405	1,842
2002	1,534	445	1,536	443	1,979
2003	1,670	462	1,656	476	2,132
2004	1,766	488	1,743	511	2,254
2005	1,793	475	1,752	516	2,268
2006	676	308	609	375	984
2007	660	303	610	353	963

	Not-Universal	Universal	Private	Public	Total
31-Dec-99	1,647	0	1,317	330	1,647
31-Mar-00	1,578	97	1,334	341	1,675
30-Jun-00	1,478	214	1,340	352	1,692
30-Sep-00	1,448	271	1,361	358	1,719
31-Dec-00	1,419	308	1,366	361	1,727
31-Mar-01	1,437	329	1,395	371	1,766
30-Jun-01	1,444	364	1,425	383	1,808
30-Sep-01	1,452	384	1,441	395	1,836
31-Dec-01	1,443	399	1,437	405	1,842
31-Mar-02	1,466	418	1,473	411	1,884

Table 3.2: Correlations of the main variables

This table presents correlation coefficients for the variables used in the analysis. Panel A presents the variables used in the risk analysis, and Panel B presents the data for the subsample used for the compensation analysis. Correlations are computed for the whole sample of 1996Q1-2007Q2. * refers to significance at 10% level. Pearson correlation coefficients are presented below the diagonal, and Spearman correlation coefficients are above the diagonal. Variables are defined in Appendix 3.A.

Panel A: Risk sample

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Universal	1	0.0744*	0.1299*	0.1943*	0.0614*	-0.1750*	-0.1030*	-0.0041	0.0186*	0.0064	0.0960*	0.0440*
(2)	Public	0.1204*	1	0.0836*	0.0513*	-0.0567*	0.0471*	-0.0828*	-0.1049*	0.0706*	0.0535*	0.1292*	-0.0523*
(3)	Asset Risk	0.1026*	0.0964*	1	0.1180*	0.4265*	0.0841*	-0.7249*	-0.0532*	0.0869*	0.0919*	0.4395*	0.0919*
(4)	Assets	0.1439*	0.1679*	0.0885*	1	0.0868*	-0.3974*	0.0520*	0.1242*	0.2445*	0.3116*	0.1547*	0.3657*
(5)	CI Loans / Assets	0.0262*	-0.0019	0.4141*	0.0871*	1	0.0599*	-0.2195*	0.0733*	0.0850*	0.0721*	0.0354*	0.1689*
(6)	Deposits / Assets	-0.1636*	-0.1727*	0.0407*	-0.3539*	0.0577*	1	-0.1130*	-0.0878*	0.0411*	-0.0138*	-0.0517*	-0.1524*
(7)	Liquid Assets / Assets	-0.0741*	-0.0629*	-0.7506*	-0.0259*	-0.2769*	-0.0364*	1	0.0227*	0.0302*	0.0456*	-0.3463*	0.0631*
(8)	NPL/Loans	-0.0521*	-0.0616*	0.0087*	0.0032	0.0133*	0.0324*	-0.0459*	1	0.0582*	0.0041	-0.1529*	0.0818*
(9)	ROA	-0.0064*	0.0117*	0.0397*	0.0516*	-0.0022	0.0494*	0.0336*	0.0159*	1	0.7814*	-0.0143*	0.0943*
(10)	ROE	-0.0001	0.0054	0.1332*	0.0806*	0.0664*	0.0535*	-0.0810*	-0.0234*	0.7818*	1	0.0413*	0.1451*
(11)	Securitized Off-BS Assets / Assets	0.0941*	0.1885*	0.4224*	0.0853*	0.0685*	-0.0230*	-0.3312*	-0.1350*	-0.0064*	0.0826*	1	0.0381*
(12)	Share of Trading Income	0.1042*	0.0778*	0.0597*	0.3851*	0.1041*	-0.2382*	-0.0014	-0.0041	0.0221*	0.0352*	0.0349*	1
(13)	Tier 1 Leverage Ratio	0.2355*	0.0683*	0.1995*	-0.0418*	-0.0526*	-0.0402*	-0.1308*	-0.0752*	0.0006	-0.0933*	0.1581*	-0.0288*
(14)	Tier1 Capital / Assets	-0.0335*	-0.0236*	-0.1129*	-0.1102*	-0.1221*	0.0135*	0.1576*	0.0484*	0.2356*	-0.2116*	-0.1062*	-0.0573*
(15)	Trading Assets / Assets	0.0906*	0.0811*	0.0082*	0.3825*	0.0625*	-0.2496*	0.0229*	0.0015	0.0137*	0.0368*	0.0168*	0.4622*
(16)	Volatility	-0.1688*	-0.1766*	-0.0801*	-0.1447*	0.0461*	0.0634*	0.0217*	0.0727*	-0.1098*	-0.0868*	-0.1462*	-0.0498*

Panel A: Risk sample (contd.)

		(13)	(14)	(15)	(16)
(1)	Universal	0.2872*	-0.0507*	0.0723*	-0.1668*
(2)	Public	0.2356*	0.0625*	-0.0356*	-0.1728*
(3)	Asset Risk	0.2803*	0.0811*	0.1172*	-0.0972*
(4)	Assets	-0.0416*	-0.3088*	0.4299*	-0.2763*
(5)	CI Loans / Assets	-0.0535*	0.0164*	0.1836*	0.0454*
(6)	Deposits / Assets	-0.0277*	0.1478*	-0.2001*	0.1444*
(7)	Liquid Assets / Assets	-0.2243*	-0.0574*	0.0314*	0.0503*
(8)	NPL/Loans	-0.2368*	-0.0139*	0.1017*	0.0733*
(9)	ROA	-0.0403*	0.1963*	0.1209*	-0.1084*
(10)	ROE	-0.1435*	-0.1884*	0.1753*	-0.0772*
(11)	Securitized Off-BS Assets / Assets	0.2572*	-0.0388*	0.0660*	-0.1735*
(12)	Share of Trading Income	-0.1056*	-0.1703*	0.6400*	-0.0774*
(13)	Tier 1 Leverage Ratio	1	0.3131*	-0.1128*	-0.3539*
(14)	Tier1 Capital / Assets	0.2697*	1	-0.1837*	0.0160*
(15)	Trading Assets / Assets	-0.0391*	-0.0541*	1	-0.1206*
(16)	Volatility	-0.3580*	0.0242*	-0.0443*	1

Panel B: Compensation sample

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	Universal	1	0.3499*	0.2747*	-0.0099	0.0794	0.044	-0.0099	0.3299*	0.1989*	0.2584*	0.3635*	0.4091*
(2)	Assets	0.2556*	1	0.8996*	-0.0653	-0.1151*	0.1825*	-0.0666	0.7405*	0.6050*	0.6853*	0.7439*	0.7198*
(3)	Ln(Assets)	0.2616*	0.5883*	1	0.0026	-0.1189*	0.2161*	0.0192	0.6748*	0.5649*	0.6134*	0.6281*	0.5771*
(4)	Book to market	0.0317	-0.1030*	-0.0195	1	-0.0585	0.2241*	0.8987*	-0.1107*	-0.1489*	-0.0786	-0.0326	-0.0643
(5)	Volatility	0.0533	-0.0246	-0.0984*	0.0842*	1	-0.0179	-0.1113*	0.0443	-0.0276	-0.0471	-0.0425	0.0329
(6)	Asset Risk	0.0673*	-0.0485	0.1437*	0.1675*	0.0098	1	0.2616*	0.0533	0.0509	0.0798	0.0803*	0.0598
(7)	Equity to total assets	0.0543	-0.1398*	-0.0486	0.8909*	0.0630*	0.2227*	1	-0.1034*	-0.1432*	-0.0877*	-0.0319	-0.0721
(8)	CEO Pay	0.2180*	0.5158*	0.4878*	-0.0452	-0.0226	-0.0352	-0.0475	1	0.6736*	0.7807*	0.8043*	0.7607*
(9)	CEO Equity Incentives	0.1002*	0.2181*	0.2199*	0.0665*	-0.0153	-0.0428	0.0927*	0.7324*	1	0.7836*	0.6623*	0.6076*
(10)	CEO's delta	0.1647*	0.3920*	0.4356*	0.0449	-0.0162	0.0151	0.0339	0.7590*	0.8148*	1	0.8191*	0.6292*
(11)	CEO's vega	0.3010*	0.5947*	0.5476*	-0.0024	-0.0247	0.0272	-0.0088	0.7763*	0.6405*	0.8504*	1	0.7329*
(12)	CEO Options Held	0.3154*	0.3279*	0.4347*	0.0236	-0.014	0.0166	-0.0014	0.4610*	0.2094*	0.4011*	0.4199*	1
(13)	Salary	0.1862*	0.4250*	0.4224*	-0.036	-0.0292	-0.0264	-0.032	0.9752*	0.7386*	0.7096*	0.7210*	0.3793*
(14)	Long-term direct compensation	0.2227*	0.6032*	0.5115*	-0.0719*	-0.0029	-0.0477	-0.0955*	0.6486*	0.4091*	0.6146*	0.6445*	0.5412*
(15)	Short-term direct compensation	0.1434*	0.0627*	0.2056*	-0.0913*	0.1275*	-0.0906*	-0.1064*	0.1214*	-0.036	0.0191	0.0388	0.1103*
(16)	LTIP	0.1948*	0.3908*	0.3379*	-0.0004	0.0198	-0.005	0.0088	0.6008*	0.7287*	0.8437*	0.8255*	0.3736*
(17)	Tenure	-0.0185	-0.1188*	-0.1133*	0.0335	-0.0238	-0.0306	0.0353	-0.0815*	-0.0098	-0.0538	-0.0846*	0.0906*

Panel B: Compensation sample (contd.)

		(13)	(14)	(15)	(16)	(17)
(1)	Universal	0.2855*	0.3092*	0.0389	0.3167*	-0.0507
(2)	Assets	0.6765*	0.6701*	0.3205*	0.6280*	-0.0449
(3)	Ln(Assets)	0.6359*	0.5821*	0.3457*	0.5284*	-0.0593
(4)	Book to market	-0.1111*	-0.0862*	-0.1495*	-0.0864*	0.0648
(5)	Volatility	0.0354	0.0622	-0.0537	-0.0059	-0.0642
(6)	Asset Risk	0.0495	0.0811*	-0.0364	0.0442	0.0252
(7)	Equity to total assets	-0.0976*	-0.0987*	-0.1304*	-0.0967*	0.0714
(8)	CEO Pay	0.9407*	0.8044*	0.2599*	0.7521*	0.0215
(9)	CEO Equity Incentives	0.5914*	0.6044*	0.0788	0.6917*	0.2108*
(10)	CEO's delta	0.7043*	0.6795*	0.1233*	0.8795*	0.069
(11)	CEO's vega	0.7673*	0.6526*	0.1073*	0.8688*	0.0374
(12)	CEO Options Held	0.6234*	0.8293*	0.1630*	0.6786*	0.1611*
(13)	Salary	1	0.6076*	0.2985*	0.6833*	-0.041
(14)	Long-term direct compensation	0.4642*	1	0.1579*	0.6316*	0.0852*
(15)	Short-term direct compensation	0.1201*	0.0754*	1	0.052	-0.0181
(16)	LTIP	0.5568*	0.5037*	-0.0033	1	0.0980*
(17)	Tenure	-0.0656*	-0.1031*	0.0189	-0.0681*	1

Table 3.3: Comparison of universal and non-universal banks (using unmatched and matched samples, risk sample)

This table presents the results of the propensity score matching procedure. Panel A shows the difference in means for the whole matched sample, Panel B shows the difference in the effects from the immediate implementation of the policy and Panel C shows the reduction in bias due to matching. Treatment identifies universal banks. Dependent variables are adjusted for the effect of the outliers by removing the top and bottom 1% of the distribution. Variables are defined in Appendix 3.A, ***, **, and * designate significance at 1%, 5% and 10% levels, respectively.

Panel A: All years

	GSA				Post-GSA				Difference - in - Differences	
Variable	**Control**	**Treated**	**Difference**	**p-value**	**Control**	**Treated**	**Difference**	**p-value**		**p-value**
	(1)	(2)	(3) = (2) - (1)	(4)	(5)	(6)	(7) = (6) - (5)	(8)	(9) = (7) - (3)	(10)
Volatility	0.383	0.351	-0.032	0.000***	0.348	0.333	-0.015	0.000***	0.018	0.000***
Asset Risk	0.647	0.658	0.011	0.000***	0.707	0.723	0.015	0.000***	0.005	0.019**
Share of Trading Income	0.001	0.004	0.003	0.000***	0.001	0.004	0.003	0.000***	0.000	0.881
Securitized Off-BS Assets / Assets	0.037	0.038	0.001	0.004***	0.059	0.065	0.006	0.000***	0.004	0.000***
Assets	810,000	2,600,000	1,800,000	0.000***	1,200,000	3,500,000	2,300,000	0.000***	460,000	0.000***
CI Loans / Assets	0.104	0.108	0.004	0.000***	0.103	0.111	0.009	0.000***	0.005	0.000***
Trading Assets / Assets	0.000	0.000	0.000	0.000***	0.000	0.000	0.000	0.000***	0.000	0.359
Share of Trading Income	0.001	0.004	0.003	0.000***	0.001	0.004	0.003	0.000***	0.000	0.881
Tier 1 Capital / Assets	0.089	0.088	-0.002	0.000***	0.09	0.086	-0.004	0.000***	-0.002	0.000***
Deposits / Assets	0.836	0.811	-0.025	0.000***	0.799	0.773	-0.026	0.000***	0.000	0.858
NPL/Loans	0.002	0.002	0.000	0.000***	0.001	0.001	0.000	0.000***	0.000	0.000***
ROA	0.003	0.003	0.000	0.000***	0.003	0.003	0.000	0.969	0.000	0.000***
ROE	0.032	0.034	0.002	0.000***	0.030	0.030	0.000	0.491	-0.002	0.000***

Panel B: 1999 and 2000

	GSA (1999)				Post-GSA (2000)				Difference - in – Differences	
Variable	**Control**	**Treated**	**Difference**	**p-value**	**Control**	**Treated**	**Difference**	**p-value**		**p-value**
	(1)	(2)	(3) = (2) - (1)	(4)	(5)	(6)	(7) = (6) - (5)	(8)	(9) = (7) - (3)	(10)
Volatility	0.415	0.392	-0.022	0.001***	0.431	0.42	-0.011	0.112	0.012	0.228
Asset Risk	0.664	0.675	0.011	0.000***	0.682	0.694	0.012	0.000***	0.001	0.829
Share of Trading Income	0.001	0.004	0.003	0.000***	0.001	0.005	0.004	0.000***	0.002	0.011**
Securitized Off-BS Assets / Assets	0.047	0.05	0.003	0.003***	0.046	0.051	0.005	0.000***	0.004	0.352
Assets	830,000	3,000,000	2,200,000	0.000***	790,000	3,100,000	2,300,000	0.000***	160,000	0.502
CI Loans / Assets	0.108	0.115	0.007	0.001***	0.111	0.119	0.008	0.000***	0.002	0.568
Trading Assets / Assets	0.000	0.000	0.000	0.000***	0.000	0.000	0.000	0.000***	0.000	0.698
Tier 1 Capital / Assets	0.089	0.087	-0.002	0.000***	0.089	0.085	-0.004	0.000***	-0.001	0.142
Deposits / Assets	0.812	0.79	-0.023	0.000***	0.807	0.785	-0.022	0.000***	0.000	0.858
NPL/Loans	0.002	0.001	-0.001	0.000***	0.001	0.001	0.001	0.002***	0.000	0.103
ROA	0.003	0.003	0.000	0.002***	0.003	0.003	0.000	0.033**	0.000	0.496
ROE	0.032	0.034	0.002	0.000***	0.032	0.033	0.000	0.001***	-0.002	0.000***

