Regulatory Burden and Bank Risk

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Abstract

We use a quasi-natural experiment to investigate how a change in the regulatory burden facing US bank holding companies following the passage of the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018 (or Crapo Bill) affects bank risk. Using a sample of 91 bank holding companies over the period 2015Q1-2020Q1, we find that risk exposure increases for large banks that benefitted from the removal of certain regulatory provisions. Moreover, these banks enjoyed higher profitability and reduced compliance costs. The results of further analyses suggest that the extent of additional risk assumed by affected banks depends on internal governance policies.

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1.Introduction

Given their unique characteristics and importance to the health of the financial system and real economy, banks have traditionally been subject to strict regulation and supervision. The global financial crisis (GFC) and subsequent bailouts of large too-big-to-fail banks highlighted the implications for the financial system (and real economy) deriving from the increased size and complexity of large banks. Subsequent regulatory reforms, including the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (widely known as Dodd-Frank Act) in the US focused on enhanced regulation and supervision of large banks in order to ensure the future stability of the banking industry. While these reforms appear to have reduced the risks posed by large banks, they have also imposed substantial costs on regulatory agencies tasked with supervisory oversight of financial institutions, as well as costs of compliance on banks themselves.[1] This has led many stakeholders (particularly lobbyists and executives at large banks) to call for a rolling back of post-GFC reforms via deregulation.

In this paper, we investigate the impact of deregulation on large bank risk. As a setting, we use the so-called the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018 (less formally known as the Crapo Bill after its sponsor Sen. Mike Crapo), which removed many of the regulations imposed under the terms of the Dodd-Frank Act.[2] The Crapo Bill raised the asset size threshold for enhanced supervision of large banks from $50 billion to $250 billion, consequently providing regulatory relief (from stringent oversight concerning in-house stress tests, chief risk officer requirement, resolution plans, capital planning, credit exposure reports, liquidity requirements and counterparty credit limits) for a small group of large banks.[3] Advocates for the rule changes contend that the Crapo Bill provides much needed regulatory relief to banks. By reducing compliance costs, the Crapo Bill frees up valuable resources that can be used by banks to better serve customers. Besides, the necessity to revise

[1] Cetorelli and Traina (2021) note an increase in bank funding costs following the introduction of Dood-Frank Act.
[2] US policymakers adopted the Dood-Frank Act in July 2010 as the most detailed overhaul of the financial system in recent history (Krainer, 2012; Acharya and Richardson, 2012; McLaughlin et al., 2021). More relevant to our case, Title I of the Dood-Frank Act devised a new inter-agency entity (Financial Stability Oversight Council-FSOC) to design enhanced supervision and prudential standards for bank holding companies (BHCs) with large, interconnected, highly levered and complex operations to promote financial stability. In this context, BHCs with larger than $50 billion asset size were defined as systemically important financial institutions (SIFIs) which were subject to stricter risk-based and contingent capital requirements, both in-company run and Fed-administered stress tests, advanced reporting requirements (living wills, credit exposure reports and other disclosures), orderly liquidation procedures, risk management requirements, concentration and short-term debt limits.
[3] Title IV of the Crapo Bill exempted banks with asset size ranging between $50 billion to $100 billion unconditionally, whereas for the banks staying within the range of $100-$250 billion, it allocated a 18-months delay period for implementation while providing Fed a discretion to apply enhanced rules on a case-by-case basis if deemed necessary.

priorly determined asset size threshold (for the eligibility of large banks for systemically important classification) had already been acknowledged by policymakers.[4] Opponents argued that the removal of many of regulations introduced in the aftermath of the GFC will lead to an increase in bank risk-taking.[5] Against this background, the present study investigates the impact of deregulation (brought about by the changes introduced via the Crapo Bill) on large bank risk.

The extant literature on the US banking system focuses on the impact on banks and the real economy of state-level and federal banking deregulatory measures such as the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (IBBEA) and Gramm-Leach-Bliley Act of 1999 (GLBA). Prior evidence suggests that the enhanced bank competition following the IBBEA: improved bank efficiency (Jayaratne and Strahan, 1997); generated abnormal stock returns for banks (Brook et al., 1998); altered credit allocation (Keil and Müller, 2020); increased voluntary disclosure (Burks et al., 2018); and boosted bank profitability (Zou et al., 2011).[6] The extant papers also show that the flexibility introduced for banks regarding business lines following the GLBA: distorted bank risk assessments (Akhigbe and Whyte, 2004) and enhanced bank efficiency (Yuan and Phillips, 2008).

In this paper, we utilize the Crapo Bill as a quasi-experimental setting in order to investigate the relationship between regulation and bank risk.[7] The setting used for the current study (which allows us to identify large BHCs affected by the enactment of the Crapo Bill versus counterparts that were not affected by the new legislation) allows for a rigorous research design. Specifically, it is possible to identify a group of affected and unaffected BHCs before (pre-treatment) and after (post-treatment) the passing of the Crapo Bill. This provides the basis for a robust research design to test our research hypothesis. For the period 2015Q1-2020Q1, we implement a difference-in-differences (DiD) framework and compare ex-ante risk of BHCs with asset size of $50 to $250 billion to other large BHCs (with assets ranging between $10 and $50 billion) that were unaffected by the terms of the Crapo Bill.[8] The results of our empirical

[4] Former member of Fed Board of Governors Daniel Tarullo stated that $50 billion threshold established by Dodd-Frank Act seems too low. Available at https://www.bis.org/review/r170407c.htm

[5] On behalf of the Systemic Risk Council, in his letter to US Senate, former BoE deputy governor Paul Tucker emphasized the financial stability concerns of revising regulatory threshold for large banks. Available at https://www.systemicriskcouncil.org/2018/10/systemic-risk-council-comments-on-jobs-act-3-0-bill/

[6] Berger et al. (2020) provide a discussion of the impact of the IBBEA on households, SMEs and large corporates.

[7] Drawing inferences on a single country setting (US banking industry) also abates cross-country confounders, faced by other studies, shaping the regulation-risk nexus. Such endogenous factors involve the differences among legal enforcement, income level, banking industry competitive structure, cross-border banking activities, macroeconomic outlook, institutional quality, the degree of economic development and monetary policy (Buch and DeLong, 2008; Behr et al., 2010; Delis and Staikouras, 2011; Delis et al., 2012; Anginer et al., 2016).

[8] In this case, we did not prefer sharp regression discontinuity design for causal inference given that the low number of BHCs in the treatment group brings challenges to satisfy the continuity of density assumption.

analysis suggest that banks influenced by the reduction in regulatory burden increased risk relative to unaffected counterparts. This increased risk exposure is observed for both on- and off-balance sheet activities, and facilitated via an adjustment in asset portfolios toward riskier assets. These findings are maintained against a myriad of robustness tests including: alternative bank risk indicators; model specifications; different sub-samples; varied event intervals; propensity score matching; entropy balancing; placebo tests; and the evaluation of the parallel trends assumption. Moreover, we observe that less intense supervisory treatment is translated into better bank profitability and reduced regulatory compliance costs. In an extended set of estimations, we further document that additional risk-taking is not uniform, but depends on individual bank characteristics shaped by existing internal governance policies. In other words, improved corporate governance mechanisms emerge as an important element limiting the increase in bank risk following the enactment of the Crapo Bill.

The contribution of this study to the prior literature is twofold. First, we provide empirical insights to the impact of bank regulation and supervision of large banks on bank risk. Recent studies suggest that the provisions of Dodd-Frank Act: increased merger and acquisition (M&A) activity (Bindal et al., 2020), reduced bank risk (Akhigbe et al., 2016; Bouwman and Johnson, 2018); reduced small business lending (Bordo and Duca, 2018); improved market discipline (Balasubramnian and Cyree, 2014; Andriosopoulos et al., 2017); increased shareholder wealth (Leledakis and Pyrgiotakis, 2019); inflated bank expenses (Hogan and Burns, 2019); and improved bank disclosure (Kleymenova and Zhang, 2019). We extend this evidence base by considering the effect of Dodd-Frank Act provisions' (for large banks) partial reversal (deregulation phase) on bank risk. We find that a relaxation in large bank regulation contributes to bank risk. As such our result have relevance for the government agencies tasked with supervising large banks, and safeguarding the stability of the financial system.

