Bank asset transparency and the impact of higher capital requirements

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Abstract

Does the impact of higher bank capital requirements vary in the cross-section? The FAS 166/167 reforms lowered regulatory capital for certain banks, without altering affected banks' risk exposures. In response, the affected banks reduce risk-taking and increase risk-weighted capital. The banks with opaque assets reduce risk-taking more than the transparent banks. While all banks increase risk-weighted capital ratio, the opaque (transparent) banks do so by adjusting the risk-weighted assets (core capital). We explain our findings in a model in which opaque banks face an adverse selection discount when selling assets.

Keywords: Securitization, Off-balance sheet activities, Variable Interest Entity, Capital requirements.

Jel Classifications: G21, G28

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1. Introduction

Capital requirements are the most prominent macro-prudential instrument in the arsenal of bank regulators. Since the global financial crisis of 2007-2009, the requirements have been further tightened under Basel III, and especially so for the banks which are the most systemically important, in an attempt to curb excessive risk-taking. Given the increasing focus of incorporating heterogeneity in bank characteristics in the design of regulation (as in Basel III), it is of particular interest to understand if banks' response to an increase in capital requirements vary in the cross-section; in this paper, we focus on the interaction of capital regulation with the degree of transparency of banks' assets.

Conceptual framework. We consider a model which suggests that there should be cross-sectional differences in banks' response to higher capital requirements. Suppose that there are two types of banks: one type owns informationally opaque assets (e.g., relationship loans) and the other type owns more marketable assets (arm's length loans and other tradeable assets). With the former there is an adverse selection problem: relationship loans are opaque and after making such a loan, a bank privately learns the type of the borrower to be of good or poor quality. With the latter type of banks, the adverse selection problem does not arise since the assets are transparent.

How will the two types of banks respond to an increase in capital requirements? Suppose that at a future date there is a liquidity shock to some banks and the realization of the shock is privately observed by the shocked bank. The banks with the opaque assets will sell their lemon loans, even if not hit by the shock. So, there is pooling between the good and poor quality loans and the market applies an adverse selection discount to the loans sold by the opaque banks. Anticipating the discount when the liquidity shock hits, the opaque banks will sell risky assets in response to the increase in capital requirements in order to avoid breaching the regulatory requirements in the event that the shock hits. In contrast, the banks with the transparent assets do not face a discount when there is a liquidity shock and they can sell their assets at fair values even after the liquidity shock hits, so in response to the increase in capital requirements they do not sell risky assets.

We summarize our theoretical contribution below: Our model bears similarities with models in banking and corporate finance in which new information arrives during the game and the information is private to some agents (e.g., Parlour and Plantin, 2009, Dang et al., 2017). In these models, informed and uninformed agents trade after the realization of private information, and inefficiencies (from the ex-ante perspective) arises due to the arrival of the private information. In contrast to the existing models, we allow for trade to occur both prior to and after the realization of the private information. In equilibrium, parties engage in trade prior to the realization of the private information, and the efficient outcome is achieved.

Empirical setting. The ideal scenario to assess the impact of capital requirements would be if the regulators impose higher capital requirements on some randomly chosen banks, and not on others. By randomly chosen banks, we mean that the regulator does not take into account bank size or systemic importance in choosing which banks are subjected to the higher capital requirements. In Basel II, changes in capital requirements are uniform across all banks in a jurisdiction and implemented at the same time for all banks, which means that there is no comparable group of banks against who the effects can be benchmarked. The various buffers introduced in Basel III give rise to some heterogeneity which may potentially be exploited for benchmarking. However, the buffers are imposed systematically, e.g., the largest banks are subject to higher requirements. The systematic nature of the regulation renders the benchmarking imperfect. In some cases (e.g., in the UK), the regulator imposes bank-specific requirements, but these correlate with potentially unobserved bank-specific characteristics.

Gropp et al. (2019) address many of these identification challenges by exploiting the institutional set-up of the 2011 capital exercise, conducted by the European Banking Authority (EBA) (see also Bostandzic et al., 2021). The exercise targeted the largest banks in each EU member country. Since the largest banks in some EU member countries are smaller than some of the smaller banks in some other EU member countries, there is a size overlap between the banks chosen to be in the capital exercise and those that are left out. However, their set-up still suffers from the issue that the largest banks in any country are systemically more important from the perspective of that country, which makes them systematically different from the similar-sized banks from the other countries which are left out of the capital exercise. In support of this argument, Gropp et al. (2021) show that the individual governments of the EU member countries protected their largest banks from the new capital charges.

Our identification relies on the implementation of the FAS 166/167 in 2010. Under the previous relevant standard, FIN 46 (R), banks kept Variable Interest Entities (VIEs) mostly off the balance sheet. Following the implementation of the FAS 166/167, banks were required to consolidate the VIEs on to their balance sheets. Consolidation of the VIEs led to a mechanical fall in the level of regulatory capital, since the VIEs were included in the calculation of the risk-weighted assets. Important for our identification, the consolidation itself did not directly affect bank risk, since the banks were already exposed to most of the risk coming from these assets even before consolidation. As with Gropp et al. (2019), there is a considerable overlap between the size distributions of the treated and control banks. Additionally, since all our banks belong to the same jurisdiction, the United States, size is a reasonable proxy for the bank's systemic importance. Thus, our identification is not subject to the shortcoming in Gropp et al. (2019) that the treated banks are likely to be more systemically important than the control banks.

Our setting has another advantage which is that capital requirements vary at the bank-level. Imbierowicz et al. (2018), Fraisse et al. (2019), De Jonghe et al. (2020) and Eckley et al. (2021), also consider settings in which capital requirements vary at the bank-level. In these settings the regulator exercises discretion in imposing the bank-level requirements, and hence, the requirements may be correlated with potentially unobserved bank-level factors. In our setting the requirements are correlated with observed bank-level factors and can be controlled for in the regressions.

Our sample consists of annual bank-level data for US Bank Holding Companies for the time-period between 2005 and 2015. To be included in our sample, we require that a bank has non-zero securitized assets in at least one year during the sample. This gives us an initial sample of 163 banks, of which 33 form the treated group since they consolidate VIE assets. Figure 1 shows the size distribution (in terms of the average total assets over the sample period) of the treated and control groups. Although the treated banks are larger on average, there is a considerable overlap in the size distributions of the treated and the control groups: the largest control bank in the sample is larger than 29 treated banks, and there are 60 control banks which are larger than the smallest treated bank. These

60 banks make up the control group in the final sample.

Results. Our main findings are as follows: in response to the increase in capital requirements induced by the FAS 166/167 regulation, the treated banks reduce risk-taking. In terms of the risk of their loan portfolio, the treated banks reduce *Net Charge-offs* by 0.22%, after controlling for bank-specific factors. The magnitude of the drop is 22% of the sample mean for this variable. The overall bank risk, reflected in the *Z-Score*, is also lower. The treated banks increase their risk-weighted capital following the reform, relative to the control banks by around 1%. The latter result is striking since the mechanical impact of the reform would be to reduce the treated banks' risk-weighted capital if banks did not respond to the reform. That the treated banks' risk-weighted capital is higher relative to the control banks', suggests that the treated banks' response to the reform was strong enough to overturn the mechanical impact of the reform. We find that the increase in the risk-weighted capital ratio is driven by reducing risk-weights, on average. We provide tests which suggests that our findings are not driven by differential impact of the global financial crisis on the treated banks vis-à-vis the control banks.

Our model predicts that the impact of reform is likely to differ across banks in the cross-section: only the opaque banks are likely to reduce risk. We classify the treated banks in our sample as transparent if their trading assets is above the 75th percentile (more than 7.5% of their assets in trading assets), and opaque otherwise. Consistent with our model predictions, we find that for both our risk proxies, the effect is statistically significant only for the opaque banks and it becomes statistically insignificant for the transparent banks (while retaining the same sign). Both transparent and opaque banks increase their risk-weighted capital ratios, although to a different extent and through different means. In order to achieve higher risk-weighted capital ratio, the opaque banks rely on adjusting the denominator, i.e., reducing risk-weighted assets, while the transparent banks rely relatively more on adjusting the numerator, i.e., increasing Tier 1 capital (although the latter effect is statistically insignificant). Gropp et al. (2019) find that banks respond to higher capital requirements by reducing risk-weighted assets, while our findings shed light on heterogenous response depending on bank asset transparency.

One possible alternate explanation for why the transparent banks is less responsive to the reform (in terms of reducing risk) is that the transparent banks are systematically less affected by the reform, which then leads to a weaker treatment effect for the transparent banks. To investigate this possibility, we split banks by the amount of consolidation of VIE assets. We show that, in fact, the transparent banks are more intensely affected by the reform, not less.