Panel C: Matching

		Mean			%reduct.		t-test
	Sample	**Treated**	**Control**	**%bias**	**|bias|**	**t**	**p>|t|**
Assets	Unmatched	3,100,000	880,000	29.700		6.420	0.000
	Matched	3,100,000	1,400,000	22.600	23.700	3.300	0.003
CI Loans / Assets	Unmatched	0.1154	0.1092	9.700		1.660	0.098
	Matched	0.1154	0.1180	-4.100	57.000	-0.570	0.571
Trading Assets / Assets	Unmatched	0.0003	0.0001	12.000		2.070	0.039
	Matched	0.0003	0.0002	9.300	22.400	1.260	0.208
Share of Trading Income	Unmatched	0.0045	0.0012	18.400		3.710	0.000
	Matched	0.0045	0.0023	12.400	32.900	1.660	0.098
Tier 1 Capital / Assets	Unmatched	0.0865	0.0893	-12.000		-1.980	0.048
	Matched	0.0865	0.0859	2.300	81.100	0.350	0.730
Deposits / Assets	Unmatched	0.7899	0.8133	-21.900		-3.960	0.000
	Matched	0.7899	0.7951	-4.900	77.500	-0.620	0.536
NPL/Loans	Unmatched	0.0013	0.0016	-19.500		-3.140	0.002
	Matched	0.0013	0.0012	6.400	67.300	1.100	0.274
ROA	Unmatched	0.0029	0.0028	9.700		1.620	0.106
	Matched	0.0029	0.0029	4.800	50.300	0.720	0.472
ROE	Unmatched	0.0336	0.0318	15.100		2.580	0.010
	Matched	0.0336	0.0334	2.000	87.000	0.290	0.774
Public	Unmatched	0.2861	0.1456	35.200		6.440	0.000
	Matched	0.2861	0.2836	0.600	98.200	0.080	0.937
Securitized Off-BS Assets / Assets	Unmatched	0.0506	0.0476	7.700		1.300	0.194
	Matched	0.0506	0.0507	-0.500	93.400	-0.070	0.941

Table 3.4: Universal banking and risk

This table presents the estimation results of the impact of the adoption of universal banking on bank risk characteristics using several measures of risk. Panel A uses the entire sample, while Panel B presents the results for the sample created using propensity score matching. Column (1) shows the effects of universal banking on annual *Volatility*. Columns (2) – (3) measure the effect of universal banking on *Asset Risk* measured as the proportion of risk-weighted assets to total assets. Columns (5) – (6) study the effect on the *Share of Trading Income*, and columns (8) – (9) show the effects on the *Off-Balance Sheet* activities. Dependent variables are adjusted for the effect of the outliers by removing the top and bottom 1% of the distribution. Control variables are lagged by one quarter. Quarterly observations are for the period of 1996Q1 to 2007Q2. Variables are defined in Appendix 3.A, and ***, **, and * designate significance at 1%, 5% and 10% levels, respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

Panel A: Whole sample

	Volatility	**Asset Risk**	**Asset Risk**	**Asset Risk**	**Trading Income**	**Trading Income**	**Trading Income**	**Securitized Off-BS Assets**	**Securitized Off-BS Assets**	**Securitized Off-BS Assets**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Universal	0.0045	0.0062	0.0060	0.0079	0.0001	0.0001	0.0001	-0.0001	-0.0004	0.0006
	(0.863)	(1.258)	(1.217)	(1.373)	(1.197)	(1.228)	(0.686)	(-0.061)	(-0.206)	(0.273)
Public			0.0092*	0.0104*		-0.0001	-0.0001**		0.0109***	0.0115***
			(1.835)	(1.939)		(-1.585)	(-2.354)		(5.630)	(5.517)
Universal * Public				-0.0063			0.0001			-0.0033
				(-0.641)			(0.559)			(-0.876)
Ln(Assets)_{t-1}	-0.0222***	0.0144***	0.0130***	0.0131***	0.0002***	0.0002***	0.0002***	0.0108***	0.0092***	0.0092***
	(-9.424)	(6.793)	(5.832)	(5.867)	(4.560)	(4.592)	(4.519)	(13.848)	(11.157)	(11.221)
$\text{(Trading Assets / Assets)}_{t-1}$	1.2507	0.1915	0.3294	0.3053	0.5322***	0.5305***	0.5310***	-1.0572**	-0.8963*	-0.9092*
	(1.543)	(0.107)	(0.182)	(0.168)	(4.285)	(4.275)	(4.279)	(-2.185)	(-1.831)	(-1.861)
$\text{(Share of Trading Income)}_{t-1}$	-0.0368	0.0503	0.0650	0.0650	0.8756***	0.8754***	0.8754***	-0.0901*	-0.0723	-0.0722
	(-0.536)	(0.603)	(0.773)	(0.771)	(43.550)	(43.557)	(43.549)	(-1.763)	(-1.393)	(-1.391)
$\text{(Tier 1 / Assets)}_{t-1}$	-0.2132	-0.6088***	-0.6204***	-0.6204***	0.0005	0.0006	0.0006	-0.1060***	-0.1196***	-0.1195***
	(-1.422)	(-6.908)	(-7.023)	(-7.025)	(0.515)	(0.692)	(0.691)	(-3.530)	(-3.978)	(-3.978)
$\text{(Deposits / Assets)}_{t-1}$	-0.0133	0.1255***	0.1257***	0.1259***	-0.0007*	-0.0007*	-0.0007*	0.0207***	0.0209***	0.0210***
	(-0.546)	(5.749)	(5.767)	(5.779)	(-1.897)	(-1.896)	(-1.911)	(2.654)	(2.666)	(2.675)
(ROA)_{t-1}	-6.5456***	5.6191***	5.7320***	5.7464***	-0.0060	-0.0074	-0.0077	-0.6454	-0.5199	-0.5129
	(-3.353)	(4.368)	(4.463)	(4.474)	(-0.323)	(-0.397)	(-0.412)	(-1.246)	(-1.011)	(-0.997)
$\text{(NPL / Loans)}_{t-1}$	0.4306	-0.0041	0.0181	0.0198	-0.0002	-0.0005	-0.0005	-0.6467***	-0.6219***	-0.6210***
	(1.399)	(-0.021)	(0.091)	(0.099)	(-0.092)	(-0.203)	(-0.216)	(-9.512)	(-9.166)	(-9.158)
Intercept	0.6824***	0.4413***	0.4572***	0.4558***	-0.0023***	-0.0025***	-0.0025***	-0.0843***	-0.0656***	-0.0663***
	(14.207)	(11.208)	(11.301)	(11.289)	(-2.845)	(-3.035)	(-2.990)	(-5.882)	(-4.409)	(-4.458)
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14,311	60,588	60,588	60,588	60,588	60,588	60,588	60,058	60,058	60,058
Adjusted R-squared	0.351	0.137	0.138	0.138	0.824	0.824	0.824	0.159	0.168	0.168

Panel B: Matched sample

	Volatility	**Asset Risk**	**Asset Risk**	**Asset Risk**	**Trading Income**	**Trading Income**	**Trading Income**	**Securitized Off-Balance Sheet Assets**	**Securitized Off-Balance Sheet Assets**	**Securitized Off-Balance Sheet Assets**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Universal	0.0053	0.0025	0.0023	0.0016	0.0002*	0.0001	0.0001	-0.0000	0.0006	0.0006
	(0.897)	(0.363)	(0.340)	(0.203)	(1.650)	(1.530)	(1.064)	(-0.007)	(0.259)	(0.234)
Public			-0.0020	-0.0025		-0.0001	-0.0001**		0.0082***	0.0082***
			(-0.268)	(-0.310)		(-1.278)	(-2.105)		(3.359)	(3.084)
Universal * Public				0.0021			0.0001			-0.0001
				(0.178)			(0.500)			(-0.017)
Ln(Assets)_{t-1}	-0.0214***	0.0158***	0.0161***	0.0161***	0.0002***	0.0002***	0.0002***	0.0105***	0.0091***	0.0091***
	(-7.295)	(5.169)	(4.806)	(4.810)	(3.859)	(3.783)	(3.749)	(10.030)	(8.287)	(8.304)
$\text{(Trading Assets / Assets)}_{t-1}$	1.7372	2.0846	2.0221	2.0276	0.5216***	0.5178***	0.5181***	-0.7190	-0.4592	-0.4594
	(1.387)	(0.879)	(0.850)	(0.852)	(3.621)	(3.608)	(3.609)	(-0.882)	(-0.533)	(-0.534)
$\text{(Share of Trading Income)}_{t-1}$	-0.0203	0.1507	0.1456	0.1444	0.9031***	0.9028***	0.9027***	-0.1087	-0.0875	-0.0875
	(-0.248)	(1.325)	(1.268)	(1.256)	(43.091)	(42.976)	(42.947)	(-1.456)	(-1.159)	(-1.155)
$\text{(Tier 1 / Assets)}_{t-1}$	-0.0566	-0.3882**	-0.3840**	-0.3839**	0.0032	0.0034*	0.0034*	-0.1350***	-0.1526***	-0.1526***
	(-0.271)	(-2.531)	(-2.503)	(-2.502)	(1.526)	(1.695)	(1.695)	(-2.747)	(-3.129)	(-3.128)
$\text{(Deposits / Assets)}_{t-1}$	-0.0054	0.1467***	0.1469***	0.1468***	-0.0005	-0.0005	-0.0005	0.0269***	0.0261***	0.0261***
	(-0.184)	(4.916)	(4.910)	(4.911)	(-1.271)	(-1.246)	(-1.253)	(2.783)	(2.686)	(2.687)
(ROA)_{t-1}	-10.0503***	6.9321***	6.9005***	6.8952***	0.0086	0.0066	0.0064	0.2461	0.3762	0.3764
	(-3.807)	(3.266)	(3.254)	(3.253)	(0.281)	(0.218)	(0.209)	(0.280)	(0.429)	(0.429)
$\text{(NPL / Loans)}_{t-1}$	0.4077	0.1025	0.0977	0.0971	0.0040	0.0037	0.0037	-0.5525***	-0.5323***	-0.5323***
	(0.959)	(0.289)	(0.277)	(0.275)	(0.873)	(0.804)	(0.798)	(-4.875)	(-4.694)	(-4.693)
Intercept	0.6615***	0.3777***	0.3735***	0.3739***	-0.0026***	-0.0028***	-0.0028***	-0.0892***	-0.0718***	-0.0718***
	(11.458)	(6.624)	(6.233)	(6.256)	(-2.734)	(-2.921)	(-2.885)	(-4.797)	(-3.755)	(-3.767)
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,277	25,912	25,912	25,912	25,912	25,912	25,912	25,851	25,851	25,851
Adjusted R-squared	0.367	0.135	0.135	0.135	0.869	0.869	0.869	0.196	0.204	0.204

Table 3.5: Comparison of universal and non-universal banks (using unmatched and matched samples, compensation sub-sample)

This table presents the univariate pre- and post-treatment effects after using the propensity score matching procedure. Panel A shows the difference in means for the whole matched sample, Panel B shows the difference in the effects from the immediate implementation of the policy and Panel C shows the reduction in bias due to matching. *Treatment* identifies universal banks before the repeal of the GSA (these are the banks that become universal after 1999). Dependent variables are adjusted for the effect of the outliers by removing the top and bottom 1% of the distribution. Variables are defined in Appendix 3.A, ***, **, * designate significance at 1%, 5% and 10% levels, respectively.

Panel A: All years

	GSA				Post-GSA				Difference - in - Differences	
Variable	**Control**	**Treated**	**Difference**	**p-value**	**Control**	**Treated**	**Difference**	**p-value**		**p-value**
	(1)	(2)	(3) = (2) - (1)	(4)	(5)	(6)	(7) = (6) - (5)	(8)	(9) = (7) - (3)	(10)
CEO Pay	7.703	7.967	0.264	0.024**	7.718	8.322	0.604	0.000***	0.34	0.021**
CEO Equity Incentives	14.018	14.706	0.688	0.039**	14.59	16.136	1.547	0.000***	0.858	0.050**
Short-term direct compensation	6.836	7.190	0.354	0.000***	6.937	7.251	0.314	0.000***	-0.039	0.710
Long-term direct compensation	6.533	6.977	0.440	0.055*	6.698	7.608	0.910	0.000***	0.466	0.110
CEO's delta	0.224	0.230	0.005	0.923	0.324	0.470	0.146	0.002***	0.140	0.056*
CEO's vega	0.082	0.11	0.028	0.438	0.161	0.370	0.209	0.000***	0.181	0.000***
Ln(Assets)_{t-1}	15.920	17.591	1.671	0.000***	15.872	17.161	1.289	0.000***	-0.382	0.043**
$\text{(Book to market)}_{t-1}$	0.081	0.081	0.001	0.823	0.084	0.083	-0.001	0.680	-0.001	0.663
$\text{Ln(Volatility)}_{t-1}$	-1.236	-1.262	-0.026	0.668	-1.210	-1.180	-0.059	0.248	-0.033	0.681
$\text{(Asset Risk)}_{t-1}$	0.713	0.801	0.089	0.000**	0.717	0.781	0.064	0.000***	-0.025	0.289
(Leverage)_{t-1}	0.086	0.085	-0.001	0.606	0.088	0.086	-0.001	0.487	0.000	0.961

Panel B: 1999 and 2000

	GSA (1999)				Post-GSA (2000)				Difference - in - Differences	
Variable	**Control**	**Treated**	**Difference**	**p-value**	**Control**	**Treated**	**Difference**	**p-value**		**p-value**
	(1)	(2)	(3) = (2) - (1)	(4)	(5)	(6)	(7) = (6) - (5)	(8)	(9) = (7) - (3)	(10)
CEO Pay	7.746	8.34	0.594	0.025**	7.732	8.305	0.573	0.034**	-0.021	0.955
CEO Equity Incentives	14.038	15.463	1.424	0.027**	14.498	16.422	1.923	0.005***	0.499	0.590
Short-term direct compensation	6.857	7.329	0.471	0.011**	6.862	7.326	0.464	0.015**	-0.007	0.979
Long-term direct compensation	7.039	7.505	0.466	0.266	6.916	7.450	0.534	0.218	0.068	0.910
CEO's delta	0.230	0.291	0.061	0.650	0.380	0.469	0.088	0.528	0.027	0.888
CEO's vega	0.099	0.203	0.104	0.045**	0.109	0.255	0.146	0.007***	0.042	0.575
Ln(Assets)_{t-1}	15.973	17.296	1.323	0.000***	15.782	17.158	1.376	0.000***	0.053	0.910
$\text{(Book to market)}_{t-1}$	0.083	0.080	-0.002	0.686	0.083	0.082	-0.002	0.807	0.001	0.929
$\text{Ln(Volatility)}_{t-1}$	-1.292	-1.250	0.043	0.664	-1.071	-1.218	-0.147	0.178	-0.189	0.197
$\text{(Asset Risk)}_{t-1}$	0.691	0.0784	0.093	0.015**	0.719	0.771	0.052	0.232	-0.041	0.479
(Leverage)_{t-1}	0.088	0.086	-0.001	0.8	0.086	0.085	-0.002	0.782	0.000	0.971

Panel C: Matching

		Mean			%reduct.	t-test	
	Sample	**Treated**	**Control**	**%bias**	**|bias|**	**t**	**p>|t|**
Ln(Assets)$_{t-1}$	Unmatched	17.296	15.973	113.4		4.34	0.000
	Matched	16.891	15.973	78.7	30.6	3.45	0.001
(Book to market)$_{t-1}$	Unmatched	0.08025	0.08254	-10.3		-0.41	0.686
	Matched	0.08016	0.08254	-10.6	-3.7	-0.38	0.703
Ln(Volatility)$_{t-1}$	Unmatched	1.2498	-1.2923	14.1		0.55	0.587
	Matched	1.2338	-1.2923	19.5	-37.7	0.73	0.467
(Asset Risk)$_{t-1}$	Unmatched	0.78398	0.69147	68		2.65	0.01
	Matched	0.75687	0.69147	48.1	29.3	1.88	0.065
(Leverage)$_{t-1}$	Unmatched	0.08639	0.08778	-6.2		-0.25	0.805
	Matched	0.08624	0.08778	-6.8	-10.5	-0.25	0.805

Table 3.6: Universal banking and executive compensation

This table presents estimation results of the impact of the adoption of universal banking on components of executive compensation. Panel A uses the entire sample, while Panel B presents the results for the sample created using propensity score matching. Column (1) shows the effects of universal banking on the CEO's total compensation, and column (2) presents the test for the effects on the CEO's equity incentives. Columns (2) – (3) measure the effect of universal banking on short-term and long-term compensation. CEO's sensitivity to the underlying stock price and its volatility are measured in columns (5) - (6). Dependent variables are adjusted for the effect of the outliers by removing the top and bottom 1% of the distribution. Control variables are lagged by one period. Annual observations are for the period of 1996 – 2007. Variables are defined in Appendix 3.A, ***, **, and * designate significance at 1%, 5% and 10% levels, respectively. *T*-statistics (reported in parenthesis) are computed based on robust standard errors clustered at the BHC level.

