1. Introduction

Recent decades witness the fast-changing in banking sector when banks are increasingly moving toward non-traditional banking activities, generally considered more complex and riskier. This in turn challenges understaffed regulators with their limited supervisory tools to accurately and timely monitor and control banks (Bliss and Flannery (2002), Tran, Hassan, and Houston (2019)). That is why regulators are drawn to the idea of harnessing the join forces from the private sectors. Meyer (1999) highlights that market discipline from outsiders is considered as a complement tools to the traditional regulatory discipline and will bring many benefits while regulators' resources (including human and knowledge) are restricted.

Under a market-based perspective, creditors ask for higher premium when perceiving a higher bank risk-taking profile. By punishing excessive risks via demanding higher yield *and/or* requesting for the funds back, they could force banks' discretionary behaviors back toward the acceptable level of risks. That ultimately contributes to enhance the system stability. These arguments in turn suggest crucial question on the mechanism through which outsiders can distinguish a "good" bank from a "bad" one. A large body of finance literature demonstrate the signaling effect of dividend policy. In contrast to non-financial firms that tend to decrease their payout ratio during the crisis, banking firms are reluctant to cut dividends even during the crisis (Floyd, Li, and Skinner (2015)) since the information embedded in bank dividend policy can convey banks' financial health to outsiders (Tripathy, Wu, and Zheng (2021)).

This study aims to shed light on this signaling effects of bank dividend policy by providing one of the first investigation on how depositors respond to bank dividend policy. This question is important and certainty of interest of regulators since almost 80% of bank liabilities are composed from bank deposits, and that is an important determinant of financial stability (Iyer, Puri, and Ryan (2016)).

There are conflicting predictions on how depositors perceive the bank dividend policy. On the one hand, dividend may be used as a tool to discipline bank insiders (managers), since paying dividends leads banks to regularly raise funds from capital markets, inducing closer scrutiny from fund providers. Further, banks are inherently more opaque than other industries (Morgan (2002)), they are indeed secret keepers (Dang et al. (2017)). By concealing the information of their risky assets from outsiders, banks produce money-like safe liquidity used for transactions and storing value. Being opaque make it costlier for outsiders (investors, depositors, creditors) to get details of the actual net worth and risk of banks (Boldin and Leggett (1995)), then preventing them to accurately assess the true quality of the bank balance sheets. Since outsiders cannot distinguish zombie banks from well-performed banks, there exists then a "lemon problem" when outsiders charge higher costs of funding for all banks (Kane (1989)). Put it differently, the quality and the suboptimal quantity of available information do not permit to an efficient resource allocation, adversely affecting the cost of capital (Tran, Hassan, and Houston (2019)).

When insiders process private information of banks whereas outsiders do not, insiders of well-performed banks are more likely to signal this information to outsiders. If they are successful, the markets are then segmented. More informed outsiders can make better decisions, and well-performed banks may enjoy lower funding costs. One vehicle to disclose the quality of banks is via paying dividends.

This interim mechanism is however costly due to its implied commitments (Floyd, Li, and Skinner (2015)). Zombie banks cannot easily mimic well-performed banks (Spence (1973)), because consistently distributing nonexistent earnings to shareholders erodes capital, and in

extreme case may cause a "fire sale" of banks assets or even a bank run for zombie banks (Tripathy, Wu, and Zheng (2021)).

In brief, the opaque features of banks induce a natural role for dividends. By committing to pay dividends, banks convey a signal to outsiders about the confidence about their financial health. This is crucial, because if depositors cast doubt on the bank financial health, the inherently fragile funding structure of banks can quickly break down, causing financial distress costs. These arguments taken together suggest a lower funding costs for dividend paying banks.

On the other hand some argue dividend can be used as a tool to shift the relative value of claims among bank stakeholders (Acharya, Le, and Shin (2016)). That is, paying dividends can extract wealth from creditors to shareholders. To mitigate this opportunistic incentive, debtholders require payout restrictions in debt covenants. Since reducing or cutting dividend may send a bad signal to the markets about the financial health, bank managers tend to manipulate reported numbers to achieve a critical threshold for paying dividends (Tran and Ashraf (2018)), leading a higher degree of opacity (Jiang, Levine, and Lin (2016)). As argued above, the increased opacity makes outsiders more difficult to accurately assess the true quality of banks, resulting a higher funding cost. In other words, paying dividends leads to higher funding costs.

In this study, we shed light on how dividend influences bank funding costs by employing the large dataset of US banks from 2001 to 2019. We use the ratio of dividend over the total equity capital (DIVIDEND) as a proxy of bank dividend policy. We also use alternative measures of bank dividend policy. Following Acharya and Mora (2015), Gilje, Loutskina, and Strahan (2016), Levine, Lin, and Xie (2020), we use the (natural logarithm) bank's costs of (domestic) deposits as the proxy of bank funding costs. That is the implicit rates defined as the interest expenses on deposits divided by the quarterly average of the deposits. Controlling for the effects of various bank characteristics and time fixed effects, our empirical analysis provides consistent evidence on a lower cost of deposits for banks that pay dividends, suggesting the positive respond of depositors to the signaling effect of bank dividend policy. This cost-decreasing effects of dividend policy are more pronounced for large banks sample, consistent with the size anomalies hypothesis of Gandhi and Lustig (2015).

