BANK PAYOUT POLICY: EVIDENCE FROM THREE REGULATORY CHANGES

Edie Erman Che Johari

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Abstract

This thesis examines contemporary issues in bank payout policy. The thesis comprises three empirical studies, which investigate how different forms of regulation in the banking industry impact payout decisions. Chapter 2 examines the effect of deposit insurance coverage on bank payout policy. We find that banks most affected by the change in deposit insurance coverage pay lower dividends than less affected counterparts. This suggests that when deposit insurance coverage increases, the need for banks to signal their strength to uninsured depositors declines. Chapter 3 investigates the effect of deregulation and competition on bank payout policy. Using an exogenous measure of competition that captures regulatory induced changes to competition, we find that banks operating in states where extensive deregulation led to intensified competition pay lower dividends than counterparts operating in states where deregulation took place more slowly. Our findings are more pronounced for banks with lower expected future earnings. This suggests that competition reduces the ability of lower performing banks to continue paying dividends. We also find that regulatory scrutiny moderates the strength of the relationship between competition and bank dividends such that banks operating in states characterised by higher competition and lower regulatory scrutiny pay higher dividends than counterparts operating in similarly competitive states, but with greater regulatory scrutiny. Chapter 4 studies how a change in the supervision of bank capital distributions affects the information content of dividends regarding the future level and the volatility of bank profitability. Employing a 2012 change in Regulation Y that requires US banks with

assets exceeding $50 billion to submit detailed capital plans for regulatory approval prior to any dividend payouts, we find that the increased supervision of capital distributions (following amendments to Regulation Y) improves the information content of dividends regarding the future level and volatility of bank profitability.

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Edie Erman Che Johari, January 2019

Contents

List of Tables

List of Figures

Chapter 1

General Introduction

1.1 Thesis Background

Bank payout (dividends and share repurchases) policy has attracted attention since the great financial crisis during when some large banks continued paying dividends despite depleted earnings and capital reserves (Acharya et al., 2011; Floyd, Li and Skinner, 2015; Hirtle, 2016). This seems a rational behaviour from bank managers' perspective based on bank franchise value (the present value of future profits that is expected by a bank). As argued theoretically by Acharya, Le and Shin (2017), lower than critical threshold franchise value encourages managers to distribute all available profits to shareholders as dividends. In contrast, bank managers will pay no dividends if franchise value is higher than critical level in order to protect banks from failure; given that dividends erode equity capital, paying dividends will increase the probability of default and banks will lose their franchise value. As a result, when the franchise value of banks is low, as observed during the recent crisis, paying dividends becomes the better option by managers.

In determining the level of payout, managers at banks face trade-offs between distributing profit to shareholders and retaining profit in order to bolster regulatory capital (in order to increase resilience to unforeseen balance sheet shocks) or fund future lending and investments (Admati et al., 2013; Cornett et al., 2018).[1] The regulated nature of the banking industry somewhat reduces the flexibility that bank managers have in making payouts to shareholders. As a consequence, bank managers attempt to adhere to regulation and satisfy shareholder interests simultaneously.

The unique feature of banks as financial intermediaries may also impact on payout to shareholders. In particular, the liability side of bank balance sheets comprises mainly (insured and uninsured) deposits from customers with only small portion from shareholder equity. This funding structure makes banks fragile given that depositors may decide to withdraw funds at very short notice and in the extreme threaten bank stability.

Prior literature suggests that non-financial firms use dividends to mitigate agency conflicts between shareholders and managers (Easterbrook, 1984; Jensen, 1986; La Porta et al., 2000) and signal future earnings prospects to investors (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). Banks must consider several stakeholders including depositors, shareholders, bondholders and regulators when making decisions regarding dividends.

This thesis investigates three contemporary issues in bank payout policy. We draw upon insights from established theoretical contributions on dividend payout policy of non-financial firms and apply this to the US banking industry. In the first empirical chapter, we rely on the signaling theory of dividends. This theory emanates

[1] Throughout the thesis, we refer to cash dividends and open-market share repurchases as dividends and share repurchases respectively. Firms may also distribute cash in the form of stock dividends. Firms may also buy back their share using other methods such as fixed-price tender offers and Dutch auction (see Allen and Michaely (2003) and Vermaelen (2005) for a detailed explanation of these alternative payout methods). Cash dividends and open-market share repurchases have become the most popular methods of cash payouts. Therefore, we focus on these two methods in the thesis.

from the seminal work of Miller and Modigliani (1961), which emphasises the irrelevancy of dividend policy for firm value. Subsequent contributions have sought to develop formal theories related to the information content of dividends (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). Based on the role of banks as financial intermediaries and their reliance on deposits in their funding structure (Diamond and Dybvig, 1983), Kauko (2014) has argued that banks pay dividends to signal financial strength to run-prone depositors.

In the second empirical chapter, we use the theories of agency and profitability to explain the relationship between competition and bank payout policy. Jensen (1986) and Easterbrook (1984) argue that dividends are paid to resolve agency conflict of free cash flow whereby dividends can reduce the possibility of unnecessary spending by managers. Similarly, competition may also cause banks to change their dividend policies if the profitability of banks declines following increased competition. As in other corporate financial policies, competition and dividends might be determined in equilibrium, and therefore a suitable identification strategy that accounts for possible endogeneity concerns is required.

For the third empirical chapter, we once again draw upon insights from the signaling theory of dividends to investigate the extent to which supervisory monitoring of bank dividends increases the information content of dividends. Testing such a relationship is also challenging given that dividends are paid based on earnings (Fama and French, 2001). The level of future profitability may also reflect the dividends paid in the previous year from the signaling hypothesis point of view (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985).

The research designs use for the empirical analysis across the three constituent empirical chapters rely on exogenous variation in: the extent of insurance coverage of customer deposits (chapter 2); state-level geographic deregulation (chapter 3); and the supervision of capital distributions to shareholders (chapter 4). We use these aforementioned research designs to conduct a series of quasi-natural experiments on samples of US bank holding companies (BHCs) spanning the period 1994 to 2017. In the first chapter, we use a sudden increase in deposit insurance coverage to test the impact of increases insured deposits on bank payout behaviour. Using this exogenous shock on bank funding structure can help us to find a causal effect on deposit insurance on bank payouts. We also employ another shock on bank competition by using the staggered US inter-state branching deregulation process, which increased competition among banks. This staggered deregulation is used as our setting to investigate whether there is a causal relation between competition and bank payout policy. Finally, we utilise the amendment to regulation that monitors bank capital distributions. With this regulation, we use the increased scrutiny on bank dividend approvals to help us in finding whether dividends can predict bank future profitability when there is heightened supervision of bank dividend payouts.

The US banking industry has undergone a number of significant changes over the past few decades. There has been a reduction in the number of banks and increases in average bank size and complexity. Banks have diversified revenue streams and geographical reach (DeYoung, 2015). These aforementioned changes have been driven by technology, regulatory change, and a major financial crisis (Avraham, Selvaggi and

Vickery, 2012; Kroszner and Strahan, 2014).[2] Official responses to the financial crisis of 2007-2009 led to wide ranging regulatory reforms in order to stabilize the banking industry and reduce the probability of future crisis events.[3] These changes have led to a substantial literature that seeks to understand how bank behaviour has changed in the light of various regulatory changes following the financial crisis (e.g. Lambert, Noth and Schüwer, 2017; Bindal et al., 2017; Bouwman, Hu and Johnson, 2018).[4] This thesis both augments and complements this literature by investigating the impact of regulatory change on the payout policy of US banks.

In common with non-financial firms, banks pay regular cash dividends. Dividends are set by the board of directors on the basis of advice provided by the senior management team.[5] For open market share repurchases, firms announce the number of shares to be repurchased.[6] Dividends payouts and share repurchases conducted by banks are monitored by regulators in order to ensure that dividends do not impair bank solvency (Spong, 2000).[7] Typically, banks must obtain an approval from regulators if

[2] For example, the inter- and intra-state geographical deregulation that started in the 1970s has led to a reduction in the number of banking institutions, but not an increase in concentration at the local level. The enactment of the Gramm–Leach–Bliley Financial Services Modernization Act of 1999 allowed for the pooling of banking, securities and insurance activities under a financial holding company structure. This allowed banks to diversify beyond traditional financial intermediation activities.

[3] The recent financial crisis has increased the regulatory scrutiny in bank activities, which led to the enactment of the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) of 2010.

[4] The literature has sought to study the consequences of these post-crisis regulations such as bank market discipline, bank risk-taking, bank asset growth rate, and merger and acquisition activities.

[5] Allen and Michaely (2003), DeAngelo, DeAngelo and Skinner (2009), Baker (2009), Farre-Mensa, Michaely and Schmalz (2014) provide detailed reviews of the corporate payout literature. Grullon and Ikenberry (2000) and Vermaelen (2005) provide a detailed overview of literature relating to share repurchases.

[6] Actual repurchases do not necessarily correspond to the announced amount because firms are not obligated to perform repurchases.

[7] The introduction of Prompt Corrective Action (PCA) under Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991 further increased the scrutiny of bank dividends and share repurchases (Dahl and Spivey, 1995; Kanas, 2013). This Act restricts dividend payments for undercapitalised banks.

dividends exceed current year net profits and retained earnings in the previous two years. In 1985, the Federal Reserve issued a statement that dividends can only be made when banks have sufficient past earnings and good prospective earnings that appear consistent with capital needs (Federal Reserve Board, 1985). In 2012, bank dividends received additional regulatory scrutiny when the Federal Reserve amended Regulation Y, a regulation that governs the corporate policies of bank holding companies.[8] This amendment required banks with assets exceeding $50 billion to submit annual capital plans to the Federal Reserve before making cash payouts.[9] Banks below the $50 billion asset threshold were unaffected.

The overarching finding of this thesis is that regulation influences the payout of banks. First, we show that an increase in deposit insurance coverage reduces the need for banks to continue paying dividends during a turbulent period when the accumulation of retained earnings is likely to be crucial to assuring bank stability. This finding is more important, given the reliance of banks on large uninsured depositors who are more likely to withdraw funds in response to negative information. Hence, the increased protection on deposits (which exogenously increases the proportion of insured deposits) appears to lessen the need for banks to signal their financial health via dividend payouts. Second, this thesis also finds that geographical branching deregulation that intensifies competition causes banks to pay lower dividends. Third,

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[8] Regulation Y (12 CFR Part 225) was established under Section 5(b) of the Bank Holding Company Act of 1956. The primary purposes of this regulation are: to regulate the acquisition of control of banks by companies or individuals; to define and regulate bank holding company non-banking activities; and to set procedures for obtaining approval for transactions and activities. See, for detail: https://www.law.cornell.edu/cfr/text/12/225.1

[9] The amendments on bank capital plans were codified under 12 CFR 225.8 (Capital Planning). This provision establishes the requirements for capital planning, prior notice, and approval of bank holding company capital distributions (i.e. dividends and share repurchases).

we find that the increased scrutiny on bank capital improves the information regarding the level and variability of future profitability embodied in bank dividend payouts. In particular, dividends paid by more intensively monitored banks contain more information regarding future bank profitability relative to less intensively monitored counterparts.

1.2 Contributions

This thesis contributes to several strands of literature pertaining to: corporate and bank payout (dividends and share repurchases) policies; deposit insurance; regulation of bank dividends; and the effects of geographic deregulation on bank behaviour. These contributions are outlined in the following paragraphs.

First, this thesis contributes to the literature that examines the relationship between bank deposits and dividend policy (Kauko, 2014; Forti and Schiozer, 2015). This literature finds that banks pay dividends to signal financial strength to bank depositors. We show that an increase in deposit insurance coverage (which leads to greater proportion of insured depositors) causes banks to pay lower dividends. This is an important addition to the literature as our research design allows us to utilise variations in the extent of deposit insurance coverage across banks in order to establish a causal link between the composition of bank deposits and bank dividends.

Second, this thesis also relates to the literature that investigates the link between product market competition and firm payout policy (Hoberg, Phillips and Prabhala, 2014; Grullon and Michaely, 2014). This literature documents an inconclusive relationship between product market competition and firm dividends.

Complementing this literature, we utilise a reliable exogenous variation of competition using geographical branching deregulation in the US banking industry. We show that increased competition leads banks to pay lower dividends, and this effect is driven by a reduction in bank profitability. This is an important addition to the literature given that we employ a reliable source of exogenous variations in competition that establishes a causal relationship between competition and dividends.

Third, this thesis adds to the literature that examines the effects of regulatory oversight on bank dividends (Abreu and Gulamhussen, 2013; Onali, 2014; Kanas, 2013). Previous findings document that regulatory oversight and pressure can play important role in shaping bank dividends. We expand this literature by showing that regulatory scrutiny at the state level moderates the impact of competition on bank dividends.

Fourth, this thesis also contributes to the literature that studies the determinants of bank share repurchases. Prior studies have investigated the role of share of repurchases in distributing bank free cash flow, signalling future performance, and managing operational risk (Hirtle, 2004; Bonaimé, Hankins and Harford, 2013). In this thesis, we show that neither deposit insurance nor competition affects bank share repurchases. These results could be explained by findings produced in prior literature, which suggest that share repurchases are used to distribute transitory earnings and non-operating cash flow.[10]

[10] In contrast to dividends, share repurchases are viewed by both managers and investors as more flexible and therefore do not constitute firm commitments (Grullon and Michaely, 2002; Brav et al., 2005; Skinner, 2008). Furthermore, share repurchases are made from less permanent cash flow (Guay and Harford, 2000; Jagannathan, Stephens and Weisbach, 2000; Lee and Rui, 2007). This renders share repurchases to be less credible as a signalling device because they can be easily cancelled or reduced.

Fifth, we contribute to a literature that investigates the relationship between dividends and future bank performance. This literature documents mixed findings regarding the impact of dividend announcements on future bank performance (Keen, 1978; Boldin and Leggett, 1995; Hirtle, 2004). Keen (1978) shows that dividend cuts are followed by higher bank profits while Boldin and Leggett (1995) and Hirtle (2004) show that dividends increases are followed by higher profits and better asset quality. In this thesis, we show that bank dividends are positively associated with bank profitability in the subsequent year. More importantly, we provide evidence that regulatory oversight can improve the information content of dividends regarding bank financial condition. That is, once a bank receives supervisory approval to pay dividends, this accounts for both supervisors' private information as well as managers' expectations regarding future performance.

Sixth, this thesis speaks indirectly to the literature that investigates how capital regulation affects the extent of market responses to bank dividend announcements (Polonchek, Slovin and Sushka, 1989; Filbeck and Mullineaux, 1993; Bessler and Nohel, 1996). This literature finds that a change in capital regulation influences the announcement effects on bank dividends. However, to date, there is a paucity of evidence regarding the impact of regulation on the relationship between dividends and profitability. We find that the provisions of Regulation Y amended in 2012 (which are designed to improve bank capital planning) to show that increased supervisory oversight of capital increases the information content of dividends future level and volatility of profitability.

Seventh, this thesis also contributes to the ongoing debate regarding the costs and benefits of deposit insurance (Diamond and Dybvig, 1983; Duan, Moreau and Sealey, 1992; Hovakimian and Kane, 2000; Guizani and Watanabe, 2016; Anginer and Demirgüç-Kunt, 2019). Prior evidence suggests that deposit insurance can lead banks to take excessive risk or risk-shifting behaviour of banks and depositors to taxpayers. However, we show that deposit insurance does not necessarily encourage bank risk-shifting behaviour via increases in dividends. Rather, we find that banks reduce dividends, when the need for signalling financial health declines following an increase in the maximum limit of deposit insurance coverage.

Finally, this thesis also extends the large literature concerned with the impact of US geographic banking deregulation on bank behaviour (Jayaratne and Strahan, 1998; Jiang, Levine and Lin, 2016b; Berger, Öztekin and Roman, 2017; Goetz, 2018). This literature argues that geographic deregulation increased the competition faced by incumbent banks at the local level with a resultant impact on bank efficiency, profitability, risk taking, transparency, and capitalisation. We show that increased competition reduces bank dividend payments to shareholders.

Overall, the above discussion can be organised under two broader contributions. Firstly, we employ three policy changes in US banking that have been used in prior contributions to the empirical banking literature as exogenous shocks. By using these policy changes, we address potential endogeneity concerns, including omitted variables bias and simultaneity, which pervade many prior studies of corporate payout policy, and undermine causal inference. For example, competition and payout policy could be jointly determined in equilibrium. The use of an exogenous variation in competition facing banks for identification purposes would allow for a causal interpretation of the effect of competition on bank payout policy.

Secondly, we investigate contemporary issues in payout policy with a particular focus on banks. In contrast to non-financial firms, banks have a more fragile funding structure, whereby illiquid assets are financed by liquid liabilities (in the forms of deposits). This fragile funding structure makes bank prone to runs. As a consequence, governments have felt it necessary to supervise and regulate the activities of individual banks. These unique features of banks along with extensive regulatory and supervisory oversight are likely to play an important role in influencing dividend payouts. Indeed, we present extensive empirical evidence that suggests this is the case. As such we contribute significantly to the existing literature on dividend payout policy.

1.3 Thesis Structure

The rest of this thesis proceeds with three independent empirical chapters (Chapters 2 to 4) and a concluding chapter (Chapter 5). Chapter 2 investigates the effects of deposit insurance on bank payout policy. As financial intermediaries that collect deposits from customers, deposits comprise from both insured and uninsured elements. This feature leads to a highly leveraged balance sheet and maturity mismatch problem, which make banks inherently fragile to deposit runs (Diamond and Dybvig, 1983; Calomiris and Kahn, 1991). Deposit runs can be minimised via deposit insurance schemes which protect depositors from bank defaults (Diamond and Dybvig, 1983) and skillful asset and liability management. During a crisis, however, deposit runs are still possible especially among uninsured depositors who are more sensitive to negative information (Huang and Ratnovski, 2011; Egan, Hortacsu and Matvos, 2017). This strengthens the need for banks to signal financial resilience to depositors. Cash payouts are likely to be used by bank managers to signal positive information to various stakeholders (shareholders, bondholders, depositors, regulators). In this chapter, we study the change in dividends and share repurchases following a sudden change in deposit insurance coverage in the US banking system in 2008. This change affected some banks, but had little effect on others. This allows us to construct a group of treated and control banks. Our identification strategy relies on the extent to which the changes in deposit insurance impacts banks across these two groups of banks. Analyzing a sample of 311 US BHCs (2007Q1-2010Q4) within a difference-in-differences framework, we show that banks affected by the change in the maximum level of deposit insurance coverage pay lower dividends than less affected counterparts. We find no significant effects of deposit insurance on share repurchases. This outcome could be driven by the prevalent characteristic of share repurchases being more flexible than dividends as a means to disgorge cash flows to shareholders (Grullon and Michaely, 2002; Brav et al., 2005; Skinner, 2008). We conduct a battery of robustness checks to assess whether confounding events or alternative explanations could explain our findings. Overall, the findings of this chapter provide insights to the role played by deposit insurance in determining bank dividends.

Chapter 3 examines the impact of competition on bank payout policy. Prior evidence suggests that competition affects bank behaviour and the real economy (Jayaratne and Strahan, 1998; Rice and Strahan, 2010; Favara and Imbs, 2015; Jiang, Levine and Lin, 2016b; Goetz, 2018). To date, there is no evidence regarding the effect of competition on bank payouts. In this chapter, we use US branching deregulation following the passage of Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994, which exogenously increased competition in the state-level banking market. The Act allowed bank holding companies to expand their branches nationwide without prior permission from state authorities. However, the Act also granted individual states the discretion to impose their own restrictions on out of state bank entry. Thus creating variation in competition across states. Using a dataset of 1,433 US BHC over the period 1994 to 2005 within a difference-in-differences framework, we find that banks subject to more competitive pressure following deregulation pay lower dividends than counterparts located in states with lower levels of competition. This result is not driven by the level of prevailing competition within states prior to 1994. Further tests reveal that variations in supervisory scrutiny moderates the link between competition and bank dividends. In contrast to dividends, we find no significant relationship between competition and share repurchases. We also find that the dividends of banks with lower expected profit and actual future profits are most affected by geographic deregulation.

Chapter 4 investigates the impact of a change in the supervision of capital distributions on the information content of dividends regarding the future level and the volatility of bank profitability. Prior evidence suggests that dividends are an important means by which managers communicate private information regarding future firm performance to outside stakeholders (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). In general, banks are required to obtain regulatory approvals to pay dividends only if they are undercapitalised. However, a change in regulation that requires banks to be assessed prior to making capital distributions regardless of their financial condition may provide additional information regarding future performance. That is dividends may signal both private information from regulators and managers regarding future bank performance. We utilise the 2012 amendment to Regulation Y which required banks with total assets exceeding $50 billion to submit annual capital plans to the Federal Reserve before making payouts to shareholders to establish exogenous variation. Banks with assets less than $50 billion were not subject to the amendment. Using a difference-in-differences setting on a sample of 947 US BHCs (2006-2017), we find that the information embodied in dividends regarding future profitability (in one year ahead) is greater for banks subject to the provisions of Regulation Y. We also find that the increased supervision of bank capital distribution improves the information content of bank dividends regarding the volatility of profits. These results are robust to a battery of additional tests that address confounding factors, bank size, and ownership structure.

Chapter 2

Deposit Insurance and Bank Payout Policy

2.1 Introduction

This chapter investigates the impact of an increase in the maximum level of deposit insurance coverage on bank payout policy. Deposit insurance has received attention following the onset of the financial crisis when a number of countries augmented deposit insurance in order to avert runs on individual banks by depositors, and reduce the risk that a run on one bank might undermine confidence in others through contagion effects. These changes to the coverage of deposit insurance have renewed debates regarding the impact of deposit insurance on individual bank and wider financial stability, and the potential moral hazard arising from such government interventions.

Deposit insurance can distort the incentives of bank managers and depositors. For banks, deposit insurance increases incentives to extend riskier loans or make investments given that any resultant profits accrue to the bank, but losses are absorbed (in part at least) by the deposit insurance fund. Moreover, for depositors, the insurance protection from the full effects of bank failure reduce incentives to monitor the financial health of their bank (Demirgüç-Kunt and Huizinga, 2004; Pennacchi, 2006; Calomiris and Jaremski, 2016; Anginer and Demirgüç-Kunt, 2019).

In the present study, we utilise a quasi-natural experiment to investigate how an unexpected change in coverage of insured deposits in the US banking system influences bank payout policy. Under the terms of Section 136 of the Emergency Economic Stabilization Act, there was an increase in the limit of the deposits insurance coverage by the Federal Deposit Insurance Corporation (FDIC). Effective on October 3, 2008, the maximum insurance coverage for bank deposits increased from $100,000 to $250,000. The Act also exempted banks from covering the costs associated with this increase in deposit insurance coverage. The increase in insurance coverage did not affect all banks equally. Some banks experienced a substantial increase in insured deposits, while others experienced a moderate or no increase at all. Using this differential change in insured deposits across banks, we investigate whether there is a causal link from deposit insurance to the payout policies of banks. As such, we make a significant contribution to a small, but important literature on the bank payout policy (Abreu and Gulamhussen, 2013; Kanas, 2013; Kauko 2014; Floyd, Li and Skinner, 2015; Forti and Schiozer, 2015; Acharya, Le and Shin, 2017).

A priori it is unclear whether increases in the maximum level of deposit insurance coverage will increase or decrease bank payout. This is likely to depend crucially upon the extent to which deposit insurance alters the incentives for banks to signal financial strength to depositors or assume increased risk. On the one hand, deposit insurance might cause banks to decrease dividends by lowering their need to use dividends to convey positive information regarding financial health to depositors

(Kauko, 2014; Forti and Schiozer, 2015; Floyd, Li and Skinner, 2015),[11] especially uninsured depositors who are prone to runs (Huang and Ratnovski, 2011; Egan, Hortacsu and Matvos, 2017). The increase in the maximum level of deposit insurance coverage reduces the proportion of uninsured deposits, thus reducing the probability of a bank run. Therefore, an increase in the maximum level of deposit insurance coverage will decrease the dividends of banks that have a smaller proportion of uninsured deposits. We refer to this as the dividend signalling view.

On the other hand, deposit insurance might cause banks to increase dividends by exacerbating moral hazard (Keeley, 1990). Prior evidence suggests that bank managers use dividends to shift risk from shareholders to depositors and other creditors (Kanas, 2013; Srivastav, Armitage and Hagendorff, 2014; Acharya, Le and Shin, 2017). That is, bank managers can transfer a larger share of earnings to shareholders by increasing dividends with resultant declines in capital and increased default risk. Deposit insurance may encourage such risk-shifting behaviour, as it reduces the incentives for depositors to monitor the financial health and risk appetite of their respective banks. That is, according to the risk-shifting view, a rise in the maximum level of deposit insurance coverage could lead banks with a smaller proportion of uninsured deposits to increase dividends to shareholders.

Share repurchases (as an alternative to dividends as a means of distributing cash to shareholders) have seen a sharp increase in over the past twenty years (Hirtle, 2004; Floyd, Li and Skinner, 2015). A priori an increase in the maximum level of deposit

[11] Previous literature also shows that outsiders may obtain the information about bank condition from periodic financial statements certified by bank managers (Hirtle, 2006) and supervisory examination and stress tests (Berger and Davies, 1998; Flannery, Hirtle and Kovner, 2017).

insurance coverage is likely to affect the level of share repurchases in a similar fashion to dividends by altering incentives to signal financial strength and assume increase risk, if the two means are used as substitutes. However, recent evidence suggests that firms do not view dividends and repurchases as substitutes (Brav et al., 2005; Grullon and Michaely, 2004). There is a growing view that firms use dividends to distribute relatively permanent cash flows to investors, whereas share repurchases are used independently of dividends in order to distribute the transient component of firms' cash flows (Guay and Harford, 2000; Jagannathan, Stephens and Weisbach, 2000; Lee and Rui, 2007). Bonaime, Hankins and Harford (2013) also show that banks use share repurchases for operational hedging purposes. In which case, any change in deposit insurance coverage would leave share repurchases unaffected.

Testing for a causal link between deposit insurance and payout policy is challenging given identification concerns. That is, the amount of insured deposits attracted by a bank and its payout policy could be jointly determined in equilibrium, thus giving rise to simultaneity bias. We overcome this challenge in the present study by utilising the Emergency Economic Stabilisation Act (EESA) of 2008, which increased the maximum limit of deposit insurance coverage provided by the Federal Deposit Insurance Corporation on October 3, 2008. The change in deposit insurance coverage significantly changed the proportion of insured deposits to assets of some banks, but left others relatively unaffected. Using this differential change to insured deposits to overcome identification concerns, we investigate whether there is a causal link from deposit insurance coverage to bank payout policy.

The change to the maximum level of deposit insurance coverage provides an ideal setting for testing the impact of deposit insurance on payout policy for several reasons. First, the increase in the maximum limit of deposit insurance more than doubles from $100,000 to $250,000. This translates into a substantial increase in the total insured deposits in the US banking system by approximately $500 billion (Lambert, Noth and Schüwer, 2017). Second, the increase in deposit insurance coverage was sudden and largely unexpected in the midst of a financial crisis. Third, the increase in proportion of insured deposits was not homogenous across banks.

Our dataset of banks comprises quarterly financial accounts over the period from 2007Q1 to 2010Q4 (which straddles the increase in deposit insurance coverage in October 2008). We calculate for each bank, the difference in the ratio of insured deposits to assets before and after the change in the maximum limit of deposit insurance coverage. This allows us to construct treatment (affected) and control (unaffected) group of banks based upon their relative exposure to the changes in deposit insurance coverage enacted under the Emergency Economic Act of 2008 (Lambert, Noth and Schüwer, 2017). In order to assess the effects of the change in the maximum level of deposit insurance on bank payout policy, we use a difference-in-differences approach to compare the difference in the cash payout of affected banks before and after the policy change with the same difference in cash payout of their unaffected counterparts.

By way of preview, we find that banks affected by the increase in the maximum limit of deposit insurance coverage pay lower dividends relative to their unaffected counterparts. This result is economically significant and robust to numerous sensitivity and falsification tests. On average, affected banks reduce dividends by $9 million following the deposit insurance increase. This corresponds to a reduction of 40% compared to the dividends paid by the average bank in the sample. We also find that the increase in the maximum level of deposit insurance coverage has no significant impact on share repurchases. This finding is in line with prior evidence, which supports the view that share repurchases are used in order to disburse the transient rather than the permanent component of cash flows.

This chapter relates to three strands of literature. First, we add to an emerging literature that examines the relationship between deposits and bank dividends (Kauko, 2014; Forti and Schiozer, 2015). Kauko (2014) derives a theoretical model combining dividend signalling theory (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985) and a bank run model (Diamond and Dybvig, 1983). He shows that banks pay dividends in order to avoid depositor runs. Supporting this theory, Forti and Schiozer (2015) find that Brazilian banks with a high percentage of deposits owned by institutional investors pay high dividends. Complementing this literature, we use US data on insured and uninsured bank deposits to distinguish between banks that are relatively affected/unaffected by the increase in the maximum level of deposit insurance coverage. The difference-in-differences approach used in the empirical analysis allows us to identify the causal impact of deposit insurance on bank payout. We find that affected banks reduce dividends following an increase in the proportion of insured deposits. Therefore, and consistent with the signalling view, banks with greater coverage of deposits feel less compelled to signal their financial strength to their depositors.

