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Published in:
Journal of Financial Stability

DOI:
10.1016/j.jfs.2020.100745

Journal of Financial Stability 48 (2020) 100745

Contents lists available at ScienceDirect

Journal of Financial Stability

journal homepage: www.elsevier.com/locate/jfstabil

Deposit insurance and bank dividend policy

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ARTICLE INFO

Article history:
Received 9 August 2019
Received in revised form 17 April 2020
Accepted 21 April 2020
Available online 29 April 2020

JEL classification:
G21
G35

Keywords:
Banking
Dividends
Difference-in-differences
Deposit insurance
Share repurchases

ABSTRACT

This study investigates whether deposit insurance affects bank payout policy. To overcome identification concerns, we use the US Emergency Economic Stabilization Act of 2008, which increased the maximum limit of deposit insurance coverage, leading to significant changes in the proportion of insured deposits to assets of some banks, while leaving others relatively unaffected. In line with the view that dividends convey information regarding financial health, we find that banks, which experience a substantial increase in insured deposits reduce dividends relative to others with a smaller increase in insured deposits. An extensive battery of further tests confirm that our results are not driven by events (such as capital injections due to participation in the Trouble Asset Relief Program, peer effects, state tax changes, deposit insurance pricing changes) that took place around the time of the increase in the maximum limit of deposit insurance coverage. Overall, the results of our empirical analysis suggest that banks holding fewer uninsured deposits pay less dividends.

1. Introduction

During the global financial crisis many banks maintained dividend payouts despite suffering losses, and while rivals went bankrupt or received large taxpayer-funded bailouts to avoid collapse. At the same time, a number of countries augmented existing deposit insurance schemes in order to avert runs on individual banks and ensure financial stability. These events have renewed debates regarding the impact of deposit insurance on bank behavior, and more generally the potential moral hazard arising from government interventions in the banking industry.[1]

In this study, we investigate the impact of an increase in the maximum level of deposit insurance coverage on bank dividends. A priori it is unclear whether increases in the maximum level of deposit insurance coverage lead to an increase or decrease in bank dividends. The direction and magnitude of any change 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 may cause banks to decrease dividends by lowering their need to use dividends in order to convey positive information regarding financial health to depositors (Bessler and Nohel, 1996; Kauko, 2014; Forti and Schiozer, 2015; Floyd et al., 2015), especially uninsured depositors who are prone to run (Huang and Ratnovski, 2011; Egan et al., 2017).[2] Evidence suggests that during the early stages of the financial crisis banks feared that cutting dividends could

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[1] Deposit insurance can distort 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, while any 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 bank health (Demirgüç-Kunt and Huizinga, 2004; Pennacchi, 2006; Calomiris and Jaremski, 2016; Anginer and Demirgüç-Kunt, 2019; Flannery and Bliss, 2019).

[2] Prior literature suggests that outsiders may obtain useful information regarding the financial condition of banks from the periodic issuance of financial statements that are certified by bank managers (Hirtle, 2006) and supervisory examination and stress tests (Berger and Davies, 1998; Flannery et al., 2017).

https://doi.org/10.1016/j.jfs.2020.100745
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result in a run by their short-term creditors (Acharya et al., 2011).[3] The increase in the maximum level of deposit insurance coverage reduces the proportion of uninsured deposits to total assets, thus reducing the probability of a run by depositors. 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 to total assets. We refer to this as the dividend signaling view.

On the other hand, deposit insurance may 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 et al., 2014; Acharya et al., 2017). That is, bank managers can transfer a larger share of earnings to shareholders by increasing dividends with resultant declines in capital reserves and increased risk of default. Deposit insurance may encourage such risk-shifting behavior, by reducing the incentives for depositors to monitor the financial health and riskiness of their respective banks (Flannery and Bliss, 2019). 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 total assets to increase dividends to shareholders.

We assess the validity of these aforementioned competing views on the impact of deposit insurance on bank dividend policy using a change in the coverage of insured deposits of US banks. Section 136 of the Emergency Economic Stabilization Act (EESA) increased the limit of the deposit insurance coverage by the Federal Deposit Insurance Corporation (FDIC (Federal Deposit Insurance Corporation), 2010). Effective on October 3, 2008 the maximum insurance coverage for bank deposits increased from $100,000 to $250,000. 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 to overcome identification concerns, 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 bank dividend policy (Abreu and Gulamhussen, 2013; Kanas, 2013; Kauko, 2014; Floyd et al., 2015; Forti and Schiozer, 2015; Acharya et al., 2017; Lepetit et al., 2018).

The change of the maximum level of deposit insurance coverage provides an ideal setting for testing the causal effect of deposit insurance on dividend 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 et al., 2017). Second, the increase in deposit insurance coverage was largely unexpected.[4] Third, the increase in proportion of insured deposits to total assets was not homogenous across banks.

Our dataset (which straddles the increase in deposit insurance coverage in October 2008) comprises quarterly financial accounts on bank holding companies over the period from 2007Q1 to 2010Q4. In line with prior literature (Abreu and Gulamhussen, 2013; Srivastav et al., 2014; Bonaimé et al., 2013), we conduct our analysis at the bank holding company level given that holding companies are a source of strength for their subsidiaries (Ashcraft, 2008) and corporate policies, including dividend policy, are determined at the parent level (Copeland, 2012; Avraham et al., 2012; Debbaut and Ennis, 2014).[5] For brevity and unless stated otherwise, we use the term *bank* to refer to bank holding company (BHC) in the remainder of the paper. We calculate for each bank, the difference in the ratio of insured deposits to assets before and after the change in deposit insurance coverage. This allows us to construct a treated (affected) and a control (unaffected) group of banks based upon the relative exposure of a given bank to the change in deposit insurance coverage enacted under the Emergency Economic Stabilization Act of 2008 in the spirit of Lambert, Noth and Schüwer (2017). In order to assess the impact of the change in the maximum level of deposit insurance on bank dividends, we use a difference-in-differences approach to compare the difference in the dividend payout of affected banks before and after the policy change with the same difference in dividend payout of their unaffected counterparts.

By way of preview, we find that banks affected by the increase in the maximum level of deposit insurance coverage pay lower dividends relative to their unaffected counterparts. This result is economically significant. On average, affected banks reduce dividends by $11.6 million following the increase in the maximum level of deposit insurance coverage. This corresponds to a reduction of 76 % compared to the dividends paid by the average bank in the sample. This finding is in line with the notion that dividends are used by banks to signal financial health to depositors. Further we find that the capital structure of banks does have a significant impact on the role of deposit insurance on bank dividend policy. In particular, we find that banks with greater dependence on deposits for financing banking operations reduce dividends more following the increase in deposit insurance coverage.[6] In addition, we find that our results are not confounded by other events (such as capital injections due to participation in the Trouble Asset Relief Program, peer effects, state tax changes, deposit insurance pricing changes, and other local time varying events) occurring around the time of the increase in the deposit insurance coverage. We also examine the internal validity of our estimations (by conducting placebo tests and using propensity score matched samples), and thus confirm the causal interpretation of our results.