We also provide a more completed picture on how dividend policy affects bank funding costs across the distribution of bank funding costs. This is of interest of investors, regulators and policy makers, since high funding costs reflect critical situation of bank financial health. We find that the relationship between dividend and funding costs is uniform in sign (negative). This evidence indicates paying dividends not only affects the conditional average funding costs, but also influences the dispersion of funding costs. We observe that the information-asymmetry-decreasing effects of dividend policy is less pronounced for riskier banks (i.e. those pay highest costs of deposits).

We address the endogeneity concerns since our results may be derived from the unobservable bank characteristics that simultaneously affect dividend and funding costs, leading to potential bias in the OLS framework. We adopt the Heckman two-step model and the propensity score matching (PSM) approach. In all specifications, our findings remain qualitatively similar.

Having established the evidence of lower deposits costs for banks that pay dividend, we perform further investigations to document whether depositors respond differently to bank dividend during the crisis. Flannery, Kwan, and Nimalendran (2013) suggest that banks become more opaque during a crisis than normal periods, leading outsiders face more difficulties to better monitor their activities. Also, the crisis may send mixed signals to depositors regarding to the intervention of governments, impairing depositors' incentives. We document that during the early

stage of the crisis when there exists a high pressure on bank funding, paying more dividends does not help banks to enjoy a lower cost than during normal times. However, in the late stage of the crisis, following the government interventions, our findings highlight banks that are able to pay dividends enjoy lower funding costs than during normal times.

Our study contributes to the literature in several ways. First, to the best of our knowledge, our study provides one of the first investigation on how depositors respond to the dividend policy of banks. A large body of literature mostly examine the discipline of stakeholders through banks' risk-taking behaviors (Tripathy, Wu, and Zheng (2021)). Since depositors could punish banks by ex-post withdrawing their funds (in extreme case, depositor runs) and by ex-ante adjusting the funding costs. We take a different perspective when assessing the depositor discipline. We document that depositors respond positively on bank dividend policy via lowering the funding costs. Second, we provide the evidence of the effects of dividends on funding costs over the entire range of the funding costs distribution. The results suggest the information-asymmetry-decreasing effects of dividend policy is less pronounced for riskier banks (i.e. those pay highest costs of deposits).

We believe that our study is of interests of regulators and policy makers. On the one hand, there are many suggestions for restrictions on dividends since dividend can induce banks to face increasing leverage and declining capital, which are the loss-absorbing cushion of banks (Tran and Ashraf (2018)). Our evidence on the costs-decreasing effects of dividend highlights the bright side of dividend policy as a tool to signal the bank quality. Our findings reaffirm that dividends are indicative of earnings quality as noted in Breeden (2003), Glassman (2005). Furthermore, our results suggest the existence of the market discipline from depositors' sides. In the aftermath of the last global crisis, some casts doubt on the existence of the market discipline (Acharya, Anginer, and Warburton (2013)). Our results document the mechanism through which stimulate the market discipline.

The rest of the paper is organized as follows. Section 2 describes the data and variables. Section 3 delineates the main results. Section 4 examines the effect of crisis. Section 5 concludes the study.

2. Data and variables

The Federal Reserve provides quarterly regulatory reports filled by bank holding companies (BHC) with assets of $150 million and over. Our raw data covers the period 2001 to 2019. We remove any bank-quarter observations with missing or incomplete financial data on accounting variables in the main regression model. Following Berger and Bouwman (2013), we replace all observations with the ratio of total equity over total assets less than 1% by 1% to avoid distortion in ratios that contain equity, and also exclude observations with negative or nonexistent outstanding loans or deposits. All financial ratios are winsorized at 1% level on the top and bottom of their distribution to dampen the effects of outliers.

Following Gilje, Loutskina, and Strahan (2016), Levine, Lin, and Xie (2020), we use the natural logarithm of the (domestic) cost of deposits. The cost of deposits is measured as the interest expense on deposits during a quarter divided by the deposits at the beginning of the quarter. Following Abreu and Gulamhussen (2013), Tran (2020), we use the ratio of dividends to equity (DIVIDEND) as a proxy for dividend policy.

We control for several time-varying bank characteristics. Since the costs of funding may differ according to bank size, or between banks with different leverage, we include banks size (SIZE), capital ratio (CAPITAL). We also control for differences in profitability by including

banks performance (EARNINGS), assets growth (GROWTH). Finally, we include the bank business model (NII). See Table 1 for definitions. Table 2 reports the summary descriptive of these variables.

Table 1. Variables Definitions

This table presents definitions of all main variables used in the analysis.

