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By:
Camilo Gómez
Mariana Escobar-Villarraga
Ligia Alba Melo-Becerra
Héctor M. Zárate-Solano

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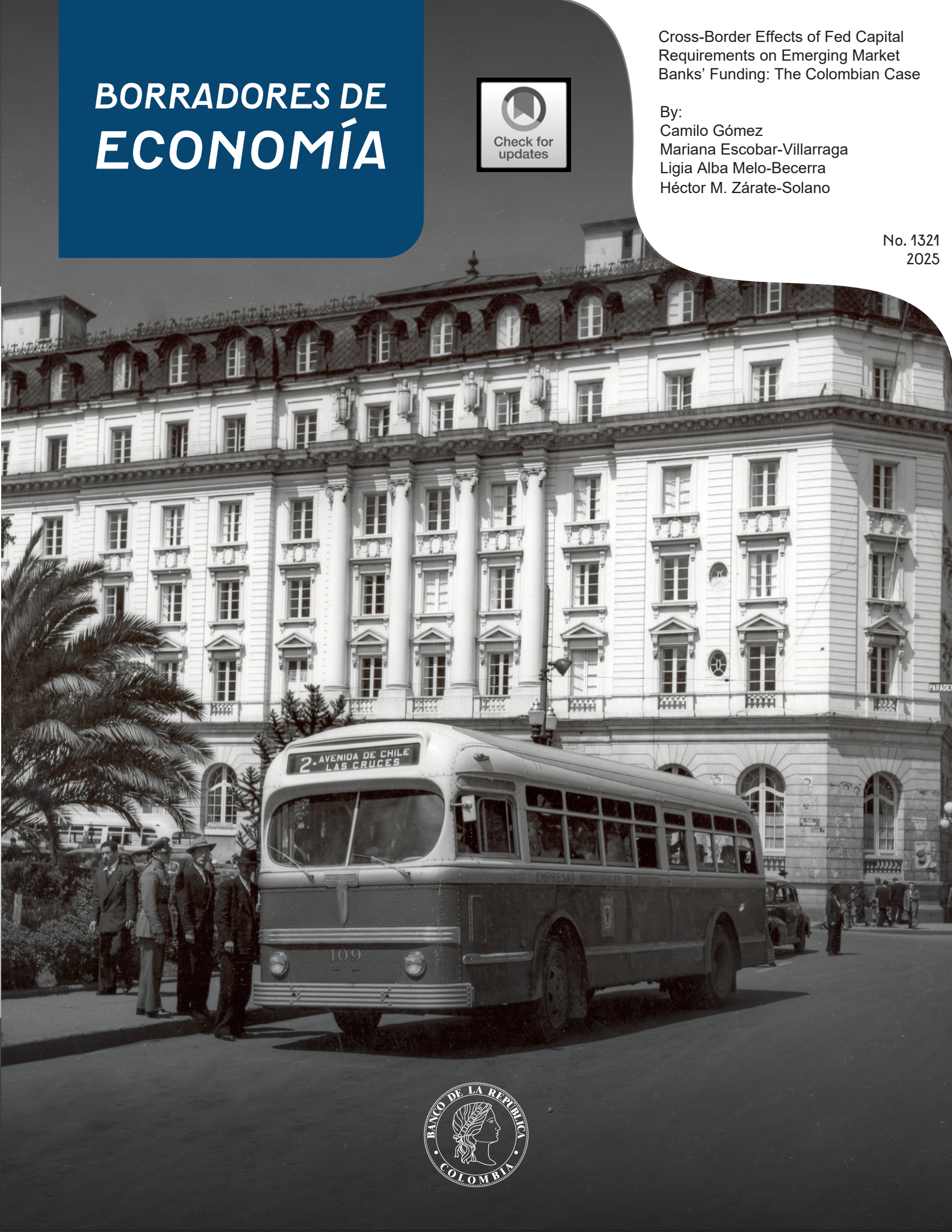

BANCO DE LA REPÚBLICA COLOMBIA

Cross-Border Effects of Fed Capital Requirements on Emerging Market Banks' Funding: The Colombian Case*

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Camilo Gómez♦
agomezmo@banrep.gov.co

Mariana Escobar-Villarraga♥
lescobvi@banrep.gov.co

Ligia Alba Melo-Becerra♣
Lmelobec@banrep.gov.co

Héctor M. Zárate-Solano♠
hzaratso@banrep.gov.co

Abstract

This paper examines the impact of the Federal Reserve's 2022 capital requirements on Colombian banks' access to foreign credit lines. These measures, more stringent than in previous years, introduced a stronger stress capital buffer in response to global recession risks and inflationary pressures. A key contribution of the study is its distinction between the announcement, publication, and implementation phases of these regulations, highlighting how expectations, information flows, and uncertainty shape banks' financial strategies. Using a Synthetic Difference-in-Differences (SDID) approach, the findings reveal that credit from affected U.S. banks declined significantly following the announcement, with further reductions observed as the enforcement date approached. Substitution effects partially mitigate this decline, offering insight into the global interconnectedness of financial systems and the broader implications of regulatory changes. The study contributes to a deeper understanding of how capital regulations influence cross-border liquidity, capital allocation, and risk exposure, particularly in periods of heightened global uncertainty.

JEL Classification: E51, E58, F34, G21, G28

Keywords: macroprudential capital restrictions, Fed, foreign capital funding, synthetic Difference-in-Differences.

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♦ Banco de la República, Bogotá, Colombia. (ORCID: 0000-0001-9168-8522).
♥ Banco de la República, Bogotá, Colombia. (ORCID: 0009-0007-1945-9320).
♣ Banco de la República, Bogotá, Colombia. (ORCID: 0000-0003-0895-9753).
♠ Banco de la República, Bogotá, Colombia ORCID: 0000-0003-1568-5789).

Efectos transfronterizos de los requerimientos de capital de la Fed en el financiamiento de los bancos de economías emergentes: El caso de Colombia[*]

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Camilo Gómez[♦]
agomezmo@banrep.gov.co

Mariana Escobar-Villarraga[♥]
lescobvi@banrep.gov.co

Ligia Alba Melo-Becerra[♣]
Lmelobec@banrep.gov.co

Héctor M. Zárate-Solano[♠]
hzaratso@banrep.gov.co

Resumen

Este documento analiza el impacto de los requerimientos de capital de la Reserva Federal de 2022 en el acceso a líneas de crédito extranjeras a los bancos en Colombia. Estas medidas, más estrictas que en años anteriores, introdujeron un buffer de capital de estrés más sólido en respuesta a los riesgos de recesión global y las presiones inflacionarias. Una contribución clave del estudio es la diferenciación entre las fases de anuncio, publicación e implementación de estas regulaciones, indicando cómo las expectativas, la información y la incertidumbre moldean las estrategias financieras de los bancos. Utilizando una aproximación de Diferencias en Diferencias Sintéticas (SDID), los hallazgos indican que el crédito de los bancos estadounidenses afectados disminuyó significativamente tras el anuncio, con reducciones que se intensificaron cerca de la fecha de implementación. Los efectos de sustitución compensaron parcialmente esta disminución, indicando la importancia de la interconectividad global de los sistemas financieros y las consecuencias de las políticas regulatorias. El estudio proporciona una comprensión más profunda de cómo las restricciones de capital influyen en la liquidez transfronteriza, la asignación de capital y la exposición al riesgo durante períodos de elevada incertidumbre global.

Clasificación JEL: E51, E58, F34, G21, G28

Palabras clave: restricciones macroprudenciales de capital, Fed, financiamiento de capital extranjero, Diferencias en Diferencias Sintéticas.

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[♦] Banco de la República, Bogotá, Colombia. (ORCID: 0000-0001-9168-8522).
[♥] Banco de la República, Bogotá, Colombia. (ORCID: 0009-0007-1945-9320).
[♣] Banco de la República, Bogotá, Colombia. (ORCID: 0000-0003-0895-9753).
[♠] Banco de la República, Bogotá, Colombia ORCID: 0000-0003-1568-5789).

1. Introduction

The 2008 global financial crisis underscored the critical role of macroprudential policies in maintaining financial stability. In response, the Federal Reserve (Fed) modified capital restrictions on banks operating in the U.S., aiming to reinforce their financial soundness and mitigate risks to the U.S. economy. The new regulations introduced three pillars of capital requirements: minimum capital requirements, supervisory review of capital adequacy and market discipline (Haubrich, 2020). As part of its regulatory approach, the Fed performs annual stress tests to assess the resilience of major banks under hypothetical recessionary conditions. These supervisory stress tests help the Fed determine whether large banks hold sufficient capital to absorb losses during economic downturns while continuing to meet financial obligations to various stakeholders, including creditors, counterparties, households, and businesses.

Capital regulation holds significant importance as deposit insurance and other components of the federal safety net motivate banks to amplify their leverage beyond the limits that would be allowed by the market if depositor protection were absent (Fed, 2023). Nonetheless, changes in capital requirement standards may cause negative effects on credit supply, as banks must comply with regulations by adjusting their credit and loan capacity. The capital constraint channel is the primary mechanism through which capital regulation impacts credit supply. When banks are required to hold higher capital buffers, they could modify their lending behavior in several ways: i) reducing loan origination: banks may limit new loan issuance, particularly in riskier or less profitable segments such as cross-border lending to emerging markets, which typically carry higher risk weights; ii) the shortening of loan maturities: given the increased cost of holding capital against long-term loans, banks often shift toward short-term credit lines, which provide greater flexibility in adjusting to capital requirements; iii) increasing loan pricing: to offset the cost of maintaining higher capital buffers, banks frequently raise interest rates and fees, making borrowing more expensive and further restricting credit availability.

These adjustments have significant implications for emerging markets, where access to foreign credit is a critical determinant of financial stability and economic growth. These economies are particularly vulnerable due to their reliance on external funding and

comparatively weaker domestic financial systems. Avdjiev, Gambacorta, Goldberg and Schiaffi (2025) highlight that when global risk perceptions rise, capital inflows to emerging markets can decline sharply, heightening their financial fragility and increasing the likelihood of macroeconomic instability. Moreover, according to the authors, the tightening of bank capital regulations in advanced economies redirected riskier borrowers, many of them located in emerging markets, towards non-bank financial institutions and international bond markets. This shift increases emerging economies' dependence on more volatile and less regulated sources of financing.

