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**Regulatory Thresholds and the Supply of Small Business
Credit**

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Abstract

This paper examines how regulatory thresholds affect the pricing and structure of small business lending. I exploit the 10 billion Dollar asset cutoff in the Dodd-Frank Act, which imposes enhanced regulatory requirements on banks, to isolate the impact of regulation on lending outcomes. Banks crossing the threshold increase loan spreads and adjust contract terms by reducing loan size, shortening maturity, and increasing reliance on government guarantees after the implementation of Dodd-Frank act. These effects are concentrated among banks with greater exposure to commercial and industrial lending, consistent with a supply-side channel through which regulatory costs are passed on to borrowers. These findings highlight how size-based regulatory thresholds can distort the allocation of credit by increasing the marginal cost of bank intermediation.

Keywords: Difference in Discontinuities, Dodd-Frank Act, Regulatory Threshold, Small Business Lending

I. Introduction

Regulatory frameworks often rely on size-based thresholds to impose additional requirements on large financial institutions. While these thresholds are intended to target systemic risk, they may also affect the pricing and allocation of credit by altering banks' incentives to lend. This paper studies how regulatory thresholds influence the cost and structure of small business lending.

I examine the 10 billion Dollar asset cutoff in the Dodd-Frank Act, which subjects bank holding companies to enhanced regulatory oversight. By comparing lending outcomes for banks just above and below this threshold before and after the reform, I isolate the impact of regulatory constraints on loan pricing and contract terms resulting from size-based threshold.

A growing literature shows that such thresholds affect bank behaviour. Bouwman et. al. (2018) document how regulatory changes shape bank capital and risk-taking, while Alvero et. al. (2023) show that banks strategically bunch just below regulatory cutoffs to avoid higher compliance costs. However, less is known about how these regulatory discontinuities translate into loan-level outcomes, particularly in small business credit markets.

This paper studies the impact of the 10 billion Dollar threshold on loan pricing and contract terms in the SBA 7(a) program. The SBA 7(a) market provides an ideal setting for this analysis: it features detailed and standardized loan-level data, includes lenders on both sides of the threshold, and—through partial government guarantees—reduces heterogeneity in borrower risk. These features allow me to isolate bank-side responses to regulatory constraints and examine their implications for small business credit.

To motivate the analysis, I begin by documenting two stylized facts.

First, banks exhibit clear evidence of sorting around the regulatory cutoff. Figure 1 plots the distribution of bank holding company assets near the 10 billion Dollar threshold and reveals significant bunching just below the cutoff, consistent with regulatory avoidance

behaviour documented in Alvero et al. (2023). This pattern is concentrated in the post-Dodd-Frank period, indicating that the threshold represents a binding constraint for bank size.

Second, I document a sharp discontinuity in loan pricing at the threshold. Figure 2 plots loan interest rate spreads—measured as the contractual rate relative to the prime rate—against bank size. The relationship between bank size and loan spreads is smooth away from the cutoff for both pre- and post- Dodd-Frank periods but displays a clear discontinuity at 10 billion Dollar cutoff. Notably, the direction of the discontinuity differs across periods, with spreads higher for smaller banks before Dodd-Frank and higher for larger banks after, suggesting a shift in pricing patterns following the regulatory change. A plausible explanation for this discontinuity in loan spreads is that banks just above the threshold charge higher loan spreads in the post-Dodd-Frank period, reflecting increased regulatory costs or constraints. These patterns suggest that regulatory thresholds may have unintended consequences for credit markets by distorting both bank size distribution and loan pricing. A visual examination indicates an increase of approximately 0.5 basis points in loan spreads at the threshold after Dodd-Frank.

Taken together, these facts highlight that the threshold affects both the distribution of bank size and loan contract outcomes, raising identification challenges. The presence of sorting around the cutoff implies that banks just below and above the threshold may differ systematically, so that a simple discontinuity may reflect both regulatory effects and endogenous selection making it hard to isolate the impact of regulation on loan level outcomes. This motivates my approach of comparing outcomes around the threshold before and after Dodd-Frank to isolate how regulatory changes affect lending outcomes. Comparing changes in outcomes for banks near the threshold before and after Dodd-Frank allows me to isolate the regulatory effect while accounting for pre-existing differences and potential sorting.

Empirical findings confirm that loan spreads rise significantly for banks that are marginally induced into the stricter regulatory regime by crossing the 10 billion Dollar threshold. At the same time banks adjust other dimensions of business lending such as

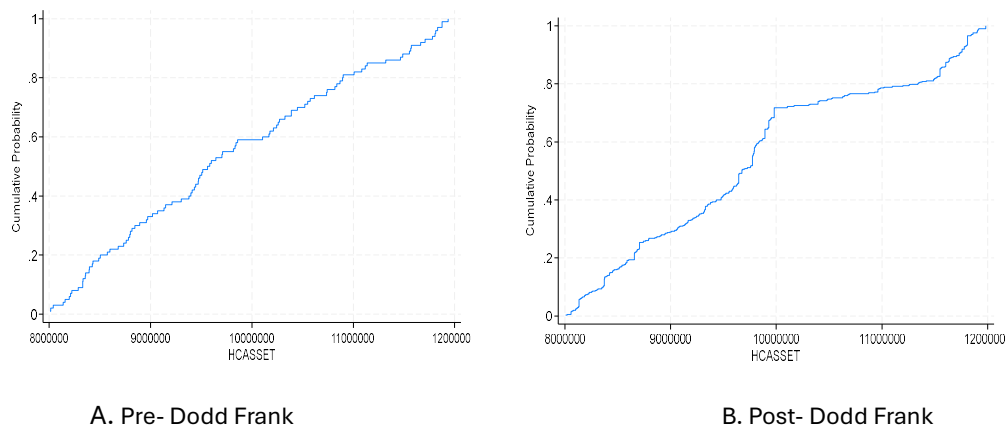
loan amount, maturity etc. simultaneously in response to higher regulatory costs. These results are robust to excluding observations near the cutoff (donut RDD), alternative bandwidth choice and inclusion of borrower level controls.

I further show that these effects are not uniform across banks but are significantly stronger among institutions with greater exposure to commercial and industrial lending. While it is natural to expect that banks more engaged in business lending are affected by the regulation, it is not clear ex ante whether the regulatory threshold would affect different banks differently, since the regulatory changes increase overall balance sheet costs rather than targeting specific lending activities.

The fact that the effects of the regulatory threshold are concentrated among banks with greater exposure to commercial and industrial lending is consistent with regulation affecting the supply of bank credit through primarily through business lending channel.

Figure 1: Distribution of Bank Assets Around the 10 Billion Dollar Threshold.