We also advance the literature on bank corporate governance for which the existing works consider individual dimensions of corporate governance on bank behavior (DeYoung et al., 2013; Ellul and Yerramilli, 2013; Berger et al., 2014; Anginer et al., 2016). We augment and complement the results produced by this literature. In order to do so, we follow a multidimensional approach to measure the strength of internal corporate governance mechanisms via indexation method. Specifically, we utilize aggregate governance scores produced by Thomson Refinitiv in composing our cross-sectional analysis. We then investigate how internal governance mechanisms interact with external regulatory attention in driving bank

risk – an issue that to date has been somewhat overlook in the salient literature. We find that the elevation in bank risk is subdued for the banks with stronger existing governance tools.

The rest of the paper is structured as follows. Section 2 reviews further literature to propose testable hypotheses. Section 3 covers a detailed background on the Crapo Bill, provides information about data and explains the methodological aspects. Section 4 presents the empirical findings. Section 5 gives conclusive remarks and discussions.

2. Hypothesis Development

To minimize the social costs and externalities, larger entities had been traditionally the focal point of banking regulation due to the inherent characteristics paving way for higher likelihood of financial fragility. Complex banks with a wider scope of operations require larger supervisory resources to oversee the financial soundness (Anginer et al., 2019). Larger banks are also flexible to engage in activities utilized to hide bank risk such as securitization, off-balance sheet transactions and issuances of subordinated debt. Conventional capital requirements might be less effective when the market is heavily concentrated with larger banks pursuing risky strategies (Agoraki et al., 2011). The tendency to perform risk-shifting is prominent when bank leverage and size already stands at higher (Klomp and De Haan, 2012). The higher possibility of bailout initiatives distorts larger banks' incentives to reduce systemic risk which creates more likelihood of systemwide failure eventually caused by the instability of moderately large institutions. Mohanty et al. (2018) show that systemically important US banks served as the catalyzer of GFC with considerable rises in total and idiosyncratic risks. The centrality of large banks in the corresponding banking networks also inflated the probability of stock crash risk during recent domestic crises faced by the European countries (Kosmidou et al., 2017).[9]

Existing cross-country evidence suggests that stringent regulation and supervisory oversight lead to declines in idiosyncratic and systemic risk and improve financial stability (Laeven and Levine, 2009; Hoque et al., 2015). Using the US banking industry as a setting, a related strand of literature utilizes a variety of exogenous regulatory events to investigate drivers of bank risk. Akhigbe and Whyte (2004) find that bank risk increases following regulations (passed via the GLBA) allowing commercial banking to be combined with

[9] The regulatory capture view also claims that powerful banks may be less likely to face restrictive supervision (Agoraki et al., 2011). Last but not least, investors of larger financial intermediaries might be less responsive to risk outlook (Mehran et al., 2011).

investment banking services. Zhao and He (2014) also find that operating and accounting risk increased following the GLBA as commercial banks diversified to business lines associated with more volatile revenue streams. Jin et al. (2013) present evidence which suggests that bank risk declined following the introduction of risk-based deposit insurance, capital requirements and internal control practices (under the terms of the Federal Deposit Insurance Corporation Improvement Act of 1991). Kandrac and Schlusche (2021) exploit the exogenous shift in supervisory attention caused by the relocation of the 9th District Federal Home Loan Bank to Texas in 1983. They document that US savings and loan institutions exempted from closer supervisory attention extend riskier loans, increase asset growth and hold less capital.

More recent research investigates the impact of the Dodd-Frank Act on bank risk. Akhigbe et al. (2016) indicate that the largest banks reduced discretionary risk-taking. Bouwman and Johnson (2018) find that banks with asset size below the regulatory threshold (above which more onerous regulatory requirement is required) grow risk-weighted assets and total loans at a slower rate than counterparts above the regulatory threshold. Clark et al. (2020) conclude that complex BHCs maintain a larger distance to default aftermath regulatory change. Hirtle et al. (2020) find that loan portfolios and earnings volatility of large BHCs declined following the enactment of the Dodd-Frank Act.[10]

Building upon the aforementioned studies, we expect that the relaxation on external regulatory burden toward large US BHCs following the Crapo Bill would lead to an increase in risk. Thus, the first hypothesis is formulated as follows:

H1: *Large banks are likely to increase risk exposure following a decline in the prudential regulatory burden after the enactment of the Crapo Bill.*

In common with non-financial firms, banks are equipped with an array of corporate governance mechanisms (including board formation, executive compensation arrangements and risk management systems) to reduce information asymmetries, alleviate agency costs, manage risk and address the interests of stakeholders (Srivastav and Hagendorff, 2016). Any change in regulation is unlikely to have a uniform impact on risk, given the heterogeneity in corporate governance practices across banks.

However, prior literature is ambiguous regarding the likely interaction between regulation with corporate governance practices and risk outcomes at banks. On the one hand,

[10] In a related study, Luu and Vo (2021) find that large banks reduced risk following the introduction of external stress tests.

governance mechanisms (such as board formation, ownership structure and risk management activities) can align management and shareholder preferences in order to preserve franchise value resulting in a less propensity to engage in risk-taking (Adams and Mehran, 2003; Alexander, 2006). This could substitute corporate governance for external regulatory oversight in solving agency problems (Hagendorff et al., 2010; Adams and Mehran, 2012). In other words, internal governance tools could hold management accountable in the absence of adequate regulatory oversight (Hermalin and Weisbach, 2003).[11] In contrast, bank managers, controlling shareholders and other insiders could harness corporate governance practices to assume excessive risk (Beltratti and Stulz, 2012; Laeven, 2013; Berger et al., 2014). Therefore, governance mechanisms designed to protect shareholder interests could be detrimental for other stakeholders like creditors. Lax regulatory arrangements may lead to damaging firm-level governance practices, eventually contributing to bank risk-taking.[12]

Consequently, after the loosening in external regulatory burden brought about by the Crapo Bill, the inherent corporate governance characteristics could either mitigate or amplify the additional bank risk, as formulated in the following hypotheses:

H2A: *Following a decline in regulatory burden with the enactment of Crapo Bill, internal bank corporate governance mechanism mitigates the additional bank risk-taking.*

H2B: *Following a decline in regulatory burden with the enactment of Crapo Bill, internal bank corporate governance mechanism amplifies the additional bank risk-taking.*

3.Empirical Design, Data and Methods

3.1.Background on Crapo Bill

The Dodd-Frank Act was the centrepiece of US regulatory reforms in the aftermath of the GFC, and is credited with reducing systemic risk and enhancing the safety and soundness of the banking industry. Nevertheless, critics have argued that the Dodd-Frank Act imposes additional regulatory burden, costs and restrictions on banks. Such concerns combined with extensive lobbying activities by banks led to a softening of Dodd-Frank Act provisions

[11] Andrieş and Nastor (2016) support this view by asserting that internal risk management reduces a bank's contribution to systemic risk in lax regulatory environments. Li and Song (2013) present cross-country evidence that bank supervision results in weaker corporate governance manifested as the erosion of board independence.

[12] Becher and Frye (2011) find that regulated banks have stronger internal monitoring mechanisms than unregulated counterparts. Switzer et al. (2018) conclude that corporate governance mechanisms and regulation are complementary (instead of substitutive) when containing bank default and credit risk. Mourouzidou-Damtsa et al. (2019) find that cultural traits (which are likely to shape corporate governance mechanisms) might increase bank risk despite regulatory constraints.

embodied in the Crapo Bill. Sponsored by Sen. Mike Crapo, the Crapo Bill enjoyed bipartisan support, and passed the Senate in March 2018 and received presidential ascent in May 2018.

More relevant to our case, Title IV of the Crapo Bill, precisely Section 401, revised the applicability of enhanced prudential regulation standards for large BHCs (previously determined by DFA) by inflating the size threshold for SIFI definition from $50 to $250 billion.[13] It immediately exempted BHCs with asset balances between $50 billion and $100 billion from prior enhanced regulatory requirements including in-company stress tests, capital planning, living will reporting and liquidity requirements among others. In the case of BHCs with asset size balance between $100 billion and $250 billion similar regulatory relief is provided with a discretion allocated to Fed for re-implementation (if deemed necessary) together with an 18-month period postponement.