In tightening scenarios, the Federal Reserve's capital requirements may further restrict foreign currency funding and credit availability for both banks and firms in these markets. The cross-border effects of such regulatory changes highlight the need for further research to inform policymakers about the unintended consequences of macroprudential policies in developed economies like the U.S. This paper examines the effects of U.S. capital requirement regulations on Colombian banks' access to foreign credit lines, offering a nuanced perspective on the global interconnectivity of financial systems. This study highlights the ripple effects of regulatory shifts on capital flow dynamics and foreign exchange funding in emerging economies by analyzing how Colombian banks adjust their foreign currency funding strategies in response to tighter U.S. regulatory requirements. It also underscores the potential for financial tightening in such contexts, providing critical insights into the interplay between regulatory policies and cross-border liquidity.

We analyze the 2022 Fed capital requirement as a case study, given that despite the annual stress test results indicating that banks maintained strong capital levels sufficient to support uninterrupted operations during a severe recession, the Fed raised the common equity tier 1 (CET1) capital requirements for large banks in October 2022. The 2022 measures were notably more stringent than in previous years, featuring a stronger stress capital buffer (SCB). These restrictions required banks to hold higher levels of high-quality capital to withstand potential economic shocks, reflecting the Fed's response to an increasingly interconnected and risk-prone global economy, where systemic risks and domestic stability necessitate stronger buffers and more prudent capital planning across banking institutions. As outlined in Section 2, some Colombian banks anticipated and raised concerns about these changes. According to Banco de la República's quarterly survey on external financing, they perceived

a decline in U.S. banks' willingness to lend, attributed to the potential increase in capital requirements following the stress test results.

The empirical strategy employed in the analysis is the Synthetic Difference-in-Differences (SDID) method proposed by Arkhangelsky et al. (2021), which is particularly well-suited for evaluating the impact of U.S. capital requirements on credit availability for Colombian banks. This method provides consistent and asymptotically normal estimators, making it robust for scenarios where treatment assignment may depend on time-varying or bank-specific factors. In particular, the SDID method relies on *synthetic* controls by reweighing untreated units and time periods to compare similar units. The analysis is based on a detailed, weekly dataset submitted by local financial institutions to the Central Bank of Colombia. These reports include comprehensive information on each bank's credit relationships, detailing balances, credit limits by counterparty, and the corresponding country of origin. By comparing changes in access to external funding and credit availability coming from the U.S. before and after the implementation of 2022 U.S. capital requirements—while considering a similar synthetic control group of U.S. banks unaffected by these changes—the study provides critical insights into the international ramifications of regulatory policies. Specifically, it highlights the potential consequences of such regulations on domestic banks' external funding and credit availability in emerging economies.

Results indicate a significant reduction in credit from affected U.S. banks, primarily concentrated in short-term debt (maturity up to 12 months), while long-term credit remains unaffected. The flexibility of short-term instruments and their shorter maturities allow banks to swiftly adjust to regulatory constraints while preserving long-term commitments tied to larger projects and established relationships. Notably, this reduction becomes statistically significant two weeks after the capital requirement announcement and continues to grow over time. The decline is particularly pronounced in the 39th week of 2022, when the capital requirements officially took effect. These findings highlight the broader implications of macroprudential regulation. While short-term credit declines in response to regulatory tightening, the stability of long-term financing suggests that such policies may contribute to a more resilient and predictable financial system by discouraging excessive reliance on short-term funding.

Regarding credit limit amounts, point estimates indicate that lines decrease transitorily. The analysis of substitution effects, which examines whether Colombian banks offset reduced credit from affected U.S. banks by accessing alternative funding sources, shows that credit with unaffected U.S. banks increased following the stress test results, becoming statistically significant at the end of the study period. In relation to substitution effects outside the U.S., results indicate a limited and transitory geographical substitution behavior, which can be related to the primary role of the U.S. as a source of funding for emerging markets.

Previous literature has explored the role of regulatory capital buffers in shaping banks' lending behavior, supporting the hypothesis that higher capital requirements lead to reductions in credit supply. Studies by Cappelletti et al. (2024), Mathur et al. (2023), Degryse et al. (2023), Couaillier et al. (2022), Berrospide et al. (2021), alongside earlier research by Aiyar et al. (2014a), Bridges et al. (2014), and Gropp et al. (2019), highlight this trend. Such reductions in credit supply carry significant implications, particularly within the framework of macroprudential policies like Other Systemically Important Institutions (OSII) buffers or SCB. Importantly, these studies have mainly emphasized the effects of local capital regulations on domestic markets. However, as mentioned, while these measures aim to bolster financial stability locally, they may also create a "beggar-thy-neighbor" effect, distorting credit markets in host countries. This underscores the complex trade-offs involved in implementing regulatory policy making.

Although previous research has examined the cross-border effects of capital regulations, the findings remain inconclusive, perhaps due to the limited availability of highly detailed transactional data. The seminal work by Ongena et al. (2013), using data at the firm, locality, and country levels, explores the role of home bank regulation on cross-border lending standards. The authors find that lower barriers to entry, tighter restrictions on activities, and to a lesser extent, higher minimum capital requirements in domestic markets are associated with lower bank lending standards in host countries. Similarly, Aiyar et al. (2014b), using U.K. resident banks data at the bank and recipient country level, find that changes in U.K. bank capital requirements reduce cross-border lending, with stronger effects in less strategically country relationships. In contrast, Buch and Goldberg (2017), using bank-level data on a multi-study initiative, evaluate the international spillovers of macroprudential

policies on bank lending growth. They find that the effects can be positive or negative depending on bank characteristics, suggesting heterogenous responses across institutions.

Building on this literature, the present study leverages a unique, weekly, highly granular dataset on foreign credit lines of Colombian banks to provide a nuanced perspective on how heightened capital requirements in advanced economies impact financial conditions in emerging markets. Employing a SDID approach, a novel econometric methodology, the study also examines substitution effects triggered by capital regulations, shedding light on how interconnected financial markets can either mitigate or exacerbate regulatory spillovers across jurisdictions. The paper emphasizes the interconnected nature of global banking systems and the need for policymakers to consider cross-border liquidity dynamics when designing regulatory measures.[1]

An important contribution of this paper is its distinction between the effects of regulatory announcements, the publication of individual capital requirements, and the subsequent implementation of these measures. This approach sheds light on how expectations, information dissemination, and uncertainty shape financial decision-making processes. As Bernardini and Conti (2023) note, financial institutions often adopt preemptive strategies during the interim period between announcement and implementation. These strategies include adjusting financing structures or reducing risk exposure to mitigate potential adverse effects. This behavior is especially pertinent in the context of banking regulation, where institutions may seek to minimize the impact of capital restrictions by lowering leverage or reallocating exposures in anticipation of regulatory enforcement. By incorporating these dynamics, our study deepens the understanding of how regulatory shifts influence capital allocation, liquidity management, and risk exposure across borders. The paper also underscores the critical role of diversified funding channels in mitigating the effects of cross-border regulatory tightening, offering valuable lessons for policymakers aiming to balance domestic stability with global financial interconnectedness.

The paper is divided into six sections, including this introduction. Section 2 details the Fed's capital restrictions measures and the stress test procedure, emphasizing the 2022 case.

[1] Recent studies have highlighted the role of granular transaction-level data to offer insights into the implications of capital regulation on the international banking system. For instance, Ponte Marques et al. (2025) examine how increases in OSII capital buffers in the Euro area at the consolidated parent bank level affect global financial structures within banking groups, reducing equity and debt in foreign subsidiaries.

Section 3 presents the data used in the analysis. Section 4 details our empirical strategy. Section 5 presents the results, and Section 6 our conclusions.

2. Capital restrictions by the Federal Reserve

The Fed's approach to capital adequacy regulation has evolved Since 2013 (Fed, 2022b). Initially, it relied on the Dodd-Frank Act Stress Test and the Comprehensive Capital Analysis and Review (CCAR), which assessed banks' capital planning in both quantitative and qualitative dimensions. The quantitative assessment focused on whether banks had enough capital to sustain operations during economic stress, while the qualitative review assessed the robustness of banks' capital planning processes. In 2019, the Fed moved the qualitative evaluation into a confidential supervisory process, and in 2020, it simplified the quantitative portion by introducing the SCB, which streamlined stress-test-based capital requirements with the broader regulatory framework. The Fed determines the SCB requirement as a forward-looking measure that integrates stress test outcomes with non-stress capital standards. The SCB requirement provides a risk-sensitive measure aimed at ensuring that banks hold adequate capital against unanticipated economic shocks.

Therefore, stress tests now serve as a cornerstone of the Federal Reserve's supervision of large financial institutions, a practice that became essential following the 2008 financial crisis. Today, the capital requirements for banks include a minimum CET1 capital ratio of 4.5%, an SCB—determined from the supervisory stress test results—of at least 2.5 percentage points (pp), and a capital surcharge for global systemically important banks (G-SIBs) if applicable. Banks unable to meet these capital requirements face automatic restrictions on capital distributions and discretionary bonus payments (Fed, 2022a). This regulatory structure has helped U.S. banks significantly strengthen their capital bases, with the largest institutions more than doubling their aggregate common equity capital since 2009.

As of 2020 (following a modification in late 2019), only large U.S. banks—those with USD 100 billion or more in consolidated assets—are required to undergo the Fed's stress test. Notably, smaller U.S. banks are not subject to the Fed's SCB and G-SIB capital buffers. Additionally, two supervision frequencies are established for these large banks. For banks with consolidated assets between USD 100 and 250 billion, stress tests are conducted

biennially, starting in 2020. If consolidated assets exceed USD 250 billion, stress tests are conducted annually, starting in 2020.

Annual exercises are conducted according to the following schedule:

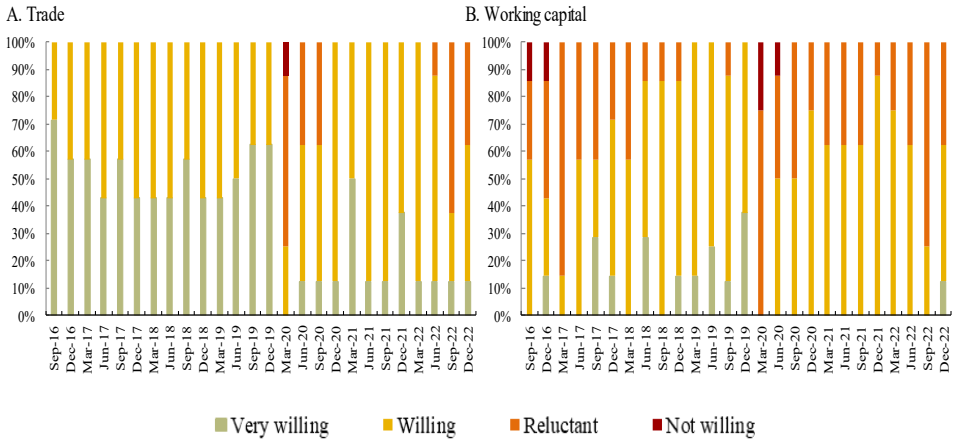
- Quarter 1: Publication of the macroeconomic scenarios for the current exercise, typically in mid-February. Publication of the methodology for the exercise, typically at the end of the quarter.
- Quarter 2: Publication of aggregated and individual results. Typically published at the end of the quarter.
- Quarter 3: Publication of CET1 requirements for all large banks. These requirements are based on the individual exercise results published in the previous quarter.
- Quarter 4: Implementation of requirements (e.g., October for the 2022 exercise).

As mentioned, this paper focuses on the stress test and capital requirements enacted in 2022. The two stress test scenarios the Fed uses to measure the banks against are the baseline and the severely adverse. For 2022, the severely adverse scenario featured a greater increase in the unemployment rate in the U.S. but a lower peak unemployment rate compared to the 2021 severely adverse scenario, as well as larger declines in real GDP and long-term interest rates. However, given that those scenarios and their dynamics are consistent with the Scenario Design Framework, which calls for a more pronounced economic downturn when economic conditions are stronger, a more severe scenario did not necessarily warn entities of possible future increases in capital requirements.

According to the quarterly survey of external financing applied to Colombian banks by Banco de la República, the 2022 capital requirements negatively affected U.S. banks' lending disposition and foreign credit supply, as depicted in Figure 1. The reduction in lending disposition started in 2022Q2 and worsened during 2022Q3 when requirements were published. The lower lending disposition during this period was also reflected on higher cost of funding for Colombian banks, as the average credit spreads reported in the survey increased. Also, according to the BIS Locational Banking Statistics, the overall outstanding credits from banks within the U.S. to banks outside its territory stagnated between the second and third quarter of 2022, which suggest a more cautious credit placement strategy in general terms. Fed data on supervisory stress tests and capital requirements also show a reduced

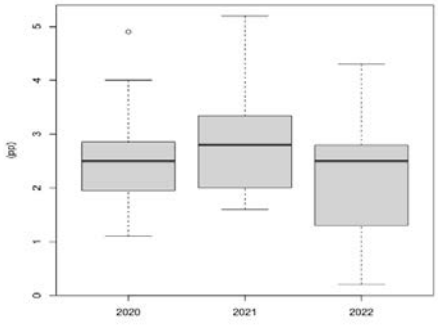
capital buffers of U.S. banks' lending to Colombian banks[2] during the same period (Figure 2). This reduction highlights the impact of increased capital requirements on U.S. banks, which is the central focus of our paper. Specifically, we examine this capital requirement shock by comparing the behavior of Colombian banks' credit lines granted by U.S. banks affected by the regulations with those not subject to the Fed's annual stress test exercise. This approach allows us to analyze the differential effects of the regulatory changes and their broader implications for cross-border liquidity supply.

Figure 1. Foreign banks' lending disposition to Colombian banks



Source: Quarterly survey on external financing applied by Banco de la República.

Figure 2. Capital buffers



Notes: The capital buffer is defined as the actual CET1 before the stress exercise (measured in the fourth quarter of the year prior to the stress test) minus the minimum capital requirement applicable for all banks, the Globally Systemic Important Banks premia and the stress capital buffer. The figure considers lenders located in the U.S. that provide credit to Colombian banks and is restricted to observations with capital buffers below 10 pp. Source: Fed.

[2] Defined as the actual CET1 before the stress exercise (measured in the fourth quarter of the year prior to the stress test) minus the minimum capital requirement applicable for all banks, the G-SIB premia and the SCB.

3. Data

This paper uses data from the external debt weekly reports submitted by local financial institutions to the Central Bank of Colombia to study the effects of the increased capital requirements enacted in 2022 in the U.S.[3] In said reports, each Colombian bank lists all its credit relations detailing the balance and credit limit by counterparty, specifying its country, and differentiating short- from long-term debt (maturity up to 12 months and above 12 months, respectively). Since we are focusing on the U.S., our main exercises are based on filtered data to include only credit lines with banks in this jurisdiction, which is the main source of funding, representing nearly 30% of Colombian banks' total outstanding credit as of the end of 2022.

We complement the mentioned dataset with two additional sources. First, we use the Fed reports on capital requirements to separate U.S. lender banks participating in the Fed's stress tests from those not subject to additional capital requirements. This database also contains information about the capital requirement buffers from each bank to which applies the Fed capital regulation (see Figure 2). Second, size, profitability, capital, and credit quality controls are also included for the lender banks (see Table 1). These controls were collected primarily from quarterly financial statements as collected by Bloomberg. In the case of incomplete data in this source, we use lenders' own publicly available reports.

The resulting database is a weekly balanced panel at the local borrower bank and foreign lender bank level, spanning from November 2021 and December 2022. This period is chosen to isolate the effect of the pandemic. In total, the data set contains 5,002 observations, 12 Colombian banks and 26 foreign lender banks located in the U.S., of which 11 are subject to capital requirements from the Fed.[4] Table 1 summarizes the credit relations between Colombian and U.S. banks in terms of total stock, stock by term, credit limits, and credit usage, defined as the stock-to-limit ratio, (panel A), as well as the lender's balance characteristics (panel B).

[3] External Circular Letter 025 of 2002 from the Financial Superintendency of Colombia.
[4] Some entities are excluded due to their nature as multilateral or governmental entities (6 entities) or because of the unavailability of their data (3 entities).

Table 1. Summary statistics

VARIABLE	Min	p25	p50	Mean	p75	Max	SD
A. Credit line characteristics							
Total credit (USD M)	0.00	0.00	0.00	22.80	25.00	242.20	44.34
Long-term credit (USD M)	0.00	0.00	0.00	2.69	0.00	160.00	18.41
Short-term credit (USD M)	0.00	0.00	0.00	20.11	20.00	242.20	41.01
Credit limit (USD M)	0.00	5.00	45.00	72.29	125.00	300.00	78.44
Credit usage (%)	0.00	0.00	0.00	25.83	49.21	100.00	34.78
B. Lender characteristics							
Ln (Assets)	9.10	13.54	14.48	14.01	14.90	15.28	1.18
CET1 (%)	8.95	10.60	12.50	12.51	14.00	22.60	2.15
ROA (%)	0.12	0.36	0.77	0.72	0.98	1.67	0.34
Loan/Deposits (%)	19.69	48.52	61.81	62.36	70.72	111.20	18.39
NPL (%)	0.00	0.46	0.60	1.17	1.80	5.17	1.11

Notes: USD M refers to Millions of U.S. Dollars.
Sources: Data sources described in Section 3.

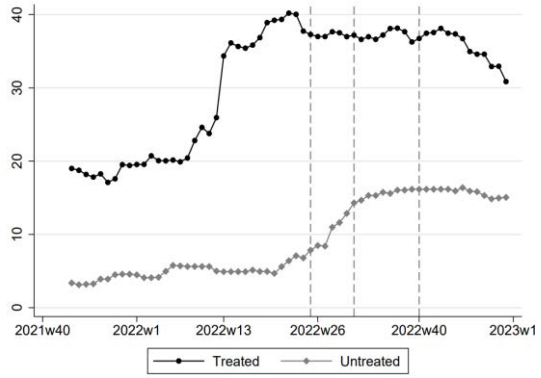
Before formally elaborating on our SDID design in the next section, Figure 3 illustrates the average credit dynamics for each U.S. bank-lender group, i.e., subject (treated) and not (untreated) to Fed's additional capital requirements. The dotted vertical lines point, in chronological order, the publication of (i) stress test result on June 23, 2022 (2022w25), (ii) capital requirements on August 4, 2022 (2022w31), and (iii) the requirements effective date of October 1, 2022 (2022w39).

Following the publication of individual stress test results, total credit exhibited stability for treated credit lines and reductions since October, when the requirements became effective (Figure 3, panel A). In contrast, the dynamic for untreated credit relations increased even after the requirements were published. These movements in average total credit were explained mainly by short-term loans (Figure 3, panel B) in contrast to long-term loans (Figure 3, panel C).[5] Regarding credit limits, an important reduction is observed for treated banks after the capital requirement release in 2022w31 (Figure 3, panel C). However, credit limit usage exhibited a downward trend since average credit stocks decreased in a higher proportion (Figure 3, panel D).

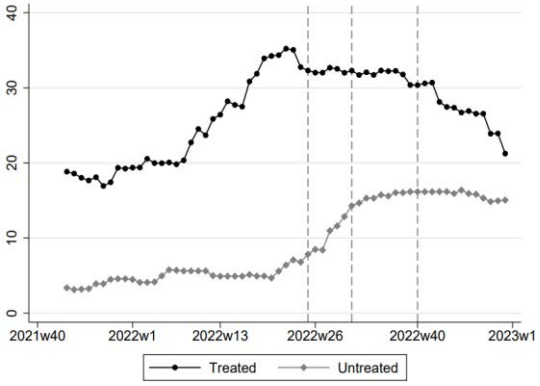
[5] The low levels of average long-term loans are expected since most Colombian banks finance their long-term needs by issuing bonds.

Figure 3. Average trends

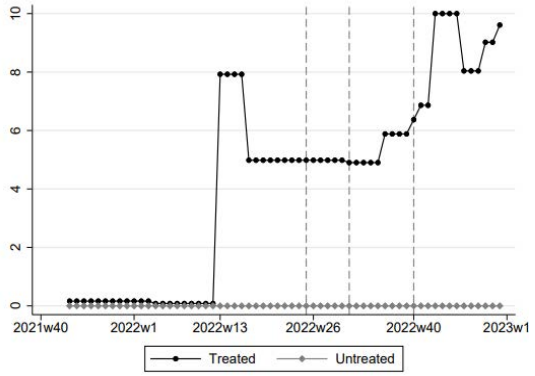
A. Total credit (USD M)



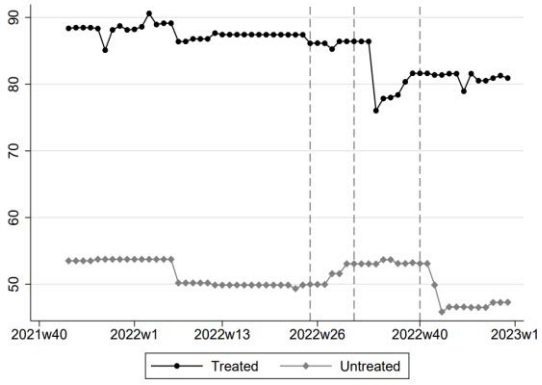
B. Short-term credit (USD M)



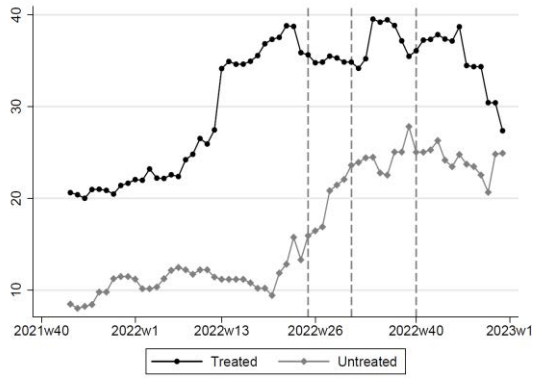
C. Long-term credit (USD M)



D. Credit limit (USD M)



E. Credit usage



Notes: Average outcomes of credit lines by treated and untreated U.S. lender banks. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Source: Data sources described in Section 3.

Despite the interesting post-treatment dynamics depicted above, when it comes to average trends before the publication of stress test results in 2022w25, some discrepancies between treated and untreated credit lines are evident. For instance, average stocks increased for

treated U.S. banks compared to untreated units. The above points out the necessity of finding comparable groups to evaluate the policy shock studied in this paper. As described in the next section, we rely on the SDID approach, which offers estimators appropriate for scenarios where treatment assignment may be affected by certain time or bank-related factors. In particular, the SDID method constructs synthetic controls by means of reweighting untreated units and periods so that similar units are compared.

4. Empirical strategy

To assess the causal effect of increased capital restrictions on Colombian Banks' access to foreign credit lines, we employ the SDID method proposed by Arkhangelsky et al. (2021), focusing on variations in credit availability between U.S. banks subject and not subject to the Fed's capital additional requirements. The SDID approach provides consistent and asymptotically normal estimators, making it well-suited for situations where time-specific or bank-specific factors may influence treatment assignment. In our context, it is crucial to acknowledge that the distinct characteristics of the banks involved may shape the treatment effect. Therefore, the SDID method is a powerful tool for causal inference, especially when dealing with policy interventions like capital requirement buffers where bank characteristics play a key role. The SDID method effectively mitigates bias in cases of non-uniform treatment assignment, ensuring more reliable comparisons. Indeed, as illustrated in Figure 3 above, the parallel trends assumption used for difference-in-differences (DID) estimation is not satisfied with the raw data in this application.

The SDID deals with the challenge of non-parallel trends between the average of treatment and control banks by combining DID and Synthetic Control (SC) methods, leveraging on the strengths of both techniques and providing a more robust analysis of the intervention's impact. The SDID compares the treated group, which comprises credit lines with U.S. banks subject to the Fed's additional capital buffers, with a synthetic control group of unaffected credit lines where the lender is an U.S. bank that is only required to meet the minimum CET1 of 4.5%. SDID constructs these synthetic controls by means of reweighting untreated units and periods so that similar units are compared. Comparison groups are adjusted to correct pre-trends (as in SC) while considering individual and time effects (as in DID), providing a more flexible model (Arkhangelsky et al., 2021).

In this study, we are working with a three-dimensional balanced panel setup at the credit line level composed by local banks (i.e., the borrowers, indexed by i), foreign U.S. banks (lenders, indexed by j) and weeks (indexed by t). Define Y_{ijt} as the outcome of credit availability that we aim to study (i.e., total credit, short- and long-term credit, credit limits, and credit usage ratio). Moreover, define N_c as the set of credit lines never exposed to treatment, i.e., (i, j) pairs with lender j an U.S. bank not subject to the Fed's requirements. Define also N_{tr} as the set of credit lines subject to capital requirement buffers. Estimating the *average casual effect of treatment* includes the following three steps (for more details, see Arkhangelsky et al., 2021).

1. Find unit weights $\widehat{w}_{ij}^{\,sdid}$ such that outcome pretreatment trends of the treated are like those of the controls. That is, $\forall\ t = 1, \dots, T_{pre}$, where T_{pre} is the last pretreatment week, find $\widehat{w}_{ij}^{\,sdid}$ such that:

$$\sum_{(i,j)\in N_c} \widehat{w}_{ij}^{\,sdid} Y_{ijt} \approx \frac{1}{|N_{tr}|} \sum_{(i,j)\in N_{tr}} Y_{ijt}.^{6}$$

2. Considering that the outcome for control units in the post-treatment differs consistently from pre-treatment observations, find time weights $\hat{\lambda}_t^{sdid}$ such that there is a balanced window where similar pre- and post-treatment periods are compared.

3. Based on the previous unit and time weight estimates, find the average causal effect of treatment $\hat{\tau}^{sdid}$ through the following weighted DID regression:

$$(\hat{\tau}^{sdid}, \hat{\mu}, \hat{\alpha}, \hat{\beta}) = \text{argmin}_{\tau,\alpha,\mu,\beta} \left\{ \sum_{(i,j)\in N_{co}\cup N_{tr}} \sum_{t=1}^{T} (Y_{ijt} - \mu - \alpha_{ij} - \beta_t - W_{ijt}\tau)^2 \widehat{w}_{ij}^{sdid}\, \hat{\lambda}_t^{sdid} \right\},$$

where α_{ij} and β_t are panel and time fixed effects, and W_{ijt} is a dynamic dummy variable switched on if the U.S. lender j is subject to the additional Fed's requirements and $t > T_{pre}$.

[6] In finding unit weights, Arkhangelsky et al. (2021) propose a flexible optimization problem where comparison units are similar in trends but not necessarily in levels as opposed to SC methods.

We set T_{pre} as 2022w24, the week before individual stress test results were released (June 23, 2022, or 2022w25).

In sum, unit-specific weights ensure that treated credit lines are compared to controls that follow parallel trends in the pre-intervention period. Meanwhile, the time weights are selected to assign more significance to pre-treatment periods that are similar to post-treatment periods by finding a constant difference between each control unit's post-treatment average and pre-treatment weighted averages across all selected controls, prioritizing periods that resemble those in the treatment phase.

Implementing the SDID approach to avoid confounding and ensure consistency requires analyzing the Fed's requirements by adjusting for the presence of lender explanatory variables which might affect treatment status so that estimated weights consider this information. To do so, we rely on the projected option proposed by Kranz (2022) and developed by Clark et al. (2024), which consists of conducting regression adjustment based on parameters estimated only for control credit lines.[7] From the coefficients estimated in this regression adjustment, the three-step SDID procedure described above is conducted for $Y_{ijt}^{adj} = Y_{ijt} - X_{jt}\hat{\beta}$, where X_{jt} are the time-varying lender characteristics we aim to control for. We control for the following lender characteristics measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. These variables are expected to influence the treatment sorting in our context and the dynamics of credit provision to Colombian banks.

Given the high frequency of our data set (weekly data), we emphasize event-study estimates following the release of the Fed's individual stress test results on June 23, 2022 (2022w25) to inspect whether the effects differ across key dates. The event-study analysis adapted from the SDID methodology follows the estimators proposed by Ciccia (2024). In this setting, the SDID estimator can be rearranged to estimate the treatment effects for banks receiving treatment starting from the cohort set in the 2022w25. This cohort-specific SDID estimator compares the average outcome difference between the treated banks in the cohort and those never treated before and after the onset of the treatment. This event-study estimator allows for the estimation of the treatment effect periods after adopting the treatment. The

[7] The regression adjustment follows the form: $Y_{ijt} = \mathrm{a} + X_{jt}\beta + \gamma_t + \mu_{ij} + u_{ijt}$, where X_{jt} are the time-varying lender characteristics we aim to control for, and γ_t and μ_{ij} are the time- and credit line-fixed effects, and u_{ijt} the error term.

event-study estimates are computed by aggregation of the cohort-specific dynamic effects into a single estimator, which is the weighted sum of the cohort-specific treatment effects periods after the onset of the treatment, with weights corresponding to the relative number of groups participating in each cohort. In addition to the event study, we also present the average post-treatment effect estimated for the whole post-treatment period ($\hat{\tau}^{sdid}$). Finally, 95% confidence intervals are calculated with a 100-repetition clustered bootstrapping procedure with replacement, following Arkhangelsky et al. (2021).

5. Results

This section presents the results of the effect of the Fed's capital requirement on loan supply to Colombian banks. Estimates follow the SDID methodology presented in Section 4. Given the high frequency of our data set (weekly data), we focus on the event-study analysis. Our main estimates include as controls the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. These controls are included using the projected method described proposed by Kranz (2022) and developed by Clark et al. (2024). Standard errors are calculated using the clustered bootstrapping procedure described in Section 4.

First, we present the main results on the credit supply of affected U.S. banks, discuss identification, and present robustness exercises. Second, we present some additional exercises to explore the role that substitution effects can play in attenuating the loan supply effects on affected U.S. lenders.

5.1 Main results on loan supply

Figure 4 illustrates the event-study results following the release of the Fed's individual stress test results on June 23, 2022 (2022w25) with 95% confidence intervals. All effects are measured compared to the base period defined one week before this announcement (2022w24). Figure 4 also presents vertical lines depicting the individual requirements released on August 4, 2022 (2022w31), and the requirements effective date of October 1, 2022 (2022w39). This timeline allows us to inspect whether the effects differ across these key dates. It is important to note that differences may arise between the announcement and the implementation of regulatory measures, as economic agents might anticipate policy

changes. According to the literature (e.g., Bridges et al., 2014; Gropp et al., 2019), announcements can trigger anticipated adjustments as banks and other financial institutions respond to expected future constraints. This behavior, known as anticipatory adjustment, may include reducing credit supply, reallocating capital, or increasing liquidity buffers to comply with forthcoming requirements. The magnitude and timing of these adjustments can vary. For example, banks can respond more strongly to the announcement when the implementation timeline is short, as there is less preparation time. Conversely, if the implementation date is distant, the adjustments may be more gradual, as banks have more flexibility to plan and adapt. This anticipation often distinguishes between immediate effects observed post-announcement and delayed effects materializing closer to the enforcement date.

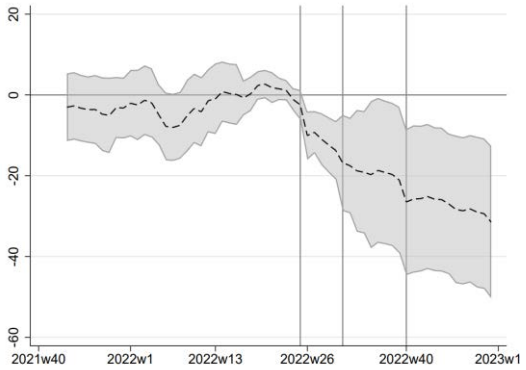
Regarding the pre-trends, the estimates generally indicate that the weights provided by the SDID method allow for comparable groups before treatment. As shown in Figure 4, for all variables studied, the differences in trends between treated and non-treated credit relations are not statistically different from zero.

Shifting to the post-treatment effects, it is noteworthy that the total credit from affected U.S. banks has been on a downward trend since the release of the Fed's results on June 23, 2022 (2022w25), as shown in panel A of Figure 4. This reduction becomes statistically significant two weeks after the announcement and increases in magnitude over time. A more pronounced reduction is observed in 2022w39, when capital requirements were in force. The effect reaches close to -30 USD millions (M) by the end of 2022.

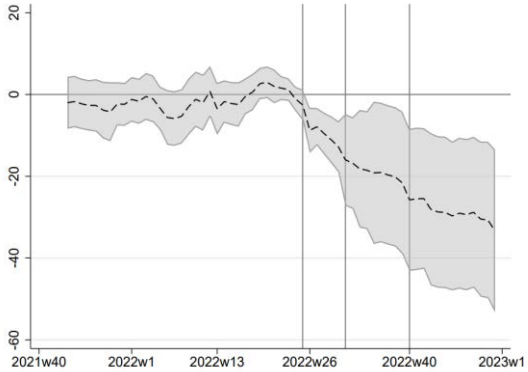
Once we decompose the effect between short- and long-term credit in panels B and C of Figure 4, we can conclude that effects are concentrated on short-term debt (up to twelve months), whereas no statistically significant differences are found on long-term credit. Regarding credit limit amounts, Figure 4, panel C, indicates that lines reduced three weeks after the capital restrictions were released by the Fed on August 4, 2022. Afterwards, the effect is reversed, indicating a short-term response. Given the higher reduction in credit amounts and the low effects on credit limits, the credit usage ratio, defined as total credit over credit lines, shows reductions (Figure 4, panel D).

Figure 4. SDID event-study effects

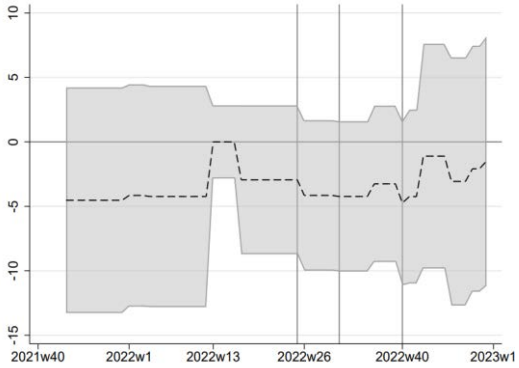
A. Total credit (USD M)



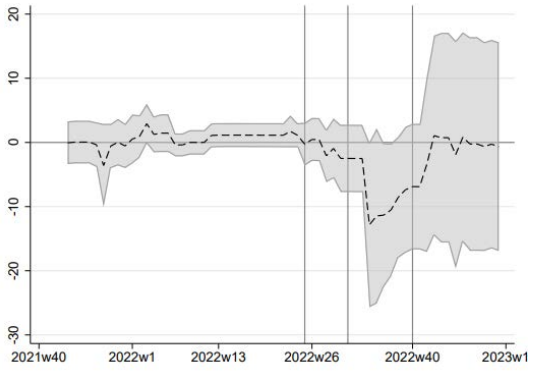
B. Short-term credit (USD M)



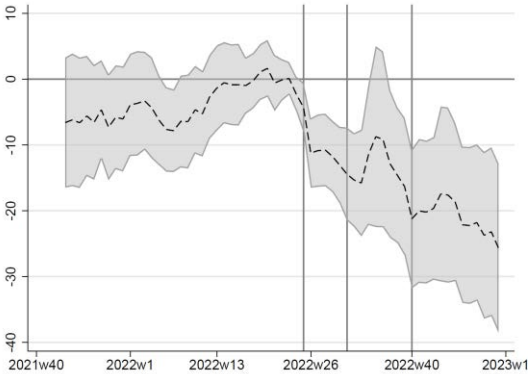
C. Long-term credit (USD M)



D. Credit limit (USD M)



E. Credit usage (pp)



Notes: Event-study SDID estimates. Estimations include as controls the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Standard errors calculated by a 100-repetition clustered bootstrapping procedure with replacement. 95% confidence intervals. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Sources: Data sources described in Section 3.

Table 2 presents the average post-treatment effect estimated for the whole post-treatment period starting from 2022w25 when the Fed released individual stress test results. The

average effect on total credit is USD -20.9 M, which is explained by short-term debt. For reference, the 4-week average credit stock for treated lines the week just before 2022w25 was 39.3 USD M, so the approximated effect represents a drop of 53% with respect to this value.

The pronounced effects on short-term debt can be attributed to the higher flexibility and quicker adjustment capabilities associated with short-term credit instruments. Banks facing tighter capital requirements often prioritize maintaining their long-term lending commitments, as these are typically tied to larger projects or long-standing relationships, which are harder to renegotiate or curtail without reputational costs. In contrast, short-term credit lines are more easily adjusted or terminated, allowing banks to respond swiftly to regulatory pressures and rebalance their portfolios to meet capital requirements.

This finding aligns with the literature, which suggests that short-term credit is more sensitive to regulatory constraints due to its lower contractual rigidity and shorter maturity (Aiyar et al., 2014b; Ponte Marques et al., 2025). Nevertheless, preferences for long-term funding may have important implications for financial resilience. By discouraging excessive reliance on short-term funding, typically more volatile and highly responsive to regulatory changes, macroprudential policies could foster a more stable credit environment, reducing banks' exposure to sudden liquidity shocks and promoting more sustainable credit allocation.

Table 2. SDID average post-treatment effects

VARIABLES	(1) Total credit (USD M)	(2) Short-term credit (USD M)	(3) Long-term Credit (USD M)	(4) Credit limit (USD M)	(5) Credit usage (pp)
ATT	-20.94***	-21.27***	-3.229	-3.296	-16.21***
	(7.146)	(7.072)	(3.191)	(4.584)	(4.355)
Observations	5,002	5,002	5,002	5,002	3,904
Credit relations	82	82	82	82	64
Controls	Yes	Yes	Yes	Yes	Yes

Notes: Average post-treatment SDID estimates. Standard errors, calculated by a 100-repetition clustered bootstrapping procedure with replacement, are in parenthesis. Controls include the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: Data sources described in Section 3.

Identifying the effects of capital restrictions

The results above rely on the parallel trend assumption of the synthetic controls. That is, after adjusting for covariates, trends in outcomes for treated credits would have evolved similarly to those of synthetic controls. The advantage of the SDID method is that, by selecting time and individual weights, the statistical procedure ensures that such comparability is achieved. Indeed, as shown in Figure 5, the pre-trends are roughly corrected when the SDID method is applied (compared with raw data in Figure 3). In any case, in this section we describe other robustness exercises to provide evidence on the advantages of the method use and the shock studied.

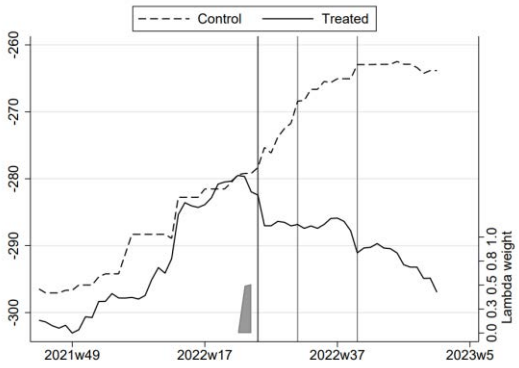
Method comparison. As first exercise, Appendix A compares the SDID estimates with the traditional DID and SC method. As shown by this comparison, SDID provides a more flexible model where i) comparison groups are adjusted to correct pre-trends (as in SC) and ii) individual and time effects are taken into account (as in DID). In sum, as Arkhangelsky et al. (2021) argue, the SDID method combines the advantageous features of both SC and DID. Indeed, by using SC alone, estimates would be higher and less precise because fewer comparison units are selected as controls since they also must be equal in levels. On the other hand, DID estimates would suffer biases from the pre-trends violation, an issue that the SDID corrects.

Placebo estimation. As a second exercise, in Appendix B we conduct the same SDID analysis but in 2021, using the announcement dates made by the Fed in that year. If our shock narrative is correct, we expect to find no results in that period. As expected, no significant differences around announcement dates are found in that year.

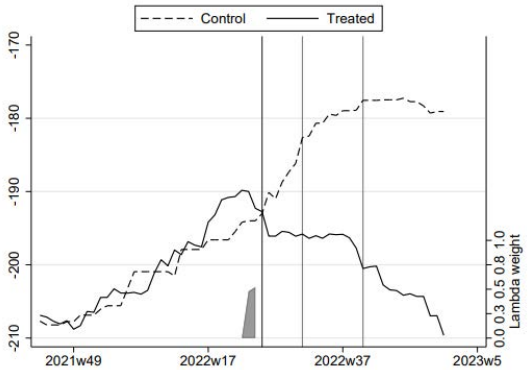
Local demand controls. The literature has pointed out that evaluating the effect of credit exogenous supply shocks (liquidity, capital, etc.) is methodologically challenging as it must be separated from the demand-driven credit channel of those seeking resources—the ability to substitute the affected source of financing with other funding sources (see Khawaja and Mian, 2008). As a final test, we horse-race our main estimates by applying debtor-week fixed effects à la Khawaja and Mian (2008) to control for local banks' demand. One drawback of this approach is that including these controls restricts the data to local banks with more than one credit relationship. Results are presented in Appendix C. As shown there, with this reduced sample, the results are qualitatively the same and quantitatively similar.

Figure 5. SDID analysis

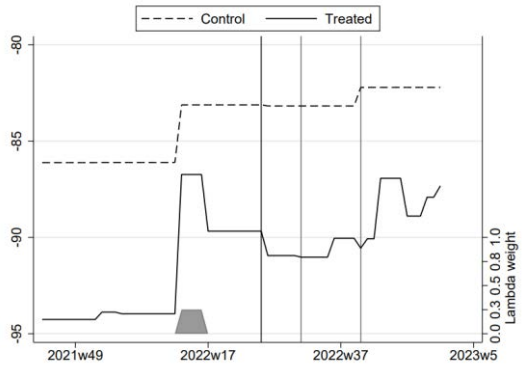
A. Total credit (USD M)



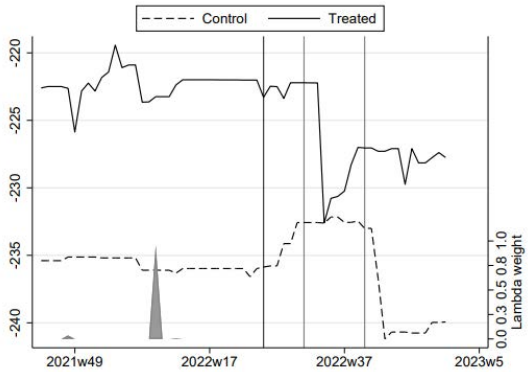
B. Short-term credit (USD M)



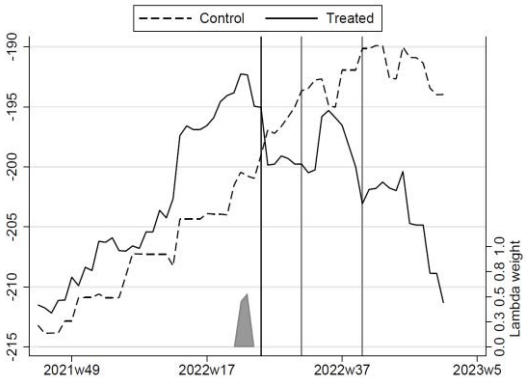
C. Long-term credit (USD M)



D. Credit limit (USD M)



E. Credit usage (%)



Notes: Treated and synthetic control tendencies and time weights. Tendencies are calculated over the adjusted variables after controlling for the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Sources: Data sources described in Section 3.

5.2 Exploring substitution effects

In this section, we build on the previously presented results by examining the role that highly diversified cross-border bank credit markets can play in attenuating the negative impact of increased capital restrictions. Diversification allows local banks to smooth policy shocks by substituting funding from affected sources with those from unaffected ones. For instance, Colombian banks facing credit restrictions under the Federal Reserve's supervisory framework can increase their borrowing from U.S. banks not subject to these restrictions or from established credit lines outside the U.S. When diversification is sufficiently robust, the aggregate effect on foreign funding may be substantially mitigated, reducing the overall disruption caused by policy changes.

To evaluate these mechanisms, we follow Önder et al. (2024) by replacing the outcome variable with Y_{i-jt}, that is, the loans contracted by local bank i with lenders different from U.S. bank j at time t. The above allows us to inspect if debtor i can substitute sources from affected j U.S. banks. We present different exercises. First, we measure Y_{i-jt} for the whole U.S. source of funding. The above allows us to assess the role played by substitution effects in the U.S. economy and between affected and unaffected U.S. banks. Second, we measure Y_{i-jt} considering only other jurisdictions. This second exercise enables us to measure geographic substitution effects (i.e., how credit from sources outside the U.S. responded to regulatory shocks). We present these exercises as exploratory complements to the main results, recognizing the limitations of the scope and the need for further research to provide more definitive evidence of substitution mechanisms. For a more precise evaluation, future analysis should incorporate variations in lender-specific and macroeconomic conditions outside the U.S., which may influence substitution patterns.

Figure 6 illustrates the event study using the SDID approach applied to the described variables. The results indicate that following the release of individual stress test results on June 23, 2022 (2022w25), credit with other unaffected banks increased. Panel A of Figure 6 shows that this substitution tendency continues after implementing heightened capital requirements on October 1, 2022 (2022w39). In terms of magnitude, the substitution estimate is close to USD 16 M at the end of the study period and becomes significant at the 10% level. This value is lower (in absolute terms) than the estimated effects on affected banks (close to

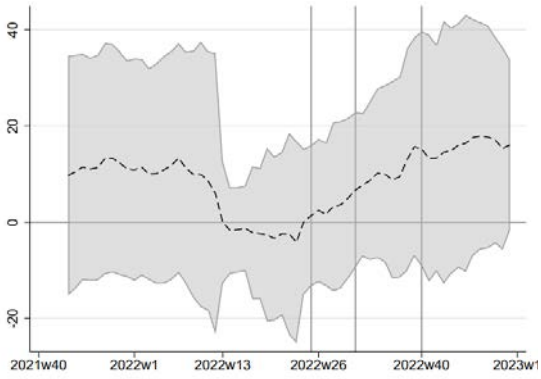
30 USD M at the end of the study period). The above provides evidence of a delayed substitution effect in the U.S. credit-loan market.

Regarding substitution effects outside the U.S., even though an increase in lending is observed between June and October, this is not statistically significant (Figure 4, Panel B). The above could indicate a limited and transitory geographical substitution effect, which can be related to the primary role of the U.S. as a source of funding for emerging markets.

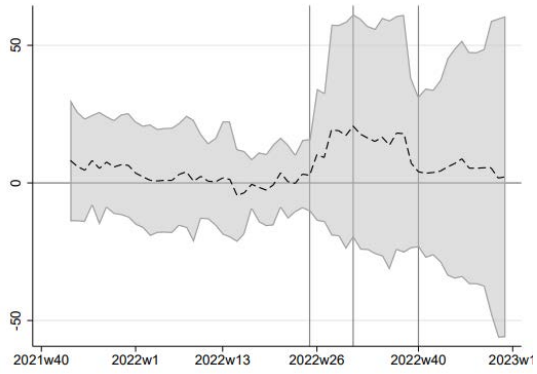
In sum, these complementary exercises provide evidence of a delayed substitution effect in the international credit loan market, underscoring the relevance of highly diversified external banking markets. This result suggests that geographic substitution beyond the U.S. may be limited and temporary, reflecting the predominant role of the U.S. as a funding source for emerging markets. Nonetheless, these findings emphasize the importance of diversified funding channels to mitigate the unintended consequences of regulatory spillovers.

Figure 6. SDID event-study substitution effects

A. Total credit in the U.S. (USD M)



B. Total credit in jurisdictions different from the U.S. (USD M)



Notes: Event-study SDID estimates. Estimations include as controls the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Standard errors calculated by a 100-repetition clustered bootstrapping procedure with replacement. 95% confidence intervals. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Sources: Data sources described in Section 3.

Table 3 complements these findings by presenting the average post-treatment substitution effects over the entire post-treatment period starting from 2022w25, when the Federal Reserve released individual stress test results. As indicated by the event study analysis, substitution effects are on average not significant which is related to the previously

documented delayed substitution response, highlighting the temporal lag in banks' ability to adjust their funding sources.

Table 3. SDID average post-treatment substitution effects

VARIABLES	(1) Unaffected banks in the U.S. (USD M)	(2) Jurisdictions different from the U.S. (USD M)
ATT	11.16	10.15
	(9.096)	(16.86)
Observations	5,002	5,002
Credit relations	82	82
Controls	Yes	Yes

Notes: Average post-treatment SDID estimates. Standard errors, calculated by a 100-repetition clustered bootstrapping procedure with replacement, are in parenthesis. Controls include the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: Data sources described in Section 3.

6. Conclusions

This paper analyzes the impact of U.S. capital requirement regulations on Colombian banks' access to foreign credit lines, focusing on the Fed's 2022 stress test announcements. The restrictions introduced a more rigorous stress capital buffer than in previous years, requiring U.S. banks to hold higher levels of high-quality capital to withstand economic shocks. These stricter requirements generated spillover effects on Colombian banks. Even before their official implementation, some Colombian banks anticipated reduced lending from U.S. banks, as indicated in the June 2022 quarterly survey on external financing by Banco de la República. These expectations were consistent with the observed decline in credit availability following the stress test results, underscoring the impact of U.S. regulatory policies on emerging markets.

By employing an SDID approach, the study provides critical insights into the interconnectedness of global financial systems and the ripple effects of regulatory policies on emerging economies. The analysis focuses on three key regulatory events: the announcement of stress test results (June 23, 2022), the release of individual requirements (August 4, 2022), and the implementation of these requirements (October 1, 2022). Results indicate that total credit from U.S. banks subject to the revised capital requirements declined

after the June announcement, with reductions intensifying closer to the enforcement date. By the end of 2022, this reduction reached nearly USD 30 M, driven primarily by short-term credit, while long-term credit remained unaffected. The heightened sensitivity of short-term debt reflects its flexibility and lower contractual rigidity, enabling banks to adapt quickly to regulatory constraints. However, excessive reliance on short-term funding can pose risks to financial stability. In this context, macroprudential policies that emphasize long-term funding could foster a more stable credit environment, reducing banks' exposure to sudden liquidity shocks and promoting more sustainable credit allocation.

Delayed substitution effects were also observed as Colombian banks sought alternative funding sources. Credit from unaffected U.S. banks increased slightly post-announcement and becomes statistically significant by the end of the study period, with an estimated substitution effect of USD 16 million. However, this effect was insufficient to offset the reductions from affected banks, indicating challenges in fully mitigating regulatory spillovers. Outside the U.S., substitution effects were limited and temporary, with non-U.S. lending showing a marginal, statistically insignificant increase. This underscores the dominant role of the U.S. in funding emerging markets and highlights the vulnerabilities created by reliance on concentrated funding sources.

The findings emphasize the importance of diversified funding channels to mitigate unintended regulatory consequences. They also reveal financial institutions' preemptive actions during the interim between announcement and enforcement, such as reallocating exposure, to minimize adverse impacts. These insights underline the need for policymakers to consider cross-border liquidity dynamics and the broader implications of regulatory measures on global financial stability and access to credit in emerging markets.

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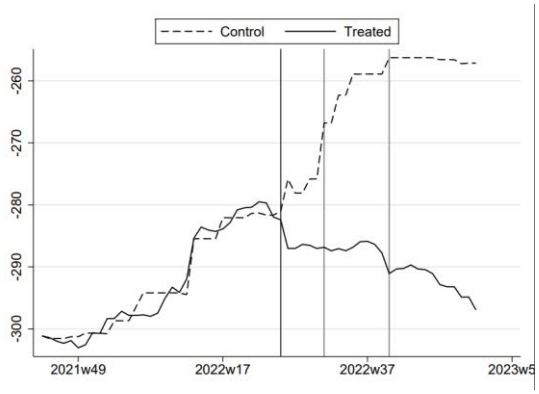
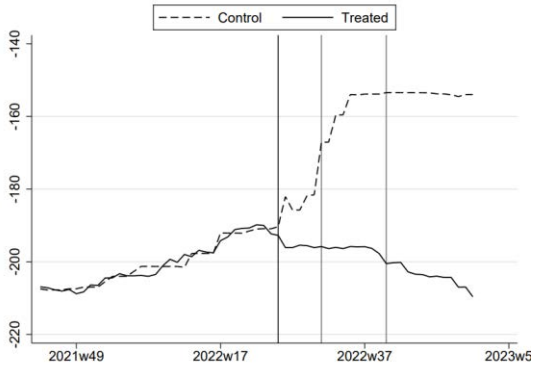
Appendix A. Method comparison

Figure A1. SC analysis

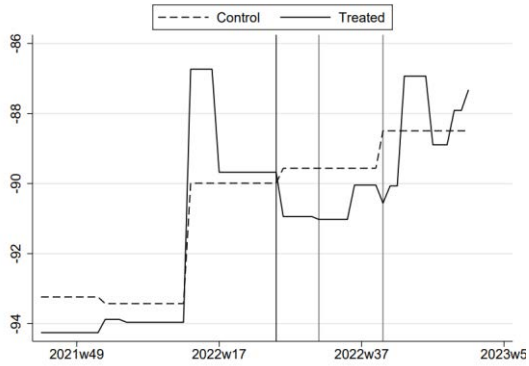
A. Total credit (USD M)



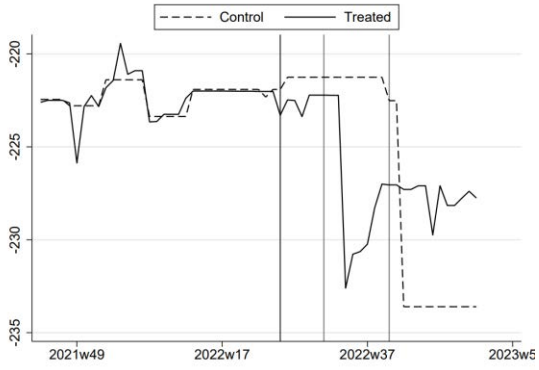
B. Short-term credit (USD M)



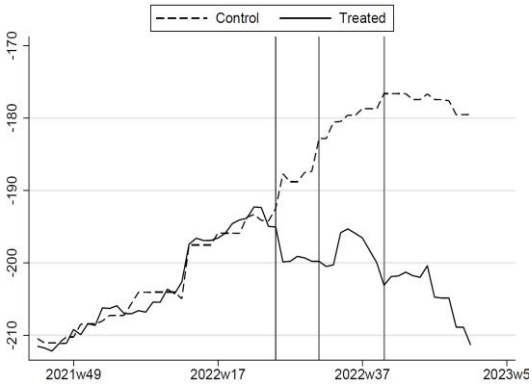
C. Long-term credit (USD M)



D. Credit limit (USD M)



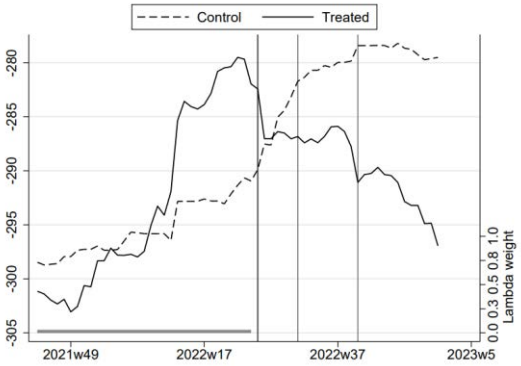
E. Credit usage (%)



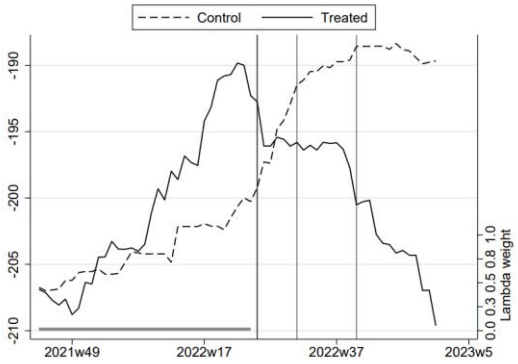
Notes: Treated and synthetic control tendencies for the SC method. Tendencies are calculated over the adjusted variables after controlling for the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Vertical lines correspond to 2022w25, 2022w31, and 2022w39. Sources: Data sources described in Section 3.

Figure A2. DID analysis

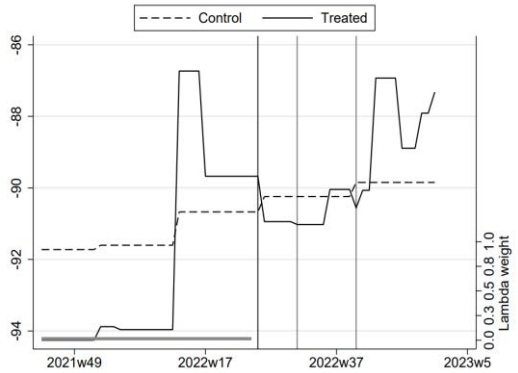
A. Total credit (USD M)



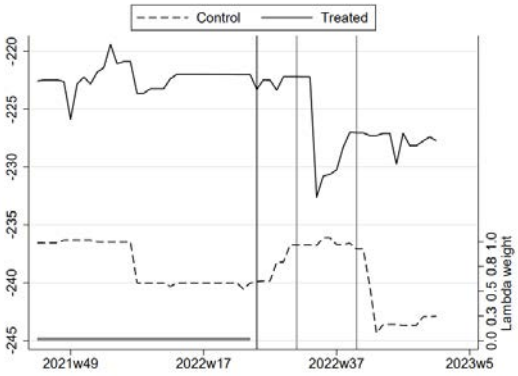
B. Short-term credit (USD M)



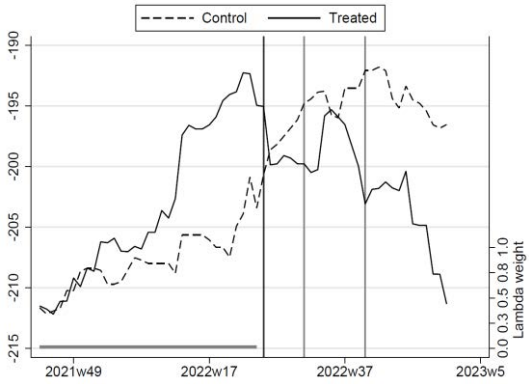
C. Long-term credit (USD M)



D. Credit limit (USD M)



E. Credit usage (%)



Notes: Treated and control tendencies for the DID method. Tendencies are calculated over the adjusted variables after controlling for the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Sources: Data sources described in Section 3.

Table A1. Average post-treatment effects by method

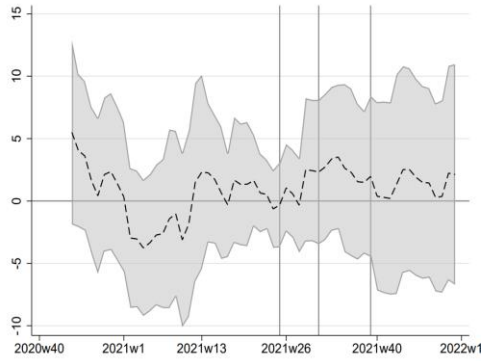
VARIABLES	(1) Total credit (USD M)	(2) Total credit (USD M)	(3) Short-term credit (USD M)	(4) Short-term credit (USD M)	(5) Long-term credit (USD M)	(6) Long-term credit (USD M)	(7) Credit limit (USD M)	(8) Credit limit (USD M)	(9) Credit usage (pp)	(10) Credit usage (pp)
ATT	-26.59*	-10.85*	-37.88**	-12.18**	-0.488	1.328	-0.253	-2.903	-20.26**	-10.69**
	(14.00)	(5.802)	(15.32)	(4.738)	(2.553)	(2.671)	(7.159)	(4.451)	(10.23)	(5.114)
Observations	5,002	5,002	5,002	5,002	5,002	5,002	5,002	5,002	3,904	3,904
Credit relations	82	82	82	82	82	82	82	82	64	64
Method	SC	DID	SC	DID	SC	DID	SC	DID	SC	DID
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Average post-treatment estimates for SC and DID methods. Standard errors, calculated by a 100-repetition clustered bootstrapping procedure with replacement in parenthesis. Controls include the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: Data sources described in Section 3.

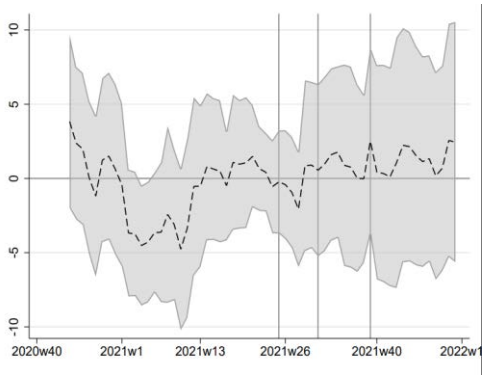
Appendix B. Placebo estimates in 2021

Figure B1. SDID Event-Study Effects

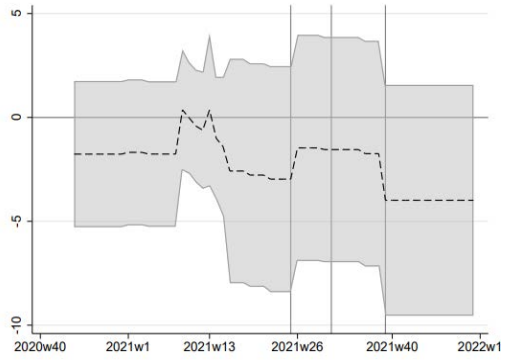
A. Total credit (USD M)



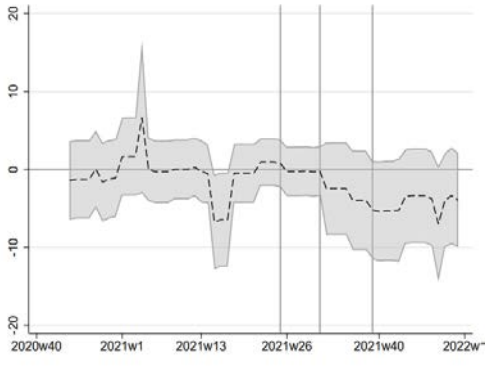
B. Short-term Credit (USD M)



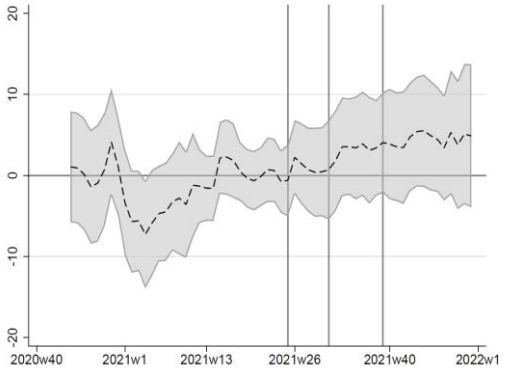
C. Long-term Credit (USD M)



D. Credit limit (USD M)



E. Credit usage (pp)



Notes: Event-study SDID estimates. Estimations include as controls the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL. Standard errors calculated by a 100-repetition clustered bootstrapping procedure with replacement. 95% confidence intervals. Vertical lines correspond to 2021w25, 2022w31, and 2021w39.
Sources: Data sources described in Section 3.

Table B1. SDID average post-treatment effects (2021 placebo)

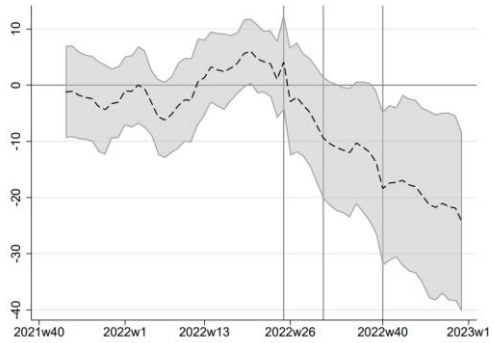
VARIABLES	(1) Total credit (USD M)	(2) Short-term credit (USD M)	(3) Long-term credit (USD M)	(4) Credit limit (USD M)	(5) Credit usage (pp)
ATT	1.603	0.832	-2.828	-3.031	3.237
	(2.614)	(2.426)	(2.760)	(2.482)	(2.731)
Observations	4,920	4,920	4,920	4,920	3,900
Credit relations	82	82	82	82	64
Controls	Yes	Yes	Yes	Yes	Yes

Notes: Average post-treatment SDID estimates. Standard errors, calculated by a 100-repetition clustered bootstrapping procedure with replacement, are in parenthesis. Controls include the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: Data sources described in Section 3.

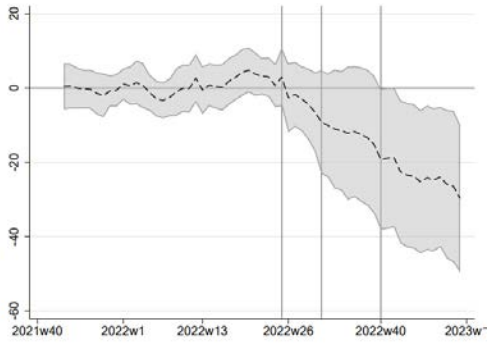
Appendix C. Controls for debtor demand

Figure C1. SDID event-study effects

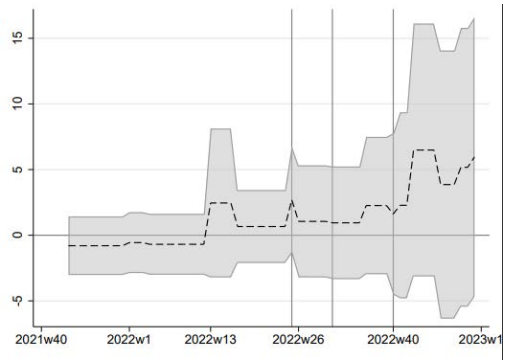
A. Total credit (USD M)



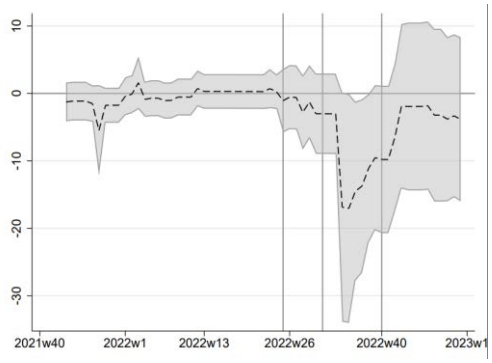
B. Short-term credit (USD M)



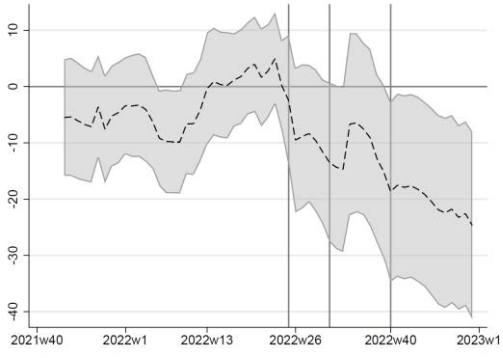
C. Long-term credit (USD M)



D. Credit limit (USD M)



E. Credit usage (pp)



Notes: Event-study SDID estimates. Estimations include debtor-week fixed effects and quarterly lender characteristics as controls. Standard errors calculated by a 100-repetition clustered bootstrapping procedure with replacement. 95% confidence intervals. Vertical lines correspond to 2022w25, 2022w31, and 2022w39.
Sources: Data sources described in Section 3.

Table C1. SDID average post-treatment effects

VARIABLES	(1) Total credit (USD M)	(2) Short-term credit (USD M)	(3) Long-term credit (USD M)	(4) Credit limit (USD M)	(5) Credit usage (pp)
ATT	-13.42**	-15.30*	2.922	-5.506	-14.91**
	(6.200)	(7.878)	(2.666)	(4.140)	(6.974)
Observations	4,148	4,148	4,148	4,148	2,928
Credit relations	68	68	68	68	48
Controls	Yes	Yes	Yes	Yes	Yes
Debtor-week FE	Yes	Yes	Yes	Yes	Yes

Notes: Average post-treatment SDID estimates. Standard errors, calculated by a 100-repetition clustered bootstrapping procedure with replacement, are in parenthesis. Controls include the following lender characteristics, measured quarterly: log of assets, CET1, ROA, loans-to-deposits ratio, and NPL.
*** p<0.01, ** p<0.05, * p<0.1.
Sources: Data sources described in Section 3.