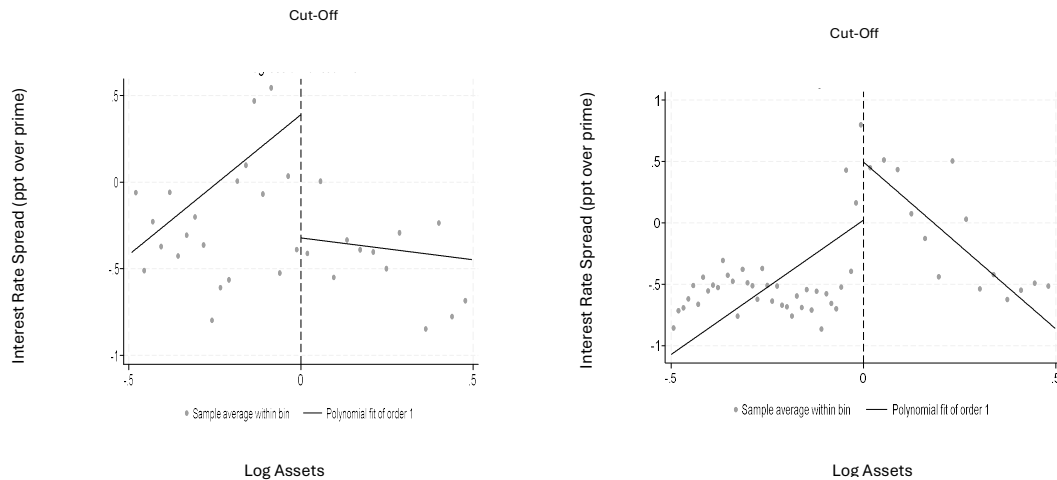
This figure plots the cumulative distribution of bank holding company assets around the 10 billion Dollar regulatory threshold before and after the passing of Dodd-Frank Act.



Notes: The figure shows a pronounced concentration of banks just below the 10 billion Dollar threshold in the post-Dodd-Frank period (2012-2019), consistent with bunching behaviour. In contrast, the distribution appears smooth around the cutoff in the pre-Dodd-Frank period (2006-2009). This pattern suggests that banks strategically adjust their balance sheet size to avoid crossing the threshold following the introduction of stricter regulatory requirements.

Figure 2: Loan Pricing Around the 10 Billion Dollar Threshold.

This figure plots loan interest rate spreads against bank holding company size around the 10 billion Dollar threshold. The figure shows binned averages of the outcome variable along with local linear fits on either side of the cutoff. Panel A presents results for the pre-Dodd-Frank period, while Panel B presents results for the post-Dodd-Frank period.



A. Pre Dodd Frank

B. Post Dodd-Frank

Notes: The relationship between bank size and loan pricing is smooth away from the threshold in both periods. However, a discontinuity is visible at the cutoff in both panels, with the direction of the jump differing across periods. In the pre-Dodd-Frank period, spreads are higher for smaller banks near the threshold, while in the post-period spreads are higher for larger banks. This reversal in the direction of the discontinuity is consistent with a shift in relative pricing associated with regulatory changes affecting banks above the threshold. Loan spreads are residualized by removing year-quarter fixed effects, thereby eliminating aggregate time variation and isolating cross-sectional differences in pricing across banks.

My findings contribute to the literature in two ways. First, they provide loan-level evidence that regulatory thresholds affect the pricing of credit, extending prior work on bank balance sheet responses (Bouwman et al., 2018; Alvero et al., 2023). Second, they highlight how endogenous sorting around regulatory thresholds materially interacts with policy effects, implying that static evaluations of regulatory changes may understate the broader impact of regulation. More broadly, these results highlight that regulatory design—particularly the use of discrete thresholds—can have unintended

consequences for credit markets, with implications for the cost of financing faced by small businesses.

Rest of the paper is organised as follows. Section II discusses the economic mechanisms underlying our main hypothesis. Section III presents our empirical model. Section IV presents our data and estimation results and Section V concludes.

II. Institutional Set up and Identification

A. Dodd-Frank Act and the 10 billion Dollar Threshold

The empirical design in this paper exploits a key feature of U.S. bank regulation: the presence of a sharp regulatory threshold at 10 billion Dollar in total consolidated assets. This threshold plays a central role in determining the regulatory environment faced by bank holding companies (BHCs) and has become increasingly important following the passage of the Dodd-Frank Act.

Dodd-Frank introduced several provisions that apply specifically and discontinuously to BHCs with assets exceeding 10 billion Dollars. These include heightened supervisory scrutiny, enhanced compliance requirements, and restrictions on certain fee-based activities, as well as the applicability of provisions such as the Durbin Amendment, which caps debit interchange fees for larger banks. As a result, crossing the 10 billion Dollar threshold after Dodd-Frank represents a meaningful shift in both the costs and constraints associated with bank operations.

This institutional feature creates a natural setting for a regression discontinuity design. In particular, BHCs with asset levels just below and just above the 10 billion Dollar threshold are expected to be similar along most observable and unobservable dimensions, except for their exposure to the stricter regulatory regime. Consequently, differences in outcomes between banks on either side of the cutoff can be attributed to the causal effect of regulation, provided that other determinants of lending behaviour evolve smoothly with bank size.

Importantly, the introduction of Dodd-Frank transforms the role of the threshold from a relatively benign size cutoff into a binding regulatory notch. This shift allows me to implement a difference-in-discontinuities design that compares the discontinuity in outcomes at the threshold before and after the reform. By differencing out any pre-existing discontinuity, this approach isolates the effect of the regulatory regime itself, rather than underlying non-linearities in the relationship between bank size and lending behaviour.

A key implication of this setting is that identification is local to banks near the 10 billion Dollar cutoff. The estimates therefore capture the effect of crossing the regulatory threshold for BHCs that are marginally above or below the threshold, rather than for the entire distribution of bank sizes.

B. Hypothesis

A large literature shows that regulation affects bank behaviour through its impact on costs, capital structure, and risk-taking incentives of the bank. For example, Bouwman et.al. (2018) show that regulatory changes alter bank capitalization and lending behaviour, while Berger and Udell (2006) emphasize how government policies affect the availability of funds to small businesses by shaping the country's financial institution and lending infrastructure. In addition, recent empirical evidence shows that banks respond to regulatory thresholds by strategically adjusting their balance sheet size, leading to bunching below regulatory cutoffs (Alvero et. al., 2023).