Our work generates new policy implications. Reforms following the global financial crisis have levied capital surcharges for the largest banks. The rationale for higher capital requirements for the global systemically important banks (G-SIBs) is that they benefit disproportionately from government guarantees due to being too-big-to-fail and that they impose negative externalities on the financial system due to being connected to many other institutions.[2] Our findings suggest that there are is an additional rationale for imposing stricter requirements for the largest banks: they are less sensitive to an increase in capital requirements because, unlike the smaller banks, they own transparent assets which do not suffer adverse selection discounts during crisis times. Hence, it is necessary to impose stricter requirements on the largest banks to extract the response of the desired magnitude, if the regulatory objective is to achieve lower bank-level risk.

Related literature. Our paper contributes to the literature on the effects of bank capital and bank capital requirements. In a frictionless Modigliani and Miller (1958) world, bank capital structure is irrelevant: higher capital requirements do not have an effect. However, in the presence of frictions, bank capital structure becomes relevant. Higher capital can extract more effort from the banker due to a skin-in-the game effect and reduce bank risk (e.g., Holmstrom and Tirole, 1997, and Mehran and Thakor, 2011). Capital requirements can also reduce risk-taking by enhancing franchise value and deterring gambling (e.g., Repullo, 2004, Mehran and Thakor, 2011, and Berger and Bouwman, 2013) provide empirical evidence that bank capital increases value in the cross-section.

Laeven and Levine (2009) find that stricter capital regulation only reduces risk if bank ownership is dispersed. Behr et al. (2010) find that capital regulation is effective in mitigating risk only if the banking sector is sufficiently competitive. These studies exploit cross-country differences in regulation.

[2] Details are here: Calibrating the GSIB Surcharge (federalreserve.gov).

In contrast to these studies, we are interested in how a *change* in capital regulation affects risk-taking, which allows us to make causal inferences. Berger and Udell (1994) find that risk-based capital requirements in Basel II lead to reallocation of bank assets from loans to securities. Since the requirements in Basel II are imposed for all banks at the same time, there is no cross-sectional heterogeneity to exploit.

We exploit the across-bank heterogeneity in capital requirements to examine how the effects vary in the cross-section, which produces two novel insights. First, we show that the largest banks are likely to be less sensitive to an increase in capital requirements and hence, we provide a new rationale for the G-SIB capital surcharge. Second, we show that there are differences in how banks with transparent and opaque assets deleverage; the latter are more reliant on reducing risk-weighted assets in increasing their regulatory capital ratio.

Our paper also adds to a small set of papers which studies the impact of the FAS 166/167 reform (e.g., Dou et al., 2018, Tian and Zhang, 2016, Dou, 2021, and Tang, 2019). Dou et al. (2018) show that the treated banks tighten credit supply in the mortgage market with a lower mortgage approval rate, and further reduce exposure to the market through a higher mortgage sale rate. Tian and Zhang (2016) find that the treated banks reduce their credit card receivables but improved the quality of the receivables following the FAS 166/167 regulation. Dou (2021) finds that the treated banks reduce small business lending. Consistent with the findings above, we show that banks reduce their loan portfolio risk. The findings in Dou et al. (2018), and Dou (2021) suggest that there are spillovers within the bank's loan's portfolio arising from the FAS 166/167 regulation. In contrast to the other studies so far, by considering the whole loan portfolio, we show that the *net* effect is lower risk-taking. Our findings shed light on potential channels driving the findings in Tian and Zhang (2016) that the treated banks improved the quality of the receivables following the FAS 166/167 regulation. The improved quality may be either due to increasing lending to safer borrowers or reducing lending by implementing stricter lending standards: while Tian and Zhang (2016) indicate that the latter is the relevant channel, our results suggest that the relevant channel may differ according to banks' asset transparency.

2. Conceptual framework

We present a simple and stylized model of banking which suggests that the bank response to an increase in capital requirements should vary in the cross-section. The model has four dates, $t = \{0, 1, 2, 3\}$. There are two types of banks: opaque banks and transparent banks. At $t = 0$, both types of banks have tradeable legacy loans, which can be either relationship or arm's length, and some non-tradeable assets. The relationship loans are owned by the opaque banks. The transparent banks own the arm's length loans and do not possess private information regarding their loans. A secondary market for loans operates at $t = 0$ and $t = 2$. All agents are risk-neutral and protected by limited liability. The risk-free rate is normalized to 0, so there is no discounting.

Bank equity capital is assumed to be costlier than deposits (e.g., due to mis-priced deposit insurance), which implies that in the absence of capital requirements, both types of banks lever up to 100% deposits. The regulator imposes capital requirements. In addition, breaching the regulatory minimum is assumed to be costly. The cost of breaching the regulatory requirements may be interpreted as reputation costs and higher compliance costs due to an increase in regulatory scrutiny. The cost is prohibitively high such that breaching the regulatory requirement in any possible state is never ex-ante optimal. This implies that a bank will hold a buffer in excess of the capital requirements at $t = 0$. With capital requirement, $k\%$, a bank brings forward a buffer, $b\%$, to $t = 0$, so the bank equity capital at this date is $(k + b)$.

For an opaque bank, the entrepreneur's project has a positive NPV at the time of the loan issuance; the gross interest rate, R, is set such that the bank makes non-negative expected profits, and it is paid at $t = 3$ only if the entrepreneur succeeds, which happens with probability, $p \in (0,1)$. With the complementary probability, $(1 - p)$, the entrepreneur's project fails, and the loan is not repaid. At $t = 1$ the bank privately learns with certainty whether the loan will be repaid or not. For a transparent bank, its loan will repay R at $t = 3$ with probability p and 0 with probability $(1 - p)$; the difference with the opaque banks is that the transparent bank does not learn anything about its loans at $t = 1$.

At $t = 2$ both types of banks face a purely idiosyncratic shock with probability $\lambda \in (0,1)$; there is no aggregate uncertainty and λ is assumed to be distributed independently of p. The shock reduces the value of the non-tradeable assets of the bank which impairs a fraction, $\alpha \in (0,1)$ of the banks' equity capital, i.e., if a shock hits a bank, its capital falls from $(k + b)$ to $(1 - \alpha)(k + b)$. The realization of the shock is privately observed by the banks. We assume that there is no equity issuance, so banks sell assets to raise capital (similar to Corona et al., 2015 and Davila and Hebert, 2020). This assumption reflects the experience of the 2008-2009 global financial crisis when many banks were forced to sell risky assets at fire sale prices to meet capital requirements (see e.g., Shleifer and Vishny, 2011). We briefly discuss the implications of relaxing this assumption below. We summarize the timeline of model below:

t=0: Banks own legacy loans with expected value, pR. Bank capital ratio is $k + b$.

t=1: The opaque banks privately learn if the legacy loans will be repaid.

t=2: Banks face a shock with probability, λ, which impairs a fraction, α, of bank capital.

t=3: All returns are realized. Loans are repaid only if entrepreneurs succeed.

Suppose that at $t = 0$ the capital requirements go up by Δ%. The increase in requirements is such that the requirements do not bind due to the existing excess buffer, i.e., $b > \Delta$. However, if the liquidity shock hits a bank at $t = 2$, the bank will need to sell assets in order not to breach the regulatory requirements. Banks can sell loans at $t = 0$ or $t = 2$. Given the increase in capital requirements, if the shock hits a bank, the bank will sell assets worth:

$$(k + \Delta) - (1 - \alpha)(k + b) = \Delta + \alpha(k + b) - b \tag{1}$$

By selling the amount of asset described in Equation (1) the bank will ensure that it will not breach the regulatory minimum. How would the opaque and transparent banks respond to an increase in capital requirements at $t = 0$? Consider an opaque bank's problem at $t = 2$. When an opaque bank sells its loans, it is either due to the liquidity shock or because it learns at $t = 1$ that the entrepreneur has failed and will not make the loan repayments: it is not clear if the bank is illiquid or insolvent. This implies that the opaque bank sells its assets with probability $\lambda + (1 - \lambda)(1 - p)$ at $t = 2$. The fair price of the loan at $t = 2$ is:

$$\Pi = \frac{\lambda\, pR}{\lambda+(1-\lambda)(1-p)} < pR \tag{2}$$

In contrast, at $t = 0$ the price of the opaque banks' loans is given by pR, which is the fair price of the loan given that the bank does not know if the entrepreneur will succeed or not. Note that $pR > \Pi$ for any $\lambda < 1$. This implies that for any feasible parameters, an opaque bank faces a discount in selling its loans at $t = 2$, relative to the price at $t = 0$.