Variable	Definition
Dependent variables	
LN_COSTDEPO	Natural logarithm of the cost of (domestic) deposits equals natural logarithm of interest expenses on domestic deposits divided by interest-bearing domestic deposits at the beginning of a period.
COSTFUND	Natural logarithm of total cost of funds. Total cost of funds is the ratio of total interest expenses to interest-bearing liability at the beginning of a period.
INTEREST EXPENSES	The total interest expenses over the total assets instead of interest-bearing liabilities.
Variable of interest	
DIVIDEND	The ratio of dividends over the total equity capital
DIVIDEND/INCOME	The ratio of dividends to income
REPUR	A dummy that takes a value of 1 if the bank do repurchase at time t, 0 otherwise
Control variables	
CAPITAL	Book value of equity over gross total assets
SIZE	The natural logarithm of gross total assets
DUMMY LOSS	A dummy variable that equals one if net income is negative, and zero otherwise
EARNINGS	Income before taxes, provisions recognized in income over gross total assets
GROWTH	Growth rate of gross total assets
NII	Non-interest incomes over the net operating incomes
CRISIS	A dummy equal to 1 for a period from 2007:Q3-2009:Q2, and 0 otherwise.
EARLY CRISIS	A dummy equal to 1 for a period from 2007:Q3-2008:Q2, and 0 otherwise
LATE CRISIS	A dummy equal to 1 for a period from 2008:Q3-2009:Q2, and 0 otherwise

Table 2. Summary Statistics

This table reports summary statistics for the main sample. All financial variables are winsorized at 1% and 99% levels.

Panel A:

	N	mean	Sd	min	max
LN_COSTDEPO	63592	-4.405211	1.133966	-14.51292	-2.237396
DIVIDEND	63592	0.0157126	0.1013852	-0.3480508	0.4327781
SIZE	63592	13.82997	1.479556	11.94966	19.48661
CAPITAL	63592	0.0939004	0.030918	0.0301283	0.226339
EARNINGS	63592	0.0017024	0.0080494	-0.0204444	0.024043
GROWTH	63592	0.018135	0.0418957	-0.0836776	0.2149443
NII	63592	0.227006	0.1404318	-0.0295074	0.8480323

Panel B:

Variables	(1)	(2)	(3)	(4)	(5)	(6)
(1) LN_COSTDEPO	1					
(2) DIVIDEND	0.038***	1				
(3) SIZE	-0.396***	-0.042***	1			
(4) CAPITAL	-0.197***	-0.029***	0.143***	1		
(5) EARNINGS	0.045***	0.632***	-0.031***	0.043***	1	
(6) GROWTH	0.020***	0.013***	0.016***	-0.054***	0.044***	1
(7) NII	-0.181***	0.007***	0.362***	0.110***	0.033***	0.004

3. Does bank dividends affect bank's funding costs?

3.1. Main findings

In this section, we conduct multivariate analysis to formally investigate the magnitude of bank dividends on funding costs after controlling other control variables. Specifically, the empirical specification we estimate is as follows:

$$Y_{it} = \alpha + Dividend_{it-1} + Z_{it-1} + \theta_t + \varepsilon_{it} \quad (1)$$

where, Y_{it} is the measure of funding costs of bank *i* at time *t*. We use the natural logarithm of the costs of deposits (LN_COSTDEPO) as the main proxy in our investigation. Our variable of interest is the bank dividends (DIVIDEND) defined above. Z_{it} is the vector of control variables. In all specifications, we use the lag (one period) of DIVIDEND and control variables to condition out

the intra-period reverse causality. We include time-fixed effects, θ_t, to control for the macroeconomic conditions which are common across banks. ε_{it} is the error term. Since LN_COSTDEPO is likely to be correlated within a bank over time, standard errors are corrected for heteroscedasticity and bank-level clustering.

Our main results are shown in Table 3. Model (1) represents the reduced model with only our variable of interests (DIVIDEND). Model (2) represents our baseline model with the inclusion of our control variables. In both models, the coefficients on DIVIDEND are negative and statistically significant at the 1% level, suggesting that banks that pay higher dividends enjoy lower funding costs. In Model (3), we include the bank fixed-effects to take into account the unobservable bank invariant characteristics such as corporate culture, bank management, etc. We still reach similar findings.

In Model (4), we exclude Top 10th dividend-paying banks since one may have concerns about excessive dividend payments due to the agency problems.[1] We exclude the sample of listed banks in Model (5) since those banks have generally more access to capital markets funding than private banks, which may alter our main findings. We continue to find that banks that pay higher dividends are associated with lower funding costs, as indicated by the negative and statistically significant coefficient on DIVIDEND.

One may have concerns about the impacts of the deposit insurance scheme which may alter the discipline of depositors (Keeley (1990)). We then re-perform our specification under two subsamples: (i) costs of insured deposits (Model (6)) and (ii) costs of uninsured deposits (Model (7)).[2] The coefficients on DIVIDEND are negative and statistically significant in Models (6) and (7), suggesting that our findings are not affected by the deposit insurance scheme. In other words, both types of depositors positively value the signal of dividend policy in banks.