The empirical findings of our study contribute to two strands of literature. First, we add to an emerging literature that examines the relationship between deposits and bank dividends. Kauko (2014) presents a theoretical exposition that combines dividend signaling theory and a bank run model. 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 higher percentage of deposits owned by institutional investors pay higher dividends. Complementing this literature, we use US data on insured and uninsured bank deposits to distinguish between the extent to which banks are affected by an 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 dividend payout. We

[3] Juelsrud and Nenov (2019) show theoretically that banks can use dividends to signal their available liquidity and provide short-term creditors with incentives to continue financing their assets and prevent a run.

[4] On 22nd September 2008, the FDIC launched an awareness campaign to reassure retail depositors that all funds within the coverage limit of $100,000 are safe (FDIC 2010). A few days later, US stock markets strongly reacted to presidential nominees' announcement of a plan to increase the coverage limit to $250,000. On 2nd October 2008, as part of the Economic Stabilization bill, the US Senate voted for the increase in deposit insurance and on October 3, 2008, President George W. Bush signed the Emergency Economic Stabilization Act of 2008, which temporarily raised the basic limit on federal deposit insurance coverage from $100,000 to $250,000 per depositor.

[5] Conducting our analysis at the bank holding company is likely to mask potential heterogeneity in the dividend policies adopted by subsidiary banks under the same parent bank company.

[6] We also find that the increase in the maximum level of deposit insurance coverage has no significant impact on share repurchases, an alternative means of channeling profits to shareholders. 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.

find that affected banks reduce dividends following an increase in the proportion of insured deposits. Therefore (and consistent with the signaling view), banks with greater deposit insurance coverage feel less compelled to signal financial strength to depositors.

Second, our study also contributes to ongoing debates regarding the merits of deposit insurance schemes relative to other forms of bank regulation and supervision (Calomiris and Jaremski, 2016). Both theoretical and empirical evidence suggests that deposit insurance can ameliorate the severity and frequency of bank runs (Diamond and Dybvig, 1983; Martin et al., 2018; Anginer and Demirgüç-Kunt, 2019). Despite this crucial role, deposit insurance has been criticized widely for inducing moral hazard and contributing to excessive risk-taking and risk-shifting behavior of banks (Keeley, 1990; Duan et al., 1992; Hovakimian and Kane, 2000; Guizani and Watanabe, 2016). Prior evidence suggests that while deposit insurance incentivizes risk-shifting, under certain conditions such behavior can be mitigated. For example, introducing risk sensitive premiums, coverage limits and co-insurance mitigates moral hazard and reduces incentives to shift risk (Hovakimian et al., 2003). González (2005) finds that deposit insurance increases bank charter value, and thus places a disciplining impact on increased risk-taking or risk-shifting. Chen et al. (2018) provide evidence that greater transparency increases the sensitivity of uninsured deposit flows to bank performance, thus enhancing the disciplining effect on bank risk-taking behavior. Our study lends support to the view that deposit insurance does not lead to risk-shifting behavior. Rather we find that banks reduce dividends, when the need for signaling lessens following an increase in deposit insurance coverage. Overall, the results of this study suggest that banks with more insured deposits pay fewer dividends as the need to signal financial strength to uninsured depositors is reduced.

The rest of this paper is organized as follows. In Section 2 we describe the empirical methodology. We present the data and summary statistics in Section 3. In Section 4, we present the results of our empirical analysis. Sensitivity checks are described in Section 5. Section 6 looks at share repurchases as an alternative payout method. Section 7 concludes.

2. Empirical methodology

2.1. Background

The financial crisis started in mid-2007 when problems with subprime mortgages caused major losses at US banks. This raised concerns about the solvency and liquidity of many financial institutions. With the failure of Lehman Brothers and Washington Mutual in September 2008, the crisis intensified into a full-blown banking panic. The US government first engaged in ad-hoc interventions to save a number of failing institutions, but was forced eventually to take a more coordinated approach. With the specific goal of stabilizing the US financial system and preventing a systemic collapse, US congress initiated the Emergency Economic Stabilization Act (EESA). The EESA included 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 qualifying financial institutions.

Another (less publicized) element of the EESA was the introduction of a temporary change to deposit insurance arrangements for federally insured banks. Section 136 of the Act provided for a temporary increase in the maximum limit of deposit insurance coverage provided by the Federal Deposit Insurance Corporation (FDIC (Federal Deposit Insurance Corporation), 2010). From enactment on October 3rd, 2008 until the end of 2009, the maximum insured amount per depositor increased from $100,000 to $250,000. On May 20th, 2009, this measure was extended for a four-year period

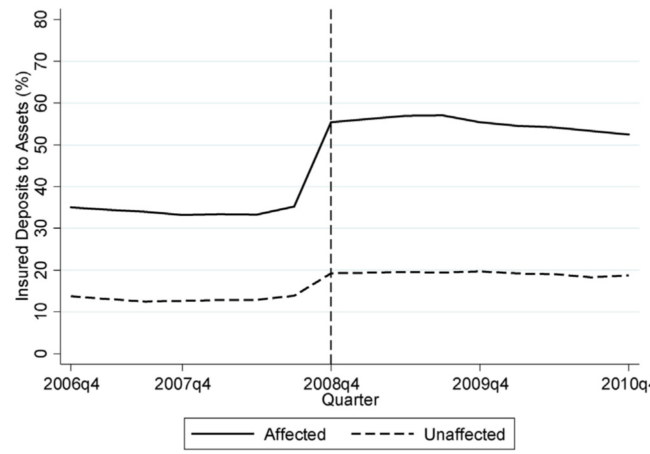

Fig. 1. US BHCs Insured Deposits in 2007Q1-2010Q4.
Note: This graph shows the evolution of the insured deposits to assets ratio (%) for affected and unaffected US BHCs over the period 2007Q1-2010Q4. The vertical dashed line marks the introduction of the increased deposit insurance coverage in 2008Q4.

(until December 31st, 2013) under the terms of Section 204 of the Helping Families Save Their Homes Act. With the passage of the Dodd-Frank Wall Street Reform and Consumer Protection Act in July 2010, the temporary increase in the maximum level of deposit insurance coverage became a permanent feature of the FDIC's deposit insurance regulation.