Second, this chapter also speaks to the debate on the costs and benefits associated with having a deposit insurance scheme in place. Both theory and empirical evidence suggest that deposit insurance can ameliorate the severity and frequency with which bank runs occur (Diamond and Dybvig, 1983; Martin, Puri and Ufier, 2018). Despite this crucial role, deposit insurance has been widely criticized for inducing a moral hazard problem and thus contributing to banks' excessive risk taking and risk shifting behaviours (Keeley, 1990; Duan, Moreau and Sealey, 1992; Hovakimian and Kane, 2000; Guizani and Watanabe, 2016). The existing empirical evidence suggests that although deposit insurance incentivizes risk shifting, under certain conditions such behaviour can be mitigated. For example, Hovakimian, Kane and Laeven (2003) provide evidence that introducing risk sensitive premiums, coverage limits and coinsurance mitigates this moral hazard problem by reducing incentives to shift risk. Moreover, González (2005) finds that deposit insurance is positively influencing bank charter value thus mitigating the risk-shifting incentives it creates. In addition, Chen et al. (2018) provide evidence that greater transparency increases the sensitivity of uninsured deposit flows to bank performance thus enhancing their disciplining effect on banks' risk taking behaviour. Our study lends support to the view that deposit insurance does not necessarily lead to risk-shifting behaviour, since we find that banks cut dividends, when the need for signalling lessens due to the increase in deposit insurance coverage limit, rather than increase it and engage in risk-shifting behaviour.

Third, we also contribute to the literature that investigates the signalling feature of share repurchases. Theory provides a clear role for share repurchases as a signalling device (Vermaelen, 1984; Ofer and Thakor, 1987), but the empirical evidence is mixed.

With regards to market valuation, prior studies find positive abnormal returns for share repurchase announcements (Ikenberry, Lakonishok and Vermaelen, 1995; Grullon and Michaely, 2004). However, more recent evidence on the information content of share repurchases and its relevance for market valuation is mixed (Boudoukh, Michaely and Richardson, 2007; Andriosopoulos, Chronopoulos and Papadimitriou, 2014). Moreover, evidence on the earnings changes following repurchase announcements, an important condition for the signalling theory to hold, is also inconclusive. Grullon and Michaely (2004) report that repurchasing firms do not experience an increase in earnings. Hirtle (2004) documents little support for the signalling theory, when analyzing bank performance following share repurchases. She finds that the signalling theory of share repurchases is only significant for private banks but not for publicly traded banks. We contribute to this literature via an examination of share repurchases as a management's device for signalling the bank's financial strength to depositors. We find that share repurchases, unlike dividends, are not affected by an exogenous change in the bank's portion of uninsured deposits. This provides some evidence that managers are less inclined to use share repurchases as a method of signalling information to depositors.

The remainder of this chapter is organised as follows. Section 2.2 reviews the related literature. Section 2.3 describes the empirical methodology. Data and summary statistics are presented in Section 2.4, followed by the results in Section 2.5. Sensitivity checks are described in Section 2.6. Section 2.7 concludes.

2.2 Related Literature

Traditional theories of payout behavior emphasize the role of dividends as a signaling device for managers to convey information to investors (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). This is confirmed by the extant empirical evidence for non-financial firms (Brav et al., 2005; Jagannathan, Stephens and Weisbach, 2000; Guay and Harford, 2000; Lee and Rui, 2007).

The role of dividends as a signaling device for non-financial firms is likely to carry over to banks, despite considerable differences in the characteristics of the two types of firms. Relative to firms in other industries banks are more leveraged, complex, opaque, and heavily regulated and supervised (Morgan, 2002; Caprio, Laeven and Levine, 2007). Given the opacity and complexity of banks, the ability of management to convey information to outside stakeholders (including investors, depositors, and creditors) takes on increased importance in the banking industry. Information asymmetry between bank managers and outside stakeholders makes it difficult to accurately value banks (Flannery, Kwan and Nimalendran, 2004, 2013; Jones, Lee and Yeager, 2012; Flannery, 2012). Financial reporting and voluntary disclosures that aim at mitigating such information asymmetries might be a flawed communication mechanism, if the objectives of managers and investors conflict (Healy and Palepu, 1993). During periods of financial distress information asymmetry can be amplified, since the interests of managers and investors can further diverge (Frost, 1997), thus necessitating the need for managers to find effective ways to convey important information to external stakeholders (Ratnovski, 2013). Among other sources of information such as bank regulatory reports and stress tests performed by regulators (e.g. Berger and Davies, 1998; Hirtle, 2006; Flannery et al, 2017), empirical evidence has demonstrated that dividends of banking firms signal important information to investors. For example, Filbeck and Mullineaux (1993) and Boldin and Leggett (1995) find that increases in dividends positively affects bank values, while Bessler and Nohel (1996) find that reductions in dividends negatively affect bank values.

In stressed periods bank (deposit and wholesale) funding is less certain given the possibility of liquidity shortages in wholesale markets and deposit withdrawals, especially by uninsured depositors (Diamond and Dybvig, 1983; Goldstein and Pauzner, 2005; Kauko, 2014). As a consequence, banks may continue to pay dividends even during stressed periods in order to send a positive signal to depositors (Forti and Schiozer, 2015; Floyd, Li and Skinner, 2015), and thus reduce the probability of sudden withdrawals. This situation is also related to signal jamming hypothesis where banks tend to signal to depositors that they are performing well relative to counterparts (Fudenberg and Tirole, 1986). This is especially important for more opaque banks with a greater proportion of uninsured depositors who have a greater incentive to monitor banks' policies (than insured counterparts) and more likely to withdraw funds at short notice during stressed periods (Kauko, 2014; Egan, Hortacsu and Matvos, 2017). Abreu and Gulamhussen (2013) find evidence in support of US banks using dividends as a signaling device during the recent financial crisis, while Floyd, Li and Skinner (2015) document a resistance of banks to lowering dividends at the onset of the financial crisis. For Brazil, Forti and Schiozer (2015) find that depositors are the targets of dividend signaling. Specifically, they document a positive relation between the percentage of deposits issued to information sensitive depositors (such as institutional investors) and the size of dividends.

During periods of financial distress it is possible that banks may maintain or increase dividends, if incentives to preserve charter value diminish (Acharya, Le and Shin, 2017). Shareholders may favor investment policies that ensure high dividend payout, but which also increase the risk of outstanding debt (bonds). Thus, transferring wealth from and risk to bondholders. In other words, if banks do not adjust dividend payout to reflect increases in their default risk, capital will be eroded at the expense of debtholders. Empirical evidence from the recent financial crisis suggests that banks do indeed use dividend policy as a means of risk-shifting (Kanas, 2013; Onali, 2014). Risk-shifting behavior among banks is further exacerbated by the financial safety nets provided by the government. The increase in deposit insurance weakens the incentives of depositors to monitor banks, thus increasing banks' moral hazard to endeavor in riskier activities (Merton, 1977; Keeley, 1990; Demirgüç-Kunt and Detragiache, 2002; Demirgüç-Kunt and Huizinga, 2004; Karas, Pyle and Schoors, 2013). The increase in insured deposits, therefore, might encourage banks to shift the risk to deposit insurer by transferring cash through dividend payouts. With no clear theoretical prediction and mixed empirical evidence, the rationale for banks maintaining high levels of dividends during crisis periods is an unresolved empirical issue.

To investigate whether banks maintain high dividends as a signal of their financial health to their depositors, their primary and most fragile of their funding sources, or simply as a means to expropriate their debtholders, one should be able to observe exogenous changes in the depositors' incentives to monitor and discipline managers. Such an exogenous variation in the depositors' incentives to monitor bank managers could arise by a change in the deposit insurance coverage. That is, as the deposit insurance coverage increases a greater proportion of depositors would be insured against the failure of their banking institutions, thus leaving fewer depositors with incentives to monitor bank behavior (Demirgüç-Kunt and Huizinga, 2004; Ioannidou and Penas, 2010). In such an environment, the signal carried by dividends would have less value to depositors, as they would be more confident about the safety of their deposits against bank failure. This would allow banks to cut dividends without de-stabilizing their main funding source (in line with the signaling view). On the other hand, increases in deposit insurance might increase bank moral hazard behavior thus leading to higher dividends (in line with the risk shifting view). These views imply two opposing hypotheses for the effects of deposit insurance on dividend policy which are formulated below:

H1a: Higher deposit insurance coverage results in a reduction in dividends.

H1b: Higher deposit insurance coverage results in an increase in dividends.

Dividends are not the only means that banks have at their disposal to channel profits to shareholders. Share repurchases are an increasingly important payout method for banks, acting as a substitute for dividends (Hirtle, 2016). Theory suggests two main reasons as to why share repurchases may act as substitutes for dividends. First, agency (Jensen, 1986) and signaling (Miller and Rock, 1985) theories posit similar roles for both dividends and share repurchases.[12] That is, theory does not treat

[12] Jensen (1986) and Easterbrook (1984) argue that shareholders may use dividends and share repurchases to extract excess free cash flow from managerial control to minimize unnecessary spending made by managers.

dividends and repurchases distinctly, but rather as similar mechanisms. Second, share repurchases can be seen as more tax effective than dividends if dividends are taxed more heavily than any capital gains realized by shareholders arising from the repurchase of shares. Therefore, banks may prefer to switch from dividends to share repurchases, and as such treat the two payout channels as substitutes. If this is the case an increase in the deposit insurance coverage would allow banks that use share repurchases as a signaling device to reduce them without creating panic among their depositors. However, an increase in the deposit insurance coverage could exacerbate moral hazard issues between shareholders and debtholders thus resulting in banks engaging in risk shifting activities via share repurchase activity. The reasoning is similar to the case of dividends explained above. We use this reasoning to formulate the following hypotheses.

H2a: Higher deposit insurance coverage results in a reduction in share repurchases.

H2b: Higher deposit insurance coverage results in an increase in share repurchases.

Nonetheless, it is equally likely that the dividend payout policy of banks is independent of share repurchases. For example, banks may undertake one-off share repurchases in order to reduce agency conflicts between managers and shareholders (Jensen, 1986) or to signal that they are undervalued to external investors by offering a premium above the market price (Vermaelen, 1984). In this case share repurchases complement dividends as a mechanism for the payout of short-term cash flows. This line of argument is also supported by empirical evidence suggesting that share repurchases are more flexible than dividends (Jagannathan, Stephens and Weisbach, 2000; Bonaimé, Hankins and Harford, 2013; Guay and Harford, 2000). As a consequence, we would expect a change in the deposit insurance coverage to have no impact on banks' share repurchase activity because managers might repurchase shares during special occasions that make share repurchases become a weak signaling device to depositors and other potential targets.

2.3 Empirical Methodology

To estimate the impact of insured deposits on bank payout policy, a source of exogenous variation in the extent to which bank deposits are insured is required. In the present study, we rely on a sudden increase in the coverage of insured deposits in the US banking system in order to examine its impact on bank payout policy. Under the terms of Section 136 of the Emergency Economic Stabilization Act, there was an increase in the limit of the deposits insurance coverage provided by the Federal Deposit Insurance Corporation (FDIC). Effective on October 3, 2008, the new maximum amount covered for insured bank deposits increased from $100,000 to $250,000.[13] Initially, this measure was temporary and scheduled to lapse on December 31, 2009. However, the measure was made permanent under the enactment of Dodd-Frank Act in July 2010.

This change in the deposit insurance coverage had a differential impact across banks (Lambert, Noth and Schüwer, 2017). We use this variation in the amount of insured deposits across banks to identify affected (treatment) and unaffected (control) banks. Following prior literature, we classify banks into treatment and control groups

[13] Following the demise of Lehman Brothers in August 2008 and the government rescue of AIG in the subsequent month, the U.S. Congress initiated the Emergency Economic Stabilization Act (EESA) which was signed into law in October 2008. The main objectives of the EESA were to restore consumer confidence and stabilise the financial system. The key element of this Act was the introduction of the Capital Purchase Program (CPP), as part of the Troubled Asset Relief Program (TARP), which allowed the Department of Treasury to infuse capital into qualified financial institutions.

as follows (Lambert, Noth and Schüwer, 2017).[14] First, we aggregate the insured deposits of all banks (subsidiary banks) to the bank holding company level.[15] Subsequently, we calculate the following quantity:

$$diffRatio_i = \left(\frac{Insured\ Deposits}{Total\ Assets}\right)^{New\ threshold} - \left(\frac{Insured\ Deposits}{Total\ Assets}\right)^{Old\ threshold}$$

That is, we calculate the difference between the original ratio of insured deposits to total assets (based on the initial $100,000 limit) and the new ratio of insured deposits to total assets (based on the new limit of $250,000). The BHCs are sorted into four quantiles based on the increase in the insured deposit to total assets ratio ($diffRatio_i$). We retain only the top and bottom quantiles to respectively form our treatment and control group of banks.[16]

Figure 2.1 illustrates how the insured deposit to total assets ratios differ between our treatment and control groups of banks around the event quarter. Following the increase in deposit insurance coverage, the treatment group of banks experience a large increase in insured deposits to total assets ratios. A similar change is not observed among the control group of banks. Overall, the average increase in the insured deposits to total assets ratio for the treated banks amounts to 20%. The corresponding figure for the control group of banks is 5%. Based on this observation,

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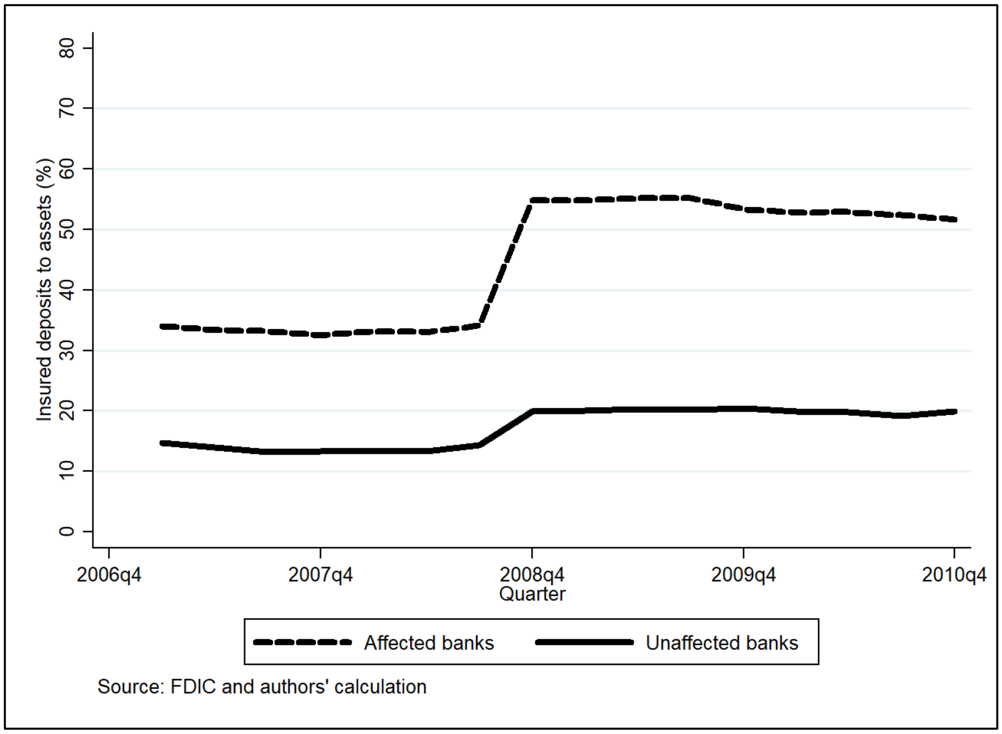
[14] Our unit of analysis is bank holding company (BHC). Unless stated otherwise, the term "bank" that we use in this study refers to BHC.

[15] We focus on BHCs instead of commercial banks mainly for two reasons. First, BHCs are the source of strength for their subsidiaries and their earnings distribution might affect the safety and soundness of the subsidiaries (Ashcraft, 2010). Second, many corporate finance decisions are made at the BHC level (Jiang, Levine and Lin, 2016a). In addition, we follow many previous studies in bank payout policy that focus on BHCs (e.g. Abreu and Gulamhussen, 2013; Srivastav, Armitage and Hagendorff, 2014; Bonaimé, Hankins and Harford, 2013)

[16] Atanasov and Black (2016) refer to this method as continuous difference-in-differences (DID), in which the treated group is formed from firms that are strongly affected by the shock, whereas the control group is formed from mildly affected firms.

we can infer that both treated and control groups differ considerably in the increase of the insured deposit amount.

Figure 2. 1: US BHC insured deposits from 2007Q1 to 2010Q4



Note: This graph shows the insured deposit to asset ratio (%) of US BHCs over the period 2007Q1-2010Q4.

To estimate the effect of deposit insurance on bank payout behaviour, we use a difference-in-differences approach. This approach compares the difference in the payouts between the treated and control banks in the pre- and post-event periods. We estimate regressions of the form:

$$Y_{i,t} = \alpha + \beta_1 (Affected_i * Post\ Event_t) + \beta_2 Post\ Event_t + \delta X_{i,t-1} + \nu_i + \varepsilon_{i,t} \quad (2.1)$$

where i indexes bank and t indexes time. $Y_{i,t}$ represents each of the dependent variables: the dividends to total equity and the share repurchases to total equity ratios.

Dividends are defined as the dollar amount of cash dividends declared on common stock, whereas share repurchases are defined as the sum of (i) treasury stock purchases and (ii) net conversions and retirement of common stock (Hirtle, 2016). In line with prior literature on bank payout policy, we normalise our dependent variables using total equity (Kanas, 2013; Onali, 2014; Onali et al., 2016).

$Affected_i$ is a dummy variable that captures whether a bank was affected by the increase in deposit insurance limit in 2008Q4 or not. Therefore, $Affected$ is equal to one for treated banks and zero for banks in the control group. $Post\ Event_t$ is a dummy variable for the post-treatment period. This variable takes the value of one for quarters after 2008Q4, and zero otherwise. $Affected_i * Post\ Event_t$ is the interaction term in our difference-in-differences regression equation. This variable takes the value of one if the bank was affected by the deposit insurance increase in the post-event period, and zero otherwise. β_1 is the coefficient of interest, which represents the impact of the increase in the deposit insurance limit on bank payout policy. A negative (positive) value of β_1 would indicate that affected banks decrease (increase) payouts, in line with the signalling (risk shifting) view.

$X_{i,t-1}$ represents a vector of bank-level control variables that vary over time and across banks. These control variables include: bank size, profitability, liquidity, bank capital, and bank risk. Prior evidence suggests that larger and more profitable banks distribute more cash to shareholders (Fama and French, 2001; Denis and Osobov, 2008; Abreu and Gulamhussen, 2013). Liquidity could also influence payout policy (dividends and share repurchases), but the precise direction of this relationship is ambiguous (DeAngelo, DeAngelo and Stulz, 2006). On the one hand, an increase in cash holdings could be the result of weak growth opportunities, in which case cash holdings would be best paid out to investors (Jensen, 1986). On the other hand, large cash holdings could indicate a build-up of funds to meet future uncertain demands for liquidity (Jensen and Meckling, 1976; Myers, 1977; Myers and Majluf, 1984), in which case there would be a negative relationship with dividends and share repurchases. The expected sign on bank capital is also ambiguous given that well capitalised banks are less constrained in making dividends, but are also under less pressure to signal (to external stakeholders) their ability to generate future cash flows. Finally, bank risk (measured by a non-performing loan ratio) could have a negative influence on dividends if banks faced with higher non-performing loans increase their retained earnings to build up capital buffers. The full list of variables included in the model and their respective definitions are provided in Table 2.1. The model also includes bank specific fixed effects, ν_i, to control for unobserved bank heterogeneity. $\varepsilon_{i,t}$ is a stochastic error term.

Our dependent variables (dividends and share repurchases) do not assume negative values. This renders estimates obtained from standard ordinary least squares (OLS) inconsistent (Wooldridge, 2002). We estimate Equation (2.1) using a censored normal regression Tobit model with fixed effects (Honoré, 1992), and bootstrapped standard error.[17]

[17] Developed by Honoré (1992), this estimator has also been used in a recent study in payout policy (Arena and Kutner, 2015).

Table 2. 1: Variables definitions and sources

Variables	Definition	Sources
Dividends	Total cash dividends paid to common shareholders divided by total equity capital	S&P Global
Repurchases	Total share repurchases (calculated as treasury stock purchases plus net conversions and retirement of common stocks) divided by total equity capital	S&P Global
Affected	A binary variable that equals one if banks are affected by the increase in deposit insurance coverage and zero otherwise	Own construction using FDIC data
Post Event	A binary variable that equals one for quarter after 2008Q4 as the event quarter of deposit insurance coverage increase and zero otherwise	Own construction
Size (log of total assets)	Size of banks as measured by the natural logarithm of total assets	S&P Global
Profitability	Bank profitability as measured by return on assets (net income divided by total assets)	S&P Global
Liquidity	Bank liquidity measured as by total cash balance divided by total assets	S&P Global
Capitalisation	Bank capitalisation as measured by total equity capital divided by total assets	S&P Global
Risk	Bank loan portfolio risk as measured by non-performing loans divided by total loans	S&P Global

Note: This table presents definitions and sources of variables in our analysis.

A key identification assumption underlying our research design is that in the absence of a treatment, the difference-in-differences estimator would equal zero (commonly referred to as the parallel trend assumption). In other words, this assumption requires that the trend in the outcome variable is similar for both treated and control groups in the period prior to the increase in the maximum amount of insured deposits. In our analysis below, we perform a variety of checks to ensure that the parallel trend assumption is satisfied.

2.4 Data and Summary Statistics

We collect the financial data of US bank holding companies (BHCs) from the Standard & Poor (S&P) Global Market Intelligence database. Our BHC data spans 16 quarters covering the period from 2007Q1 to 2010Q4. This time period straddles the increase in the amount of the deposit insurance coverage. Given that insured deposits are not available at the BHC level, we rely on FDIC reports produced by commercial banks owned by our sample BHCs. We then aggregate the insured deposits of each commercial bank to their respective parent BHCs. Merging data on insured deposits aggregated at the BHC level with financial data drawn from S&P Global results in 627 unique BHCs. We also exclude observations with dividend to asset ratios that greater than one to mitigate the effects of outliers. Assigning banks to treatment and control groups as described in Section 2.3 results in a final sample of 311 unique BHCs (155 treated and 156 control banks) with 4,803 BHC-quarter observations.

Of our sample of 311 banks, 271 (87%) paid dividends and 247 (79%) repurchased shares at least once during the sample period. In terms of observations, 39% of dividend observations and 70% of share repurchases are zero.[18] 201 (67%) from 311 banks paid both dividends and share repurchases in the same quarter at least once during the sample period. Table 2.2 provides the summary statistics on the number of observations, means, medians, and standard deviations for the full sample as well as for the affected and unaffected banks. The average dividend to equity ratio and the share repurchase to equity ratio for the full sample are 0.88% and 0.28% respectively. Affected and unaffected banks are almost similar across both measures.

[18] This justifies using the Tobit model (censored regression).

Specifically, the mean value of dividend to equity ratio for affected banks and unaffected banks is 0.90% and 0.86% respectively. Corresponding figures for the repurchase to equity ratio are 0.21% and 0.35% respectively. These figures imply that banks in our sample pay more dividends than share repurchases over the sample period. Unaffected banks are on average slightly larger, more profitable, but less liquid (hold less cash) than affected banks. Moreover, the two groups of banks do not differ much in terms of their respective capitalisation. A correlation between all variables is presented in Table 2.3.

Table 2.4 reports the results from an initial investigation of the parallel trend assumption (further test results are reported in Section 2.6.2). The results indicate that the parallel trend assumption is satisfied with growth in payouts during pre-treatment period being statistically identical across treated and control groups.

Table 2. 2: Summary statistics

Variables	All BHCs				Affected BHCs				Unaffected BHCs				Test of significance
	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	N	Mean	Median	Std. Dev.	*p*-value
Payout measures													
Dividends	4803	0.0088	0.0043	0.0144	2371	0.0090	0.0038	0.0156	2432	0.0086	0.0047	0.0132	0.3379
Repurchases	4803	0.0028	0	0.0128	2371	0.0021	0	0.0125	2432	0.0035	0	0.0132	0.0002
Bank characteristics													
Size (log of total assets)	4803	14.2634	13.7737	1.4391	2371	13.8291	13.6561	0.8509	2432	14.6868	14.0881	1.7384	0.0000
Profitability	4803	0.0011	0.0018	0.0046	2371	0.0009	0.0019	0.0055	2432	0.0013	0.0017	0.0037	0.0086
Liquidity	4803	0.0492	0.0318	0.0495	2371	0.0510	0.0349	0.0416	2432	0.0473	0.0295	0.0560	0.0092
Capitalisation	4803	0.0891	0.0864	0.0277	2371	0.0880	0.0880	0.0261	2432	0.0903	0.0846	0.0292	0.0047
Risk	4803	0.0239	0.0144	0.0285	2371	0.0267	0.0165	0.0334	2432	0.0211	0.0131	0.0225	0.0000
No. of banks	311				155				156				

Note: This table reports summary statistics for the variables in our analysis. It tabulates the number of observations, means, medians, and standard deviations (Std. Dev.) for all banks, affected banks, and unaffected banks separately. The sample is unbalanced panel covering 311 US bank holding companies over the period from 2007Q1 to 2010Q4. We use two payout measures: Dividends and repurchases. We control for five important characteristics of banks that may affect payout decisions following previous literature: Size, Profitability, Liquidity, Capitalisation, and Risk. The definitions of these variables are summarised in Table 2.1.

Table 2. 3: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dividends (1)	1.0000						
Repurchases (2)	0.0313	1.0000					
Size (3)	-0.0301	0.0406	1.0000				
Profitability (4)	0.2422	0.0635	-0.0395	1.0000			
Liquidity (5)	-0.0351	-0.0395	0.0775	-0.0478	1.0000		
Capitalisation (6)	0.0223	-0.0006	0.0654	0.2614	-0.0221	1.0000	
Risk (7)	-0.2115	-0.1018	0.0696	-0.4169	0.1676	-0.1410	1.0000

Note: This table tabulates the correlations between variables.

Table 2. 4: Test of parallel trend assumption

Variables	Mean growth of control group	Mean growth of treatment group	Difference	Std. Errors
Dividend growth	-0.0006	-0.0009	0.0003	0.0004
Repurchase growth	-0.0002	-0.0005	0.0003	0.0007

Note: This table presents the result of statistical test for parallel trend assumption following Lemmon and Roberts (2010) by comparing the growth rate of the dependent variables in the pre-treatment period.

2.5 Results

Table 2.5 tabulates the main regression results for the Equation (2.1) using dividends and share repurchases normalized by total equity as the dependent variables. The coefficient of the difference-in-differences (DID) interaction term, β_1, in column 1, is negative and statistically significant at the 5% level. This result is consistent with H1a, which suggests a negative relationship between deposit insurance and bank dividends. The point estimate suggests that the dividend to equity ratio for affected banks declines by 35 basis points. This reduction is economically significant as affected banks cut their dividends by $9 million. This is a large reduction relative to the $21.5 million dividends paid by the average bank in the sample. Overall, the results lend support to the notion that dividends are used by banks to signal financial health to depositors whereby banks reduce dividends when they feel the risk of losing their deposits is less pronounced following the increase in deposit insurance coverage (Kauko, 2014; Forti and Schiozer, 2015; Floyd, Li and Skinner, 2015).

Table 2. 5: Deposit insurance and bank payout policy: Main results

Dependent variables:	Dividends	Repurchases
	(1)	(2)
Post Event	-0.0036***	-0.0214
	(0.0010)	(0.0133)
Affected * Post Event	-0.0035**	-0.0225
	(0.0017)	(0.0228)
Size	0.0137***	0.0193
	(0.0048)	(0.0261)
Profitability	0.9234***	-0.1077
	(0.3389)	(1.4592)
Liquidity	-0.0337**	0.0687
	(0.0138)	(0.1303)
Capitalisation	0.2259***	0.7473
	(0.0739)	(0.6607)
Risk	-0.3112***	-0.9908*
	(0.0607)	(0.5088)
Bank fixed effects	Yes	Yes
No. of observations	4747	4747
No. of banks	311	311
Prob > Chi2	0.00	0.00

Note: This table reports the results of difference-in-differences estimation. We examine the effects of increased coverage of deposit insurance on bank payout policy for a sample of 311 US BHCs in 2007Q1-2010Q4. The dependent variables are dividends to equity ratio and share repurchases to equity ratio. Affected is a dummy variable for banks that are affected by the increase in deposit insurance coverage and zero otherwise. Post Event is a dummy variable for the quarters after 2008Q4 and zero otherwise. The variable of interest is Affected * Post Event, which indicates the difference of payout changes between affected and unaffected banks following the increase in deposit insurance coverage. We include a set of control variables (Size, Profitability, Liquidity, Capitalisation, and Risk) as defined in Section 2.4. Columns 1 and 2 are estimated using Honoré's (1992) fixed-effect Tobit, which allows to control for unobserved time-invariant characteristics among banks in our sample. The reported coefficients are marginal effects and estimated using maximum likelihood technique. Standard errors are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

For share repurchases, β_1, in column 2, is statistically insignificant. This result suggests that the increase in the deposit insurance coverage has no impact on banks' share repurchase activity. This is in line with the notion that share repurchases are used as a mechanism for paying out the transient rather than the permanent component of earnings (Lee and Rui, 2007). Share repurchases are known to be pro-cyclical and more flexible than dividends, while dividends are sticky and can be interpreted as a signal (Jagannathan, Stephens and Weisbach, 2000; Bonaimé, Hankins and Harford, 2013; Guay and Harford, 2000). Therefore, the findings that affected banks reduce dividend payouts once the deposit insurance coverage increases, but do not adjust their repurchases relative to the control group, further supports the view that dividends are used by banks to signal financial health to depositors.[19]

Our dataset also contains observations where banks pay dividends and make share repurchases at the same time. This may also drive our main findings where banks substitute dividends for share repurchases or vice versa (Grullon and Michaely, 2002). That is dividends are reduced as a result of an increase in share repurchases. In order to account for this substitution effect, we re-estimate the baseline model for both dividends and share repurchases by including dummies for increased share repurchases (for dividends) and increased dividends (for share repurchases). The results, tabulated in Table A2 of the Appendix remain unchanged.