Lemma 1: *The opaque banks receive a higher price if selling the loan at $t = 0$ than if selling at $t = 2$.*

Suppose that the shock hits at $t = 2$. Consider the following set of parameters:

$$pR > \Delta + \alpha(k + b) - b > \Pi > \alpha(k + b) - b \tag{3}$$

For these parameters, an opaque bank avoids breaching the higher capital requirements if it sells its loans at $t = 0$ (first inequality), but not if it sells its loans at $t = 2$ (second inequality). The third inequality ensures that if there is no increase in capital requirements at $t = 0$, the opaque bank can meet the regulatory requirements by selling the assets at $t = 2$ implying that if there is no increase in capital requirements the opaque bank is indifferent between selling the loan at $t = 0$ or $t = 2$. If the magnitude of the liquidity shock, α, is more severe (the first inequality flips), selling loans never avoids breaching the regulatory requirement. If the magnitude of the liquidity shock is less severe (the second inequality flips), the bank avoids breaching regulatory requirement by selling its loans $t = 2$.

Supposing that α is in the intermediate range, the opaque bank always sells its loans at $t = 0$. Waiting to sell till $t = 2$ is never an optimal strategy for the bank since with a positive probability there will be a liquidity shock leading to a breach of the regulatory capital requirements, which is to be avoided in all states given the cost it entails. To ensure that the bank does not fall short of the regulatory requirements in all future states, the opaque bank responds to an increase in capital requirements by selling its loans, even though the requirement do not bind at $t = 0$.

Lemma 2: *For intermediate values of α (given by Equation 3), the opaque banks sell assets at $t = 0$ in response to an increase in capital requirements at $t = 0$, even if the increase in requirements is not immediately binding.*

Next, consider a transparent bank's problem. It does not face the adverse selection problem like the opaque banks. If it sells its assets at $t = 2$, it is clearly because of the shock, and not because it is attempting to hide the sale of bad assets behind the shock. Therefore, its assets are sold at the same price at $t = 2$ as at $t = 0$.

Lemma 3: *The transparent banks are indifferent between selling their assets at $t = 0$ or $t = 2$, in response to an increase in capital requirements at $t = 0$.*

To summarize, there are two key frictions in the model:

i. the opaque banks privately learn at the intermediate date whether the loan will be repaid and,

ii. breaching the regulatory requirements is prohibitively costly.

In the presence of the two frictions, the opaque banks, but not the transparent banks, sell assets in response to an increase in capital requirements, even if the requirements are not binding. The reason is that in the event of a crisis, an opaque bank will face an adverse selection discount in selling its assets such that the proceeds from the sale may not be sufficient to cover the shortfall in equity capital. In contrast, a transparent bank is able to sell its assets at a fair price at any given point in time. In reality, both types of banks are likely to face some discounts in selling their assets during crisis times (e.g., due to a temporary lower demand for riskier securities during the crisis, as in Shleifer and Vishny, 1992, Allen and Carletti, 2008, and Shleifer and Vishny, 2011); the model's predictions are qualitatively unchanged as long as the discount for the opaque assets is larger than the discount for the transparent assets. Our assumption that breaching the regulatory requirements is prohibitively costly is also innocuous. If we are to assume that the cost of breaching the regulatory requirements is smaller, then there will be a larger range of parameters for which the opaque banks do not sell assets at $t = 0$ in response to an increase in capital requirements at $t = 0$, but qualitatively the results are unaffected.

Finally, we briefly discuss the implications of relaxing the assumption that banks cannot issue equity capital. Suppose that banks can issue equity at $t = 0$. Issuing equity is costly, and the banks will account for this cost in their decision to issue equity capital or not by trading off the issuance cost against the cost of selling risky assets. Banks are likely to face different issuance costs in the cross-section. Banks which face high issuance costs will sell risky assets to meet regulatory requirements (bad deleveraging), while banks which face smaller issuance costs and have ready access to the capital markets will raise equity capital (good deleveraging). How issuance costs interact with bank opacity is an empirical question. Regardless of whether a bank is transparent or opaque, if it faces a low issuance cost then it will raise equity following an increase in requirements at $t = 0$. If issuance costs are high, only the opaque banks will sell risky assets at $t = 0$, while the transparent banks will wait to see if the liquidity shock hits and then sell risky assets at $t = 2$, only if necessary. We conjecture (and empirically verify) that the opaque banks are likely to face higher equity issuance costs, while the transparent banks are likely to face lower equity issuance costs. Therefore, the main prediction from the model is stated below:

Empirical Prediction: *Following the reforms, the opaque banks will sell risky assets and reduce risk, while the transparent banks will increase capitalization but not sell risky assets or reduce loan risk.*

It is important to note that the prediction relies on an *anticipated* liquidity shock, which implies that it is not necessary to observe a liquidity shock in the data to test the prediction. As long as there is a positive probability of a future liquidity shock, the transparent and opaque banks respond differentially to an increase in capital requirements. Therefore, to test the prediction, we need an exogenous shock to banks' capital requirements; the FAS 166/167 reforms offer precisely this empirical setting.

3. Data and Methodology

3.1 Data

We use annual bank balance sheet data collected from the FR Y-9C reports of US bank holding companies in the SNL Financial database. Our sample covers 2005–2015, with the implementation of the FAS 166/167 at the beginning of 2010, which falls roughly in the middle of the sample period. The initial sample contains all 3920 US bank holding companies. We only keep the banks that have non-zero off-balance sheet securitized assets in at least one year during our sample to ensure comparability between the banks affected by the FAS 166/167 and those which were not. We end up with a total of 163 banks in our sample. Starting in 2011, banks disclose the data on the size of assets in consolidated VIEs on Schedule RC-V of the Call Reports (in 2010 disclosure of this information was not required). We identify 33 banks which reported the consolidation of at least one VIE under the FAS 166/167 between 2011-2015; these 33 banks make up the treatment group. Of the 133 control banks, we identify a sub-sample of 60 banks, the smallest of which is larger than the smallest treated bank. We call this the size-matched control group. We have 869 bank-year observations when considering the size-matched control group. Including control variables in the regressions reduces the number of observations. To retain the largest sample size possible, we report the regressions both with and without including the control variables. We define the main variables in our analysis below, and the summary statistics are in Table 1. All continuous variables are winsorized at the 1st and 99th percentiles to avoid the effects of outliers in the regressions.

Our basic dependent variable is bank risk-taking, measured by two different proxies: *Net Charge-offs* and *Z-score*. *Net Charge-offs* is the ratio of net charge-off to average gross loans. Higher values of *Net Charge-offs* indicate higher risk-taking. Our second risk proxy is the *Z-Score* which measures the distance to default. The *Z-Score* is calculated as follows:

$$Z - Score_{i,t} = \frac{ROA_{i,t} + Equity_{i,t}/Assets_{i,t}}{\sigma(ROA)_{i,t}} \tag{4}$$

$\sigma(ROA)$ is the volatility of ROA. We use the quarterly ROA to construct the volatility variable, so it is time-varying at the annual frequency. A higher *Z-Score* signals that a bank has a lower insolvency risk. It may be interpreted as the number of standard deviations that a bank's profits have to fall for the bank to just deplete its equity capital and become insolvent (Roy, 1952). Since the distribution of *Z-Score* is known to be highly skewed, we use the natural logarithm of *Z-Score* in the regressions, as is the standard practice (e.g., Laeven and Levine, 2009, and Beck et al., 2013). Unlike *Net Charge-offs*, which measure the risk in banks' loan portfolios, the *Z-Score* measure captures the overall bank risk. From Table 1, the average *Net Charge-offs* in our sample is 0.988, and the average *Z-Score* is 3.893.

Under Basel capital adequacy standards, riskier asset categories entail higher risk-weights, implying a higher associated capital charge for them. Therefore, higher capital requirements may be met by reducing risk-weighted assets (*RWA*) by tilting the asset portfolio away from the riskier assets to the safer ones (e.g., reduce lending and hold cash) and/or by issuing Tier 1 capital (*CET1*), which is composed of core capital including common equity and retained earnings. Unrealized gains and losses on available-for-sale (AFS) securities and loan loss reserves are excluded from Tier 1 capital. We examine the impact of FAS 166/167 on the risk-weighted capital ratio, *CET1/RWA*; additionally, we use *CET1* and *RWA* (and scale them by total assets) to examine the impact of the reform on the components separately. To relate the *RWA* variable to the risk measures discussed above, note that the *Net Charge-offs* measure is scaled by gross loans (not total assets). Therefore, if the bank simply re-balances its portfolio from assets with high capital charges to assets with lower capital charges, this effect may not show up in the *Net Charge-offs*, but it will show up in the *Z-Score* measure.