The increase in the maximum level of deposit insurance coverage in October 2008 had a differential impact across banks. Differences in banks' exposure to deposits that became subject to full insurance coverage meant that some banks were affected more by the new legislation.

2.2. Research design

To estimate the impact of deposit insurance on bank dividends, we rely on the increase in the coverage of insured deposits in the US banking system. The passage of the EESA Act in October 2008 provides a source of exogenous change in the extent to which bank deposits are insured. We use the variation in the quantity of insured deposits across banks to identify affected (treated) and unaffected (control) banks. Following prior literature, we classify banks into treatment and control groups, based on the ratio of insured deposits to total assets, as follows (Lambert et al., 2017).

In order to create the ratio of insured deposits to total assets at the bank holding company level, we aggregate the insured deposits of all subsidiary banks. We do the same for total assets. Subsequently, we calculate the difference in the ratio of insured deposits to total assets before (based on the initial $100,000 limit) and after (based on the new limit of $250,000) the increase in deposit insurance coverage. The bank holding companies are then assigned to four quartiles based on the increase in the insured deposit to total assets ratio. We retain only the top and bottom quartiles respectively in order to form our treated and control groups of banks. Fig. 1 illustrates the insured deposit to total assets ratio for our treated and control groups around the event quarter. Following the increase in deposit insurance coverage, the average increase in the ratio of insured deposits to total assets is 20 percentage points for the treated group of banks and five percentage points for the control group of banks.

To estimate the effect of deposit insurance on bank dividends, we use a difference-in-differences approach. This approach compares the difference in dividend payouts between the treated and

Table 1
Variable Definitions.

Variable	Definition
Panel A: Variables used in main analysis	
DPE	Total cash dividends paid to common shareholders divided by total equity capital
Affected	A binary variable that equals one if banks are affected by the increase in deposit insurance coverage and zero otherwise
Post Event	A binary variable that equals one for quarters after 2008Q4 as the event quarter of deposit insurance coverage increase and zero otherwise
Size	Size of banks as measured by the natural logarithm of total assets
Profitability	Bank profitability as measured by return on assets (net income divided total assets)
Liquidity	Bank liquidity as measured by total cash balance divided by total assets
Capital	Bank capital as measured by total equity capital divided by total assets
Risk	Bank loan portfolio risk as measured by non-performing loans divided by total loans
Charter Value	Bank charter value measured by the (demeaned) ratio of demand deposits to total assets
Deposit Dependence	Bank deposit dependence measured by the (demeaned) ratio of deposits divided by the sum of equity and non-deposit debt
TARP	Binary variable equal to one if a bank received government funding and zero otherwise
Panel B: Variables used in sensitivity analyses	
Tax	State level statutory corporate income tax rate
Peer	Peer effect is defined as the average dividend to equity of all banks in state *s* except bank *i* in quarter *t*
High Assessment	A binary variable that equals one if the growth rate of a bank's insurance costs is above the sample median value and zero otherwise
Trans Accounts	Transactions accounts is defined as the ratio of non-interest bearing amounts over $250,000 to total domestic deposits
Dividends	The natural logarithm of one plus the dollar amount of dividends paid by a bank in a quarter
RPE	Share repurchases divided by total equity capital. Share repurchases are defined as the sum of treasury stock purchases and net conversions and retirement of common stock

control banks in the pre- and post-event periods. We estimate regressions of the form:

$$Y_{i,t} = \beta_1 \left(Affected_i{}^{*}Post\ Event_t\right) + \delta X_{i,t-1} + \nu_i + \gamma_t + \varepsilon_{i,t} \quad (1)$$

where *i* indexes bank and *t* indexes time. $Y_{i,t}$ denotes the dividends to total equity ratio (in line with prior literature on bank payout policy, Kanas, 2013; Onali, 2014; Onali et al., 2016). $Affected_i$ is a dummy variable equal to one that captures whether a bank was affected by the increase in deposit insurance coverage in 2008Q4, and zero otherwise. $Post\ Event_t$ 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 an interaction term which takes the value of one if the bank was affected by the increase in deposit insurance coverage in the post-event period, and zero otherwise. β_1 is the coefficient of interest, which represents the impact of the increase in deposit insurance coverage on bank dividends. A negative (positive) value of β_1 would indicate that affected banks decrease (increase) dividends, in line with the signaling (risk-shifting) view.

$X_{i,t-1}$ represents a vector of bank-level control variables that vary across banks and over time. These control variables include bank size, profitability, liquidity, capital and 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 dividend policy, but the precise direction of this relationship is ambiguous (DeAngelo et al., 2006). An increase in cash holdings could reflect a lack of growth opportunities, in which case these cash holdings would be distributed to shareholders (Jensen, 1986). However, 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. The expected sign on capital is also ambiguous, given that well capitalized 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, risk (measured by a non-performing loans 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. Table 1 provides a full list of variables included in the model along with their respective definitions. The model also includes time fixed effects, γ_t, to capture time effects common to all banks, as well as, bank fixed effects, ν_i, to control for unobserved bank heterogeneity. $\varepsilon_{i,t}$ is a stochastic error term.

Our dependent variable (dividends to total equity ratio) does not assume negative values. This renders estimates obtained from standard ordinary least squares (OLS) inconsistent (Wooldridge, 2002). We estimate Eq. (1) using a censored normal regression Tobit model with fixed effects instead (Honoré, 1992). This estimator takes into consideration the nature of our dependent variable and is consistent and asymptotically normal in the presence of bank fixed effects.[7]

A key 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 empirical analysis below, we perform a variety of checks to ensure that the parallel trend assumption is satisfied.

3. Data and summary statistics

We collect the financial data of US bank holding companies (BHCs) from the S&P Global Market Intelligence database. Our sample period spans 16 quarters from 2007Q1 to 2010Q4. This period straddles the increase in deposit insurance coverage that took place in 2008. 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 BHC. Merging data on insured deposits aggregated at the BHC level, with financial data drawn from S&P Global results in 973 unique BHCs. Assigning banks to treatment and control groups as described in Section 2

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

Table 2
Summary Statistics.