Banks provide liquidity to firms through lending arrangements such as credit lines and commitments, which are sensitive to balance sheet constraints (Kashyap et. al., 2002) and are therefore likely to be affected by such adjustments in response to regulatory changes. Cortés et al. (2020) show that post-crisis regulatory interventions in the form of Dodd-Frank act have had an impact on small business lending volumes, particularly through stress tests. This paper complements their findings by demonstrating that regulatory thresholds not only affect the quantity of lending but also its pricing and

contractual features, and by showing that these effects are concentrated in banks more exposed to business lending.

More recently, (Kovner et. al., 2022) show that post-crisis regulatory reforms increased banks' cost of capital and induced changes in lending behaviour suggesting that regulatory costs may be transmitted to borrowers. While Kovner et. al. (2022) document that regulatory reforms increase banks' cost of capital and affect lending, this paper shows how these higher costs are transmitted to borrowers through higher loan spreads and changes in contract terms, using a difference-in-discontinuities design that identifies local causal effects around a regulatory threshold.

Overall, regulatory constraints can increase the marginal cost of bank intermediation by raising the cost of balance sheet usage. In models of bank intermediation, capital requirements force banks to rely more heavily on costly equity financing, which raises the cost of lending (Van den Heuvel, 2008). More broadly, similar mechanisms suggest that regulatory constraints can lead banks to adjust the pricing and terms of credit supplied to borrowers.

Crossing the 10 billion Dollar threshold increases the marginal cost of intermediation through several channels: higher compliance and monitoring costs, tighter capital and supervisory constraints, and potentially more conservative risk management. As a result, banks just above the threshold face higher effective costs than otherwise similar banks just below it. In competitive credit markets, these higher costs can be transmitted to borrowers through adjustments in loan contract terms, most directly via loan pricing, but also through other margins of the contract.

This framework yields the following testable hypotheses.

Hypothesis 1: Regulatory Discontinuity in Loan Pricing

The introduction of Dodd-Frank generates a discontinuity in loan pricing at the 10 billion Dollar threshold.

Rationale:

An increase in regulatory costs raises the marginal cost of lending, which banks pass through to borrowers in the form of higher interest rates. Under standard models of loan pricing with imperfect competition or balance sheet constraints this results in a discrete jump in pricing at the regulatory cutoff.

Hypothesis 2: Adjustment Along Multiple Contract Margins

Banks above the threshold adjust additional loan contract terms, such as maturity or guarantee structure.

Rationale:

Regulatory constraints may affect not only pricing but also risk management and screening behaviour. As in models of relationship lending and contract design (Berger and Udell, 2006), banks may respond by adjusting multiple dimensions of the loan contract.

Hypothesis 3: Heterogeneity in the Response to Regulatory Costs

The effects of the regulatory threshold are stronger for banks whose lending activities are more sensitive to regulatory costs.

Rationale:

If regulation increases the marginal cost of supplying credit, its impact should vary across banks depending on their exposure to activities that are more risk-sensitive, capital-intensive, or monitoring-intensive. Banks that are more heavily engaged in such activities are expected to face tighter constraints under regulation and therefore adjust their lending behaviour more aggressively in terms of pricing and contract design.

We test these hypothesis using data from SBA 7(a) loan program.

C. Identification Strategy

We examine the impact of the 10 billion Dollar regulatory threshold on loan-level outcomes using a regression discontinuity framework combined with a temporal

difference-in-discontinuities design. Our empirical strategy exploits the discrete change in regulatory requirements faced by bank holding companies that cross the asset threshold under the Dodd Frank Act, while accounting for endogenous sorting around the cutoff.

A central challenge for identification in this setting is the presence of endogenous sorting around the 10 billion Dollar threshold following Dodd-Frank. Figure 1 shows a pronounced concentration of banks just below the cutoff in the post-Dodd-Frank period. We formally confirm this using the McCrary (2008) density test.

Figure 3 shows that the density of bank assets is smooth at the cutoff in the pre-Dodd-Frank period (2006-2009) but exhibits a significant discontinuity in the post-Dodd-Frank period (2012-2019), with excess mass just below the 10 billion Dollar threshold. This pattern is consistent with banks strategically managing their size to avoid stricter regulatory requirements. The presence of such sorting implies that banks just below and above the cutoff may not be directly comparable, motivating our use of a difference-in-discontinuities design to isolate the causal effect of the regulatory threshold.

The difference-in-discontinuities design exploits the absence of sorting and weak discontinuities in the pre-Dodd-Frank period to difference out baseline heterogeneity and isolate the change in outcomes attributable to the Dodd-Frank Act. The identifying assumption is that, in the absence of the policy change, any discontinuity at the threshold would have remained stable over time.

Given the absence of sorting and weak discontinuities in the pre-period, this approach allows me to isolate the causal effect of the regulatory threshold from baseline differences and endogenous selection.

The pre-Dodd-Frank period serves as a benchmark in my framework during which banks around the threshold are more plausibly comparable, while the post-Dodd-Frank period captures both the direct impact of regulation and the behavioural responses it induces.

By differencing across periods, I net out pre-existing discontinuities and recover the change attributable to regulatory reform.

I further examine whether pre-determined bank and loan characteristics exhibit discontinuities at the 10 billion Dollar threshold in the pre–Dodd-Frank period. As shown in Appendix Table A.1¹, I find no evidence of statistically or economically significant jumps in these covariates. This lack of discontinuity suggests that banks just above and below the threshold are locally comparable prior to treatment, reinforcing the credibility of the identification strategy².

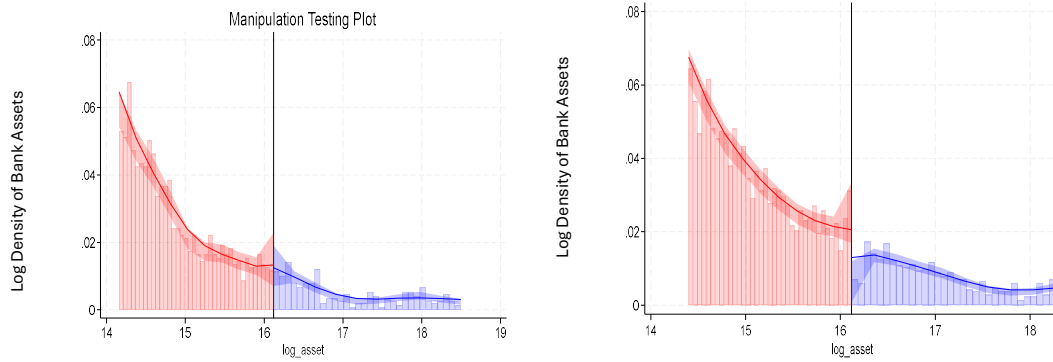
In the next section I lay out the empirical design based in this insight.

Figure 3: Density of Bank Assets Around the \$10 Billion Threshold.