We control for various bank characteristics in our regressions. Bank size is proxied using the natural logarithm of the total assets, *Size*. *GrowthTA* is the growth rate in *Size*. The return on assets, *ROA*, reflects bank profitability. The average bank in the sample has a *ROA* of 1.033%. *Loan* and *Cash*, which are the ratio of gross loans to the total assets and the ratio of total cash to total assets, reflect the bank's business model and liquidity, respectively. The average bank's loan portfolio makes up 63.58% of its total assets, and it holds 1.99% of the total assets in cash. *Deposit* is the total deposits scaled by the total assets and *Equity* is the total equity divided by the total assets; together, they reflect the bank's funding structure. The ratio of overheads to the total assets, *Overheads,* captures the bank's operating costs. *Trading Assets* is calculated as the bank trading assets scaled by the total assets. Finally, we control for the size of the off-balance sheet activities, *OFBS*, by using the total assets securitized divided by the total assets. Off-balance sheet activities make up 5.791% of the bank's total assets.

The main prediction of our model is that the impact of reform should differ in the cross-section of banks. To test the cross-sectional differences across transparent and opaque banks, we construct an indicator variable, *Transparent,* which equals 1 if a treated bank has trading assets above the 75th percentile (among the treated banks), while it equals 0, otherwise. The idea is that the banks with a high fraction of their assets in trading assets can sell these assets at fair price whether there is liquidity shock or not. Additionally, the lending model of the banks with a high fraction of their assets in trading assets is less likely to be relationship-oriented and more likely to be arm's length. This would further suggest that these banks do not have private information regarding their loans, making them easier to sell (i.e., without an adverse selection discount) in the event of a liquidity shock.

3.2 Methodology

We identify the impact of the higher capital requirements on bank risk-taking using a difference-in-differences research design. We estimate the following regression:

$$Y_{i,t} = \beta_1 * Post_t * Consolidation_i + \alpha X_{i,t-1} + \gamma_i + \gamma_t + \varepsilon_{i,t} \quad (5)$$

where Y_{it} is the outcome variable (e.g., risk-taking) for bank i in year t. $Consolidation$ is an indicator variable that equals one if a bank consolidated VIEs under the FAS166/167 and zero otherwise. $Post$ is an indicator variable, which equals one if the year is 2010 or later and zero otherwise. We include the bank fixed effects, γ_i, to control for time-invariant bank characteristics and the year fixed effects, γ_t, to control for time-varying shocks. We cannot estimate the coefficients on *Post* and *Consolidation* because these are subsumed by the included fixed effects. The variable of interest is the interaction term, *Post***Consolidation*, which captures the banks in the treated group in the post-reform period. The vector, X_{it-1}, is the set of bank characteristics (e.g., *Size, OFBS,* and others discussed in Section 3.1); the controls are lagged by one period to mitigate endogeneity concerns. We estimate Equation (5) using OLS, and the standard errors are clustered at the bank level.

4. Results

4.1 Parallel Trends

The validity of our difference-in-differences set-up requires that the parallel trend assumption is not violated, i.e., the change in the treated and control banks' outcome variables reflecting bank risk would have followed a similar trend in the absence of the FAS 166/167 implementation (Angrist and Krueger, 1991). In Table 2, we compare the treated and control groups' average annual growth rates for the primary outcome variables, *Net Charge-offs, Z-Score*, and *CET/RWA*, for each of the pre-treatment years in the sample. In panel A the treated banks are compared against all securitizing banks, while in panel B, the size-matched control group is used (these are the 60 banks, the smallest of which is larger than the smallest treated bank). For the risk variable, the differences in the two groups' growth rates are not statistically different from zero for any of the pre-treatment years in either sample. The growth rate in *CET1/Assets* for the treated banks is faster in the most recent year prior to the reform (2008-2009), which is not ideal from the view of drawing causal inferences. However, when we use the size-matched control group in panel B, the differences in the growth rates in this variable is statistically insignificant for each pre-reform year. These observations potentially reflect differential access or use of TARP funds by small and large banks. We infer that the size-matched control group is a more suitable control group for our study. Overall, these observations suggest that the parallel trends assumption is likely to be satisfied vis-à-vis the size-matched control group since for all three of our primary outcome variables the growth rates are similar across the treatment and the size-matched control group.

Table 3 compares the average pre-treatment growth rates for different variables across the treated and control groups. In panel A the treated banks are compared against all securitizing banks, while in panel B, the size-matched control group is used. In Panel A, for several variables, the differences in the two groups' growth rates are not statistically different from zero. However, for some variables, including one of our main dependent variables, *CET1/RWA*, the differences between the two groups' growth rates are statistically significant. In Panel B, we report the average pre-treatment growth rates for different variables in the treated and size-matched control group. Panel B shows the similar results for the most variables (the only statistically significant difference between the two groups is in the growth rate *Loans*). Notably, for *CET1/RWA*, the difference in the two groups' growth rates is not statistically different from zero. Therefore, we can infer that the banks in the treatment group and the size-matched control group appear to follow a similar path before the implementation of the FAS 166/167. Given the greater comparability of the size-matched control group vis-à-vis the treated group (as illustrated in Tables 2 and 3), we only focus on the regressions using the size-matched control group.

4.2 Baseline Results

We begin by visually inspecting the treated banks' response in terms of our main dependent variables to the reforms in Figure 2. We plot the means of all the outcome variables, *Net Charge-Offs*, *Z-Score*, *CET1/RWA*, *RWA/Assets*, and *CET1/Assets*, in the treated and size-matched control banks. In panel (a), we plot the mean *Net Charge-Offs* around the reform. This figure shows that, before the reform, the *Net Charge-Offs* for the two groups are both increasing (during the global financial crisis), visibly more sharply for the treated banks, and the treated banks have a higher *Net Charge-Offs*, on average. Post-reform, the *Net Charge-Offs* falls for both the treated and control groups, the effect is more stark for the treated banks, and the difference in means between the two groups disappears by the end of the sample. In panel (b), we plot the mean *Z-Score* around the FAS 166/167 reform. Pre-reform, *Z-Score* is falling for both groups and the slope of the fall is parallel. The mean *Z-Score* recovers for both groups following the reform. Consistent with the *Net Charge-Offs* results*,* the recovery is stronger for the treated banks. The visuals in panels (a) and (b) are consistent with our hypothesis that some banks reduce risk following an increase in capital requirements.

In panel (c), we plot the mean risk-weighted capital ratio, *CET1/RWA*, around the reform. The ratio begins to climb for both groups in the year before the reform (possibly due to TARP). However, while post-reform, the increase in the risk-weighted capital ratio slows down for the control banks, the increase continues for the treated banks till the later part of the sample. Indeed, the differential post-treatment evolution eliminates the pre-treatment differences in the risk-weighted capital ratio (and the treated banks hold higher average risk-weighted capital by 2014). Note that the mechanical impact of the reforms (if the banks did not respond) would be to lower the amount of regulatory capital in the treated banks. That we observe the opposite is indicative of a strong response by the treated banks. In panels (d) and (e), we plot the means of the risk-weighted assets to total assets ratio, *RWA/Assets,* and the Tier 1 capital to total assets ratio, *CET1/Assets.* There is an immediate (resp. a more gradual) differential impact following the reforms in the *RWA/Assets* (resp. *CET1/Assets*) variable, with a much sharper fall (resp. a muted rise) for the treated banks compared to the control banks. The observation in panels (d) and (e) suggest that the post-reform differences between the treated and control banks in the risk-weighted capital ratio is largely driven by the denominator, on average. Again, the visuals in panel (d) are quite striking: the mechanical impact of consolidating the VIEs on the balance sheet would lead to higher risk-weighted assets for the treated banks, while we see the opposite in the data. Of course, what is represented in these graphs in the average effect and our model has specific predictions which vary by bank type, which we study in the regressions.

In Table 4, we present the results of estimating Equation (5) with the risk-taking variables as the dependent variables. In column 1 and 2 the dependent variable is *Net Charge-offs*, without and with the control variables, respectively. The coefficient on the interaction term, *Post*Consolidation*, is negative and statistically significant at the 5% level in column 1 and column 2 when we include the controls. The estimated coefficients suggest that the magnitude of the effect is sizable. Following the implementation of the FAS 166/167, the treated banks reduce *Net Charge-offs* by 0.21% or 0.22%, depending on the specification. Taking the coefficient in full specification, *Net Charge-offs* for the treated banks fall by 22% $(0.216/0.988)$ relative to the mean. In columns 3 and 4, the dependent variable is the *Z-Score*, which captures the overall risk-taking of the bank. The *Z-Score* provides a slightly different information than *Net Charge-offs*, since loans in our sample only make up 63.58 % of the total assets for the average banks. Consistent with lower risk-taking following the treatment, the coefficient on the interaction term is positive and statistically significant, whether we include the controls or not. When we include the controls, the coefficient is 0.371 and significant at the 10% level, which implies that the reform leads to a 44.9% $(e\text{\textasciicircum}0.371 - 1)$ average increase in the *Z-Score*.