	All BHCs				Affected BHCs				Unaffected BHCs			
	N	Mean	Median	Std	N	Mean	Median	Std	N	Mean	Median	Std
Panel A: Variables used in main analysis												
DPE	6323	0.0077	0.0023	0.0137	3070	0.0075	0.0000	0.0143	3253	0.0078	0.0035	0.0132
Size	6321	14.1650	13.7628	1.3573	3069	13.8075	13.6660	0.7968	3252	14.5023	13.9716	1.6577
Profitability	6303	0.0005	0.0016	0.0066	3057	−0.0001	0.0016	0.0077	3246	0.0010	0.0016	0.0054
Liquidity	6321	0.0461	0.0300	0.0472	3069	0.0481	0.0325	0.0424	3252	0.0443	0.0281	0.0512
Capital	6321	0.0876	0.0828	0.0445	3069	0.0840	0.0827	0.0300	3252	0.0910	0.0829	0.0546
Risk	6316	2.7202	1.3800	3.6972	3069	3.2485	1.7300	4.1889	3247	2.2209	1.1900	3.0815
Charter Value	6323	0.0000	−0.0164	0.0626	3070	0.0039	−0.0122	0.0590	3253	−0.0030	−0.0187	0.0652
Deposit Dependence	6323	0.0000	−0.4022	2.8592	3070	0.7164	0.1718	3.3615	3253	−0.6761	−0.9929	2.0704
TARP	6323	0.3454	0.0000	0.3454	3070	0.3013	0.0000	0.4588	3253	0.3870	0.0000	0.4871
Panel B: Variables used in sensitivity analyses												
Tax	6312	0.0622	0.0650	0.0292	3059	0.0544	0.0600	0.0308	3253	0.0696	0.0710	0.0254
Peer	6323	0.0083	0.0075	0.0062	3070	0.0083	0.0074	0.0070	3253	0.0083	0.0076	0.0054
High Assessment	6323	0.4373	0.0000	0.4961	3070	0.3798	0.0000	0.4854	3253	0.4915	0.0000	0.5000
Trans Account	5138	0.0319	0.0000	0.0939	2485	0.0227	0.0000	0.0497	2653	0.0406	0.0000	0.1208
Dividends	6323	4.0771	5.5909	3.8147	3070	3.4069	0.6931	3.5211	3253	4.7096	6.0661	3.9704
RPE	6323	0.0029	0.0000	0.0137	3070	0.0022	0.0000	0.0137	3253	0.0035	0.0000	0.0137
No. of banks	425				212				213			

Note: This table reports summary statistics for the variables in our analysis. It tabulates the number of observations (N), means, medians, and standard deviations (Std) for all banks, affected banks, and unaffected banks separately. The sample is comprised of 425 US bank holding companies over the period from 2007Q1 to 2010Q4. *Deposit Dependence* is demeaned to ease the interpretation of the analysis. Variable definitions can be found in Table 1.

Table 3
Test of Parallel Trend Assumption.

Variables	Mean growth of control group	Mean growth of treatment group	Difference	p-value
Dividend-to-equity growth	−0.0006	−0.0009	0.0003	0.6667

Note: This table presents the result of a test of the parallel trend assumption by comparing the mean growth rate of the dependent variable between treatment and control groups during the pre-treatment period.

results in a final sample of 425 unique BHCs (212 treated and 213 control banks) with 6,323 BHC-quarter observations.

Of our sample of 425 banks, 360 (85 %) paid dividends at least once during the sample period. In terms of observations, 43 % of dividend observations are zero.[8] Table 2 provides the summary statistics on the number of observations, means, medians, and standard deviations for the full sample as well as for affected and unaffected banks. The average dividend to equity ratio for the full sample is 0.77 %. Affected and unaffected banks are similar in terms of this measure. Specifically, the mean value of dividend to equity ratio for affected banks and unaffected banks is 0.75 % and 0.78 % respectively. Unaffected banks are on average slightly larger and better capitalized, more profitable, but less liquid (hold less cash) than affected counterparts. In Section 5, using a propensity score matched sample, we provide evidence that our findings are not driven by these differences in the characteristics of banks

Table 3 reports the results from an initial investigation of the parallel trend assumption. (Further test results are reported in Section 5). The results indicate that the parallel trend assumption is satisfied with growth in dividends during pre-treatment period being statistically identical across treated and control groups. Fig. 2 provides a graphical illustration of this finding. In the years prior to 2008Q4 (pre-treatment period), the dividend to equity ratios of affected and unaffected banks evolve along overlapping (parallel) paths. From 2008Q4, we observe diverging trends for the two groups as the dividend to equity ratio of affected banks declines by more than that of unaffected banks.

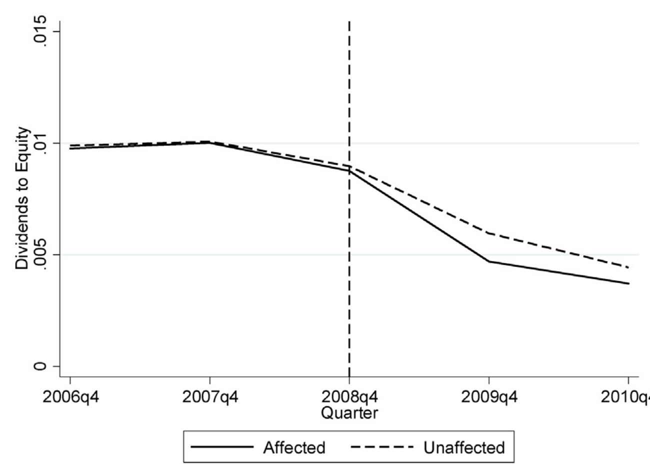

Fig. 2. US BHCs Dividends in 2007Q1-2010Q4.
Note: This graph shows the evolution of the dividend to equity ratio for affected and unaffected US BHCs over the period 2007Q1-2010Q4. The vertical dashed line marks the introduction of the increased deposit insurance coverage in 2008Q4.

4. Results

Table 4 presents the main regression results. The coefficient of the difference-in-differences (DID) interaction term, β_1 (in column 1) is negative and statistically significant at the 1% level. The point estimate suggests that the dividend to equity ratio for affected banks declines by 58 basis points. This decline is also economically significant; affected banks reduce dividends by \$11.6 million.[9] This is a large reduction relative to the \$15.4 million dividend paid by

[8] This justifies the use of Tobit estimator (censored regression) for our analysis.

[9] Economic significance is calculated by multiplying the coefficient of interaction term by the amount of equity of an average bank in our sample.

Table 4
Deposit Insurance and Bank Payout Policy - Main Results.

	(1)	(2)	(3)	(4)
Affected x Post Event	−0.0058***	−0.0057***	−0.0056***	−0.0065***
	(0.0019)	(0.0022)	(0.0020)	(0.0021)
Affected x Post Event x Charter Value		−0.0003		
		(0.0169)		
Affected x Post Event x Deposit Dependence			−0.0019*	
			(0.0011)	
Affected x Post Event x TARP				0.0031
				(0.0025)
Size	0.0117**	0.0110**	0.0116**	0.0107*
	(0.0058)	(0.0056)	(0.0057)	(0.0057)
Profitability	0.8577***	0.8486***	0.8446***	0.8600***
	(0.3107)	(0.3109)	(0.3053)	(0.3112)
Liquidity	−0.0204	−0.0196	−0.0245	−0.0215
	(0.0137)	(0.0143)	(0.0158)	(0.0138)
Capital	0.2472***	0.2555***	0.2744***	0.2395***
	(0.0778)	(0.0779)	(0.0856)	(0.0779)
Risk	−0.0031***	−0.0031***	−0.0032***	−0.0031***
	(0.0005)	(0.0005)	(0.0005)	(0.0005)
Charter Value		−0.0141		
		(0.0281)		
Deposit Dependence			0.0004	
			(0.0008)	
Bank fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes
Observations	6298	6298	6298	6298
No. of banks	425	425	425	425

Note: This table reports the results of Tobit (censored) regressions using a sample of 425 US BHCs in 2007Q1-2010Q4. The dependent variable is the dividend to equity ratio. Column 1 investigates the effect of the increase in the deposit insurance coverage on bank dividend policy. The variable of interest is *Affected x Post Event*, which indicates the difference of payout changes between affected and unaffected banks following the increase in deposit insurance coverage. Column 2 investigates the moderating effect of charter value on the impact of deposits insurance on bank dividend policy. *Charter Value* is defined as the demeaned ratio of demand deposits to total assets. Column 3 investigates the moderating effect of capital structure on the impact of deposit insurance on bank dividend policy. *Deposit Dependence* is the demeaned ratio of total deposits to the sum of equity and total debt issued by each bank. Column 4 investigates heterogeneity in the reaction of affected banks following the increase in deposit insurance coverage on the basis of them receiving TARP funding or not. In all regressions, we include a set of control variables (Size, Profitability, Liquidity, Capital, and Risk) as defined in Table 1. Quarter fixed effects are also included in all models. The models are estimated using Honoré's (1992) fixed-effect Tobit estimator, which allows to control for unobserved time-invariant characteristics among banks in our sample. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

the average bank in the sample. We further investigate whether banks, faced with an increase in deposit insurance coverage change their dividend policies based on their respective charter values. That is, banks with lower charter values may be more inclined to exploit the increase in the public subsidy (in the form of the deposit insurance) than counterparts with a higher charter value (Keeley, 1990; Acharya et al., 2017). To this end (and following prior literature) we use *Charter Value*, which is defined as the ratio of demand deposits to total assets, to proxy for bank charter value (Hutchison and Pennacchi, 1996; Goyal, 2005; Onali, 2014). Specifically, we introduce *Charter Value* and its interaction with *Affected* x *Post Event* in Eq. (1) and re-estimate the model.[10] The results are presented in column 2 of Table 4. The triple interaction term does not enter the regression with a statistically significant coefficient. This suggests that charter value does not play a significant role in determining how bank dividends respond to a change in deposit insurance coverage.

The results of our empirical analysis thus far indicate that banks reduce dividends in response to higher deposit insurance coverage. While bank managers may use dividends as a device to signal financial health to uninsured depositors (Kauko, 2014; Forti and Schiozer, 2015; Floyd et al., 2015), that same signal is also received by other stakeholders. Shareholders may react negatively to reductions in dividend payouts, given the negative implications for their wealth. Debtholders, on the other hand, are likely to view dividend reductions more favorably as these conserve cash during periods of financial difficulty and avoid risk-shifting. Prior empirical evidence however suggests that debtholders' reaction to dividend reductions is negative (Woolridge, 1983; Handjinicolaou and Kalay, 1984), with adverse effects on the cost of debt (Mathur et al., 2013), which could result in a run by creditors (Acharya et al., 2011; Juelsrud and Nenov, 2019). Therefore, managers faced with an increased deposit insurance coverage may be inclined to moderate the amount of any dividend reduction based on their dependence on equity and non-deposit debt (relative to deposits) for financing operations.

To investigate this possibility, we construct *Deposit Dependence* equal to the ratio of deposits to the sum of equity and non-deposit debt. Subsequently, we re-estimate Eq. (1) with *Deposit Dependence*, and its interaction with *Affected* x *Post Event*. *Deposit Dependence* is demeaned such that the *Affected* x *Post Event* dummy shows the impact for the average bank, while the coefficient on the interaction term with *Deposit Dependence* indicates the impact of a change in the bank's dependence on deposits. The results are presented in column 3 of Table 4. The coefficient on the triple interaction term enters with a negative sign, and is statistically significant at the 10 % level. That is, affected banks that are more dependent on deposits relative to equity and non-deposit debt funding reduce dividends more than their less dependent counterparts. This suggests that the capital structure of the bank influences its decision to reduce dividends in response to the increase in deposit insurance coverage.

During our sample period, a number of banks received capital infusions via the Troubled Asset Relief Program (TARP). These capital infusions could influence banks' dividend policies by altering the risk-taking incentives of bank shareholders (Black and Hazelwood, 2013; Duchin and Sosyura, 2014). Therefore, we investigate whether TARP participation created heterogeneity in the way banks faced with an increase in deposit insurance coverage change their dividend policy. We re-estimate Eq. (1) augmented with an

[10] We demean *Charter Value* to ease the interpretation of the triple interaction term.

interaction term comprising *TARP* (a dummy variable that is equal to one if a bank received TARP funding and zero otherwise) and *Affected* x *Post Event*. The results are presented in column 4 of Table 4. The coefficient on the triple interaction term enters with a positive sign, but it is statistically insignificant at the usual levels of significance. This suggests that TARP participating banks do not change their dividend policies in a way that is different from non-participating banks when faced with an increase in deposit insurance.[11]

Turning to our control variables we focus our discussion on the baseline specification (column 1), although the results are robust across all specifications reported in Table 4. Specifically the coefficients on both *Size* and *Profitability* are positive and statistically significant at the 5% and 1% level, respectively, suggesting that larger and more profitable banks pay higher dividends (Fama and French, 2001; Denis and Osobov, 2008; Forti and Schiozer, 2008). *Liquidity* enters the regression with a negative but statistically insignificant coefficient. We also find that better capitalized banks pay higher dividends as indicated by the positive and statistically significant coefficient on *Capital*. This is in line with the notion that poorly capitalized banks face greater regulatory constraints in distributing cash flows to shareholders (Abreu and Gulamhussen, 2013; Onali, 2014). Finally, in line with prior literature, the negative coefficient on *Risk* suggests that banks facing higher loan portfolio risk pay lower dividends in an effort to build up capital (Forti and Schiozer, 2015).

Overall, our results suggest that banks with more insured deposits pay fewer dividends as the need to signal financial strength to uninsured depositors is reduced. Our findings largely support those of Floyd, Li and Skinner (2015) who contend that unlike industrial firms, banks distribute cash to shareholders in order to signal their financial strength. They are also in line with recent theoretical and empirical evidence which suggests that dividends signal bank quality during a time of uncertainty (Acharya et al., 2017; Juelsrud and Nenov, 2019).

5. 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.

5.1. TARP capital injections

The validity of our approach would be undermined if factors other than the increase in the deposit insurance coverage are 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 troubled banks via the Troubled Asset Relief Program (TARP). As a result, TARP participating banks faced restrictions on dividend payouts (Bayazitova and Shivdasani, 2011; Calomiris and Khan, 2015). Specifically, banks that received TARP funding were not allowed to increase dividends above pre-TARP levels. Therefore, the TARP program could have an effect on bank payout policy similar to that attributed to the increase in 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. This restriction results in a reduction in our sample from 425 to 282 non-TARP banks (151 treated and 131 control). We then re-estimate Eq. (1). The results of this analysis are presented in column 1 of Table 5. The coefficient on the interaction term of interest remains negative and statistically significant. This suggests that our main findings are not driven by the capital infusions and restrictions on payout policy following the introduction of TARP.

5.2. State corporate income tax

Another source of shock that could confound the results of our analysis are changes in the state corporate income tax facing banks in our sample. Tax rate changes have been shown to influence bank dividend policies. For instance, Hemmelgarn and Teichmann (2014) find that in response to tax rate changes, banks adjust capital structure via an adjustment to dividend payments.[12] If tax rates in states where treated banks are located were decreased around the same time as the increase in deposit insurance coverage, then this could mimic the observed impact of deposit insurance on dividends. In order to check the robustness of our findings to changes in state taxation we re-estimate Eq. (1), augmented with *Tax*, the statutory corporate income tax rate in each state, and its interaction term with *Affected*.[13] The results of this analysis, which are presented in column 2 of Table 5, indicate that both new variables enter the regression with statistically insignificant coefficients, while the coefficient on the interaction term of interest (*Affected* x *Post Event*) remains negative and statistically significant. This finding indicates that state taxation does not explain our main results.

5.3. Peer effects

We also investigate peer effects as a potential confounder to our findings. Prior studies provide evidence that peer effects are important for a number of corporate policies, including: corporate governance (John and Kadyrzhanova, 2008); fixed capital investment and research and development (Patnam, 2011); capital structure (Leary and Roberts, 2014); and dividends (Adhikari and Agrawal, 2018; Grennan, 2019). Therefore, we explore whether our findings are driven by peer-influenced dividend changes rather than signaling reasons. In order to check the robustness of our findings to bank peer effects, we re-estimate Eq. (1) by incorporating a measure of peer influence based on the location of bank headquarters. That is, we define peer banks as those banks that operate in the same state. Following prior literature, we define peer influence, $Peer_{-i,s,t}$, as the average dividend to equity of all banks in state *s* except bank *i* in quarter *t* (John and Kadyrzhanova, 2008; Adhikari and Agrawal, 2018; Grennan, 2019). The results, which are tabulated in column 3 of Table 5, indicate that $Peer_{-i,s,t}$ is statistically insignificant, while the interaction term of interest (*Affected* x *Post Event*) retains its sign and significance. These results suggest that peer effects do not drive our main findings.

5.4. Local events

We also explore the possibility that the observed reduction in dividends arises from unexpected events at the local level and not from the increase in deposit insurance coverage. To rule out this possibility, we estimate an augmented version of Eq. (1) where we add state-quarter fixed effects. In doing so, any confounding factor that varies by state and quarter is absorbed in the state-quarter fixed effects, and cannot explain any of our regression findings. The

[11] As part of our robustness tests, we further control for confounding effects from TARP by excluding TARP banks from our sample (see Section 5).

[12] To raise equity capital in response to a reduction in the corporate tax burden, banks can rely on a number of instruments. A reduction in the distribution of dividends represents a less costly alternative to raising capital relative to issuing new capital.

[13] State level statutory corporate income tax rates are collected from various publications of the US Master Multistate Corporate Tax Guide.

Table 5
Confounding Events.

	Non-TARP Banks (1)	State Corporate Income Tax (2)	Peer Effects (3)	Local Events (4)	Insurance Premiums (5)	TAG Costs (6)
Affected x Post Event	−0.0102***	−0.0057***	−0.0058***	−0.0064***	−0.0070***	−0.0069***
	(0.0028)	(0.0019)	(0.0019)	(0.0022)	(0.0023)	(0.0025)
Tax		0.0365				
		(0.0975)				
Affected x Tax		−0.0222				
		(0.1940)				
Peer			−0.0087			
			(0.0729)			
Affected x Post Event x High Assessment					0.0013	
					(0.0038)	
Trans Accounts						−0.0035
						(0.0110)
Affected x Post Event x Trans Accounts						0.0102
						(0.0131)
Bank level controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
State x Quarter fixed effects	No	No	No	Yes	No	No
Observations	4122	6287	6298	6298	6298	5120
No. of banks	282	424	425	425	425	342

Note: This table presents results of the effect of the increase in the limit of deposit insurance coverage on bank dividends, while considering potential confounding events. The dependent variable is the dividend to equity ratio. The main variable of interest is *Affected x Post Event*, an indicator variable equal to one for banks affected by the increase in the limit of deposit insurance coverage when it comes into effect, and zero otherwise. The set of control variables include Size, Profitability, Liquidity, Capital, and Risk. To rule out the role of TARP capital injections received by banks in our sample column 1 presents estimates from a restricted sample excluding TARP recipient banks. Column 2 includes *Tax*, which captures the state statutory corporate income tax, and its interaction term with the dummy for treated banks, *Affected*, to alleviate concerns that tax changes across states drive our results. Column 3 includes the variable *Peer* to consider the peer effects on banks dividend policy. Peer is defined as the average dividend to equity of all banks in state *s* except bank *i* in quarter *t*. Column 4 estimates Eq. (1) saturated with state by quarter fixed effects to capture unobserved state specific time varying unobserved characteristics. Columns 5 and 6, respectively, include *High Assessment* and *Trans Accounts* and their interaction terms with *Affected x Post Event* to capture any increases in insurance costs after the increase in deposit insurance coverage level. *High Assessment* is a dummy variable equal to one if the growth rate of a bank's insurance costs is above the sample's median value, and zero otherwise. *Trans Accounts* is defined as the ratio of non-interest bearing amounts over $250,000 to total domestic deposits. Quarter fixed effects are also included in all models. All specifications are estimated using Honoré's (1992) fixed-effect Tobit to control for unobserved time-invariant characteristics among banks in our sample. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

results of this analysis, presented in column 4 of Table 5, indicate that the interaction term of interest (*Affected* x *Post Event*) remains negative and retains its magnitude and significance. These results suggest that events at the local level (state-quarter varying unobserved variables) are not driving our findings.

5.5. Deposit insurance pricing

Next, we investigate whether changes in the pricing of deposit insurance could be driving our results. Although Section 136 of the EESA exempts the temporary increase in deposit insurance coverage from banks' insurance assessments, other FDIC initiatives including changes in the assessment rates and the Transaction Account Guarantee program (TAG) are likely to have increased the cost of deposit insurance.[14] If insurance related costs are changed substantially for the affected banks after the increase in deposit insurance coverage, this could reduce bank profitability and result in a (mechanical reduction) in dividends. To address such concerns, ideally we would like to be able to control for the growth rate of the assessments paid by banks in our baseline regression for the entire period under investigation. However, as such data have become confidential in nature since 2009Q2, we instead calculate the growth rate in banks' insurance costs from 2008Q3 to 2009Q1 (i.e. for the quarters surrounding the increase in deposit insurance coverage that took place in 2008Q4). Subsequently, we construct *High Assessment*, a dummy variable equal to one if the growth rate of a bank's insurance costs is above the sample's median value, and zero otherwise. We re-estimate Eq. (1) augmented with the interaction term *High Assessment* x *Affected* x *Post Event.* The separate inclusion of *High Assessment* in Eq. (1) is not possible as the variable is spanned by the bank fixed effects. A negative and statistically significant coefficient on the triple interaction term would imply a mechanical reduction in dividends as a result of increased insurance costs. The results of this analysis, which are presented in column 5 of Table 5, suggest that this is not the case and thus confirm our main findings.

Further, we control for the costs banks face when insuring the full amount of non-interest bearing transaction accounts in excess of the $250,000 deposit insurance coverage in Eq. (1). Banks participating in the TAG program faced a 10 basis point annual surcharge applied to non-interest bearing transaction deposit amounts over $250,000. In particular, we augment Eq. (1) with *Trans Accounts*, defined as the ratio of non-interest bearing amounts over $250,000 to total domestic deposits, and its interaction term with *Affected* x *Post Event*, and re-estimate it. The results of this specification are presented in column 6 of Table 5. We find that the coefficient on the triple interaction term is statistically insignificant, while the interaction term *Affected* x *Post Event* enters the regression with a negative and statistically significant coefficient. These results confirm our main findings.

5.6. 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 behavior of the banks assigned to the control group. This so-called parallel trends assumption is key to the validity of our

[14] The TAG provided a temporary guarantee for funds held in non-interest bearing transaction accounts above the $250,000 coverage limit. The program was established by the FDIC on October 14, 2008, and came into effect on December 19, 2008. The program set the premium at 10 basis points for all participating banks. The TAG program established by the FDIC expired on December 31, 2010.

identification strategy (Abadie, 2005). We complement the investigation of the parallel trends assumption reported in Section 3 (Table 3) by conducting a placebo test, where we falsely assume that the increase in deposit insurance coverage was introduced in 2006Q4 rather than in 2008Q4. We use a period spanning sixteen-quarters surrounding the false change to 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 the placebo test.

Column 1 of Table 6 presents the results of this test. The coefficient on the interaction term (*Affected* x *Placebo Post Event*) is statistically insignificant. 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. The results above provide confidence 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 2 of Table 6, show that the magnitude of the coefficient of interest remains unchanged and our main conclusions still hold.

5.7. Serial correlation

Serially correlated errors in a difference-in-differences estimation can result in a downward bias in any estimated standard errors (Bertrand et al., 2004). To alleviate concerns regarding serial correlation, we collapse our sample into two time periods. That is, we average the data for the period before and after the increase in deposit insurance coverage. The results, which are reported in column 3 of Table 6 confirm our main findings.

5.8. Alternative measure of dividend payout

We also investigate the sensitivity of our findings to alternative measures of bank dividends. A number of alternative measures of dividend payouts including the dollar amount of dividends (Chetty and Saez, 2005), dividend per share and dividend yield (Cziraki et al., 2019) are used in the extant literature. Given erroneous data for the number of outstanding shares reported by a number of banks as well as lack of market information for unlisted banks in our sample, we employ the dollar amount of dividends as an alternative dependent variable for Eq. (1). Specifically, we define *Dividends* as the natural logarithm of one plus the dollar amount of dividends paid by a bank in a quarter. Column 4 of Table 6 shows that the interaction term *Affected* x *Post Event* remains significantly and negatively associated with this alternative measure of bank dividends. This further illustrates the robustness of our main findings.

5.9. Sample selection issues

We also investigate whether our results are driven by a bias in sample selection. Our classification of banks into treated and control groups is based on the ratio of insured deposits to assets following the increase in deposit insurance coverage. This is due to the difference in the value of deposits greater than $100,000 across institutions just before the change in the deposit insurance coverage came into effect. 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 interpretation of our conjecture. This could be the case if the treated group of banks reduced dividends more than counterparts in the control group during recessions, but not in 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 comprise capital, asset quality, earnings, liquidity, and size.

Following Berger and Roman (2015), we construct matched samples of banks using three different matching methods. First, we conduct a one-to-one matching, which matches each treated bank to the nearest-neighboring bank in the control group. This matching is performed with replacement such that one control bank could act as the closest match for multiple treated banks. This matching results in a sample of 320 banks (212 treated and 108 control banks). We also conduct a nearest neighboring matching with n = 2 with replacement, which matches each treated bank with two banks from the control group. Finally, we also perform a nearest-neighbor matching with n = 3 with replacement. Table 7 presents the difference-in-differences estimates using the aforementioned matched samples. The results are qualitatively similar to those obtained from the unmatched sample, and thus lend support to the signaling hypothesis.

6. Share repurchases

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. Indeed, share repurchases have seen a sharp increase over the past twenty years (Hirtle, 2004; Floyd et al., 2015). However, it remains unclear whether dividends and share repurchases act as substitutes or complements in distributing cash to shareholders and this could matter for whether deposit insurance impacts on banks' share repurchase activity.

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.[15] That is, theory does not treat 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, and applying the same reasoning used for dividends above, 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.

Nonetheless, it is equally likely that the dividend 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 (Guay and Harford, 2000; Jagannathan et al., 2000; Bonaimé et al., 2013). As a consequence,

[15] 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.

Table 6
Robustness Checks.

	Placebo event 2006Q4 (1)	Covariates exclusion (2)	Two-period sample (3)	Alternative measure of dividend payout (4)
Affected x Placebo Post Event	0.0001 (0.0014)			
Affected x Post Event		−0.0063*** (0.0021)	−0.0024** (0.0012)	−0.645*** (0.251)
Bank level controls	Yes	No	Yes	Yes
Bank fixed effects	Yes	Yes	Yes	Yes
Quarter fixed effects	Yes	Yes	No	Yes
Observations	5861	6323	841	6298
No. of banks	425	425	425	425

Note: This table presents the results of a number of robustness tests on the effect of deposit insurance on bank dividends as well as on the validity of the "parallel trend" assumption. In column 1, we create a hypothetical event 2 years prior to the actual event in 2008Q4. The results are estimated using a sample spanning the period before the actual increase in the deposit insurance coverage. In column 2, we exclude covariates from the main model. In column 3, following Bertrand et al. (2004), we collapse our dataset into a two-period panel by averaging the observations before and after the change in the deposit insurance coverage, respectively. In column 4, the dependent variable is replaced with the (log of) the dollar amount of dividends plus one. All models are estimated using Honoré's (1992) fixed-effect Tobit estimator to control for unobserved time-invariant characteristics among banks in our sample. Standard errors are reported in parentheses. ***,**, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

Table 7
Further Robustness Checks - Matched Samples.

	N=1 (1)	N=2 (2)	N=3 (3)
Affected x Post Event	−0.0089*** (0.0026)	−0.0072*** (0.0022)	−0.0072*** (0.0022)
Bank level controls	Yes	Yes	Yes
Bank fixed effects	Yes	Yes	Yes
Observations	4744	5438	5721
No. of banks	320	364	382

Note: This table reports the results of Tobit (censored) regressions using matched samples based on different matching methods. We match treated and control banks based on their fundamentals (size, profitability, capital, liquidity, and risk) and using the nearest neighbor matching method with N=1,2 or 3 and with replacement.

Table 8
Deposit Insurance and Bank Share Repurchases.

Affected x Post Event	−0.0455 (0.0324)
Size	0.0486** (0.0247)
Profitability	0.3071 (0.9653)
Liquidity	0.0638 (0.0925)
Capital	0.5180 (0.4772)
Risk	−0.0045 (0.0032)
Bank fixed effects	Yes
Quarter fixed effects	Yes
Observations	6298
No. of banks	425

Note: This table reports the results of Tobit (censored) regressions using a sample of 425 US BHCs in 2007Q1-2010Q4. The dependent variable is the share repurchases to equity ratio. The variable of interest is *Affected x Post Event*, which indicates the difference of share repurchase changes between affected and unaffected banks following the increase in deposit insurance coverage. Quarter fixed effects are also included. The model is estimated using Honoré's (1992) fixed-effect Tobit estimator, which allows to control for unobserved time-invariant characteristics among banks in our sample. Standard errors are reported in parentheses. ***, **, and * indicate significance at the 1 %, 5 %, and 10 % level, respectively.

we would expect a change in the deposit insurance coverage to have no impact on banks' share repurchase activity. Thus the deposit insurance effect on share repurchases may depend on whether banks view share repurchases as a substitute or a complement to dividends, which is, therefore, ultimately an empirical question.

To test this, we estimate Eq. (1) with share repurchases to total equity as the dependent variable (RPE). Following Hirtle (2016) we define share repurchases as the sum of treasury stock purchases and net conversions and retirement of common stock. In this regression, we include the same set of bank control variables and fixed effects as in the baseline model. The results are reported in Table 8. The negative and insignificant coefficient for the difference-in-differences interaction term, β_1, indicates that following the increase in deposit insurance coverage there is little change in share repurchase activity for affected banks. This is in line with the view that share repurchases are pro-cyclical and more flexible than dividends, while dividends are sticky, and can be interpreted as a signal (Guay and Harford, 2000; Jagannathan et al., 2000; Bonaimé et al., 2013). Therefore, the findings that affected banks reduce dividends once the deposit insurance coverage increases, but do not adjust their repurchases, further supports the view that dividends are used by banks to signal financial health to depositors.

7. Conclusions

In this study, we investigate the impact on the dividend payouts of US banks following a change in deposit insurance coverage (from \$100,000 to \$250,000). 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 to overcome identification concerns, we investigate whether there is a causal link from deposit insurance to bank dividends.

Using a difference-in-differences approach, we show that following the increase in deposit insurance coverage, affected banks pay lower dividends than unaffected counterparts. This reduction is also economically significant and not driven by heterogeneity across bank charter values. On average, affected banks lower their dividends by \$11.6 million following the deposit insurance increase. This suggests that banks with a large reduction in uninsured deposits pay lower dividends due to a reduced need to signal financial health to depositors. We also find that capital structure moderates the impact of deposit insurance on bank dividends. For banks with greater reliance on deposits as a funding source, an increase in the deposit insurance coverage is associated with a larger reduction in dividends. An exhaustive series of additional tests suggest that our findings are not attributable to other possible considerations such as: capital injections due to participation in the Trouble Asset Relief Program; peer effects; changes in state taxation; changes in the pricing of deposit insurance; and other local time varying events.

Overall, our findings are consistent with our priors that increases in deposit insurance coverage reduce the need for banks to use dividends in order to convey positive information regarding financial health to depositors. As such, our findings contribute to a growing evidence base, which suggests that deposits play an important role in determining dividend payout policy, and that banks pay dividends to signal financial strength to depositors. Our findings also cast doubt on the view that following increases in deposit insurance coverage, banks use dividends as a tool to shift risk from shareholders to depositors (and taxpayers in general).

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 to 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 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, an increase in the maximum level of deposit insurance coverage appears to lessen the need for banks to signal financial health via dividend payouts.

Given the permanent nature of the increase in deposit insurance coverage used in the current setting, our results do not explain how bank dividend payouts respond to a reduction in the maximum level of coverage. Consequently, future research could usefully address whether bank dividend payouts respond differently to: decreases in deposit insurance coverage; and changes in deposit insurance coverage during non-crisis periods when there is potentially less need for banks to signal financial strength (via dividend payments) to outside stakeholders.

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