This figure plots the density of bank holding company assets around the 10 billion Dollar regulatory threshold using the McCrary (2008) test. The running variable is the logarithm of bank holding company assets centered at the threshold. Panel A presents the density in the pre–Dodd-Frank period, while Panel B presents the density in the post–Dodd-Frank period. The solid lines show local polynomial estimates on either side of the cutoff, and the vertical line indicates the location of the threshold.

¹ Table A.1 reports the results from the following regression - $X_{i,t} = \alpha + \beta D_{i,t} + \gamma_1 \text{Running}_{i,t} + \gamma_2 (D_{i,t} \times \text{Running}_{i,t}) + \delta_t + \varepsilon_{i,t}$, run using the pre-Dodd Frank reform data. $X_{i,t}$ denotes the covariate of interest. The coefficient β captures the discontinuity at the threshold. The treatment indicator $D_{i,t}$ equals one if the bank holding company's lagged assets exceed 10 billion Dollar, and zero otherwise. The running variable is defined as the logarithm of lagged BHC assets centered at the 10 billion Dollar threshold.

² As a further validation test we check for differential pre-trends in loan spreads between banks above and below the 10 billion Dollar asset threshold prior to Dodd-Frank. Pre-trend tests reported in Appendix Table A.2 show no evidence of differential trends in loan spreads between banks just above and below the threshold prior to Dodd-Frank.



A. Pre- Dodd Frank (P-val. 0.7)

B. Post - Dodd-Frank (P-val. 0.0002)

Notes: In Panel A (pre-Dodd-Frank), there is no visible discontinuity in the density at the threshold, consistent with the absence of bunching. In contrast, Panel B (post-Dodd-Frank) exhibits a significant increase in density just below the cutoff, indicating bunching consistent with strategic bank behaviour. Formal McCrary test results confirm that the discontinuity is statistically insignificant in the pre-period but positive and significant in the post-period.

III. Empirical Model

A. Loan Spreads and 10 billion Dollar Regulatory Threshold

To estimate the effect of the 10 billion Dollar regulatory threshold on loan pricing, I implement a difference-in-discontinuities (DiD-RDD) design that exploits both the cross-sectional discontinuity in bank size at the regulatory cutoff and the temporal variation induced by the introduction of Dodd-Frank.

Let

$$X_{it} = \log(\text{Assets}_{i,t-1}) - \log(10 \text{ billion})$$

denote the running variable, defined as the logarithm of lagged bank holding company (BHC) assets centred at the regulatory threshold. We define:

- $D_{it} = \mathbb{1}(X_{it} \geq 0)$, an indicator equal to one if the BHC is above the 10 billion Dollar threshold, and
- $Post_t = \mathbb{1}(t \geq 2012)$, an indicator for the post-Dodd-Frank period.

To isolate the impact of Dodd-Frank, I define the post-reform period as beginning in 2012 and restrict the analysis to a pre-period spanning 2006–2009 and a post-period spanning 2012 onward. I intentionally exclude the transition years immediately surrounding the passage and implementation of Dodd-Frank (2010–2011)³, during which regulatory provisions were phased in and banks adjusted their balance sheets in anticipation of the new regime. This sample construction ensures a cleaner comparison between a stable pre-regulatory environment and a fully implemented post-reform period. Accordingly, the indicator $Post_t$ captures exposure to the new regulatory regime rather than short-run adjustment dynamics or transitional effects.

The outcome variable, Y_{it} , is the loan interest rate spread at origination, measured relative to the prevailing prime rate. To remove aggregate variation in interest rates over time, loan spreads are residualized with respect to year-quarter fixed effects, so that the dependent variable captures cross-sectional differences in pricing across banks.⁴

I estimate the following baseline specification:

$$Y_{it} = \alpha + \beta D_{it} + \gamma Post_t + \delta(D_{it} \times Post_t) + f(X_{it}) + g(X_{it}) \cdot D_{it} + \epsilon_{it}, \quad (1)$$

where $f(X_{it})$ and $g(X_{it})$ are linear functions of the running variable estimated separately on either side of the cutoff. This flexible specification allows for different slopes in the relationship between bank size and loan pricing below and above the threshold. Standard errors are clustered at the BHC level.

The coefficient of interest, δ , captures the change in the discontinuity at the regulatory threshold following Dodd-Frank. Intuitively, it measures how the difference in loan spreads between banks just above and just below the 10 billion Dollar cutoff evolves after the introduction of the regulation.

³ Using alternative starting points such as 2011 or 2013 does not affect my results in any meaningful way

⁴ In the following section where I look at other loan characteristics such as loan amount, loan maturity, share of loan amount covered by SBA guarantee and the type of loan (revolver or otherwise) to explore different dimensions of loan contracting affected by regulatory threshold effects, we include year-quarter fixed effects directly in the regression to control for common time trends. This is done to preserve the interpretation of these variables—particularly for binary outcomes such as the revolver indicator—while still controlling for common time trends.

To account for differences in bank balance sheet characteristics that may influence lending behaviour, I augment the baseline specification with a set of lagged BHC-level controls. Specifically, I include: the capital-to-asset ratio, capturing bank capitalization and regulatory constraint, the loan-to-asset ratio, measuring the intensity of lending activity, the core deposit ratio, capturing reliance on stable funding sources, and the nonperforming loan (NPL) ratio, proxying for asset quality and credit risk.

All control variables are measured at the BHC level and lagged by one period to ensure they are predetermined with respect to loan origination. This timing structure mitigates concerns about simultaneity or reverse causality, as contemporaneous bank characteristics may themselves be affected by lending decisions.

B. Bandwidth Choice

The DiD-RDD specification is estimated using observations within a symmetric window around the threshold. The baseline specification adopts a fixed bandwidth, while subsequent specifications use a data-driven bandwidth selected according to the procedure described in Calonico et.al. (2014) to optimally balance bias and variance in estimating local discontinuities⁵.

C. Addressing Sorting: Donut RDD

As discussed in the identification section, banks exhibit sorting behaviour around the 10 billion Dollar threshold in the post-Dodd-Frank period. To address potential concerns that this sorting may bias the estimated discontinuity, I further estimate a donut RDD specification that excludes observations within a narrow band around the cutoff. This approach removes banks most likely to have manipulated their size to remain below the threshold. Taken together, this framework isolates the effect of regulatory discontinuities

⁵ The bandwidth is selected using the full sample and then applied symmetrically across pre- and post-Dodd-Frank periods, ensuring consistency with the pooled DiD-RDD design.

on loan pricing by combining cross-sectional identification at the threshold with time variation from Dodd-Frank, while addressing potential concerns arising from sorting and observable heterogeneity across banks.