In terms of the set of control variables, the coefficient on *Size* is positive in the *Net Charge-offs* regression and negative in the *Z-Score* regression, indicating that larger banks are riskier, consistent with a 'too-big-to-fail' hypothesis. The coefficient on *ROA* is negative in the *Net Charge-offs* regressions, implying that the profitable banks take less risk. The coefficient on *OFBS* is insignificant in both regressions, implying that conditional on being a securitizing bank (which makes up our sample), the intensity of the securitization is not significantly associated with risk-taking.

Regulatory capital requirements under Basel II are in terms of Tier 1 capital over risk-weighted assets. Higher capital requirements may be met either through increasing Tier 1 capital on the liability side or reducing risk-weights of assets. The former is the so-called good deleveraging and it is arguably what the regulators aim to achieve. The latter could potentially be done through cutting lending which could lead to a dry-up of credit in the economy, and hence, it is termed bad deleveraging.

In Table 5, we examine both possibilities. In column 1, we estimate Equation (5) using *CET1/RWA* as the dependent variable. The coefficient on the interaction term, *Post*Consolidation*, is positive and statistically significant at the 5% level. The magnitude of the effect is economically important. The treated banks increase their risk-weighted capital ratio by 1.0%, which is roughly 8.8% of the sample average for this variable. This result confirms that the treated banks increased the ratio of high-quality regulatory capital over risk-weighted assets in response to the higher capital requirements. To disentangle whether the numerator or the denominator drives the result, we consider them separately. In column 2 the dependent variable is *RWA* scaled by total assets. The coefficient on the interaction term is negative and statistically significant at the 5% level. This result suggests that in response to the higher requirements, banks re-balance their portfolio towards assets which have lower risk-weights attached to them. The response is sufficiently strong to overturn the mechanical impact of the reform which is to increase the amount of risk-weighted assets. The finding is consistent with Dou et al. (2018) who find that the banks affected by the FAS 166/167 reform reduce mortgage origination and increase the sale of existing mortgages. In column 3 the dependent variable is *CET1* scaled by total assets. The coefficient on the interaction term is positive, but statistically insignificant at the conventional levels.

GFC and ensuing regulations. Since the post-reform period begins in 2010, one possibility is that global financial crisis of 2007-2009 drives our results. Additionally, motivated by the crisis, this period also experienced other major reforms, such as the Dodd-Frank Act and the Basel III. Our choice of control banks mitigates these concerns to some extent, since they are also securitizing banks and similar in size. This is evident in the evolution of the *CET1/RWA* ratio in the pre-treatment period since the differences in the growth rates across the treated and the size-matched control banks are similar, suggesting that they had similar exposure to TARP funding. We perform two additional tests to further address these concerns using our three principal dependent variables and report the results in Table 6.

In the first three columns, we use the year before the crisis, 2006, as the placebo treatment year (with the sample from 2003-2009): if the crisis is driving our original findings, then the placebo effect should be significant in the treated banks. We do not find this to be the case, which suggests that the crisis is not driving our findings. Additionally, the crisis and the concurrent reforms are likely to have differentially impacted on the largest and systemically most important banks. We create an indicator variable, *G-SIB*, which takes the value 1 if it was included in the 2011 G-SIB list and 0 otherwise. We append the baseline regressions by including *G-SIB* (which is absorbed by the fixed effects) and its interaction with *Post*. The findings are in columns (4) - (6). If the crisis and regulation are driving our findings, the coefficient on the interaction term, *Post*Consolidation*, should enter insignificantly. In all three regressions, the coefficient on *Post*Consolidation* enters with the consistent sign as before, and the coefficients are still statistically significant for the *Net Charge-Offs* and *CET1/RWA* variables; the coefficient is statistically insignificant in the *Z-Score* regression. The coefficient on *Post*G-SIB* is statistically insignificant in all three regressions.

4.3 Cross-sectional heterogeneity

Our model predicts that the effects of an increase in capital requirements should be stronger for the banks which own fewer marketable securities, since they face an adverse selection cost in selling the non-marketable assets. To test the hypothesis, we construct an indicator variable, *Transparent,* which equals 1 if a treated bank has trading assets above the 75th percentile (among the treated banks), while it equals 0, otherwise.[3] We estimate an augmented version of Equation (5) as follows:

$$Y_{i,t} = \beta_1 * Post_t * Consolidation_i + \lambda_1 * Post_t * Transparent_i + \alpha X_{i,t-1} + \gamma_i + \gamma_t + \varepsilon_{i,t} \quad (6)$$

Since only the treated banks can take the value 1 for the variable, *Transparent*, the interaction, *Post*Consolidation*Transparent*, and *Consolidation*Transparent* are subsumed due to perfect multicollinearity. The coefficient, λ_1, captures the heterogenous effect. By itself, the coefficient, β_1, reflects the treatment effect for the opaque banks, while the sum, $\beta_1 + \lambda_1$, represents the treatment effect for the transparent banks. The prediction from the model is that λ_1 will take the opposite sign to β_1, when the dependent variable is bank risk.

We report the findings for the two risk proxies in Table 7. In column 1 the dependent variable is *Net Charge-Offs*. As before, the coefficient on the interaction term, *Post*Consolidation*, is negative and statistically significant. The coefficient, λ_1, is positive, although statistically insignificant. The sum, $\beta_1 + \lambda_1$, becomes statistically insignificant. These findings suggest that banks with smaller amounts of trading assets reduced their risk more aggressively post-treatment, which is consistent with our hypothesis. In column 2 the dependent variable is *Z-Score*. The coefficient on the interaction term,

[3] The 50th percentile Trading assets value is < 1%, and hence, not a significant proportion of bank's assets. For this reason, we pick the 75th percentile as the cut-off which is 7.5%.

*Post*Consolidation*, is positive, but statistically insignificant. Consistent with expectation, the coefficient, λ_1, is negative. Overall, we infer that while the risk-curbing effects are relatively muted for the transparent banks, compared to the opaque banks.

In Table 8, we estimate Equation (6), with *CET1/RWA*, *RWA/Assets* and *CET1/Assets* as the dependent variables. In column 1 the dependent variable is the risk-weighted capital ratio, *CET1/RWA*. The coefficient on the interaction term, *Post*Consolidation*, is positive and statistically significant, and the coefficient, λ_1, is positive. This suggests that in response to the increased capital requirements, both transparent and opaque banks increase their risk-weighted capital ratio. In column 2 the dependent variable is *RWA/Assets*. The coefficients on the interaction term, *Post*Consolidation,* is negative, while the coefficient, λ_1, is positive. The sum, $\beta_1 + \lambda_1$, is also negative but statistically insignificant. This suggests that only the opaque banks reduce risk-weighted assets sufficiently to overturn the mechanical impact of the reform, consistent with the opaque banks selling riskier assets in order to avoid the adverse selection costs in the potential event of a crisis. The transparent banks too reduce risk-weighted assets, but the response is only offsets the mechanical impact of the reform. In column 3 the dependent variable is *CET1/Assets*. Both β_1 and λ_1 are positive, although the tests lack power. The positive λ_1 indicates that the transparent banks increase Tier 1 capital relatively more, reflecting their low equity issuance costs.[4] Therefore, we find some evidence that although both transparent and opaque banks deleverage following the reform, they do so in different ways, with the opaque banks mainly reducing risk-weights (bad deleveraging) and the transparent banks increasing Tier 1 capital (good deleveraging), with the caveat that the latter effect is not statistically significant at the conventional levels.

Treatment intensity. One possibility is that the transparent banks are systematically less affected by the reform, which then leads to a weaker treatment effect for the transparent banks. However, we show that in fact, it is the opposite: the transparent banks are more intensely affected by the reform. We perform a pre-treatment comparison of the treated banks in the fourth quartile of VIE consolidation

[4] The transparent banks have a deposit ratio of 41.17% on average, while the opaque banks have a deposit ratio of 73.892%; the difference between the means is statistically significant (t-statistic is 17.41). This suggests that the transparent banks are relatively less reliant on deposit financing, reflecting cheaper access to the capital markets.

(which we call the Q_4 banks) and the treated banks in the first three quartiles of VIE consolidation (the $Q_1 - Q_3$ banks). We report the findings in Table 9. We find that the most intensely treated banks have more trading assets (i.e., they are more transparent), are larger and have lower loan to assets ratios relative to the other treated banks. That the $Q_1 - Q_3$ banks are smaller than the Q_4 banks indicates that the $Q_1 - Q_3$ banks are more likely to be relationship lenders with more opaque assets, while the Q_4 banks are more likely to be the arm's length lenders with more transparent assets (e.g., Stein, 2002 and Berger et al., 2005). We expect that the Q_4 banks are more transparent along two dimensions: they hold more marketable securities which tilts their asset portfolio away from loans, and their loan portfolios consist of arm's length loans rather than relationship loans (which makes their loans more saleable).