In our empirical design, we combine the aforementioned two sub-classes of BHCs together to form the treated bank list (the asset size ranging from $50 billion to $250 billion) because of the following rationale. First, Crapo Bill removed SIFI classification for both groups which constituted the backbone of prudential bank regulation framework in the post-crisis era. Second, the adoption of the law lifted the "compulsory" feature of supervisory implementation for both groups which resulted in exogenous variation of external attention. Third, in our empirical specification, we mainly deal with ex-ante risk exposure (as dependent variable) measuring the current perception of expected future bank riskiness alleviating concerns for differential implementation timing to some extent. Lastly, this strategy allows us to increase the number of banks covered by the treatment group for drawing more sensible inferences.

3.2.Data

Our data collection process commences by identifying entities covered by the BHC list at the National Information Center (NIC).[14] In order to mitigate possible issues related to self-selection into treatment, we download this list one quarter prior (2018Q1) to the signing of the Crapo Bill into law. The treated BHC group is formed from entities with consolidated total asset

[13] The content of the Crapo Bill was not limited to supervision of large BHCs and brought revisions for financial intermediation activities on a wider spectrum (Labonte and Perkins, 2017; Perkins et al., 2018; Labonte, 2018, 2019). Title I of the law aims to improve access to mortgage credits by providing regulatory relief to commercial banks and credit unions concerning lending standards. Title II has the goal of enhancing consumer access to credit via rule changes regarding capital and reporting requirements of community banks alongside different revisions for regulatory aspects of smaller BHCs, federal savings associations and public housing agencies. Title III deals with promoting protections for veterans, consumers and homeowners in terms of reporting processes and information sharing. Title V is designed to implement measures for existing SEC regulations to encourage capital formation, whereas Title VI tries to protect student borrowers.

[14] This data is accessed at the following link: https://www.ffiec.gov/npw/Institution/TopHoldings

size ranging between $50 billion and $250 billion. BHCs with total assets within the interval $10 billion to $50 billion constitute the control group. We exclude BHCs with assets exceeding the $250 billion threshold, given that the enactment of the Crapo Bill did not alter regulatory arrangements for these banks.[15] Smaller BHCs under the $10 billion threshold are also discarded (given that their risk-taking tendencies, organizational structure, managerial motives and business practices are distinct from larger counterparts).

We merge the sample bank list with financial statement data of BHCs presented under FR Y-9C forms through unique identifiers (RSSD ID). Balance sheet and income statement information of BHCs are retrieved from the Federal Reserve Bank of Chicago.[16] The sample period is confined to the interval 2015Q1-2020Q1 in order to exclude any possible effect of prior regulations including the Dodd-Frank Act, and more recent distortions caused by the Covid-19 pandemic (Berger and Demirgüç-Kunt, 2021). The post-treatment period covers the interval from 2018Q2 onwards initiated by the official signing of the Crapo Bill into law. After obtaining the financial statement data of sample banks, we delete any entities with missing observations for key items including total assets, equity, loans, net income and risk-weighted assets. We also eliminate BHCs which do not satisfy the requirement of a balanced data structure to account for M&A activities. Our final sample comprises 91 BHCs with 1911 bank-quarter observations. The treated group comprises 20 BHCs with 420 bank-quarter observations.

In the scope of subsequent analysis testing the moderating impact of corporate governance orientation, we collect additional data. We merge our sample with Refinitiv Environmental, Social and Governance (ESG) scores provided by the Thomson ONE database. We consider the "Governance" pillar of ESG rankings (derived from annual reports, company websites, news sources and stock exchange filings) that assesses bank performance with respect to a variety of themes including CSR strategy, reporting and transparency, board structure, management compensation, shareholder rights and takeover defenses. The resultant ordinal ranking scores range from D- to A+. We manage to obtain the latest governance scores for 74 BHCs for which indicators are available.

[15] Besides, we aim to drop any global systemically important banks (G-SIBs) which remained to be subject to advanced oversight after the enactment of the law.
[16] This data is accessed at the following link:
https://www.chicagofed.org/banking/financial-institution-reports/bhc-data

3.3.Methodology

In order to investigate the impact of a shift in regulatory bank oversight (consistent with Bouwman and Johnson, 2018; Leledakis and Pyrgiotakis. 2019; Bindal et al., 2020), we use a DiD framework as follows:

$$\Delta RWA_{it} = \alpha + \beta(Post_t \; x \; Treated_i) + \gamma X_{it} + f_i + \delta_t + \varepsilon_{it} \quad (1)$$

The dependent variable (ΔRWA) is the variation in bank risk measured as the quarterly logarithmic change in risk-weighted assets of bank i from time $t-1$ to t. We prefer this accounting-based standardized indicator (to a stock market-based measure, which would limit our sample coverage due to privately held BHCs) given that risk-weighted assets capture the overall risk faced by banks via exposure to a variety of liquidity, market, credit and maturity risks.[17] Risk-weighted assets also quite relevant to how prudential regulation perceives bank risk given that the indicator continues to serve as an input to capital adequacy calculations and stress-testing under the post-GFC bank supervision framework worldwide (Lesle and Avramova, 2012; Berger et al., 2014; Anginer et al., 2019). More importantly, with this choice, we aim to utilize ex-ante variation in risk-taking tendencies considering the relatively shorter post-treatment phase and differential treatment timing of our empirical design (Casu et al., 2011; Luu and Vo, 2021).[18]

$Post$ takes a value of one after 2018Q2 following the enactment of the Crapo Bill, and zero otherwise. $Treated$ characterizes the treatment group by assigning a value of one to BHCs with assets exceeding $50 billion prior to the enactment of the Crapo Bill, and zero otherwise. The main coefficient of interest (β) is assigned to the $Post \; x \; Treated$ DiD interaction term. This coefficient gauges the change in risk-taking behavior of treated BHCs (relative to control BHCs) from pre- to post-treatment period. The baseline specification is saturated with bank (f_i) and time (δ_t) fixed effects to absorb bank-level persistent characteristics and time-varying

[17] Other accounting-based measures may not fully capture the multidimensional nature of bank activities' riskiness, particularly for larger banks (Klomp and De Haan, 2012).

[18] A potential criticism directed to risk-weighted assets measure is the comparability problems across banks caused by the distinctive business practices, the use of internal models (for some banks) in the quantification process and the inability to reflect the underlying risk of financial institutions during turmoil times (Ferri and Pesic, 2017; Santos et al., 2020). We expect that the aforementioned issue has negligible implications on our estimations concerning that our empirical design is solely composed of large BHCs in a single country context. Within the scope of robustness analysis, we also analyze alternative proxies for bank risk-taking behavior with narrower definitions and ex-post features, specifically insolvency risk ($Z-Score$) and asset quality ($NPA\ Ratio$). We further consider monitoring individual bank risk via the change in capital adequacy ratio calculated following the Basel III guidelines, $\Delta(Tier-1\ Capital/RWA)$.

aggregate economic and political forces, respectively. ε_{it} is the error term. Standard errors clustered at the BHC level, given that treatment status is determined based upon bank asset size.

Equation (1) incorporates other control variables (X_{it}) used in prior empirical investigations of bank risk. $Deposit\ Funding$ denotes the ratio of interest-bearing deposits to total assets (Ellul and Yerramilli, 2013; DeYoung and Torna, 2013; Ly et al., 2018). A priori, the relationship between a reliance on deposit funding and bank risk is unclear. On the one hand, the intensity of deposit financing is likely to limit bank risk with the help of funding stability. Banks with higher deposit base and charter value show a tendency to circumvent risky operations to prevent an eventual drop in charter value resulting in low riskiness (Gonzalez, 2005).[19] On the other hand, banks with heavier dependence on deposit funding could face sudden demands for liquidity, leading to a subsequent increase in risk.[20]

$Provisions$ is constructed as the ratio of loan loss provisions to total loans (Jokipii and Milne, 2011; Goetz et al., 2016). Provisions allow banks to engage in earnings management but excessive provisioning is bound to amplify complexity and bank opacity, in turn, becoming an important predictor of bank risk (Beatty and Liao, 2014; Cohen et al., 2014). Increased complexity coupled with a lower level of transparency might diminish the effectiveness of bank supervision and market monitoring designed to contain information asymmetry and accompanying agency problems (Adams and Mehran, 2012; Laeven, 2013).

$Operating\ Efficiency$ is the ratio of non-interest expenses to total income. Higher values of are interpreted as declining efficiency. Prominent operational risks, excessive overhead costs, organizational inefficiency faced by banks are expected to increase total riskiness (Chortareas, 2012).