IV. Data and Estimation Results

This section describes my main data sources in detail and presents the estimation results.

A. Data

The loan-level data used in the analysis are obtained from the U.S. Small Business Administration (SBA) 7(a) loan program. This dataset provides detailed information on individual small business loans, including interest rate spreads, loan size, maturity, and other contract characteristics. The SBA 7(a) program is the largest federal loan guarantee program for small businesses in the United States and offers a rich source of information on the pricing and structure of small business lending.

Bank-level characteristics are obtained from regulatory filings compiled through WRDS, which sources data from bank holding company (BHC) reports, including the FR Y-9C and FR Y-9LP filings. These reports provide detailed information on balance sheet composition, capital ratios, asset quality, and lending activities at the BHC level. We construct measures of bank capitalization, lending intensity, funding structure, and exposure to commercial and industrial (C&I) lending using these filings.

The loan-level SBA data are merged with BHC-level regulatory data using lender identifiers, allowing us to link individual loan outcomes to bank characteristics. Unless otherwise noted, bank-level variables are measured using lagged values to mitigate concerns regarding simultaneity. The final dataset provides a loan-level view of small business lending combined with detailed information on the balance sheet and lending activities of the originating bank.

Table 1: Summary Statistics.

This table reports summary statistics for loan- and bank-level variables used in the empirical

analysis. Loan-level variables are constructed from the SBA loan dataset. Bank-level variables are obtained from regulatory filings and measured at the bank holding company level. The sample includes observations within the baseline estimation window.

Variable	Mean	Std. Dev	P ₂₅	P ₅₀	P ₇₅
SBA 7(a) Loan Characteristics					
Loan Spread	2.83	1.43	2	2.74	3.25
Log Loan Size	11.4	1.45	10.3	11.38	12.4
Loan Maturity (in months)	106	75	60	84	120
Revolving Credit Indicator	0.3	0.46	0	0	1
Share of SBA Guarantee (%)	64	15	50	50	75
BHC Controls					
Capital-to-Asset Ratio	0.096	0.047	0.075	0.09	0.11
Loan-to-Asset Ratio (%)	67	11.8	60.3	68.4	75.6
Core Deposit Ratio (%)	78.5	10.3	73.9	80.8	85.9
NPL Rate (%)	0.21	1.1	0	0	0.09
C&I Loan Share (%)	11.2	0.07	6.4	9.9	14.6

Table 1 presents the summary statistics for the key variables. Average loan spread is 2.83 percentage points in my sample, with substantial variation across loans, reflecting dispersion in borrowing costs for small firms. Loan characteristics also exhibit considerable heterogeneity, with meaningful variation in loan size, maturity, and contract structure. Bank-level variables indicate differences in capitalization, asset quality, and lending composition across institutions, providing the variation necessary to examine how regulatory thresholds affect lending behaviour. At the same time, there are significant number of banks with C&I loans making up more than 10 percent of their total assets. The average number of SBA loans made by a bank in the sample is 140 with more than 50 percent of banks making 33 SBA loans or more.

B. Results

B.1. Main Results

Table 2 reports estimates from my main model. Column (1) presents the baseline DiD-RDD estimate, while Column (2) adds BHC-level controls. Column (3) restricts the

sample to the optimal bandwidth selected using the Calonico et. al. (2014) procedure, and Column (4) reports estimates from the donut RDD specification.

The coefficient on $D_{it} \times Post_t$ identifies the change in the discontinuity at the 10 billion Dollar threshold following Dodd-Frank. Under the standard continuity assumption of the regression discontinuity design, this coefficient can be interpreted as a local average treatment effect of the regulatory threshold on loan pricing for banks near the cutoff. Intuitively, it measures how loan spreads change for banks that are marginally induced into the stricter regulatory regime by crossing the threshold.

Across all specifications, the coefficient on $D_{it} \times Post_t$ remains stable in sign and magnitude, indicating that loan spreads increase at the regulatory threshold following Dodd-Frank. The robustness of the estimates to the inclusion of controls, alternative bandwidths, and exclusion of observations near the cutoff supports a causal interpretation of the results.⁶

Table 2: Effect of the 10 Billion Dollar Threshold on Loan Pricing.

This table reports estimates of the effect of crossing the 10 billion Dollar regulatory threshold on loan interest rate spreads using a difference-in-discontinuities (DiD-RDD) design. The dependent variable is the residual loan interest rate spread, measured as the contractual rate at origination relative to the prime rate and adjusted for year-quarter fixed effects. The table presents results for progressively more restrictive specifications, including the addition of bank-level controls, data-driven bandwidth selection, and exclusion of observations close to the cutoff. z-Statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
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⁶ To further assess whether the estimated discontinuity is specific to the 10 billion Dollar regulatory threshold, we conduct placebo tests using alternative asset cutoffs below this level. Re-estimating the specification at fictitious thresholds, we find no evidence of statistically significant discontinuities in loan spreads away from the regulatory boundary (see Appendix Table A.3). These results support the interpretation that the effects documented in Table 2 are not driven by spurious nonlinearities in bank size but instead reflect the impact of the regulatory threshold. Table A.4 presents robustness of our results to the choice of bandwidth.

	Baseline	(+) Controls	Optimal Bandwidth	Donut RDD
D_{it}	-0.4 (-1.6)	-0.4 (-1.4)	-0.07 (-0.3)	0.45 (0.9)
$Post_t$	-0.45** (-2.3)	-0.43*** (-3)	-0.5*** (-2.9)	-0.55** (-2.4)
$D_{it} \times Post_t$	0.86*** (2.8)	0.83** (2)	0.6** (2.4)	0.5** (2)
Running variable (separate slopes)	Yes	Yes	Yes	Yes
BHC Controls	No	Yes	Yes	Yes
Bandwidth	0.5	0.5	0.65	0.65
Donut Exclusion	None	None	None	0.05
Observations	40,902	40,164	50,398	44,928
R-squared	0.06	0.07	0.054	0.07

Note: Table 2 reports estimates from the difference-in-discontinuities design in eq. (1). The running variable, X_{it} , is defined as the logarithm of lagged BHC assets centered at the 10 billion Dollar threshold. D_{it} is an indicator equal to one if the BHC's assets exceed the threshold, and $Post_t$ is an indicator for the post-Dodd-Frank period. The coefficient on $D_{it} \times Post_t$ measures the change in the discontinuity at the threshold after Dodd-Frank and can be interpreted as the local average treatment effect of the regulatory threshold on loan spreads for banks near the cutoff. All specifications include local linear controls for the running variable, allowing for different slopes on either side of the threshold. Column (2) adds lagged BHC-level controls, including the capital-to-asset ratio, loan-to-asset ratio, core deposit ratio, and nonperforming loan (NPL) ratio. These controls account for differences in capitalization, lending intensity, funding structure, and asset quality across banks and are measured at the BHC level to align with the regulatory threshold. Column (3) restricts the sample to a data-driven bandwidth selected using the Calonico et. al. (2014) procedure. Column (4) reports estimates from a donut RDD specification that excludes observations within 0.05 log points of the cutoff to address potential sorting behaviour around the threshold. Standard errors are clustered at the BHC level.