We estimate an augmented version of Equation (5) as follows:

$$Y_{i,t} = \beta_1 Post_t * Consolidation_i + \beta_4 Q_{4,t} + \alpha X_{i,t-1} + \gamma_i + \gamma_t + \varepsilon_{i,t} \tag{7}$$

In this specification, we include the indicator variable for the fourth quartile of VIE asset consolidation, while the banks in the first three quartiles serve as the benchmark. All other interactions with the fourth quartile dummy (i.e., $Q_4 * Post$, $Q_4 * Consolidation$, and $Q_4 * Post * Consolidation$) are absorbed due to perfect collinearity (since Q_4 may take a value of 1 only for the treated banks in the post-treatment period). The coefficient β_1 captures the treatment effect for the banks in the first three quartiles. For the banks in the highest quartile, the treatment effect is $\beta_1 + \beta_4$.

We present the findings in Table 10. In column 1 the dependent variable is *Net Charge-offs*. The coefficient on the interaction term, *Post*Consolidation*, is negative and statistically significant at the 1% level. For the banks which consolidated the relatively smaller amount of VIEs, the implementation of the FAS 166/167 triggered reduced risk-taking. The coefficient, β_4, is positive, suggesting that the effect is weaker for the banks which consolidated the most VIE assets. Indeed, the sum of the two coefficients, $\beta_1 + \beta_4$, is positive. That is, the risk-curbing effect is weaker for the banks consolidating the most VIE assets. In column 2, the dependent variable is *Z-Score*. A similar pattern emerges as column 1, except that the treatment effect is statistically insignificant also for the banks in the first three quartiles. The coefficient, β_1, is positive but statistically insignificant. $\beta_1 + \beta_4$ is also positive but statistically insignificant. In column 3, the dependent variable is *CET1/RWA.* For all quartiles, the ratio increases following the implementation of the FAS 166/167. That is, the coefficient, β_1, is positive and so is the sum, $\beta_1 + \beta_k$. Notably, only the coefficient, β_1, is statistically significant. Therefore, despite the treatment being more intense for the transparent banks, the treatment effect is weaker for this group, consistent with our model prediction and earlier results.

5. Conclusion

We examine how the bank capital requirements affect bank risk-taking. We exploit the FAS 166/167 for identification. After its implementation in 2010, banks were required to consolidate the securitized VIEs onto their balance sheets. The consolidation itself did not directly affect the banks' risk exposures, so any effects observed cannot be attributed to the consolidation. Since the consolidated assets were included in the risk-weighted assets, the treated banks' capital requirements increased. We identify 33 banks which consolidated VIEs, which make up the treated group, and a further 130 securitizing banks as the control group. Important for our identification, there is considerable overlap between the size distributions of the treated and control banks. We exploit this feature to extract a more appropriate control group from the overall sample of control banks, the size-matched control group. The size-matched control group consists of 60 banks, the smallest of which is larger than the smallest treated bank. In addition to this feature, since all banks belong to the US, overlap in the size distribution implies overlap in systemic importance distribution. This implies that the two groups are comparable, and we further verify that the pre-treatment trends are similar for the treated and size-matched control groups.

We find that an increase in the capital requirements induced by the FAS 166/167 reform leads the treated banks to lower risk-taking. The treated banks increase risk-weighted capital ratio. Surprisingly, the banks which are most intensely treated by the reform have a weaker response to the reform. We argue that this is the case since these banks are larger and have more transparent assets which implies that they suffer smaller adverse selection discounts in selling their assets in times of crisis. Our findings provide a new rationale for imposing stricter requirements for the largest banks (the capital surcharge for the G-SIBs): they are less sensitive to an increase in capital requirements because, unlike the smaller banks, they own transparent assets which do not suffer adverse selection discounts during crisis times. Hence, it is necessary to impose stricter requirements on the largest banks to extract the response of the desired magnitude.

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Figure 1: Bank size distribution.

This graph shows the size distribution of the control and treated groups. The Y-axis is the log of size. The value, 0, on the X-axis denotes the controls banks, while the value, 1, denotes the treated banks.

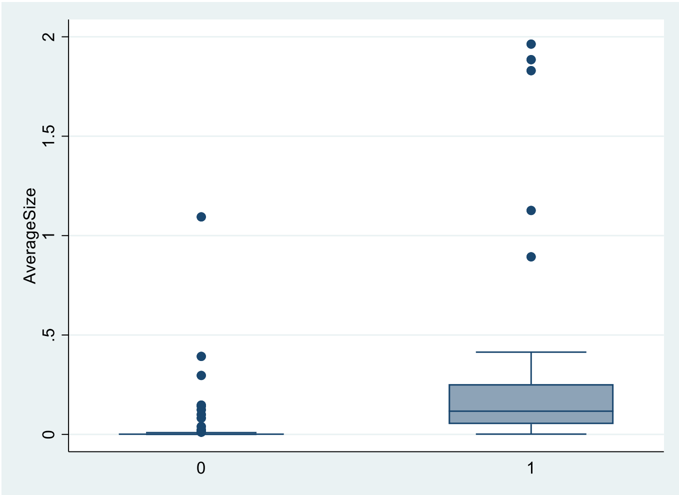
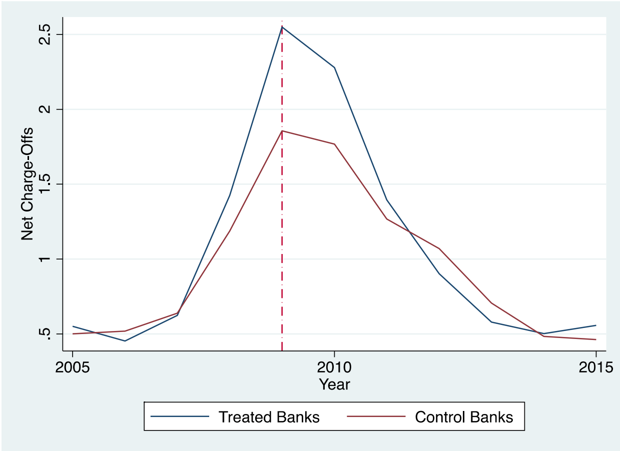
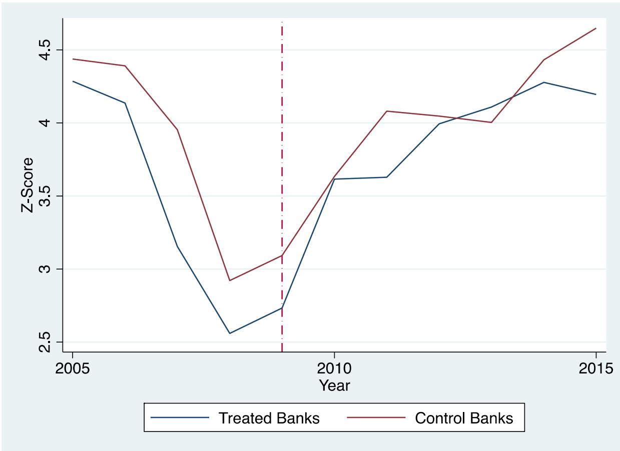


Figure 2: Unconditional average effects.

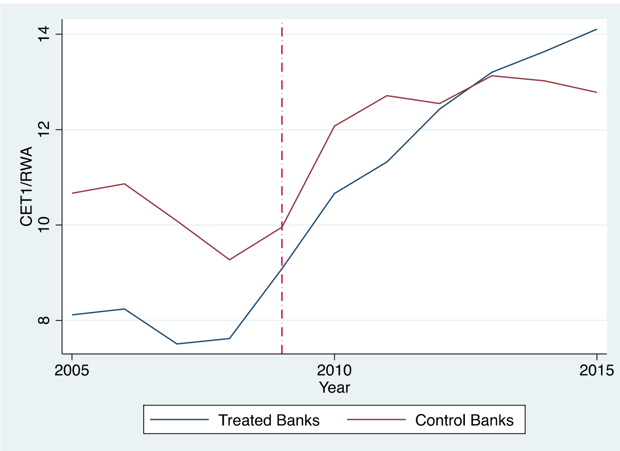
This figure plots the means of the outcome variables, *Net Charge-Offs*, *Z-Score, CET1/RWA, RWA/Assets, and CET1/Assets*, separately for the treated and size-matched control groups over the sample period. The reform date is the start of 2010.