$Liquidity$ is measured as the ratio of cash and equivalent balances to total assets. This variable represents the extent to which highly liquid assets are available to meet immediate liquidity demands and avoid bank runs in the face of maturity mismatches, unexpected withdrawals and funds tied up with illiquid assets (Curry et al., 2008; Jokipii and Milne, 2011).

$Dividends\ Payout$ is the ratio of dividends declared on common stock to total assets. On the one hand, payout policy might be positively related to risk if dividends are excessively

[19] Deposit market competition may also encourage banks with lower charter values to increase risk yielding a negative correlation between bank deposits and level of risk (Agoraki et al., 2011).

[20] Additionally, while depositors perform monitoring by charging higher rates, the existence of a deposit insurance system decreases monitoring incentives by exacerbating the moral hazards problem (Demirgüç-Kunt and Huizinga, 2004; Anginer et al., 2014).

used to transfer wealth from other stakeholders to owners through risk-shifting (Srivastav et al., 2014; Acharya et al., 2017).[21] On the other hand, payout policy might be negatively correlated with risk outlook if the signaling function of dividends is used to convey a decline in firm risk to outside stakeholders.[22] Banks with riskier loan portfolios and undercapitalized equity positions might also choose to retain earnings rather than pay dividends in order to sustain a certain level of capital, reinforcing the negative association between payouts and risk (Forti and Schiozer, 2015; Tripathy et al., 2021).

$Derivatives$ is defined as the ratio of off-balance sheet derivative items held for trading to total assets. Although the use of derivatives for hedging purposes could mitigate bank risk by lowering cash flow volatility, the speculative positions taken in derivative contracts are ascertained to propagate overall bank riskiness since these instruments are heavily used to tailor leverage buildup and accumulate systemic risk (Li and Marinč, 2014).

Variable definitions and summary statistics are provided in Table 1 (and Table A1 of the Appendix). All continuous variables are winsorized at 1st and 99th percentiles to negate the possible effect of outliers. The correlation matrix of control variables is examined in the Appendix (Table A2) confirming no severe multicollinearity problem.[23]

[**Insert Table 1 Here**]

4.Empirical Results

4.1.Baseline Findings

In this section, we present baseline empirical results, which quantify the impact of the Crapo Bill on bank risk. Two-way fixed effects (TWFE) estimations utilizing time-varying controls may induce bias to DiD estimates. Therefore, in column (1) of Table 2, we use a parsimonious version of equation (1) excluding other controls. $Post\ x\ Treated$ variable takes positive and significant coefficient, suggesting that the risk exposure of treated banks increases relative to control group counterparts in the post-adoption period. In column (2), this relationship remains the same when other control variables are added to the model specification.

[21] Payout mechanism can also increase bank risk by depleting the higher-quality assets and leaving riskier ones on the balance sheet (Kanas, 2013; Onali, 2014).
[22] Theoretical underpinnings put forward by Bhattacharya (1979) specify that the firms with inferior prospects are not able to mimic the dividend policies of successful entities. Therefore, the increases in dividends can manifest declining firm risk.
[23] In an untabulated analysis, we produce variance inflation factor (VIF) values staying lower than the commonly referred threshold of 5. This analysis further supports the non-existence of multicollinearity in the set of covariates.

The effect is also economically significant given that the coefficient size in column (2) corresponds to a 79% (=0.0195/0.0247) premium (in contrast to average quarterly risk-weighted assets growth throughout the sample period). Overall, our baseline findings render support to hypothesis (H1) by showing that relaxed external regulatory attention allows banks to assume additional risk.

In terms of other covariates, coefficient estimates are in line with prior expectations and literature. However, the statistical significance is retained for $Operating\ Efficiency$, $Liquidity$ and $Dividend\ Payout$. Operational inefficiencies increase bank risk (Chortareas, 2012), while liquidity buffers (Jokipii and Milne, 2011; Hogan and Meredith, 2016), and payout schemes reduce risk (Tripathy et al., 2021).

[**Insert Table 2 Here**]

The validity of DiD estimation relies on the parallel trends assumption requiring that outcome of interest for treated and control BHCs should adhere to similar trends in the absence of the policy change (Roberts and Whited, 2013). Although this assumption is not directly testable, we attempt to provide indirect evidence for parallel trends by estimating the dynamics of the treatment effect (Celerier et al., 2020). Figure 1 plots the evolution of the treatment throughout the sample period by adjusting the baseline model with DiD interactions terms accompanying lag/lead versions of the $Post$ variable. As expected, coefficients are inconsequential before the shock, while the increased risk of treated BHCs is evident following the adoption of the Crapo Bill. The magnitude of the impact is considerable given that the size of the coefficient jumps following the shock. These findings render support to the applicability of parallel trends assumption to our empirical setting.

[**Insert Figure 1 Here**]

4.2.Robustness Checks

We undertake a myriad of robustness checks to ensure the validity of baseline findings with respect to the dependent variable and standard error construction, unique features of US BHCs influencing risk-taking, data processing, endogeneity concerns and placebo test procedures. In this set of exercises, we deploy the variants of the empirical specification given in column (2) of Table 2. Results are presented as rows in Table 3 (for the sake of brevity and space considerations).

[**Insert Table 3 Here**]

In row (1), we prefer the ex-post bank $Z - Score$ risk measure, capturing the leverage and portfolio risk jointly (Lepetit and Strobel, 2013). This measure captures the required degree of potential decline in profitability for a bank to deplete its equity base and become insolvent. Under the assumption that bank profits are shaped by a normal distribution, the $Z - Score$ has a probabilistic interpretation reversely and monotonically analogous to the likelihood of insolvency (Lepetit and Strobel, 2015). Higher values of the indicator attest to a larger distance to default and lower risk. Akin to Delis and Staikouras (2011) and Delis et al. (2012), we apply a logarithmic transformation in order to avoid highly skewed distributions.[24] When the $Z - Score$ is taken as the dependent variable in DiD estimations, it is found that treated BHCs face higher default risk relative to control group counterparts following the enactment of the Crapo Bill.

In rows (2) and (3), narrower definitions of bank risk concentrating on ex-post asset quality are adopted. Large BHCs are sophisticated entities executing a variety of activities in addition to traditional deposit taking and lending (Flood et al., 2020). Thus, indicators with limited focus and content (e.g. credit risk) may not adequately capture risk-taking behavior. For such larger banks, due to the availability and complexity of financial instruments used to manage the exposure to credit risk, loan quality may not be manifested in conventional credit risk proxies in a timely manner (Berger et al., 2014; John et al., 2016). Moreover, the opaqueness and backward-looking nature of loan portfolios may prevent outsiders from assessing the managerial inclination to pursue foreseeing risky policies, especially with a shorter prediction horizon similar to our setting (Mehran et al., 2011). Nevertheless, deteriorating asset quality is likely to have an adverse impact on the profitability, liquidity and pricing of banks (Fernandez et al., 2016). The risk of bank borrowers also serves as an integral input to the regulatory oversight process including stress-testing (Acharya et al., 2018). Therefore, we expand our analysis to cover alternative indicators such as the ratio of non-performing assets to total assets. Fortunately, the data source for BHC financial statements (FR Y-9C forms) is granular enough to construct various credit risk measures. $NPA\ Ratio\ 1$ denotes the portion of total contractual assets (loans, lease financing receivables, debt securities and other assets) past due 30-89 days, while $NPA\ Ratio\ 2$ denotes the portion past due 90 days (or more) and non-accruing items. Given the positive coefficients observed in rows (2) and (3),

[24] We also follow the approach of Laeven and Levine (2009) and Lepetit and Strobel (2013) to retrieve the bank-level fixed (time-invariant) standard deviation of return on assets (ROA) by employing all sample observations.

treated banks seem to face elevated credit risk but the statistical significance is marginally retained only for the initial ratio definition.

A potential concern for the dependent variable used in our baseline specification is that ΔRWA might be driven by size distortions observed across treatment and control BHCs. Although we confirm that results remain the same when the size and scope of bank operations are added to the model as an independent variables (in an untabulated analysis), we construct another variable, $\Delta(Tier-1\ Capital/RWA)$, which compares the availability of Tier-1 capital to counteract the risk-weighted asset base (Hoque et al., 2015; Abdelbadie and Salama, 2019). In recognition of the post-GFC emphasis on narrow equity standards and quality of capital in containing bank risk (Acharya et al., 2019), we employ a Tier-1 core capital measure. Row (4) validates the existence of a higher risk-taking trend among treated banks compared to control banks manifested in negative and significant coefficient predicting capital adequacy.

We adopt two alternative strategies to generate standard errors. Unlike the general choice of clustering at the BHC level, in row (5), we cluster the standard errors at the state (of BHC headquarters) level to capture correlation within localities. In row (6), we work with bootstrapped standard errors derived from 1000 draws. In both cases, the baseline relationship between regulatory oversight and bank risk remains highly significant. Region-specific banking industry conditions, economic activity, competition, cultural factors, policy uncertainty and legal and political forces are influential determinants of bank risk and financial stability (Ghosh, 2015; Kick and Prieto, 2015; Jin et al., 2017; Goetz, 2018; Ashraf and Shen, 2019). To control such state-level time-varying confounders, we add state-by-time fixed effects to the baseline model as given in row (7). Our findings are robust to inclusion of these aforementioned fixed effects.

The relationship between regulatory attention and bank risk is also contingent on bank ownership status. Recent regulatory reforms emphasize the necessity of transparency and information disclosure and sharing in order to improve market discipline in the banking industry (Godspower-Akpomiemie and Ojah, 2021). In this context, prior literature argues that the private banks might assume more risk in the absence of outside monitoring by financial market participants (Kwan, 2004; Barry et al., 2011). Therefore, a potential criticism of our study relates to our sample composition and the possibility that results are driven by privately held entities. To alleviate this concern, we first identify publicly quoted sample BHCs matching our

data with the Federal Reserve Bank of New York link table via RSSD ID identifiers.[25] Our sample is dominated by publicly traded large BHCs (78 out of 91 sample BHCs). After retrieving ownership status, in row (8), we discard private banks to repeat the estimations. Our results still point out increasing risk exposure of treated banks when this sub-sample is considered.

A particular mechanism transmitting from the reduction in regulatory burden to risk is bank complexity. The post-GFC financial architecture had experienced mounting complexity of banking institutions limiting the ability of supervisory and regulatory resources to ensure bank soundness (Anginer et al., 2019). Growing bank complexity might also erode investors' incentive to contain bank risk (Mehran et al., 2011). Although complex organizational structure could bring cost-effectiveness thanks to operational diversification, some studies indicate that enhancing complexity might exacerbate systemic risk and default probabilities (Casu et al., 2016). In the US banking sector, BHCs are inherently complex umbrella organizations consisting of a network of subsidiaries that have varied business lines and geographical concentrations. Thus, in the US case, the post-GFC reform agenda manifested in the implementation of Dodd-Frank Act had aimed to tackle bank complexity by constraining the range of banking activities (Avraham et al., 2012). More importantly, Clark et al. (2020) empirically document that the prudential regulatory framework introduced by Dodd-Frank Act reduces the market and default risk of complex BHCs. In row (9), we pursue a similar strategy and measure BHC complexity by evaluating FR Y-9C form indicator RSSD9057. This series is created with supervisory purpose and analyzes the complexity of BHC organization concerning: credit-extending activities (either of the parent BHC or its nonbank subsidiaries), the nature and scale of non-bank activities, high-risk business areas (such as securities broker/dealer activities, insurance underwriting, and merchant banking), the issuance of public debt to unsophisticated investors, management practices (such as the nature of intercompany transactions or centralized risk management policies) and supervisory judgment. When the sample is restricted only to complex BHCs based on regulatory definition, estimation results still validate increasing risk-taking for treated BHCs in the post-Crapo Bill interval.

Investigating bank regulations based upon pre-determined asset size thresholds with DiD methods might be complicated if banks slightly below or above the regulatory threshold alter their behavior, leading to indirect treatment effects which diminish the reliability of treated

[25] This table is accessed at the following link:
https://www.newyorkfed.org/research/banking_research/datasets.html

and counterfactual BHCs. Prior studies examining the impacts of Dodd-Frank regulatory thresholds on bank behavior acknowledge this possibility (Bouwman and Johnson, 2018; Bindal et al., 2020). In line with practice adopted in prior studies, we adjust our empirical design by excluding observations belonging to 30% band around the asset size regulatory threshold. In rows (10) and (11) of Table 3, we eliminate treated/control banks with asset size remaining in the intervals $50 billion to $65 billion and $35 billion to $50 billion, respectively in order to -and incrementally, to show that baseline findings are not distorted by indirect treatment effects.

In row (12), we use one-quarter lagged values of control variables to address potential simultaneity concerns. In row (13), we use raw versions of variables without winsorization to ensure that the main findings are not driven by data handling choices. Moreover, simple DiD estimations can be flawed in the presence of serial correlation (Bertrand et al., 2004). Given that banking outcomes are prone to persistence, and our sample formation is shaped by high-frequency quarterly data, it is likely to face serial correlation problems (Goddard et al., 2011). Hence, we collapse the data at the BHC level before and after the legislative change determining the intensity of regulatory oversight. In row (14), the estimations based on the collapsed sample negate serial correlation concerns by continuing to indicate positive and a significant coefficient. In order to circumvent the possible impact of events occurring before and after the enactment of the Crapo Bill, the estimation window is shortened to four-quarters over the pre- and post-treatment phase. The results (presented in row 15) continue to hold.

The aim of the Crapo Bill is to remove enhanced regulations of banks with assets exceeding $50 billion. Thus, the assignment of banks to the treatment group raises concerns regarding comparability with respect to control banks (Pierret and Steri, 2020). Moreover, the number of banks included in the treatment group is disproportionately small relative to the banks in the control group. In order to curb endogeneity concerns (due to treatment assignment) and potential covariate imbalance, we first implement a conventional matching procedure. We adopt a propensity score matching approach to create a sub-sample of control banks that more closely match our treatment group (Rosenbaum and Rubin, 1983; Lambert, 2019). To that end, we retain cross-sectional bank observations one period before the enactment of the Crapo Bill (precisely 2018Q1) and run a probit regression model to predict binary treatment status variable through the set of control variables included in equation (1). Then, we derive propensity scores to implement one-to-one matching without replacement to assign a specific control bank to each treated bank. The baseline estimation is repeated using the matched sample of banks. The results presented in row (16) continue to validate baseline hypothesis.

As an alternative to propensity score matching, we also employ an entropy balancing procedure as a remedy to latent confounding factors (Hainmueller, 2012). This method has certain advantages over traditional matching techniques employed to alleviate systematic observable differences between treatment and control observations (Zhao and Percival, 2017).[26] Entropy balancing is essentially a re-weighting scheme applied to the pre-processing of units in a binary treatment observational study with the intent that the moments of covariate distributions are identical across treatment and re-weighted control groups (Hainmueller and Xu, 2013). The technique essentially integrates the balance of control variables directly into the weight function applicable to units in the control group. The assigned weights are chosen by minimizing the entropy distance metric subject to balance and normalizing constraints imposed on the moments of transformed control units' distributional properties. As seen in row (17), the impact of the Crapo Bill on bank risk is retained when the balanced sample is utilized for estimations.

We also employ placebo tests to support the validity of our empirical design. The first test entails the exclusion of the post-treatment period and the introduction of a pseudo shock date. Here, we falsely assume that the Crapo Bill was passed in 2016Q4. As anticipated, the placebo coefficient estimate provided in row (18) is negligible and insignificant. This verifies the parallel trends assumption. By means of the second placebo test, we keep sample period coverage and shock timing the same, but randomize the assignment of treatment status across BHCs. The results presented in row (19) suggest that the pseudo interaction coefficient obtained from this placebo test is trivial and insignificant.

As a final set of robustness tests, we implement an alternative DiD estimator. The recent discussion in the econometrics literature reveals that traditionally preferred TWFE technique could be biased in DiD designs with staggered exogenous shocks (Callaway and Sant'Anna, 2021; Goodman-Bacon, 2021). Even considering the vanilla DiD settings with multiple time periods (similar to our case), the existence of heterogeneous dynamic treatment effects and other controls are likely to cast doubt on the TWFE method due to identification problems (De Chaisemartin and d'Haultfoeuille, 2020; Sun and Abraham, 2021). As a remedy to this issue in calculating treatment effects, we utilize the robust and efficient estimator outlined by the

[26] Entropy balancing does not trim individual observations so it can retain valuable information about the entire sample. The technique also inherently yields perfect covariate balance by using the distributional properties. Moreover, this procedure is not influenced by researcher discretion in choosing the auxiliary empirical model to predict the assignment of observations to the treatment group. The entropy balancing framework is fairly flexible and its superiority over other matching methods had been confirmed with simulation studies in the prior literature.

imputation approach of Borusyak et al. (2021). As evident in row (20), we still detect the differential risk-taking behavior under an alternative DiD estimator.