The results of our empirical analysis so far suggest that banks use dividends (rather than share repurchases) as a device to signal financial health to uninsured depositors. However, bank managers may use dividends to signal other stakeholders. Therefore, one could argue that our results may be driven by dividend policy changes

[19] Our baseline results remain robust when using quarterly fixed effects. These results are reported in Table A1 of the Appendix.

targeted for shareholders (Bhattacharya, 1979; John and Williams, 1985) or non-depository debtholders (Ashcraft, 2008; Schaeck et al., 2012). To alleviate such concerns, we re-estimate our models by controlling for such possible signalling targets.

First, we focus our analysis on a subsample that includes only BHCs classified as S-corporations.[20] The main requirements for these banks to become an S-corporation are (i) the number of shareholders must not exceed 100 and (ii) the shareholders must be individuals.[21] In addition, many of the S-corporation owners are also the managers of the firms (Mehran and Suher, 2009). These conditions imply that informational asymmetry between owners (i.e. shareholders) and managers of S-corporations is at a minimum level due to their concentrated ownership. Such a subsample analysis, therefore, significantly reduces the possibility that managers signal information to shareholders via means of dividend policy changes. The results, reported in column 1 of Table 2.6, suggest that following the increase in the deposit insurance coverage, affected banks reduce their dividends payouts.[22] These results, which are in line with Table 2.5, lend support to the notion that reductions in dividend payments following the change in the deposit insurance coverage are not driven by managers signalling information to shareholders.

[20] The passing of the Small Business Job Protection Act of 1996 (which became effective in January 1997) allowed banks to convert from a C corporation (an entity paying corporation tax) to Sub-chapter S Corporation status. Sub-chapter S banks must have 75 shareholders or less prior to 2004, when the American Job Creation Act changed the threshold to and 100 shareholders or less. This limitation on the maximum number of shareholders precludes many larger banks from electing Sub-chapter S status. We obtain the information on a BHC's S-corporation status from the FR Y-9C reports, (item BHCKA530).
[21] *GAO Report to Congressional Committees,* "Banking Taxation: Implications of Proposed Revisions Governing S-Corporations on Community Banks," GAO/GGD-00-159, June 2000.
[22] Here we focus on dividends since share repurchases are not affected by deposit insurance changes according to our baseline specification.

Next, we investigate whether our findings are driven by managers signalling information to non-depository debtholders. The market discipline literature suggests that other than shareholders, regulators, and depositors, banks are also monitored by non-depository debtholders (Schaeck et al., 2012). These debtholders may demand a higher price of financing or even withdraw existing financing when banks become riskier. Therefore, the possibility of banks signalling financial strength and stability to non-depository debtholders via dividend payouts could also explain the results in Table 2.5. To alleviate such concerns, we re-estimate Equation (2.1) using two different subsamples. First, we restrict our sample to those banks without subordinated debt. Subordinated debtholders hold last claims of a bank's assets in the event of default, hence they have a strong incentive to monitor bank's health. Second, we restrict the

Table 2. 6: Ruling out alternative explanations

	Dependent variable: Dividends				
	Sub-chapter S banks	Banks without subordinated debt	Banks with below median debt to equity ratio	Private banks	Banks with low free cash flow
	(1)	(2)	(3)	(4)	(5)
Post Event	-0.0030	-0.0030***	-0.0016	-0.0045*	-0.0043***
	(0.0036)	(0.0011)	(0.0023)	(0.0027)	(0.0013)
Affected * Post Event	-0.0097*	-0.0066***	-0.0070**	-0.0083**	-0.0049**
	(0.0051)	(0.0021)	(0.0029)	(0.0042)	(0.0024)
Size	0.0360	0.0212**	0.0207	0.0346*	0.0128***
	(0.0245)	(0.0086)	(0.0132)	(0.0196)	(0.0043)
Profitability	2.4722**	0.7019	1.5303*	2.1459**	0.6586*
	(1.0605)	(0.5315)	(0.8551)	(0.9719)	(0.3513)
Liquidity	-0.0176	-0.0401	-0.0563*	-0.0198	-0.0209
	(0.0421)	(0.0271)	(0.0313)	(0.0178)	(0.0224)
Capitalisation	0.4100	0.3432**	0.3699**	0.5042*	0.3080***
	(0.3369)	(0.1493)	(0.1843)	(0.3021)	(0.1133)
Risk	-0.4577***	-0.3522***	-0.3762***	-0.3516***	-0.3301***
	(0.1405)	(0.0659)	(0.0881)	(0.1069)	(0.0472)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
No. of observations	951	3306	2349	2296	3438
No. of banks	65	216	156	152	238
Prob > Chi2	0.00	0.00	0.00	0.00	0.00

Note: This table presents the additional sensitivity tests related to other possible reasons driving our main results. Column 1 presents estimates using a sample comprised of Sub-chapter S banks to alleviate concerns of bank signalling to shareholders instead of depositors. In columns 2 and 3, we exclude banks with subordinated debt and banks with above median value of debt-to-equity ratio, respectively, to rule out the possibility of banks signalling to non-depositor debtholders via dividends. Column 4 restricts the sample to private banks only to alleviate concerns regarding differential payout policy behaviour across private and publicly held banks. In column 5 the sample contains banks with above median loan growth rates and below median cash flow as estimated during the pre-treatment period to alleviate concerns that results are driven by changes in agency problems across banks. All models are estimated using Honoré's (1992) fixed-effect Tobit to control for unobserved time-invariant characteristics among banks in our sample. The reported coefficients are marginal effects and estimated using maximum likelihood technique. Standard errors are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

sample to those banks that have below median value of debt to asset ratio.[23] Columns 2 and 3 of Table 2.6 report the results, showing that the coefficient of interest remains statistically significant and with the same sign as in Table 2.5. These results further demonstrate that our findings are less likely driven by managers signalling information to non-depository debtholders.

Another potential concern that might drive our results is the ownership structure of the sampled banks. Michaely and Roberts (2012) provide evidence that the listing status of a corporate can influence dividend payout. The authors show that publicly held companies have a tendency to smooth dividends more than their privately-owned counterparts. To alleviate such concerns, we re-estimate Equation (2.1) using a restricted sample containing private banks only. The results, which are reported in column 4 of Table 2.6, are in line with the findings documented in Table 2.5.

Finally, we investigate the concern that the reduction in dividends might not be due to banks' lessening need to signal to depositors following the change in the deposit insurance coverage, but rather by a change in the magnitude of the agency problem of free cash flow across the banks sampled. Agency problems are a frequently cited motivation of firm payout policy. Managers typically pay dividends to resolve agency problems associated with free cash flow (Easterbrook, 1984; Jensen, 1986). That is, dividends reduce agency conflicts between managers and shareholders by limiting management's ability to channel unused resources away from shareholders. Given that our identification strategy relies on the differential increase in insured deposits across

[23] We also analyse a subsample of banks with less than the median value of debt to equity ratio and find similar results.

banks, growth opportunities (and/or cash flows) would have to be positively (negatively) correlated with the change in the insured deposits in order to drive our empirical results. To address this concern, we purge our sample from those banks that are likely to face such agency problems in the pre-treatment period. That is, we exclude those banks with above average cash flow (measured by operating cash flow)[24] and below average growth opportunities (measured by quarterly asset growth rate)[25] from our sample, and re-estimate Equation (2.1). The results, presented in column 5 of Table 2.6, are in line with those presented in Table 2.5, suggesting that agency problems associated with the free cash flow are not driving our findings.

Overall, our results suggest that banks with more insured deposits pay fewer dividends as the need to signal their financial strength to uninsured depositors declines. Our findings largely support the notion that unlike industrial firms, banks distribute cash to shareholders in order to signal their financial strength (Floyd, Li and Skinner, 2015). They are also in line with the argument that dividends signal bank quality during a time of uncertainty (Acharya, Le and Shin, 2017). This is because banks compete for depositors who are sensitive to bank financial distress and thus prone to run during the times of uncertainty (Egan, Hortacsu and Matvos, 2017). Finally, our results lend empirical support to Kauko's (2014) theoretical argument that banks use dividends as a signalling device of their solvency to their depositors.

[24] Following Lang, Stulz and Walkling (1991), we calculate a bank's cash flow by subtracting operating income before depreciation with its cash out flows (interest expenses, taxes, preferred dividends, and common dividends), normalised by bank total assets.

[25] Using loan growth rates gives us similar results.

2.6 Robustness Checks

This section discusses possible confounding effects and presents a number of robustness checks that support the causal interpretation of the findings obtained from our analysis above.

2.6.1 TARP capital injections

The validity of our approach would be threatened if factors other than the increase in the amount of insured deposits were driving our estimated results. Therefore, we isolate any contemporaneous activities that could have the potential to confound our analysis. As already mentioned, during the same quarter of the increase in deposit insurance coverage, there were capital infusions to the troubled banks in the U.S banking system via the Troubled Asset Relief Program (TARP). As a result, TARP participating banks faced restrictions on dividend payouts (Bayazitova and Shivdasani, 2011). Therefore, the TARP program could have an effect on banks payout policy similar to that attributed to the increase of the deposit insurance coverage.

In order to check the robustness of our findings to the TARP effect, we limit our sample to banks that did not participate in the TARP and re-estimate Equation (2.1). This restriction results in a reduction in our sample from 311 to 205 non-TARP banks (110 treated and 95 control). The results of the analysis for dividend payouts and share repurchases are presented in columns 1 and 2 of Table 2.7, respectively. With regards to dividends (share repurchases) we continue to find a negative and statistically significant (insignificant) coefficient on the interaction term of interest. This suggests that our main findings are not driven by the capital infusions and the accompanied restrictions on payout policy received by a number of banks included in our sample.

2.6.2 Falsification tests and sensitivity checks

The validity of the difference-in-differences estimation requires that in the absence of treatment the payout policy of banks belonging to the treated group would have evolved in a similar fashion to the behaviour of the banks in the control group. This is a key assumption of our identification strategy that is often referred to as the parallel trends assumption (Abadie, 2005). We complement the investigation of the parallel trend assumption reported in Section 2.4 (Table 2.4) by conducting two placebo tests, where we falsely assume that the increase in the maximum limit in deposit insurance coverage was introduced in 2004Q4 and 2006Q4 rather than in 2008Q4. We use a period spanning sixteen-quarters surrounding each of the false introductions of increases in deposit insurance coverage. If our main results indeed reflect the causal effect of the true increase in insured deposits, then β_1 should not be significant in any of the placebo tests.

Table 2. 7: Additional robustness tests

Dependent variables:	Dividends	Repurchases	Dividends	Dividends	Dividends	Dividends
	Non-TARP banks	Non-TARP banks	Placebo event 2004Q4	Placebo event 2006Q4	Covariate exclusion	Matched sample
	(1)	(2)	(3)	(4)	(5)	(6)
Post Event	-0.0030*	-0.0118	0.0026*	-0.0004	-0.0074***	-0.0035**
	(0.0017)	(0.0088)	(0.0016)	(0.0011)	(0.0009)	(0.0014)
Affected x Post Event	-0.0067***	-0.0260	-0.0017	0.0002	-0.0042**	-0.0046**
	(0.0024)	(0.0210)	(0.0016)	(0.0017)	(0.0019)	(0.0021)
Bank level controls	Yes	Yes	Yes	Yes	No	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3138	3138	4144	4279	4803	3491
No. of banks	206	206	291	311	311	228
Prob > Chi2	0.00	0.01	0.00	0.00	0.00	0.00

Note: This table presents the additional robustness tests related to confounding event and parallel trend assumption of our difference-in-differences approach. In columns 1 (dividends) and 2 (share repurchases), we exclude bank holding companies that received TARP in 2008. In columns 3 and 4, we create hypothetical events in 4 and 2 years prior to the actual event in 2008Q4. In column 5, we exclude covariates from the main model. Finally, in column 6, we matched the affected and affected banks based on bank fundamentals (size, profitability, capital, liquidity, and risk) using 1 nearest neighbour matching method following Berger and Roman (2015) (we also match banks with 2 and 3 nearest neighbours and get the same results, but not reported for brevity). All models are estimated using Honore's (1992) fixed-effect Tobit to control for unobserved time-invariant characteristics among banks in our sample. The reported coefficients are marginal effects and estimated using maximum likelihood technique. Standard errors are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Columns 3 and 4 of Table 2.7 present the results of these tests. None of the coefficients on the interaction term (*Affected * Post Event*) are significant. This suggests that the affected banks did not change their dividends in a systematic way before the actual increase in deposit insurance coverage. This implies that the parallel trend assumption holds for our analysis, and also indicates no anticipation effects of the increase in the amount of insured deposits in our sample.[26] The results above provide confidence in that our research design does not violate the parallel trends assumption. Our analysis also includes a number of time-varying control variables as a way to ameliorate such risk. Such inclusion, however, introduces the risk of biasing the estimated treatment effect (Atanasov and Black, 2016). To provide additional evidence on the robustness of our analysis we replicate our main results without the time-varying control variables. The results, tabulated in column 5 of Table 2.7, show that the magnitude of the coefficient of interest remains unchanged and our main conclusions still hold.

Finally, we also investigate whether our results are driven by a sample selection bias. As mentioned in Section 2.3, the classification of banks into treated and control groups is based on the proportion of insured deposits following the increase in the maximum limit of deposit insurance coverage. This is due to the difference in the number of deposits greater than $100,000 across institutions just before the change in the deposit insurance coverage came into effect (Lambert, Noth and Schüwer, 2017). However, if this difference across banks is non-random and correlated with dividend policy then this could lead to sample selection bias and an erroneous causal

[26] In un-tabulated results we also find that the parallel trends assumption holds for share repurchases.

interpretation of our conjecture. For instance, that could be the case if treated group banks cut dividends more than their counterparts in the control group during recessions but not so during normal times. We address this issue by employing a propensity score matching technique that allows the treated and control banks to have similar scores based on a number of observed characteristics in the pre-treatment period. These characteristics are comprised of capitalisation, asset quality, earnings, liquidity, and size.

Following Berger and Roman (2015), we construct a matched set of neighboring banks using the closest neighboring bank in the control group.[27] We perform the matching with replacement. This means that one control bank could act as the closest match for multiple treated banks. This matching results in a sample of 228 banks (149 treated and 79 control banks). Column 6 of Table 2.7 presents the difference-in-differences estimates using the matched sample. The results are qualitatively similar to the ones obtained from the unmatched sample. This implies that changes in the dividend policy of affected banks are due to the increase in deposit insurance coverage and not driven by differences in bank characteristics. Therefore, these findings lend support to the signalling hypothesis.

2.7 Conclusions

In this study, we investigate the effect of deposit insurance on bank payout policy. We utilise the sudden change in the maximum limit of deposit insurance

[27] The results are robust to using a matched sample based on the two (and three) nearest neighboring banks.

coverage in 2008, which had a differential impact on the insured deposits held by banks in our sample. We classify our sample into two groups of affected and unaffected banks based on their exposure to the increase in insured deposits (calculated as the difference in the ratio of insured deposits to assets before and after the change in the maximum limit of deposit insurance coverage).

Using difference-in-differences approach, we show that following the increase in deposit insurance coverage, affected banks pay lower dividends than unaffected banks. This suggests that banks with a large reduction in uninsured deposits pay lower dividends due to the reduced need to signal financial health. Our results are not driven by other possible considerations such as banks signalling to shareholders and non-depository debtholders or agency problems associated with free cash flow.

As such, our findings have implications for public policy. Prior evidence suggests that deposit insurance can lead banks to take excessive risk or engage in shifting risk onto taxpayers. We show that an increase in deposit insurance coverage reduces the need for banks to continue paying dividends during turbulent periods when the accumulation of retained earnings in order to bolster capital is likely to be crucial for financial stability. This finding is important, given the reliance that many banks place on large uninsured depositors who are more likely to withdraw funds in response to negative information. Hence, increases in the maximum level of deposit insurance coverage appears to lessen the need for banks to signal their financial health via dividend payouts. Nevertheless, we are aware that the use of an exogenous increase in deposit insurance coverage in this chapter could raise a concern because all banks were affected by the deposit insurance increase. Hence, further research could usefully seek an alternative form of identification in order to understand the causal effects of government safety nets on bank payout policy.

Chapter 3

Competition, Regulation and Bank Payouts

3.1 Introduction

Banks are among firms that consistently pay a high level of dividends. During the recent crisis, US banks continued paying dividends, while their earnings were declining (Acharya et al. 2011; Floyd et al. 2015; Hirtle, 2016). This trend is particularly important for regulators because bank cash payouts reduce bank equity capital, which is crucial in ensuring bank safety and soundness. To date, the literature has focused on the dividend policy of non-financial firms (Baker and de Ridder, 2018). We address this imbalance (to some extent) by focusing on the dividend policy of banks, which limited prior evidence suggests is driven by regulatory pressure (Abreu and Gulamhussen, 2013), corporate governance (Srivastav, Armitage and Hagendorff, 2014; Onali et al., 2016; Anginer et al., 2016), and creditor and shareholder rights (Lepetit et al., 2018).

A large body of literature has established a link between competition and bank level strategic decisions with respect to: capital structure (Inderst and Muller, 2008; Allen, Carletti and Marquez, 2011; DeAngelo and Stulz, 2015), loan portfolio composition (Chan, Greenbaum and Thakor, 1986; Niu, 2008), and the type of lending relationships with borrowers (Petersen and Rajan, 1995; Degryse and Ongena, 2007). However, this literature provides limited evidence regarding whether competition affects bank payout policy. In this paper, we significantly augment this prior literature by investigating the impact of deregulation and resultant increased competition on bank payout policy.

Competition can spur financial innovation, boost efficiency, and result in increased profitability (Jayaratne and Strahan, 1998; Casu and Girardone, 2006; Koetter, Kolari and Spierdijk, 2012; Chortareas, Garza-García and Girardone, 2012; Goetz, 2018). However, given the discretionary nature of payout policy, it is unclear whether returns to shareholders are likely to change following an increase in competition. More competition may increase dividends by inducing bank managers to dispense free cash flows (Grullon and Michaely, 2014). By reducing monitoring costs through generating greater opportunities for investors to benchmark the performance of bank managers against peers (Holmstrom, 1982; Nalebuff and Stiglitz, 1983; Shleifer, 1985), more competition increases the risk of managerial overinvesting being discovered. As such, increases in competition can induce banks to reduce overinvesting and disburse excess cash through increased dividends. Additionally, increased competition may also increase dividends if catering (Baker and Wurgler, 2004) and wealth transfer (Acharya, Le and Shin, 2017) incentives are prevalent. In a similar vein, competition may also increase managerial incentives to increase dividends if "deep-pocket" effects (Bolton and Scharfstein, 1990) and signal-jamming by the incumbents (Van Tassel, 2002) play a significant role in deterring entry. These theories argue that cash rich firms pay higher dividends in order to force new competitors (that are less capable to pay the same level of dividends) to exit the market. However, increased competition may reduce dividends if the earnings and free cash flow of incumbents are reduced (Hoberg, Phillips and Prabhala, 2014). As such, it seems competition acts as an external governance mechanism (see, Shleifer and Vishny, 1997; Allen and Gale, 2000), which reduces any agency conflict between managers and shareholders (Grossman and Hart, 1986; Easterbrook, 1984; Jensen, 1986). As a consequence, when competition is higher, managers pay lower dividends, because they have less incentives to signal reputation to investors.

Dividends are not the only form of cash flow distribution to shareholders that is available to bank managers. Over the past twenty years, share repurchases have grown to become a significant form of cash payouts from banks to shareholders (Floyd, Li and Skinner, 2015). The two are not identical though. Recent evidence suggests that firms use share repurchases to disburse transitory earnings and non-operating cash flows (Brav et al., 2005; Jagannathan, Stephens and Weisbach, 2000; Guay and Harford, 2000; Lee and Rui, 2007). In this case, given that transitory earnings and non-operating cash flows are not systematically affected by competition, any increased competition following deregulation would have no impact on share repurchases.

Testing the relationship between competition and payout policy (or any corporate finance policy for that matter) is not straightforward as competition could be jointly determined in equilibrium with bank payout policy. For example, bank managers may choose which market to operate in and decide financial policies simultaneously (Graham, Harvey and Rajgopal, 2005). Consequently, it is difficult to disentangle the effect of competition on bank payouts, unless one has a source of exogenous variation in the extent of competition facing banks.

In order to address the aforementioned concerns, we use a quasi-natural experiment to investigate how a change in state-level competition, following US interstate bank branching deregulation influences bank payout policy. Beginning in the 1970s and continuing throughout the 1980s, the US banking industry experienced a significant reduction in the regulations relating to restrictions on bank location. In the early 1980s, many states began to allow out-of-state banks to enter and compete with incumbent banks. This culminated in the US Congress passing the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994. The IBBEA removed many of the restrictions on opening bank branches across state lines, thus formally allowing banks to establish branches outside of their headquartered state.[28] However, the IBBEA also granted individual states the right to impose their own restrictions to prohibit the entry of out-of-state banks. Individual states could impose up to four restrictions relating to: the minimum age of a target institution (Minimum Age); de novo interstate branching (De Novo Branching); the acquisition of individual bank branches (Acquisition); a state-wide deposit cap (Deposit Cap).[29] As a result, the level of competition facing incumbent banks continued to vary across states following the passage of the IBBEA. Using information regarding these aforementioned restrictions, we follow prior literature (Rice and Strahan, 2010) to develop a time-varying branching restrictiveness index spanning from 1994 to 2005. We use this index within a difference-in-differences framework in order to estimate the marginal effect of competition on bank payouts.

Our findings (which are robust to several sensitivity and falsification tests) suggest that competition influences bank dividend policy. In particular, we find that banks operating in more competitive markets reduce dividends relative to counterparts operating under less competition. This effect is economically

[28] The IBBEA effectively repealed the federal geographic banking restrictions introduced under the McFadden Act of 1927 (Berger, Kasyap and Scalise, 1995; Spong, 2000; DeYoung, 2015).
[29] Rice and Strahan (2010, p.866-867) provide a detailed description of these restrictions.

significant.[30] Unlike dividends, competition has no significant impact on share repurchases. This corroborates prior evidence which suggests that share repurchases are used typically to distribute transitory rather than operational earnings.

The result of a further analysis (which decomposes the time varying branching restrictiveness index into four constituent parts) suggests that the relationship between competition and dividends is driven by the removal of deposit market cap restrictions.[31] We also find that variation in regulatory scrutiny across states moderates the effect of competition on bank dividends. In particular, we find that dividend policies of banks operating in states with more lenient regulators are affected less by increased competition following deregulation.

We conduct an additional analysis where we investigate the extent to which bank profitability and agency issues related to free cash flow affect bank dividend policies in states characterized by lower or higher levels of competition. The results suggest that banks with higher expected profitability are less affected by increased competition following deregulation. In particular, banks that have lower expected earnings experience a reduced ability to pay dividends relative to counterparts with better cash flow prospects. We find no evidence supporting the view that banks rely less on dividends to signal good cash flow management after competition increases.

We contribute to three strands of literature. First, we contribute to cross-industry studies that investigate the relationship between product market competition and dividend policy for non-financial firms. For example, Hoberg,

[30] For example, for a bank operating in a state which removes restrictions on the entry out-of-state banks, the estimated coefficient suggests that such an increase in competition would reduce dividends by $1.1 million, when the average bank in our sample pays out $19.5 million in dividends.
[31] Prior evidence suggests that such a restriction is effective in reducing competition from out of state banks (Nguyen, Hagendorff and Eshraghi, 2017).

Philips and Prabhala (2014) show that higher competition reduces dividends. In contrast, Grullon and Michaely (2014) show that lower market concentration (a proxy for higher competition) leads to increases in dividends. In the present chapter, we provide evidence from a single industry and use a reliable exogenous source of competition as a quasi-natural experiment. We find that increased competition leads to a reduction in bank dividends.

Second, we contribute to the literature that investigates the influence of regulatory oversight on bank dividend policy. Previous findings suggest that both oversight and pressure from regulators and supervisors plays an important role in determining bank dividend policy (Abreu and Gulamhussen, 2013; Kanas, 2013; Onali, 2014). We augment this literature to show that regulatory oversight moderates the impact of increased competition on bank dividends. Competition is associated with a smaller reduction in dividends in states with more lenient bank regulators.

Third, we contribute to the large literature on the effects of geographical banking deregulation in the US on bank behaviour (Jayaratne and Strahan, 1998; Jiang, Levine and Lin, 2016; Goetz, 2018; Berger, Öztekin and Roman, 2017; Nguyen, Hagendorff and Eshraghi, 2018). Results emanating from this literature suggest that deregulation has a significant impact on bank behaviour via reduced risk taking, increased transparency, increased efficiency, and improved capitalisation.[32] We show that competition reduces incentives to pay dividends.

[32] In addition to influencing bank behaviour, documented evidence suggests that the deregulation of the US banking industry had a significant impact on real economic outcomes. Jayaratne and Strahan (1996) show that state level output increases following the relaxation of bank branch restrictions. Moreover, there is evidence that bank deregulation: increases credit supply (Rice and Strahan, 2010); tightens the income distribution of households (Beck, Levine and Levkov, 2010); promotes entrepreneurship (Black and Strahan, 2002; Kerr and Nanda, 2009); increases firm innovation (Cornaggia et al., 2015); and increases house prices (Favara and Imbs, 2015).

The remainder of this chapter is structured as follows. Section 3.2 presents our identification strategy, empirical specification, dataset and descriptive statistics. Empirical findings are presented in Section 3.3, while Section 3.4 presents the results of a series of additional tests. Section 3.5 concludes.

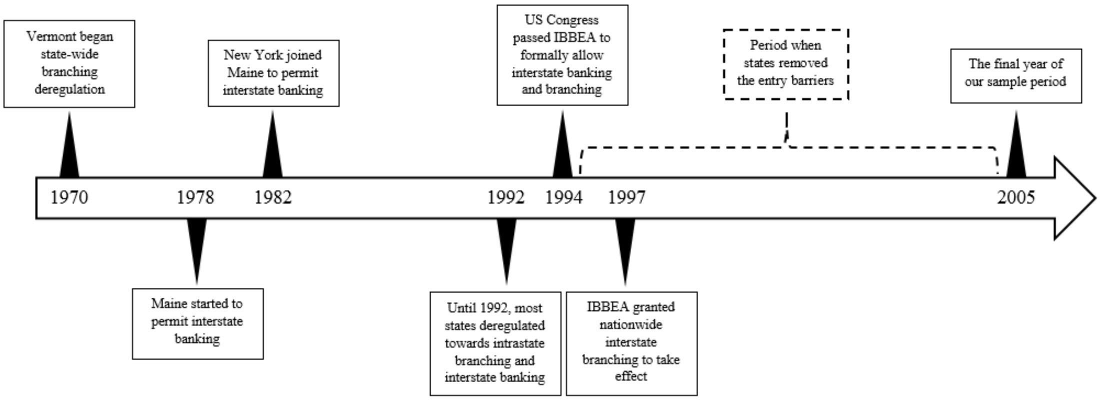
3.2 Identification Strategy, Empirical Specification, and Data

In this section, we discuss our identification strategy (Section 3.2.1), estimable model (Section 3.2.2), and the sample selection and resulting dataset (Sections 3.2.3 and 3.2.4).

3.2.1 Interstate branching deregulation

Assessing the impact of competition on bank payout policy is challenging given that competition could be jointly determined in equilibrium with bank payout policy. We aim to alleviate such endogeneity concerns by exploiting the staggered deregulation of interstate bank branching enacted in the 1990s. The US Congress passed the Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994, which formally legalized the statewide branching and interstate banking that started in the early 1970s, and subsequently spread across states (Berger, Kasyap and Scalise, 1995; Spong, 2000; DeYoung, 2015). Moreover, the Act also allowed interstate branching starting in 1997. Johnson and Rice (2008) show that the interstate branching deregulation increased the number of out-of-state bank branches and competition within states. Figure 3.1 presents a timeline of the deregulation of intrastate and interstate banking in the US from 1970 to 2005.

Figure 3. 1: US banking deregulation timeline from 1970 to 2005



This figure shows the timeline of intrastate and interstate banking deregulation in US banking industry over the period 1970-2005. Source: Rice and Strahan (2010, p. 870)

One feature of the IBBEA was that states retained discretion and flexibility over implementation. This led to differences in competition across states that persisted over time. Such variations in competition across states and over time allow us to test the impact of competition on bank payouts, while controlling for other possible confounding events.

More specifically, the IBBEA allowed states to restrict the entry of out-of-state branches by imposing restrictions or prohibitions on: de novo interstate branching; the minimum age of the target institutions for acquisitions; acquisitions of an individual branch or a portion of an institution; and any branch acquisition of in-state banks that hold more than 30% of the deposits in that state. These restrictions are discussed further in Table A3 of the Appendix. Using information of these aforementioned restrictions, Rice and Strahan (2010) construct a time-varying regulatory restrictiveness index across states from 1994 to 2005.[33] For ease of interpretation, and following Favara and Imbs (2015), we use the inverse of this

[33] The Rice and Strahan (2010) index takes a value of 0 to 4 (0 if a state does not implement any of the restrictions and 4 if state implements all four restrictions). This higher values of the index entail lesser competition among banks in a state.

index, which we denote as *DREG*.[34] We set *DREG* to 0 in 1994, and add 1 if a given state lifts one of the restrictions described above. Therefore, *DREG* ranges from 0 to 4, with higher values implying fewer restrictions on the entry of out-of-state branches.[35] We also decompose *DREG* into four constituent parts in order to understand the mechanisms underlying our baseline findings. Table A4 of the Appendix provides details of the timing of interstate branching deregulation across states following the passage of the IBBEA.

3.2.2 Empirical specification

To examine the relationship between competition and bank payout policy, we use the following difference-in-differences regression equation:

$$Y_{i,s,t} = \beta\, DREG_{\mathrm{s,t}} + \delta X_{i,s,t} + a_i + \gamma_t + \epsilon_{\mathrm{i,s,t}}, \qquad (3.1)$$

where i indexes bank, s indexes state, and t indexes time. In line with prior literature on bank dividend policy (Kanas, 2013; Onali, 2014; Onali et al., 2016), $Y_{i,s,t}$ denotes the change in dividends or change in share repurchases normalized by the lagged value of total bank equity. $DREG_{s,t}$ is an index of banking competition in state s and at time t. The index takes the value of 0 to 4. Higher values imply higher competition in the banking market following the removal or relaxation of the entry barriers by a given state. $X_{i,s,t}$ is a vector of bank level control variables that vary over time and across banks. These control variables include size, profitability, liquidity, capitalisation, and risk (see Section 3.2.4 for a discussion of variables). a_i and γ_t denote bank and year fixed effects respectively. $\epsilon_{\mathrm{i,s,t}}$ is the error term.

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[34] Other previous studies have used this index to gauge the impact of banking competition on firm innovation (Cornaggia et al., 2015) and bank capitalisation (Berger, Öztekin and Roman, 2017).

[35] As in Favara and Imbs (2015), the states are assumed fully restricted in 1994 (takes the value of 0) and become less restricted (the value of 1 to 4) following the IBBEA passage in 1994 by lifting one or more among the four restrictions.

We estimate Equation (3.1) via Ordinary Least Squares (OLS). Standard errors are clustered at the state level in order to control for spatial correlation arising from the state-specific variation in deregulation. The coefficient of interest β, captures the impact of increased competition on bank payout policy.

3.2.3 Data and sample

We use information collected from the annual financial statements of US bank holding companies (BHC) over the period 1994 to 2005, obtained from S&P Global Market Intelligence.[36] The period of analysis is determined primarily by the passage of the IBBEA Act in 1994, and the availability of the Rice and Strahan (2010) index which spans the years 1994-2005. We collect information on: deposit market shares from the Federal Deposit Insurance Corporation (FDIC) Summary of Deposits; Gross State Product (GSP) from the Bureau of Economic Analysis; state coincident index data from the Federal Reserve Bank of Philadelphia; and state economic freedom index data from the Fraser Institute.

In order to mitigate the effects of outliers, we also exclude observations with dividend payout ratios greater than one.[37] Finally, we eliminate banks that are headquartered in Puerto Rico. Our final dataset is an unbalanced panel comprising 1,433 BHC with 10,257 bank-year observations over 12 years. The number of banks is higher than in the previous chapter. This is because in this chapter, we use the sample period prior to 2006 where banks with less than $50 million total assets were also required to file their FR Y-9C report to the Federal Reserve. Hence, the number of banks in the database are higher in the period prior to 2006.

[36] We refer to bank holding companies (BHCs) as banks throughout this chapter for convenience.
[37] Including these observations does not affect our main results.

3.2.4 Variable definitions and summary statistics

The payout variables are dividends and share repurchases. Unlike dividends, the value of share repurchases is not readily available from the regulatory report. Following Hirtle (2016) and similar to Chapter 2, share repurchases are calculated as the sum of treasury stock purchases and the net of common stock retirements minus conversion (if positive).[38] Following prior literature (Srivastav, Armitage and Hagendorff, 2014), we use the magnitude of change in the payout variables normalized by a bank's total equity lagged by one period, as our dependent variable. We normalise our dependent variable using total equity to account for heterogeneity in the size of banks included in our sample.

Competition is measured using a geographic deregulation index, *DREG*, which takes values between 0 and 4. We also recognise that banks may have presence outside the state they are headquartered in. Following Berger, Oztekin and Roman (2017) we also use a weighted version of *DREG*, where the weights applied are based on the proportion of bank deposits in every state that the bank has a physical presence.

We also control for other factors that are likely to affect bank payout policy. Other control variables comprise bank size, profitability, liquidity, capitalisation, and risk. Bank size is measured by the natural logarithm of total assets. Profitability is measured by the return on assets. We expect that larger and more profitable banks to pay higher dividends and repurchase more shares (Fama and French, 2001; Abreu and Gulamhussen, 2013). Bank liquidity is measured as the ratio of cash to total assets (DeAngelo, DeAngelo and Stulz, 2006). The relationship between

[38] We also obtain similar results when we only use the purchase of treasury stocks to proxy for share repurchases as in Bonaimé, Hankins and Harford (2013).

liquidity and bank payouts can be positive or negative depending on whether banks use cash to fund payouts to shareholders (positive effect), or boost internal cash reserves and capital (negative effect).

Bank capitalisation is measured by the ratio of equity to total assets. We expect banks with lower capital ratios to make lower payouts, so as to prevent capital from falling below minimum regulatory requirements. Prior evidence suggests that banks close to regulatory capital minima reduce dividends so as to avoid regulatory action (Onali, 2014). Risk is measured as the ratio of non-performing loans to total loans. Higher values of this ratio indicate higher risk (Forti and Schiozer, 2015). Prior evidence for non-financial firms suggests that there is a negative relationship between risk and dividends (DeAngelo, DeAngelo and Stulz, 2006). However, evidence for banking suggests the opposite. For example, Acharya, Le and Shin (2017) present a theoretical model that suggests that there is a positive link between dividends and bank risk-shifting behaviour. Onali (2014) shows that dividends and bank risk-taking are positively related. Table 3.1 provides detailed definitions of the variables used in our empirical analysis.

Table 3.2 presents the summary statistics of the variables used in the empirical analysis. The average value of the change in dividends is 0.61%. Corresponding values of the competition variables *DREG* and *Weighted DREG* are equal to 1.4. The identical values of *DREG* and *Weighted DREG* imply that banks face similar competition within and outwith of their home state. We tabulate the correlations of all variables in Table A5 of the Appendix.

Table 3. 1: Variable definitions and sources

Variables	Definition	Sources
Change in Dividends	Change in cash dividends paid to common shareholders scaled to lagged total equity (%)	S&P Global
Change in Share Repurchases	Change in share repurchases scaled to lagged total equity (%)	S&P Global
DREG	Inverse Rice and Strahan's (2010) index on interstate branching deregulation	Rice and Strahan (2010)
Weighted DREG	Weighted DREG based on BHC nationwide deposit market shares	Own calculation using data from FDIC's Summary of Deposit
Size	Natural log of total assets	S&P Global
Profitability	Return on assets	S&P Global
Liquidity	Total cash balance to total assets	S&P Global
Capitalisation	Equity capital to total assets	S&P Global
Risk	Bank risk measured by the ratio of non-performing loans to total loans	S&P Global
HHI	Herfindahl-Hirschman Index (HHI) based on deposit market shares in 1993	S&P Global & FDIC's Summary of Deposit
Reg Leniency	State regulatory leniency measure that takes the value from 1 to 10 (higher values indicate greater leniency)	Agarwal et al. (2014) and own calculations
HCLG	A binary variable that equals one for banks with above median cash flow (high cash flow) and below median asset growth (low growth opportunities)	Own calculations
Peer	The average dividend change of all banks in state s except bank i in year t	S&P Global and own calculations
PCA	A binary variable that equals one if; a bank's total risk-based capital ratio falls below 12%; its tier 1 risk-based capital ratio falls below 8%; or its tier 1 leverage ratio falls below 7%	Own calculations
Dividend Premium	A time series variable that captures investors' demand for dividends	Compustat, CRSP, and own calculations
SOX	A binary variable equal to one for publicly listed banks after the implementation of the Sarbanes-Oxley Act in 2002 and zero otherwise	Own calculations
Log GSP	Natural log of gross state product	Bureau of Economic Analysis
Coincident Index	Index that summarizes state-level economic conditions. It combines four variables: Nonfarm payroll employment, average hours worked in manufacturing by production workers, the unemployment rate, and wage and salary disbursements.	Federal Reserve Bank of Philadelphia
Freedom Index	State-level index of economic freedom provided by Fraser Institute	Fraser Institute

Note: This table provides the definitions and sources of variables used in this chapter.

Table 3. 2: Summary statistics

Variables	N	Mean	Std. Dev.	Median
Change in Dividends	10257	0.610	3.530	0.183
Change in Share Repurchases	10257	0.079	5.297	0.000
DREG	10257	1.400	1.462	1.000
Weighted DREG	9762	1.421	1.448	1.000
Size	10257	13.024	1.177	12.665
Profitability	10257	0.012	0.007	0.011
Liquidity	10257	0.044	0.028	0.038
Capitalisation	10257	0.094	0.032	0.090
Risk	10257	0.007	0.009	0.004
HHI	10163	0.359	0.235	0.274
Reg Leniency	10091	5.231	2.897	5.000
HCLG	10257	0.221	0.415	0.000
Peer	10218	0.623	0.859	0.534
PCA	10257	0.296	0.456	0.000
Dividend Premium	10257	-0.347	0.150	-0.387
SOX	10257	0.123	0.329	0.000
Log GSP	10257	12.218	0.949	12.233
Coincident Index	10246	130.291	11.872	128.861
Freedom Index	10246	7.394	0.817	7.519

Note: This table presents the summary statistics of the 10,257 observations of 1,433 US bank holding companies in our sample from 1994 to 2005. The definitions and sources of the variables are given in Table 3.1. Observations with the missing values of total assets and equity are excluded. To mitigate the effects of outliers, the observations with the dividend to equity ratio of more than one are also excluded.

3.3 Empirical Results

3.3.1 Baseline results

Table 3.3 reports the results of estimating Equation (3.1). Column 1 shows the results using the magnitude of change in dividends as the dependent variable and *DREG* as the main explanatory variable. The coefficient on *DREG* enters the regression negatively and is statistically significant at the 5% level, suggesting a negative relationship between competition and dividends.[39] This is in line with prior evidence of such a relationship for non-financial firms (Hoberg, Phillips and Prabhala, 2014). It is also significant in an economic sense given that banks located in states where competition is intense (where *DREG* equals 4) reduce their dividends by 0.33% (= -0.0823 x 4). This is a large reduction relative to the

[39] This finding is robust to winsorizing the data at the 1% and 99% of their distribution. The results of this analysis are presented in Table A6 of the Appendix.

unconditional mean of dividend change which is equal to 0.6%. In terms of real dollar values, this translates into a reduction in dividends by $1.1 million, when the average bank in our sample pays out $19.5 million in dividends.

Table 3. 3: Competition and bank payout policy: Baseline results

Dependent variables:	Change in Dividends	Change in Share repurchases
	(1)	(2)
DREG	-0.082**	0.031
	(0.036)	(0.034)
Size	0.205	0.021
	(0.257)	(0.232)
Profitability	125.349***	-0.788
	(18.350)	(11.797)
Liquidity	0.319	-2.411
	(3.309)	(3.660)
Capitalisation	-10.696	0.177
	(7.131)	(4.005)
Risk	-14.729*	4.943
	(8.502)	(7.589)
Bank fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
No. of observations	10257	10257
R-squared	0.03	0.003

Note: This table presents the baseline results. The dependent variables are the magnitude of change in dividends or share repurchases scaled to lagged equity. $DREG_{s,t}$ is the variable of interest, which takes the value of 0 (most restricted) to 4 (least restricted). The control variables include size, profitability, liquidity, capitalisation, and risk. The definitions of these variables are provided in Section 3.2.4. Standard errors are clustered at the state level and shown in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

Column 2 shows the estimation results investigating the impact of competition on share repurchases. Unlike dividends, the coefficient of *DREG* is not statistically different from zero. This finding, coupled with the negative impact of competition on dividends, implies that the increase in competition is likely to have shifted the permanent component of earnings to a new long run average, while leaving that of the transitory earnings unaffected. As such, this finding is consistent with the view that share repurchases are paid using transitory cash flow and, therefore, are weaker commitment devices for managers than dividends

(Jagannathan, Stephens and Weisbach, 2000; Guay and Harford, 2000; Lee and Rui, 2007).

The results above point to a causal relationship between competition and dividends, but not so between competition and share repurchases. Therefore, we only focus on the analyses of dividends for the remaining of this chapter. Turning to our control variables, the coefficient on bank size is positive, but statistically insignificant. The coefficient on profitability is positive and highly significant, indicating that profitable banks are more likely to increase dividends. Both liquidity and capitalisation variables are insignificant. The coefficient for risk is negative and marginally significant at the 10% level. These results are in line with previous findings for both financial and non-financial firms (Fama and French, 2001; Denis and Osobov, 2008; Forti and Schiozer, 2015; Srivastav, Armitage and Hagendorff, 2014).

Next, we investigate whether the prevailing market structure in each state when the IBBEA was enacted, played a moderating role on the impact of deregulation on bank dividends. That is, we explore whether at the point when states started lifting barriers to out-of-state bank entry and competition intensified, banks operating in states with lower market concentration reduced their dividends at a different pace relative to counterparts in states with higher market concentration. To this end, we interact the Herfindahl-Hirschman Index (HHI) for deposits in 1993 at the state level with the DREG and include it in Equation (3.1).[40] The results are presented in column 1 of Table 3.4. Although the coefficient on DREG is similar to column 1 of Table 3.3 (our baseline result) in terms of significance and

[40] The separate inclusion of the Herfindahl-Hirschman Index for deposits in 1993 is not possible as it is spanned by the inclusion of the bank fixed effects. Our results are robust to the use of a Herfindahl-Hirschman Index for loans in 1993.

magnitude, the coefficient on the interaction term is statistically insignificant. This suggests that initial market structure conditions do not play any role in moderating the effect of deregulation (following IBBEA) on bank dividends.

Table 3. 4: Competition and bank dividend policy: Initial condition, regulatory leniency, and decomposed DREG

	Dependent variable: Change in dividends		
	Initial condition of DREG change	Regulatory leniency	Decomposed DREG
	(1)	(2)	(3)
DREG	-0.087**	-0.175***	
	(0.041)	(0.037)	
DREG * HHI	0.010		
	(0.058)		
DREG * Reg Leniency		0.021***	
		(0.007)	
Minimum Age			-0.260
			(0.164)
De Novo			0.127
			(0.229)
Acquisition			0.001
			(0.226)
Deposit Cap			-0.351**
			(0.149)
Size	0.205	0.107	0.214
	(0.257)	(0.372)	(0.257)
Profitability	125.349***	131.445***	125.512***
	(18.350)	(19.695)	(18.362)
Liquidity	0.319	1.121	0.297
	(3.309)	(3.091)	(3.341)
Capitalisation	-10.696	-15.299*	-10.611
	(7.131)	(8.245)	(7.143)
Risk	-14.729*	-16.825*	-14.730*
	(8.502)	(9.840)	(8.484)
Bank fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
No. of observations	10163	8317	10257
R-squared	0.03	0.03	0.03

Note: This table presents the additional tests supporting our baseline results. The dependent variable is the magnitude of change in dividends scaled to lagged equity. In column 1, we interact DREG with the Herfindahl Hirschmann Index (HHI) for deposits as of 1993 to investigate the influence of initial market structure conditions in conjunction with DREG on dividends. In column 2, we interact DREG with Reg Leniency, a measure of regulatory leniency across US states, to investigate the moderating effect of regulators on the impact of competition on dividends. In column 3, the components of DREG (Minimum Age, De Novo, Acquisition, and Deposit Cap) are included in the regression. The control variables are size, profitability, liquidity, capitalisation, and, risk. Standard errors are clustered at the state level and shown in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

In a further step, we attempt to shed light on the role that regulatory scrutiny at state level plays in moderating the effect of competition on bank dividend policy. Recent evidence suggests that the leniency of state bank regulators varies across states (Agarwal et al., 2014). Lenient state regulators may be slow to take corrective action against financially troubled banks (Agarwal et al., 2014). Consequently, lenient regulators may allow potentially troubled banks to maintain their level of dividend payments despite any financial pressures arising from intensified competition following deregulation. We use a measure of regulatory leniency at state level developed by Agarwal et al. (2014). This is based on the difference in proprietary CAMELS ratings assigned by state and federal regulators once information about a bank's quality becomes available.[41] We normalise this measure of state regulatory leniency (*Reg Leniency*) to range between 1 and 10, by classifying states into deciles. Higher values imply greater regulatory leniency. Subsequently, we interact *Reg Leniency* with *DREG*, and include it in Equation (3.1).[42] The results are reported in column 2 of Table 3.4. As in column 1 of Table 3.3, the coefficient on *DREG* enters negatively and significantly. The coefficient on the interaction term enters the regression positively and significantly. This suggests in states with more lenient bank regulators an increase in competition is associated with a smaller dividend cut. Column 3 of Table 3.4 decomposes the *DREG* index into its constituent components. The results suggest that the negative relationship

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[41] The US banking system operates under a dual state and federal system of chartering and safety and soundness regulation. According to the law, supervisors assigned to state chartered banks alternate between state and federal at predetermined time intervals. Bank supervisors conduct on-site safety and soundness examinations which result in the assignment of CAMELS ratings. Agarwal et al. (2014) rely on the CAMELS ratings produced by the rotating regulators (for the same bank) to identify inconsistencies in the regulatory process. They provide evidence of heterogeneous implementation of the same set of rules by different state regulators when benchmarked against the same federal regulator.

[42] The separate inclusion of the *Reg Leniency* in the regression equation is not possible as it is spanned by the inclusion of the bank fixed effects.

between competition and dividends is driven by the increased competition induced by the removal of the Deposit Cap restriction.[43]

3.3.2 Testing the mechanisms

The results of our empirical analysis (outlined in Section 3.3.1) suggest that competition has a significant impact on bank dividends. In this section, we explore the extent to which bank profitability and free cash flow issues affect bank dividend policies across states characterized by low and high levels of competition.

3.3.2.1 Competition, bank profitability, and dividends

Entry and increased competition is likely to lead to reductions in the future cash flows accruing to incumbent banks and affect dividends to shareholders. If competition affects dividends via a decline in profitability, then any resultant impact of competition on dividends should be smaller among banks with higher expected profitability.

In order to test this proposition, we augment Equation (3.1) with an interaction term between *DREG* and *Expected Profitability*. *Expected Profitability* is a dummy variable that captures managerial expectations of future profitability. According to prior literature discretionary loan loss provisions signal management's private information regarding future earnings. Therefore, an increase in the discretionary component of provisions should indicate an increase in future bank cash flows (Wahlen, 1994; Liu, Ryan and Wahlen, 1997; Gibson,

[43] Prior evidence suggests that out of state banks cannot easily circumvent this restriction (Nguyen, Hagendorff and Eshraghi, 2017). Consequently, any removal would increase competition.

2000). Following Wahlen (1994) we estimate the following loan loss provision model:

$$\Delta NPL_{i,t} = \sum_{j=1}^{2}\left(\alpha_{1j}Loans_{i,t-j} + \alpha_{2j}\Delta NPL_{i,t-j}\right) + \varepsilon_{i,t} \quad (3.2)$$

$$LLP_{i,t} = \sum_{j=1}^{3}\left(\beta_{1j}Loans_{i,t-j} + \beta_{2j}NPL_{i,t-j} + \beta_{3j}LLR_{i,t-j}\right) + \beta_4 E\Delta NPL_{i,t} + \varepsilon_{i,t} \quad (3.3)$$

ΔNPL denotes change in non-performing loans. $Loans_{i,t-j}$ denotes the amount of loans granted. $LLP_{i,t}$ denotes loan loss provisions. $Loans_{i,t-j}$ denotes the amount of loans granted. $NPL_{i,t-j}$ and $LLR_{i,t-j}$ denote non-performing loans and loan loss reserves respectively. EΔNPL is the predicted value of an autoregressive model of the growth of non-performing loans augmented with the amount of loans granted by the bank lagged up to three years, estimated using model (3.2).[44] Finally, $\varepsilon_{i,t}$ denotes the error term. The residuals of Equation (3.2) serve as a proxy for the discretionary component of loan loss provisions (Wahlen, 1994; Liu, Ryan and Wahlen, 1997). We set *Expected Profitability* equal to one if the discretionary component of loan loss provisions is positive and zero otherwise. A priori we expect a positive coefficient on this interaction term.

The results of this analysis are presented in column 1 of Table 3.5. The estimated coefficient on the interaction term between *DREG* and *Expected Profitability* is positive and statistically significant at the 1% level, implying that impact of competition on dividends is smaller among banks with higher expected profitability. We also test the robustness of this finding by replacing the *Expected Profitability* with *Future Profitability*. *Future Profitability* is measured by a dummy variable that is equal to one if bank profitability (measured as return on assets, ROA) five years ahead, (ROA_{t+5}), is higher than profitability in the current time

[44] The mean and median values of EΔNPL are -785 and -16407, respectively.

period (ROA_t).[45] The results of this robustness test are presented in column 2 of Table 3.5. Again, the coefficient on the interaction term is positive and statistically significant at the 1% level. Overall, the results suggest a less profound impact of bank competition on dividends for banks with higher expected profitability.

Table 3. 5: Testing the mechanisms: Profitability and free cash flow channels

	Dependent variable: Change in dividends		
	Profitability		Free cash flow
	(1)	(2)	(3)
DREG	-0.194***	-0.151***	-0.091**
	(0.042)	(0.041)	(0.057)
DREG * Expected Profitability	0.128***		
	(0.037)		
Expected Profitability	0.166		
	(0.234)		
DREG * Future Profitability		0.138***	
		(0.048)	
Future Profitability		-0.089	
		(0.130)	
DREG * HCLG			0.040
			(0.053)
HCLG			-0.620***
			(0.123)
Size	0.246	0.279	0.104
	(0.266)	(0.259)	(0.269)
Profitability	125.604***	126.915***	123.458***
	(18.440)	(20.597)	(18.933)
Liquidity	0.258	0.215	-0.036
	(3.303)	(3.284)	(3.312)
Capitalisation	-10.566	-10.564	-8.256
	(7.143)	(7.170)	(7.016)
Risk	-14.456*	-14.696*	-11.486
	(8.542)	(8.415)	(8.886)
Bank fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
No. of observations	10257	10257	1792
R-squared	0.03	0.03	0.05

Note: This table presents the results of the mechanism analyses. For profitability channel, columns 1 and 2 test whether banks with higher expected profitability are less affected by increased competition. Column 3 tests whether the level of agency cost of free cash flow in banks explains the competition and dividend relationship. In column 1, we interact DREG with the Expected Profitability, a proxy for management expectation of future earnings. In column 2, we interact DREG with Future Profitability, the actual profitability in 5 years ahead. In column 3, we interact the DREG with HCLG, an indicator variable that takes the value of one if banks have high cash flow and low growth opportunities, and zero otherwise, which indicates the agency cost of free cash flow problem. We use the ratio of operating income to asset and asset growth as proxies for cash flow and growth opportunities, respectively. All models are estimated using OLS with bank and year fixed effects. Standard errors are clustered at the state levels and shown in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

[45] The results are robust across various time periods including ROA_{t+2}, ROA_{t+4} and ROA_{t+6}.

3.3.2.2. Competition, free cash flow, and payout

Competition can reduce the amount of dividends paid to shareholders via an alternative agency cost driven mechanism related to the free cash flow of banks. Prior studies suggest that in order to attract and retain investors, firms signal efficient cash flow management by paying high dividends (Easterbrook, 1984; Grullon and Michaely, 2014). That is, dividends reduce agency conflicts between managers and shareholders by limiting management's ability to channel unused resources away from shareholders. As a consequence, firms (especially those with substantial free cash flow) paying low dividends are likely to be regarded less favourably by investors (Jensen, 1986). However, an increase in the degree of competition facing firms can also serve as a powerful tool to mitigate agency conflicts at the firm (Hart, 1983; Schmidt, 1997; Allen and Gale, 2000). Increased competition can induce a more efficient cash flow management resulting in firms paying lower dividends. Therefore, if competition affects dividends via a decline in agency conflicts at the firm, then any resultant impact of competition on dividends should be higher among banks with higher agency problems due to free cash flow.

In order to test this proposition, we follow Lang, Stulz and Walkling (1991) and classify banks into groups based on whether they have high or low levels of operating cash flow relative to growth prospects. To this end, operating cash flow and growth prospects are measured by the ratio of operating income to total assets and asset growth respectively.[46] Banks with high cash flow (above the median value for the sample) and low growth prospects (asset growth less than the median value for the sample) are more likely to face free cash flow problems. Therefore, in

[46] These findings are robust to the use of Tobin's Q and the Market to Book ratio as a proxy for investment opportunities. The use of market prices to calculate investment opportunities limits our sample to publicly listed banks only.

Equation (3.1) we include *HCLG*, which takes the value of one if a bank is likely to face free cash flow problems and zero otherwise, together with its interaction with *DREG*. The results are reported in column 3 of Table 3.5. They indicate that the interaction between *DREG* and *HCLG* enters the regression with a negative coefficient, but it is not significant. This suggests that when competition in the market increases, banks facing agency issues arising from high free cash flow do not change their dividend policies in a way that is systematically different from banks without such agency issues.

3.4 Additional Tests

3.4.1 Other known dividend determinants

In this section we investigate the robustness of our main findings to the inclusion of a number of known additional determinants of dividends. These include peer-effects, regulatory pressure, catering by managers, and external corporate governance mechanisms.

First, we investigate whether peer-effects could act as a potential confounder to our findings. Prior literature suggests that firm behaviour can be influenced by the various policy choices of industry peers: including capital structure (Leary and Roberts, 2014); capital investments and research and development (Patnam, 2011); and dividends (Grennan, 2018; Adhikari and Agrawal, 2018). To alleviate concerns that our findings could be driven by such peer effects, we re-estimate Equation (3.1) by incorporating a measure of peer influence at state level. We define peer banks as those banks that operate in the same state. Following Adhikari and Agrawal (2018), we measure peer influence on bank dividend policy at the state level by $Peer_{-i,s,t}$. $Peer_{-i,s,t}$ is the average dividend change of all banks in state s

except bank *i* in year t. The results, which are tabulated in column 1 of Table 3.6, show that the coefficient on the peer effect variable $Peer_{-i,s,t}$ is not statistically significant, whereas the DREG remains negative and significant at the 5%. These results suggest that peer effects do not drive our main findings.

Table 3. 6: Other known determinants of dividend policy

	Dependent variable: Change in dividends				
	(1)	(2)	(3)	(4)	(5)
DREG	-0.086**	-0.082**	-0.067*	-0.083**	-0.043
	(0.038)	(0.035)	(0.037)	(0.036)	(0.061)
Peer	-0.055				
	(0.056)				
PCA		-0.013			
		(0.148)			
Dividend Premium			0.504*		
			(0.286)		
SOX				0.109	
				(0.099)	
DREG*Public					-0.065
					(0.061)
Size	0.203	0.201	-0.021	0.185	0.225
	(0.263)	(0.255)	(0.130)	(0.264)	(0.256)
Profitability	125.678***	125.543***	125.852***	125.592***	125.090***
	(18.623)	(18.297)	(18.242)	(18.343)	(18.361)
Liquidity	0.198	0.316	0.672	0.400	0.301
	(3.321)	(3.309)	(3.323)	(3.311)	(3.304)
Capitalisation	-10.623	-10.572	-10.858*	-10.630	-10.786
	(7.136)	(7.182)	(6.422)	(7.114)	(7.143)
Risk	-14.451*	-14.729*	-15.774*	-14.777*	-14.634*
	(8.543)	(8.479)	(8.215)	(8.510)	(8.513)
Bank fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	No	Yes	Yes
No. of observations	10218	10257	10257	10257	10257
R-squared	0.03	0.03	0.03	0.03	0.03

Note: This table presents the results of robustness checks of our baseline estimation. Column 1 includes the variable *Peer* to consider the peer effects on banks dividend policy. *Peer* is defined as the average dividend change of all banks in state *s* except bank *i* in year t. Column 2 includes *PCA*, a binary variable that equals one if a bank's total risk-based capital ratio falls below 12% or its tier 1 risk-based capital ratio falls below 8% or its tier 1 leverage ratio falls below 7% and zero otherwise to control for regulatory pressure. Column 3 accounts for the Baker and Wurgler's (2004) catering measure (*Dividend Premium*). This is a time varying only measure and thus time fixed effects are excluded from this specification to avoid collinearity. Column 4 focuses on the Sarbanes-Oxley Act of 2002. To account for governance mechanisms externally imposed on publicly listed banks during the period of our analysis it includes *SOX*, a binary variable equal to one for publicly listed banks after the implementation of the Act and zero otherwise. Column 5 tests whether publicly listed banks are differently affected by the deregulation relative to private banks. Standard errors are shown in parentheses and are clustered at the state levels in all models unless explicitly stated otherwise. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

Next, we investigate the impact of regulatory pressure on bank dividend policy. A number of studies argue that undercapitalised banks could be forced by the regulators to retain earnings rather than pay dividends (Theis and Dutta, 2009; Abreu and Gulamhussen, 2013). Following Abreu and Gulamhussen (2013) we construct a prompt corrective action indicator, *PCA* that takes the value of one if: a bank's total risk-based capital ratio falls below 12%; its tier 1 risk-based capital ratio falls below 8%; or its tier 1 leverage ratio falls below 7%.[47] In column 2, we include *PCA* in Equation (3.1) and re-estimate the model. Our main findings remain robust to the inclusion of the *PCA* variable.

We also investigate the impact of shareholders' demand for dividends on bank dividend policy. Prior literature argues that firms alter their dividend policies in order to cater to shareholder needs, by responding to the premium that the capital market assigns to dividends (Baker and Wurgler, 2004; Li and Lie, 2006). To alleviate any concerns that the time-varying dividend premium could confound our results, the model specification in our main analysis contains time fixed effects. Nevertheless, we also test directly, the impact of the dividend premium on bank dividends. To this end, we replace time fixed effects in Equation (3.1) with a measure of the dividend premium used in previous studies (Baker and Wurgler, 2004). Specifically, we use the difference in logs of the average market-to-book ratios of payers and non-payers (Baker and Wurgler, 2004). That is, we first calculate market-to-book ratio using the information of book value and market

[47] Section 38 of Federal Deposit Insurance Act requires regulators to categorize banks into five categories based on: total risk-based capital ratio; tier 1 risk-based capital ratio; and a leverage ratio. A bank must significantly exceed the minimum standard for all three capital measures. Banks classified as well capitalised are not subject to supervisory interference. Banks failing to meet the minimum standard are subject to increasingly stringent supervisory actions. These include: annual earnings retentions; the submission and adherence to a capital restoration plan; and lending restrictions.

value of equity. We then identify dividend payer and non-payer firms. Next, we calculate the logs of market-to-book value for both payer and non-payer firms. We finally find the difference of the market-to-book value logs for payers and non-payers in each year to create a time-series dividend premium variable. The results, presented in column 3 of Table 3.6, suggest that our main conclusions are not driven by the dividend premium.

Next, we also consider the results of our analysis could be confounded by external corporate governance mechanisms that became effective during our sample period. We turn our attention to the Sarbanes-Oxley Act of 2002, which placed certain constraints on the boards of all publicly listed firms including banks (Adams and Mehran, 2008; Macey and O'Hara, 2016). In particular, the Sarbanes-Oxley Act requires boards of publicly traded firms to have a majority of independent directors and mandates the existence of three board committees, namely audit, nominating, and compensation. Such changes, which aimed at strengthening the independence of the board to better monitor management behaviour, could substitute for the monitoring role of dividends and thus result in dividend cuts (John, Knyazeva and Knyazeva, 2015; La Porta et al., 2000). One could argue that these externally implemented constraints on the board of publicly listed banks have influenced dividend policy in a similar fashion to that observed for geographic deregulation. To alleviate such concerns, we account directly for the impact of the Sarbanes-Oxley Act in our analysis. To this end, we include in Equation (3.1), *SOX*, a binary variable that takes the value of one for all publicly listed banks after the implementation of the Sarbanes-Oxley Act and zero otherwise. The results presented in column 4 of Table 3.6, indicate that the effect of *DREG* on bank dividend policy is robust to the introduction of the Sarbanes-Oxley Act in 2002.

Finally, we check whether there are differential effects between publicly listed and private banks of competition on dividends. Prior literature finds that public firms are more reluctant to cut dividends than their private counterparts (Michaely and Roberts, 2012). Public banks are also more sensitive to investment opportunities than privately owned firms due to differences in governance structure and capital markets scrutiny. Consequently, the impact of competition on bank dividends may also differ on the basis of listing status. In order to test this hypothesis, we augment Equation (3.1) with *Public*, a dummy variable that equals one if a bank is publicly listed, and zero otherwise, and its interaction term with DREG. A significant coefficient of the interaction term would imply a differential impact of competition induced by deregulation between public and private banks. The coefficient of the interaction term, as presented in column 5 of Table 3.6, is negative but statistically insignificant. This indicates that the listing status has no effect on the competition-dividend relationship.

3.4.2 Sensitivity checks

The main results obtained in Section 3.3.1 support the notion that competition leads to a reduction in dividends. This section provides several sensitivity checks of our main findings in relation to: model specification; estimation of standard errors; competition measurement and sample composition. We tabulate the results of these tests in Table 3.7.

The first six sensitivity checks involve different model specifications and different methods for the clustering of standard errors. In column 1, we replace bank fixed effects with state fixed effects (to control for time invariant state unobserved characteristics) in the main model. In column 2, we retain the bank fixed effects and add state time trends in order to control for any pre-trends in our data set. In column 3 we include three additional state level time varying variables to control for the economic environment, which could potentially be correlated with the timing of deregulation in a given state. These variables are the natural logarithm of the Gross State Product (*Log GSP*), the *Coincident Index*, and the *Freedom Index*. The Coincident Index is an index that combines four economic indicators comprising: non-farm payroll employment; average hours worked in manufacturing sector; the unemployment rate; and wage and salary disbursement. The Freedom Index, taken from the Fraser Institute, is an index that measures government spending, taxation, and labour market restrictions for each of the states in the US. This index gauges the level of restrictions imposed by governments on individuals. Together with Gross State Product, these two indices account for the level of economic conditions within each state and the extent to which these could affect the ability of banks to pay dividends. The results (of re-estimating our main model incorporating these changes) are consistent with the findings reported in Table 3.3. Moreover, a key condition for causal inferences is the random assignment of interstate branching laws across states. The magnitude of the difference-in-differences coefficient should remain unaffected by the inclusion of control variables if treatment is to be assumed as good as random (Roberts and Whited, 2013). Therefore, we re-estimate our baseline model in column 4 excluding the time-varying bank specific control variables. We find that the magnitude of the coefficient of interest remains unchanged.

In the baseline model we cluster standard errors at the state level to allow for any correlation among banks located within a state. In column 5 of Table 3.7, we re-estimate the baseline model by clustering the standard errors at the bank level.

This accounts for possible autocorrelation in the panel dataset. The results are consistent with our baseline model. In column 6, we re-estimate the baseline model by clustering at both state and year levels (Krishnan, Nandy and Puri, 2014). The main conclusions remain unchanged.

Next, we investigate whether our findings are sensitive to the inclusion of banks in our sample that have presence in multiple states, and thus are likely to be exposed to changes in competition outside of the state they are headquartered in. In column 7 of Table 3.7, we replace our main independent variable (*DREG*) with *Weighted DREG* (as in Berger, Öztekin and Roman, 2017). Using deposit market share data obtained from FDIC Summary of Deposit (SOD) database, we weight *DREG* based on the share of deposits that banks have in all states where they have presence. The *Weighted DREG* accounts for the fact that most banks do not only operate in their home state (the state where they are headquartered), but also have branches or subsidiaries in other states. Therefore, changes in the interstate

Table 3. 7: Sensitivity checks

	Dependent variable: Change in dividends									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DREG	-0.068*	-0.132***	-0.080**	-0.087*	-0.082*	-0.082*		-0.063*	-0.073*	-0.087**
	(0.038)	(0.045)	(0.037)	(0.044)	(0.048)	(0.047)		(0.033)	(0.040)	(0.036)
Weighted DREG							-0.076**			
							(0.036)			
Log GSP			-1.420							
			(1.309)							
Coincident Index			0.013							
			(0.011)							
Freedom Index			-0.052							
			(0.162)							
Bank controls	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	No	No	No	No	No	No	No	No	No
State time trends	No	Yes	No	No	No	No	No	No	No	No
No. of observations	10257	10257	10246	10257	10257	10146	9762	8428	10511	10116
R-squared	0.03	0.03	0.03	0.005	0.03	0.03	0.02	0.03	0.03	0.02

Note: This table presents the results of the sensitivity checks of our baseline estimation. In column 1, we include year and state fixed effects while in column 2, we include state-time trends to control for pre-trends in our data. In column 3 we include three state level time varying control variables (Log GSP, Coincident Index, and Freedom Index). In column 4 we exclude the time varying bank-level control variables from the model. In column 5, we cluster the standard errors at the bank level whereas in column 6 we cluster the standard errors at both state and year levels. In column 7, we use an alternative proxy of competition, which is Weighted DREG. We weight the original DREG with the state-level deposits of BHC operations in all states. In column 8, we restrict our sample to only banks that operate in a single state where they are headquartered. Column 9 includes those banks that are owned by other financial institutions. Column 10 exclude banks in South Dakota and Delaware as these two states have very liberal banking rules. All models are estimated using OLS. Bank-level control variables are included in all columns (except column 4) but they are not reported for brevity. Standard errors are shown in parentheses and are clustered at the state levels in all models unless explicitly stated otherwise. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

branching regulation in states where a bank has presence other than the one it is headquartered may also affect its dividend policy. The result suggests that the *Weighted DREG* negatively affects bank dividend payments consistent with our main results in Table 3.3. We further corroborate our findings by re-estimating Equation (3.1) using a restricted sample containing banks that operate in a single state. As such these banks are only exposed to changes in the competitive environment within the state they are headquartered. The results are reported in column 8, and are in line with the main results (reported in column 1 of Table 3.3).

We also investigate the sensitivity of our findings to ownership composition. Given that payout decisions are normally made at the parent level, the sample used for obtaining the main results in Table 3.3 excludes those BHCs owned by other banks. In column 9, we re-estimate our model including these banks in the sample. Our conclusions remain unchanged. Moreover, following Berger, Öztekin and Roman (2017), we re-estimate our baseline model excluding banks located in South Dakota and Delaware (two states with very liberal banking rules). The results, which are reported in column 10, are in line with our main results.

3.4.3 Falsification tests

A key identification assumption behind the difference-in-differences approach is that, in the absence of treatment, changes in the magnitude of dividends for both treated and control banks demonstrate similar trends, commonly referred to as the parallel trend assumption (Abadie, 2005). We conduct a placebo test to alleviate concerns regarding violations of this parallel trend assumption. Following Bertrand and Mullainathan (2003), Krishnan, Nandy and Puri (2014), and Berger, Öztekin and Roman (2017), among others, we re-estimate Equation (3.1) including a *Before (3,1)* dummy that equals one in the three years prior to the interstate bank branching deregulation in the state, and zero otherwise.[48] The results are reported in column 1 of Table 3.8. We find that the coefficient on the *Before (3,1)* dummy is not statistically significant, which suggests that the parallel trend assumption for the pre-treatment period is not violated. This result also alleviates concerns that our main findings reported in Table 3.3 are driven by secular trends or reverse causality.

Table 3. 8: Falsification tests

	Dependent variable: Change in dividends		
	(1)	(2)	(3)
DREG	-0.086**		
	(0.041)		
Before (3,1)	-0.032		
	(0.156)		
Placebo-DREG		-0.022	0.035
		(0.022)	(0.054)
Bank controls	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
No. of observations	10463	10463	10463
R-squared	0.03	0.03	0.03

Note: This table presents the results of the falsification tests to satisfy the "parallel trend" assumption in difference-in-differences approach. In column 1, we re-estimate our baseline model using a dummy variable called Before (3,1) that equals to one in the three years prior to the actual deregulation. In column 2, we randomly assign DREG to the states in our sample while in column 3, we randomly assign the states to their corresponding DREG values. All models are estimated using OLS with bank and year fixed effects. Bank-level control variables are included but they are not reported for brevity. Standard errors are clustered at the state levels and shown in parentheses. *,**, and *** denote significance level at 10%, 5%, and 1%, respectively.

Next, we investigate the concern that changes in bank payout policy might not be caused by the branching deregulation process, but rather by some omitted variable. In that case, our findings would not support a causal interpretation. Instead, they would imply a mere correlation between bank payouts and

[48] The results are robust to different definitions of the dummy ranging from one to four years.

deregulation. Given that our identification strategy relies on different states erecting barriers to bank branching at different points in time, an omitted variable would have to fluctuate every time a deregulatory event takes place for it to drive our results. The likelihood of such unobserved events coinciding with the deregulation process given its staggered nature is very small. As such, our strategy ameliorates the omitted variables concern. Nevertheless, (and following Berger, Öztekin and Roman, 2017), we conduct two placebo tests to further address this concern. The first placebo test assigns *DREG* values to states in a random manner, while maintaining the original empirical distribution of the *DREG* variable. The second placebo test randomly assigns states to each of the deregulation years with their corresponding *DREG* values. The results are reported in columns 2 and 3 of Table 3.8, respectively. None of the coefficients on *Placebo-DREG* are statistically significant. This suggests that our results are unlikely to be driven by unobserved factors that largely coincide with the bank branching deregulation pattern. Taken together, the results from the falsification tests support a causal interpretation of the findings obtained from estimating Equation (3.1).

3.5 Conclusions

This chapter seeks to examine the effects of competition on bank payout policy of US bank holding companies from the period 1994-2005. We employ an exogenous measure of competition that captures regulatory induced changes to competition following the passage of Interstate Banking and Branching Efficiency Act (IBBEA) of 1994. One of the important features of the IBBEA was that states retained discretion and flexibility over implementation, leading to differences in regulation and competition, which persisted across states. These patterns allow us to isolate unobserved factors that may undermine the causal relation between competition and bank payout policy.

We find that banks operating in states characterised by higher levels of competition pay lower dividends than counterparts operating in states with less competition. This relationship is stronger for banks with low expected future earnings. We also find that regulatory scrutiny moderates the relationship between competition and bank dividends. In states with stricter bank regulators, an increase in competition is associated with a larger proportionate decrease in dividends. In contrast to dividends, we find no evidence that increased competition impacts on share repurchases. This lends support to prior literature that shows that share repurchases are used by managers to distribute transitory and non-operating earnings (both of which are unlikely to be permanently influenced by competition). Our main results suggest a significant impact of increased deposit insurance coverage on bank dividend behaviour. However, additional robustness tests lend weaker support for our main results. Hence, additional evidence is required in order to understand the role played by deposit insurance on bank payout policy.

In addition to the recent evidence showing that deregulation improves bank transparency and capitalisation (Jiang, Levine and Lin, 2016b; Berger, Öztekin and Roman, 2017), this chapter shows another potential effect of deregulation that has not been documented in the related literature. The results of this chapter suggest that competition leads banks to pay fewer dividends. Our results inform regulators that the level of supervisory leniency could also affect bank dividends. This is important if supervisors need to increase capital levels of a particular bank. Furthermore, our results also suggest that shareholders could enjoy a higher return on investment if they invest in banks operating in less competitive market. One limitation in this chapter is that our deregulation index and thus sample period end in 2005. Extending this index for a longer period could provide another fruitful improvement to our findings. Additional empirical evidence on bank competition and payout policy is required to better understand the interconnections between bank deregulation, competition, and bank payout decisions.

Chapter 4

Dividends and Future Bank Profitability: The Role of Supervisory Approvals

4.1 Introduction

In this chapter, we investigate the impact of a change in supervision of bank capital distributions on the information content of dividends for future bank profitability. Bank payouts have received increased attention in policy circles since the global financial crisis of 2007-2009, when despite deteriorating earnings banks continued to pay dividends (Acharya et al., 2011; Hirtle, 2016). In the US, this prompted regulatory change (via an amendment to Regulation Y of the Bank Holding Company Act of 1956) which requires large bank holding companies to obtain prior approval for dividend payouts.

Prior evidence suggests that dividends are paid when managers believe that future profitability is likely to increase (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985) or be less volatile (Shapiro and Zhuang, 2015; Michaely, Rossi and Weber, 2018). Consequently, any changes to regulations governing dividends are likely to influence the information content of dividends regarding the future level and volatility of profitability.

Investigating the relationship between dividends and earnings can be challenging given the reverse causality concerns. On the one hand, dividends might be driven by the level of profitability of a firm (Fama and French, 2001). On the other hand, future profitability might also reflect the level of dividends paid in the previous year through the signaling channel (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985).

In this chapter, we utilise a quasi-natural experiment to investigate how an increase in the supervision of dividends influences the information content of dividends with respect to the future level and volatility of bank profits. The increase in supervision came in 2012 via an amendment to Regulation Y of the 1956 Bank Holding Company Act. This amendment requires large BHCs (with assets exceeding $50 billion) to obtain prior regulatory approval before paying dividends. Using this differential regulatory treatment to overcome identification concerns, we investigate whether there is a link between dividends and future bank profitability. We classify treated banks as those that are subject to the change to Regulation Y, and control banks as those that were unaffected by the amendment. We employ a difference-in-differences approach to a sample of 947 US bank holding companies over the period 2006-2017. In doing so, we compare the level and volatility of profitability of dividend paying treated banks and control banks in the period before and after the amendment to Regulation Y.

By way of preview, we find that an increase in supervision (of bank capital distributions) leads to an increase in the information content of dividends with respect to the future level and volatility of bank profitability. Dividends paid by large bank holding companies subject to changes to Regulation Y provide greater information content for the subsequent level and volatility of profitability than smaller counterparts unaffected by regulatory change. These findings are robust to a battery of additional tests to ensure the internal validity of our estimated results. Moreover, we test that the estimated bank response to changes in Regulation Y is free from confounding factors that may have occurred around the time of the regulatory amendment (such as the establishment of separate risk committees mandated by the Dodd-Frank Act). Finally, we also show that differences in size or ownership structure between treated and control groups do not drive our main findings.

The results of this chapter are related to two strands of literature. First, we contribute to the literature that investigates the relationship between dividends and future bank performance. Keen (1978) shows that dividend cuts are followed by higher bank profits. Boldin and Leggett (1995) and Hirtle (2004), however, provide evidence that bank dividend increases are followed by higher profits and improved asset quality. We extend this literature by showing that dividends can predict not only the level, but also the volatility of a bank's future profitability. More importantly, we show that enhanced supervision of bank dividends augments existing information embodied in dividends regarding future profitability.

Second, we contribute to the literature that examines the effect of bank capital regulation on the information content of banks' capital decisions. Prior literature investigates the impact of changes in capital regulation on bank equity issuance and dividends. For example, Polonchek, Slovin and Sushka (1989) and Li et al. (2016), respectively use the 1981 (tighter definition of capital) and 2010 (Dodd Frank Act) tightening of regulatory standards of capital adequacy to show that both reduced the negative announcement effects associated with banks' security issuance. Polonchek, Slovin and Sushka (1989) and Bessler and Nohel (1996) provide evidence that the 1981 capital regulation change also reduced the negative announcement effects of bank dividend cuts. Unlike these studies, we use the Regulation Y amendment on large bank holding companies in 2012, which allows us to test the effect of increased capital regulation on bank dividend signalling using a difference-in-differences framework. We find that the amendment to Regulation Y increased the information content of bank dividends on the future profitability of banks.

The rest of this chapter proceeds as follows. Section 4.2 reviews the related literature. Section 4.3 describes the methodology while Section 4.4 discusses our dataset. Section 4.5 presents the main results and robustness checks. Section 4.6 concludes.

4.2 Hypothesis Development

Prior literature (or so called signalling theories) suggests that dividend announcements contain important information regarding the future cash flow prospects of firms (Bhattacharya, 1979; Miller and Rock, 1985; John and Williams, 1985). The announcement of high (low) dividends sends a positive (negative) signal that future cash flows are likely to be sufficient (insufficient) to cover future payouts. Consequently, announcements of an increase (decrease) in dividends are likely to be followed by future increases (decreases in profitability). Empirical evidence in support of the aforementioned proposition is rather mixed. For example, Nissim and Ziv (2001) find evidence that profitability is positively associated with dividend increases, while Benartzi, Michaely and Thaler (1997) and Grullon et al. (2005) find no evidence for such relationship.

In the banking industry, the discretion that firms have to pay dividends to signal future profitability may be constrained by regulations designed to prevent wealth expropriation by shareholders and the transfer of risk to debtholders and taxpayer-funded government safety guarantees (Guntay, Jacewitz and Pogach, 2017). Prior to the financial crisis of 2007-2009, US Bank holding companies (BHCs) could pay dividends without prior regulatory approval from the supervisory authority unless they were undercapitalised or if the level of dividends declared exceeded current earnings (Federal Reserve Board, 2009).[49] In 2012, an amendment to Regulation Y required large BHCs (with assets exceeding $50 billion) to obtain prior regulatory approval before paying dividends. The amendment stipulates that large BHCs must submit an annual comprehensive capital plan, which incorporates forward-looking projections on revenues and losses, and any substantive capital distributions.[50] Supervisory objections to a capital plan may arise if any proposed capital distributions could threaten the safety and soundness of the BHC. As a consequence, the approval/non-approval of proposed capital distributions by regulators is likely to augment any information regarding the future prospects for firm performance following an announcement of increased or decreased dividends.

Therefore, our first hypothesis is as follows:

H1: Supervisory scrutiny of capital planning strengthens the relationship between bank dividends and future profitability.

Other than signalling the level of future profitability, dividend announcements may also provide relevant information regarding the volatility of future profits. Prior literature that investigates the relationship between dividends and the volatility of earnings (Grullon, Michaely and Swaminathan, 2002; Shapiro and Zhuang, 2015; Michaely, Rossi and Weber, 2018) predicts that managers increase dividends when earnings are more certain (less volatile). Lie (2005) shows

[49] Routine dividends made from sustained and recurring earnings do not require BHCs to obtain prior approvals from the supervisor.

[50] See Section 4B (Mandatory Elements of a Capital Plan) in the final rule of Regulation Y by Federal Reserve Board (2011).

that dividend increases are associated with lower earnings volatility in future years. In a recent study, Michaely, Rossi and Weber (2018) show both theoretically and empirically that lower expected earnings volatility is associated with higher dividends. The authors argue that managers' commitment to paying dividends is stronger if future earnings are expected to be stable. Survey evidence confirms earnings persistence following dividend payout (Lintner, 1956; Brav et al., 2005).

The 2012 amendment to Regulation Y may augment any signal regarding future profits volatility following a dividend announcement. Furlong and Keeley (1989) argue that bank capital regulation incentivises value-maximizing banks to reduce risk. Given that capital plans undergo a number of stress scenarios prior to supervisory approval, it is less likely that bank managers will set dividends based upon overly optimistic earnings scenarios. Therefore, any approval made by the board of directors to a dividend change is likely to be mindful of both the likely future volatility of profits and supervisory scrutiny. This would be consistent with the survey evidence by Lintner (1956) and Brav et al. (2005) who find that managers commit to paying high dividends only if they are confident that the risk of future cash flow is low so they do not have to reverse their decision in the near future. Similarly, the improved capital monitoring through Regulation Y amendments could have an impact on how managers project bank future revenues and losses which should now be based on both expected and unexpected economic conditions. The amendments also require banks to provide pro-forma risk-based capital ratios (leverage, risk-based, and total capital ratios) that account for bank asset portfolio risk. As such, these projected capital levels might also reflect a lower level of asset risk which might decrease the risk/volatility of bank profitability. In light of the above discussion, our second hypothesis reads as follows:

H2: Supervisory scrutiny of capital planning strengthens the relationship between bank dividends and any volatility in profitability.

4.3 Identification, Model Specification, and Data

This section begins with a brief background to the 2012 amendment to Regulation Y that is used as a setting to test our research hypotheses (Section 4.3.1). This is followed by the discussion of our estimable model (Section 4.3.2) and data set (Sections 4.3.3 and 4.3.4).

4.3.1 Regulation Y amendment on bank capital plans

In 2012, the Federal Reserve amended rules contained in Regulation Y that govern the corporate policies of bank holding companies.[51] This amendment pertains to a tighter restriction on large bank holding company capital distribution policy, while leaving requirements for smaller bank holding companies unchanged.[52] In particular, the amendment requires large bank holding companies with consolidated assets exceeding $50 billion to submit comprehensive capital plans to the Federal Reserve on an annual by 5th January each year. [53] The Federal Reserve can make a decision to object by March 31st.[54]

[51] Bank Holding Companies and Change in Bank Control or Regulation Y (12 CFR Part 225) is aimed to govern the corporate practices of bank holding companies and certain practices of state-member banks. See: https://www.frbsf.org/banking/regulation/regulations-policies-guidance/reg-y/.

[52] For more extensive information on the amendment made on December 30, 2011, refer: https://www.federalregister.gov/documents/2011/12/01/2011-30665/capital-plans.

[53] Using FR Y-14A and FR Y114Q forms, these banks are required to report the data needed for capital plan assessment including financial condition, structure, assets, risk exposure, policies and procedure, liquidity and management.

[54] This timing is set to give banks sufficient time to pay dividends (or buy back shares) in the first quarter of each year without any distortions that might arise from awaiting approval from the Federal Reserve.

During the assessment period, the Federal Reserve shall make the final decision as to whether banks are able to proceed with their proposed capital distribution plans. One of the components assessed by the Federal Reserve is the expected uses and sources of capital over the planning horizon under normal and stressed economic conditions. The supervisor then runs several tests to examine various hypothetical conditions banks might face in the future regarding their respective projected revenues, losses, and capital. If accepted, the Federal Reserve notifies a bank to proceed with planned capital distributions.[55]

Any proposed capital distribution plan is likely to be rejected if a bank fails to maintain capital above minimum regulatory minima under normal and stressed economic scenarios. Any capital distribution plan may also be rejected if any proposed dividends constitute an unsafe and unsound practice as stipulated under the Federal Reserve regulation. In case of objection, banks must resubmit their revised capital plans in a specific time-frame in order to proceed with their capital distribution. As mentioned above, the Regulation Y amendment is only applied to bank holding companies with assets exceeding $50 billion, leaving banks below this threshold unaffected. Using this criterion for our empirical analysis, we classify treated banks (banks with asset exceeding $50 billion) and control banks (banks with less than $50 billion assets) based on their total assets. Such a classification allows us to assess how the information content of dividends of affected bank

[55] This non-objection is extended through the first quarter of the following year. This is to avoid any interruption on banks' ability to make capital distributions in the first quarter of the following year due to the concern on the timing of capital plan submission and review processes. In a case of re-submission of a capital plan after the first quarter, the non-objection is extended to the first quarter of the following year.

holding companies relative to unaffected counterparts' changes following an increase in supervisory scrutiny.

4.3.2 Model specification

To investigate the relationship between increased supervision (via the amendment to Regulation Y) and dividend signalling, we estimate the following model using a difference-in-differences approach:

$$Perf_{i,s,t} = \alpha + \beta_1.Dividends_{i,s,t-1} + \beta_2.(Dividends * Post\ Y)_{i,s,t-1}$$
$$+ \beta_3.(Dividends * Affected)_{i,s,t-1} + \beta_4.(Post\ Y * Affected)_{i,s,t-1}$$
$$+ \beta_5.(Dividends * Post\ Y * Affected)_{i,s,t-1} + \delta.X_{i,s,t-1} + \varphi.GSP_{s,t}$$
$$+ \nu_i + \gamma_t + \epsilon_{i,s,t} \quad (4.1)$$

where *i* indexes banks, *s* indexes states, and *t* indexes years. $Perf_{i,s,t}$ is return on equity (*ROE*) and the volatility of return on equity (*ROE Volatility*). *ROE* is calculated as net income normalised by total equity capital. The use of *ROE* as our proxy for profitability is motivated by prior research that investigates the relationships between dividends and future earnings (Benartzi, Michaely and Thaler, 1997; Nissim and Ziv, 2001; Hirtle, 2004). We compute *ROE Volatility* using a three-year rolling ROE (De Haan and Poghosyan, 2012; Schaeck et al., 2012). The net income in years t=0, t=1, and t=2 to compute the standard deviation of bank earnings. The intuition behind this is that dividends are paid when managers predict stable cash flow over the next few years. In line with prior literature on bank dividend policy (Kanas, 2013; Onali, 2014; Onali et al., 2016), $Dividends_{i,s,t-1}$ is calculated as total cash dividends paid to common shareholders divided by total equity capital. *Post Y* is a dummy variable that equals one after 2011, zero otherwise. This dummy variable indicates the post-treatment period of the

Regulation Y amendment that came into effect in 2012. $Affected$ is a dummy variable that equals one for large bank holding companies with consolidated assets above $50 billion at the end of fiscal year 2011 and zero otherwise.[56] This variable reflects the Regulation Y requirements on large bank holding companies above the specified asset threshold. $X_{i,s,t-1}$ is a vector of bank-specific variables (*Size, Asset Growth, Capitalisation, Loans to Asset,* and *Loan Loss Provisions*) and market characteristic (*HHI Loans*), which are likely to affect bank profitability. Finally, $GSP_{s,t}$ is the real gross state product growth rates of each state in the US. $GSP_{s,t}$ is included to control for difference in economic performance across states. Further details related to these variables are discussed in Section 4.3.4. Our model also includes bank specific fixed effects,v_i, to account for unobserved bank level heterogeneity as well as time dummies, γ_t, to capture time effects common to all banks. $\epsilon_{i,s,t}$ is the regression error term.

Estimation of Equation (4.1) is conducted using Ordinary Least Squares, with standard errors that are robust to heteroscedasticity and clustered at the bank level to control for within-bank correlation. The coefficient on the triple interaction term, β_5, is the coefficient of interest. This coefficient captures the difference in the relationship of dividends and future profitability between affected and unaffected banks after the amendment of Regulation Y.

[56] As discussed, the amendment became effective on December 30, 2011 and banks submitted their first capital plans in the first quarter of 2012. Hence, we classify the affected banks based on their assets as of end 2011.

4.3.3 Data

We test our hypotheses using the annual data of US bank holding companies (BHCs) over the period 2006-2017.[57] This period is determined primarily by the introduction of the Regulation Y amendment on December 30, 2011. This divides our sample into a balanced pre- and post-intervention time periods. We collect our data from the S&P Global Market Intelligence database, which provides US BHC consolidated regulatory financial statements filed with the Federal Reserve. These consolidated regulatory data provide the information on annual cash dividends paid to common shareholders, the number of common shares outstanding, and other information on bank accounting variables. After excluding observations with missing asset values and the dividend to asset ratio of greater than one (to control for the effects of outliers), our final sample contains 947 private and public listed BHCs with 8,028 bank-year observations. Among these banks, 461 (49%) are listed banks and another 486 (51%) are non-listed banks. For our analysis using the Regulation Y amendment, we classify 26 banks as treated (banks with greater than $50 billion consolidated assets as of end 2011 fiscal year) and 921 banks in the control group.[58] As explained in the previous chapter, the number of banks in the database from 2006 onwards is lower. As a result, our sample in this chapter covers a smaller number of banks than in Chapter 2.

[57] Throughout the chapter, we interchangeably use the term "bank holding company" and "bank" for convenience.
[58] In one of our robustness checks, we reduce the number of control banks using a sample above $10 billion assets and get the same results.

4.3.4 Variables and summary statistics

We include several bank-specific variables, which according to prior literature are likely to determine profitability. First, we control for bank size (*Size*) as measured by the natural log of total assets. Large banks might generate higher profitability that comes from higher economies of scale, higher market power, better brand image, and superior government protection than their smaller counterparts (Short, 1979; Smirlock, 1985; Demirgüç-Kunt and Huizinga, 2000; Goddard, Molyneux and Wilson, 2004b; a). However, large banks also might face lower profitability if diseconomies of scale dominate banks' operations. Therefore, we might expect either a positive or negative relationship between bank size and profitability. Second, we introduce the *Asset Growth* variable in our model as a proxy for bank growth following previous literature (e.g. Chronopoulos et al., 2015). This variable is measured using the year-over-year percentage change in bank total assets. The expected relationship between asset growth and bank profitability is ambiguous. On the one hand, the increase in bank assets such as loans might increase bank profitability if loans are managed efficiently. On the other hand, if the growth is accompanied by low quality assets, banks profitability could be adversely affected. Third, we also account for bank capitalisation using the ratio of bank equity capital to total assets. Previous literature shows that bank capital reduces profitability because higher capital implies that banks are less risky, which leads to lower returns (Goddard et al., 2013). In contrast, higher capital may also increase bank profitability because banks are safer and benefit from lower cost of uninsured funding (Berger, 1995; Goddard, Molyneux and Wilson, 2004a). Next, we also control for bank balance sheet structure by using *Loans to Asset* ratio. Banks with higher loans might have higher informational advantage and lower intermediation costs, and therefore, earn higher profits. Consistent with this, Demirgüç-Kunt and Huizinga (1999) show that banks with high interest earning assets are more profitable. We also include a proxy for loan portfolio risk using the ratio of loan loss provisions to total assets (*Loan Loss Provisions*). A higher ratio indicates lower asset quality causing bank profits to decline (Athanasoglou, Brissimis and Delis, 2008; García-Herrero, Gavilá and Santabárbara, 2009).

We also control for the market structure facing banks (Gilbert, 1984; Bourke, 1989; Berger et al., 2004). To this end, we construct the *Herfindahl-Hirschman Index (HHI) Loans* at the state level using loan market share. A higher index indicates a more concentrated banking market at the state level. The expected relationship between *HHI Loans* and *ROE* is ambiguous. Lower market concentration might increase bank efficiency and reduce operational costs thus resulting in high profitability. However, lower concentration might also reduce bank profitability due to greater price competition among banks that leads to lower profit margins. Finally, we also include a macroeconomic indicator that measures economic performance at the state level as proxied by the growth rate of real gross domestic product (*GSP*). This variable controls for economic fluctuations over time, which is likely to influence banks' ability to generate high revenues that contribute to high profitability (Albertazzi and Gambacorta, 2009). Table 4.1 summarizes the definitions and sources of these variables.

Table 4. 1: Variable definitions and sources

Variables	Definition	Sources
Return on Equity (ROE)	Bank profitability proxy measured by net income to total equity capital (%)	S&P Global
ROE Volatility	The volatility of ROE measured by the standard deviation of ROE in three years (year zero to year two)	S&P Global
Dividends	Dividend payout ratio measured using cash dividends paid to common shareholders in a calendar year divided by total equity capital (%)	S&P Global
Post Y	A binary variable that equals one in years 2012 and beyond reflecting the amendment of Regulation Y in 2012	Own construction
Affected	A binary variable that equals one for banks with total consolidated assets of more than $50 billion in fiscal year 2011	Own construction
Size	Bank size proxy measured by the natural logarithm of bank total assets	S&P Global
Asset Growth	The growth rate of bank assets measured by the change of bank asset from previous years divided by the asset of previous year (%)	S&P Global
Capitalisation	Bank capitalisation as measured by total equity capital to total assets (%)	S&P Global
Loans to Assets	Proxy for banks liquidity and lending specialization as measured by total loans divided by total assets (%)	S&P Global
Loan Loss Provisions	Loan loss provision to total asset ratio as a proxy for bank expectation of loan losses	S&P Global
HHI Loans	The proxy of bank market concentration as measured by bank market shares on loans at state level	S&P Global & own calculations
GSP	The macroeconomic performance indicator as measured using the growth rate of real gross domestic product at state levels (%)	Bureau of Economic Analysis

Note: This table provides the definitions and sources of variables used in this chapter.

Table 4. 2: Summary statistics

	All banks					Affected banks					Unaffected banks				
Variables	N	Mean	Std. Dev.	Min	Max	N	Mean	Std. Dev.	Min	Max	N	Mean	Std. Dev.	Min	Max
ROE	8024	6.41	20.89	-982.61	130.20	295	7.65	8.95	-57.99	28.47	7729	6.37	21.21	-982.61	130.20
ROE Volatility	7053	5.34	17.77	0.00	565.25	269	3.75	5.53	0.02	38.23	6784	5.41	18.08	0.00	565.25
Dividends	7928	3.18	4.07	0.00	55.60	295	2.57	2.28	0.00	13.37	7633	3.20	4.12	0.00	55.60
Post Y	8028	0.50	0.50	0.00	1.00	295	0.52	0.50	0.00	1.00	7733	0.50	0.50	0.00	1.00
Affected	8028	0.04	0.19	0.00	1.00	295	1.00	0.00	1.00	1.00	7733	0.00	0.00	0.00	0.00
Size	8028	14.32	1.41	10.80	21.67	295	19.24	1.14	17.38	21.67	7733	14.13	1.02	10.80	18.13
Asset Growth	7589	6.84	13.51	-94.92	160.73	290	6.31	15.18	-17.10	127.59	7299	6.86	13.44	-94.92	160.73
Capitalisation	8028	9.95	3.83	0.42	100	295	10.95	2.19	5.19	18.94	7733	9.92	3.87	0.42	100
Loans to Assets	7877	65.57	13.33	0.00	96.21	295	54.34	22.01	2.57	84.70	7582	66.00	12.68	0.00	96.21
Loan Loss Provisions	7928	0.42	0.80	-1.54	15.44	295	0.63	0.84	-0.17	4.86	7633	0.41	0.79	-1.54	15.44
HHI Loans	7877	0.34	0.26	0.06	1.00	295	0.51	0.27	0.07	0.96	7582	0.33	0.25	0.06	1.00
GSP	8028	1.34	2.34	-8.41	22.24	295	1.28	2.00	-8.42	8.55	7733	1.34	2.36	-8.41	22.23

Note: This table presents the summary statistics of 947 US bank holding companies in our sample from 2006 to 2017 (8,028 bank-year observations). We also present separate statistics for the affected and unaffected banks. The definitions of these variables are given in Table 4.1.

Table 4. 3: Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
ROE (1)	1.00											
ROE Volatility (2)	-0.58	1.00										
Dividends (3)	0.21	0.02	1.00									
Post Y (4)	0.10	-0.15	-0.08	1.00								
Affected (5)	0.01	-0.02	-0.03	0.01	1.00							
Size (6)	0.03	-0.04	-0.03	0.15	0.70	1.00						
Asset Growth (7)	0.16	-0.08	0.03	0.06	0.00	0.12	1.00					
Capitalisation (8)	0.16	-0.17	0.01	0.15	0.07	0.13	0.05	1.00				
Loans to Assets (9)	-0.02	0.04	-0.02	-0.07	-0.16	-0.16	0.04	-0.12	1.00			
Loan Loss Provisions (10)	-0.37	0.27	0.03	-0.26	0.05	0.01	-0.17	0.11	0.12	1.00		
HHI Loans (11)	-0.04	0.04	-0.02	-0.03	0.14	0.11	0.02	0.03	0.03	0.05	1.00	
GSP (12)	0.15	-0.09	0.07	0.18	0.00	0.03	0.06	0.04	-0.08	-0.21	-0.02	1.00

Note: This table tabulates the correlation between variables. Dividends is dividend payout to equity capital ratio. ROE is return on equity while ROE Volatility is the 3-year rolling standard deviation of ROE. Post Y is a binary variable that equals one for years 2012 and beyond. Affected is a binary variable that equals one for bank holding companies with above $50 billion consolidated total assets at fiscal year-end 2011. Size is bank size measured by natural log of total assets. Capitalisation is measured by total equity capital divided by total assets. Loans to Assets is total loans to total asset ratio. Loan Loss Provisions is the ratio of loan loss provisions to total assets. HHI Loans is Herfindahl-Hirschman Index based on bank loan market shares as proxy for market concentration. GSP is the growth rate of real gross domestic product at the state levels. Detailed definitions of these variables are presented in Table 4.1.

Table 4.2 tabulates the summary statistics of our data. The mean value of return on equity (*ROE*) for all banks in our sample is 6.41%, while the median value is 8.31% (not reported). This suggests that the distribution is slightly skewed to the left. The mean value of *Dividend* is 3.18%. The *Affected* variable has a mean value of 0.04 suggesting a large number of control banks, whereas the mean value of 0.5 for the *Post Y* variable reflects a balanced number of pre- and post-treatment years in our sample. Comparing the dividend for both groups of bank, unaffected banks, on average, pay more dividends than affected banks (3.20 and 2.57 respectively). Table 4.3 provides correlations of all variables used.

4.4 Results

This section discusses the main empirical results (Section 4.4.1) and robustness checks (Sections 4.4.2 to 4.4.4).

4.4.1 Regulation Y and bank dividend signalling

Table 4.4 reports the results of estimating Equation (4.1). We find that the coefficient of the triple interaction term β_5, reported in column 1 is positive and statistically significant at the 5% level. This suggests that a positive link between dividends and future profitability strengthens in the period after the Regulation Y amendment. This result is consistent with our first hypothesis (H1) which predicts that more intense supervision increases the information content of dividends regarding future profitability. Our result is also in line with prior literature, which suggests that capital regulation plays an important role in influencing bank dividend signalling (Polonchek, Slovin and Sushka, 1989; Bessler and Nohel, 1996). We find that dividends are more positively related to future earnings following increased scrutiny of bank capital distribution plans.

Table 4. 4: Regulation Y and bank dividend signalling: Main results

Dependent variables:	ROE	ROE Volatility
	(1)	(4)
Dividends	0.426***	-0.083
	(0.119)	(0.166)
Dividends*Post Y	-0.426***	0.300***
	(0.099)	(0.107)
Dividends*Affected	-1.841***	0.859***
	(0.399)	(0.313)
Post Y*Affected	-8.331***	5.543***
	(2.148)	(1.497)
Dividends*Post Y*Affected	1.377**	-1.076**
	(0.663)	(0.462)
Size	-14.620***	15.150***
	(2.123)	(2.675)
Asset Growth	0.034	-0.020
	(0.036)	(0.019)
Capitalisation	-1.182***	0.764***
	(0.261)	(0.285)
Loans to Asset	0.058	0.059
	(0.045)	(0.048)
Loan Loss Provisions	-8.697***	2.072*
	(1.595)	(1.234)
HHI Loans	4.909	-3.059
	(3.727)	(2.418)
GSP	0.258**	-0.060
	(0.130)	(0.074)
Constant	222.333***	-214.737***
	(30.303)	(37.639)
Bank fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
No. of observations	6617	5807
No. of banks	820	786
Adjusted R-squared	0.12	0.10

Note: This table presents the results investigating the effects of Regulation Y amendment on bank dividend signalling. Dependent variables are return on equity (ROE) and the volatility of return on equity (ROE Volatility). Dividends are measured using dividends paid to common shareholders deflated by the book value of equity capital. Post Y is a dummy variable for years 2012 and beyond, zero otherwise. Affected is a dummy variable that equals one for treated banks that are subject to Regulation Y (with total asset greater than $50 billion in fiscal year 2011), zero otherwise. The variable of interest is the interaction term of Dividend*Post Y*Affected, which captures the effects of capital regulation on dividend predictability of future profitability. Column 1 uses ROE while column 2 uses ROE volatility calculated using three year rolling standard deviation of return on equity. All regressions are estimated using Ordinary Least Squares with lagged bank-specific and market control variables and contemporaneous macroeconomic indicator. See Table 4.1 for the definitions of these variables. Standard errors are clustered at bank level reported in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

In column 2 of Table 4.4 we re-estimate Equation (1) using *ROE Volatility* as the dependent variable. As such, we investigate whether the Regulation Y amendment changes the relationship between dividends and the volatility of future profitability. The coefficient on the triple interaction term is negative and statistically significant at the 5% level. This result indicates that banks that pay dividends expect a lower profit volatility if subject to the Regulation Y amendment. Our finding is consistent with our second hypothesis (H2) and also in line with recently documented evidence of signalling content in dividends regarding the volatility of future cash flow (Michaely, Rossi and Weber, 2018).

The coefficients of control variables are in line with our initial expectation. Based on column 1 (column 2), the coefficients of *Size*, *Capitalisation*, and *Loan Loss Provisions* are negative (positive) and highly statistically significant. These suggest that bigger, more capitalised, and riskier banks tend to have lower profitability (higher earnings volatility). In contrast, *GSP* is statistically significant only in the case of future profitability (column 1) and enters the regression with a positive coefficient. This suggests that a better economic environment has a positive impact on bank profitability.

4.4.2 Confounding factors

The results obtained in Section 4.4.1 could be driven by confounding factors that influence the main outcome and therefore threaten the internal validity of our approach. We are aware of one potential factor that might also improve the information content of dividends. The passage of the Dodd–Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) required publicly listed banks with assets exceeding $10 billion to establish risk committees to oversee overall bank risks.[59] Such risk committees can increase risk awareness by providing the board with relevant information, which facilitates better operational and strategic decision making. Although this requirement does not specifically focus on bank capital distributions, it may cause banks to take more conservative decisions regarding safer capital distributions. In order to explore this possibility, we replace the variables *Post Y* and *Affected* with *Post IRC*, a binary variable that equals one for years 2011 and beyond, and zero otherwise, and *IRC*, a binary variable that takes the value of one if a bank is publicly listed with more than $10 billion assets as of end 2010 fiscal year, respectively. Subsequently, we re-estimate Equation (4.1).[60] If the requirement to establish risk committees confounds our main results, we should find a statistically significant coefficient on the triple interaction term. Columns 1 and 2 of Table 4.5 present the results of this analysis, when the dependent variables are, respectively, *ROE* and *ROE Volatility*. The coefficient of interest is statistically insignificant in both cases. This implies the requirement to establish risk committees does not confound the effect of the amendment to Regulation Y on the information content of dividends.

Another confounding event that may also influence bank dividends is the capital injection by the US Treasury Office of Financial Stability through Trouble Asset Relief Program (TARP) in October 2008. Under the terms of this program, participating banks received a certain amount of capital through the purchase of preferred stock and equity warrants under the Capital Purchase Program (CPP). As

[59] Bouwman, Hu and Johnson (2018) provide a brief review about this Act from BHC perspective. For more extensive information, see "Summary of Dodd-Frank Financial Regulation Legislation" by David S. Huntington at: https://corpgov.law.harvard.edu/2010/07/07/summary-of-dodd-frank-financial-regulation-legislation/

[60] In estimating Equation 4.1 we exclude banks with assets in excess of $50 billion to ensure that the results are not driven by the treated banks of our main analysis.

Table 4. 5: Confounding factor and placebo tests

Dependent variables:	ROE	ROE Volatility	ROE	ROE Volatility	ROE	ROE Volatility	ROE	ROE Volatility
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dividends	0.463***	-0.103	0.393**	-0.055	0.502***	-0.062	0.418**	-0.074
	(0.128)	(0.172)	(0.172)	(0.095)	(0.171)	(0.071)	(0.175)	(0.143)
Dividends*Post IRC	-0.464***	0.327***						
	(0.104)	(0.107)						
Dividends*IRC	-1.001**	-0.104						
	(0.499)	(0.286)						
Post IRC*IRC	-5.964**	1.698						
	(2.538)	(1.736)						
Dividends*Post IRC*IRC	0.288	0.185						
	(0.486)	(0.255)						
Dividends*Post TARP			-0.110	0.001				
			(0.221)	(0.334)				
Dividends*TARP Bank			0.009	0.239				
			(0.312)	(0.272)				
Post TARP*TARP Bank			4.337**	-1.402				
			(1.787)	(1.684)				
Dividends*Post TARP*TARP Bank			-0.508	0.078				
			(0.411)	(0.390)				
Dividends*Post DI					-0.402***	0.185***		
					(0.124)	(0.065)		
Dividends*DI Bank					-0.345	0.141		
					(0.290)	(0.150)		
Post DI*DI Bank					-1.653	-1.225		
					(1.690)	(1.759)		
Dividends* Post DI * DI Bank					0.584	-0.493		
					(0.410)	(0.698)		
Dividends*Placebo Post Y							-0.049	-0.262
							(0.326)	(0.561)
Dividends*Affected							-2.227***	1.297**
							(0.735)	(0.522)
Placebo Post Y*Affected							0.988	0.493
							(4.155)	(2.928)
Dividends*Placebo Post Y*Affected							-1.536	0.066
							(1.008)	(0.858)
Constant	217.032***	-217.188***	226.286***	-222.420***	216.668***	-217.202***	352.171***	-290.797***
	(30.988)	(38.616)	(31.429)	(39.682)	(33.835)	(42.383)	(74.190)	(64.583)
Lagged bank and market controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Macroeconomic control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	6353	5569	6353	5569	5790	5106	3612	3585
No. of banks	794	760	794	760	691	663	712	703
Adjusted R-squared	0.12	0.10	0.12	0.10	0.11	0.10	0.08	0.08

Note: This table presents the results of confounding factor and placebo tests. Dependent variables are return on equity (ROE) and the volatility of return on equity (ROE Volatility). Dividends are measured using dividends paid to common shareholders deflated by the book value of equity capital. In columns 1 and 2, we test whether the establishment of independent risk committees on publicly listed banks with assets exceeding $10 billion confounds our main results. In this test, we create two dummy variables: Post IRC equals to 1 for years 2011 and above and IRC equals to 1 for publicly listed banks with assets exceeding $50 billion as of 2011. We then interact these variables as in Equation (4.1) and re-estimate the effects of independent risk committees on our main results. In columns 3 and 4, we test whether TARP capital injection confounds our results. We create two dummy variables, Post TARP and TARP Bank, where the former is equal to one for years 2009 and above and the latter is equal to one for TARP banks. We repeat the same technique we use for Dodd-Frank Act test in columns 1 and 2. In columns 5 and 6, we re-estimate Equation (4.1) using a placebo Regulation Y in 2009 in order to test the parallel trend assumption in difference-in-differences approach. All regressions are estimated using Ordinary Least Squares. Lagged bank-specific and market control variables and contemporaneous macroeconomic indicator are included but not reported for brevity. See Table 4.1 for the definitions of these variables. Standard errors are clustered at bank level reported in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

shown by Berger and Roman (2015), TARP participants had a competitive advantage over non-participating counterparts. This event, which happened during our sample period, might lead to the dividend payments of banks not reflecting future profitability, but rather the outcome of the extra capital that banks received from the Office of Financial Stability. To alleviate such concerns, we repeat the same procedure used when using TARP payments. In order to do so we replace Post Y and Affected variables with *Post TARP* and *TARP Bank*, respectively. *Post TARP* is a binary variable that equals one for years 2009 onwards. *TARP Bank* equals one if banks participated in TARP, and zero otherwise. We then re-estimate Equation (4.1). In this test, if the TARP capital injection confounds our main findings, we should get a statistically significant result on the triple interaction term. The results of this test are reported in columns 3 and 4 of Table 4.5. The coefficients of interest for both ROE and ROE volatility are statistically insignificant. This suggests that our baseline results are unlikely to be driven by TARP capital injections.

In 2008, the coverage limit of deposit insurance was increased from $100,000 to $250,000 under the Emergency Economic Stabilization (EESA) Act of 2008. Lambert, Noth and Schüwer (2017) show that some banks were significantly affected, while others were mildly affected by this change. They also find that significantly affected banks alter the riskiness of their respective loan portfolios compared to mildly affected counterparts. The change in the level of insured deposits may also influence bank payout policy because of the fragility of bank funding structure and dividend signaling (Kauko, 2015; Forti and Schiozer, 2015). That is, banks upon feeling less need to signal financial strength to depositors are likely to cut dividends. This event may also drive our results if affected banks pay dividends to falsely signal financial strength to depositors (Fudenberg and Tirole, 1986). To alleviate such concerns, we identify banks that are affected by the increase in the deposit insurance coverage using the data from FDIC Summary of Deposits. As in Chapter 2, we calculate the extent of the deposit insurance coverage increase for each bank by taking the difference between the post- and pre-event insured deposit to total asset ratios. We then create a variable called *DI Bank* that equals one if the difference is above the median value and zero otherwise. We also create *Post DI* variable that equals one for years 2009 onwards and zero otherwise. We then replace *Post Y* and *Affected* with *Post DI* and *DI Banks*, respectively, in Equation (4.1). Finally, we re-estimate Equation (4.1) and tabulate the results in columns 5 and 6 of Table 4.5. The results of this test show that none of the coefficients of interest are statistically significant. These results rule out the possibility that deposit insurance coverage increase in 2008 confounds our main findings.

4.4.3 Placebo test

Next, we examine the so-called parallel trend assumption. That is, the identifying assumption behind the difference-in-differences approach (Roberts and Whited, 2013). Under this assumption, the behaviour of affected banks should have evolved in the same manner as the unaffected banks in the absence of treatment (i.e. the Regulation Y amendment). This assumption is necessary to show that the change in dividend signalling is only observed once banks are required to submit their capital plans but not prior to the regulatory change. To check whether the parallel trend assumption holds, we repeat the analysis during a period when there was no amendment to Regulation Y. To this end, we falsely assume that the Regulation Y amendment occurred in 2009, three years prior to the actual amendment.[61] Columns 7 and 8 present results of this test, when the dependent variables are, respectively, *ROE* and *ROE Volatility*. None of the coefficients on the triple interaction term (*Dividend*Placebo Post Y*Affected*) are statistically significant, indicating that the parallel trend assumption holds.

4.4.4 Other sensitivity tests

To provide additional insight, we also examine whether certain groups of banks in our sample are driving our results. First, we consider the possibility that ownership structure could bias our main findings. Our main analysis is based on the comparison of the future earnings-dividend link between the treated group (which only comprises publicly traded banks) and the control group (which comprises both public and privately held banks). Prior literature finds that public and private firms have different dividend behaviours (Michaely and Roberts, 2012). This difference in ownership structure could also influence the dividend signalling of banks. To alleviate such concerns, we re-estimate Equation (4.1) excluding privately held banks from the sample. The results of this test are presented in column 1 of Table 4.6 and are consistent with our main findings.

Second, in column 2 of Table 4.6 we address the possibility that our results are driven by banks included in our control group that are relatively smaller in size compared to the treated banks. To this end we restrict our sample to banks above $10 billion assets. That is, we essentially restrict the control group to include banks

[61] Roberts and Whited (2013) suggest that this type of placebo test can be done using one, two, three, or any other years prior to the actual event year. We also use four years before as the treatment year (i.e. 2008) and get the same results.

with assets between $10 billion and $50 billion.[62] The results of this analysis are also consistent with our main findings.

Next, we also consider the possibility that our results are confounded by changes in the composition of the treated and control groups as banks sizes might change and thus cross the $50 billion size threshold after the introduction of the Regulation Y amendment. However, two of our control banks surpassed the $50 billion threshold for a year and a third one for two consecutive years, before dropping below the threshold again, in the post-treatment period.[63] Although the four occasions that these banks were subjected to Regulation Y amendments are

[62] There are 32 control banks with assets between $10 billion and $50 billion as of end 2011 fiscal year. The treated banks remain 26 as in our main analysis.
[63] These banks are: SVB Financial Group (in 2017), CIT Group Inc. (in 2015 and 2016), and New York Community Bankcorp, Inc. (in 2015).

Table 4. 6: Sensitivity checks

Dependent variables:	ROE					ROE Volatility				
	Public listed bank sample	Above $10 billion asset sample	Sample without banks with asset change	Dividend change	Dummy dividend increase	Public listed bank sample	Above $10 billion asset sample	Sample without banks with asset change	Dividend change	Dummy dividend increase
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dividends	0.366*	0.560	0.425***	13.699	0.702	-0.037	0.332	-0.082	15.016*	-0.103
	(0.202)	(0.456)	(0.119)	(19.984)	(1.023)	(0.186)	(0.597)	(0.166)	(8.844)	(0.599)
Dividends*Post Y	-0.776***	-1.263***	-0.421***	-1.516	-1.835*	0.310*	0.586***	0.292***	-6.707	0.942
	(0.203)	(0.306)	(0.099)	(21.117)	(1.029)	(0.183)	(0.196)	(0.107)	(11.874)	(0.754)
Dividends*Affected	-1.478***	-0.824	-1.845***	-278.043***	-8.728***	0.795**	0.128	0.863***	101.414*	1.763*
	(0.390)	(0.605)	(0.400)	(79.009)	(2.216)	(0.318)	(0.666)	(0.314)	(52.568)	(1.043)
Post Y*Affected	-7.641***	-3.895**	-8.339***	-3.130***	-7.094***	5.325***	2.880*	5.563***	2.373**	4.038***
	(2.297)	(1.806)	(2.152)	(1.018)	(1.737)	(1.615)	(1.530)	(1.503)	(0.990)	(1.216)
Dividends*Post Y*Affected	1.401**	1.473**	1.382**	313.916***	9.028***	-1.096**	-1.135**	-1.080**	-206.855***	-3.475***
	(0.685)	(0.636)	(0.663)	(76.899)	(2.261)	(0.470)	(0.533)	(0.463)	(67.085)	(1.194)
Constant	152.240***	138.850***	224.059***	222.269***	215.646***	-150.652***	-79.024**	-217.353***	-219.587***	-214.639***
	(30.704)	(38.510)	(30.701)	(31.086)	(30.421)	(38.088)	(35.498)	(38.146)	(38.209)	(37.519)
Lagged bank and market controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	3532	593	6588	6596	6617	3128	535	5781	5786	5807
No. of banks	408	58	817	820	820	399	58	783	780	786
Adjusted R-squared	0.21	0.26	0.12	0.12	0.11	0.18	0.33	0.10	0.10	0.10

Note: This table presents the results of sensitivity tests. Dependent variables are return on equity (ROE) and the volatility of return on equity (ROE Volatility). In column 1, we restrict the sample to publicly traded banks while in column 2 we restrict the sample to banks above $10 billion assets. In column 3, exclude banks that changed their asset size in the post-treatment period. In column 4, we measure the Dividend variable using dividend change calculated as the change of dividends from previous year divided by the lagged equity capital. In column 5, we use a dummy variable that equals one if banks increase their dividend payout ratio from the previous year, zero otherwise. We repeat the same regressions using ROE volatility in columns 6-10. All regressions are estimated using Ordinary Least Squares. Lagged bank-specific and market control variables and contemporaneous macroeconomic indicator are included but not reported for brevity. See Table 4.4.1 for the definitions of these variables. Standard errors are clustered at bank level reported in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

unaccounted for in our analysis, they could only bias our results against finding support for our hypothesis. We re-estimate Equation (4.1) excluding these three banks from the sample. The results, as presented in column 3 of Table 4.6, remain consistent with our main findings.

Finally, we investigate the robustness of our results with regards to the use of the change in dividends as opposed to that of the levels used throughout our analysis. To this end, we re-estimate Equation (4.1) after replacing $Dividend$ with $Change\ in\ Dividend$ defined as the difference in cash dividends paid to common shareholders in the current year and those in the previous year scaled by total equity in the previous year (Srivastav, Armitage and Hagendorff 2014). In addition, we also use a dummy variable that equals one if banks increase their dividend payout ratio, and zero otherwise ($Dividend\ Increase$).[64] The results from these two different dividend measures are presented in columns 4 and 5 of Table 4.6. The coefficients of interest remain significant at the 5% level. This implies that our main results that use dividend payout ratio are robust to using alternative dividend measures.

We then replicate these five sensitivity checks using ROE Volatility as the dependent variable. The results are reported in columns 6-10 of Table 4.6. For all tests, we find that the main coefficients of interest, β_5, are significant at least at the 5% level. These suggest that our main result in column 2 of Table 4.4 for ROE Volatility is robust to these sensitivity tests.

[64] We also calculate bank dividends per share (DPS) using data on common shares outstanding from the S&P Global database. Using both change in DPS (the difference of DPS divided by lagged DPS) and DPS increase dummy variables, our results remain significant at the usual levels.

4.5 Conclusions

In this chapter, we investigate whether an increase in supervision augments the information content of dividends for the future level and volatility of bank profitability. Using the 2012 amendment to Regulation Y (that requires banks with assets exceeding $50 billion to submit comprehensive annual capital plans) we show that increased supervision improves the information of dividends regarding the future level and volatility of bank profits.

To the best of our knowledge, this is the first study to assess the impact of supervision on bank dividend signalling following the amendment to Regulation Y. Prior literature has examined the effects of capital regulation on dividend announcement effects, but not the relationship between dividends and profitability. This chapter makes an important contribution to the bank dividend literature by showing that regulation plays a vital role in certifying banks' financial condition through dividend approvals. Hence, increased regulation and supervision of bank capital distributions provide more information to investors and depositors regarding the future level and volatility of bank profitability following dividend announcements. Our findings are also consistent with supervisory guidelines that require banks to consider capital and earnings prospects when paying dividends (Federal Reserve Board, 2017). Hence, our findings reinforce the importance of intensified supervision on capital that can encourage bank managers to pay dividends based on realistic earnings projections.

Our conclusion above has some limitations in terms of the number of treatment and control banks used in the sample. Since the amendment of regulation Y only requires large banks to submit capital plans, we only have a small number of banks in the treatment group, but a much larger number of banks in the control group. A more balanced number of banks and characteristics between treatment and control groups would give us a better inference to our findings regarding the effects of increased supervisory monitoring on bank dividend signaling.

Chapter 5

General Conclusions

This thesis examines contemporary issues in bank payout policy. Identifying a suitable exogenous shock that influences bank behaviour is challenging given that shocks are not assigned randomly to a subset of firms, and so are likely to be confounded by other events that simultaneously affect the outcome variables of interest. In this thesis, we utilise three regulatory changes (as sources for exogenous variation) in the US banking system to understand how these changes affect bank payout decisions.

Banks are highly leveraged with a large proportion of funding coming from short-term insured and uninsured deposits. These deposits are used to fund longer term loans and investments. This creates a maturity mismatch (liquid liabilities and illiquid assets) which makes banks inherently fragile and prone to depositor runs. Through diversification of asset portfolios, banks minimise the risk of defaulting on meeting deposit obligations. Deposit insurance schemes also lessen the probability of depositor runs, albeit such runs are still possible especially during a crisis period. Uninsured depositors, in particular, are likely to withdraw deposits when banks signal negative information, for example by reducing dividends. In Chapter 2, we extend the literature by investigating the impact of deposit insurance on bank payout policy. We utilise an unexpected change in coverage of insured deposits (from $100,000 to

$250,000) in the US banking system, which occurred under the terms of Section 136 of the Emergency Economic Stabilization Act of 2008. The increase did not affect all banks equally, thus allowing us to utilise a research design to test whether there is a causal link from deposit insurance to the payout policies of banks. We show that banks affected by the change in deposit insurance coverage pay lower dividends than less affected counterparts.

Competition among banks plays a significant role in influencing bank efficiency, profitability and risk, as well as the availability and cost of credit to firms and households. To date, there is no evidence regarding whether banking competition impacts payouts to shareholders. In Chapter 3, we study the impact of competition on bank payout policy using an exogenous increase in bank competition induced by geographical branching deregulation, which took place in the US banking system. In particular, we utilise the passage of Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) in 1994, which gradually intensified the level of competition among banks at the state level. The IBBEA granted individual states the discretion to impose their own restrictions on out of state bank entry, which led to variation in competition across states. Using a difference-in-differences approach, we document that banks in states subject to more extensive deregulation (which intensified competition) pay lower dividends than counterparts in states with less deregulation. We also show that the reduction in profitability drives this result. The results of further tests show that the extent of state-level supervisory scrutiny moderates the relationship between competition and bank dividends. We also show that among four provisions used by states, deposit cap restrictions are the most effective means to deter competition from out of state banks.

Prior literature shows that dividends are used to signal managerial expectations regarding future firm performance. The extent to supervisory oversight on bank safety and soundness may increase the information content embodied in the dividends paid by banks. Therefore, the extent to which dividend payouts contain useful information regarding the future profitability of banks is likely to be stronger under more intense supervision. In Chapter 4, we examine the role played by the supervisory scrutiny of bank capital distributions in affecting the information content of bank dividends. We use the 2012 amendment to Regulation Y, which required large bank holding companies (only) to submit annual capital plans to the Federal Reserve before making payouts to shareholders. We show that increased scrutiny on capital distributions of banks increases the information content of current dividends on future profitability. Moreover, we also show that the change in regulation improves the information content of current dividends on future profit volatility.

Overall, the findings emanating from all three chapters of this thesis offer a number of valuable contributions to bank payout literature. As discussed in the introductory chapter, we contribute to the distinct strands of literature including corporate and bank payout policies, the cost and benefits of deposit insurance implementation, bank dividend regulation, and the impact of geographic deregulation on bank behaviour. Given that the bank payout literature has received attention in recent years, this thesis contributes significantly to this body of knowledge. Prior literature shows that the common drivers of firm payout policy also apply in a banking context (Abreu and Gulamhussen, 2013; Onali, 2014; Srivastav, Armitage and Hagendorff, 2014; Lepetit, Meslier and Wardhana, 2017; Lepetit et al., 2018). In this thesis, we augment bank payout literature that focuses on bank funding structure as a significant determinant of bank dividend policy (Kauko, 2014; Forti and Schiozer, 2015). We show that an increase in deposit insurance coverage affects bank dividends. Furthermore, we also contribute to the literature that investigates the costs and benefits of deposit insurance (Diamond and Dybvig, 1983; Duan, Moreau and Sealey, 1992; Hovakimian and Kane, 2000; Guizani and Watanabe, 2016; Anginer and Demirgüç-Kunt, 2019). We show that deposit insurance does not necessarily encourage bank risk-shifting, but rather helps banks reduce dividends without losing deposits.

In another strand of literature, we also complement the findings of Hoberg, Phillips and Prabhala (2014) who document that competition reduces firm dividends. We significantly contribute to this literature by using an exogenous shock in the US banking system that increases the level of competition among banks. We provide evidence that banks in states where the competition is more intense reduce dividends at a faster rate than banks in states with less competitive banking markets. We complement a large body of work on the impact of US banking deregulation on bank behaviour (Jayaratne and Strahan, 1998; Jiang, Levine and Lin, 2016b; Berger, Öztekin and Roman, 2017; Goetz, 2018). While this literature documents evidence that deregulation affects bank efficiency, risk-taking, and profitability, we also show that deregulation affects bank dividends.

This thesis also makes a contribution to the literature that studies the relationship between dividends and bank future performance (Keen, 1978; Boldin and Leggett, 1995; Hirtle, 2004). This literature produces mixed findings as to whether dividends have a positive or negative impact on bank future profitability. In this thesis, we exploit an exogenous shock on bank capital plan approvals by supervisors. We utilise this shock to gauge the impact of supervisory approval on bank dividend signaling. We find a stronger relationship between dividends and future profitability for banks facing stricter requirements regarding capital planning approvals relative to counterparts with more lenient capital plan monitoring.

Finally, the use of three different forms of regulation that exogenously affect bank behaviour provides reliable settings for our empirical investigations. Moreover, we also document a number of findings that are related closely to banking firms as financial intermediaries. That is, we show that high leverage and regulation play a significant role in influencing managerial decisions regarding payout policy.

Limitations

There are several limitations to the findings presented in this thesis. The first limitation of the thesis is regarding the use of an exogenous increase in the maximum level of insured deposits. The fact that this affected all banks, albeit to varying degrees necessitates a continuous difference-in-differences approach where very affected and mildly affected banks are classified as treated and control banks respectively. Ideally, we would prefer to find a shock that only affects or changes deposit structure of one group of banks, but not another. This would provide a cleaner identification strategy.

The second limitation faced in this thesis is the relatively restricted sample period of the analysis in Chapter 3. The sample begins in 1994 and stops in 2005 due to the available data on deregulation constructed previously (Rice and Strahan, 2010). Our sample could be extended to cover a longer period. Unfortunately, this would require a considerable amount of additional time to obtain specific data for each state in the sample regarding their removals or implementation of the various barriers to out-of-state bank entry allowed by the IBBEA Act of 1994.

The third limitation faced in this thesis (Chapter 4) is that the amendments to Regulation Y affect large bank holding companies only. Since the number of large BHCs is small, this makes the size (in term of bank sizes and the number of banks in both groups) of our treatment group is much smaller than the control group. With Regulation Y, we have limited options in making the analysis to be more balanced. Nonetheless, we have done our best to address this shortcoming by using a near control group approach.

Policy Implication

This thesis offers some insights that might be useful for policymakers. Chapter 2 demonstrates that deposit insurance causes banks to pay lower dividends because they no longer need to signal positive information to run-prone depositors. As such, our findings have implications for public policy. Prior evidence suggests that deposit insurance can lead banks to take excessive risk or engage in shifting risk onto taxpayers. We show that an increase in deposit insurance coverage reduces the need for banks to continue paying dividends during turbulent periods when the accumulation of retained earnings in order to bolster capital is likely to be crucial for financial stability. This finding is important, given the reliance that many banks place on large uninsured depositors who are more likely to withdraw funds in response to negative information. Hence, increases in the maximum level of deposit insurance coverage appears to lessen the need for banks to signal their financial health via dividend payouts.

The results in Chapter 3 suggest that that banks located in states with more lenient supervisors reduce dividend more slowly than banks in states with stricter supervisors. Our finding, therefore, suggests that supervisory leniency plays an important role in affecting bank dividend policy. Hence, supervisory leniency can be reduced in order to ensure banks pay sustainable and responsible level of dividends that will not affect their future level of capital. In addition, the results also suggest that investors enjoy higher returns on investment (i.e. dividends) when they invest in bank stocks located in a less competitive market.

Finally, in Chapter 4, we show that recent amendments to Regulation Y (which require large bank holding companies (only) to submit annual capital plans to the Federal Reserve before making payouts to shareholders) increased the information content of current dividends regarding the future level and volatility of profitability. In other words, increased regulatory scrutiny of banks dividends improves managerial engagement in paying dividends based on more realistic earnings/loss projections. In the supervision manual of US bank holding companies, the regulator urges banks to consider various criteria before making capital distributions. One of the criteria is to ensure the quality of current and prospective earnings. As such, it is important for regulators to continue with the current state of monitoring on bank capital plans. Strictly examined capital plans might be useful for bank managers to consider prospective earnings capital while making dividend decisions. If necessary and practical in term of regulatory costs, the asset threshold for mandatory capital plan submission can be lowered further in order to involve with more banks for the intensive capital examination.

Directions for Future Research

Several directions can be taken for future research. First, all of our three empirical chapters are based upon US banking. More evidence is required for other banking markets outside the US, which can provide us more insight regarding bank payout policy.

Second, it is also interesting to investigate the market perception and response following increased competition faced by banks. For example, is there any differential in stock returns across banks following the interstate banking deregulation and could such differential be driven by changes in the degree of information asymmetry, financial slack, or agency conflicts as a result of the deregulation? This might be a fruitful study in enriching further the effects of geographical regulation on bank behaviour in general.

Further research can shed light into the effects of the amendment to Regulation Y on bank dividend announcements from the perspective of outside investors. That is, information asymmetry between banks and market participants could be ameliorated following the amendment to Regulation Y. As a result, there might be a change in the bid-ask spreads of affected banks in the post-amendment period. A further investigation on this issue may provide greater understanding on the role of regulation on information asymmetry between insiders and outside shareholders.

Finally, more research is also needed in the area of bank corporate governance and bank payouts. Research on bank corporate governance has received great attention following the recent financial crisis (de Haan and Vlahu, 2016; John, De Masi and Paci, 2016). Many changes have been made to improve bank governance, which aims to increase the alignment between managers and other stakeholders. Given a broad coverage of agency explanation on firm dividend policy, it is also interesting to investigate how such corporate governance changes affect bank payout policy.

Appendix

Table A1
Robustness test using time fixed effects

Dependent variables:	Dividends	Repurchases
	(1)	(2)
Affected * Post Event	-0.0033*	-0.0194
	(0.0017)	(0.0199)
Size	0.0182***	0.0515*
	(0.0049)	(0.0279)
Profitability	0.7914**	-0.6403
	(0.3736)	(1.4241)
Liquidity	-0.0349**	0.0794
	(0.0155)	(0.1328)
Capitalisation	0.2282***	0.7511
	(0.0741)	(0.6218)
Risk	-0.2893***	-0.8020*
	(0.0562)	(0.4709)
Bank fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
No. of observations	4747	4747
No. of banks	311	311

Note: This table reports the baseline results that include time fixed effects as the substitution for Post Event time dummy. The dependent variables are dividends to equity ratio and share repurchases to equity ratio. Affected is a dummy variable for banks that are affected by the increase in deposit insurance coverage and zero otherwise. Post Event is a dummy variable for the quarters after 2008Q4 and zero otherwise. The variable of interest is Affected * Post Event, which indicates the difference of payout changes between affected and unaffected banks following the increase in deposit insurance coverage. We include a set of control variables (Size, Profitability, Liquidity, Capitalisation, and Risk) as defined in Section 2.4. The models are estimated using Honoré's (1992) fixed-effect Tobit, which allows to control for unobserved time-invariant characteristics among banks in our sample. Bootstrapped standard errors are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table A2
Additional test for substitution hypothesis of dividends and share repurchases

Dependent variables:	Dividends	Repurchases
	(1)	(2)
Post Event	-0.0037***	-0.0219**
	(0.0010)	(0.0100)
Affected * Post Event	-0.0035**	-0.0226
	(0.0017)	(0.0231)
Size	0.0137***	0.0201
	(0.0038)	(0.0242)
Profitability	0.9259**	0.1093
	(0.3765)	(1.4159)
Liquidity	-0.0338**	0.0765
	(0.0154)	(0.1403)
Capitalisation	0.2267***	0.7530
	(0.0762)	(0.6733)
Risk	-0.3109***	-0.9991**
	(0.0523)	(0.4641)
Increase Repurchase	-0.0006	
	(0.0006)	
Increase Dividend		-0.0159***
		(0.0053)
Bank fixed effects	Yes	Yes
No. of observations	4747	4747
No. of banks	311	311

Note: This table reports the baseline results that include additional variables to control for substitution hypothesis of dividends and share repurchases. The dependent variables are dividends to equity ratio and share repurchases to equity ratio. Affected is a dummy variable for banks that are affected by the increase in deposit insurance coverage and zero otherwise. Post Event is a dummy variable for the quarters after 2008Q4 and zero otherwise. The variable of interest is Affected * Post Event, which indicates the difference of payout changes between affected and unaffected banks following the increase in deposit insurance coverage. We include a set of control variables (Size, Profitability, Liquidity, Capitalisation, and Risk) as defined in Section 2.4. In column 1, we control for the change in share repurchases using the dummy variable Increase Repurchases while in column 2 we control for the change in dividends using Increase Dividend dummy. The models are estimated using Honoré's (1992) fixed-effect Tobit, which allows to control for unobserved time-invariant characteristics among banks in our sample. Bootstrapped standard errors are reported in parentheses. ***,**, and * indicate significance at the 1%, 5%, and 10% level, respectively.

Table A3
Interstate branching restrictions

Restrictions	Explanation
De novo interstate branching	This is a restriction on the ability of out-of-state banks to open a new branch in a state. Out-of-state banks only can open new state within a state if the state expressly opts-in to lift this restriction. With this restriction, an entry by opening a new branch becomes more difficult.
Minimum age of the target institution	This is a restriction that allows a state to determine its own minimum age requirement of bank existence before a bank is allowed to merge with an out-of-state bank. This means that an out-of-state bank has to wait until a bank has reached its minimum age requirement before this bank can be merged. The maximum age for this restriction is 5 years.
Acquisition of an individual branch	This restriction is similar to de novo branching whereby an out-of-state bank can only acquire a single branch if a state opts-in to allow the acquisition of a single branch. This restriction avoids out-of-state bank to pick and choose a single branch instead of buying the entire bank.
Deposit cap	This restriction gives states to impose a deposit cap for a bank before the bank can be acquired by an out-of-state bank. This restriction avoids outside banks to merge with large banks that hold high deposit proportion in a state. For example, a 15% deposit cap would prevent the acquisition by an out-of-state bank on a bank with more than 15% share of deposit in the state.

Note: This table describes the restrictions on interstate branching as in Rice and Strahan (2010).

Table A4
Interstate branching deregulation in 1994 to 2005

State	Rice and Strahan's Branching Restrictiveness Index	Effective date	Allow de novo interstate branching	Minimum age of institution for acquisition	Allow acquisition of single branch or portion of an institution	State-wide deposit cap on branch acquisition	DREG
Alabama	3	5/31/1997	No	5 years	No	30%	1
Alaska	2	1/1/1994	No	3 years	Yes	50%	2
Arizona	2	8/31/2001	No	5 years	Yes	30%	2
Arizona	3	1/9/1996	No	5 years	No	30%	1
Arkansas	4	1/6/1997	No	5 years	No	25%	0
California	3	9/28/1995	No	5 years	No	30%	1
Colorado	4	1/6/1997	No	5 years	No	25%	0
Connecticut	1	6/27/1995	Yes	5 years	Yes	30%	3
Delaware	3	9/29/1995	No	5 years	No	30%	1
DC	0	6/13/1996	Yes	No	Yes	30%	4
Florida	3	1/6/1997	No	3 years	No	30%	1
Georgia	3	10/5/2002	No	3 years	No	30%	1
Georgia	3	1/6/1997	No	5 years	No	30%	1
Hawaii	0	1/1/2001	Yes	No	Yes	30%	4
Hawaii	3	1/6/1997	No	5 years	No	30%	1
Idaho	3	9/29/1995	No	5 years	No	None	1
Illinois	0	8/20/2004	Yes	No	Yes	30%	4
Illinois	3	1/6/1997	No	5 years	No	30%	1
Indiana	1	1/7/1998	Yes	5 years	Yes	30%	3
Indiana	0	1/6/1997	Yes	No	Yes	30%	4
Iowa	4	4/4/1996	No	5 years	No	15%	0
Kansas	4	9/29/1995	No	5 years	No	15%	0
Kentucky	3	3/22/2004	No	No	No	15%	1
Kentucky	3	3/17/2000	No	No	No	15%	1
Kentucky	4	1/6/1997	No	5 years	No	15%	0
Louisiana	3	1/6/1997	No	5 years	No	30%	1
Maine	0	1/1/1997	Yes	No	Yes	30%	4
Maryland	0	9/29/1995	Yes	No	Yes	30%	4
Massachusetts	1	2/8/1996	Yes	3 years	Yes	30%	3
Michigan	0	11/29/1995	Yes	No	Yes	None	4
Minnesota	3	1/6/1997	No	5 years	No	30%	1
Mississippi	4	1/6/1997	No	5 years	No	25%	0
Missouri	4	9/29/1995	No	5 years	No	13%	0
Montana	4	1/10/2001	No	5 years	No	22%	0
Montana	4	9/29/1995	N/A	N/A	N/A	18% to 22%	0
Nebraska	4	5/31/1997	No	5 years	No	14%	0
Nevada	3	9/29/1995	Limited	5 years	Limited	30%	1
New Hampshire	0	1/1/2002	Yes	No	Yes	30%	4
New Hampshire	1	1/8/2000	Yes	5 years	Yes	30%	3
New Hampshire	4	1/6/1997	No	5 years	No	20%	0
New Jersey	1	4/17/1996	No	No	Yes	30%	3
New Mexico	3	1/6/1996	No	5 years	No	40%	1
New York	2	1/6/1997	No	5 years	Yes	30%	2
North Carolina	0	1/7/1995	Yes	No	Yes	30%	4
North Dakota	1	1/8/2003	Yes	No	Yes	25%	3
North Dakota	3	5/31/1997	No	No	No	25%	1
Ohio	0	5/21/1997	Yes	No	Yes	30%	4
Oklahoma	1	5/17/2000	Yes	No	Yes	20%	3
Oklahoma	4	5/31/1997	No	5 years	No	15%	0
Oregon	3	1/7/1997	No	3 years	No	30%	1

Table A4
Interstate branching deregulation in 1994 to 2005

State	Rice and Strahan's Branching Restrictiveness Index	Effective date	Allow de novo interstate branching	Minimum age of institution for acquisition	Allow acquisition of single branch or portion of an institution	State-wide deposit cap on branch acquisition	DREG
Pennsylvania	0	6/7/1995	Yes	No	Yes	30%	4
Rhode Island	0	6/20/1995	Yes	No	Yes	30%	4
South Carolina	3	1/7/1996	No	5 years	No	30%	1
South Dakota	3	9/3/1996	No	5 years	No	30%	1
Tennessee	1	3/17/2003	Yes	3 years	Yes	30%	3
Tennessee	1	1/7/2001	Yes	5 years	Yes	30%	3
Tennessee	2	1/5/1998	No	5 years	Yes	30%	2
Tennessee	3	1/6/1997	No	5 years	No	30%	1
Texas	2	1/9/1999	Yes	No	Yes	20%	2
Texas	4	8/28/1995	N/A	N/A	N/A	20%	0
Utah	1	4/30/2001	Yes	5 years	Yes	30%	3
Utah	2	1/6/1995	No	5 years	Yes	30%	2
Vermont	0	1/1/2001	Yes	No	Yes	30%	4
Vermont	2	5/30/1996	No	5 years	Yes	30%	2
Virginia	0	9/29/1995	Yes	No	Yes	30%	4
Washington	1	9/5/2005	Yes	5 years	Yes	30%	3
Washington	3	6/6/1996	No	5 years	No	30%	1
West Virginia	1	5/31/1997	Yes	No	Yes	25%	3
Wisconsin	3	1/5/1996	No	5 years	No	30%	1
Wyoming	3	5/31/1997	No	3 years	No	30%	1

Note: This table tabulates the timing of the interstate branching deregulation by states in the US from 1994 to 2005. The Riegle-Neal Interstate Banking and Branching Efficiency Act (IBBEA) of 1994 allows individual states to implement the following restriction: (1) do not allow de novo interstate branching; (2) restrict the minimum age of the target institutions for acquisitions; (3) do not permit the acquisitions of an individual branch or a portion of an institution; and (4) block any branch acquisition of in-state banks that hold more than 30% of the deposits in that state. We use a similar index to Favara and Imbs (2015), which is the inverse value of Rice and Strahan's (2010) branching restrictiveness index. Our index (DREG) ranges from 0 to 4 with higher value indicates fewer restrictions on interstate branching against out-of-state banks. The index starts with zero in 1994 assuming that states are highly regulated and becomes larger (less restrictive) throughout the sample period as states started to remove the restrictions. Source: Rice and Strahan (2010).

Table A5
Correlation matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
Change in dividends (1)	1.000																	
DREG (2)	-0.019	1.000																
Weighted DREG (3)	-0.020	0.989	1.000															
Size (4)	0.029	0.093	0.082	1.000														
Profitability (5)	0.200	-0.033	-0.033	0.023	1.000													
Liquidity (6)	0.023	-0.112	-0.115	0.022	0.056	1.000												
Capitalisation (7)	-0.005	0.038	0.040	-0.125	0.413	0.064	1.000											
Risk (8)	-0.049	-0.024	-0.025	-0.033	-0.137	-0.004	0.021	1.000										
HHI (9)	0.021	0.162	0.159	0.080	0.019	0.086	0.026	0.010	1.000									
Reg Leniency (10)	0.018	0.016	0.014	-0.003	0.025	0.103	0.011	0.012	0.380	1.000								
HCLG (11)	-0.059	-0.076	-0.080	-0.175	-0.002	0.089	0.098	0.166	0.016	0.054	1.000							
Peer (12)	0.015	-0.083	-0.086	0.002	0.027	0.078	-0.012	0.013	0.097	0.076	0.008	1.000						
PCA (13)	0.022	-0.054	-0.057	0.064	-0.095	-0.017	-0.210	0.009	-0.022	-0.001	-0.041	0.018	1.000					
Dividend Premium (14)	0.014	0.131	0.134	0.009	-0.021	0.028	0.006	0.041	0.006	0.008	-0.024	0.051	0.015	1.000				
SOX (15)	-0.019	0.282	0.284	0.223	-0.057	-0.112	-0.016	-0.012	0.071	-0.020	-0.076	-0.051	-0.046	-0.130	1.000			
Log GSP (16)	-0.006	0.338	0.338	0.140	-0.067	0.024	-0.020	0.006	0.313	0.132	-0.051	-0.015	-0.061	0.018	0.172	1.000		
Coincident Index (17)	0.015	0.276	0.279	0.046	0.033	0.026	0.007	-0.061	0.318	0.297	-0.003	0.060	0.009	0.070	0.245	0.252	1.000	
Freedom Index (18)	0.009	-0.079	-0.081	-0.099	0.015	0.090	-0.035	-0.094	-0.150	-0.076	0.022	0.040	0.056	0.041	-0.197	-0.104	0.101	1.000

Note: This table tabulates the correlations between variables used in this study. The dependent variable is the change in dividends scaled to lagged total equity capital. The main independent variable is DREG. We use the inverse value of branching restrictiveness index from Rice and Strahan (2010). It takes the value of 0 to 4, which higher values indicate more competitive banking industry in a state. The control variables are size (log of total assets), profitability, liquidity, capitalisation, and risk. Weighted DREG is an alternative proxy of competition used in our robustness tests. HHI is the Herfindahl-Hirschman Index at the state level using deposit in 1993; Reg Leniency is the proxy of state regulator leniency; HCLG is a binary variable for high cash and low growth banks: Peer is the average dividend change of a bank's peers at the state level; PCA is a binary variable if a bank's tier 1 leverage ratio fells below 7% or tier a risk-weighted capital ratio fells below 8%; Dividend Premium is a time series variable that captures investors' demand for dividends; and SOX is a binary variable for publicly listed banks after 2002, reflecting Sarbanes-Oxley Act of 2002. Log Gross State Product (GSP), Coincident Index, and Freedom Index are used to control for state level differences that may affect the DREG value.

Table A6
Baseline results using winsorized control variables

Dependent variables:	Change in Dividends	Change in Share repurchases
	(1)	(2)
DREG	-0.081**	0.031
	(0.034)	(0.034)
Size	0.428**	0.219
	(0.172)	(0.191)
Profitability	173.238***	1.024
	(21.918)	(18.815)
Liquidity	-1.031	-2.225
	(3.726)	(4.128)
Capitalisation	-4.902	-0.115
	(3.558)	(4.803)
Risk	-11.054	5.610
	(9.161)	(8.243)
Bank fixed effects	Yes	Yes
No. of observations	10257	10257
R-squared	0.03	0.003

Note: This table presents the baseline results using winsorized control variables at the 1% and 99% of their distributions. The dependent variables are the magnitude of change in dividends or share repurchases scaled to lagged equity. $DREG_{s,t}$ is the variable of interest, which takes the value of 0 (most restricted) to 4 (least restricted). The control variables include size, profitability, liquidity, capitalisation, and risk. The definitions of these variables are provided in Section 3.2.4. Standard errors are clustered at the state level and shown in parentheses. *, **, and *** denote significance level at 10%, 5%, and 1%, respectively.

Bibliography

Abadie, A., 2005. Semiparametric difference-in-differences estimators. *The Review of Economic Studies*, 72(1), pp.1–19.

Abreu, J.F. and Gulamhussen, M.A., 2013. Dividend payouts: Evidence from U.S. bank holding companies in the context of the financial crisis. *Journal of Corporate Finance*, 22, pp.54–65.

Acharya, V.V., Gujral, I., Kulkarni, N. and Shin, H.S., 2011. Dividends and bank capital in the financial crisis of 2007-2009. *NBER Working Paper Series No. 16896*.

Acharya, V.V., Le, H.T. and Shin, H.S., 2017. Bank capital and dividend externalities. *The Review of Financial Studies*, 30(3), pp.988–1018.

Adams, R.B. and Mehran, H., 2008. Corporate performance, board structure, and their determinants in the banking industry. *Federal Reserve Bank of New York Staff Report*, No. 330.

Adhikari, B.K. and Agrawal, A., 2018. Peer influence on payout policies. *Journal of Corporate Finance*, 48, pp.615–637.

Admati, A.R., DeMarzo, P.M., Hellwig, M.F. and Pfleiderer, P., 2013. Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not socially expensive. *Stanford Graduate School of Business Working Paper*.

Agarwal, S., Lucca, D., Seru, A. and Trebbi, F., 2014. Inconsistent regulators: Evidence from banking. *The Quarterly Journal of Economics*, 129(2), pp.889–938.

Albertazzi, U. and Gambacorta, L., 2009. Bank profitability and the business cycle. *Journal of Financial Stability*, 5(4), pp.393–409.

Allen, F., Carletti, E., Marquez, R., 2011. Credit market competition and capital regulation. *Review of Financial Studies*, 24(4), pp.983-1018.

Allen, F. and Gale, D., 2000. Corporate governance and competition: Theoretical and empirical perspectives. *Cambridge University Press*, pp.23–94.

Allen, F. and Michaely, R., 2003. Payout policy in G. M. Constantinides, M. Harris, and RM Stultz, ed. In: *Handbook of the Economics of Finance*. pp.337–429.

Andriosopoulos, D., Chronopoulos, D.K. and Papadimitriou, F.I., 2014. Can the information content of share repurchases improve the accuracy of equity premium predictions? *Journal of Empirical Finance*, 26, pp.96–111.

Anginer, D. and Demirgüç-Kunt, A., 2019. Bank runs and moral hazard: A review of deposit insurance. In: *Berger, A.N., Molyneux, P. and Wilson, J.O.S. (eds.) Oxford Handbook of Banking*, 3rd edition, forthcoming. Oxford: Oxford University Press.

Anginer, D., Demirgüç-Kunt, A., Huizinga, H. and Ma, K., 2016. Corporate governance and bank capitalization strategies. *Journal of Financial Intermediation*, 26, pp.1–27.

Arena, M.P. and Kutner, G.W., 2015. Territorial Tax System Reform and Corporate Financial Policies. *Review of Financial Studies*, 28(8), pp.2250–2280.

Ashcraft, A.B., 2008. Does the market discipline banks? New evidence from regulatory capital mix. *Journal of Financial Intermediation*, 47(4), pp.543–561.

Ashcraft, A.B., 2010. Are bank holding companies a source of strength to their banking subsidiaries? *Journal of Money, Credit and Banking*, 40(2–3), pp.273–294.

Atanasov, V. and Black, B., 2016. Shock-based causal inference in corporate finance and accounting research. *Critical Finance Review*, 5, pp.207–304.

Athanasoglou, P.P., Brissimis, S.N. and Delis, M.D., 2008. Bank-specific, industry-specific and macroeconomic determinants of bank profitability. *Journal of International Financial Markets, Institutions and Money*, 18(2), pp.121–136.

Avraham, D., Selvaggi, P. and Vickery, J., 2012. A structural view of U.S. bank holding companies. *Economic Policy Review, Federal Reserve Bank, New York*, pp.65–81.

Baker, H.K., 2009. *Dividends and dividend policy*. Hoboken, New Jersey: John Wiley & Sons, Inc.

Baker, H.K. and De Ridder, A., 2018. Payout policy in industrial and financial firms. *Global Finance Journal*, 37, pp.138–151.

Baker, M. and Wurgler, J., 2004. A catering theory of dividends. *The Journal of Finance*, 59(3), pp.1125–1165.

Bayazitova, D. and Shivdasani, A., 2011. Assessing TARP. *The Review of Financial Studies*, 25(2), pp.377–407.

Beck, T., Levine, R. and Levkov, A., 2010. Big bad banks? The winners and losers from bank deregulation in the United States. *The Journal of Finance*, 65(5), pp.1637–1667.

Benartzi, S., Michaely, R. and Thaler, R., 1997. Do changes in dividends signal the future or the past? *The Journal of Finance*, 52(3), pp.1007–1034.

Berger, A.N., 1995. The relationship between capital and earnings in banking. *Journal of Money, Credit and Banking*, 27(2), pp.432–456.

Berger, A.N. and Davies, S.M., 1998. The information content of bank examinations. *Journal of Financial Services Research*, 14(2), pp.117–144.

Berger, A.N., Demirgüç-Kunt, A., Levine, R. and Haubrich, J.G., 2004. Bank concentration and competition: An evolution in the making. *Journal of Money, Credit and Banking*, 36(3), pp.433–451.

Berger, A.N., Kasyap, A.K. and Scalise, J.M., 1995. The transformation of the U.S. banking industry: What a long, strange trip it's been. *Brookings Papers on Economic Activity*, 2, pp.55–218.

Berger, A.N., Öztekin, Ö. and Roman, R.A., 2017. How does competition affect bank capital structure? Evidence from a natural experiment. *Unpublished Working Paper*.

Berger, A.N. and Roman, R.A., 2015. Did TARP banks get competitive advantages? *Journal of Financial and Quantitative Analysis*, 50(6), pp.1199–1236.

Bertrand, M. and Mullainathan, S., 2003. Enjoying the quiet life? Corporate governance and managerial preferences. *Journal of Political Economy*, 111(5), pp.1043–1075.

Bessler, W. and Nohel, T., 1996. The stock-market reaction to dividend cuts and omissions by commercial banks. *Journal of Banking & Finance*, 20(9), pp.1485–1508.

Bhattacharya, S., 1979. Imperfect information, dividend policy, and" the bird in the hand" fallacy. *The Bell Journal of Economics*, 1(1), pp.259–270.

Bindal, S., Bouwman, C.H.S., Hu, S. (Sophia) and Johnson, Shane A., 2017. Regulatory size thresholds and merger and acquisition behavior. *Texas A&M University working paper*.

Black, S.E. and Strahan, P.E., 2002. Entrepreneurship and bank credit availability. *The Journal of Finance*, 57(6), pp.2807–2833.

Boldin, R. and Leggett, K., 1995. Bank dividend policy as a signal of bank quality. *Financial Services Review*, 4(1), pp.1–8.

Bolton, P. and Scharfstein, D.S., 1990. A theory of predation based on agency problems in financial contracting. *American Economic Review*, 80(1), pp.93–106.

Bonaimé, A.A., Hankins, K.W. and Harford, J., 2013. Financial flexibility, risk management, and payout choice. *The Review of Financial Studies*, 27(4), pp.1074–1101.

Boudoukh, J., Michaely, R. and Richardson, M., 2007. On the importance of measuring payout yield: Implications for empirical asset pricing. *The Journal of Finance*, 62(2), pp.877–915.

Bourke, P., 1989. Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking & Finance*, 13(1), pp.65–79.

Bouwman, C.H.S., Hu, S. (Sophia) and Johnson, S.A., 2018. Differential bank behaviors around the Dodd–Frank Act size thresholds. *Journal of Financial Intermediation*, 34, pp.47–57.

Brav, A., Graham, J.R., Campbell, C.R. and Michaely, R., 2005. Payout policy in the 21st century. *Journal of Financial Economics*, 77(3), pp.483–527.

Calomiris, C.W. and Jaremski, M., 2016. Deposit insurance: Theories and facts. *Annual Review of Financial Economics*, 8, pp.97–120.

Calomiris, C.W. and Kahn, C.M., 1991. The role of demandable debt in structuring optimal banking arrangements. *The American Economic Review*, 81(3), pp.497–513.

Caprio, G., Laeven, L. and Levine, R., 2007. Governance and bank valuation. Journal of Financial Intermediation, 16(4), pp.584–617.

Casu, B. and Girardone, C., 2006. Bank competition, concentration and efficiency in the single European market. *The Manchester School*, 74(4), pp.441–468.

Chan, Y., Greenbaum, S.I., Thakor, A.V., 1986. Information reusability, competition and bank asset quality. *Journal of Banking & Finance*, 10(2), pp.243-253.

Chen, Q., Goldstein, I., Huang, Z. and Vashishtha, R., 2018. Bank transparency and deposit flows. *Working Paper, Duke University*.

Chortareas, G.E., Garza-García, J.G. and Girardone, C., 2012. Competition, efficiency and interest rate margins in Latin American banking. *International Review of Financial Analysis*, 24, pp.93–103.

Chronopoulos, D.K., Liu, H., McMillan, F.J. and Wilson, J.O.S., 2015. The dynamics of US bank profitability. *The European Journal of Finance*, 21(5), pp.426–443.

Cornaggia, J., Mao, Y., Tian, X. and Wolfe, B., 2015. Does banking competition affect innovation? *Journal of Financial Economics*, 115(1), pp.189–209.

Cornett, M.M., Minnick, K., Schorno, P.J. and Tehranian, H., 2018. An examination of bank behavior around Federal Reserve stress tests. *Journal of Financial Intermediation*, forthcoming.

Dahl, D. and Spivey, M.F., 1995. Prompt corrective action and bank efforts to recover from undercapitalization. *Journal of Banking & Finance*, 19(2), pp.225–243.

De Haan, J. and Poghosyan, T., 2012. Size and earnings volatility of US bank holding companies. *Journal of Banking & Finance*, 36(11), pp.3008–3016.

DeAngelo, H., DeAngelo, L. and Skinner, D.J., 2009. Corporate payout policy. *Foundations and Trends in Finance*, 3(2–3), pp.95–287.

DeAngelo, H., DeAngelo, L. and Stulz, R.M., 2006. Dividend policy and the earned/contributed capital mix: a test of the life-cycle theory. *Journal of Financial Economics*, 81(2), pp.227–254.

DeAngelo, H., Stulz, R.M., 2015. Liquid-claim production, risk management and bank capital structure: Why high leverage is optimal for banks*. Journal of Financial Economics,* 116(2), pp.219-236.

Degryse, H., Ongena, S., 2007. The impact of competition on bank orientation, *Journal of Financial Intermediation*, 16(3), pp.399-424.

Demirgüç-Kunt, A. and Huizinga, H., 1999. Determinants of commercial bank interest margins and profitability: Some international evidence. *The World Bank Economic Review*, 13(2), pp.379–408.

Demirgüç-Kunt, A. and Detragiache, E., 2002. Does deposit insurance increase banking system stability? An empirical investigation. *Journal of Monetary Economics*, 49(7), pp.1373–1406.

Demirgüç-Kunt, A. and Huizinga, H., 2000. Financial structure and bank profitability. *The World Bank Policy Research Working Paper Series 2430*.

Demirgüç-Kunt, A. and Huizinga, H., 2004. Market discipline and deposit insurance. *Journal of Monetary Economics*, 51(2), pp.375–399.

Denis, D.J. and Osobov, I., 2008. Why do firms pay dividends? International evidence on the determinants of dividend policy. *Journal of Financial Economics*, 89(1), pp.62–82.

DeYoung, R., 2015. Banking in the United States. In: *Berger, A.N., Molyneux, P. and Wilson, J.O.S. (eds.) Oxford Handbook of Banking*, 2nd edition. Oxford: Oxford University Press.

Diamond, D.W. and Dybvig, P.H., 1983. Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3), pp.401–419.

Duan, J.-C., Moreau, A.F. and Sealey, C.W., 1992. Fixed-rate deposit insurance and risk-shifting behavior at commercial banks. *Journal of Banking & Finance*, 16(4), pp.715–742.

Easterbrook, F.H., 1984. Two agency-cost explanations of dividends. *The American Economic Review*, 74(4), pp.650–659.

Egan, M., Hortacsu, A. and Matvos, G., 2017. Deposit competition and financial fragility: Evidence from the US banking sector. *The American Economic Review*, 107(1), pp.169–216.

Fama, E.F. and French, K.R., 2001. Disappearing dividends: changing firm characteristics or lower propensity to pay? *Journal of Financial Economics*, 60(1), pp.3–43.

Farre-Mensa, J., Michaely, R. and Schmalz, M., 2014. Payout policy. *Annual Review of Financial Economics*, 6(1), pp.75–134.

Favara, G. and Imbs, J., 2015. Credit supply and the price of housing. *The American Economic Review*, 105(3), pp.958–992.

Federal Reserve Board, 1985. *Policy statement on payment of cash dividends*. Available at: <https://fraser.stlouisfed.org/files/docs/historical/frbdal/circulars/frbdallas_circ_19851212_no85-146.pdf>.

Federal Reserve Board, 2009. *Applying supervisory guidance and regulations on the payment of dividends, stock redemptions, and stock repurchases at bank holding companies*. Available at: <https://www.federalreserve.gov/boarddocs/srletters/2009/SR0904a3.pdf>.

Federal Reserve Board, 2011. Federal Reserve System, 12 CFR Part 225, capital plans. *Federal Register*, [online] 76(231), pp.74631–74648. Available at: <https://www.federalreserve.gov/reportforms/formsreview/RegY13_20111201_ffr.pdf>.

Federal Reserve Board, 2017. *Bank holding company supervision manual*. Available at: <https://www.federalreserve.gov/publications/files/bhc.pdf>.

Filbeck, G. and Mullineaux, D.J., 1993. Regulatory monitoring and the impact of bank holding company dividend changes on equity returns. *The Financial Review*, 28(3), pp.403–415.

Flannery, M.J., 2012. Corporate finance and financial institutions. *Annual Review of Financial Economics*, 4, pp.233–253.

Flannery, M.J., Hirtle, B. and Kovner, A., 2017. Evaluating the information in the federal reserve stress tests. *Journal of Financial Intermediation*, 29, pp.1–18.

Flannery, M.J., Kwan, S.H. and Nimalendran, M., 2013. The 2007–2009 financial crisis and bank opaqueness. *Journal of Financial Intermediation*, 22(1), pp.55–84.

Floyd, E., Li, N. and Skinner, D.J., 2015. Payout policy through the financial crisis: The growth of repurchases and the resilience of dividends. *Journal of Financial Economics*, 118(2), pp.299–316.

Forti, C. and Schiozer, R.F., 2015. Bank dividends and signaling to information-sensitive depositors. *Journal of Banking & Finance*, 56, pp.1–11.

Frost, C.A., 1997. Disclosure policy choices of UK firms receiving modified audit reports. *Journal of Accounting and Economics*, 23(2), pp.163–187.

Fudenberg, D. and Tirole, J., 1986. A 'Signal-Jamming' Theory of Predation. *RAND Journal of Economics*, 17(3), pp.366–376.

Furlong, F.T. and Keeley, M.C., 1989. Capital regulation and bank risk-taking: A note. *Journal of Banking & Finance*, 13(6), pp.883–891.

García-Herrero, A., Gavilá, S. and Santabárbara, D., 2009. What explains the low profitability of Chinese banks? *Journal of Banking & Finance*, 33(11), pp.2080–2092.

Gibson, S., 2000. On the information content of bank loan-loss disclosures: A theory and evidence from Japan. *International Review of Finance*, 1(1), pp.53–80.

Gilbert, A., 1984. Bank market structure and competition: A survey. *Journal of Money, Credit and Banking*, 16(4), pp.617–645.

Goddard, J., Liu, H., Molyneux, P. and Wilson, J.O.S., 2013. Do bank profits converge? *European Financial Management*, 19(2), pp.345–365.

Goddard, J., Molyneux, P. and Wilson, J.O.S., 2004a. Dynamics of growth and profitability in banking. *Journal of Money, Credit and Banking*, 36(6), pp.1069–1090.

Goddard, J., Molyneux, P. and Wilson, J.O.S., 2004b. The profitability of European banks: A cross-sectional and dynamic panel analysis. *The Manchester School*, 72(3), pp.363–381.

Goetz, M.R., 2018. Competition and bank stability. *Journal of Financial Intermediation*, 35, pp.57–69.

Goldstein, I. and Pauzner, A., 2005. Demand–deposit contracts and the probability of bank runs. *Journal of Finance*, 60(3), pp.1293–1327.

González, F., 2005. Bank regulation and risk-taking incentives: An international comparison of bank risk. *Journal of Banking & Finance*, 29(5), pp.1153–1184.

Graham, J.R., Harvey, C.R. and Rajgopal, S., 2005. The economic implications of corporate financial reporting. *Journal of Accounting and Economics*, 40(1–3), pp.3–73.

Grennan, J., 2018. Dividend payments as a response to peer influence. *Journal of Financial Economics*, forthcoming.

Grossman, S.J. and Hart, O.D., 1986. Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics*, 11(1), pp.42–64.

Grullon, G. and Ikenberry, D., 2000. What do we know about stock repurchases? *Journal of Applied Corporate Finance*, 13(1), pp.31–51.

Grullon, G. and Michaely, R., 2002. Dividends, share repurchases, and the substitution hypothesis. *The Journal of Finance*, 57(4), pp.1649–1684.

Grullon, G. and Michaely, R., 2004. The Information Content of Share Repurchase Programs. *The Journal of Finance*, 59(2), pp.651–680.

Grullon, G. and Michaely, R., 2014. The impact of product market competition on firms' payout policy. *Unpublished Working Paper*.

Grullon, G., Michaely, R., Benartzi, S. and Thaler, R., 2005. Dividend changes do not signal changes in future profitability. *The Journal of Business*, 78(5), pp.1659–1682.

Grullon, G., Michaely, R. and Swaminathan, B., 2002. Are dividend changes a sign of firm maturity? *The Journal of Business*, 75(3), pp.387–424.

Guay, W. and Harford, J., 2000. The cash-flow permanence and information content of dividend increases versus repurchases. *Journal of Financial Economics*, 57(3), pp.385–415.

Guizani, B. and Watanabe, W., 2016. The effects of public capital infusions on banks' risk-shifting to the deposit insurance system in Japan. *Journal of Financial Stability*, 26, pp.15–30.

Guntay, L., Jacewitz, S. and Pogach, J., 2017. Proving approval: Bank dividends, regulation, and runs. *FDIC Center for Financial Research Paper No. 2015-05*.

de Haan, J. and Vlahu, R., 2016. Corporate governance of banks: A survey. *Journal of Economic Surveys*, 30(2), pp.228–277.

Hart, O.D., 1983. The market mechanism as an incentive scheme. *The Bell Journal of Economics*, 14(2), pp.366–382.

Healy, P.M. and Palepu, K.G., 1993. The effect of firms' financial disclosure strategies on stock prices. *Accounting Horizons*, 7(1), pp.1–11.

Hirtle, B., 2004. Stock repurchases and bank holding company performance. *Journal of Financial Intermediation*, 13(1), pp.28–57.

Hirtle, B., 2006. Stock market reaction to financial statement certification by bank holding company CEOs. *Journal of Money, Credit and Banking*, 38(5), pp.1263–1291.

Hirtle, B., 2016. Bank holding company dividends and repurchases during the financial crisis. *Federal Reserve Bank of New York Staff Report*, No. 666.

Hoberg, G., Phillips, G. and Prabhala, N., 2014. Product market threats, payouts, and financial flexibility. *The Journal of Finance*, 69(1), pp.293–324.

Holmstrom, B., 1982. Moral hazard in teams. *The Bell Journal of Economics*, 13(2), pp.324–340.

Honoré, B.E., 1992. Trimmed Lad and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects. *Econometrica*, 60(3), pp.533–565.

Hovakimian, A. and Kane, E.J., 2000. Effectiveness of capital regulation at US commercial banks. *The Journal of Finance*, 55(1), pp.451–468.

Hovakimian, A., Kane, E.J. and Laeven, L., 2003. How country and safety-net characteristics affect bank risk-shifting. *Journal of Financial Services Research*, 23(3), pp.177–204.

Huang, R. and Ratnovski, L., 2011. The dark side of bank wholesale funding. *Journal of Financial Intermediation*, 20(2), pp.248–263.

Ikenberry, D., Lakonishok, J. and Vermaelen, T., 1995. Market underreaction to open market share repurchases. *Journal of Financial Economics*, 39(2–3), pp.181–208.

Inderst R., and Mueller H.M., 2008. Bank Capital Structure and Credit Decisions, *Journal of Financial Intermediation*, 17(3), pp.295-314.

Ioannidou, V.P. and Penas, M.F., 2010. Deposit insurance and bank risk-taking: Evidence from internal loan ratings. *Journal of Financial Intermediation*, 19(1), pp.95–115.

Jagannathan, M., Stephens, C.P. and Weisbach, M.S., 2000. Financial fexibility and the choice between dividends and stock repurchases. *Journal of Financial Economics*, 57(3), pp.355–384.

Jayaratne, J. and Strahan, P.E., 1996. The finance-growth nexus: Evidence from bank branch deregulation. *The Quarterly Journal of Economics*, 111(3), pp.639–670.

Jayaratne, J. and Strahan, P.E., 1998. Entry restrictions, industry evolution, and dynamic efficiency: evidence from commercial banking. *Journal of Law and Economics*, 41(1), pp.239–274.

Jensen, M.C., 1986. Agency costs of free cash flow, corporate finance, and takeovers. *The American Economic Review*, 76(2), pp.323–329.

Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), pp.305–360.

Jiang, L., Levine, R. and Lin, C., 2016a. Competition and bank liquidity creation. *NBER Working Paper Series No. 22195*.

Jiang, L., Levine, R. and Lin, C., 2016b. Competition and bank opacity. *The Review of Financial Studies*, 29(7), pp.1911–1942.

John, K., De Masi, S. and Paci, A., 2016. Corporate governance in banks. *Corporate Governance: An International Review*, 24(3), pp.303–321.

John, K., Knyazeva, A. and Knyazeva, D., 2015. Governance and payout precommitment. *Journal of Corporate Finance*, 33, pp.101–117.

John, K. and Williams, J., 1985. Dividends, dilution, and taxes: A signalling equilibrium. *The Journal of Finance*, 40(4), pp.1053–1070.

Johnson, C.A. and Rice, T., 2008. Assessing a decade of interstate bank branching. *Washington & Lee Law Review*, 65, pp.73–127.

Jones, J.S., Lee, W.Y. and Yeager, T.J., 2012. Opaque banks, price discovery, and financial instability. Journal of Financial Intermediation, 21(3), pp.383–408.

Kanas, A., 2013. Bank dividends, risk, and regulatory regimes. *Journal of Banking & Finance*, 37(1), pp.1–10.

Karas, A., Pyle, W. and Schoors, K., 2013. Deposit insurance, banking crises, and market discipline: Evidence from a natural experiment on deposit flows and rates. *Journal of Money, Credit and Banking*, 45(1), pp.179–200.

Kauko, K., 2014. Does opaqueness make equity capital expensive for banks? *Revista de Economía del Rosario*, 17(2), pp.203–227.

Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. *The American Economic Review*, 80(5), pp.1183–1200.

Keen, H., 1978. Bank dividend cuts: Recent experience and the traditional view. *Business Review*, (Nov 1978), pp.3–13.

Kerr, W.R. and Nanda, R., 2009. Democratizing entry: Banking deregulations, financing constraints, and entrepreneurship. *Journal of Financial Economics*, 94(1), pp.124–149.

Koetter, M., Kolari, J.W. and Spierdijk, L., 2012. Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for US banks. *The Review of Economics and Statistics*, 94(2), pp.462–480.

Krishnan, K., Nandy, D.K. and Puri, M., 2014. Does financing spur small business productivity? Evidence from a natural experiment. *The Review of Financial Studies*, 28(6), pp.1768–1809.

Kroszner, R.S. and Strahan, P.E., 2014. Regulation and deregulation of the US banking industry: causes, consequences, and implications for the future. In: *Economic Regulation and Its Reform: What Have We Learned?* University of Chicago Press.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A. and Vishny, R.W., 2000. Agency problems and dividend policies around the world. *The Journal of Finance*, 55(1), pp.1–33.

Lambert, C., Noth, F. and Schüwer, U., 2017. How do insured deposits affect bank risk? Evidence from the 2008 Emergency Economic Stabilization Act. *Journal of Financial Intermediation*, 29, pp.81–102.

Lang, L.H.P., Stulz, R.M. and Walkling, R.A., 1991. A test of the free cash flow hypothesis: The case of bidder returns. *Journal of Financial Economics*, 29(2), pp.315–335.

Leary, M.T. and Roberts, M.R., 2014. Do peer firms affect corporate financial policy? *The Journal of Finance*, 69(1), pp.139–178.

Lee, B.-S. and Rui, O.M., 2007. Time-series behavior of share repurchases and dividends. *Journal of Financial and Quantitative Analysis*, 42(1), pp.119–142.

Lemmon, M. and Roberts, M.R., 2010. The response of corporate financing and investment to changes in the supply of credit. *Journal of Financial and Quantitative Analysis*, 45(3), pp.555–587.

Lepetit, L., Meslier, C., Strobel, F. and Wardhana, L.I., 2018. Bank dividends, agency costs and shareholder and creditor rights. *International Review of Financial Analysis*, 56, pp.93–111.

Lepetit, L., Meslier, C. and Wardhana, L.I., 2017. Reducing agency conflicts through bank dividend payout decisions: the role of opacity and ownership structure. *Applied Economics*, 49(49), pp.128–155.

Li, H., Liu, H., Siganos, A. and Zhou, M., 2016. Bank regulation, financial crisis, and the announcement effects of seasoned equity offerings of US commercial banks. *Journal of Financial Stability*, 25, pp.37–46.

Li, W. and Lie, E., 2006. Dividend changes and catering incentives. *Journal of Financial Economics*, 80(2), pp.293–308.

Lie, E., 2005. Financial flexibility, performance, and the corporate payout choice. *The Journal of Business*, 78(6), pp.2179–2202.

Lintner, J., 1956. Distribution of incomes of corporations among dividends, retained earnings, and taxes. *The American Economic Review*, 46(2), pp.97–113.

Liu, C.-C., Ryan, S.G. and Wahlen, J.M., 1997. Differential valuation implications of loan loss provisions across banks and fiscal quarters. *The Accounting Review*, 72(1), pp.133–146.

Macey, J. and O'Hara, M., 2016. Bank corporate governance: a proposal for the post-crisis world. *FRBNY Economic Policy Review*, (August), pp.85–106.

Marris, R., 1964. *The Economic Theory of 'Managerial' Capitalism*. London: Macmillan.

Martin, C., Puri, M. and Ufier, A., 2018. Deposit inflows and outflows in failing banks: The role of deposit insurance. *NBER Working Paper Series No. 24589*.

Mehran, H. and Suher, M., 2009. The impact of tax law changes on bank dividend policy, sell-offs, organizational form, and industry structure. *Unpublished Working Paper*.

Merton, R.C., 1977. An analytic derivation of the cost of deposit insurance and loan guarantees An application of modern option pricing theory. *Journal of Banking & Finance,* 1(1), pp.3–11.

Michaely, R. and Roberts, M.R., 2012. Corporate dividend policies: Lessons from private firms. *The Review of Financial Studies*, 25(3), pp.711–746.

Michaely, R., Rossi, S. and Weber, M., 2018. The information content of dividends: Safer profits, not higher profits. *NBER Working Paper Series No. 24237*.

Miller, M.H. and Modigliani, F., 1961. Dividend policy, growth, and the valuation of shares. *Journal of Business*, 34(4), pp.411–433.

Miller, M.H. and Rock, K., 1985. Dividend policy under asymmetric information. *The Journal of Finance*, 40(4), pp.1031–1051.

Morgan, D.P., 2002. Rating banks: Risk and uncertainty in an opaque industry. *American Economic Review*, 92(4), pp.874–888.

Myers, S.C., 1977. Determinants of corporate borrowing. *Journal of Financial Economics*, 5(2), pp.147–175.

Myers, S.C. and Majluf, N.S., 1984. Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), pp.187–221.

Nalebuff, B.J. and Stiglitz, J.E., 1983. Prizes and incentives: Towards a general theory of compensation and competition. *The Bell Journal of Economics*, 14(1), pp.21–43.

Nguyen, D.D., Hagendorff, J. and Eshraghi, A., 2017. Does a CEO's cultural heritage affect performance under competitive pressure? *The Review of Financial Studies*, 31(1), pp.97–141.

Nissim, D. and Ziv, A., 2001. Dividend changes and future profitability. *The Journal of Finance*, 56(6), pp.2111–2133.

Niu, J., 2008. Bank competition, risk, and subordinated debt. *Journal of Financial Services Research*, 33(1), pp.37-56.

Ofer, A.R. and Thakor, A.V., 1987. A theory of stock price responses to alternative corporate cash disbursement methods: Stock repurchases and dividends. *The Journal of Finance*, 42(2), pp.365–394.

Onali, E., 2014. Moral hazard, dividends, and risk in banks. *Journal of Business Finance & Accounting*, 41(1–2), pp.128–155.

Onali, E., Galiakhmetova, R., Molyneux, P. and Torluccio, G., 2016. CEO power, government monitoring, and bank dividends. *Journal of Financial Intermediation*, 27, pp.89–117.

Patnam, M., 2011. Corporate networks and peer effects in firm policies. *Unpublished Working Paper*.

Pennacchi, G., 2006. Deposit insurance, bank regulation, and financial system risks. *Journal of Monetary Economics*, 53(1), pp.1–30.

Petersen, M.A., Rajan, R.G., 1995. The effect of credit market competition on lending relatinoships, *Quarterly Journal of Economics*, 110(2), pp.407-443

Polonchek, J., Slovin, M.B. and Sushka, M.E., 1989. Valuation effects of commercial bank securities offerings: A test of the information hypothesis. *Journal of Banking & Finance*, 13(3), pp.443–461.

Ratnovski, L., 2013. Liquidity and transparency in bank risk management. *Journal of Financial Intermediation*, 22(3), pp.422–439.

Rice, T. and Strahan, P.E., 2010. Does credit competition affect small-firm finance? *The Journal of Finance*, 65(3), pp.861–889.

Roberts, M.R. and Whited, T.M., 2013. Endogeneity in empirical corporate finance. In: *Handbook of the Economics of Finance*. pp.493–572.

Schaeck, K., Cihak, M., Maechler, A. and Stolz, S., 2012. Who disciplines bank managers? *Review of Finance*, 16(1), pp.197–243.

Schmidt, K.M., 1997. Managerial incentives and product market competition. *The Review of Economic Studies*, 64(2), pp.191–213.

Shapiro, D. and Zhuang, A., 2015. Dividends as a signaling device and the disappearing dividend puzzle. *Journal of Economics and Business*, 79, pp.62–81.

Shleifer, A., 1985. A Theory of yardstick competition. *The RAND Journal of Economics*, 16(3), pp.319–327.

Shleifer, A. and Vishny, R.W., 1997. A survey of corporate governance. *The Journal of Finance*, 52(2), pp.737–783.

Short, B.K., 1979. The relation between commercial bank profit rates and banking concentration in Canada, Western Europe, and Japan. *Journal of Banking & Finance*, 3(3), pp.209–219.

Skinner, D.J., 2008. The evolving relation between earnings, dividends, and stock repurchases. *Journal of Financial Economics*, 87(3), pp.582–609.

Smirlock, M., 1985. Evidence on the (non) relationship between concentration and profitability in banking. *Journal of Money, Credit and Banking*, 17(1), pp.69–83.

Spong, K., 2000. *Banking regulation: Its purposes, implementation, and effects*. 5th ed. Kansas: Federal Reserve Bank of Kansas City.

Srivastav, A., Armitage, S. and Hagendorff, J., 2014. CEO inside debt holdings and risk-shifting: Evidence from bank payout policies. *Journal of Banking & Finance*, 47, pp.41–53.

Theis, J. and Dutta, A.S., 2009. Explanatory factors of bank dividend policy: revisited. *Managerial Finance*, 35(6), pp.501–508.

Van Tassel, E., 2002. Signal jamming in new credit markets. *Journal of Money, Credit and Banking*, 34(2), pp.469–490.

Vermaelen, T., 1984. Repurchase tender offers, signaling, and managerial incentives. *Journal of Financial and Quantitative Analysis*, 9(2), pp.163–181.

Vermaelen, T., 2005. Share repurchases. *Foundations and Trends in Finance*, 1(3), pp.171–268.

Wahlen, J.M., 1994. The nature of information in commercial bank loan loss disclosures. *The Accounting Review*, 69(3), pp.455–478.

Wooldridge, J.M., 2002. *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.