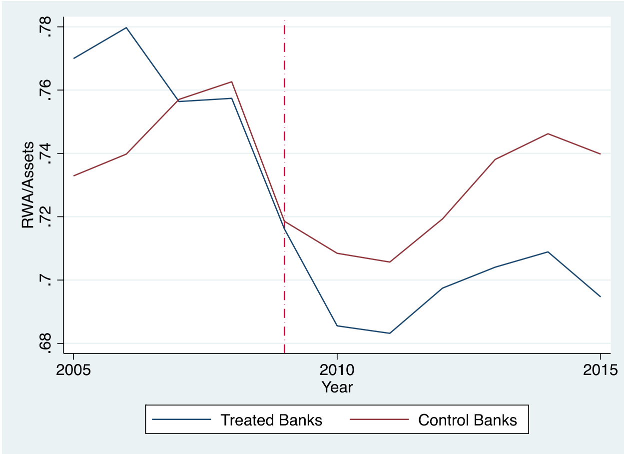
Panel (a): *Net Charge-Offs*



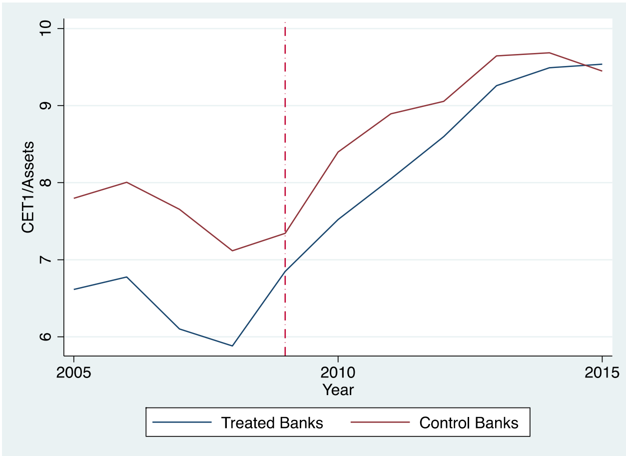
Panel (b): *Z-Score*



Panel (c): *CET1/RWA*



Panel (d): *RWA/Assets*



Panel (e): *CET1/Assets*

Table 1: Descriptive statistics.

The table shows the summary statistics of the key variables when using the size-matched control group. All variables are winsorized at the 1^{st} and 99^{th} percentiles to minimize the effects of outliers.

Variable	N.	Mean	SD	p10	p25	P50	p75	p90
Dep. Variables								
Charge-offs	869	0. 988	1.888	0.050	0.160	0.420	1.090	2.310
Z-Score	869	3.893	1.396	1.934	3.032	4.126	4.846	5.512
Control Variables								
Size	869	16.601	2.021	14.420	14.857	16.074	18.241	19.537
GrowthTA	851	7.716	15.111	-4.887	0. 587	5.293	10.711	20.305
ROA	869	1.033	2.079	0.010	0.600	0.960	1.230	1.550
Loan	869	63.578	16.796	40.840	59.690	67.550	73.920	78.750
Cash	869	1.987	1.131	0.870	1.260	1.770	2.440	3.370
Deposit	869	69.322	16.883	46.140	65.170	74.410	80.030	83.770
Equity	869	10.979	5.804	6.890	8.450	10.100	12.070	14.400
Overheads	869	3.549	2.519	2.250	2.660	3.030	3.590	4.750
Trading Assets	829	1.583	4.670	0	0	0	0. 473	3.513
OFBS	869	5.791	23.159	0	0	0	2.189	15.347

Table 2: Average pre-treatment growth rates.

The table reports the year-by-year average growth rates in means for the primary outcome variables, *Net Charge-Offs*, *Z-Score,* and *CET1/RWA*. Columns 1 and 2 show the growth rates in the treated and control groups, respectively. Column 3 calculate the difference and the t-statistic testing the equality of means is reported in column 4.

Panel A: Treated banks are compared against all securitizing banks

Year prior to reform	(1) Treated	(2) Control	(3) Differences	(4) T-Statistic
Charge-Offs				
2009-2008	1.113	1.311	0.198	0.378
2008-2007	1.657	2.549	0.892	0.530
2007-2006	0.378	0.589	0.210	0.449
2006-2005	0.025	0.242	0.218	0.501
Z-Score				
2009-2008	0.222	1.435	1.213	0.412
2008-2007	-0.059	-0.164	-0.104	-0.730
2007-2006	-0.165	-0.055	0.110	1.357
2006-2005	0.012	-0.111	-0.123	-0.462
CET1/RWA				
2009-2008	0.278	0.032	-0.246**	-2.297
2008-2007	-0.059	-0.047	0.012	0.237
2007-2006	-0.053	-0.027	0.026	0.778
2006-2005	0.017	-0.010	-0.026	-0.828

Panel B: Treated banks are compared against the size-matched control banks

Year prior to reform	(1) Treated	(2) Control	(3) Differences	(4) T-Statistic
Charge-Offs				
2009-2008	1.113	1.199	0.086	0.243
2008-2007	1.657	3.290	1.633	0.799
2007-2006	0.378	0.797	0.419	0.802
2006-2005	0.025	0.001	-0.024	-0.072
Z-Score				
2009-2008	0.222	-0.262	-0.483	-0.657
2008-2007	-0.059	-0.172	-0.113	-0.654
2007-2006	-0.165	-0.083	0.082	0.886
2006-2005	0.012	0.020	0.008	0.113
CET1/RWA				
2009-2008	0.278	0.079	-0.199	-1.440
2008-2007	-0.059	-0.059	-0.000	-0.001
2007-2006	-0.053	-0.041	0.012	0.315
2006-2005	0.017	-0.001	-0.018	-0.516

Table 3: Average pre-treatment growth rates.

This table reports the average growth rates for the different variables in the treated and control groups before the reform that is implemented in the start of 2010. Columns 1 and 2 show the average growth rates of the variables for the treated and control banks, respectively. Column 3 calculates the difference and the t-statistic testing the equality of means is reported in column 4.

Panel A: Treated banks are compared against all securitizing banks

Bank characteristics	(1)	(2)	(3)	(4)
	Treated	**Control**	**Difference**	**T-Statistic**
Net Charge-Offs	0.769	1.337	0.567	1.107
Z-Score	0.002	0.273	0.271	0.368
Size	0.006	0.006	-0.000	-0.152
GrowthTA	5.402	0.370	-5.032**	-1.969
ROA	-0.382	-0.555	-0.173	-0.290
Loan	-0.020	-0.002	0.018*	1.921
Cash	-0.063	-0.021	0.043	0.704
Deposit	0.030	0.139	0.110	0.472
CET1/RWA	0.046	-0.016	-0.062*	-1.943
RWA/Assets	-0.017	0.007	0.023	1.207
CET1/Assets	0.032	-0.016	-0.048	-1.415
Trading Assets	0.552	3.675	3.122	1.412
Overheads	0.022	0.032	0.009	0.394
OFBS	0.057	2.350	2.293	0.886

Panel B: Treated banks are compared against the size-matched control banks

Bank characteristics	(1) **Treated**	(2) **Control**	(3) **Difference**	(4) **T-Statistic**
Net Charge-Offs	0.769	1.369	0.600	1.093
Z-Score	0.002	-0.123	-0.126	-0.673
Size	0.006	0.005	-0.001	-0.797
GrowthTA	5.402	0.412	-4.991	-1.530
ROA	-0.382	-0.325	0.057	0.138
Loan	-0.020	-0.002	0.018*	1.658
Cash	-0.063	-0.012	0.052	0.743
Deposit	0.030	0.230	0.200	0.658
CET1/RWA	0.046	-0.007	-0.053	-1.322
RWA/Assets	-0.017	0.014	0.030	1.251
CET1/Assets	0.032	-0.004	-0.036	-0.843
Trading Assets	0.552	4.287	3.735	1.576
Overheads	0.022	0.043	0.021	0.719
OFBS	0.057	3.539	3.482	1.073

Table 4: Higher capital requirements and bank risk-taking.

The dependent variables are bank risk-taking proxies. All columns present the regressions using the size-matched control group. In columns 1, and 2, the dependent variable is *Charge-offs*, and in columns 3, and 4, the dependent variable is the *Z-Score*. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. *Post* is an indicator variable that equals one after the implementation of the FAS166/167. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1) *Charge-Offs*	(2) *Charge-Offs*	(3) *Z-Score*	(4) *Z-Score*
*Post*Consolidation*	-0.208**	-0.216**	0.339*	0.371*
	(-2.19)	(-2.28)	(1.93)	(1.80)
Size		0.426***		-0.499**
		(3.50)		(-2.09)
GrowthTA		-0.005**		0.005
		(-2.60)		(1.38)
ROA		-0.286***		
		(-4.77)		
Loan		0.009**		0.006
		(2.19)		(0.66)
Cash		0.071		-0.050
		(1.46)		(-0.68)
Deposit		0.001		0.005
		(0.20)		(0.40)
Equity		0.065***		
		(3.65)		
Overheads		-0.138***		0.067
		(-3.34)		(0.88)
Trading Assets		0.006		-0.024
		(0.87)		(-1.15)
OFBS		0.009		0.008
		(1.54)		(0.97)
Observations	869	720	869	720
R^2	0.477	0.582	0.270	0.295
Bank FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Table 5: Higher capital requirements and regulatory capital.