4.3.Additional Analyses

4.3.1.Risk Exposure and Portfolio Adjustment

In this section, we present additional analysis to test the underlying mechanism driving the change in bank risk following the enactment of the Crapo Bill. Theoretical underpinnings imply that banks tend to enlarge the scope of operations to pursue risky strategies due to moral hazard problems (Boyd et al., 1998). Policies implemented to restrict the range of activities tend to improve financial stability by containing systemic bank risk (Hovakimian and Kane, 2000; Laeven and Levine, 2009; Agoraki et al., 2011). In this context, the risk source holds importance given that the exposure might not be only observed among on-balance sheet items as off-balance sheet activities also externalize risky strategies through leverage reduction via derivative positions and excessive liquidity creation via credit commitments (Berger and Bouwman, 2017).[27] Prior literature also suggest that regulation can prompt banks to revise portfolio risk by altering their exposure to different asset risk categories (Berger and Udell, 1994; Luu and Vo, 2021).Therefore, how additional riskiness assumed by treated BHCs after the Crapo Bill is distributed across a broader range of bank activities carries informative value to reveal the underlying mechanism.

In order to assess whether on- or off-balance sheet items facilitate the elevation of bank risk, we use data drawn from Schedule HC-R of FR Y-9C form. These data filings equip us to obtain detailed information for the distribution of bank exposure across different asset classes. We create dependent variables ΔOBS and $\Delta OFBS$ by aggregating the individual on- and off-balance sheet financial statement items (listed on Schedule HC-R) being subject to risk-weight calculations. We estimate the specification detailed in equation (1) with these alternative dependent variables. The results presented in columns (1) and (2) of Table 4 measure the source of the growth in risk exposure following the enactment of the Crapo Bill. We find that an increase in bank risk in the post-treatment period is rooted in both on- and off-balance sheet activities. By using the Schedule HC-R reporting, we also derive the dependent variables $\Delta 20\% RW$, $\Delta 50\% RW$ and $\Delta 100\% RW$ which monitor the growth of exposure to low, medium and high-risk assets (serving as inputs to risk weight calculations), respectively. The results

[27] In addition to this, the post-GFC regulatory infrastructure in the US confronts the drawbacks related to the disclosure of entire class of bank transactions (Krainer, 2012; Anginer et al., 2019).

presented in column (3) to (5) suggest that the DiD term is positive and significant for high-risk asset classes following the enactment of the Crapo Bill.

[**Insert Table 4 Here**]

4.3.2.The Impact of Deregulation on Bank Profitability and Compliance Costs

As a profound driver of bank risk-taking, we further examine profitability outlook attained by sample BHCs following the enactment of the Crapo Bill.[28] Stringent regulatory attempts aiming to curb bank fragility might impose a hurdle on bank efficiency and profitability by preventing economies of scale/scope and diversification, whereas inefficiently designed bank supervision could result in inferior bank performance (Barth et al., 2013).[29] In particular, studies like Balasubramnian and Cyree (2014) and Bouwman and Johnson (2018) reveal that the precedent of Crapo Bill (Dodd-Frank Act) elevate loan spreads and cost of borrowing for banks, respectively. In this context, we presume that the removal of SIFI status and the loosening of enhanced prudential provisions for treated banks improve profitability in the post-adoption period. To this end, we construct the dependent variable ROE measuring the bank performance via the ratio of net income to total equity. In columns (1) and (2) of Table 5, we predict this outcome variable and observe that the easing in regulatory attention is translated into improved bank profitability which is manifested in positive and significant coefficients.

[**Insert Table 5 Here**]

In addition to its focus on systemic risk and large banks, Dodd-Frank Act has been considered as the most comprehensive and detailed financial regulation in recent history regarding coverage and implications. Thus, aligning bank practices with new provisions and providing more detailed disclosures due to Dodd-Frank Act are expected to bring higher monitoring expenditures and compliance costs.[30] Since Crapo Bill has exempted treated BHCs from several reporting hurdles including company-run stress tests, resolution plans and capital

[28] Traceable to limited liability, highly levered capital structure and intense competition features, unless regulated properly, banks are inherently directed to risk activities in order to maximize profits and consequently shareholder value as bank shareholders are reluctant to internalize the externalities of bank operations (Jensen and Meckling, 1976; Laeven, 2013).

[29] Drawing on a cross-country sample, Demirguc-Kunt et al. (2003) find that regulatory impediments inflate the costs of financial intermediation. Chortareas (2012) study a group of European commercial banks to document that interventionist bank policies exacerbate bank inefficiency. Hirtle et al. (2020) examine the relevance of regulatory scrutiny to profitability for US banks.

[30] Cyree (2016) identifies that the compliance burden for smaller banks jumps considerably after the passage of Dodd-Frank Act. Bouwman and Johnson (2018) document that Dodd-Frank Act result in rising regulatory costs. Hogan and Burns (2019) assess the increasing course of non-interest expenses which are closely related to compliance, reporting and accounting activities after the implementation of Dodd-Frank Act.

planning, we expect that treated banks would experience a decline in compliance costs. To this end, similar to Hogan and Burns (2019), we select a specific group of non-interest expense items and create an alternative dependent variable ($Compliance\ Expenses$). We bundle data processing, accounting and auditing, consulting and advisory expenses which are later normalized by total non-interest expenses. Estimation results provided in columns (3) and (4) of Table 5 indicate that BHCs for which the regulatory attention has been relaxed by Crapo Bills face less intense regulatory costs in the post-treatment interval.

4.3.3.The Role of Corporate Governance Mechanisms

In this section, we investigate whether bank corporate governance tools interact with the degree of additional bank risk following the change in regulatory attention. However, corporate governance is a multidimensional concept so it is less straightforward to empirically isolate the influence of a particular component (De Haan and Vlahu, 2016; Srivastav and Hagendorff, 2016; John et al., 2016). Additionally, internal governance strategies are mostly simultaneously determined leading to interdependencies among tools which are difficult to analyze in an isolated manner (Adams and Mehran, 2012).[31]

A potential remedy to this dimensionality issue is to utilize ordinal indices summarizing the quality and effectiveness of governance practices. We proceed by employing Refinitiv ESG index accessed via the Thomson ONE database. This comparable and standardized index is produced from the content of annual reports, company websites, stock exchange filings, CSR reports and other news sources of individual companies. We retrieve the "Governance" pillar of overall ESG scores assessing firms based on 6 governance sub-themes including CSR strategy, ESG reporting and transparency, managerial structure (independence, diversity, committees), managerial compensation, shareholder rights and takeover defenses. The aggregated "Governance" scores are assigned with letter grades ranging from D- to A+ contingent on the relative effectiveness of governance features at the firm-level. We manage to retrieve index values for 74 sample BHCs corresponding to 1554 bank-quarter observations. Due to data limitations caused by the unavailability of high-frequency historical values, we decide to obtain the latest index values for governance proxy with time-invariant characteristics.

[31] The scant banking literature lists the following governance mechanisms concerning bank risk and performance: executive compensation and pay structure (DeYoung et al., 2013; Bai and Elyasiani, 2013); board characteristics like orientation, size, independence, demographics (Beltratti and Stulz, 2012; Berger et al., 2014); CEO-board chair duality (Anginer et al., 2016; Faleye and Krishnan, 2017); ownership structure involving institutional and insider holdings (Erkens et al., 2012; Chen and Lin, 2016; Berger et al., 2016); risk management functions and risk committee (Ellul and Yerramilli, 2013); audit committee (Sun and Liu, 2014); and antitakeover provisions (Anginer et al., 2018).

Nevertheless, as argued by the prior literature, corporate governance orientation tends to display high persistence and evolve slowly which mitigate potential concerns given that our sample period is relatively shorter (Cremers and Ferrell, 2010).

After collecting governance indicators at the bank level, we match the information with our original sample and undertake a cross-sectional analysis to identify the aforementioned channel. We create binary variable $Governance$ taking the value of one for banks with higher than sample median threshold governance score (B-), otherwise assuming the value of zero. The dichotomous proxy allows us to decompose the sample banks into two groups and apply the exact specification in equation (1) to sub-samples separately. We demonstrate estimation results for corporate governance in columns (1) and (2) of Table 6. This analysis suggests that the coefficient assigned to $Post\ x\ Treated$ term is statistically and economically more significant for the banks with relatively worse corporate governance performance. This finding confirms that the incremental increase in the risk level of treated BHCs is muted to some extent when banks utilize internal governance mechanisms to contain agency problems. Hence, we validate the argument pointing out that external regulations and internal corporate governance structure work as substitutes to avoid bank fragility in line with hypothesis (H2A). On the other hand, we do not attain evidence for the validity of hypothesis (H2B).

[**Insert Table 6 Here**]

As a robustness analysis, we consider alternative indices constructed by International Shareholder Services (ISS) examining the disaggregated nature of corporate governance practices. From the Bloomberg Terminal, we access $ISS\ Board\ Score$, $ISS\ Audit\ Score$ and $ISS\ Shareholder\ Rights\ Score$ data that assigns rankings to the quality of companies' board of directors structure, audit processes and shareholder rights, respectively, in the form of scores ranging from 1 (best) to 10 (worst). After matching this information to the original sample, we repeat the cross-sectional estimations by disentangling banks into two groups based on median score thresholds. As observed in Table A3 (of the Appendix), the increases in risk taking behavior are relatively subdued when banks operate with adequate board formations and audit procedures to limit the overall riskiness. Moreover, in Table A3, we find that risk exposure tendencies are amplified if bank shareholders assume stronger rights as they are inclined to direct bank management to risky activities to maximize the returns.

5.Conclusion

The regulation of the US banking industry was subject to a complete overhaul following the taxpayer-funded bailout of large complex banks during GFC of 2007-2009. Under the terms of the Dodd-Frank Act, regulation of BHCs was tiered by asset size thresholds with very large entities subject to enhanced oversight (including stress tests, resolution plans and capital planning) in order to limit the risks posed to the financial system. Despite a general consensus suggesting these changes have been successful in improving the safety and soundness of the financial system, many commentators, lobbyists, banks and industry stakeholders argued that undue regulatory burden was being placed on large (as well as small banks). Consequently, in response to industry pressure and bi-partisan pollical support, the enhanced prudential oversight of a certain asset size class of large banks was reduced in 2018 following the enactment of the Crapo Bill

In this paper, we exploit the exogenous variation in external oversight of large BHCs induced by the Crapo Bill to analyze the relationship between bank regulation and risk within a DiD framework. We find that relative to other large BHCs, banks affected by Crapo Bill requirements respond to less intense regulatory burden by increasing risk exposure. This finding is robust to a myriad of additional checks, alternative bank risk indicators, modeling choices, sample composition, endogeneity concerns and placebo tests.

Further analyses suggest that additional risk is driven by adjustments in both on- and off-balance sheet asset categories. Moreover, banks subject to less regulatory burden improve profitability and reduce compliance expenses. Internal corporate governance mechanisms also interact with bank regulation. The effect of a decline in regulatory oversight on increased bank risk is mitigated for banks with stronger corporate governance procedures.

Overall, our analysis has implications for policymakers and banking industry practitioners. As the first study focusing on the Crapo Bill, which is the most influential regulatory modification for large banks since the passing of the Dodd-Frank Act, we show that a shift in regulatory oversight designed to reduce the regulatory and compliance burden facing large banks has unintended consequences in the form of rising risk exposure paving way for potential financial stability concerns.

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Table 1: Variable Definitions and Summary Statistics

Panel A: Variable Definitions

Variables	Definition	FR Y-9C Items
ΔRWA	$\ln((\text{Risk-Weighted Assets})_t/(\text{Risk-Weighted Assets})_{t-1})$	$\ln(\text{BHCKG641}_t/\text{BHCKG641}_{t-1})$
Deposit Funding	Interest Bearing Deposits/Total Assets	(BHDM6636+BHFN6636)/BHCK2170
Provisions	Loan Loss Provisions/Total Loans	BHCK4230/BHCK2122
Operating Efficiency	Non-Interest Expenses/(Non-Interest Income+Net Interest Income)	BHCK4093/(BHCK4079+BHCK4074)
Liquidity	Cash and Equivalents/Total Assets	(BHCK0081+BHCK0395+BHCK0397)/BHCK2170
Dividend Payout	Dividends/Total Assets	BHCK4460/BHCK2170
Derivatives	Derivatives Held for Trading/Total Assets	(BHCKA126+BHCKA127)/BHCK2170

Panel B: Summary Statistics

Variables	Obs.	Mean	Std. Dev.	Median	P5	P95
ΔRWA	1,820	0.0247	0.0462	0.0158	-0.0207	0.0973
Deposit Funding	1,820	0.5527	0.0988	0.5576	0.3704	0.7344
Provisions	1,820	0.0898	0.1574	0.0443	-0.0155	0.4568
Operating Efficiency	1,820	0.6239	0.1087	0.6205	0.4339	0.8190
Liquidity	1,819	0.0455	0.0402	0.0325	0.0114	0.1159
Dividend Payout	1,820	0.0848	0.0636	0.0849	0.0000	0.1828
Derivatives	1,820	0.1421	0.3129	0.0176	0.0000	0.5400

Table 2: Baseline Results

	(1) ΔRWA	(2) ΔRWA
Post x Treated	0.0166***	0.0195***
	(0.0037)	(0.0044)
Deposit Funding		-0.0097
		(0.0319)
Provisions		0.0115
		(0.0170)
Operating Efficiency		0.2401***
		(0.0505)
Liquidity		-0.1311**
		(0.0649)
Dividend Payout		-0.0546*
		(0.0294)
Derivatives		0.0176
		(0.0133)
Observations	1,820	1,819
Other Controls	No	Yes
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-Squared	0.077	0.161

Figure 1: Dynamics of the Treatment Effect

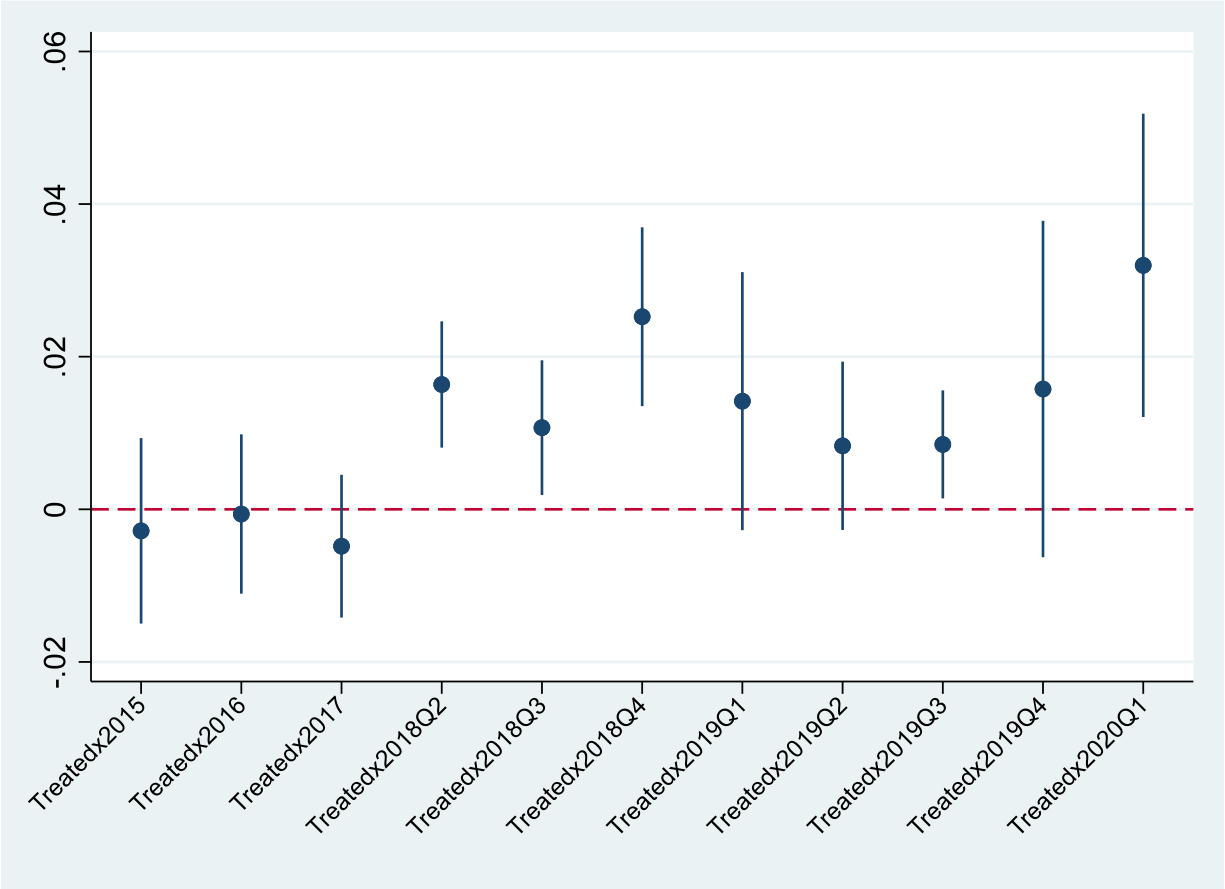

Table 3: Robustness Analysis

	Coefficient	Obs.
(1) Alternative proxy for bank risk: Z-Score	-0.0955**	1,910
(2) Alternative proxy for bank risk: NPA Ratio 1	0.0386*	1,910
(3) Alternative proxy for bank risk: NPA Ratio 2	0.0251	1,910
(4) Alternative proxy for bank risk: Δ(Tier-1 Capital/RWA)	-0.0139**	1,819
(5) Standard errors clustered at state level	0.0195***	1,819
(6) Bootstrapped standard errors	0.0195***	1,819
(7) State-by-time fixed effects	0.0199***	1,538
(8) Excluding private banks	0.0197***	1,559
(9) Excluding non-complex banks	0.0180***	927
(10) Excluding banks with asset size $50-65 billion	0.0213***	1,774
(11) Excluding banks with asset size $35-50 billion	0.0206***	1,695
(12) Lagged control variables	0.0159***	1,820
(13) Non-winsorized data	0.0224***	1,819
(14) Estimations with collapsed data	0.0176***	182
(15) Estimations with [-4, +4] quarter event window	0.0245***	728
(16) Propensity score matching	0.0196***	799
(17) Entropy balancing	0.0229***	1,819
(18) Placebo test 1	-0.0004	1,092
(19) Placebo test 2	-0.0046	1,819
(20) Borusyak et al. (2021) DiD estimator	0.0184***	1,819

Table 4: Exposure to Different Risk-Weights and On/Off-Balance Sheet Classifications

	(1) ΔOBS	(2) ΔOFBS	(3) Δ20%RW	(4) Δ50%RW	(5) Δ100%RW
Post x Treated	0.0175**	0.0765***	0.0147	0.0136	0.0333***
	(0.0075)	(0.0192)	(0.0139)	(0.0170)	(0.0078)
Observations	1,819	1,819	1,819	1,819	1,819
Other Controls	Yes	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
Adj. R-Squared	0.127	0.006	0.010	0.041	0.134

Table 5: Profitability Analysis

	(1) ROE	(2) ROE	(3) Compliance Expenses	(4) Compliance Expenses
Post x Treated	0.2519* (0.1465)	0.2421** (0.1194)	-0.8879** (0.4244)	-0.8496** (0.4232)
Observations	1,911	1,910	1,911	1,910
Other Controls	No	Yes	No	Yes
Bank FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
Adj. R-Squared	0.618	0.740	0.749	0.749

Table 6: Corporate Governance and Bank Risk

	(1) ΔRWA (High Governance)	(2) ΔRWA (Low Governance)
Post x Treated	0.0143*	0.0216***
	(0.0084)	(0.0060)
Observations	639	840
Other Controls	Yes	Yes
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-Squared	0.181	0.151

Appendix

Table A1: Variable Definitions and Summary Statistics

Panel A: Variable Definitions

Variables	Definition
Z-Score	(Capital Ratio+Return on Assets)/σ(Return on Assets)
NPA Ratio 1	(Past Due 30-89 Days Loans, Lease Financing Receivables, Debt Securities, Other Assets)/Total Assets (x100)
NPA Ratio 2	(Past Due 90 Days and Non-Accruing Loans, Lease Financing Receivables, Debt Securities, Other Assets)/Total Assets (x100)
Δ(Tier-1 Capital/RWA)	$\ln((\text{Tier-1 Capital/Risk-Weighted Assets})_t/(\text{Tier-1 Capital/Risk-Weighted Assets})_{t-1})$
ΔOBS	$\ln((\text{Exposure to On-Balance Sheet RW Items})_t/(\text{Exposure to On-Balance Sheet RW Items})_{t-1})$
ΔOFBS	$\ln((\text{Exposure to Off-Balance Sheet RW Items})_t/(\text{Exposure to Off-Balance Sheet RW Items})_{t-1})$
Δ20%RW	$\ln((\text{Exposure to 20\% RW Items})_t/(\text{Exposure to 20\% RW Items})_{t-1})$
Δ50%RW	$\ln((\text{Exposure to 50\% RW Items})_t/(\text{Exposure to 50\% RW Items})_{t-1})$
Δ100%RW	$\ln((\text{Exposure to 100\% RW Items})_t/(\text{Exposure to 100\% RW Items})_{t-1})$
ROE	Net Income/Total Equity (x100)
Compliance Expenses	(Data Processing Expenses+Accounting and Auditing Expenses+Consulting and Advisory Expenses)/Non-Interest Expenses (x100)
Governance	A dummy variable taking the value of one if "Governance" pillar of Thomson Refinitiv ESG score for a bank i is higher than sample median threshold, otherwise assuming the value of zero

Panel B: Summary Statistics

Variables	Obs.	Mean	Std. Dev.	Median	P5	P95
Z-Score	1,911	4.8571	0.7144	5.0358	3.4827	5.7892
NPA Ratio 1	1,911	0.3526	0.4640	0.2368	0.0428	0.9802
NPA Ratio 2	1,911	0.6821	0.9100	0.5026	0.1193	1.4964
Δ(Tier-1 Capital/RWA)	1,820	-0.0031	0.0365	0.0003	-0.0671	0.0478

ΔOBS	1,820	0.0243	0.0499	0.0133	-0.0201	0.1033
ΔOFBS	1,820	0.0310	0.1179	0.0205	-0.1067	0.2213
Δ20%RW	1,820	0.0149	0.0918	0.0078	-0.1050	0.1746
Δ50%RW	1,820	0.0264	0.0818	0.0131	-0.0733	0.1605
Δ100%RW	1,820	0.0257	0.0507	0.0172	-0.0280	0.1078
ROE	1,911	2.2813	1.1837	2.1831	0.6993	4.3091
Compliance Expenses	1,911	5.7562	4.3392	5.2758	0.0000	12.7304

Table A2: Correlation Matrix

	Deposit Funding	Provisions	Operating Efficiency	Liquidity	Dividend Payout	Derivatives
Deposit Funding	1					
Provisions	-0.1988	1				
Operating Efficiency	-0.0286	-0.0634	1			
Liquidity	-0.0909	0.2421	0.0907	1		
Dividend Payout	-0.0458	0.0078	-0.2494	-0.0893	1	
Derivatives	-0.0917	-0.0360	0.1627	0.3733	-0.0750	1

Table A3: Corporate Governance and Bank Risk

Panel A	(1) ΔRWA (High ISS Board Score)	(2) ΔRWA (Low ISS Board Score)
Post x Treated	0.0173**	0.0214***
	(0.0073)	(0.0078)
Observations	680	760
Other Controls	Yes	Yes
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-Squared	0.172	0.152
Panel B	(3) ΔRWA (High ISS Audit Score)	(4) ΔRWA (Low ISS Audit Score)
Post x Treated	0.0147	0.0229***
	(0.0095)	(0.0076)
Observations	580	860
Other Controls	Yes	Yes
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-Squared	0.153	0.171
Panel C	(5) ΔRWA (Low ISS Shareholder Rights Score)	(6) ΔRWA (High ISS Shareholder Rights Score)
Post x Treated	0.0101	0.0292***
	(0.0067)	(0.0073)
Observations	780	660
Other Controls	Yes	Yes
Bank FE	Yes	Yes
Time FE	Yes	Yes
Adj. R-Squared	0.178	0.138