Having established that the regulatory threshold affects loan pricing, I next examine whether this effect operates through adjustments in other dimensions of loan contracts. Specifically, I estimate the difference-in-discontinuities specification using alternative outcome variables that capture loan size, maturity, guarantee structure, and contract type. These variables reflect key margins along which banks may adjust lending in response to increased regulatory costs.

B.2. Simultaneous Adjustment Across Multiple Dimensions

To understand how the regulatory threshold affects lending, I examine whether banks adjust not only the price of credit but also other dimensions of loan contracts. In response to higher regulatory costs, banks can modify lending along multiple margins, including the size, maturity, and structure of loans. These adjustments provide insight into whether the observed increase in spreads reflects broader changes in the supply of credit.

Table 3 examines whether the effects of Dodd-Frank extend beyond loan pricing to other dimensions of contract design. Across specifications, the estimated coefficients on $D_{it} \times Post_t$ are economically meaningful and consistent with banks adjusting lending along multiple margins. In particular, loans issued by banks just above the threshold tend to be smaller, shorter in maturity, and less likely to be structured as revolving credit facilities. While these estimates are imprecisely measured, their magnitudes suggest non-trivial changes in contract structure.

Notably, I find that the share of SBA-guaranteed lending increases at the threshold and is statistically significant at conventional levels, indicating that banks above the regulatory cutoff rely more heavily on government-backed risk sharing following Dodd-Frank. Taken together, these findings suggest that regulatory costs are transmitted not only through loan pricing but also through economically meaningful adjustments in the allocation of credit and contract design.

Table 3: Effect of the 10 Billion Dollar Threshold on Loan Contract Terms.

This table examines how crossing the 10 billion Dollar regulatory threshold affects the structure of loan contracts using a difference-in-discontinuities (DiD-RDD) design. The dependent variables capture key dimensions of lending, including loan size, maturity, share of SBA guarantee, and loan type. The table reports estimates of how these outcomes change discontinuously at the threshold following the implementation of Dodd-Frank. z-Statistics are in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Dependent Variable	(1)	(2)	(3)	(4)
	Loan Amount	Loan Maturity	SBA Guarantee	Revolver Status

D_{it}	0.2 (0.8)	0.1 (1)	-0.05* (-1.74)	0.03 (0.4)
$Post_t$	0.6*** (3)	0.4*** (3)	-0.03 (-1.1)	0.04 (1)
$D_{it} \times Post_t$	-0.06 (-0.2)	-0.08 (-0.6)	0.06* (1.7)	-0.08 (-1.5)
BHC Controls	No	Yes	Yes	Yes
Bandwidth	0.5	0.5	0.5	0.5
Donut Exclusion	None	None	None	None
Observations	52,190	52,140	52,190	52,190
R-squared	0.04	0.03	0.09	0.02

Notes: This table reports estimates from a difference-in-discontinuities design that exploits variation around the 10 billion Dollar asset threshold for bank holding companies (BHCs) and the introduction of Dodd-Frank. The running variable, X_{it} , is defined as the logarithm of lagged BHC assets centered at the threshold. D_{it} is an indicator equal to one if the BHC's assets exceed 10 billion Dollar, and $Post_t$ is an indicator for the post-Dodd-Frank period. The dependent variables are, respectively, the logarithm of loan amount, loan maturity, the SBA guarantee share of the loan, and an indicator equal to one if the loan is structured as a revolving credit facility.

The coefficient on $D_{it} \times Post_t$ measures the change in the discontinuity at the threshold following Dodd-Frank and captures how loan contract terms adjust for banks near the cutoff. All specifications include local linear controls for the running variable, allowing for different slopes on either side of the threshold. Additional controls include lagged BHC-level characteristics—capital-to-asset ratio, loan-to-asset ratio, core deposit ratio, and nonperforming loan (NPL) ratio—to account for differences in bank balance sheet structure, risk, and funding.

The revolver outcome is estimated using a linear probability model. Standard errors are clustered at the BHC level. All regressions include year-quarter fixed effects.

Together, the results from Tables 2 and 3 suggest that the effects of Dodd-Frank on lending extend beyond pricing to multiple dimensions of contract design. Consistent with increased regulatory costs, banks just above the threshold raise loan spreads while simultaneously adjusting lending along other margins. In particular, they reduce loan size, shorten loan maturity, and are less likely to extend revolving credit facilities, indicating a contraction in both the scale and flexibility of credit. At the same time, the

increase in SBA guarantee share suggests greater reliance on government-backed risk sharing.

Overall, these patterns point to a contraction and reallocation of credit supply rather than a simple repricing of loans. By reducing exposure, limiting flexibility, and transferring risk, banks appear to adjust their lending behaviour in response to increased regulatory costs. This multi-dimensional response suggests that regulation affects not only how much borrowers pay for credit, but also the form in which credit is extended.

B.3. Exposure to Commercial and Industrial Lending and 10 billion Dollar Regulatory threshold.

I next examine whether the effects of the regulatory threshold vary across banks with different lending profiles. While the preceding analysis shows that crossing the 10 billion Dollar threshold increases loan spreads and alters contract terms, identifying where these effects are most pronounced helps clarify the underlying mechanism through which regulation operates.

Dodd-Frank affects banks' capital requirements, supervisory oversight, and compliance burdens in ways that increase the cost of risk-taking and balance sheet usage. These costs are likely to be felt most strongly in segments of lending that are more risk-sensitive, capital-intensive, and information-intensive. Commercial and industrial (C&I) lending fits these characteristics: such loans typically involve higher credit risk, require more monitoring, and are less standardized than other forms of lending. As a result, banks with greater exposure to C&I lending are more likely to face higher marginal regulatory costs when extending business credit.

At the same time, it is not a priori clear that crossing the 10 billion Dollar threshold would generate differential causal effects across institutions. Regulatory costs could, in principle, be absorbed uniformly, passed through across all types of lending, or offset by adjustments elsewhere on the balance sheet. The heterogeneity analysis therefore provides direct evidence on whether the observed increase in loan spreads reflects a targeted response in business lending or a more diffuse adjustment.

To examine this, I split the sample based on the bank holding company's share of C&I loans in total assets, measured relative to the median within the estimation window and estimate our benchmark DiD model for both the samples separately. Table 4 reports the results. I find that the increase in loan spreads at the threshold is significantly larger for banks with higher C&I exposure, while the effect is smaller and less precisely estimated for banks with lower exposure.

This pattern indicates that the impact of Dodd-Frank is concentrated in the segment of the banking system most actively engaged in supplying business credit. The stronger response among C&I-intensive banks is consistent with a supply-side mechanism in which higher regulatory costs lead banks to increase the price of lending and adjust contract terms more aggressively where such costs are most binding. Taken together with the evidence on loan contract adjustments, these findings support the interpretation that the regulatory threshold increases the cost of supplying credit to firms thereby altering banks' lending behaviour⁷.

Table 4: Heterogeneity by Exposure to Commercial and Industrial (C&I) Lending.

This table examines whether the effect of crossing the 10 billion Dollar regulatory threshold on loan spreads varies with banks' exposure to commercial and industrial (C&I) lending. The sample is split based on the bank holding company's share of C&I loans in total assets, measured relative to the median within the estimation window. The table reports estimates of the difference-in-discontinuities design for subsamples of banks with low and high exposure to business lending. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Sub-sample	(1)	(2)
	Low C&I Exposure	High C&I Exposure
$D_{it} \times Post_t$	0.86** (2.1)	0.2 (0.6)
BHC Controls	Yes	Yes
Bandwidth	0.5	0.5

⁷ Appendix Figure A.1 illustrates the same graphically

Observations	19,465	20,699
R-squared	0.1	0.18

Notes: This table reports heterogeneity in the estimated effects of the 10 billion Dollar regulatory threshold based on banks' exposure to commercial and industrial (C&I) lending. The running variable, X_{it} , is defined as the logarithm of lagged bank holding company (BHC) assets centered at the threshold. The dependent variable is the residualized loan interest rate spread. Standard errors are clustered at the BHC level. The sample is restricted to observations within the baseline bandwidth ($|X_{it}| \leq 0.5$), and banks are classified as having high or low C&I exposure based on the median share of C&I loans in total assets within this window.

The coefficient on $D_{it} \times Post_t$ captures the change in the discontinuity in loan spreads at the regulatory threshold following Dodd-Frank. A larger estimated effect for banks with higher C&I exposure indicates that the impact of the regulatory threshold is concentrated among institutions more actively engaged in business lending, consistent with regulatory costs affecting the supply and pricing of commercial credit.

V. Conclusion

This paper provides evidence that regulatory thresholds have important effects on the pricing and structure of bank lending. The empirical evidence paints a consistent picture of how the regulatory threshold affects bank lending. Crossing the 10 billion Dollar cutoff leads to higher borrowing costs for firms, reflecting an increase in the price of credit. Banks do not rely on pricing alone, however, but adjust lending along multiple margins, including the size, maturity, and risk structure of loan contracts. These responses are not uniform across institutions: they are concentrated among banks more heavily engaged in commercial and industrial lending. This pattern suggests that the regulatory threshold operates by raising the cost of supplying business credit, prompting banks—particularly those most exposed to this segment—to adjust both the price and structure of lending.

Overall, the results indicate a tightening and reallocation of credit supply driven by regulatory constraints, rather than a uniform or purely mechanical response across banks.

Taken together, these findings highlight that regulatory thresholds can have targeted effects on credit supply, shaping not only the cost but also the structure and allocation of lending. This has important implications for the design of size-based regulation and its impact on credit availability for businesses.

Appendix Table A.1: Validation Tests: Covariate Smoothness at the 10 Billion Dollar Threshold.

This table reports tests for discontinuities in pre-determined bank and loan characteristics at the 10 billion Dollar asset threshold using pre-Dodd-Frank data. Each row presents the estimate of the discontinuity parameter β from the following local linear specification:

$$X_{i,t} = \alpha + \beta D_{i,t} + \gamma_1 \text{Running}_{i,t} + \gamma_2 (D_{i,t} \times \text{Running}_{i,t}) + \delta_t + \varepsilon_{i,t}$$

where $X_{i,t}$ denotes the covariate of interest. The coefficient β captures the discontinuity at the threshold. The absence of statistically and economically significant estimates of β indicates that covariates evolve smoothly around the cutoff, supporting the identifying assumption of the regression discontinuity design.

Variable	D_{it}	Std. Error	N
Capital to Asset Ratio	-0.008	-0.007	858
Default Ratio	-0.0005	-0.0006	858
Loan to Asset Ratio	1	3	972
Core Deposit Ratio	-2.3	-2.7	972
Log Loan Size	0.26	0.2	34507
C&I Loan Share	-0.02	-0.015	858
Running variable controls:	Yes (separate slopes)		
Time Fixed Effects:	Yes		
Sample:	Pre-Dodd-Frank		
Bandwidth:	0.5		

Notes: The dependent variable $X_{i,t}$ in each row is a pre-determined bank or loan characteristic, including balance sheet measures and proxies for borrower composition. The treatment indicator $D_{i,t}$ equals one if the bank holding company's lagged assets exceed 10 billion Dollar, and zero otherwise. The running variable is defined as the logarithm of lagged BHC assets centered at the 10 billion Dollar threshold.

All specifications include local linear controls for the running variable, allowing for separate slopes on either side of the cutoff through the interaction $D_{i,t} \times \text{Running}_{i,t}$, as well as time fixed effects δ_t . The sample is restricted to the pre-Dodd-Frank period to ensure that the estimates are not influenced by post-reform adjustments. Standard errors are clustered at the bank holding company (BHC) level.

The coefficients reported correspond to the estimated discontinuity β ; the absence of statistically or economically meaningful discontinuities supports the assumption that observations just above and below the threshold are comparable prior to treatment.

Appendix Table A.2: Validation Tests: Pre-Trends in Loan Spreads

This table reports tests for differential pre-trends in loan spreads between banks above and below the 10 billion Dollar asset threshold prior to Dodd-Frank. The reported coefficient corresponds to the interaction between the treatment indicator $D_{i,t}$ and a linear time trend, estimated using the following specification:

$$\text{Spread}_{i,t} = \alpha + \beta(D_{i,t} \times \text{Time}_t) + \gamma_1 D_{i,t} + \gamma_2 \text{Running}_{i,t} + \gamma_3(D_{i,t} \times \text{Running}_{i,t}) + \delta_t + \varepsilon_{i,t}$$

where $D_{i,t}$ is an indicator for banks above the \$10 billion threshold and $\text{Running}_{i,t}$ denotes the running variable. The coefficient β captures differences in trends between banks just above and below the cutoff in the pre-period. The absence of a statistically significant estimate indicates no evidence of differential pre-trends. Figure in the parentheses is the z-stat.

Dependent Variable:	(1)
	Loan Spread
$D_{i,t} \times \text{Time}_t$	-0.001 (-0.6)
Observations	4122
R-squared	0.15
Running variable controls:	Yes (separate slopes)
Time Fixed Effects	Yes
BHC Controls	Yes
Sample	Pre Dodd-Frank
Bandwidth	0.5

Notes: The dependent variable is the loan interest rate spread. The table reports the coefficient on the interaction between the treatment indicator $D_{i,t}$ and a linear time trend, which captures differential trends

in loan spreads between banks just above and below the 10 billion Dollar threshold in the pre–Dodd-Frank period. The running variable is defined as the logarithm of lagged bank holding company (BHC) assets centered at the threshold. All specifications include local linear controls for the running variable with separate slopes on either side of the cutoff, time fixed effects, and bank-level control variables. The sample is restricted to pre–Dodd-Frank years. Standard errors are clustered at the BHC level.

Appendix Table A.3 Placebo Tests Using Alternative Asset Thresholds.

This table reports placebo estimates of the difference-in-discontinuities design using alternative asset size cutoffs below the 10 billion Dollar regulatory threshold. The specification mirrors the baseline regression but replaces the true cutoff with fictitious thresholds at which no regulatory discontinuity exists, providing a test for whether the main results reflect spurious nonlinearities in bank size rather than the regulatory boundary.

Asset Size Cutoff	$D_{i,t}^{placebo} \times Post_t$
6 bn	1 (1.6)
7 bn	0.77 (1.5)
8 bn	0.78 (1.6)
Running variable (separate slopes)	Yes
BHC Level controls	Yes
Bandwidth	0.5

Notes: This table presents placebo tests of the difference-in-discontinuities design using alternative asset thresholds below 10 billion Dollar. The running variable is defined as the logarithm of lagged bank holding company (BHC) assets centered at each placebo cutoff. For each threshold, a corresponding indicator $D_{it}^{placebo}$ is defined as equal to one if BHC assets exceed the specified cutoff, and zero otherwise. The specification is identical to the baseline regression, including local linear controls for the running variable with separate slopes on either side of the cutoff and lagged BHC-level controls (capital-to-asset ratio, loan-to-asset ratio, deposit ratio, and nonperforming loan ratio).

The coefficient of interest is the interaction between the placebo threshold indicator and the post–Dodd-Frank period indicator, which captures the change in the discontinuity at the fictitious cutoff following the reform. Since no regulatory break occurs at these thresholds, the absence of statistically significant discontinuities supports the identification assumption that the main results are driven by the 10

billion Dollar regulatory boundary rather than by spurious nonlinearities in the relationship between bank size and loan pricing. Standard errors are clustered at the bank holding company level.

Appendix Table A.4 Robustness to Bandwidth Choice.

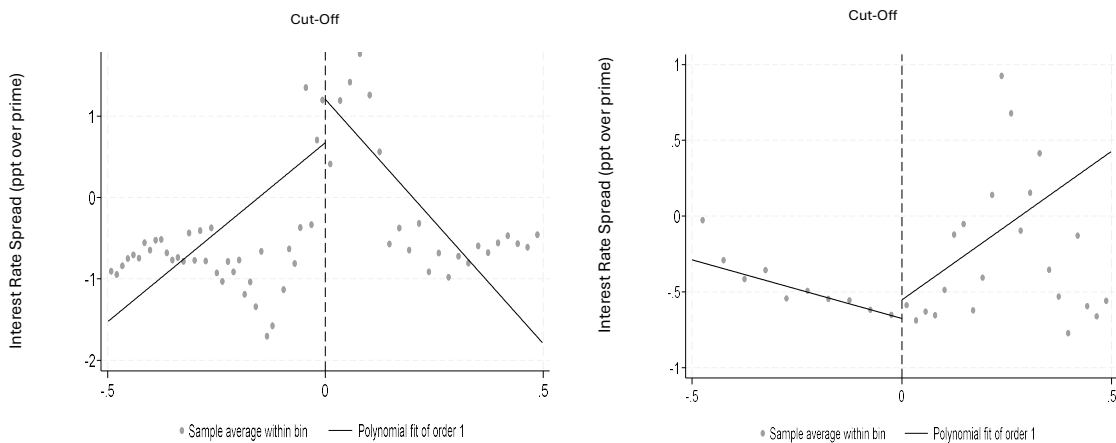
This table examines the robustness of the main results to alternative bandwidth choices around the 10 billion Dollar asset threshold. Each column reports estimates of the difference-in-discontinuities specification using increasingly narrower and wider bandwidths around the cutoff. The stability of the estimated coefficients across bandwidths indicates that the results are not sensitive to the choice of estimation window. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Bandwidth	$D_{i,t}^{placebo} \times Post_t$	Observations
0.7	0.46** (2)	53,864
0.6	0.6** (2.4)	47,723
0.5	0.86*** (2.8)	40,902
0.4	1 (1.7)	33,080
0.3	0.89 (1.6)	25,833
Running variable (separate slopes)	Yes	
BHC Level controls	Yes	
Donut Exclusion	No	

Notes: The table reports estimates of the baseline specification using alternative bandwidths around the 10 billion Dollar threshold. The dependent variable is the loan interest rate spread. The treatment indicator $D_{i,t}$ equals one if lagged BHC assets exceed 10 billion Dollar. The running variable is defined as the logarithm of lagged BHC assets centered at the cutoff. All specifications include local linear controls for the running variable with separate slopes on either side of the threshold, time fixed effects, and standard control variables. Standard errors are clustered at the bank holding company (BHC) level.

Appendix Figure A.1: Heterogeneity by Exposure to Commercial and Industrial Lending.

This figure presents regression discontinuity plots of loan spreads around the 10 billion Dollar asset threshold in the post-Dodd-Frank period, separately for banks with below-median (Panel A) and above-median (Panel B) exposure to commercial and industrial (C&I) lending. Each panel plots binned averages of loan spreads (residualized) against the running variable, along with local linear fits on either side of the cutoff. The discontinuity is more pronounced for C&I-intensive banks, consistent with a stronger response to regulatory costs in business lending.



Notes: The dependent variable is the loan interest rate spread. The running variable is defined as the logarithm of lagged BHC assets centered at the 10 billion Dollar threshold. The sample is restricted to the post-Dodd-Frank period. Banks are classified as having high (low) C&I exposure based on whether their share of commercial and industrial loans in total assets is above (below) the sample median. Each panel displays binned averages of the outcome variable and local linear fits estimated separately on either side of the cutoff. The vertical line denotes the regulatory threshold.

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