Panel A: Whole sample

	CEO Pay	**CEO Equity Incentives**	**Short-term direct compensation**	**Long-term direct compensation**	**CEO's delta**	**CEO's vega**
	(1)	(2)	(3)	(4)	(5)	(6)
Universal	0.1392	-0.1002	0.0427	0.1907	-0.0048	0.0584
	(0.987)	(-0.218)	(0.420)	(0.720)	(-0.043)	(1.272)
Ln(Assets)$_{t-1}$	0.4841***	1.1081***	0.3348***	0.6245***	0.2386***	0.1687***
	(12.066)	(10.361)	(9.555)	(9.230)	(4.214)	(4.757)
(Book to market)$_{t-1}$	-11.5360*	-19.3318	-2.5816	-21.1284**	-1.9940	-1.6950
	(-1.856)	(-1.364)	(-0.674)	(-2.371)	(-0.574)	(-1.006)
Ln(Volatility)$_{t-1}$	0.1252	-0.1536	0.0483	0.1792	-0.0181	-0.0115
	(1.557)	(-0.842)	(0.961)	(1.316)	(-0.327)	(-0.473)
(Asset Risk)$_{t-1}$	-0.6135*	-0.5017	-0.3998	-0.5826	-0.3687	-0.2067
	(-1.867)	(-0.448)	(-1.377)	(-1.028)	(-1.013)	(-1.259)
(Leverage)$_{t-1}$	9.8049	10.7523	0.3859	18.6414**	4.0122	1.6765
	(1.500)	(0.627)	(0.083)	(2.014)	(0.892)	(0.912)
Intercept	0.5534	-2.4222	2.0439***	-2.6455*	-3.5097***	-2.4679***
	(0.647)	(-1.090)	(2.942)	(-1.951)	(-3.865)	(-4.983)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	694	538	692	693	565	565
Adjusted R-squared	0.478	0.441	0.469	0.308	0.202	0.349

Panel B: Matched sample

	CEO Pay	CEO Equity Incentives	Short-term direct compensation	Long-term direct compensation	CEO's delta	CEO's vega
	(1)	(2)	(3)	(4)	(5)	(6)
Universal	0.0702	-0.1020	-0.0484	0.1744	-0.1485	0.0318
	(0.429)	(-0.158)	(-0.385)	(0.573)	(-1.091)	(0.574)
Ln(Assets)$_{t-1}$	0.4012***	1.0960***	0.2717***	0.5506***	0.1347***	0.0785***
	(5.468)	(6.177)	(5.165)	(4.630)	(4.420)	(5.824)
(Book to market)$_{t-1}$	-30.0027***	-41.1904*	-14.7805**	-48.2074***	-6.5668**	-3.9889**
	(-3.933)	(-1.817)	(-2.456)	(-3.695)	(-2.011)	(-2.384)
Ln(Volatility)$_{t-1}$	0.1944*	-0.1411	0.1043*	0.1951	0.0362	-0.0040
	(2.000)	(-0.612)	(1.677)	(1.154)	(0.702)	(-0.205)
(Asset Risk)$_{t-1}$	-0.6737	-1.2768	-0.2604	-0.9954	0.3194	0.0827
	(-1.633)	(-0.843)	(-0.666)	(-1.560)	(0.815)	(0.695)
(Leverage)$_{t-1}$	28.2500***	35.1622	13.8641**	46.6799***	7.7613	4.1681**
	(3.693)	(1.383)	(2.143)	(3.715)	(1.506)	(2.075)
Intercept	2.0162	-1.7849	2.9266***	-1.2529	-2.1847***	-1.2321***
	(1.636)	(-0.560)	(3.057)	(-0.648)	(-2.914)	(-4.568)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	414	332	416	413	349	349
Adjusted R-squared	0.311	0.329	0.275	0.201	0.178	0.347

4 Regulation of Compensation[53]

4.1 Introduction

The level and structure of executive compensation has become even more frequently debated among politicians, CEOs, and academics since the financial crisis of 2008. For example, critiques of the existing compensation practices at financial service companies at least partly attribute the crisis to incentive pay encouraging excessive risk taking.[54] Regulators in Europe and US have proposed, and in some cases even implemented regulation that monitors the level and the structure of executive compensation in the financial services industry. Our objective in this paper is to examine the consequences of regulating executive compensation. We use UK as our setting for the study as it is one of the earliest countries that implemented such regulation.[55]

Lord Turner, the then chairman of the UK Financial Services Authority (FSA) states in his review of the causes of the 2008 crisis that "There is a strong prima facie evidence that inappropriate incentive structures played a role in encouraging behavior which contributed to the financial crisis" (Turner Review, 2009). [56] In August 2009, after a period of consultation and having considered the recommendations of the Turner Review and Walker Review, the FSA published its Remuneration Code. This was

[53] This chapter is joint work with İrem Tuna (London Business School). İrem Tuna gratefully acknowledges the financial support of the European Research Council (Grant ERC-2010-263525). We thank Sam Harrington, Johanna Cowan, Martin Walker (discussant), and the participants at the Manchester Business School Executive Compensation conference, and the 2013 EAA Annual Congress for their helpful comments and suggestions.

[54] Throughout the paper, we use the terms "banks", "BIPRU firms" and "firms in the financial services sector (or industry)" interchangeably. All references are made to firms that fall under the FSA Remuneration Code.

[55] We are currently in the process of extending our analysis to include European and US banks as additional control groups.

[56] On April 1, 2013, FSA was abolished and became two separate regulatory authorities: the Prudential Regulation Authority (PRA) as part of the Bank of England and the Financial Conduct Authority (FCA). The Remuneration Code remains in effect and for consistency we continue referring to the FSA as the main regulator behind the Remuneration Code throughout this paper.

widely seen as FSA's response to the financial crisis and an effort to curtail the pay practices, which have allegedly contributed to the crisis.

Recent literature examining the relationship between executive compensation policies of the financial services industry prior to the financial crisis finds mixed evidence. On the one hand, Fahlenbrach and Stulz (2011) find that firms whose CEOs' incentives were better aligned with those of the shareholders performed worse during the financial crisis. They also find that banks, which paid their CEOs larger option-based compensation and cash bonuses, did not fare worse than other banks. Furthermore, they also find that CEOs did not decrease holdings of their company stock leading up to the financial crisis, therefore losing material wealth during the crisis. These findings provide evidence that the financial crisis cannot be attributed to the incentive pay practices at banks. Gregg, Jewell, and Tonks (2012) find that compensation in the financial services industry in the UK is high, but pay-performance sensitivity of compensation in this industry is not higher than that in other industries, challenging the notion that excessive risk-taking incentives underlie the financial crisis. On the other hand, using a global sample of banks, Suntheim (2011) finds that banks whose CEOs have high vega (sensitivity of compensation to changes in the underlying stock volatility) and low delta (sensitivity of compensation to changes in the underlying stock price) have higher leverage and are riskier. Finally, Ayadi, Arbak, and De Groen (2012) find that the use of long-term incentive plans increases risk-taking; however, the use of option plans does not.

Unlike prior literature, which studies whether the financial crisis could be attributed to risk-taking behavior caused by executive compensation in the financial services industry, we examine the changes in the pay practices in the financial services industry as a result of the new regulation and investigate its consequences. Given the

short period of time since the Remuneration Code has become effective in the UK, and ongoing international effort in designing new regulation, the extent of changes that have been implemented by firms and their consequences are of interest internationally, not only to academics but also to policymakers.

We find that total compensation seems to have increased for all firms in our sample after the Remuneration Code became effective, however when BIPRU firms changed compensation contracts, the resulting contracts were associated with lower total compensation after the regulation. Consistent with the Remuneration Code, we observe that BIPRU firms have higher deferred bonuses after the regulation became effective. When we examine the consequences of the compensation changes brought on by the regulation, we see that these changes increase pay-performance sensitivity, albeit weakly. When BIPRU firms make changes to their compensation contracts post-2010, they seem to be deferring more bonuses, consistent with BIRPU firms making the changes to comply with the regulation.

We also find evidence of a decrease in measures of firm risk in response to changes to compensation contracts of BIPRU firms post 2010. To evaluate the concerns raised about regulation potentially resulting in unintended consequences, we examine whether there is a change in turnover behavior after the regulation. We find that CEO turnover likelihood for BIPRU firms is lower in the post-2010 period. This could be due to the decreased job opportunities in the financial service sector after the financial crisis. This could also be because of the upcoming constraints on executive pay in other markets.

Last but not least, we also conduct an event study to assess the market reaction to the recent proposal by the European Union to cap bonuses. BIPRU firms experience a significant -1.04% abnormal return on the event date, although in a multiple regression,

difference in abnormal stock returns on the event date is sensitive to the bonus cap assumption used.

The regulatory changes on compensation are very recent. However, we think it useful to document some evidence given a lot of regulatory effort is spent on executive pay. We find that some changes take place in compensation; however, it may be too soon to tell whether the intended objectives are achieved and potential unintended consequences are avoided.

The remainder of this chapter is organized as follows. Section 4.2 discusses the evolution of the Remuneration Code. Section 4.3 provides a literature review, whereas section 4.4 describes our data and research design. We present our results in section 4.5. Finally, Section 4.6 concludes.

4.2 The evolution of the Remuneration Code

The chairman of the UK Financial Services Authority (FSA), Lord Turner, was asked in October 2008 by the Chancellor of the Exchequer to prepare a review of the causes of the financial crisis and make recommendations for changes in regulation in order to improve the quality of the banking system. The Turner Review was issued in March 2009 and listed various "actions required to create a stable and effective banking system" (page 7). One of these actions is on remuneration policies and it states the following: "Remuneration policies should be designed to avoid incentives for undue risk taking; risk management considerations should be closely integrated into remuneration decisions. This should be achieved through the development and enforcement of UK and global codes". Page 79 of the report states: "There is a strong prima facie case that inappropriate incentive structures played a role in encouraging behavior which contributed to the financial crisis." However, Turner also acknowledges that it is difficult to measure the extent of this contribution, and that this contribution

may be secondary to other factors such as "inadequate approaches to capital, accounting, and liquidity". He later states on page 81 that "…it is important to be realistic about the extent to which remuneration policies can ensure sensible risk assessment and behavior, and about the relative importance of remuneration polices compared to other regulatory levers."

In February 2009, Sir David Walker was asked by the UK prime minister to review banks' corporate governance. The review was first issued on July 16, 2009 for consultation and the final draft of the review and its recommendations were issued on November 26, 2009. The review included 38 recommendations on corporate governance issues organized under five sections, namely (i) board size, composition, and qualification, (ii) functioning of the board and evaluation of performance, (iii) the role of institutional shareholder: communication and engagement, (iv) governance of risk, and (v) remuneration. Remuneration-related recommendations focused on the "high end employees" (i.e. those with total remuneration in excess of £1 million) and were about the roles of the remuneration committee of the board, the contents of the remuneration committee report, the structure of incentive pay, target shareholding, interaction between the remuneration and risk committees of the board, voting on the remuneration committee report, and the code of conduct for compensation consultants.

Of particular relevance for our study is the recommendation on the structure of incentive pay. Recommendation 33 of the Walker Review states the following:

> "Deferral of incentive payments should provide the primary risk adjustment mechanism to align rewards with sustainable performance for executive board members and "high end" employees in a BOFI included within the scope of the FSA Remuneration Code. Incentives should be balanced so that at least one-half of variable remuneration offered in respect of a financial year is in the form of a long-term incentive scheme with vesting subject to a performance condition with half of the award vesting after not less than three years and of the remainder after five years. Short-term bonus awards should be paid over a three-year period with not more than one-third in the first year. Clawback should be used as the means to reclaim amounts in circumstances of misstatement and misconduct. This recommended structure should be incorporated in the FSA remuneration Code review process next year and the remuneration committee report for

> 2010 and thereafter should indicate on a "comply or explain" basis the conformity of an entity's "high end" remuneration arrangements with this recommended structure" (p. 21).

During the consultation period of the Walker Review, more than 180 submissions of feedback were received. In one of these submissions dated September 30, 2009, Alan Brener, the Director of Regulatory Risk Management at Abbey National plc, stated the following:

> "…Secondly, as you are aware, we are part of a major European banking group which operates globally. Many of our senior management have international careers with Santander Group (Santander) and some, as part of their career, will spend a few years in the UK and are effectively "on loan" to us. Their remuneration is determined by a Remuneration Committee in Madrid and clearly this will comply with both EU and Spanish law and regulations. The pay arrangements will, of course, comply with the UK requirements while they are working in this country.
>
> These individuals are talented and their services are in demand whether it be in the Group's offices in Norway or Chile or Hong Kong or New York. However, if the proposed measures governing remuneration in the UK exceed those of the EU and/or other member states, it is highly likely that a posting to the UK will be unattractive.
>
> Santander is one of the few successful banking groups which has successfully avoided the problems of the current financial crisis. This is due to the mixture of good regulation and good management. There is a danger that inappropriate regulation of remuneration, particularly if it goes further than that required by the EU, may turn the UK into a financial services backwater with, in this case, Santander senior management reluctant to be posted here…"

Concurrent with the Turner and Walker reviews, the FSA issued a proposed remuneration code on February 26, 2009. It circulated a consultation paper on March 18, 2009, which invited feedback for 16 consultation questions. Based on the feedback received, the FSA amended the proposal and issued a policy statement in August 2009 in response (PS 09/15). As a result, a new chapter (Chapter 19) entitled "The Remuneration Code" was included in the Senior Management Arrangement, Systems and Controls (SYSC) sourcebook. The code requires remuneration policies be consistent with effective risk management. Section 2.1 of the code states that "A firm must establish, implement, and maintain remuneration policies, procedures and practices that are consistent with and promote effective risk management." Section 3 of

the code contains eight principles of remuneration. These principles are “roles of bodies responsible for remuneration policies and their members,” “procedures and risk and compliance function input,” “remuneration of employees in risk and compliance functions,” “profit-based measurement and risk-adjustment,” “long-term performance measurement,” “non-financial performance metrics,” “measurement of performance for long-term incentive plans,” and “remuneration structures”. The implementation date of the code was January 1, 2010.

As agreed in PS 09/15, the FSA reviewed the code and on July 29, 2010, it issued another consultation paper (CP 10/19) that proposed revisions to the remuneration code taking into account the new developments. The main developments were the enactment of The Financial Services Act 2010, which contains various remuneration-related provisions, international changes in remuneration principles guided by the Financial Stability Board and changes to the Capital Requirements Directive (CRD3), and the Walker Review of corporate governance in BIPRU firms. On December 17, 2010, the FSA issued the revised remuneration code based on the feedback received on CP 10/19. The effective date of the revised code was January 1, 2011 and it had a much wider application. The revised code contains thirteen remuneration principles, namely (i) risk management and risk tolerance, (ii) supporting business strategy, objectives, values and long-term interests of the firm, (iii) avoiding conflicts of interest, (iv) governance, (v) control functions, (vi) remuneration and capital, (vii) exceptional government intervention, (viii) profit-based measurement and risk-adjustment, (ix) pension policy, (x) personal investment strategies, (xi) avoidance of the remuneration code, (xii) remuneration structures, and (xiii) effect of breach of the remuneration principles.

In 2010, the Remuneration Code applied to the 26 largest banks, building societies and broker-dealers. Starting from January 1, 2011 the Remuneration Code applies to all banks, building societies, investment banks and firms covered by the Capital Adequacy Directive (UCITs, fund managers, broker-dealers, asset management firms and some firms that engage in corporate finance, venture capital, the provision of financial advice and stockbrokers). The FSA refers to these firms collectively as "BIPRU" in the Remuneration Code. The FSA expects over 2,500 firms to fall within the wider scope of the regulation.

Not all BIPRU firms are affected in the same way as there are proportionality requirements. In particular, FSA defines 3 proportionality tiers: Tiers 1 and 2 contain credit institutions and broker-dealers that engage in significant propriety trading/investment banking activities and have assets in excess of £50 billion for Tier 1 and between £15 billion and £50 billion for Tier 2. Tier 3 mainly consists of smaller banks and building societies (with total assets not exceeding £15 billion) and firms that may occasionally take overnight/short term risks with their balance sheet. Tier 3 also contains firms that generate income from agency business without putting their balance sheets at risk. The proportionate approach implies that the requirements for Tier 3 will be less onerous than for Tiers 1 and 2. Firms in Tier 3, for instance, are not expected to have a remuneration committee or apply some of the more prescriptive elements of the remuneration rules.[57]

Remuneration principle 12 (19A.3.33 to 19A.3.53) includes the rules on remuneration structures. These rules describe how to assess performance and the circumstances under which firms can grant guaranteed variable remuneration, prescribe the ratios between fixed and variable components of total remuneration, payments

[57] See for example, http://www.fsa.gov.uk/about/what/international/remuneration/application; http://fsahandbook.info/FSA/html/handbook/SYSC/19A/1
and http://www.fsa.gov.uk/static/pubs/guidance/fg12-19.pdf.

related to early termination, amount of remuneration that is granted in form of retained shares or other instruments, amount of deferral and the horizon over which the remuneration is deferred, and performance vesting conditions. The rules under this principle are applicable to executives receiving more than 33% of total remuneration in variable pay, and whose total remuneration exceeds £500,000. According to the FSA, the principle on remuneration structures generated the largest amount of feedback throughout the consultation stages.

4.3 Literature review

There is considerable research on banks' executive compensation. Barro and Barro (1990) find that banks' CEO compensation depends on both accounting and stock performance as in other industries; however, Adams and Mehran (2003) find that the proportion of pay granted in form of stock and options is lower than that in other industries. Kaplan and Rauh (2010) show that, relative to the non-financial industry, financial services industry has more highly-compensated employees. Guo, Jalal, and Khaksari (2014) find that bank risk, measured as volatility of stock returns and Z-score, increases with both short-term and long-term incentives, although the greater the proportion of incentive pay, the less likely the bank is to fail.

Unlike most other industries, financial services are regulated and prior research also explored the differences in executive compensation as a result of deregulation. For example, Crawford, Ezzell and Miles (1995) and Hubbard and Palia (1995) find that pay-performance sensitivity of CEO compensation increases due to deregulation. In addition to the studies listed above that focus on executive compensation in the US, various researchers also examined pay in the UK and other countries. For example, Conyon and Murphy (2000) find that, in 1997, UK CEO's compensation consisted of salary and pension (64%), options and LTIPs (19%), and bonuses (18%). Fernandes,

Ferreira, Matos, and Murphy (2013) find that, in 2006, salary and pensions represented 51%, equity incentives 30%, and bonus 19% of CEO pay, consistent with an increase in incentive pay and decrease in salary and pensions, from 1997 to 2006 in the UK.

Prior research finds both similarities and differences in executive compensation in the UK and US. Pay-performance sensitivity in the UK is around 0.15, and similar to the evidence from the US, is deemed low (e.g. Conyon, Gregg, and Machin, 1995; Conyon, 1997; and Benito and Conyon, 1999). The sensitivity of pay to size in the UK is lower than that in the US. Conyon and Murphy (2000) find this sensitivity to be 0.32 for US firms and 0.2 for UK firms. Conyon, Core, and Guay (2011) find that UK CEOs are paid less than the US CEOs on an unadjusted basis. However, they also document that UK CEOs have less stock and option incentives. When executive compensation is adjusted by estimates of risk premiums, risk-adjusted pay of UK and US CEOs no longer seems to be different.

Although the above studies provide details on executive compensation in the UK, they do not specifically address compensation in the financial services industry. The recent financial crisis drew additional attention to CEO pay in this industry internationally. Gregg, Jewell, and Tonks (2012) find that compensation in the financial services industry in the UK is high. But pay-performance sensitivity of compensation in this industry is not higher than that in other industries, which the authors interpret as being inconsistent with the argument that excessive incentives caused the financial crisis. Using a sample of 53 systemically significant banks in the EU over the 1999-2009 period, Ayadi, Arbak, and De Groen (2012) find that the use of long-term incentive plans increases risk-taking while option plans do not, which is also inconsistent with the reasoning underlying the proposed regulation in the EU to curb option pay but encourage long-term incentive plans closely linked to performance.

Using an international sample of banks over the 2000-2008 period, Suntheim (2011) finds that banks whose CEOs had high risk-taking incentives performed worse after the collapse of Lehman Brothers, whereas banks that granted more stocks performed better. He also finds that CEOs with high vega and low delta undertake riskier, fee-based activities and their firms have higher leverage. For a sample of 270 banks from 48 countries, Laeven and Levine (2009) show that banks' ownership concentration determines the relation between national regulation and bank risk. Ferrarini and Ungureanu (2011) examine the changes in pay practices as a result of the Principles and Standards for Sound Compensation Practices that were accepted by the G20 countries. The authors state that the resulting regulation of bankers' pay is more detailed in Europe than in the US, but remuneration practices at large US banks are converging to those of EU banks.

Our paper contributes to the literature on executive compensation, and in particular its regulation. Unlike papers such as Bebchuk and Spamann (2010) and Bhagat and Romano (2010) that criticize existing pay practices and propose a reform in executive compensation, or Core and Guay (2010) and Murphy (2013) that provide an *ex ante* economic analysis of the proposed changes discussing whether the proposals would result in their intended consequences, our paper undertakes an analysis of the consequences of compensation regulation using its actual implementation in the UK as a setting. Given the potential similarities of CEO pay in the UK, continental Europe, and US (e.g. Conyon, Core, and Guay, 2011), and to the extent that the existing institutions and enforcement are similar across the countries currently in the process of proposing regulation of compensation, our findings should be of international interest to the parties engaged in the compensation debate. Our paper contributes to the literature on executive compensation, and in particular its regulation.

4.4 Data and research design

4.4.1 Sample selection and description

Our data comes from several sources. We obtain CEO and other top executives' compensation data for the UK FTSE350 firms trading on the London Stock Exchange Main Market from Thomson Reuters IDS. IDS collect compensation and incentives data from companies' annual remuneration reports. This dataset contains information on components of executive compensation and their contractual features. The dataset spans the period of 2006 to 2011 and contains information for 2,470 unique executives from 462 firms. We supplement this data with market and accounting data from Thomson Reuters Datastream, and risk data from SNL.

As the recent regulation of executive compensation focuses on BIPRU firms, we split our sample into the firms that fall under the FSA Remuneration Code regulation (BIPRU) and other firms. We have 103 firm-year observations for BIPRU firms, and 1,214 firm-year observations for the non-BIPRU firms.[58] Our final sample consists of 1,317 CEO-year observations from 2007 to 2011. We remove the firm-year observations where a CEO spent only a part-year at the firm to prevent our results from being influenced by unusual circumstances which may generate atypical compensation outcomes.[59]

Table 4.1 presents descriptive statistics for the sample, where Panel A contains the subsample of BIPRU firms and Panel B contains all other firms. In this table, we tabulate the main compensation components and their determinants. Panel A also shows

[58] Remuneration Code is in effect for all BIPRU firms that are FSA regulated. For evaluating the sensitivity of our results to our sample composition, we collected data on the BIPRU firms that do not belong to FTSE350 via Capital IQ, where available. Not surprisingly, total compensation and its components for those BIPRU firms are lower than the respective value for the group of FTSE350 BIPRU firms. Although inclusion of the non-FTSE350 BIPRU firms result in reduced differences between BIPRU and non-BIPRU firms, our inferences from multivariate analyses remain unchanged.

[59] In our analysis of CEO turnover, however, we retain the partial year observations to identify the instances of turnover.

whether average values of tabulated variables are significantly different between the two subsamples. Detailed definitions of all variables used in our analysis are in Appendix 4.A. To mitigate the effects of extreme observations, all continuous variables are winsorized at the 1st and 99th percentile of their respective distributions in each year.

As can be seen from Panel A of Table 4.1, CEOs at BIPRU firms on average receive higher total compensation (at the time of the grant or at the time of vesting, the latter of which is labelled as "Take Home Pay") than non-BIPRU firms. BIPRU firms have higher bonus and deferred bonus, whereas non-BIPRU firms have higher salary. LTIP and Options constitute a larger proportion of total compensation at non-BIPRU firms. CEOs of BIPRU firms have tenure of similar length to other CEOs (9 years on average vs. 8 years) but they tend to oversee larger institutions as the average size (measured as the market value of the firm) and revenues (measured as sales or the top line of revenue) of BIPRU firms are significantly larger than those of other firms in our sample. BIPRU firms also have higher book-to-market ratios, higher leverage, and higher idiosyncratic risk. Finally, BIPRU firms also generate lower shareholder return, which is measured as the total return to shareholders for a one-year holding period, starting from the beginning of the corresponding fiscal year.

Figure 4.1 and Figure 4.2 provide some univariate evidence on changes in compensation components and performance targets, respectively, over time for BIPRU and all other firms. Our sample period starts in 2007 as IDS did not start collecting option and LTIP data until 2007 and Capital IQ's coverage for these items in earlier years is spotty. Figure 4.1 shows that total compensation initially declined and then increased for both groups of firms over our sample period. However, not surprisingly, the dip in pay for BIPRU firms is more exacerbated given the financial crisis. Figure 4.2 plots the average number of performance targets used within each component of a

compensation contract, and the total number of unique performance targets across the years. Although the average number of performance targets used by BIRPU firms has increased, the increase observed for the non-BIRPU firms is more remarkable. Figure 4.3 shows that both BIPRU and non-BIPRU firms made the most number of changes to contractual features of the compensation contract in 2010, coinciding with the enactment of the Remuneration Code. However, the pattern is also consistent with all-firms suffering during the financial crisis and therefore aiming to incentivize better performance via changes to the compensation contracts.

Panels C and D of Table 4.1 present summary statistics of contractual features and their changes for BIPRU and non-BIPRU firms in our sample. Panel C also shows whether the mean values of contract variables differ significantly from those of all other firms. For example, BIRPU firms are more likely to have a bonus deferral scheme (95% on average for the whole sample period compared to 64% for other firms). Although bonus deferrals are compulsory for BIPRU firms starting from 2009 for large BIPRU firms and from 2010 for the remaining BIPRU firms, the evidence in this table is suggestive of firms voluntarily requiring bonus deferrals prior to the introduction of regulation. When comparing year-on-year changes in contractual features capturing performance targets for bonus, options, and LTIPS; firms' bonus deferral policy; and the shareholding requirement policy, we find 4.97 (4.09) contractual changes for BIPRU (all other) firms.

4.5 Results

We begin our multivariate analysis by examining whether CEO compensation at BIPRU firms is different from that of other firms, and whether BIPRU firms behave differently after the Remuneration Code comes into effect. Following the extant literature on executive compensation (see for example Conyon, Core and Guay, 2011), we estimate a

set of multivariate regressions using ordinary least squares and controlling for the determinants of CEO pay, namely size (*Log(Sales)*$_{t-1}$), growth opportunities (*Book to market*$_{t-1}$), idiosyncratic risk (*Log(Idio. Risk)*$_{t-1}$), leverage (*Leverage*$_{t-1}$), firm's overall performance (*Shareholder return*$_t$), CEO tenure (*Log*(*Tenure*)$_{t-1}$), and industry fixed effects.

Table 4.2 presents our results for CEO's total pay (measured as the natural logarithm of CEO total compensation, *Log CEO Total Compensation*) and its main components; namely salary (*Log CEO Salary*) and grants of annual incentive-based pay (*Log of CEO incentive grants* and *Log of Deferred Bonus*).[60] Although all our analyses include industry fixed effects, we suppress the coefficients on all the industry indicators with the exception of that on BIPRU firms, as they are the focus of the regulation the effects of which we study in this paper. *BIPRU* is the indicator variable for financial firms subject to the Remuneration Code, which takes the value of one if a financial firm falls under the FSA Remuneration Code guidelines and is subject to the FSA regulation. These are the largest BIPRU firms mostly consisting of universal BIPRU firms, investment BIPRU firms and investment management companies. In addition to the industry fixed effects, the first model under each dependent variable contains the standard economic determinants. The second model adds an indicator variable, *Post 2010*, which takes the value of one for years 2010 and 2011, i.e. the years in which the Remuneration Code is in effect, and its interaction with *BIPRU*. The third model introduces the number of changes that take place in identifiable compensation contract

[60] *Total Compensation* is the sum of salary, cash bonus, and cash benefits (*CEO Cash Compensation*), deferred bonus and equity incentives, such as the value of options and LTIPs granted (*CEO Incentives*). Unfortunately, we do not have sufficient information about existing option and stock holding as well as grant expiration dates to compute Core and Guay (1999 and 2001) sensitivities of CEO equity incentives to changes in stock price (*delta*) and volatility (*vega*). IDS does not collect this information for their dataset and the coverage in Capital IQ is insufficient to compute meaningful statistics. Furthermore, although the percentage of firms with live option plans is 32 (11) in BIPRU (non-BIPRU) firms, the percentage of option grant values in total pay is only 2 percent for both groups of firms. We currently do not have the ownership data for the CEOs.

features, *Number of Contract Changes*, which is defined as the number of contractual features changing in a given component of compensation scaled by the number of contractual features present in that component at the beginning of the year, summed across the components with weights applied as the proportion that the corresponding compensation component represents in total pay. This model also includes the interaction of *Number of Contract Changes* with *Post 2010*, and a three-way interaction between *BIPRU, Post 2010*, and *Number of Contract Changes.* For parsimony, although we tabulate all models, we only discuss the results based on the full model in the main text, and highlight important differences from the other two models wherever relevant.

Models (1) through (3) have *Log CEO Total Compensation* as the dependent variable. Model (3) shows that, consistent with prior research (e.g. Conyon, Core, and Guay, 2011), total compensation increases with size and decreases with idiosyncratic risk. *Book-to-Market, Log(Tenure), and Shareholder Return* are insignificant, whereas *Leverage* is weakly negative. BIPRU firms receive higher total pay, pre- and post-2010. We find however that the two groups of firms receive similar levels of total compensation post-2010. Although the extent of changes to the contract features in the post-2010 period are associated with lower total compensation, the changes introduced at BIPRU firms' contracts in the same time period result in higher pay.

Models (4) through (6) use *Log CEO Salary* as the dependent variable. We find in Model (6) that CEO's cash compensation increases with size and *Book-to-Market*, and decreases with idiosyncratic risk and *Shareholder Return*. *Leverage, and Tenure* are insignificant. Although BIPRU firms seem to pay lower salaries on average, there is no observed difference in the salary level for BIPRU firms post-regulation, while the number of changes made to the contract features at BIPRU firms seem to be associated with lower cash compensation.

In Models (7) through (9), we use *Log CEO Incentive Grants* as the dependent variable. The evidence for the control variables in Model (9) is consistent with that presented for Model (6), with the exception of *Book-to-Market*, which becomes insignificant. Model (9) shows that contract changes in the post-2010 period are associated with higher CEO incentive grants, whereas the remaining variables of interest are insignificant.

Models (10) through (12) utilize *Log of Deferred Bonus* as the dependent variable. Since the Remuneration Code specifically aims for more deferrals of pay, the evidence from these models are potentially more relevant. The evidence for the control variables in Model (12) is consistent with that presented for Model (9), with the exception of *Book-to-Market*, which is negative and significant, and *Shareholder return*, which is insignificant. Model (12) shows that BIPRU firms grant more deferred bonus in the post-2010 period, as indicated by a positive and significant interaction term between *BIPRU* and *Post 2010*.

4.5.1 Analysis of the effect of the Remuneration Code

Given that the Remuneration Code was aimed at changing pay practices, it is therefore not surprising that we observe the aforementioned changes in compensation. We next focus on the effects of the Remuneration Code on pay-performance sensitivity, risk and CEO turnover. Table 4.3 examines whether the Remuneration Code brought any changes to CEO's pay-performance sensitivity at BIPRU firms. In panel A of this table, for each of the four compensation variables that we use as our dependent variable, namely *Log CEO Total Compensation*, *Log of CEO Incentive Grants* and *Log of Deferred Bonus*, we present three columns. The first column under each dependent variable shows the results using the full sample, whereas the second (third) column provides the results for the pre-2010 (post-2010) period.

We measure performance as total shareholder return (e.g. John, Mehran and Qian, 2012). The regressions tabulated in Columns (1) through (3) use *Log CEO Total Compensation* as the dependent variable. We observe no evidence supporting that total compensation is sensitive to performance. We also find that the contract feature changes at BIPRU firms are associated with higher pay both in the pre- and post-2010 period.

Columns (4) through (6) tabulate the results for the regression where *Log CEO Incentive Grants* is the dependent variable. The findings are similar to those presented for total compensation. We fail to find any evidence of pay-performance sensitivity using incentive grants for BIPRU firms and non-BIPRU firms, pre- or post-2010. However, we see that the number of contract feature changes is associated with lower incentive grants prior to 2010, but is not significant post-2010. This effect is similar across BIPRU and non-BIPRU firms, whereas only those by BIPRU firms in the post-2010 period are associated with larger incentive grants.

The final three columns of Table 4.3 present the regressions where the dependent variable is the natural logarithm of deferred bonus. Shareholder returns are weakly negatively associated with deferred bonus in the post-2010 period, suggesting when performance is worse during this period; CEOs defer a more bonuses. The number of contract feature changes is associated with lower deferred bonus in the post-2010 period, where the significance is at the 10 percent level. The coefficient on the interaction term between the *Number of Contract Changes* and *Shareholder Return* in the post-2010 period suggests that the changes made in the post-2010 seem to increase significantly, albeit weakly, the pay-performance sensitivity. The number of contract changes is positively associated with deferred bonus for BIPRU firms in both periods. Contract feature changes at BIPRU firms are associated with higher deferred bonus in

the post-2010 period, consistent with BIRPU firms deferring more bonuses to comply with the regulation.[61]

Table 4.4 explores the effects of changes in compensation on risk using three proxies: (i) idiosyncratic volatility, which measures firm-specific risk, (ii) total volatility, which measures the overall risk exposure, (iii) and leverage. For the subsample of BIPRU firms, for which bank-specific data is available through SNL, we also test changes in bank-specific measures of risk following the implementation of the Remuneration Code. The measures of bank-specific risk are: the Leverage ratio, which is computed as Tier 1 bank regulatory capital divided by tangible assets adjusted by derivative liabilities (*Leverage Ratio*); the proportion of risk-weighted assets in total assets (*RWA as a Proportion of Total Assets*), which measures the overall riskiness of banks' assets; the share of Level 3 assets in total assets (*Proportion of Level 3 Assets in Total Assets*), which measures the uncertainty about the fair-valued assets which have been marked-to-model; and provisions as a share of total loans (*Provisions as a Proportion of Total Loans*), which measures the quality of the loan portfolio. Please note that the adjusted R^2 in panel A (panel B) where the dependent variable is *Leverage* (*Leverage Ratio*) is very high since we control for lagged leverage in the regression model. This is likely due to the sticky nature of banks' capital structure.

In Panel A of Table 4.4, we see that all three measures of risk are lower post-2010, and BIPRU firms behave similarly to the rest of the sample, as evidenced by the insignificant coefficient on the interaction between *BIPRU* and *Post 2010*. Although

[61] One shortcoming of the dependent variables used in this table is that they are measured as values on the grant date and they do not essentially capture performance incentives as appropriately as deltas. Due to data limitations, we cannot compute deltas. However, we are in the process of cleaning data for the realizations in a given year of former grants. The advantage of using this realization data is that it eliminates the need to make assumptions about how much of the grants will eventually vest. This is particularly important in our setting as many grants in the UK are performance vesting, making it challenging to come up with an expectation for the probability that a given firm would achieve its performance targets. Carter, Ittner, and Zechman (2009) also benefit from this advantage as they analyze the percentage of LTIP awards that ultimately vest.

change in *Variable Pay Multiple* and its interactions are all insignificant, we find some interesting evidence in the presence of changes in other features of compensation contracts. In particular, whereas *Number of contract changes* is associated with lower risk for non-BIPRU firms, and with higher risk for the same group of firms post-2010, *Number of contract changes* is associated with higher risk for BIPRU firms pre-2010, but with lower risk after the Remuneration Code came into effect. This finding is consistent with BIPRU firms making changes to their contract features post-2010 to comply with the Remuneration Code, and these changes are affecting risk taking behavior. This finding is also consistent with firms inherently taking less risk in the aftermath of the financial crisis or having fewer opportunities to do so.

Panel B of Table 4.4 presents bank-specific measures of risk for the subsample of BIPRU firms for which data is available through SNL Financial. Since this panel uses data only for BIPRU firms, the models do not include the *BIPRU* indicator. We find some evidence in columns (3), (4), and (7) that the BIPRU firms are less risky post-2010, at the 10 percent level of significance for the results in columns (4) and (7). Although *Number of Contract Changes* (*Change in Variable Pay Multiple*) is positively (marginally positively) associated with the *Proportion of Level 3 Assets in Total Assets* as presented in column (6), this association gets mitigated in the post-2010 period for *Number of Contract Changes*. In contrast to the results tabulated in column (6), *Number of Contract Changes* is associated with higher risk post-2010, and *Change in Variable Pay Multiple* is positively associated with *Provisions as a Proportion of Total Loans.*

Our next analysis focuses on the effects of changes in compensation on CEO turnover. The potential loss of talent due to constrained compensation was one of the main concerns brought up during the consultation stage for the Remuneration Code. In particular, if changes to compensation brought on by the Remuneration Code constrain

the ability of the firm to achieve the optimal level or structure of pay to retain talent, the likelihood of turnover can increase. In Table 4.5, we find that the likelihood of CEO turnover for BIPRU firms is lower in the post-2010 period. Although the likelihood of turnover increases with the number of changes in contract features for BIPRU firms, we do not observe any association between turnover likelihood and *Change in Variable Pay Multiple* and its interactions. The evidence presented in this table suggests that the Remuneration Code is associated with lower executive turnover for the regulated firms. This could be due to the decreased job opportunities in the financial service sector after the financial crisis. This could also be because of the movement towards "reform in executive pay in financial services" across many countries. Our results may be capturing that CEOs are less likely to voluntarily leave in the post-regulation period since alternative markets are also in the process of implementing pay restrictions.

4.5.2 Event study analysis of the EU proposals to cap bankers' pay

Our final piece of analysis studies the market reaction to the recent proposal by the European Union to cap bonuses in the financial sector at the level of salary, with a possibility of increasing it to two times the salary if the firm has the supermajority backing of its shareholders. The decision was announced on February 27, 2013, which we use as our event date. As in all event studies, we jointly test whether the market revised its priors about the likelihood of regulation going forward and shareholders assessment that the regulation is going to have an effect on shareholders' wealth.

Table 4.6 Panel A presents our findings for the average abnormal returns computed relative to the UK FTSE All-share value-weighted index on the event date.[62] On average, all firms in our sample experienced significant negative abnormal returns

[62] Our results are insensitive to the choice of the reference market index measure and constituents weights.

of -0.56%. However, non-BIPRU firms experienced an average negative and significant abnormal return of -0.49% while BIPRU firms saw an average negative abnormal return of -1.01%. BIPRU firms that already paid bonuses that are more than two times the corresponding salary (*Affected*) seemed to have the largest reaction with the average abnormal return of -1.04%.[63]

Panel B of Table 4.6 presents more informative results, by showing the coefficients of regressing the event-day abnormal returns on the variables of interest and controlling for firm characteristics. *Bonus > 2 x Salary indicator* (*Cash Bonus > 2 x Salary indicator*) identifies firms potentially affected by the EU proposal. *Bonus > 2 x Salary indicator* (*Cash Bonus > 2 x Salary indicator*) is equal to 1 for all companies that have bonuses (cash bonuses) equal to at least two times the corresponding salaries. We control for firm size (*Size*), which is the natural logarithm of market value, *Book to market* and *Momentum*, defined as the market adjusted return for a given stock in the sample over the prior six months. As can be seen from the results presented in all models, on average the sample firms showed a negative reaction on the event day. This is consistent with the presence of a bad-news event that was relevant for all firms on the event day, although we tried to rule out this explanation by searching the news (see footnote 63).

Based on the results tabulated in column (3), the negative reaction to the announcement of bonus cap by the BIPRU firms whose cash bonus was greater than two times the salary is significantly larger. However, when we focus on total bonus

[63] We have conducted an extensive Factiva and general news search to identify whether any other material events have occurred on our event date. To the best of our knowledge, no material events occurred on February 27, 2013 apart from the EU decision. However, events during the week leading up to February 27 might have affected our results. In particular, on February 25, 2013 the UK sovereign debt got downgraded by Moody's (negative market reaction), on February 26, 2013 the outcome of the Italian elections became known (negative market reaction) and on February 27 a number of industrial firms in the UK had their conference calls (not discussed in the news, however). There was also some mixed news for the banking sector: the FSA and the Bank of England announced on February 27 that they will loosen capital regulations in the banking sector to encourage more entry (could be bad for large banks, however, there was no discussion about what the market reaction to this news was).

instead of cash bonus (column 6), there is no incremental negative reaction to the news by BIPRU firms, consistent investors perceiving only the cap on cash bonus to be bad news.[64]

This negative reaction to the announcement of bonus cap implies that shareholders expect a loss of company value due to the pay restrictions imposed, consistent with the view in Demsetz and Lehn (1985) that corporate governance is chosen optimally. Therefore constraints imposed by regulation can move companies out of equilibrium. The observed loss of value could be due to the expectation that firms would increase their fixed pay to comply with the regulation, therefore increasing their fixed costs, or due to larger proportion of total pay coming from fixed pay, generating the incentive for the executives to take bad risks and avoid good risks, or shareholders rationally expecting that firms would increase other components of pay not subject to the cap, thereby not effectively decreasing excess pay, or the anticipation that the specialized talent at regulated financial services companies would migrate to unregulated companies within the sector or to unregulated countries.

4.6 Conclusion

The 2008 financial crisis brought further attention to executive compensation in the financial services industry. In the UK, the new Remuneration Code came into effect in 2009 as a result of the allegation that misalignment of shareholders' and executives incentives was at least partly to blame for excessive risk-taking leading up to the financial crisis.

[64] In the next version of this paper, we plan to extend our event study analysis to include other events surrounding the introduction of the Remuneration Code and the various EU discussions regarding bonus cap and executive compensation. We will also use other EU and US banks as additional control groups since they were not subject to UK remuneration regulations, but were likely to have been affected by the financial crisis in a similar fashion.

In this paper, we examine the changes in compensation practices after the passage of the Remuneration Code and study the related consequences. We find that BIPRU firms experience a decrease in total compensation when their compensation contracts change in the post-2010 period. We find that BIPRU firms have higher deferred bonuses after the regulation became effective, as prescribed by the regulation. We find some evidence of increase in pay-performance sensitivity. BIPRU firms exhibit less risk when they make changes to compensation contracts after the regulation. We also find lower turnover among BIPRU firms post-2010, potentially due to decreased job opportunities in the financial services sector. Although some of the above changes seem to indicate beneficial outcomes following the regulation, an event study we conducted on the day the European Union announced a bonus cap shows negative abnormal returns. This finding is suggestive of investors perceiving that regulation executive compensation might also result in some endogenous costs.

Although we use the UK as our setting in this paper, our evidence should be of interest to regulators that are currently in the process of developing their own set of compensation rules, to the extent that the existing institutions, compensation practices, and proposed changes in compensation of CEOs in the financial sector in the UK and other countries, such as US and EU member countries are similar. However, since the Remuneration Code is very recent and therefore our post-regulation data is limited, we would recommend caution with interpreting our results. It may be too soon to tell the net benefits of regulating compensation.

We also note that the findings of this paper may be affected by the fact that we compare large financial firms with non-financial sector UK firms. If the impact of the financial crisis on BIPRU executive remuneration behavior differed from the impact on non-BIPRU firms, then our analysis may capture the effect of the end of the financial

crisis as well as the enactment of the Remuneration Code. In order to address this concern, in the next version of this paper, we will construct propensity-score matched control groups of other banks that were affected by the crisis but were not subject to this particular regulation. Furthermore, we will provide a more extensive event study analysis documenting investors' reactions to the initial proposals of the Remuneration Code and other proposed changes in executive pay regulation in the European Union.

Appendix 4.A: Variable Definitions

Variable	Definition	Source
% Deferred bonus in total compensation	Share of total bonus (cash and deferred) in total compensation.	Computed by the authors using IDS data
% LTIPs in total compensation	Share of long-term incentive performance plans (LTIP) to total compensation.	Computed by the authors using IDS data
% Options granted in total compensation	Share of the value of options granted during the fiscal year in total compensation.	Computed by the authors using IDS data
% Salary in total compensation	Share of base salary in the CEO's total compensation.	Computed by the authors using IDS data
% Total bonus in total compensation	Share of total bonus (cash and deferred) in total compensation.	Computed by the authors using IDS data
Abnormal return	Market-adjusted event day return.	Computed by the authors using Datastream data
Annual bonus deferral scheme	Indicator variable which takes the value of 1 if a company has a deferral policy in place for bonuses and 0 otherwise.	IDS
Annual bonus scheme	Indicator variable which takes the value of 1 if a company has an annual bonus scheme in place.	IDS, CIQ
Annual matching scheme	Indicator variable which takes the value of 1 if a company has an annual bonus matching scheme in place.	IDS
Bonus > 2 x Salary indicator	Indicator variable which takes the value of 1 for all companies that have bonuses at least two times greater than the corresponding base salaries.	Computed by the authors using IDS data
BIPRU	Indicator variable which takes the value of 1 if the company is a UK-based financial institution subject to the FSA Remuneration Code regulation and 0 otherwise.	FSA
BIPRU x Post 2010 interaction	Interaction variable between the indicator variable for UK financial institutions and post-2010 period.	
Book to market	Ratio of book value of assets to the sum of book value of liabilities plus market value of equity.	Datastream
Cash bonus	Cash bonus received in a given year (£thousands).	IDS, CIQ
Cash Bonus > 2 x Salary indicator	Indicator variable which takes the value of 1 for all companies that have cash bonuses at least two times greater than the corresponding base salaries.	
Cash compensation	Cash component of total compensation computed as the sum of salary, cash bonus and other annual cash compensation in a given year (£thousands).	IDS, CIQ
CEO Incentives	Sum of values of granted shares, LTIPs and options (£thousands).	IDS, CIQ
Change in the variable pay multiple	Year-on-year changes in the variable pay multiple, where the variable pay multiple is computed as variable pay divided by salary.	Computed by the authors using IDS data
Change in the bonus deferral period	Indicator variable which takes the value of 1 if there is a change to the deferral period.	IDS
Change to compulsory deferral bonus policy	Indicator variable which takes the value of 1 if there is a change to compulsory bonus deferral policy.	IDS
Change to contract complexity	Indicator variable which takes the value of 1 if there is a change to contract complexity compared to the previous year. Contract complexity is defined as the total number of targets and other requirements an executive has to satisfy in a given year to qualify for incentives-based pay.	Computed by the authors using IDS data
Change to shareholding requirements	Indicator variable which takes the value of 1 if there is a change to the shareholding requirement policy.	Computed by the authors

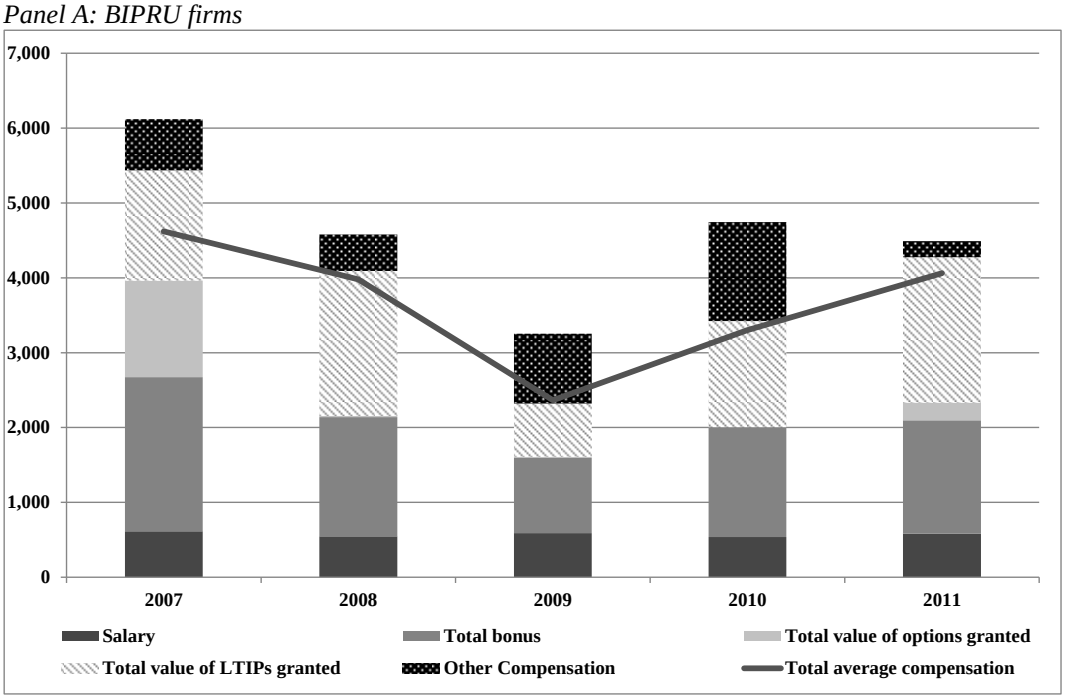
Variable	Definition	Source
		using IDS data
Contract change	Indicator variable which takes the value of 1 if the overall compensation contract has changed from one year to the next.	Computed by the authors using IDS data
Deferral policy compulsory	Indicator variable which takes the value of 1 if a company has a compulsory bonus deferral policy in place.	IDS
Deferral policy voluntary	Indicator variable which takes the value of 1 if a company has a voluntary bonus deferral policy in place.	IDS
Deferred bonus	Deferred portion of a bonus received in a given year. Typically subject to performance conditions (£thousands).	IDS, CIQ
Idiosyncratic risk	Standard deviation of the residuals from the market model estimated using daily returns over the previous year (t-1).	Datastream
Leverage	Ratio of book value of liabilities to the market value of assets.	Datastream
Leverage ratio	IFRS Leverage ratio (for BIPRU only). Computed as Tier 1 regulatory capital divided by tangible assets adjusted by derivative liabilities.	SNL Financial
Log CEO Deferred Bonus	The natural logarithm of CEOs' total deferred bonus in a given year.	Computed by the authors using IDS, CIQ data
Log CEO Incentive Grants	The natural logarithm of CEOs' incentive pay computed as the sum of values of deferred bonus, options granted and LTIPs granted.	Computed by the authors using IDS, CIQ data
Log CEO Salary	The natural logarithm of CEOs' base salary.	Computed by the authors using IDS, CIQ data
Log CEO Total Compensation	The natural logarithm of CEOs' total compensation computed as the sum of basic salary, total bonus, other benefits, options granted valued using the Black Scholes method and LTIPs values as options, restricted stock or cash depending on their respective category.	Computed by the authors using IDS, CIQ data
Momentum	Market adjusted return over the six months prior to the event date.	Computed by the authors using Datastream data
MV	Market value at the start of the year (£thousands).	Datastream
Number of contract changes	The number of contractual features changing in a given component of compensation scaled by the number of contractual features present in that component at the beginning of the year, summed across the components with weights applied as the proportion that the corresponding compensation component represents in total pay.	Computed by the authors using IDS data
Number of live LTIP schemes	Number of live LTIP schemes.	IDS
Number of live Option schemes	Number of live Options-granting schemes.	IDS
Other compensation	Total compensation – Total bonus – Base salary – CEO Incentives (£thousands)	Computed by the authors using IDS data
Post 2010 Indicator	Indicator variable which takes the value of 1 starting from the fiscal year of 2010 to indicate changes in the remuneration policy.	
Proportion of Level 3 Assets in total assets	Share of reported Level 3 assets for fair value estimation in total assets (for BIPRU only).	SNL Financial
Provisions as a proportion of Total Loans	Provisions for non-performing loans as a proportion of average total loans (for BIPRU only).	SNL Financial
ROA	Return on assets computed as the ratio of net income before extraordinary items to average total assets.	Datastream
RWA as a proportion of total assets	Ratio of risk-weighted assets to total assets (for BIPRU only).	SNL Financial
Sales	Sales or gross interest and other income for financial institutions (measured in £thousands).	Datastream
Shareholder return	One-year total return to shareholders.	Datastream
Shareholding requirement	Indicator variable which takes the value of one if a company	IDS

Variable	Definition	Source
	has a shareholding requirement policy in place.	
Size	Natural logarithm of market value.	Datastream
Take home pay	Total cash compensation computed as the sum of Base salary, Cash bonus, Other cash compensation and the value of vested Options and LTIP grants.	Computed by the authors using IDS, CIQ data
Tenure	CEO's tenure measured as the number of year spent with a given firm.	Computed by the authors using IDS, CIQ data
Total compensation	Total amount received by the CEO in a given year; consists of base salary, total bonus, option and LTIP incentives grants valued at the point of granting and miscellaneous payments.	Computed by the authors using IDS data
Total contract change	Indicator variable which takes the value of 1 if the overall contract has changed compared to the previous year.	Computed by the authors using IDS data
Total number of bonus targets per year	Total number of performance targets relating to annual bonus payments.	Computed by the authors using IDS data
Total number of changes in a contract per year	Total number of changes to the overall incentives contract.	Computed by the authors using IDS data
Total number of changes to bonus targets	Total number of changes to the number of annual bonus performance targets.	IDS
Total number of changes to bonus targets weighted by the share of total bonus	Total number of changes to bonus targets weighted by the share of total bonus	Computed by the authors using IDS, CIQ data
Total number of changes to LTIP targets	Total number of changes to the number of annual LTIP performance targets.	Computed by the authors using IDS data
Total number of changes to LTIP targets weighted by the share of total bonus	Total number of changes to LTIP targets weighted by the share of total bonus	Computed by the authors using IDS, CIQ data
Total number of changes to Option targets	Total number of changes to the number of annual Option-grants-related performance targets.	Computed by the authors using IDS data
Total number of changes to Option targets weighted by the share of total bonus	Total number of changes to Option-grants targets weighted by the share of total bonus	Computed by the authors using IDS, CIQ data
Total number of LTIP targets per year	Total number of performance targets relating to annual LTIP grants.	Computed by the authors using IDS data
Total number of Option targets per year	Total number of performance targets relating to annual Option grants.	Computed by the authors using IDS data
Total number of unique performance targets	Number of performance targets for each individual contract. Overlapping targets, such as for example TSR for bonus targets and TSR for LTIP performance targets were counted as one, indicating that an individual needs to meet only one performance target to satisfy performance conditions.	Computed by the authors using IDS
Total value of LTIPs granted	Total value of LTIPs granted (if granted as restricted stock or stock) valued at the point of grant (£thousands). LTIPs are valued using the Black Scholes methodology if LTIPs are granted as options and exercise price is clearly identifiable.	Computed by the authors using IDS, CIQ, Datastream
Total value of Options granted	Total value of options granted at the end of the fiscal year, valued using Black-Scholes formula and assuming a 7-year maturity (£thousands).	Computed by the authors using IDS, CIQ, Datastream
Total volatility	Standard deviation of returns estimated daily over the previous year (t-1).	Datastream

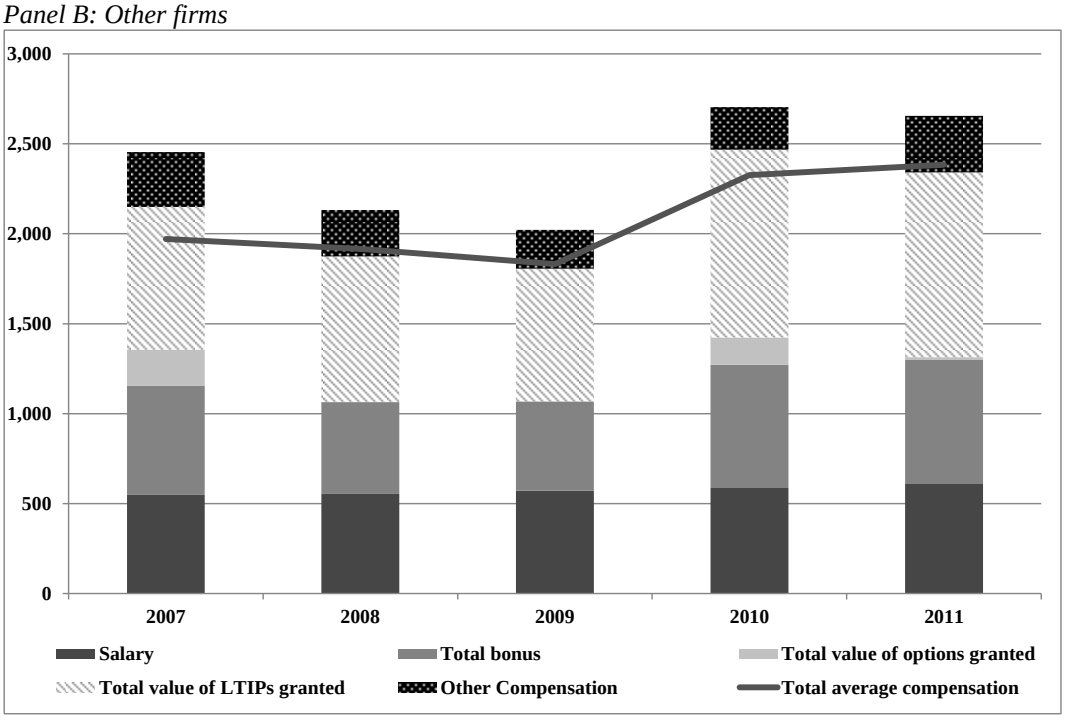
Variable	Definition	Source
Turnover	Indicator variable which takes the value of 1 if there is a change of CEO in a given year.	Computed by the authors using IDS and CIQ data

Figure 4.1: Components of CEO compensation (£thousands)

Panel A: BIPRU firms



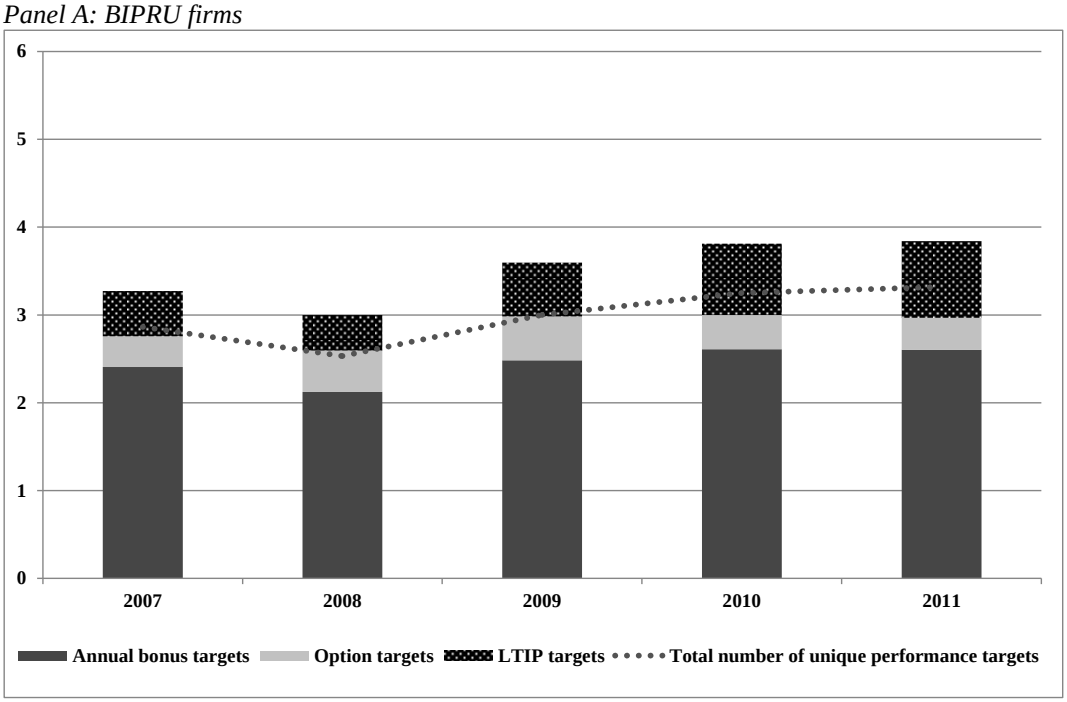
Panel B: Other firms



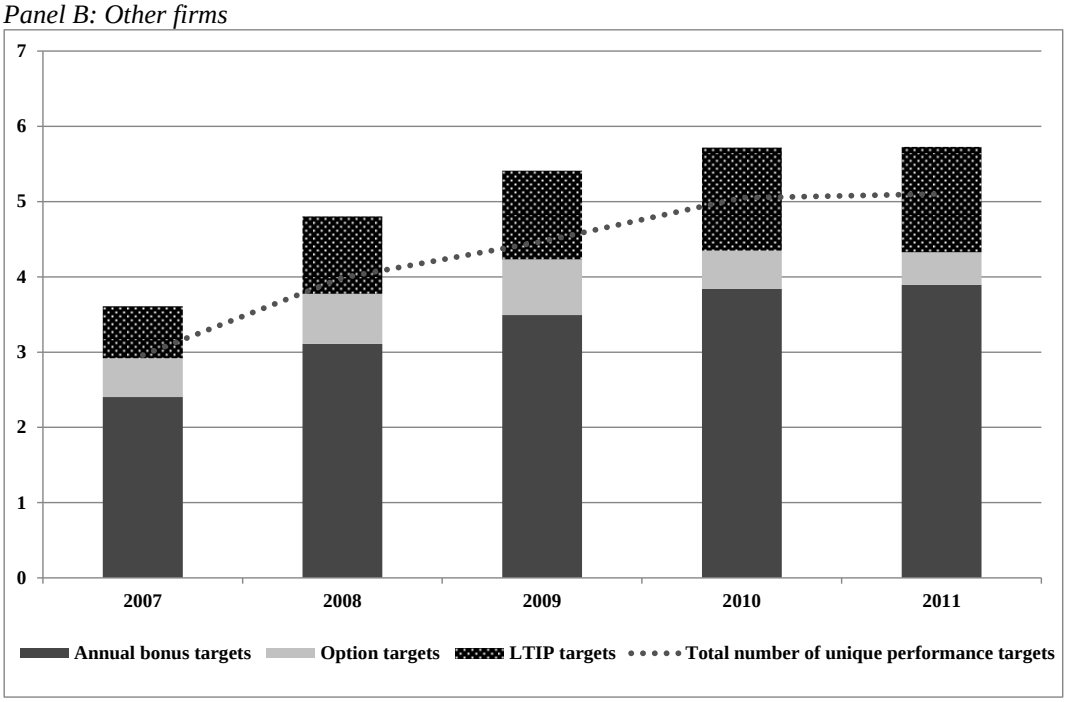
This figure presents the component breakdown of average proportions of CEO compensation for the 2007-2011 period. Panel A presents the results for the BIPRU firms subject to the Remuneration Code (BIPRU) and Panel B shows the results for the largest UK companies (constituents of FTSE350, excluding BIPRU). Please note that due to winsorization the total average compensation plotted in this figure is not the same as sum of the components. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year.

Figure 4.2: Average number of performance targets

Panel A: BIPRU firms



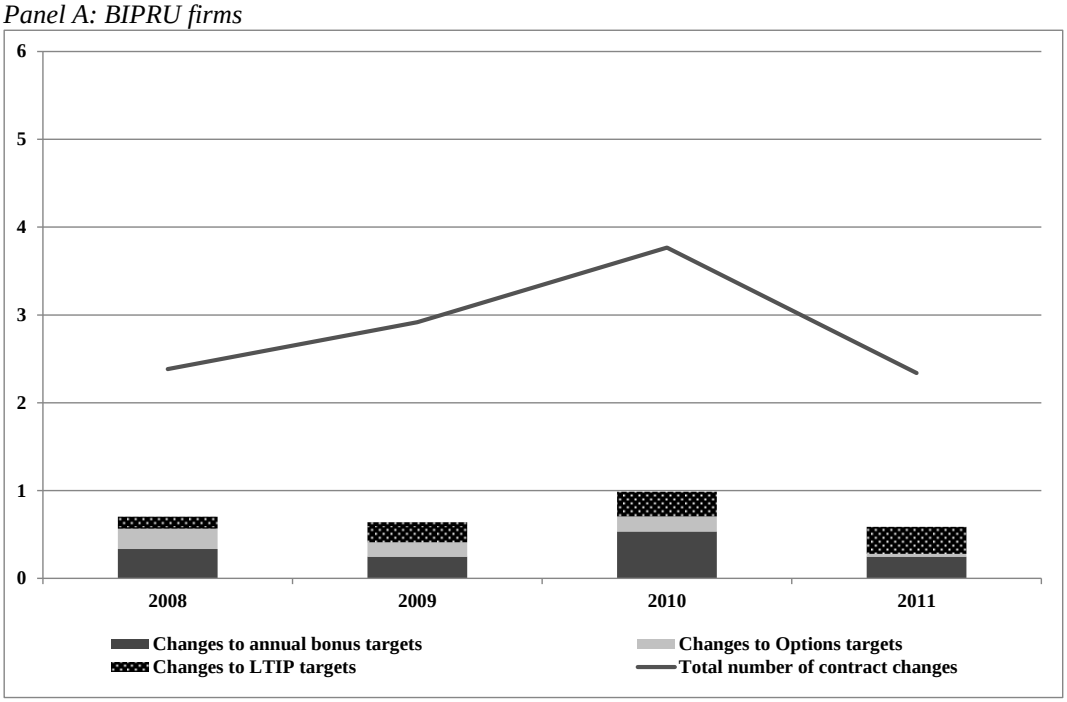
Panel B: Other firms



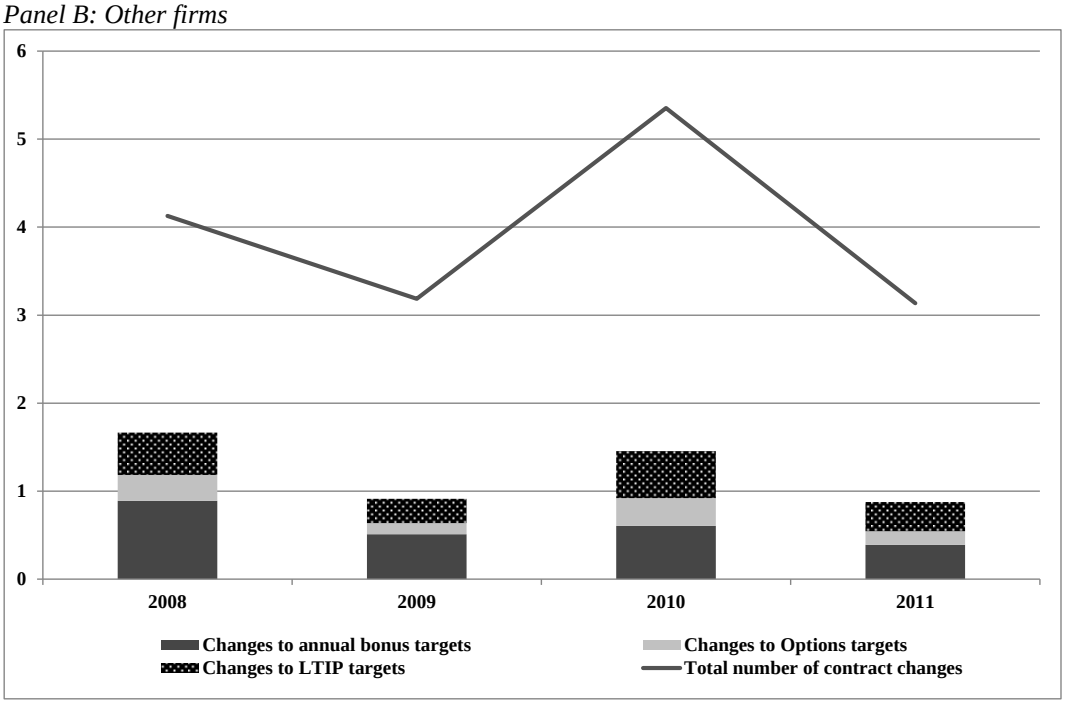
This figure presents the component breakdown of average number of performance targets for CEOs. Panel A shows the results for the CEOs of BIPRU firms subject to the Remuneration Code and Panel B shows the results for CEOs of UK largest companies (constituents of FTSE350 excluding BIPRU). The dashed line shows the average number of unique performance targets (i.e., counting LTIP TSR target and Annual Bonus TSR target as one rather than two) for the period of 2007-2011. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year.

Figure 4.3: Average number of changes in performance targets

Panel A: BIPRU firms



Panel B: Other firms



This figure presents the component breakdown of average number of year-on-year changes in the performance targets for CEOs of BIPRU firms subject to the Remuneration Code in Panel A and CEOs of the largest UK companies (constituents of FTSE350 excluding BIPRU) in Panel B. The figures are for the period of 2008-2011. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year.

Table 4.1: Descriptive statistics

Panel A: BIPRU firms

Variable	N	Mean	Std dev.	Min	Median	Max
Total compensation	103	3,592.63***	2,752	405.92	2,866	17,055
Take home pay	103	3,323.5***	3,337	405.92	2,209	16,089
% Salary in total comp.	103	0.24***	0.21	0.01	0.19	0.99
% Total bonus in total comp.	103	0.43***	0.29	0.00	0.38	0.98
% Deferred bonus in total comp.	103	0.08***	0.13	0.00	0.00	0.49
% Options granted in total comp.	103	0.02	0.09	0.00	0.00	0.78
% LTIPs in total comp.	103	0.28	0.26	0.00	0.32	0.92
Tenure	103	9	7	1	8	29
Sales	103	12,800,000***	22,300,000	48,970	826,521	74,300,000
MV	103	15,800,000***	29,200,000	189,280	1,605,090	123,000,000
Book to Market	103	0.77***	0.27	0.12	0.90	1.04
Leverage	103	0.66***	0.32	0.05	0.79	0.99
Shareholder Return	103	0.06**	0.41	-0.71	0.01	1.27
Idiosyncratic Risk	103	0.37**	0.21	0.10	0.31	1.33

Panel B: Other firms

Variable	N	Mean	Std dev.	Min	Median	Max
Total compensation	1,214	2,080	1,837	150.00	1,483	10,709
Take home pay	1,214	2,002	2,269	69.00	1,298	19,715
% Salary in total comp.	1,214	0.39	0.20	0.05	0.35	1.00
% Total bonus in total comp.	1,214	0.28	0.17	0.00	0.27	0.92
% Deferred bonus in total comp.	1,214	0.02	0.07	0.00	0.00	0.47
% Options granted in total comp.	1,214	0.02	0.08	0.00	0.00	0.81
% LTIPs in total comp.	1,214	0.28	0.23	0.00	0.33	0.85
Tenure	1,214	8	7	0	7	35
Sales	1,214	4,106,541	8,674,953	1,848	1,000,813	58,900,000
MV	1,214	4,714,818	10,500,000	15,730	1,224,220	76,200,000
Book to Market	1,214	0.70	0.29	0.10	0.68	2.14
Leverage	1,212	0.43	0.21	0.01	0.42	0.98
Shareholder Return	1,214	0.15	0.56	-0.94	0.09	5.88
Idiosyncratic Risk	1,214	0.33	0.14	0.05	0.29	1.15

Panel C: Incentives and contract changes (BIPRU firms)

Variable	N	Mean	Std dev.	Min	Median	Max
Annual bonus scheme	122	0.98	0.13	0.00	1.00	1.00
Annual bonus deferral scheme	122	0.92***	0.27	0.00	1.00	1.00
Deferral policy compulsory	122	0.9***	0.30	0.00	1.00	1.00
Deferral policy voluntary	122	0.07	0.26	0.00	0.00	1.00
Number of live LTIP schemes	122	0.08	0.28	0.00	0.00	1.00
Number of live Option schemes	122	0.32***	0.52	0.00	0.00	2.00
Shareholding requirement	122	0.12	0.33	0.00	0.00	1.00
Total number of unique performance targets per year	122	4.47**	1.97	1.00	5.00	8.00
Total number of performance targets per year	122	5.11***	2.22	1.00	5.00	10.00
Total number of bonus targets per year	122	3.52	1.65	1.00	3.00	7.00
Total number of LTIP targets per year	122	1.14**	0.92	0.00	1.00	3.00
Total number of Option targets per year	122	0.51*	0.84	0.00	0.00	4.00
Total number of changes in a contract per year	122	4.97**	4.33	0.00	4.00	18.00
Total number of changes to bonus targets	122	0.64	1.01	0.00	0.00	5.00
Total number of changes to LTIP targets	122	0.39	0.62	0.00	0.00	3.00
Total number of changes to Option targets	122	0.28	0.85	0.00	0.00	5.00
Bonus target changes as a percentage of total changes	122	0.24	0.36	0.00	0.00	1.00
LTIP target changes as a percentage of total changes	122	0.17	0.30	0.00	0.00	1.00
Options target changes as a percentage of total changes	122	0.06	0.17	0.00	0.00	0.75
Change to shareholding requirements	122	0.12	0.33	0.00	0.00	1.00
Change in the deferral period	122	0.16	0.36	0.00	0.00	1.00
Change to compulsory deferral bonus policy	122	0.07*	0.35	0.00	0.00	1.00
Number of contract changes (weighted)	122	0.18	0.43	0.00	0.00	2.88

Panel D: Incentives and contract changes (Other firms)

Variable	N	Mean	Std dev.	Min	Median	Max
Annual bonus scheme	974	0.98	0.12	0.00	1.00	1.00
Annual bonus deferral scheme	974	0.64	0.48	0.00	1.00	1.00
Deferral policy compulsory	974	0.63	0.48	0.00	1.00	1.00
Deferral policy voluntary	974	0.10	0.29	0.00	0.00	1.00
Number of live LTIP schemes	974	0.05	0.21	0.00	0.00	2.00
Number of live Option schemes	974	0.11	0.33	0.00	0.00	2.00
Shareholding requirement	974	0.09	0.29	0.00	0.00	1.00
Total number of unique performance targets per year	974	4.85	1.75	1.00	5.00	9.00
Total number of performance targets per year	974	5.61	2.08	0.00	6.00	11.00
Total number of bonus targets per year	974	3.71	1.41	1.00	4.00	7.00
Total number of LTIP targets per year	974	1.31	0.80	0.00	1.00	4.00
Total number of Option targets per year	974	0.65	0.88	0.00	0.00	3.00
Total number of changes in a contract per year	974	4.09	3.58	0.00	4.00	18.00
Total number of changes to bonus targets	974	0.64	1.06	0.00	0.00	6.00
Total number of changes to LTIP targets	974	0.42	0.65	0.00	0.00	4.00
Total number of changes to Option targets	974	0.25	0.61	0.00	0.00	3.00
Bonus target changes as a percentage of total changes	974	0.25	0.36	0.00	0.00	1.00
LTIP target changes as a percentage of total changes	974	0.19	0.32	0.00	0.00	1.00
Options target changes as a percentage of total changes	974	0.09	0.23	0.00	0.00	1.00
Change to shareholding requirements	974	0.09	0.29	0.00	0.00	1.00
Change in the deferral period	974	0.14	0.34	0.00	0.00	1.00
Change to compulsory deferral bonus policy	974	0.11	0.31	0.00	0.00	1.00
Number of contract changes (weighted)	974	0.22	0.35	0.00	0.00	2.32

This table presents the descriptive statistics for CEO compensation and its determinants for the BIPRU firms subject to the Remuneration Code (BIPRU) and the largest UK companies (constituents of FTSE350, excluding BIPRU). All values are in thousands of pound sterling (£thousands) unless otherwise indicated. Panel A presents the summary statistics data for BIPRU firms and Panel B shows summary statistics for other UK institutions. Panel A also shows whether means of the variables are significantly different from the corresponding variables of Panel B using the difference in means test. Panel C and Panel D show the complexity of CEO compensation contracts in relation to the number of targets and corresponding changes. Panel C also shows whether means of the variables are significantly different from those of Panel D using the difference in means test. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year. All variables are defined in Appendix 4.A. ***, **, * designate significance at 1%, 5% and 10% levels respectively.

Table 4.2: Determinants of CEO compensation

	Log CEO Total Compensation			Log CEO Salary			Log CEO Incentive Grants			Log CEO Deferred Bonus		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
BIPRU	0.38***	0.43***	0.33**	-0.31***	-0.31***	-0.33***	0.46	0.51	0.06	0.57	0.08	-0.08
	(3.748)	(3.393)	(2.340)	(-6.700)	(-6.034)	(-5.039)	(1.219)	(1.361)	(0.138)	(1.173)	(0.263)	(-0.251)
Post 2010		0.08**	-0.00		0.02	0.01		0.26	-0.07		0.52***	0.51***
		(2.560)	(-0.071)		(1.342)	(0.520)		(1.543)	(-0.281)		(5.728)	(4.940)
BIPRU x Post 2010		-0.10	-0.01		-0.00	0.03		-0.03	0.54		1.45***	1.33***
		(-0.830)	(-0.041)		(-0.196)	(0.498)		(-0.047)	(0.665)		(3.895)	(3.870)
Number of contract changes			-0.24***			-0.06*			-0.83			-0.08
			(-2.668)			(-1.750)			(-1.647)			(-0.312)
Number of contract changes x Post 2010			0.39**			0.02			1.68**			0.04
			(2.570)			(0.343)			(2.483)			(0.074)
BIPRU x Number of contract changes			0.39***			0.07			1.66***			0.50
			(3.580)			(1.023)			(3.142)			(0.858)
BIPRU x Number of contract changes x Post 2010			-0.49**			-0.15			-2.92			0.97
			(-2.350)			(-0.940)			(-1.622)			(0.946)
Log(Sales)_{t-1}	0.25***	0.25***	0.25***	0.20***	0.20***	0.20***	0.36***	0.37***	0.36***	0.28***	0.31***	0.31***
	(12.999)	(12.942)	(12.589)	(24.828)	(24.813)	(24.401)	(4.154)	(4.256)	(4.093)	(4.861)	(5.360)	(5.376)
$\text{Book to market}_{t-1}$	0.02	-0.00	-0.04	0.15**	0.14**	0.13**	0.44	0.36	0.24	-0.70**	-0.88**	-0.91**
	(0.166)	(-0.036)	(-0.314)	(2.434)	(2.344)	(2.248)	(0.876)	(0.713)	(0.472)	(-2.105)	(-2.533)	(-2.528)
$\text{Log(Idio. Risk)}_{t-1}$	-1.53***	-1.38***	-1.52***	-0.28***	-0.23**	-0.26***	-5.13***	-4.57***	-5.05***	-2.72***	-1.22*	-1.29*
	(-8.691)	(-6.624)	(-7.035)	(-3.502)	(-2.470)	(-2.818)	(-5.420)	(-4.249)	(-4.385)	(-3.969)	(-1.834)	(-1.945)
Log(Tenure)_{t-1}	0.03	0.02	0.02	0.02	0.02	0.02	-0.08	-0.10	-0.11	0.11	0.09	0.09
	(1.057)	(0.857)	(0.743)	(1.606)	(1.531)	(1.503)	(-0.752)	(-0.856)	(-0.941)	(1.604)	(1.291)	(1.284)
Leverage_{t-1}	-0.27*	-0.28*	-0.24*	-0.14*	-0.15*	-0.14	0.50	0.47	0.61	0.54	0.44	0.53
	(-1.907)	(-1.952)	(-1.703)	(-1.685)	(-1.699)	(-1.599)	(0.608)	(0.573)	(0.722)	(1.091)	(0.841)	(0.971)
$\text{Shareholder return}_{t}$	-0.02	-0.02	-0.02	-0.06***	-0.06***	-0.06***	-0.37**	-0.37**	-0.35**	0.09	0.08	0.08
	(-0.552)	(-0.601)	(-0.435)	(-3.122)	(-3.101)	(-2.975)	(-2.342)	(-2.445)	(-2.390)	(0.803)	(0.690)	(0.681)
Industry Indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,317	1,317	1,317	1,317	1,317	1,317	1,317	1,317	1,317	1,317	1,317	1,317
Adjusted R-squared	0.432	0.433	0.437	0.555	0.555	0.554	0.088	0.088	0.090	0.110	0.133	0.132

This table presents the results of OLS regression estimation of the determinants of CEO compensation for CEOs of the largest BIPRU and non-BIPRU firms. *Log CEO Total Compensation* is the natural logarithm of CEOs' total compensation computed as the sum of basic salary, total bonus, other benefits, options granted valued using the Black Scholes method and LTIPs valued as options, restricted stock or cash depending on their respective category. *Log CEO Salary* is the natural logarithm of CEOs' base salary. *Log CEO Incentives Grants* is the natural logarithm of CEOs' incentive pay computed as the sum of values of deferred bonus, options granted and LTIPs granted. *Log CEO Deferred Bonus* is the natural logarithm of CEO's total deferred bonus in a given year. *BIPRU* is equal to one for BIPRU firms subject to the FSA Remuneration Code. *Post 2010* takes the value of 1 for years 2010 and 2011. *Number of contract changes* is computed as a number of changes in a given contract divided by the number of aspects in a given contract and weighted by the importance of each category of compensation in the total contract. All other variables are defined in Appendix 4.A. The sample period is 2007-2011. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year. Values of *t*-statistics (reported in parentheses) are computed based on robust standard errors clustered at the industry and year level. ***, **, * designate significance at 1%, 5% and 10% levels respectively.

Table 4.3: Effect of new regulation on pay-performance sensitivity for UK CEOs

	Log CEO Total Compensation			Log CEO Incentive Grants			Log CEO Deferred Bonus		
	All	**Pre 2010**	**Post 2010**	**All**	**Pre 2010**	**Post 2010**	**All**	**Pre 2010**	**Post 2010**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BIPRU	-0.86***	-0.73***	-1.39***	-2.81***	-2.83***	-2.03***	0.08	-0.08	0.14
	(-6.234)	(-4.045)	(-7.072)	(-6.959)	(-5.553)	(-3.805)	(0.336)	(-0.251)	(0.168)
Shareholder return	0.03	0.08	-0.06	-0.23	-0.28	0.04	-0.08	0.09	-0.39*
	(0.532)	(1.502)	(-0.729)	(-1.234)	(-1.249)	(0.128)	(-0.659)	(0.801)	(-1.952)
Number of contract changes	-0.04	-0.04	0.08	-0.54**	-0.68**	0.03	-0.42**	-0.12	-0.57*
	(-0.743)	(-0.636)	(0.782)	(-2.164)	(-2.229)	(0.058)	(-2.544)	(-0.689)	(-1.722)
Number of contract changes x Sh. return	-0.10	-0.19	0.05	0.01	0.04	-0.35	0.34	-0.02	1.14*
	(-0.956)	(-1.635)	(0.470)	(0.036)	(0.112)	(-0.402)	(1.641)	(-0.118)	(1.879)
BIPRU x Sh. return	0.01	-0.21	0.41	-1.07	-0.73	-2.71	1.16	0.62	2.34
	(0.041)	(-0.580)	(1.171)	(-1.302)	(-1.041)	(-1.592)	(0.976)	(0.519)	(1.189)
BIPRU x Number of contract changes	0.56***	0.54***	0.71***	0.54*	0.40	2.35***	1.07***	0.74***	2.62**
	(8.204)	(8.118)	(3.768)	(1.690)	(1.110)	(4.889)	(4.277)	(4.817)	(2.601)
BIPRU x Number of contract changes x Sh. return	-0.25*	-0.18	-0.45	0.40	-0.23	2.35	-2.33*	-1.57	-8.17
	(-1.823)	(-0.885)	(-0.378)	(0.340)	(-0.175)	(0.723)	(-1.972)	(-1.084)	(-1.491)
Log(Sales) $_{t-1}$	0.25***	0.26***	0.23***	0.40***	0.38***	0.44***	0.18***	0.11**	0.26**
	(15.262)	(12.463)	(11.218)	(5.424)	(3.922)	(5.275)	(3.371)	(2.241)	(2.721)
Book to market $_{t-1}$	0.10	0.05	0.05	0.40	0.30	0.29	-0.33	-0.22	-0.75
	(0.977)	(0.371)	(0.312)	(0.875)	(0.438)	(0.527)	(-1.093)	(-0.662)	(-1.229)
Log(Idio. Risk) $_{t-1}$	-1.31***	-0.87***	-2.15***	-4.94***	-4.60***	-5.01**	-2.88***	-0.43	-5.54***
	(-4.827)	(-2.849)	(-4.087)	(-5.146)	(-3.880)	(-2.382)	(-3.896)	(-0.635)	(-3.092)
Log(Tenure) $_{t-1}$	0.04	0.06*	-0.00	-0.05	0.05	-0.20	0.10	0.13*	-0.02
	(1.619)	(2.001)	(-0.012)	(-0.509)	(0.337)	(-1.558)	(1.558)	(1.991)	(-0.135)
Leverage $_{t-1}$	-0.35**	-0.42**	-0.15	0.02	0.07	0.19	0.68	-0.02	1.70
	(-2.416)	(-2.443)	(-0.676)	(0.026)	(0.067)	(0.244)	(1.316)	(-0.035)	(1.544)
Industry Indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,331	799	532	1,331	799	532	1,331	799	532
Adjusted R-squared	0.394	0.396	0.373	0.111	0.102	0.097	0.088	0.044	0.118

This table presents the results of OLS regressions to estimate CEO's pay sensitivity to performance. *Log CEO Total Compensation* is defined as the sum of salary, bonus, other benefits, value of options and LTIPs. *Log CEO Incentive Grants* is the natural logarithm of CEOs' incentive pay computed as the sum of values of deferred bonus, options granted and LTIPs granted. *Log CEO Deferred Bonus* is the natural logarithm of CEO's total deferred bonus in a given year. Models (2), (3), (5), (6), (8) and (9) provide the results split by before and after

the introduction of the Remuneration Code. *BIPRU* is equal to one for BIPRU firms subject to the FSA Remuneration Code. *Shareholder return* is the one-year total return to shareholders. All other variables are defined in Appendix 4.A. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year. Values of *t*-statistics (reported in parentheses) are computed based on robust standard errors clustered at the industry and year level. ***, **, * designate significance at 1%, 5% and 10% levels respectively.

Table 4.4: Effect of new regulation on risk-taking

Panel A: General risk

	Idiosyncratic Risk		Total Volatility		Leverage	
	(1)	(2)	(3)	(4)	(5)	(6)
BIPRU	-0.06	-0.05	-0.08	-0.08	0.05	0.05
	(-0.715)	(-0.648)	(-0.767)	(-0.914)	(1.152)	(0.982)
Post 2010	-0.12***	-0.16***	-0.14***	-0.18***	-0.05***	-0.06***
	(-8.198)	(-11.461)	(-7.676)	(-9.508)	(-2.926)	(-2.781)
BIPRU x Post 2010	-0.04	-0.07	-0.05	-0.08	0.03	0.04
	(-0.483)	(-0.960)	(-0.538)	(-0.967)	(1.142)	(1.056)
Number of contract changes		-0.12***		-0.14***		-0.06***
		(-9.367)		(-8.784)		(-3.194)
Number of contract changes x Post 2010		0.12***		0.14***		0.04
		(7.603)		(6.326)		(1.605)
BIPRU x Number of contract changes		0.08***		0.12***		0.02
		(3.668)		(5.183)		(0.601)
BIPRU x Number of contract changes x Post 2010		-0.10**		-0.13**		-0.09**
		(-2.057)		(-2.403)		(-2.122)
Ch. Variable pay multiple		-0.00		-0.00		-0.00
		(-0.779)		(-0.684)		(-0.646)
Ch. Variable pay multiple x Post 2010		-0.00		0.00		-0.00
		(-0.370)		(0.012)		(-0.020)
BIPRU x Ch. Variable pay multiple		-0.00		-0.00		0.00
		(-0.321)		(-0.243)		(0.658)
BIPRU x Ch. Variable pay multiple in total salary x Post 2010		0.00		0.00		0.00
		(0.923)		(0.591)		(0.068)
Log(Sales)_{t-1}	-0.03***	-0.03***	-0.02***	-0.02***	0.01***	0.01***
	(-9.807)	(-7.649)	(-4.019)	(-3.112)	(6.141)	(4.836)
Book to market $_{t-1}$	0.06**	0.04	0.09***	0.06*	-0.06	-0.09***
	(2.314)	(1.266)	(3.150)	(1.754)	(-1.573)	(-2.652)
Leverage $_{t-1}$	0.17***	0.17***	0.13***	0.14**	0.81***	0.83***
	(4.770)	(3.928)	(3.166)	(2.591)	(26.663)	(22.046)
Industry Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,316	1,316	1,316	1,316	1,316	1,316
Adjusted R-squared	0.304	0.369	0.300	0.368	0.771	0.774

Panel B: Banks-specific measures of risk

	Leverage Ratio		RWA as a Proportion of Total Assets		Proportion of Level 3 Assets in Total Assets		Provisions as a Proportion of Total Loans	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	0.01	0.01	-0.10	-0.12	-0.04*	-0.13**	-5.02***	-4.98**
	(0.371)	(0.289)	(-0.245)	(-0.301)	(-1.716)	(-2.204)	(-2.892)	(-2.125)
Post 2010	0.00	0.01	-0.11***	-0.07*	0.00	0.00	-0.44*	-0.33
	(0.691)	(1.328)	(-2.994)	(-1.950)	(0.360)	(1.280)	(-1.955)	(-1.032)
Number of contract changes	-0.00	0.00	0.00	-0.01	0.00	0.01***	-0.10	0.00
	(-0.205)	(0.462)	(0.107)	(-0.166)	(1.440)	(3.150)	(-0.400)	(0.006)
Number of contract changes x Post 2010	0.00	0.01	0.05	0.19**	-0.01	-0.01*	0.89	2.11***
	(0.489)	(1.172)	(0.409)	(2.329)	(-1.452)	(-1.825)	(1.223)	(3.262)
Ch. Variable pay multiple		0.00		0.00		0.00*		0.01
		(0.299)		(1.328)		(1.964)		(0.869)
Ch. Variable pay multiple x Post 2010		-0.00		-0.01		-0.00		-0.07**
		(-0.465)		(-1.581)		(-0.410)		(-2.187)
Log(Sales)_{t-1}	-0.00	-0.00	0.01	0.02**	0.00	-0.00	-0.01	-0.01
	(-1.579)	(-1.198)	(0.860)	(2.706)	(1.618)	(-0.670)	(-0.200)	(-0.193)
Book to market $_{t-1}$	0.66***	0.57***	4.72***	4.30***	-0.02	0.08	9.76	7.90
	(6.452)	(5.019)	(4.487)	(3.519)	(-0.357)	(0.864)	(1.630)	(0.995)
Leverage $_{t-1}$	-0.61***	-0.51***	-4.51***	-4.26***	0.06	0.07	-2.97	-1.12
	(-5.581)	(-3.755)	(-5.691)	(-4.225)	(1.363)	(1.447)	(-0.509)	(-0.145)
Observations	54	31	53	30	42	23	54	31
Adjusted R-squared	0.761	0.661	0.542	0.545	0.282	0.502	0.068	0.063

This table presents the results of OLS regressions to estimate the effect of new regulation on risk. Panel A presents results using the idiosyncratic measure of volatility (*Idiosyncratic risk*) computed from the market model, *Total Volatility* and *Leverage* for the whole sample. Panel B presents bank-specific measures of risk. *Leverage ratio (for banks only)* is Tier 1 regulatory capital divided by tangible assets adjusted by derivative liabilities. *RWA as a Proportion of Total Assets* is the ratio of risk-weighted assets to total assets. *Proportion of Level 3 Assets in Total Assets* is a share of assets recorded as Level 3 assets in fair value estimation in total assets. *Provisions as a Proportion of Total Loans* is a ratio of annual provisions to average total loans for the period. *BIPRU* is equal to one for BIPRU firms subject to the FSA Remuneration Code. *Post 2010* takes the value of 1 for years 2010 and 2011. *Number of contract changes* is computed as a number of changes in a given contract divided by the number of aspects in a given contract and weighted by the importance of each category of compensation in the total contract. *Ch. variable pay multiple* is the year-on-year change in the multiple of variable pay to salary, where variable pay is defined as a sum of total bonus, value of option grants and value of LTIP grants. All other variables are defined in Appendix 4.A. The sample period is 2007-2011. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year. Values of *t*-statistics (reported in parentheses) are computed based on robust standard errors clustered at the industry and year level (Panel A) and robust standard errors (Panel B). ***, **, * designate significance at 1%, 5% and 10% levels respectively.

Table 4.5: Effect of new regulation on CEO turnover

	(1)	(2)
BIPRU	0.43	1.05**
	(1.166)	(2.425)
Post 2010	0.09	0.17
	(0.686)	(1.294)
BIPRU x Post 2010	-0.50***	-0.51***
	(-2.632)	(-3.417)
Number of contract changes		-0.01
		(-0.063)
Number of contract changes x Post 2010		-0.47
		(-0.815)
BIPRU x Number of contract changes		-0.21
		(-1.016)
BIPRU x Number of contract changes x Post 2010		-0.64
		(-1.084)
Ch. Variable pay multiple		0.03
		(1.237)
Ch. Variable pay multiple x Post 2010		0.02
		(0.383)
BIPRU x Ch. Variable pay multiple		-0.03
		(-1.157)
BIPRU x Ch. Variable pay multiple x Post 2010		-0.03
		(-0.454)
Shareholder return $_{t}$	-0.06	-0.24
	(-0.463)	(-1.636)
ROA $_{t-1}$	-0.61	-0.76
	(-1.022)	(-1.454)
Book to market $_{t-1}$	0.20	0.05
	(0.590)	(0.115)
Log(Tenure) $_{t-1}$	-0.08	-0.06
	(-0.596)	(-0.387)
Industry Indicators	Yes	Yes
Observations	1,011	1,011
Pseudo R-squared	0.0427	0.0479

This table presents conditional logistic regressions to estimate the effect of new regulation on the likelihood of CEO turnover. *Number of contract changes* is computed as a number of changes in a given contract divided by the number of aspects in a given contract and weighted by the importance of each category of compensation in the total contract. *Ch. Variable pay multiple* is the year-on-year change in the multiple of variable pay to salary, where variable pay is defined as a sum of total bonus, value of option grants and value of LTIP grants. All variables are defined in Appendix 4.A. The sample period is 2007-2011. To mitigate the effects of extreme observations all continuous variables are winsorized at the 1% and 99% tails of their respective distributions in each sample year. Values of *z*-statistics (reported in parentheses) are computed based on robust standard errors. ***, **, * designate significance at 1%, 5% and 10% levels respectively.

Table 4.6: Market reaction to the bonus cap event

Panel A: Event day returns

Categories	All	All without BIPRU	BIPRU	BIPRU Affected by EU Bonus Cap
Abn. Return	-0.56***	-0.49***	-1.01***	-1.04**
	(-6.066)	(-4.793)	(-5.136)	(-2.353)
Observations	494	426	68	12

Panel B: Cross-sectional variation

	Affected=1 if Cash Bonus > 2 x salary			Affected=1 if Total Bonus > 2 x salary		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-0.04**	-0.04*	-0.04*	-0.04**	-0.04*	-0.04*
	(-2.177)	(-1.938)	(-1.965)	(-2.177)	(-1.938)	(-1.959)
BIRPU		-0.00	-0.00		-0.00	-0.00
		(-0.948)	(-0.216)		(-0.948)	(-0.280)
Affected			-0.00			-0.00
			(-0.597)			(-0.499)
BIPRU x Affected			-0.01*			-0.01
			(-1.742)			(-0.891)
Size	0.00**	0.00**	0.00**	0.00**	0.00**	0.00**
	(2.209)	(1.996)	(2.014)	(2.209)	(1.996)	(2.014)
Book to market	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(-0.215)	(-0.211)	(-0.248)	(-0.215)	(-0.211)	(-0.207)
Momentum	-0.77	-0.79	-0.80	-0.77	-0.79	-0.80
	(-1.235)	(-1.261)	(-1.280)	(-1.235)	(-1.261)	(-1.278)
Observations	383	383	383	383	383	383
R-squared	0.085	0.088	0.095	0.085	0.088	0.092
F	2.089	3.711	3.219	2.089	3.711	2.662

This table presents the results from estimating the market reaction to the announcement of the European Union decision on capping bonuses in the financial sector. The official decision was made on February 27, 2013, which is our event date. Panel A presents the average abnormal return on the event date, in which the abnormal return is computed relative to the UK FTSE All-share value-weighted market index. The results are insensitive to the choice of the reference market index measure. Panel B presents results from a regression of abnormal returns on the day of the event on the variables of interest and control variables. *Total Bonus* refers to the aggregate bonus a CEO received in the corresponding year with the indicator variable capturing whether this amount was greater than two-times the corresponding base salary. *Cash bonus* refers to the cash proportion of the total bonus received by the CEO compared to the base salary. *Affected* is equal to one when either *Bonus* is greater than two times the salary or *Cash Bonus* is greater than two times the salary. *Size* is the natural logarithm of market value, *Book to market* is the ratio of book value to market value and *Momentum* is the market adjusted return for a given stock in the sample over the prior six months. All variables are defined in Appendix 4.A. The event date is February 27, 2013. Values of *t*-statistics (reported in parentheses) are computed based on robust standard errors. ***, **, * designate significance at 1%, 5% and 10% levels respectively.

5 Conclusion

This thesis studies the role of accounting information in understanding banks' behavior using quasi-experimental research design. Chapter 2 studies the effect of disclosure on banks' liquidity in the presence of externalities and informational and market frictions. It finds that following the unexpected disclosures of banks' access to the DW facility of the Federal Reserve, banks change their behavior in anticipation of future disclosures. This finding is consistent with the theoretical predictions of Goldstein and Sapra (2013) and is indicative of endogenous costs of disclosure. Chapter 3 investigates whether a universal banking model, which combines financial services under one umbrella, is more risky and hence results in different governance and compensation mechanisms than a pure-play commercial banking model. The evidence shows that following the reintroduction of universal banking in the United States, both type of banks that chose to become universal or remain pure-play commercial banks became more risky and changed compensation packages of their executives. However, the evidence shows that the two different models do not appear to be statistically different from each other. Finally, Chapter 4 investigates changes in regulation of compensation by utilizing a recent change in executive pay regulation in the UK. While it finds evidence of the intended outcome of the regulatory changes by documenting decreases in risk-taking behavior, it also shows that investors respond negatively in anticipation of future changes in compensation regulation.

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