Our results may be concentrated on a particular bank size, we then re-estimate our baseline model across the range of bank size. Following Berger et al. (2016), we classify bank sizes into three groups: banks with gross total assets (GTA) under $1B (small banks), banks with GTA between $1B and $5B (medium banks), and banks with GTA above $5B (large banks). The results in Model (8)-(10) show that the coefficients on DIVIDEND are negative and statistically significant across bank size range. Interestingly, we observe that the effect of DIVIDEND on bank deposit costs is strongest for the sample of large banks. A potential explanation is as follow. Large banks have more rooms to access to capital markets funding, enjoy the implicit government guarantees in disaster states, which in turns lower their funding costs. Even that large banks experience closer scrutiny from the markets, tighter prudential supervision, the complexity of their business models makes them more opaque than other banks, inducing higher moral hazard problems in larger banks. Depositors consequently value more large banks when paying more dividends, leading to lower deposit costs. Our evidence is consistent with the size anomalies hypothesis of Gandhi and Lustig (2015) who document large US banks have significantly lower risk-adjusted returns than other banks, even though large banks are significantly more levered.

Regardless of the control variables, the results also document the evidence of depositor responsiveness to the bank characteristics. Additionally, well-capitalized and diversified banks enjoy lower costs of deposits. High profitable banks and bank size also experience lower costs of funding. Meanwhile, we document that the costs of funding are higher for high growth banks, but the coefficient is not statistically significant.

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[1] We use alternative thresholds in in unreported tests, and find similar results.

[2] We thank to an anonymous referee to remark this point.

In brief, our findings suggest the information-asymmetry-decreasing effects of dividend policy helps banks to convey their financial health to external stakeholders, lowering the deposit rates.

3.2. Quantile regressions

Our main purpose is to investigate the relation between banks' deposits costs and their dividend policy. Meanwhile, stakeholders including investors, regulators, and policy makers seem to be more interested in bank behaviors at the tails of the distribution of (funding) costs, since high (funding) costs reflect a critical situation of bank financial health.

Our previous specifications reflect the conditional mean relationship between banks' deposits costs and dividend payouts with the assumption of the homogeneity of the effects of DIVIDEND on bank's funding costs (Tran, Hassan, and Houston (2019)). However, when there exists an important heterogeneity as in our sample of study, the use of the traditional approach might not be ideal. In Table 4, we perform quantile regression – a generalization of median regression analysis to other quantiles - to assess whether the association between deposit costs and dividend payments varies across the distribution of deposit rates. Rather than relying on a single description of the central behavior of the sample, the quantile approach explores a range of conditional quantile functions.

Models (1) - (5) show the impact of DIVIDEND on bank's deposit rates is indeed uniform in sign (negative). Interestingly, we observe that the coefficient on DIVIDEND is smaller for banks that pay highest deposit costs (i.e. at 90^{th} percentiles), suggesting the information-asymmetry-decreasing effects of dividend policy is less pronounced for riskier banks (i.e. those pay highest costs of deposits).

Overall, these results reaffirm our previous findings that paying dividends lower bank' funding costs. Dividend not only affect the conditional average funding costs, but also affects their distribution.

3.3. Alternative measures of dividends

In Table 5, Panel A, we re-conduct our baseline model with alternative measures of DIVIDEND. In Model (1), we use the ratio of dividend over the net incomes. In Model (2), we use the ratio of dividend over gross total assets. In all specifications, our results remain unchanged.

Firms may also signal material information to the markets through shares repurchase, then in Model (3), we use the ratio of net repurchases following Bonaimé (2012). The coefficient on REPUR is negative but statistically not significant, suggesting that depositors are insensitive to banks that repurchase shares. This finding can be explained as follows. Repurchases are more pro-cyclical, are usually used to distribute transient cash-flow shocks in case of high earnings (Guay and Harford (2000)), and are less likely to be used as a signal since repurchases do not involve an ongoing commitment (Floyd, Li, and Skinner (2015)).

3.4. Alternative measures of funding costs

In Table 5, Panel B, we re-estimate our baseline model with alternative measures of bank's funding costs. First, following Demirgüç-Kunt and Huizinga (2004), Levine, Lin, and Xie (2020), we use the total cost of funds (COSTFUND), which is the ratio of total interest expenses over the interest-bearing liabilities in Model (1). In Model (2), following Tran (2020), we divide the total interest expenses over the total assets, INTEREST EXPENSE, instead of interest-bearing liabilities. In all specifications, our findings remain unchanged.

Table 3. Baseline Multivariate Analysis

This table reports regression estimates of the relation between LN_COSTDEPO and Dividend. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Standard errors are clustered at the bank level. Numbers in parentheses are t-statistics.

	Reduced model	Baseline model	Controlling Bank FE	Excluding Top 10th payers	Excluding public banks	Cost of insured deposits	Cost of uninsured deposits	Small banks	Medium banks	Large banks
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DIVIDEND	-0.66992***	-0.32911***	-0.10241***	-0.77846***	-0.28929***	-0.18835***	-0.17520***	-0.31604***	-0.25022***	-0.53475***
	(0.04471)	(0.05095)	(0.02672)	(0.05263)	(0.05430)	(0.03146)	(0.03286)	(0.06043)	(0.09114)	(0.14684)
SIZE		-0.10229***	0.02871	-0.11325***	-0.09197***	-0.01233**	-0.02482***	-0.04628**	-0.22137***	-0.06649**
		(0.01091)	(0.03405)	(0.01151)	(0.01445)	(0.00583)	(0.00712)	(0.02071)	(0.05845)	(0.02996)
CAPITAL		-0.79171*	-1.14293***	-1.03330**	-0.52331	-0.38757*	-0.12647	-1.18424***	0.76498	-0.12277
		(0.43104)	(0.32137)	(0.41611)	(0.42835)	(0.20478)	(0.20604)	(0.35379)	(0.73856)	(1.53089)
EARNINGS		-11.08084***	-12.84090***	-8.48464***	-12.22406***	-12.25605***	-12.56702***	-12.84294***	-11.59487***	-5.05953**
		(0.74250)	(0.44605)	(0.70420)	(0.85336)	(0.56929)	(0.55404)	(0.71291)	(1.55553)	(2.52139)
GROWTH		-0.21024	-0.27978***	-0.24899*	-0.09301	-0.15002*	-0.23091***	-0.11800	-0.07850	-0.66113*
		(0.13294)	(0.06891)	(0.14079)	(0.13111)	(0.07788)	(0.06765)	(0.11017)	(0.24003)	(0.37086)
NII		-0.58043***	-0.01869	-0.57382***	-0.51526***	-0.05012	-0.07668	-0.36189***	-0.30691*	-1.27330***
		(0.11593)	(0.05954)	(0.12064)	(0.11585)	(0.05747)	(0.07377)	(0.09008)	(0.17254)	(0.31122)
Constant	-3.45904***	-1.65205***	-3.44038***	-1.53372***	-1.84592***	-2.35289***	-2.27588***	-2.38140***	-0.10448	-1.95704***
	(0.01751)	(0.14238)	(0.45000)	(0.14940)	(0.19229)	(0.07944)	(0.10213)	(0.26501)	(0.83995)	(0.42934)
Obs	64,609	63,592	63,592	56,376	43,751	60,736	60,788	38,211	14,582	10,799
Adj R2	0.53894	0.56654	0.63212	0.57495	0.54418	0.50895	0.51526	0.43684	0.60185	0.51027
FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table 4. Quantile regression

This table reports regression estimates of the relation between LN_COSTDEPO and Dividend using quantile regression. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Numbers in parentheses are t-statistics.

	Q10	Q25	Q50	Q75	Q90
	(1)	(2)	(3)	(4)	(5)
DIVIDEND	-0.33607***	-0.32509***	-0.28593***	-0.33987***	-0.28452***
	(0.05895)	(0.03482)	(0.02696)	(0.03023)	(0.03919)
SIZE	-0.12623***	-0.09765***	-0.07761***	-0.08057***	-0.06035***
	(0.00486)	(0.00271)	(0.00221)	(0.00253)	(0.00307)
CAPITAL	-1.23483***	-1.24234***	-1.23761***	-0.65005***	-0.48368***
	(0.16726)	(0.08788)	(0.07788)	(0.12627)	(0.10599)
EARNINGS	-5.20631***	-4.69945***	-6.49039***	-16.04755***	-17.29056***
	(0.97772)	(0.55895)	(0.42443)	(0.51116)	(0.65037)
GROWTH	-0.48629***	-0.01377	0.21333***	0.10916*	-0.12572*
	(0.12321)	(0.07064)	(0.05691)	(0.06489)	(0.07442)
NII	-0.80428***	-0.60687***	-0.48624***	-0.32558***	-0.25050***
	(0.04834)	(0.02437)	(0.02018)	(0.02516)	(0.02683)
Constant	-1.88192***	-2.06071***	-2.11199***	-1.69116***	-1.34216***
	(0.06592)	(0.03669)	(0.03015)	(0.09094)	(0.04048)
Obs	63,592	63,592	63,592	63,592	63,592

3.5. Endogeneity concerns

Our results may be derived from the unobservable bank characteristics that simultaneously affect the deposit rates and the dividend policy of banks, which in turns lead to potential bias in the OLS framework. Thus, we use different approaches: Heckman two-step model and the propensity score matching (PSM) approach to control for any selection bias that could be present in the above estimation. The results are tabulated in Table 6.

The results from Heckman two-step models are reported in Model (1) and Model (2). First, inspiring from Chen, Huang, and Zhang (2016), we rank all banks in each quarter based on DIVIDEND into 3 groups, then create a dummy variable DUM_DIVIDEND equal to unity if a bank is belongs to the group with highest dividend payments, and zero if it is in the group with lowest dividend payments. Then, we model the probability to pay higher dividends by using the logit selection model and then obtain the inverse Mills ratio (IMR). We use the fraction of banks that pay dividends in each quarter as the instrumental variable. The second-stage of Heckman selection model is reported in Model (2). We still find a negative coefficient on DIVIDEND, consistent with our main results.

Next, we use the propensity score matching (PSM) approach. In Model (3), we first use the one-to-one matching without replacement, which allows each untreated bank (i.e. bank that is belongs to the lowest dividend payments group) to be used exactly one time. In Model (4), we use one-to-one matching with replacement, which allows each untreated bank to be used more than once. In Model (5) – (6), we match each treated bank (i.e. bank that is belongs to the highest dividend payments group) with two (N=2), three (N=3) untreated banks with the closest scores. In all specifications, we obtain similar results.

4. The effects of the financial crisis

In this section, we examine the effects of the global financial crisis on the association between dividend policy of banks and their funding costs. Our study covers the period includes the last crisis from 2007:Q3-2009:Q2. We run our baseline model by including the crisis dummy variable and the interaction term of DIVIDEND and the crisis dummy (DIVIDEND*CRISIS). The estimation results are reported in Model (1), Table (7). The coefficient on DIVIDEND*CRISIS is negative, but not statistically significant, suggesting that the effect of dividend policy on bank funding costs during the crisis is not different than during normal times.

However, as suggested in Acharya and Mora (2015), the last financial crisis is a crisis of banks as liquidity providers. During the first phrase of the crisis (2007Q3-2008Q2), the pressure on deposit funding is widespread, banks experience the breakdown of deposit inflows. Until the government interventions in the fall of 2008 following the failure of Lehman (i.e. 2008Q3), there is a rebound of funding into the banking system when the government explicitly backed the depository system through an increase in deposit insurance to $250,000, among other measures. Then following Acharya and Mora (2015), we divide the last financial crisis into two sub-periods: (i) early crisis for the period of 2007Q3-2008Q2, and (ii) late crisis (2008Q3-2009Q2). The results in Models (2)-(3) of Table (7) suggest that during the early crisis period, depositors seem to be indifferent regarding to bank dividend policy, whereas they positively value the signal of dividend policy during the late crisis period.

In brief, the evidence shines the bright side of dividend payments over the crisis, when banks will feel necessary to convey private information to depositors about their confidence on financial health.

Table 5. Alternative Measures of Dividend and Funding cost

Panel A reports regression estimates of the relation between LN_COSTDEPO and alternative measures of Dividend. Panel B reports estimates using alternative measures of funding costs. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Standard errors are clustered at the bank level. Numbers in parentheses are t-statistics.

Panel A: Alternative measures of Dividend

	DIVIDEND/INCOME	DIVIDEND/ASSETS	REPUR
	(1)	(2)	(3)
DIVIDEND	-0.06437***	-2.91762***	-0.12862
	(0.01965)	(0.66584)	(0.08692)
SIZE	-0.09538***	-0.10232***	-0.10207***
	(0.01090)	(0.01091)	(0.01093)
CAPITAL	-0.15646	-0.74368*	-0.74289*
	(0.45113)	(0.43085)	(0.42949)
EARNINGS	-21.46013***	-11.41177***	-13.31696***
	(2.37766)	(0.71250)	(0.70365)
GROWTH	-0.17111	-0.21039	-0.19689
	(0.15002)	(0.13292)	(0.13280)
NII	-0.54484***	-0.57959***	-0.57869***
	(0.12219)	(0.11603)	(0.11606)
Constant	-1.75244***	-1.65808***	-1.66405***
	(0.14040)	(0.14252)	(0.14283)
Obs	46,427	63,592	63,549
Adj R2	0.56366	0.56635	0.56601
FE	Yes	Yes	Yes

Panel B: Alternative measures of funding costs

	COSTFUND	INTEREST EXPENSES
	(1)	(2)
DIVIDEND	-0.24581***	-0.00375***
	(0.03323)	(0.00111)
SIZE	-0.01331**	0.00002
	(0.00618)	(0.00006)
CAPITAL	-1.09930***	-0.02658***
	(0.22845)	(0.00253)
EARNINGS	-11.30954***	-0.27754***
	(0.54047)	(0.01754)
GROWTH	0.00527	0.01343***
	(0.06598)	(0.00198)
NII	-0.27148***	-0.00242***
	(0.06424)	(0.00058)
Constant	-2.51024***	0.05247***
	(0.08115)	(0.00112)
Obs	63,944	79,864
Adj R2	0.58867	0.59556
FE	Yes	Yes

5. Conclusions

We investigate the association between banks' dividend policy and their funding costs. Our empirical evidences emphasize on the bright side of dividend policy that helps banks to reduce funding costs, supporting the signaling effects of dividend to convey information about banks' financial health. The results also show that dividend-paying banks enjoy lower-deposits costs during the late crisis period, suggesting not only during normal times, but also during the turmoil times, dividend serves as a vital signal to outsiders to segment the markets. Our results survive after a battery of sensitivity tests by using alternative proxies of dividends, funding costs, by testing various subsamples, and by using a variation in methods to control for endogeneity. We strongly believe that this study is of interest of regulators and policymakers, especially in the reform time, when there have calls for restriction on dividends, since they can erode capital and decrease the loss-absorbing cushion of banks.

Table 6. Endogeneity concerns

The table reports regression estimates of the relation between LN_COSTDEPO and Dividend. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Standard errors are clustered at the bank level. Numbers in parentheses are t-statistics.

	Hckman selection		PSM			
	1rst stage	2nd stage	N=1 W/o replacement	N=1 with replacement	N=2	N=3
	(1)	(2)	(3)	(4)	(5)	(6)
DIVIDEND		-0.32349***	-0.24923***	-0.29250***	-0.26972***	-0.24011***
		(0.05380)	(0.06485)	(0.08606)	(0.07312)	(0.06643)
SIZE	0.09545***	-0.08922***	-0.11036***	-0.10445***	-0.11476***	-0.11604***
	(0.01574)	(0.01331)	(0.01836)	(0.02054)	(0.01978)	(0.01978)
CAPITAL	1.47063**	-0.72316	-0.73432	-0.47220	-0.99942*	-0.89594*
	(0.57333)	(0.49691)	(0.55000)	(0.57620)	(0.51540)	(0.52976)
EARNINGS	-5.93152***	-12.49293***	-14.20312***	-12.65996***	-14.08857***	-13.57883***
	(1.03365)	(0.91350)	(1.21561)	(1.59062)	(1.19688)	(1.07930)
GROWTH	-0.45911**	-0.40322**	-0.20522	-0.55935**	-0.26711	-0.31307
	(0.20234)	(0.15693)	(0.20126)	(0.22794)	(0.20294)	(0.21213)
NII	0.27020**	-0.60588***	-0.69202***	-0.68038***	-0.63709***	-0.65406***
	(0.13062)	(0.12815)	(0.14451)	(0.14376)	(0.13999)	(0.14397)
FRAC_PAYER	3.09713***					
	(0.13482)					
IMR		0.05877***				
		(0.01722)				
Constant	-3.33579***	-1.77310***	-1.45722***	-1.57333***	-1.40724***	-1.42537***
	(0.21909)	(0.17503)	(0.24492)	(0.26561)	(0.25882)	(0.26000)
Obs	52,284	44,534	24,880	11,469	16,690	20,156
Adj R2	0.004	0.54681	0.54969	0.54549	0.54026	0.53987
FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7. The effects of the crisis

The table reports regression estimates of the relation between LN_COSTDEPO and Dividend. All financial variables are winsorized at the 1% and 99% levels. ***, **, * indicate significance at the 1%, 5%, and 10% level respectively. Standard errors are clustered at the bank level. Numbers in parentheses are t-statistics.

	X=CRISIS	X=EARLY CRISIS	X=LATE CRISIS
	(1)	(2)	(3)
DIVIDEND	-0.34270***	-0.35572***	-0.33855***
	(0.05748)	(0.05635)	(0.05594)
DIVIDEND*X	-0.07500	0.07790	-0.26583**
	(0.08068)	(0.09357)	(0.13026)
SIZE	-0.09877***	-0.09876***	-0.09879***
	(0.00959)	(0.00959)	(0.00958)
CAPITAL	-1.04443***	-1.04483***	-1.04401***
	(0.39324)	(0.39313)	(0.39316)
EARNINGS	-11.32237***	-11.32434***	-11.31872***
	(0.69120)	(0.69106)	(0.69122)
GROWTH	-0.32202**	-0.32207**	-0.32155**
	(0.12935)	(0.12935)	(0.12934)
NII	-0.48163***	-0.48191***	-0.48126***
	(0.10356)	(0.10355)	(0.10355)
Constant	-1.69262***	-1.69191***	-1.69273***
	(0.12848)	(0.12849)	(0.12846)
Obs	57,623	57,623	57,623
Adj R2	0.50462	0.50462	0.50464
FE	Yes	Yes	Yes

References

Abreu, José Filipe, and Mohamed Azzim Gulamhussen, 2013, Dividend payouts: Evidence from U.S. bank holding companies in the context of the financial crisis, *Journal of Corporate Finance* 22, 54–65.

Acharya, Viral V., Deniz Anginer, and A. Joseph Warburton, 2013, The end of market discipline? Investor expectations of implicit state guarantees, *December). www. papers. ssrn. com/sol3/papers. cfm*.

Acharya, Viral V., Hanh Le, and Hyun Song Shin, 2016, Bank Capital and Dividend Externalities, *Review of Financial Studies*, hhw096.

Acharya, Viral V., and Nada Mora, 2015, A Crisis of Banks as Liquidity Providers, *The Journal of Finance* 70, 1–43.

Berger, Allen N., and Christa H. S. Bouwman, 2013, How does capital affect bank performance during financial crises?, *Journal of Financial Economics* 109, 146–176.

Berger, Allen N., Sadok El Ghoul, Omrane Guedhami, and Raluca A. Roman, 2016, Internationalization and Bank Risk, *Management Science* 63, 2283–2301.

Bliss, Robert R., and Mark J. Flannery, 2002, Market Discipline in the Governance of U.S. Bank Holding Companies: Monitoring vs. Influencing, *Review of Finance* 6, 361–396.

Boldin, Robert, and Keith Leggett, 1995, Bank dividend policy as a signal of bank quality, *Financial Services Review* 4, 1–8.

Bonaimé, Alice Adams, 2012, Repurchases, reputation, and returns, *Journal of Financial and Quantitative Analysis* 47, 469–491.

Breeden, Richard C., 2003, Restoring trust: Report to the Hon. Jed S. Rakoff, the United States District Court for the Southern District of New York, on corporate governance for the future of MCI, Inc, *Inc. Corporate Monitor* 44.

Chen, Carl R., Ying Sophie Huang, and Ting Zhang, 2016, Non-interest Income, Trading, and Bank Risk, *Journal of Financial Services Research*, 1–35.

Dang, Tri Vi, Gary Gorton, Bengt Holmström, and Guillermo Ordoñez, 2017, Banks as Secret Keepers, *American Economic Review* 107, 1005–1029.

Demirgüç-Kunt, Asli, and Harry Huizinga, 2004, Market discipline and deposit insurance, *Journal of Monetary Economics* 51, 375–399.

Flannery, Mark J., Simon H. Kwan, and Mahendrarajah Nimalendran, 2013, The 2007–2009 financial crisis and bank opaqueness, *Journal of Financial Intermediation* 22. Research on the Financial Crisis, 55–84.

Floyd, Eric, Nan Li, and Douglas J. Skinner, 2015, Payout policy through the financial crisis: The growth of repurchases and the resilience of dividends, *Journal of Financial Economics* 118, 299–316.

Gandhi, Priyank, and Hanno Lustig, 2015, Size Anomalies in U.S. Bank Stock Returns, *The Journal of Finance* 70, 733–768.

Gilje, Erik P., Elena Loutskina, and Philip E. Strahan, 2016, Exporting Liquidity: Branch Banking and Financial Integration, *The Journal of Finance* 71, 1159–1184.

Glassman, J., 2005, When numbers don't add up, *Kiplinger's Personal Finance* 59, 32–34.

Guay, Wayne, and Jarrad Harford, 2000, The cash-flow permanence and information content of dividend increases versus repurchases, *Journal of Financial Economics* 57, 385–415.

Iyer, Rajkamal, Manju Puri, and Nicholas Ryan, 2016, A Tale of Two Runs: Depositor Responses to Bank Solvency Risk, *The Journal of Finance* 71, 2687–2726.

Jiang, Liangliang, Ross Levine, and Chen Lin, 2016, Competition and bank opacity, *Review of Financial Studies* 29, 1911–1942.
Kane, Edward J., 1989, The High Cost of Incompletely Funding the FSLIC Shortage of Explicit Capital, *Journal of Economic Perspectives* 3, 31–47.
Keeley, Michael C., 1990, Deposit Insurance, Risk, and Market Power in Banking, *The American Economic Review* 80, 1183–1200.
Levine, Ross, Chen Lin, and Wensi Xie, 2020, Geographic Diversification and Banks' Funding Costs, *Management Science* 67, 2657–2678.
Meyer, Laurence H., 1999, Market Discipline as a Complement to Bank Supervision and Regulation,"remarks before the Conference on Reforming Bank Capital Standards, *Sponsored by Ernst & Young and AEI-Brookings Joint Center on Regulatory Studies, New York, New York, June* 14.
Morgan, Donald P., 2002, Rating Banks: Risk and Uncertainty in an Opaque Industry, *The American Economic Review* 92, 874–888.
Spence, Michael, 1973, Job Market Signaling, *The Quarterly Journal of Economics* 87, 355–374.
Tran, Dung Viet, 2020, Does bank diversification affect funding cost? Evidence from the US banks, *Asian Academy of Management Journal of Accounting & Finance* 16.
Tran, Dung Viet, 2020, Economic policy uncertainty and bank dividend policy, *International Review of Economics* 67, 339–361.
Tran, Dung Viet, and Badar Nadeem Ashraf, 2018, Dividend policy and bank opacity, *International Journal of Finance & Economics* 23, 186–204.
Tran, Dung Viet, Kabir M. Hassan, and Reza Houston, 2019, How does listing status affect bank risk? The effects of crisis, market discipline and regulatory pressure on listed and unlisted BHCs, *The North American Journal of Economics and Finance* 49, 85–103.
Tran, Dung Viet, Kabir M. Hassan, and Reza Houston, 2019, Activity strategies, information asymmetry, and bank opacity, *Economic Modelling* 83, 160–172.
Tripathy, Niranjan, Da Wu, and Yi Zheng, 2021, Dividends and financial health: Evidence from U.S. bank holding companies, *Journal of Corporate Finance* 66, 101808.