The dependent variables are the risk-weighted capital ratio and its components, scaled by assets. All columns present the regressions using the size-matched control group. In column 1 the dependent variable is *CET1/RWA*, in column 2 it is *RWA/Assets*, and in column 3 it is *CET1/Assets*. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. *Post* is an indicator variable that equals one after the implementation of the FAS166/167. Control variables are lagged by one year. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1)	(2)	(3)
	$CET1/RWA$	$RWA/Assets$	$CET1/Assets$
*Post*Consolidation*	0.998**	-0.025**	0.334
	(2.32)	(-2.57)	(1.04)
Size	-2.568***	0.025*	-1.841***
	(-3.63)	(1.84)	(-4.15)
GrowthTA	0.004	-0.000***	-0.002
	(0.62)	(-3.09)	(-0.44)
ROA	0.470**	-0.001	0.325**
	(2.25)	(-0.15)	(2.41)
Loan	-0.043	0.006***	0.028
	(-1.25)	(12.84)	(1.48)
Cash	0.056	0.002	-0.019
	(0.48)	(0.62)	(-0.15)
Deposit	-0.043	-0.000	-0.011
	(-1.51)	(-0.43)	(-0.63)
Equity		0.000	
		(0.09)	
Overheads	0.112	0.001	0.126
	(0.69)	(0.23)	(1.12)
Trading Assets	-0.008	-0.001	-0.006
	(-0.29)	(-1.40)	(-0.39)
OFBS	0.028	0.002*	0.049***
	(1.61)	(1.93)	(2.78)
Observations	708	717	708
R^2	0.487	0.463	0.441
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table 6: Falsification test

The dependent variables are risk-taking proxies, *Net Charge-Offs*, and *Z-Score*, and the risk-weighted capital ratio, *CET1/RWA*. All columns present the regressions using the size-matched control group. In columns 1 to 3, we report the results of placebo tests using the sample period as 2003-2009. *Post* is an indicator variable that equals one after 2006 (i.e. the year preceding the crisis). In columns 4-6 the interactions with G-SIB are included. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. In columns 4-6, Post is an indicator variable that equals one after the implementation of the FAS166/167. *G-SIB* is an indicator variable that equals one if a treated bank was included in the 2011 G-SIB list. Control variables are lagged by one year. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1) *Charge-Offs*	(2) *Z-Score*	(3) *CET1/RWA*	(4) *Charge-Offs*	(5) *Z-Score*	(6) *CET1/RWA*
*Post*Consolidation*	-0.019	-0.175	0.487	-0.206*	0.321	0.981**
	(-0.17)	(-0.63)	(1.09)	(-1.77)	(1.28)	(2.08)
*Post*G-SIB*				-0.036	0.132	0.115
				(-0.23)	(0.48)	(0.19)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Observations	421	421	407	720	720	708
R^2	0.629	0.378	0.151	0.583	0.296	0.488
Bank FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 7: Higher capital requirements, bank risk-taking, and trading assets.

The dependent variables are risk-taking proxies. All columns present the regressions using the size-matched control group. In columns 1 the dependent variable is *Charge-offs*, and in column 2 the dependent variable is the *Z-Score*. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. *Post* is an indicator variable that equals one after the FAS166/167. *Transparent* is an indicator variable that equals one if a treated bank's trading assets above the 75th percentile. Control variables are lagged by one year. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1) *Charge-Offs*	(2) *Z-Score*
*Post*Consolidation*	-0.231**	0.376
	(-2.11)	(1.65)
*Post*Transparent*	0.081	-0.027
	(0.59)	(-0.06)
Trading Assets	0.005	-0.024
	(0.76)	(-1.09)
Size	0.433***	-0.501**
	(3.44)	(-2.03)
GrowthTA	-0.005***	0.005
	(-2.62)	(1.36)
ROA	-0.286***	
	(-4.77)	
Loan	0.010**	0.006
	(2.20)	(0.66)
Cash	0.070	-0.050
	(1.42)	(-0.68)
Deposit	0.002	0.005
	(0.22)	(0.39)
Equity	0.065***	
	(3.63)	
Overheads	-0.138***	0.067
	(-3.33)	(0.88)
OFBS	0.009	0.008
	(1.52)	(0.97)
*Post*Consolidation+Post*	-0.150	0.349
**Transparent*	(-1.44)	(0.94)
Observations	720	720
R^2	0.582	0.295
Bank FE	Yes	Yes
Year FE	Yes	Yes

Table 8: Higher capital requirements, regulatory capital, and trading assets.

The dependent variables are the risk-weighted capital ratio and its components, scaled by assets. All columns present the regressions using the size-matched control group. In column 1 the dependent variable is *CET1/RWA*, in column 2 it is *RWA/Assets*, and in column 3 it is *CET1/Assets*. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. *Post* is an indicator variable that equals one after the implementation of the FAS166/167. *Transparent* is an indicator variable that equals one if a treated bank's trading assets above the 75th percentile. Control variables are lagged by one year. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1) CET1/RWA	(2) RWA/Assets	(3) CET1/Assets
*Post*Consolidation*	0.759**	-0.028***	0.214
	(2.08)	(-2.93)	(0.68)
*Post*Transparent*	1.258	0.018	0.632
	(1.23)	(0.97)	(0.92)
Trading Assets	-0.020	-0.001	-0.012
	(-0.75)	(-1.41)	(-0.67)
Size	-2.454***	0.027*	-1.784***
	(-3.47)	(1.95)	(-4.04)
GrowthTA	0.003	-0.000***	-0.002
	(0.40)	(-3.21)	(-0.64)
ROA	0.475**	-0.001	0.327**
	(2.27)	(-0.13)	(2.43)
Loan	-0.042	0.006***	0.029
	(-1.22)	(13.01)	(1.55)
Cash	0.041	0.001	-0.026
	(0.36)	(0.56)	(-0.21)
Deposit	-0.039	-0.000	-0.009
	(-1.36)	(-0.34)	(-0.53)
Equity		0.000	
		(0.05)	
Overheads	0.109	0.001	0.124
	(0.68)	(0.23)	(1.11)
OFBS	0.025	0.002*	0.048***
	(1.42)	(1.93)	(2.82)
*Post*Consolidation+Post *Transparent*	2.017*	-0.009	0.846
	(1.86)	(-0.50)	(1.21)
Observations	708	717	708
R^2	0.491	0.464	0.443
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes

Table 9: Comparing pre-treatment means of Q_4 and $Q_1 - Q_3$ banks.

Bank characteristics	(1)	(2)	(3)	(4)
	Q_4 banks	$Q_1 - Q_3$ banks	Difference	T-Statistic
Net Charge-Offs	2.146	0 .880	-1.265***	-4.513
Z-Score	2.967	3.484	0. 517*	1.643
Size	19.698	17.959	-1.739***	-4.622
GrowthTA	11.338	13.774	2.436	0.462
ROA	0.788	0.724	-0.064	-0.252
Loan	51.012	58.141	7.129*	1.678
Cash	2.544	2.452	-0.092	-0.393
Deposit	52.380	60.125	7.745**	2.098
Equity	9.877	10.933	1.055	0.838
Overheads	4.527	3.499	-1.028***	-3.037
Trading Assets	11.236	3.208	-8.028***	-4.932
OFBS	22.084	9.790	-12.294***	-3.328

Table 10: Higher capital requirements, bank risk-taking, and treatment intensity.

The dependent variables are risk-taking proxies, *Net Charge-Offs*, and *Z-Score*, and the risk-weighted capital ratio, *CET1/RWA*. All columns present the regressions using the size-matched control group. *Consolidation* is an indicator variable that equals one if banks consolidated VIEs under the FAS166/167. *Post* is an indicator variable that equals one after the implementation of the FAS166/167. Q_4 is the indicator variables for the fourth quartile of VIE asset consolidation. β_1 is the coefficient on *Post*Consolidation* and β_4 is the coefficient on Q_4. Control variables are lagged by one year, and included in the regressions, but not reported. Bank fixed effects and year fixed effects are included in all regressions. The standard errors are clustered at the bank level. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

	(1) *Charge-Offs*	(2) *Z-Score*	(3) *CET1/RWA*
*Post*Consolidation*	-0.278***	0.362	1.024**
	(-3.12)	(1.59)	(2.41)
Q_4	0.318	0.046	-0.137
	(1.58)	(0.15)	(-0.19)
$\beta_1 + \beta_4$	0.040	0.408	0.887
	(0.19)	(1.45)	(1.13)
Controls	Yes	Yes	Yes
Observations	720	720	708
R^2	0.585	0.295	0.487
Bank FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes