Basel III Implementation and SME Financing

Evidence for Emerging Markets and Developing Economies

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Abstract

This paper examines the effect of Basel III implementation on the access to finance of small and medium-size enterprises in 32 emerging markets and developing economies. Analyzing rich, repeated cross-sectional data and a panel of matched firm-bank data in a difference-in-differences setting with sample selection adjustment, the authors find a short-term, moderately negative effect of Basel III on small and medium-size enterprises' access to financing. The results suggest that firms with access to bank credit prior to Basel III implementation could have been affected less than firms that were initially on the fringes of financial inclusion—firms with only a bank account. The paper fails to find any additional heterogeneous effects across firm size or age, bank capitalization or liquidity, or across countries that transitioned to Basel III from Basel II versus Basel 2.5. Overall, the initial conditions of the banking system as well as of complementary business and financial regulation can co-determine the size of short-term costs from the newly implemented global financial regulation in emerging markets and developing economies.

Basel III Implementation and SME Financing:

Evidence for Emerging Markets and Developing Economies[#]

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1. Introduction

In 2018, the Financial Stability Board (FSB) launched an evaluation of the effects of G20 financial reforms on the financing of small and medium-size enterprises (SMEs). According to FSB (2019), reforms such as the Basel III bank regulatory framework shall boost financial stability and systemic resilience in the long term. But they may be associated with some short-run costs. The global community is interested in learning if any such short-run costs may be incurred by SMEs—the main job providers and conduits of shared prosperity. Because banks provide SMEs with most of their external finance, the main transmission mechanism from the reforms to SME growth could work through bank credit provision to SMEs (FSB 2019).

Although the FSB evaluation focuses on the group of G20 jurisdictions, this paper conducts a similar evaluation for SMEs in countries covered by the World Bank Enterprise Surveys. More specifically, the paper uses firm-level panel and repeated cross-sectional data for 32 countries from the Enterprise Surveys together with banking system–level data from the World Bank's FinStats, individual bank-level data from Fitch (to create matched firm-bank data for a subset of firms), and with the Bank of International Settlements Financial Stability Institute Survey of Basel III implementation in emerging markets and developing economies (EMDEs). The Enterprise Surveys offer some benefits in comparison with other available databases, for example, allowing us to examine a broad measure of access to finance in the EMDEs—like the European Central Bank's Survey on the Access to Finance of Enterprises,[1] which was used as the leading data set in the FSB evaluation.

We examine whether Basel III capital requirements,[2] the first and most prominent regulation of the Basel III package, had any short- to medium-term effects on SME access to finance in EMDEs. Access to finance as a constraint reflects the firm's overall perception of difficulties in accessing financing and is tracked before and after the Basel III implementation for matching firms. This subjective measure of access to finance has been used by, for example, Beck, Demirgüç-Kunt, and Maksimovic (2004) and Beck et al. (2006). Examining the access to finance measure from the World Bank Enterprise Surveys and comparing it with more objective measures of financial

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[1] https://www.ecb.europa.eu/stats/ecb_surveys/safe/html/index.en.html.
[2] BCBS (2019) provides a survey on the benefits and costs of higher bank capital.

constraints, Hallward-Driemeier and Aterido (2009) conclude that: "*Overall, the analysis shows that subjective rankings are significantly correlated with objective measures.*"[3]

The estimations are performed using the difference-in-differences (DiD) methodology, controlling for the main confounding factors on the demand and supply side of the SME finance market, main country characteristics, and quality of business regulation—including contract enforcement, resolving insolvencies, and sharing credit information. Concurrently, the estimation adjusts for a possible sample selection bias because the decision to implement Basel III may be nonrandom.

Our paper contributes to the scant literature examining the consequences of bank (financial) regulations for SME financing, such as Ayyagari, Beck, and Martinez Peria (2017), Bordo and Duca (2018), Cortés et al. (2018), and Mayordomo and Rodriquez-Moreno (2018). However, we differ from these studies in several aspects. First, we focus on EMDEs. We are not aware of any other study examining the effects of bank regulations on SME financing in this set of countries. Second, we examine the effects of Basel III implementation—that is, global financial regulation— rather than of national financial regulations or macroprudential policies, as do the studies cited above. Third, we utilize a quasi-experimental setting—in which some countries implemented the Basel III reform while other countries did not—and estimate the effect using the DiD method, addressing possible sample selection issues. Fourth, we focus on a comprehensive measure of the firm's constraints in accessing finance, whereas previous evidence for developed countries examined varying aspects of financing constraints. Fifth, by having Basel III treated and untreated countries in our sample, we can estimate an absolute effect of Basel III for EMDEs—in contrast with the FSB (2019) evaluation for only treated (G20) countries, which is naturally constrained to the estimation of only relative effects.[4]

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[3] We conduct a similar exercise in this paper and confirm the findings of Hallward-Driemeier and Aterido (2009).

[4] In addition, using their proprietary European banking balance sheet model, Copenhagen Economics (2019) provides a comprehensive assessment of the Basel III effect on the bank and bank customers, including SMEs. Simulating out the semi-structural model, they find that Basel III implementation is associated with a higher cost of lending to SMEs, with an impact on interest rates of the magnitude of approximately 0.2 percentage points. However, unlike our paper, this report does not focus explicitly on a more comprehensive indicator of access to finance. Using their proprietary model, Copenhagen Economics (2019) also illustrate the benefits of more resilient lending in the long-term through lower GDP at risk after Basel III implementation.

Our results suggest that, in EMDEs, Basel III implementation is associated with a short-term, moderately negative effect on SME assess to financing. The SMEs with a bank account and no bank loan before Basel III implementation could have been affected more adversely than SMEs that were already using bank credit. Considering other possible heterogeneous effects, we fail to find any additional heterogeneity across firm or bank characteristics—namely, any evidence that young or small firms in less capitalized or less liquid bank systems would suffer disproportionally more from Basel III implementation. In addition, we test for a possibly varying effect of Basel III implementation on SME access to financing, depending on whether the country transitioned to Basel III from Basel II versus Basel 2.5; we fail to find any such evidence.

The paper is organized as follows. Section 2 reviews the related literature. Section 3 presents the conceptual framework and the progress in the Basel III implementation. Section 4 describes our data sets. Section 5 provides a detailed descriptive analysis of trends characterizing how countries, banks, and firms (and their financing conditions) evolved before and after Basel III implementation. Section 6 describes our regression framework. Section 7 discusses our regression results. Section 8 assesses the economic significance of the estimated effect. Section 9 presents conclusions. The appendix with additional results follows.

2. Literature Review

We briefly review the empirical literature examining the determinants of SME financing. The literature highlights the causes and consequences of informational opacities inherent in SME operations and examines the demand side (firms) and the supply side (banks) of SME financing. In addition, we zoom in to discuss the scant literature analyzing the response of SME financing, particularly to changes in financial regulation. Stiglitz and Weiss (1981), Fama (1985), and Rajan (1992) provide theoretical underpinnings for this body of literature.

On the demand side, the literature finds that smaller and younger firms typically face greater credit constraints and are more likely to rely on internal funds to finance their investments (Beck, Levine, and Loayza 2000; Cetorelli and Strahan 2006; Beck and Demirgüç-Kunt 2006; Arraiz, Meléndez, and Stucchi 2014; Beck et al. 2006; Ferrando and Griesshaber 2011).

The credit constraints of opaque SMEs arise from the difficulties of assessing credit risk accurately, causing the banks to be more prudent in extending credit to small and young firms (Love and Mylenko 2003; Beck, Demirgüç-Kunt, and Maksimovic 2005). Not only does the inability to assess the credit risk matter, low competition among banks can limit the risk-appetite of banks and reduce their willingness to lend to SMEs (Beck, Demirgüç-Kunt, and Levine 2010). Several studies show that gathering soft information about SMEs and establishing long-term relationships may help overcome financial constraints (Petersen and Rajan 1994; Berger and Udell 2002; Degryse and Van Cayseele 2000; López-Espinoza, Mayordomo, and Moreno 2017). Because of their centralized and hierarchical approach, large or foreign banks could lend less to SMEs (Berger, Klapper, and Udell 2001; Berger et al. 2005; Mian 2006; Beck and Rojas-Suarez 2019; Cotugno, Monferrà, and Sampagnaro 2013; DeYoung et al. 2015).

The literature on the effects of financial regulations on lending to SMEs is more limited. Ayyagari, Beck, and Martinez Peria (2017) represent an exception. They find that macroprudential policies reduced credit growth in the short term, especially for small firms, suggesting a trade-off between financial stability and financial development. In addition, Bordo and Duca (2018) find that the effects of the Dodd-Frank Act induced supply shifts away from small business lending. Cortés et al. (2018) find that the banks that are most affected by stress test results lend less to small and risky businesses, and that smaller banks—which were not subjected to the stress tests—took up the slack. Mayordomo and Rodriquez-Moreno (2018) find that the EU SME supporting factor did not reduce SME credit constraints in general. Only medium-size firms were less constrained than small and micro firms as a result.

As for the specific effects of Basel III regulation, Allen et al. (2012) and Angelini et al. (2015) argue that the long-term benefits of Basel III implementation can be associated with short-term costs, as banks may constrain the volume of credit to SMEs. Relatedly, BCBS (2016) surveys the literature on the effect of Basel III capital requirements on bank lending. The attendant literature shows that increased capital requirements are likely to reduce bank lending in the short to medium term (Peek and Rosengren 1995; Thakor 1996; Francis and Osborne 2009; Aiyar et al. 2014; Bridges et al. 2014; Behn, Hasselman, and Wachtel 2016; Jiménez et al. 2017). In the long term,

however, better-capitalized banks could better sustain lending and even lend more (Gambacorta and Shin 2018).

3. Conceptual Framework: Basel III Implementation and Transmission Mechanism

This section provides a conceptual framework on how the Basel III implementation can affect SME access to financing. First, we describe the progress with Basel III implementation by country and how we classify whether a country is considered a Basel III implementer or not. Second, we focus on the potential transmission mechanisms from Basel III implementation to SME access to financing.

3.1 Basel III Implementation

We use the BIS Financial Stability Institute's survey on Basel II, 2.5, and III Implementation (FSI 2015) to determine whether a country implemented Basel III. The value of the variable *Def cap* in the survey needs to be equal to the value of 3 or 4 for the country to be classified as a Basel III implementer for the purpose of our study.[5] *Def cap* stands for a definition of capital. Table A.1, in the appendix, provides country-specific information on the implementation status—along with the list of countries and the availability of World Bank Enterprise Surveys (which we discuss in detail in the following data section).

The value for most countries classified as Basel III implementors is 4, that is, the final rule on capital adequacy is already in force (FSI 2015). Basel III implementers that show the value of 3 published the final rule but the rule is not yet in force. The values of 1 and 2 in FSI (2015) denote that the regulation is published in draft form or is not published at all. Table A.1 shows that, according to our classification, Basel III has been implemented (for our sample of countries) mostly in 2013 (Argentina, Bolivia, Colombia, India, Indonesia, Kenya, Malaysia, the Philippines, Thailand, and Turkey) and 2012 (North Macedonia and Peru).[6] We label these countries as treated countries or Basel III implementors, interchangeably. Other EMDEs did not implement Basel III

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[5] However, G20 countries are not included in the FSI Survey. Consequently, for the G20 countries in our sample (Argentina, India, Indonesia, and Turkey), we use the data from the progress reports on adoption of the Basel regulatory framework, which are regularly prepared by the Basel Committee on Banking Supervision (BIS 2015).
[6] We include Peru in the treated group of countries—although it did not yet implement Basel III definition of capital, Peru started with the introduction of capital buffers in line with Basel III (as well as a few other aspects of the Basel III framework; see table A.2).

and are regarded as control countries. FSI (2015) also reports on the progress of other elements of Basel III implementation, such as liquidity standards, the countercyclical capital buffer, or risk coverage.

We define Basel III implementation as the introduction of the Basel III definition of capital into the national regulatory framework. Often, the capital adequacy framework was implemented in tandem with liquidity rules (liquidity coverage ratio). Therefore, examining the effects of capital and liquidity rules separately from each other may not be possible. In addition to the implementation of capital requirements, table A.2, in the appendix, reports the implementation progress with the liquidity coverage ratio, Tier 1 leverage ratio, as well as the existence of rules for global systemically important banks (G-SIB) and domestic systemically important banks (D-SIB). G20 countries progressed not only with the Basel III definition of capital, but also in many other elements (mostly with the liquidity or leverage ratios). For other Basel III implementers from non-G20 countries, the progress is more uneven. The rules of the G-SIB and D-SIB requirements have been typically lagging the implementation of the capital and liquidity rules. As of 2015, none of the non-G20 countries in our sample has defined the G-SIB requirements, and only a few have implemented the D-SIB requirements.

3.2 Transmission Mechanism

Figure 1 depicts the main channels through which Basel III implementation could affect SME financing. The several main channels that we assume could work with various intensity.

We suppose that the main channel through which Basel III implementation affects SME access to financing is the availability of bank credit. In principle, the Basel III package focuses on increasing the quality and quantity of capital and liquidity at banks. Banks may need to strengthen their capitalization and adjust their balance sheets to improve their short-term liquidity and secure stable funding. Reducing credit to SMEs—one of the riskier lending categories (asset classes)—could represent one adjustment mechanism through which a bank can improve its capitalization in response to stricter capital regulation. In figure 1, this transmission mechanism is denoted by α and ρ. Further, the strength with which the Basel III implementation affects SME financing may depend on the degree of financial inclusion of SMEs—for example, whether firms have a bank

account, bank loan, or both) and firm risk characteristics (such as its size, age, or financial performance). Hence, it is important to control for individual bank and banking system characteristics as well as firm characteristics.

SMEs can be affected by Basel III implementation through the buyers and suppliers of SMEs, such as consumers and large firms. As Basel III tightens the lending standards and credit availability for buyers and suppliers of SMEs, two things can happen. One, SMEs confront lower demand for their products and services, lowering their own demand for credit correspondingly. Two, the supply-chain credit (trade credit) available to SMEs from large firms that they supply is reduced as well.[7] In figure 1, this channel is denoted as γ and ω. Basel III and changes in bank financing of property markets may indirectly affect SME access to finance by affecting the value of property collateral that SMEs may own and use, especially to back their investment borrowing. We denote this channel as δ and ϕ.

Figure 1: Conceptual framework for the effect of Basel III on SME financing
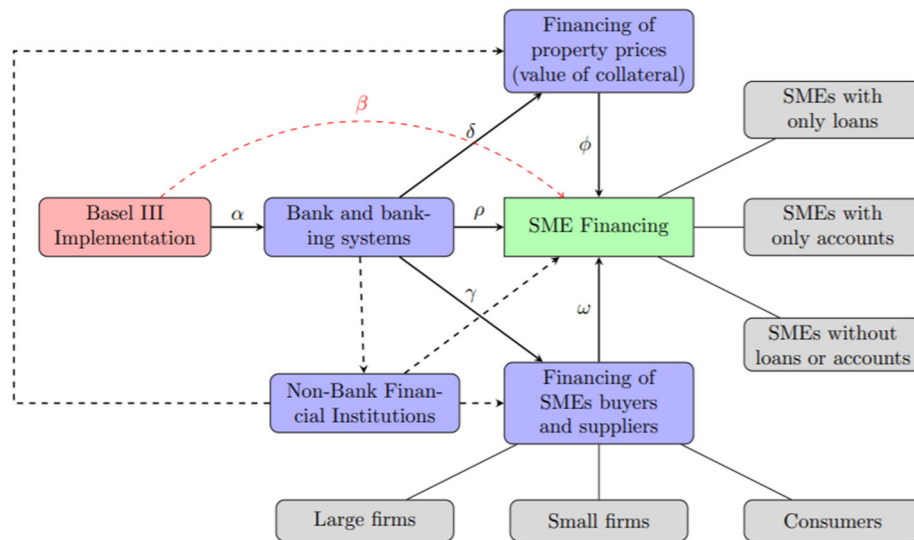
The transition from Basel II (or Basel 2.5) to Basel III has likely increased the average weighted cost of capital for banks on direct SME lending—the risk-weights stayed largely unchanged, in the first phase, and the capital requirements increased overall. The phase two of Basel III, however,

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[7] The trade credit channel can be a powerful determinant of firm financing conditions (Carbó-Valverde et al., 2016; Coricelli and Frigerio 2019).

lowers the risk weights for corporate SMEs (BBB and unrated) relative to the first phase of Basel III and Basel II (FSB, 2019). At least the initial phase of the transition to Basel III could have incentivize the banks to seek exposures to SMEs—as well as their buyers, suppliers, and the property market—more through non-bank credit institutions. This channel is depicted in figure 1 by the black dashed arrows.

Basel III implementation can also affect SME financing via an expectation channel. That is, SMEs may change their perception about future credit availability—for SMEs, their buyers and suppliers, and the property (collateral) market—and preemptively adjust. Once banks expect that Basel III can be implemented in their country, the bank lending practices may be tightened or altered. Figure 1 captures this channel, which denoted β. Because of this expectation channel and possibly systemic factors that determine (nonrandom) Basel III implementation across countries, possible endogeneity and sample selection issues need to be addressed when estimating the effect of Basel III implementation on SME financing in a reduced-form framework—as we do in this paper.

The transmission mechanisms depicted in figure 1 will work on the back of the country context, which may also determine their relative intensity. The relevant country context can include variables such as the level of economic development, sharing of credit history information, the strength of contract enforcement, and so forth. These need to be controlled to properly isolate the effect of Basel III on SME financing in the cross-country variation in the data.

The structure in figure 1 can be expressed as:

$$A2F^{sme} = f(X, Y, U, Z, S, W \; E_t\{A2F^{sme}_{t+1}\}) \tag{1}$$

where X are bank characteristics, Y denote firm characteristics, U represent conditions of SME buyers and suppliers, Z are conditions in property (collateral) markets, S represent bank lending to SMEs and related economic agents through non-bank credit institutions, W is the country context, and $E\{A2F^{sme}_{t+1}|X, Y, U, Z, S, W\}$ is the expected availability of SME financing in the future, given conditions in the banking system, SME conditions, conditions of SMEs' buyers and

suppliers, conditions in the property (collateral) markets, and changing country context. Further, we assume that:

$$X_t = a(X_{t-1}, B3, \varepsilon 1_t), \tag{2}$$
$$Y_t = b(Y_{t-1}, \varepsilon 2_t), \tag{3}$$
$$U_t = c(X_t, \varepsilon 3_t), \tag{4}$$
$$Z_t = d(X_t, \varepsilon 4_t), \tag{5}$$
$$S_t = b(X_t, \varepsilon 5_t), \tag{6}$$
$$W_t = e(W_{t-1}, \varepsilon 6_t) \tag{7}$$

where $B3$ is the Basel III implementation shock, and $\varepsilon 1_t \ldots \varepsilon 6_t$ are shocks to bank conditions, firm risk characteristics, property market conditions, conditions of buyers and suppliers, non-bank credit institutions, and country context, respectively.

Substituting equations (2) to (7) into equation (1), the reduced-form solution takes the following form:

$$A2F^{sme} = g(X_{t-1}, Y_{t-1}, W_{t-1}, B3, \varepsilon 1_t \ldots \varepsilon 6_t) \tag{8}$$

It is used as a basis for the formulation of our reduced-form linear regression in section 6. Although the simple model in equations (1) to (8) is not derived from behavioral micro-foundations, it illustrates how the thinking framework in figure 1 could be translated into a formal model. In this way, it also helps motivate the regression model specifications that we present in section 6.

4. Data

We use firm-level data from the World Bank's Enterprise Surveys as our primary source and match them with several other databases (World Bank's Global Financial Development Database, BankScope/Fitch, and BIS Financial Stability Institute's report on the implementation of Basel reforms). The World Bank Enterprise Surveys, which are conducted periodically, are a survey of a representative sample of firms with global coverage. We focus on the EMDEs for which an Enterprise Survey has been conducted before and after countries in the survey implemented Basel III—that is, we have in our sample countries that implemented and did not implement Basel III.

Our baseline specifications use a panel data structure, that is, we examine the identical firms before and after the policy intervention (Basel III implementation). We restrict our data set of firms to SMEs only, that is, to firms with fewer than 250 employees (and split the estimations for small and medium-size firms in some cases). If SMEs confront challenges in accessing finance that are different from those confronted by large firms, focusing on SMEs only could help sharpen the identification of Basel III effects from cross-country data. In addition to the panel, we form the data set of firms with repeated cross-sections. Although the drawback is that we cannot track the individual firms over time using this data set, we can examine a richer sample of countries and firms. Therefore, we trade off cleaner identification for greater statistical power between the panel and repeated cross-section estimations to gain complementary perspectives.

The list of countries included in our analysis, together with the years of pre-treatment and post-treatment Enterprise Surveys, is available in table A.1 in the appendix. Overall, our sample contains 32 countries—29 countries with a panel structure of firms and three additional countries with repeated cross-sections. In our sample, 12 countries implemented Basel III, and among those,, nine countries have a panel structure.

Our panel data set contains 4,475 firms from 29 EMDEs—nine of these countries introduced the Basel III framework, and we consider them as the treated group, while the remaining 20 countries comprise the control group, which had not implemented the Basel III at the time when the post-treatment Enterprise Survey was conducted (therefore, the number of observations for the panel is 4,475 x 2 = 8,950). Our repeated cross-sectional data set contains 33,449 observations.

Our dependent variable, *access to finance as a constraint*, is a categorical variable that represents the firm's overall perception of its access to finance and reasonably aggregates different elements of the constraints in accessing finance (lending rate, loan volume, maturity, and collateralization). The values range from 1 to 5—that is, from access to finance being a very severe obstacle to it being no obstacle at all (we inverted the original scale for ease of interpretation). In the panel

regression analysis, the dependent variable is defined as the difference between its post-treatment and pre-treatment values to get rid of fixed effects.[8]

To obtain a fuller picture of SMEs' financing options, we also look at several additional aspects of firms' access to finance. *Line of credit or loan* is a dummy variable with the value equal to 1 if the firm has some line of credit or loan from a bank, 0 otherwise. *Working capital financed by banks* captures the proportion of a firm's working capital financed by banks. *Fixed assets financed by banks* shows the share of fixed assets funded by banks. *Required collateral* is the share of loans of all loans for which collateral was required. *The collateral-to-loan ratio* indicates how much collateral a firm must provide the bank for a loan of a given size.

Basel Dummy Gest is our main explanatory variable of interest—the variable is equal to zero for all firms from (control) countries that did not implement Basel III. For firms from the treated group of countries, this variable takes a value larger than zero, depending on the gestation lag at the time of the first available Enterprise Survey after Basel III implementation—its maximum value is 1. The maximum difference between Basel III implementation and the post-treatment Enterprise Survey is five years, and the value of 1 is assigned in this case. The value of 0.8 is assigned in the case of four years, 0.6 for three years, and so forth. Defining the variable *Basel Dummy Gest* in this way, we assume that it takes time until financial regulations fully affect SME financing. Alternatively, we employ a dummy variable for Basel III, with the value of 1 in the case of implementation and 0 otherwise. We discuss in the following section the source of our data on Basel III implementation and how we determine whether the country implemented Basel III.

Table 1 presents the summary statistics for firm characteristics, bank system indicators, and country and institutional variables. We observe that more than half of the firms report that they do not have a line of credit and have certain difficulties in accessing finance. The firms typically rely

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[8] Because access to finance is derived from the perceptions regarding financing obstacles, we examine to what extent these perceptions are related to more objective measures of access to finance, such as whether the firm has a line of credit, the proportion of fixed assets financed by banks, or the proportion of working capital financed by banks. We estimate an ordered logit model and find that the perception-based access is statistically significantly related to several (objective but more specific) measures of access to financing. Clearly, this exercise cannot provide a definite test of the accuracy of the commonly used measure of access to finance, but it suggests that the measure has certain links to more specific objective measures of SME financing. The regression results are available in table A.6 in the appendix.

on internal funds to finance their working capital and fixed assets. Due to the issue of data availability, any analysis of other potential measures of access to finance is constrained (for example, rejected loan applications are available only in the post-treatment period in our data sample).

We find that the firms are on average more than two decades old; they have approximately 40 employees; their direct exports account for less than 10 percent of their sales; and they are mostly owned by domestic private individuals. In our baseline regressions, we use the pre-treatment levels of all the firm-level explanatory variables to address potential concerns of reverse causality.

The bank systems in our sample are characterized by relatively high returns on equity, good capitalization, and a reasonably low share of nonperforming loans. However, these averages mask a great deal of variation among the banks. We examine in the following section whether Basel III implementation affects this variation. We present summary statistics for the whole banking industry in table 1. Some of our regressions use overall bank systems data, while in other regressions we identify the supply-side effects of the SME financing market more accurately by employing the matched firm-bank data.

Table 1: Summary statistics

	Observations	Mean	St. dev.	Min	Max
SME financing: Dependent variable					
Access to finance as a constraint	31,014	3.43	1.31	1	5
SME financing: Other variables					
Line of credit or loan	32,156	0.36	0.48	0	1
Working capital financed by banks (%)	29,249	16.71	26.81	0	100
Fixed assets financed by banks (%)	9,448	18.81	33.16	0	100
Internal financing of working capital (%)	26,189	70.04	33.64	0	100
Internal financing of fixed assets (%)	10,884	67.88	39.68	0	100
Collateral-to-loan ratio	6,096	1.47	1.13	0	5.95
Collateral value required	12,212	0.74	0.44	0	1
Main explanatory variable					
Basel Dummy Gest	33,449	0.14	0.26	0	1
Firm explanatory variables					
Employees	33,449	41.80	49.38	0	249
Age	32,020	18.32	14.43	0	187
Foreign owners share (%)	32,864	6.27	22.32	0	100
Government owned share (%)	32,794	0.39	4.82	0	98
Direct exports share (%)	32,918	6.46	20.41	0	100
Annual sales paid after delivery (%)	31,195	43.97	38.19	0	100
Annual employment growth (%))	29,246	5.63	113.85	-96.57	1,266.67

Bank system explanatory variables					
Bank regulatory capital to risk-weighted assets (%)	27,607	16.51	4.09	6.31	29.77
Regulatory Tier 1 capital to risk-weighted assets (%)	27,676	13.58	4.22	5.75	28.68
Bank capital to total assets (%)	27,920	10.42	3.32	6.63	20.49
Credit to government and state-owned enterprises to GDP (%)	31,381	11.83	7.45	0.64	23.77
Bank nonperforming loans to gross loans (%)	27,607	6.90	6.12	1.34	30.47
Bank credit to bank deposits (%)	31,381	91.35	26.10	27.73	195.39
Liquid assets to short-term liabilities (%)	26,732	59.49	66.29	17.95	503.08
Bank overhead costs to total assets (%)	33,449	3.57	1.99	1.12	10.02
Bank return on equity (%, after tax)	33,449	12.87	12.11	-30.14	52.53
Lerner index	28,374	0.34	0.19	0.15	1.48
Five-bank asset concentration	32,133	65.03	18.53	34.94	100
Foreign bank among total bank assets (%)	28,552	24.93	28.25	0	100
Country and institutional variables					
GDP (current US$, billions)	33,449	628.11	866.47	1.80	2,300.00
GDP per capita (constant 2005 US$)	33,449	3,506	3,053	391	14,117
Ease of Doing Business	33,449	59.30	8.90	43.80	81.44
Getting Credit	33,449	60.43	19.85	5.00	100.00
Enforcing Contracts	33,449	52.84	12.55	29.04	73.24
Financial Crises	33,449	0.25	0.54	0	2

Note: GDP = gross domestic credit; SME = small and medium-size enterprises.

All the institutional variables are expressed as scores. These scores capture the gap from the best performance ever attained for a given indicator since the World Bank started compiling the Ease of Doing Business (EADB) survey. Therefore, each of the institutional variables takes values from 0 to 100—with 100 being the best performance. The Ease of Doing Business represents an overall indicator of pro-business regulation and the protection of property rights. Enforcing contracts is a sub-index of EADB that measures the time and cost for resolving business disputes in local courts, as well as the overall quality of judicial processes. Getting Credit is an EADB sub-index that examines two aspects of the regulatory framework for access to external sources of financing: the strength of credit reporting systems and the effectiveness of bankruptcy and collateral laws. Tables A.3 to A.5, in the appendix, contain the correlations among the explanatory variables.

Additionally, we include the pre-treatment level of the dependent variable in all our regressions and label this variable as *Initial conditions.* In doing so, we appreciate the role of initial conditions, which have been shown to be a determining factor in firms' outcomes in emerging markets (Ayyagari, Demirgüç-Kunt, and Maksimovic 2017).

5. Countries, Banks, and Firms: Description of Trends Before and After Basel III Implementation

To examine the transmission of Basel III implementation to SME financing, this section analyzes how the SME financing conditions, country context, and national banking sectors evolved before and after Basel III implementation for the treated group relative to their peers that did not implement Basel III (the control group).

5.1 SME Financing Conditions and Basel III

First, we inspect the extent to which Basel III implementation could have affected the financing conditions for SMEs. Table 2 reports these results from a simple DiD method. Overall, financing became less of a constraint for firms in Basel III implementing countries and other EMDEs. However, SMEs in Basel III countries perceived financing constraints as being alleviated by about 5 percentage points lower. This overall perception is reflected in the declining share of SMEs with a bank loan or credit line in Basel III countries against the roughly constant situation in other EMDEs. Despite that, firms with access in Basel III countries financed a greater share of fixed assets through bank loans—and somewhat more working capital.

Table 2: Basel III implementation and SME financing: Treated and untreated firms

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	Before	After	Before	After			
Access to finance as a constraint	3.63	3.79	3.19	3.50	4	9	-5
Line of credit or loan	0.54	0.51	0.36	0.36	-6	0	-6
Working capital financed by banks (%)	15.16	15.42	13.67	13.69	2	0	2
Fixed assets financed by banks (%)	25.34	30.15	14.4	14.56	17	1	16
Internal financing of working capital (%)	62.65	62.55	68.55	73.07	0	6	-7
Internal financing of fixed assets (%)	58.54	60.14	69.99	74.12	3	6	-3
Collateral required (%)	0.69	0.63	0.8	0.82	-9	2	-12
Collateral-to-loan ratio (%)	1.41	1.83	2.03	2.06	26	1	25

Note: DiD = difference-in differences; p.p. = percentage points; SME = small and medium-size enterprises.

In parallel, the share of internally financed fixed assets increased among Basel III firms (from much higher levels than bank external financing of fixed assets) but less so than in other EMDEs. The share of loans to firms for which banks required collateral declined in Basel III countries, compared with a slight increase in other EMDEs. Banks thus extended relatively more unsecured lending in Basel III countries. In contrast, firm loans for which banks required collateral had loan-

to-value ratios that were much lower than before Basel III implementation, by 26 percentage points (p.p.), and compared with other EMDEs by 25 p.p. Therefore, financing conditions for SME investments could have tightened considerably.

5.2 Heterogeneity in the Basel III Effect on SME Financing?

To provide some context for possible heterogeneous effects of Basel III, in table 3, we compare several measures of financing conditions across the treated and control firms as well as across firms of smaller and bigger sizes. We find that smaller firms in countries that implemented Basel III saw their access to finance constraints continue easing as much as those of bigger firms. But they were more often requested to provide collateral. And because of tighter collateral requirements, smaller firms took bank loans less often and financed a smaller share of fixed assets with bank loans. At the same time, they managed to finance a greater share of working capital from bank loans—possibly as an offset.

Table 3: Access to finance as a constraint, by firm size

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	Before	After	Before	After			
Access to finance as a constraint	3.53	3.73	3.72	3.86	2	2	0
Line of credit or loan	0.44	0.41	0.62	0.61	-3	-1	-2
Working capital financed by banks (%)	12.09	13.48	18.15	17.37	5	-2	7
Fixed assets financed by banks (%)	23.22	24.01	26.64	33.43	1	10	-8
Collateral required (%)	0.64	0.65	0.72	0.62	1	-6	7
Collateral-to-loan ratio	1.64	2.10	1.28	1.65	11	11	0

Note: In the treated group, small firms are below the median, and the sample only includes firms from countries that implemented Basel III, In the control group, large firms are above median, and the sample only includes firms from countries that implemented Basel III. DiD = difference-in-differences; p.p. = percentage points.

Next, we explore a possible heterogeneous effect of Basel III by firm age, in table 4. The results indicate that, after Basel III implementation, younger firms were constrained in accessing finance slightly more than older firms. Younger firms also saw collateral required more frequently and the loan-to-value ratio dropping more substantially compared with older firms. As a result, younger firms were less likely (by 3 p.p.) to have a bank loan and finance fixed assets using a bank loan (by 8 p.p.). The decline in fixed asset financing and higher collateral requirements seem to have

been only marginally compensated by better access and a greater share of working capital financing. When comparing the upper and lower quartiles of firms by age, the results still hold, and the estimated differences are more pronounced (these results are available upon request).

Table 4: Access to finance as a constraint, by firm age

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	Before	After	Before	After			
Access to finance as a constraint	3.68	3.80	3.59	3.79	1	2	-1
Line of credit or loan	0.50	0.46	0.56	0.55	-4	-1	-3
Working capital financed by banks (%)	14.06	14.44	16.07	16.19	1	0	1
Fixed assets financed by banks (%)	25.71	27.04	25.06	31.97	2	11	-8
Collateral required (%)	0.69	0.67	0.69	0.60	-1	-6	5
Collateral-to-loan ratio	1.15	1.91	1.58	1.78	22	5	17

Note: In the treated group, younger firms are below median age, and the sample only includes firms from countries that implemented Basel III. In the control group, older firms are above median age, and the sample only includes firms from countries that implemented Basel III. DiD = difference-in-differences; p.p. = percentage points.

5.3. Country Context and Basel III

We first examine the institutional context of our sample countries before and after Basel III implementation, separately for the implementers and non-implementers. The results in table 5 suggest that Basel III has been implemented more often in EMDEs with higher gross domestic product (GDP) per capita. These countries also had a better business climate, which further improved but not more than in other EMDEs. Basel III implementors boosted their contract enforcement framework—although from slightly lower levels compared with other EMDEs—and boosted the regulatory framework for getting credit from already more advanced levels compared with other EMDEs. Basel III implementors and other countries experienced financial crises, but the latter more so—before 2012 and during 2013–16.

Table 5: Comparing the country context across Basel III implementers and other EMDEs

Variable	Treated group		Control group		Treated % change	Control % change
	2012	2016	2012	2016		
GDP per capita	5469	6035	2121	2374	10	5
Ease of Doing Business	61.04	64.2	55.14	57.95	5	5
Getting Credit	57.50	58.33	55.31	50.5	1	-8
Enforcing Contracts	53.13	54.53	57.65	52.54	3	-10
Financial crises[a]	0.08	0.08	0.30	0.40	0	33

5.4. Firms and Basel III

Table 6 compares the average values of all firm-level variables separately for the treated and untreated firms, before and after the Basel III implementation. We observe that the average firm size, measured by the number of employees, is similar across Basel III implementors and other EMDEs. Both country groups experienced a similar drop in employment growth—albeit EMDEs were at a higher rate before 2012. The annual sales were higher in Basel III implementors but dropped similarly in both country groups following Basel III implementation. Firms in countries implementing Basel III have seen their productivity growth accelerating, while those in other EMDEs have seen it decelerating from higher rates. Foreign ownership of firms in treated countries was initially slightly lower than in other EMDEs and further declined over time—compared with an increased share in other EMDEs. Firms in countries implementing Basel III were more export oriented, but their direct export share declined similarly as in other EMDEs. The government ownership share was much smaller than in other EMDEs and declined further—although less than in other EMDEs, which experienced a big decline in state ownership.

Table 6: Firm sector in Basel III implementers and other EMDEs

Variable	Treated group		Control group		Treated % change	Control % change
	Before	After	Before	After		
Employees	45.31	46.7	41.07	39.02	3	-5
Annual sales paid after delivery (%)	61.97	48.85	37.06	29.40	-21	-21
Foreign owners share (%)	7.29	6.36	8.36	9.15	-13	9
Government owned share (%)	0.20	0.18	0.48	0.41	-10	-15
Direct exports share (%)	9.10	8.04	4.51	4.13	-12	-8
Annual labor productivity growth (%)	4.00	6.60	7.65	3.34	65	-56
Annual employment growth (%)	6.94	2.72	11.40	4.57	-61	-60

Note: EMDEs = emerging markets and developing economies.

5.5. Banks and Basel III

We review the evolution of banking sector indicators before and after Basel III implementation, separately for the Basel III implementors and other EMDEs, in table 7. We observe positive effects on relative capitalization: Basel III implementation is associated with a slight increase in the capital

adequacy ratio and constant (preserved) Tier 1 ratio and leverage. This is relative to other EMDEs, which experienced more negative developments—such as declining capital adequacy ratios and deleveraging. Here, the Basel III effect seems significantly positive.

There is weak evidence of declining financial repression. With financing of state and state-owned enterprises having been greater at the start, Basel III implementation is associated with a decline in government and state-owned enterprise financing by banks. The Basel III reforms changed (mostly increased) the risk weights on most sovereign and quasi-sovereign exposures.

Nonperforming loan (NPL) ratios increased in treated and control countries. The NPL ratios were very low in Basel III countries at the start and have grown more than in other EMDEs after Basel III implementation. However, the NPL ratios are far from the nearly double-digit levels observed in other EMDEs (our control group). Relocation to a segment with higher expected losses (among sovereign exposures) could be one explanation for the observed increase in the NPL ratios. However, the NPL ratios of about 4 percent could represent more typical risk-taking levels (than 2.5 percent) if correctly disclosed.

Table 7: Banking system characteristics most affected by Basel III implementation

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	2012	2016	2012	2016			
Bank regulatory capital to risk-weighted assets (%)	17.03	17.26	19.43	18.2	1	-7	8
Regulatory Tier 1 capital to risk-weighted assets (%)	14.15	14.19	16.15	15.8	0	-2	2
Bank capital to total assets (%)	11.85	11.83	13.26	11.28	0	-16	16
Credit to government and state-owned enterprises to GDP (%)	8.54	8.36	5.27	7.11	-2	30	-32
Bank nonperforming loans to gross loans (%)	2.57	4.09	8.3	10.02	46	19	28
Bank credit to bank deposits (%)	95.04	104.33	94.67	98.54	9	4	5
Liquid assets to short-term liabilities	50.6	48.4	92.21	105.75	-4	14	-18
Bank overhead costs to total assets (%)	4.24	4.18	5.09	4.06	-1	-23	21
Bank return on equity (%, after tax)	19.15	16.9	16.66	9.92	-12	-52	39
Lerner Index	0.34	0.37	0.35	0.43	8	21	-12
Five-bank asset concentration	66.44	66.84	81.01	78.2	1	-4	4
Foreign bank assets among total bank assets (%)	21.5	23.13	48.42	42.6	7	-13	20

Note: DiD = difference-in-differences; GDP = gross domestic product; p.p. = percentage points.

The results also suggest a greater ability to attract foreign savings but with declining liquidity buffers. Basel III implementors exhibit greater increases in loan-to-deposit ratios and foreign bank assets, but also lower and declining liquidity ratios. In addition, Basel III countries are associated with smaller declines in cost efficiency, but they already started as more efficient. Perhaps also for this reason, Basel III countries experienced smaller declines in profitability.

Our findings indicate that the Basel III effects on the degree of competition are small. Basel III implementors are associated with smaller decreases in competition on the back of slightly increasing—but still relatively lower—concentration. We observe similarly low but significantly growing—in relative terms—foreign bank participation in the domestic systems.

In addition to comparing the mean values of banking indicators for Basel III implementors versus other EMDEs, we also examine the effects on the higher moments of banking system indicators. It may well be the case that Basel III implementation affects not only the first moments (mean values) of banking indicators, but also the higher moments, such as standard deviation, skewness, and kurtosis. For example, the implementation of Basel III standards is likely to decrease the number of banks with very low capitalization and, therefore, reduce the standard deviation of bank capital in the banking industry. We do not expect that the Basel III implementation would affect the higher moments for firms or country context because, as discussed in the section on the conceptual framework, we expect that the bulk of transmission from the Basel III implementation to access to finance propagates through the banking sector. To our knowledge, examining the higher moments concerning Basel III implementation is a novel contribution.

Tables 8 to 11 report the summary statistics (mean, median, standard deviation, skewness, and kurtosis) for four main bank characteristics: capitalization, liquidity, profitability, and loan loss reserves (as a measure of borrower default risk). We accompany these tables with figures, which show the kernel density estimation of the bank characteristics. For a visually examination of the effects of Basel III implementation, we provide the kernel density estimation separately for Basel III implementers (treated group) and other EMDEs (control group), before and after Basel III

implementation (such as for 2012 versus 2016). These figures are available in the appendix (figures A.1 to A.4).[9]

For this purpose, we rely on individual, bank-level balance sheet data from Bankscope. For the analysis, we consider all the banks available in Bankscope for the countries in our sample. Consequently, for 2012, the data set consists of 389 banks from the treated group and 402 banks from the control group. The corresponding figures for 2016 are 408 and 306 banks for the treated and control group countries. As the data set is limited to only the balance sheet data, we do not conduct this analysis for the same variables as our banking system indicators studied earlier. Consider the results in table 8 first.

Table 8: Higher moments of bank capitalization: Treated versus control group

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	2012	2016	2012	2016			
Mean	21.25	21.69	20.46	20.46	1	0	1
Median	13.80	14.54	15.02	14.07	2	-3	5
Std. dev.	30.52	20.69	17.12	18.13	-17	2	-19
Skewness	-5.63	2.39	1.92	1.73	-	-5	-
Kurtosis	90.17	8.06	8.85	7.39	-105	-8	-97

Note: The bank capitalization is measured by the ratio of the bank's capital to total assets. The distribution of bank capitalization in the figures is based on the univariate kernel density estimation. DiD is calculated as the difference between the percentage change for the treated and control groups. DiD = difference-in-differences; p.p. = percentage points.

The results suggest that the standard deviation decreases for all bank characteristics in the countries that implemented Basel III, while the opposite is the case for other EMDEs. This result suggests that Basel III contributed to a more harmonized banking sector environment and reduced the presence of extreme outliers (banks).

On the specific bank characteristics, we find that, unlike in other EMDEs, bank systems in Basel III countries became marginally more capitalized at the mean and around the median. Moreover, the dispersion around this higher average capitalization declined in Basel III countries, while it slightly increased in other EMDEs. In the latter countries, the probability mass in the tails of the distribution (kurtosis) also increased—that is, the relative number of banks at the extremes

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[9] All the plots of kernels are censored for extreme values for better readability, while the tables are not.

(undercapitalized and overcapitalized banks) increased. The negative skewness of banking system capitalization before Basel III implementation changed into positive skewness (more banks with above-average capitalization)—an even greater positive than the one of the control group.

Against the general increase in liquidity in other EMDEs, the banks in countries that implemented Basel III show a much slower increase at the median, with a slight decline at the mean. In contrast to the other EMDEs, the dispersion of liquidity position shrunk overall in the Basel III countries. Given the mild decline in positive skewness, more banks with above-average liquidity slightly declined, similarly as in other EMDEs. We present these results in table 9.

Table 9: Higher moments of bank liquidity: Treated versus control group

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	2012	2016	2012	2016			
Mean	13.87	12.95	7.25	11.10	-3	18	-21
Median	5.83	8.09	1.40	6.27	14	65	-51
Std. dev.	18.71	15.57	11.26	13.57	-8	8	-16
Skewness	2.07	1.92	2.11	1.80	-4	-7	3
Kurtosis	7.93	7.81	7.76	6.01	-1	-11	10

Note: The liquidity is measured by the ratio of liquid assets to total assets. The distribution of bank liquidity in the figures is based on the univariate kernel density estimation. DiD is calculated as the difference between the percentage change for the treated and control groups. DiD = difference-in-differences; p.p. = percentage points.

The evolution of loan loss reserves to total assets differs markedly between treated and control countries, as table 10 shows. In contrast to control countries, the mean loan loss reserves decreased somewhat in Basel III countries. The variability in the loan loss reserves dropped dramatically for Basel III implementors, while the opposite happened in other EMDEs. The decline in the positive skewness in treated countries indicates that there were fewer banks with low loan loss reserve ratios following Basel III implementation. Kurtosis declined significantly in the treated countries, indicating a lower occurrence of extreme values in loan loss reserves to total loans.

Table 10: Kernel density estimation of banks' loan loss reserves: Treated versus control group

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	2012	2016	2012	2016			
Mean	3.32	2.64	4.38	8.99	-10	31	-41
Median	1.56	1.67	2.21	3.02	3	14	-11
Std. dev.	12.04	3.46	6.57	19.26	-54	47	-101
Skewness	14.56	4.82	4.21	4.61	-48	4	-52
Kurtosis	241.48	38.90	26.11	28.15	-79	3	-83

Against the general decline in profitability in EMDEs, the banks in the treated countries performed somewhat better, starting from higher profitability rates (table 11). The dispersion in bank profitability increased vastly in other EMDEs. Compared with that, the dispersion in the performance of banks in Basel III countries decreased mildly—albeit from higher values. The number of banks at the extremes (in the tails; kurtosis) and more banks with above-average performance (positive skewness) in Basel III countries did not change much. In contrast, many more banks in other EMDEs migrated to the extremes (tails) and more so to extremely worse performance.

Table 11: Higher moments of bank profitability: Treated versus control group

Variable	Treated group		Control group		Treated % change	Control % change	DiD in p.p. (%)
	2012	2016	2012	2016			
Mean	4.60	4.01	0.33	-0.76	-6	-	-
Median	0.51	0.51	0.06	0.08	0	12	-12
Std. dev.	13.05	12.19	1.51	18.22	-3	108	-111
Skewness	4.76	4.73	2.02	-16.96	0	-	-
Kurtosis	27.77	27.87	39.52	293.21	0	87	-87

Note: Profitability is measured by the banks' return on equity. The distribution of profitability in the figures is based on the univariate kernel density estimation. DiD is calculated as the difference between the percentage change for the treated and control groups. DiD = difference-in-differences; p.p. = percentage points.

6. Regression Framework

We use the DiD approach to examine the consequences of Basel III implementation for SME financing. We opt for the DiD, given its simplicity, and utilize that some countries adopted the Basel III framework, while others did not. Therefore, our estimation framework shares common elements with Ongena et al. (2013) and Ferrando et al. (2017), who also apply the DiD method. Ongena, Popov, and Udell (2013) examine the consequences of domestic financial regulation on bank risk-taking abroad using data from Europe and the United States. Ferrando, Popov, and Udell (2017) study the effects of sovereign stress on SMEs' access to finance in the euro area.

As in Ongena, Popov, and Udell (2013) and Ferrando, Popov, and Udell (2017), we also address the sample selection issues. In our case, this means an assessment of whether some countries are

systematically more likely to implement Basel III. We discuss the sample selection issues and then introduce our baseline framework. Given that our panel contains only two periods, we take the first difference of our dependent variable and regress it on the pre-treatment values of the explanatory variables.

Therefore, our baseline panel specification in its differenced form is as follows:

$$\Delta a2f\_sme_{f,c} = c + \boldsymbol{\beta} B3A(0/\#)_c + \alpha W_{c,t0} + \gamma X_{f,c,t0} + \delta Z_{c,t0} + \theta ES\_gap_c + \lambda IC_{c,t0} + \varepsilon_{f,c} \ (8)$$

$\Delta a2f\_sme_{f,c,t}$ denotes the measure of access to finance constraints for firm f in country c. The difference, Δ, is taken between the values before and after the treatment—the exact years are specified in table A.1, in the appendix. $B3A(0/\#)_c$ represents our variable capturing the effect of Basel III implementation, with $\boldsymbol{\beta}$ assessing the estimated effect of Basel III on SME access to finance. The symbol # captures the gestation lag at the time of the availability of the Enterprise Survey data after Basel III implementation and is distributed between $(0,1]$. $X_{f,c,t0}$ controls for firm-level and $Z_{c,t0}$ for bank and/or banking system characteristics before the treatment. $W_{c,t0}$ captures the country-level variables (such as the initial GDP per capita or contract enforcement levels). ES_gap_c is a variable controlling for the time between the spells of the Enterprise Surveys across countries. This could be important for trending dependent variables, such as progressing financial inclusion. $\lambda IC_{c,t0}$ represents initial conditions, that is, the level of access to finance constraints prior to Basel III implementation (in the initial period). $\varepsilon_{f,c}$ is a residual.

For simplicity, we present the above equation in linear form, which is accurate in case we were to estimate it using ordinary least squares. However, because of the limited dependent variable (access to finance as a constraint), the equation translates accordingly to a nonlinear form and is estimated using the ordered logit model. The standard errors are clustered at the country level, and the fixed effects disappear because of differencing.

We also examine whether there is a varied impact of Basel III on firm access to finance depending on firm characteristics. Young and small firms, which are typically subject to greater informational opacity than older and bigger firms, may experience the effect of the treatment in a differentiated

manner—the prior here is that younger and smaller firms could have suffered more from Basel III implementation. For this reason, we estimate the impact of Basel III dependent on firm characteristics ($\boldsymbol{\varphi}$) using interaction terms:

$$\Delta a2f\_sme_{f,c} = c + \boldsymbol{\beta}B3A(0/\#)_c + \boldsymbol{\varphi}B3A(0/\#)_c X(0/1)_{f,c,t0} + \alpha W_{c,t0} + \gamma X_{f,c,t0} + \delta Z_{c,t0} + \theta ES\_gap_c + \lambda IC_{c,t0} + \varepsilon_{f,c} \tag{9}$$

where $X(0/1)_{f,c,t0}$ are firm characteristics below and above the median.

Next, we assess whether potential heterogeneity in the response of the access to finance to the Basel III implementation could be linked to the initial conditions of banks/the banking system. Here, we focus on analyzing whether the less capitalized banking systems drive the heterogeneity. We focus the effect through capitalization because the capitalization could be most directly affected by the Basel III package—including because the initial measures of the package target the quality and quantity of capital. We estimate the impact of Basel III dependent on banking-system characteristics ($\boldsymbol{\omega}$) using interaction terms:

$$\Delta a2f_sme_{f,c} = c + \boldsymbol{\beta}B3A(0/\#)_c + \boldsymbol{\omega}B3A(0/\#)_c Z(0/1)_{c,t0} + \alpha W_{c,t0} + \gamma X_{f,c,t0} + \delta Z_{c,t0} + \theta ES_gap_c + \lambda IC_{c,t0} + \varepsilon_{f,c} \tag{10}$$

$Z(0/1)$ are banking sector characteristics below and above the median.

Our baseline regressions and regressions allowing for heterogeneous impacts are estimated on the panel of firms—that is, based on the sample for which we can track identical firms before and after the treatment. We impose the restriction that the set of observations for the dependent and explanatory variables is identical across the regression specifications. Doing so, we ensure that changes in the estimated coefficients (and their significance) across the regression specifications are not because of missing observations and different composition of the sample. For the subset of

our panel sample, we can match firms with their banks[10] to identify the demand and supply on the SME financing market more accurately.

We also estimate the regressions using repeated cross-sections—to maximize the number of observations (countries and firms) and, thus, the statistical power for estimating the average cross-country effect of Basel III implementation. However, the increased statistical power comes at the cost of not comparing identical firms before and after the treatment. We do not take the first difference when estimating the regressions for repeated cross-sections and include country- (and firm-) level fixed effects. Thanks to such broadening of the sample, our regressions for repeated cross-sections of firms contain more than 20,000 observations.

Basel III implementation may be nonrandom (Beck and Rojas-Suarez 2019) and our regressions may be susceptible to sample selection issues. To that end, we construct an inverse Mills ratio using a logit model that explains the probability that a country implements Basel III. We re-estimate our baseline regression and the regression with heterogeneous impacts by firm and banking system characteristics, including the inverse Mills ratio to control for possible selection bias. The regression results are reported and discussed in the next section.

7. Regression Results: Basel III Implementation and SMEs' Access to Finance

This section reports and discusses our regression results. First, we investigate whether some quantitative factors could help explain the nonrandom implementation of Basel III in EMDEs, as highlighted by Beck and Rojas-Suarez (2019) and help us address possible selection bias in our main regressions.

Second, we present the baseline results for the repeated cross-sections and panel of firms estimated using the ordered logit model and adjusting for possible selection bias. For the panel of firms, we present the results with the matched bank-firm data as well as with bank systems characteristics.[11]

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[10] Not all firms report the name of the bank that granted credit to the firm.
[11] In the latter case, firms are matched with the average bank indicators at the country level rather than with the individual bank that grants credit to the firm.

This approach enables us to work with firms that are, for various reasons, not financially included in using credit.

Third, we report and discuss the results examining whether the effect of Basel III implementation on SME access to finance could vary by the firm or bank characteristics. Specifically, we assess whether the Basel III effects are more pronounced for young and small firms or whether the less capitalized or liquid banks/banking sectors could have caused the Basel III implementation to affect SMEs' access to finance more adversely.

7.1. Nonrandom Basel III Implementation

This subsection examines whether the Basel III regulatory framework was more likely implemented in some countries than in others. Beck, Jones, and Knaack (2018) argue that the propensity to implement Basel III among EMDEs has been very heterogeneous and depended on several qualitative factors, such as signaling to international investors, reassuring host regulators, facilitating home-host supervision, peer learning and peer pressure, and receiving technical advice from the International Monetary Fund and/or the World Bank. To complement Beck et al.'s findings, we test whether some candidate quantitative factors could help describe any systematic pattern (non-randomness) in Basel III implementation.

To this end, we estimate logit regressions for the panel and repeated cross-section samples and test whether the level of economic development, experience of financial crises, institutional characteristics (Ease of Doing Business), or foreign ownership of banks could help determine the likelihood that an EMDE implemented Basel III. Table 12 reports the estimation results. In addition to the qualitative aspects highlighted by Beck, Jones, and Knaack (2018), we find that more developed EMDEs (those with higher GDP per capita) could have been more likely to implement Basel III—although this result is significant only for our panel sample. Further, countries with larger GDP or countries that are members of the G20 group of developing countries were more likely to implement Basel III.[12] EMDEs with a greater presence of foreign bank ownership were systematically less likely to implement Basel III. And EMDEs with a greater presence of foreign bank ownership were systematically less likely to implement Basel III. One

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[12] Obviously, members of the G20, such as India in our sample, committed to implementing Basel III. We cannot however include the G20 dummy in our logit regression because of the perfect separation issue.

conjecture could be that countries with largely domestically owned financial systems could be more eager to implement Basel III for reasons of signaling and attracting future foreign direct investment into their banking systems. Another explanation may be that the variation in foreign ownership share reflects some systematic, qualitative factors behind a country's choice to implement Basel III—such as those described by Beck, Jones, and Knaack (2018). Based on the results from table 12, we include variables that were statistically significant for both the panel and cross-section samples in our selection equation.

7.2. Baseline Results

This subsection discusses the baseline results for the repeated cross-section and the panel of firms in turn. The regression results for the repeated cross-section sample address the sample selection issues. The estimated regression specifications broaden by consecutively including firm, country, and bank characteristics.[13] In addition, we estimate the regressions for sample splits of firms with a bank account and loan (the most financially included) and firms with a bank account and no loan (the moderately financially included).[14] Table 13 reports the results.

Here, we estimate the Basel III effect on SME access to financing as significantly negative in all the regression specifications, even when controlling for banking system indicators and country context. The size of the coefficient remains largely stable across the specifications. Moreover, the coefficients in the regressions split by the degree of financial inclusion are similar—that is, similar for firms that initially used payment accounts and bank credit (table 13, column (5)) versus firms that initially used only payment accounts and no credit (column (6)). This result suggests that the estimated effect of Basel III on the access to finance has not depended on the degree of financial inclusion.

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[13] The number of observations in columns (1) to (4) is identical by construction. This is to avoid that the results differ across different regression specifications merely because of changing the composition of firms included in the regression. Some explanatory variables—typically the ones for the banking systems—are not available for certain firms; for this reason, the number of countries included in the regressions decreases to 20.

[14] Firms with no bank account or loan (the least financially included) are excluded from the sample to mitigate a possible upward bias from over-pessimistic reporting of financial constraints (see Hallward-Driemeier and Aterido (2009), on the usefulness and limitations of perception-based indicators of financial constraints).

Table 12: What matters for Basel III implementation?

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						Basel III implementation						
Sample	CS	Panel	CS	Panel	CS	Panel	CS	Panel	CS	Panel	CS	Panel
Log of GDP per capita (constant 2005 US$)	0.552	2.163**										
	(0.603)	(0.907)										
Log of GDP (current US$)			1.854***	1.131**								
			(0.533)	(0.516)								
Financial Crisis Dummy					-1.542*	-0.990						
					(0.936)	(0.902)						
Ease of Doing Business							-0.001	0.089				
							(0.072)	(0.068)				
G20 Developing Dummy									2.894**	2.521**		
									(1.219)	(1.170)		
Foreign bank assets to total bank assets (%)											-0.044**	-0.051***
											(0.020)	(0.019)
Constant	-3.525	-16.953**	-46.689***	-27.933**	1.174*	0.803	0.853	-4.767	-0.331	-0.653	1.863**	2.579***
	(5.034)	(7.393)	(13.768)	(13.129)	(0.698)	(0.595)	(4.695)	(4.178)	(0.652)	(0.792)	(0.899)	(0.940)
Observations	16,120	2,989	16,120	2,989	16,120	2,989	16,120	2,989	16,120	2,989	16,120	2,989
Countries	22	18	22	18	22	18	22	18	22	18	22	18
Pseudo R-squared	0.028	0.207	0.590	0.341	0.110	0.049	0.000	0.055	0.266	0.233	0.207	0.258

Note: The table reports the coefficients estimated with logit regression for Basel III implementation (0/1). "CS" stands for the sample of repeated cross-sections and "Panel" stands for the sample of countries with available firm panel data. GDP = gross domestic product.

For comparison, FSB (2019) finds that the Basel III effects on SME financing in G20 countries are, on average, weak and short-lived. However, FSB (2019) examines the *relative* effect—that is, whether the SMEs in countries with more binding capital positions are more affected that the SMEs in countries with less binding capital positions. In contrast, we investigate the absolute effect of Basel III, by comparing impacts across countries that have implemented the Basel III package versus countries that have not implemented it. In addition, we consider the varying gestation lags in the Basel III effect—that is, the difference between the year of Basel III implementation and the year of the Enterprise Survey data, when the effect is estimated—while the FSB (2019) study does not consider possible gestation lags, perhaps because these would be less varying in their case.

During the Basel III implementation period, firms with initially more employees and a larger share of foreign ownership perceived their constraints in accessing finance as easing across all the countries in our sample. Our result that greater firm size eases access to finance accords with the relevant literature (Beck, Levine, and Loayza 2000; Cetorelli and Strahan 2006; Beck and Demirgüc-Kunt 2006; Arraiz, Meléndez, and Stucchi 2014; Beck et al. 2006; Ferrando and Griesshaber 2011). In contrast, firms with initially larger (and perhaps overheated) sales experienced subsequent worsening of access to finance constraints. There is also some evidence that older firms may have benefited from better access to finance.

Firms facing banking systems that were initially less competitive (as captured by a higher Lerner index), more profitable, and more plagued with nonperforming loans experienced growing constraints in accessing finance. The result that the lack of competition undermines access to financing corresponds with that of Beck, Demirgüç-Kunt, and Levine (2010).

Interestingly, capital adequacy levels did not have an effect across all the countries—perhaps because banks in EMDEs were initially well-capitalized relative to banks in the advanced economies. In general, SMEs in countries with functioning contract enforcement frameworks experienced a significantly greater improvement in access to finance. In contrast, firms in countries hit by the financial crisis saw their access to finance worsen significantly during the studied period. We observe that improving liquidity positions by banks (perhaps in some cases even hoarding of

liquidity because of uncertainty) could have constrained lending to SMEs in the treated and untreated countries in the period after the global financial crisis.

In our sample of countries, we observe that Basel III was implemented dominantly by larger countries. Although they add to the explanatory power of the (first-stage) selection regression, other characteristics, such as foreign ownership of banks and membership in the G20 group of developing countries, do not appear significant at common statistical levels.

Table 14 shows the estimation results for our panel of firms. Here, we also find a negative effect of Basel III implementation on SME access to financing. In general, the panel results largely correspond to the cross-sectional results. The Basel III coefficient is negative but insignificant in columns (1) and (2), regression specifications that may still carry too much residual variation that is cleaned up by including country context and bank characteristics. In columns (3) and (4), which do so, the estimated effect is significantly negative—about half the size of the coefficient estimated for the cross-section data set. The panel regressions use matched, firm-bank data as well as firm–banking system data for firms that did not have credit or did not report the name of the bank.

Initially less financially included SMEs—those with bank accounts but without a bank loan (column (6) in table 14)—felt that their access to finance constraints worsened more than those of SMEs that were initially more financially included—those that had bank accounts and credit with a bank (column (5)). Interestingly, SMEs that were initially using bank credit (and having bank accounts) did not perceive a significant worsening in access to finance after Basel III implementation—although the estimated coefficient still bears a negative sign. We examine this result further by estimating a supplementary regression on a smaller sample of firms that initially used credit and can be matched to banks. The estimation results, reported in table A.13, in the appendix, provide some support for the insignificant effect of Basel III on firms that had access to credit before Basel III implementation.

The panel structure allows us to control for the initial conditions in access to finance. We find that the initial level of access to finance is an important determinant. This result broadly concurs with Ayyagari, Demirgüç-Kunt, and Maksimovic (2017), who find initial conditions to be critical for

entrepreneurial outcomes in India. We also find that firms with initially more employees saw their constraints in accessing finance ease during the studied period. Other firm characteristics did not play a significant role. Bank capitalization (measured by the leverage ratio) played a significantly positive role. Firms encountering less leveraged (more capitalized) banks and banking systems benefited from easier access to finance. Further, our results suggest that SMEs in richer countries and countries with better contract enforcement experienced greater easing of access to finance constraints. In contrast, in countries that experienced financial crises, SMEs felt significantly greater worsening of access to finance constraints.

In our panel sample of countries, we find that sample selection bias could be smaller, based on statistical tests and because we do not find as strong a predictor for systematically higher Basel III implementation, apart from membership in the G20 group of developing countries.

Table 13: Basel III and SME access to finance: Repeated cross-sections

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Access to finance as a constraint					
Basel Dummy Gest	-0.944**	-0.965**	-1.162***	-0.914***	-0.994***	-0.973**
First period dummy	-1.051***	-1.074***	-1.196***	-1.094***	-1.131***	-1.148***
ES gap	-0.157*	-0.157*	-0.336***	-0.323***	-0.337***	-0.371***
Employees		0.002***	0.002***	0.002***	0.003***	0.002***
Age		0.003	0.004**	0.004**	0.003*	0.005***
Foreign owners share (%)		0.004***	0.005***	0.005***	0.001	0.007***
Government-owned share (%)		0.001	0.001	0.001	0.017***	-0.005
Direct exports share (%)		0.001	-0.000	-0.001	0.000	-0.001
Annual sales paid after delivery (%)		-0.001	-0.002**	-0.002***	-0.000	-0.003***
Log of GDP per capita (constant 2005 US$)			-0.103	-0.132	-0.249	-0.078
Log of population			0.087	-0.093	-0.317**	-0.057
Ease of Doing Business			0.006	-0.004	-0.010	-0.007
Getting Credit			-0.002	0.005	0.010**	0.005
Enforcing Contracts			0.030***	0.020**	0.014	0.025**
Financial Crisis Dummy			-0.876***	-1.024***	-1.211***	-1.066***
Bank return on equity (%, after-tax)				-0.022**	-0.007	-0.027***
Credit to government and state-owned enterprises to GDP (%)				-0.006	0.000	0.004
Bank nonperforming loans to gross loans (%)				-0.012	0.015	-0.036*
Bank credit to bank deposits (%)				-0.003	-0.004	-0.000
Bank regulatory capital to risk-weighted assets (%)				0.009	0.016	-0.006
Lerner index				-0.835*	-1.034**	-0.968*
Liquid assets to short-term liabilities (%)				-0.001***	-0.002***	-0.002***
Observations	16,462	16,462	16,462	16,462	6,448	10,014
Countries	20	20	20	20	20	20
Pseudo R-squared	0.025	0.027	0.045	0.047	0.037	0.058
Selection equation	Basel III Implementation					
Log of GDP (current US$)	1.083**	1.083**	1.083**	1.083**	1.166**	1.001**
Foreign bank assets among total bank assets (%)	-0.020	-0.020	-0.020	-0.020	-0.009	-0.035
G20 Developing Dummy	1.322	1.322	1.322	1.322	0.967	1.477
Observations	16,462	16,462	16,462	16,462	6,448	10,014
Countries	20	20	20	20	20	20
Pseudo R-squared	0.555	0.555	0.555	0.555	0.481	0.616

Note: This table presents the estimates of the effect of Basel III implementation on the firm's subjective assessment of access to finance, which was estimated with an ordered logit and for the repeated cross-section sample. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. Standard errors clustered at the country level are in parentheses. Column (5) presents the results for the firms that had a bank account and a loan; column (6) shows the results for firms with a bank account but without a loan. ES = Enterprise Survey; GDP = gross domestic product; SME = small and medium-size enterprises.
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 14: Basel III and SMEs' access to finance: Panel of firms

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Access to finance as a constraint					
Basel Dummy Gest	-0.162	-0.146	-0.464**	-0.462***	-0.224	-0.439**
Initial conditions	-1.066***	-1.080***	-1.114***	-1.128***	-1.161***	-1.156***
ES gap	-0.267**	-0.274**	-0.146	-0.114	-0.050	-0.127
Employees		0.002***	0.002***	0.002***	0.003***	0.003**
Age		-0.000	-0.000	-0.000	-0.000	-0.000
Foreign owners share (%)		0.002	0.002**	0.002*	0.001	0.002
Government-owned share (%)		-0.000	-0.003	-0.004	-0.027	-0.000
Direct exports share (%)		-0.000	-0.001	-0.001	-0.001	-0.000
Annual sales paid after delivery (%)		0.001	0.000	-0.000	-0.000	0.001
Log of GDP per capita (constant 2005 US$)			0.269**	0.323***	0.330***	0.245
Getting Credit			-0.003	-0.004	-0.003	-0.007**
Enforcing Contracts			0.029***	0.033***	0.039***	0.032***
Financial Crisis Dummy			-0.395***	-0.545***	-0.696***	-0.563***
Bank capital to total assets (%)				0.041***	0.042**	0.031
Bank overhead costs to total assets (%)				-0.026	-0.027*	0.007
Bank return on equity (%)				-0.007*	-0.011*	0.005
Bank loan loss reserves to total assets (%)				-0.000	-0.002	0.026**
Observations	2,808	2,808	2,808	2,808	1,391	1,417
Countries	20	20	20	20	20	20
Pseudo R-squared	0.141	0.143	0.150	0.153	0.152	0.164
Selection equation						
Log of GDP (current US$)	0.941	0.941	0.941	0.941	1.108*	0.764
Foreign bank assets among total bank assets (%)	-0.002	-0.002	-0.002	-0.002	0.004	-0.006
G20 Developing Dummy	1.900	1.900	1.900	1.900	1.399	2.391**
Observations	2,808	2,808	2,808	2,808	1,391	1,417
Countries	20	20	20	20	20	20
Pseudo R-squared	0.422	0.422	0.422	0.422	0.393	0.472

Notes: This table presents the estimates of the effect of Basel III implementation on the firm's subjective assessment of access to finance, which was estimated with an ordered logit and for both the bank-firm linked and unlinked panel sample. The models were estimated with the Heckman selection model – with the selection equation being estimated with a logit model. Standard errors are clustered at the country level are in parentheses. Column (5) presents the results for the firms that both had a bank account and loan, while column (6) shows the results for the firms with bank account but without loan. ES = Enterprise Survey; GDP = gross domestic product; SMEs = small and medium enterprises. *** indicates significance at 1% level, ** at the 5% level, and * at the 10% level.

Finally, we conduct robustness checks. We estimate regressions for which we redefine the dependent variable into two categories—whether the access to finance improved (eased) or did not change or worsened. We estimate these additional regressions using the multinomial logit model and present them in table A.7, in the appendix. We find that Basel III implementation could have intensified the worsening of access to finance for many SMEs and curtailed any progress in easing the access to finance constraints for SMEs. But the significance of the latter result does not reach common statistical levels. Next, we exclude the African countries from our sample and re-estimate

the regressions using repeated cross-section and panel data. We find that the results remain largely unchanged, although the Basel III effect, while negative, loses its significance in certain specifications (the results are available upon request).

7.3 Heterogeneity in the Basel III Effect on SME Financing?

The previous subsection examines the average effect of the Basel III implementation on access to finance—including by the initial degree of financial inclusion. However, the effect can be heterogeneous and more pronounced for young and small firms or in a less stable banking environment. The existing empirical literature suggests that small firms are more vulnerable to tightening of financial regulation (see Ayyagari, Beck, and Martinez Peria (2017), among others). Further, less capitalized banks are more likely to be affected by the Basel III implementation and more likely to reduce lending temporarily, at least to the corporate sector (Bridges et al. 2014; Behn, Haselmann, and Wachtel 2016; Jiménez et al. 2017).

Table A.8, in the appendix, presents regression results assessing whether the effect of Basel III implementation on SME access to finance varies by firm size and/or age. In accord with the unconditional DiD estimates (see tables 9 and 10), we do not find any significantly differentiated effects of Basel III implementation on the access to finance constraints by firm size and/or age. There is some indication that younger SMEs could have suffered more from worsening access to finance with Basel III implementation; however, this effect is not robust and goes away with the inclusion of size and size-age interactions.

Next, we examine whether better capitalized bank systems absorbed Basel III implementation better—that is, were less constraining on the access to finance for SMEs. Table A.9, in the appendix, reports the estimation results. When including the interaction of the Basel III dummy with pre-treatment bank capitalization (the capital adequacy ratio and the capital to asset ratio), the results do not suggest that better capitalized banking systems/banks absorbed the Basel III implementation shock in a way that less adversely affected SME access to finance. Therefore, our results do not suggest any systematic heterogeneity in which SMEs facing less capitalized banks/banking systems would suffer more in access to finance.

Our results do not reveal much about possible heterogeneity in the effects of Basel III on SME financing across EMDEs, compared with the results presented by FSB (2019) for G20 countries. FSB (2019) finds that the Basel III effects are heterogeneous across G20 countries. The heterogeneity is related to the strength of bank capitalization before Basel III implementation. Namely, SME access to finance worsens only in countries with the least capitalized banks. In EMDEs, bank capitalization has typically remained higher than in developed countries. We conjecture that this could be the reason why we fail to find heterogeneous effects across varying levels of bank capitalization.

Although banks in EMDEs could have been less constrained by their capitalization, they could have been constrained more by their liquidity positions—which the Basel III package also affected, mainly through the liquidity coverage ratio. Therefore, we perform analogous estimations for short-term liquidity positions—interacting the Basel III dummy with a dummy for more liquid banks/banking systems. Here, our results also do not indicate any significant heterogeneous effects. Only for combined and linked panel samples do our results seem to indicate that banks with a lower ratio of liquid assets to total assets exerted a significantly less negative effect on SME access to finance. However, we do not find statistically significant results for banking systems with lower ratios of liquid assets to short-term liabilities—a closer analog to the Basel III liquidity coverage ratio. The results are included in table A.10, in the appendix.

Finally, we examine whether the transition to Basel III from Basel II versus Basel 2.5 could have influenced the effect of Basel III implementation on access to finance. Basel 2.5 represented an update of Basel II and has been characterized by increased capital requirements. Therefore, transitioning to Basel III from Basel 2.5 could have been, hypothetically, associated with lower costs. We test this hypothesis and present the regression results in tables A.11 and A.12, in the appendix, for the repeated cross-section and panel samples, respectively. In these regressions, we add the interaction between the Basel III and the Basel 2.5 dummy variables to examine whether progressing from Basel 2.5 to Basel III reduced the moderately negative effects of Basel III implementation on SME access to finance. Overall, our results do not reveal a significant difference for SME access to finance when a country had transitioned to Basel III from Basel 2.5 versus Basel II.

8. Economic Significance of the Estimated Effect

To summarize the results from our regressions, this section briefly discusses the economic significance of the estimated effect of Basel III on SME financing. To this end, we gauge the marginal effects from the estimated baseline models in tables 13 and 14 (column (4)) around the mean of the independent variables as well as the dependent variables. We do so by running simple ordinary least squares on the column (4) specifications in tables 13 and 14. This approach offers a range for the effect that could be more informative about the average economic significance of our estimates.

The economic effect of Basel III implementation on SME access to financing in EMDEs can range between negative 0.244 and negative 0.593. The SME access to financing variable has a mean of 3.43 in our sample and a standard deviation of 1.31. These values imply that Basel III implementation could, on average, increase the access to finance constraints by about one-third of the standard deviation. Although this effect could be less economically important for countries such as Turkey and the Philippines, with the best financial access in our sample (values of 4.3 and 4.2 out of 5), it may be more important for countries such as Kenya and Ghana, with the worst access (2.4 out of 5). For instance, Basel III implementation could, keeping other things constant, push Peru (3.8) back to the level of Ukraine (3.4), or Thailand (3.4) back to the level of Argentina (3.0). On economic significance, we assess the short-run effect of Basel III implementation on SME financing in EMDEs as moderately negative.

9. Concluding Remarks

This paper studied the effect of Basel III implementation on SME financing in EMDEs. The literature on the consequences of implementing (global) financial regulations, including Basel III, is burgeoning (Boissay et al. 2019). But it typically centers around the regulatory effect on overall bank lending or economic activity. This paper contributes to the scant and recently growing literature studying the effect of Basel III on SME financing—an effect in which policy makers are highly interested.

We used firm-level data from the World Bank's Enterprise Surveys as the core data set and merged it with several other data sets containing bank as well as country characteristics. We analyzed

repeated cross-section and panel samples of firms covering 32 EMDEs before and after Basel III implementation, with only some countries exposed to the treatment (Basel III implementation) and others not. To gauge the effect of Basel III on SME financing, we employed the difference-in-differences method and used a regression setup to control for confounding factors and address possible sample selection issues. To tighten the identification, we also formed a panel of matched firm-bank data to isolate the supply-side factors of the SME finance market more accurately.

Overall, our results indicate that Basel III implementation had a moderately negative effect on SME assess to finance in EMDEs. Differentiating across the intensity of financial inclusion, SMEs that were initially on the fringes of financial inclusion could have been affected more adversely than SMEs already using bank credit. Firms accessing credit prior to Basel III implementation may have been less negatively affected, but also the effect could have been insignificant. This finding dovetails with practitioners' view that once SMEs have an established relationship with a bank, they typically do not face problems in renewing credit—that is, in the absence of large shocks to SME performance or financial stability (Campello, Graham, and Harvey 2010).

One channel for the negative effect of Basel III could arise because of banks shifting toward more unsecured (presumably short-term) lending and, on secured lending, banks requiring much more collateral from SMEs. Financial crises curtailed the progress in easing SME access to finance across the board. In contrast, SMEs in countries with better contract enforcement saw their access to finance ease significantly more.

In addition, we examined whether young and small firms suffered disproportionally more and whether initially less capitalized and less liquid banking systems enhanced the moderately negative effects of Basel III. However, we found little support for heterogeneity in the effects of Basel III across these firm and bank characteristics. Further, we failed to find evidence that the moderately negative effect of Basel III on SME financing would be less negative in countries transitioning to Basel III from Basel 2.5 versus Basel II.

Our findings have important policy implications. According to our results, well-capitalized and provisioned banking systems could be more successful in improving SME access to finance and,

in turn, cushion any short-term, moderately negative effect of Basel III implementation on SME financing. Likewise, successful macroprudential management that helps avoid financial crises can help support improvements in SME access to financing, by ensuring a stable and risk-tolerant environment in which banks continue providing credit and financially including SMEs. Moreover, improving contract enforcement could help avoid situations in which banks preemptively restrict lending when faced with growing risk and uncertainty.

Future research could focus on how Basel III implementation affects more specific aspects of SME financing, such as SMEs whose loan applications were rejected by banks—this was not possible with our sample because of data unavailability. Overall, the literature on how financial regulation influences SME access to finance and firm performance is still scarce, and we need more evidence to understand the consequences of these regulations, including the consequences outside the banking sector.

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APPENDIX

Table A.1: Sample countries, timing of pre- and post-treatment Enterprise Surveys, and Basel III implementation

Country	Pre-treatment ES	Post-treatment ES	Basel III implementation	Implementation status
Treated group				
Argentina	2010	2017	2013	4
Bolivia	2010	2017	2013	3
Colombia	2010	2017	2013	4
India*	2005	2014	2013	4
Indonesia	2009	2015	2013	4
Kenya	2007	2018	2013	4
Malaysia*	2007	2015	2013	4
North Macedonia	2009	2013	2012	4
Peru	2010	2017	2012	1
Philippines	2009	2015	2013	4
Thailand*	2006	2016	2013	4
Turkey	2008	2013	2013	4
Control group				
Azerbaijan	2009	2013	---	---
Benin	2009	2016	---	---
Bhutan	2009	2015	---	---
Cameroon	2009	2016	---	---
Dominican Rep.	2010	2016	---	---
El Salvador	2010	2016	---	---
Ethiopia	2011	2015	---	---
Ghana	2007	2013	---	---
Guatemala	2010	2017	---	---
Côte d'Ivoire	2009	2016	---	---
Kyrgyzstan	2009	2013	---	---
Lao PDR	2012	2016	---	---
Mali	2010	2016	---	---
Moldova	2009	2013	---	---
Mongolia	2009	2013	---	---
Paraguay	2010	2017	---	---
Sierra Leone	2009	2017	---	---
Tajikistan	2008	2013	---	---
Ukraine	2008	2013	---	---
Zambia	2007	2013	---	---

Note: The countries with * are only included in repeated cross-section analysis. For countries in italics, we were able to match firms with specific banks (that is, they are included in the matched sample). We define the Basel III implementation as the introduction of the Basel III definition of capital into the national regulatory framework. Degrees of implementation: 1. Draft regulation not published, 2. Draft regulation published, 3. Final rule published, 4. Final rule in force, 5. Not applicable. We include Peru in the treated group of countries— – although it did not yet implement the Basel III definition of capital, because Peru started with the introduction of capital buffers in line with Basel III (as well as a few other aspects of the Basel III framework).

Table A.2: Basel III implementation: Beyond capital

Country	Definition of capital	Liquidity (LCR)	Leverage ratio	G-SIB requirements	D-SIB requirements
Argentina	4	4	4	3	3
Bolivia	3	5	5	5	5
Colombia	4	4	5	5	5
India	4	4	4	4	3
Indonesia	4	2	4	1	1
Kenya	4	1	1	5	4
Malaysia	4	3	1	1	1
North Macedonia	4	4	1	5	1
Peru	1	3	5	5	3
Philippines	4	2	2	5	3
Thailand	4	1	1	5	1
Turkey	4	4	4	1	1

Note: The BIS (2015) survey is the source of data for G 0 countries. FSI (2015) is the source for non-G20 countries. Degrees of implementation: 1. Draft regulation not published, 2. Draft regulation published, 3. Final rule published, 4. Final rule in force, 5. Not applicable. LCR = liquidity coverage ratio; G-SIB = global systemically important banks; D-SIB = domestic systemically important banks.

Table A.3: Correlation matrix for all bank system explanatory variables

Variable	Bank overhead costs to total assets (%)	Bank return on equity (%, after tax)	Credit to government and state-owned enterprises to GDP (%)	Bank nonperforming loans to gross loans (%)	Bank credit to bank deposits (%)	Bank regulatory capital to risk-weighted assets (%)	Lerner index	Five-bank asset concentration	Foreign bank assets among total bank assets (%)	Liquid assets to short-term liabilities	Tier 1 to risk-weighted assets
Bank overhead costs to total assets (%)	1										
Bank return on equity (%, after tax)	0.248***	1									
Credit to government and state-owned enterprises to GDP (%)	-0.150***	-0.230***	1								
Bank nonperforming loans to gross loans (%)	0.252***	-0.706***	0.029	1							
Bank credit to bank deposits (%)	0.206***	-0.189***	-0.045**	0.146***	1						
Bank regulatory capital to risk-weighted assets (%)	0.067***	-0.306***	0.407***	0.172***	0.129***	1					
Lerner index	-0.176***	0.272***	-0.157***	-0.358***	-0.210***	-0.143***	1				
Five-bank asset concentration	-0.002	0.193***	-0.574***	-0.179***	0.079***	-0.362***	0.294***	1			
Foreign bank assets among total bank assets (%)	0.224***	-0.091***	-0.505***	0.366***	-0.128***	-0.127***	0.074***	0.406***	1		
Liquid assets to short-term liabilities	0.391***	-0.116***	-0.018	0.285***	0.041*	-0.122***	-0.328***	0.054***	-0.129***	1	
Tier 1 to risk-weighted assets	-0.037*	-0.383***	0.253***	0.264***	-0.023	0.912***	-0.217***	-0.286***	-0.048**	0.004	1

Table A.4: Correlation matrix for all firm explanatory variables

Variable	Employees	Age	Foreign owners share (%)	Government owned share (%)	Direct exports share (%)	Annual sales paid after delivery (%)
Employees	1					
Age	0.019	1				
Foreign owners share (%)	0.146***	-0.019	1			
Government owned share (%)	0.053***	0.070***	0.004	1		
Direct exports share (%)	0.200***	-0.005	0.258***	-0.002	1	
Annual sales paid after delivery (%)	0.053***	-0.018	0.092***	-0.017	0.139***	1

Table A.5: Correlation matrix for all country characteristics explanatory variables

Variable	GDP per capita	Ease of Doing Business	Enforcing Contracts	Getting Credit	Financial Crisis dummy
GDP per capita	1				
Ease of Doing Business	0.671***	1			
Enforcing Contracts	-0.044***	0.008	1		
Getting Credit	0.573***	0.666***	0.079***	1	
Financial Crisis dummy	0.156***	-0.255***	0.318***	0.356***	1

Table A.6: Is access to finance related to other financing measures?

VARIABLES	(1)	(2)	(3)	(4)
	Access to finance as a constraint			
Bank financing of working capital	0.001	0.001	0.007**	0.004**
	(0.002)	(0.001)	(0.004)	(0.002)
Bank financing of fixed assets	0.003*	0.001	0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.001)
Internal financing of working capital	0.006***	0.003***	0.008***	0.004***
	(0.002)	(0.001)	(0.002)	(0.001)
Internal financing of fixed assets	0.003***	0.002**	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Dummy – has a loan/line of credit from a bank	0.018	0.013	-0.153	-0.091
	(0.138)	(0.082)	(0.173)	(0.102)
Dummy – has a bank account	0.592***	0.334***	0.325*	0.197*
	(0.212)	(0.114)	(0.193)	(0.110)
Estimator	Ordered logit	Ordered probit	Ordered logit	Ordered probit
Sample	Panel	Panel	Repeated CS	Repeated CS
Observations	3,465	3,465	10,365	10,365
Countries	21	21	31	31

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.7: Basel III and SMEs' access to finance: Easing versus worsening access to finance

	(1)		(2)		(3)	
Dependent variable	**Access to finance as a constraint**					
Sample	**Panel all**		**Panel non-linked**		**Panel linked**	
Outcome (base outcome = 0)	**-1**	**1**	**-1**	**1**	**-1**	**1**
Basel Dummy Gest	0.190*	-0.250	0.185	-0.573*	0.126	0.811***
Initial conditions	0.355***	-1.179***	0.310***	-1.232***	0.514***	-1.138***
ES Gap	-0.006	-0.161	-0.038	-0.118	-0.034	0.017
Employees	-0.002**	0.001	-0.002**	0.000	-0.002	0.003
Age	0.000	0.000	0.000	0.000	-0.001	-0.003*
Foreign owners share (%)	-0.002	-0.002	-0.002	-0.001	-0.004	-0.005
Government owned share (%)	-0.002	-0.024	-0.006	-0.021	0.014	-6.640***
Direct exports share (%)	0.001	0.003	-0.000	0.001	0.004	0.007**
Annual sales paid after delivery (%)	0.000	0.001	0.001	0.002*	-0.002	-0.003
Bank capital to total assets (%)	-0.040***	0.034	-0.037***	0.066*	-0.047	-0.009
Bank overhead costs to total assets (%)	0.031*	0.019	0.029	0.005	-0.001	0.080
Bank return on equity (%)	0.005	-0.006	0.002	-0.003	-0.004	0.002
Bank loan loss reserves to total assets (%)	0.005	0.013	-0.012	0.020	0.046	0.057***
Log of GDP per capita (constant 2005 US$)	-0.421***	-0.011	-0.453***	0.020	0.050	0.488
Getting Credit	0.010***	0.001	0.011***	-0.001	-0.001	0.004
Enforcing Contracts	-0.028***	0.014	-0.029***	0.014	-0.030***	0.016*
Financial Crisis Dummy	0.286**	-0.471***	0.431***	-0.407***	-0.047	-0.576***
Observations	3,227		2,495		732	
Countries	20		20		11	
Pseudo R-squared	0.204		0.212		0.213	
Selection equation	**Basel III Implementation**					
Log of GDP (current US$)	1.001		1.027		1.164**	
Foreign bank assets among total bank assets (%)	-0.002		-0.006		0.032	
G20 Developing Dummy	2.013*		2.460**		0.124	
Observations	3,227		2,495		732	
Countries	20		20		11	
Pseudo R-squared	0.457		0.543		0.213	

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with a multinomial logit. The estimates are presented for the matched (linked) bank-firm linked panel sample, unmatched (unlinked) bank-firm panel sample, and all firms panel sample. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. Standard errors clustered at the country level are in parentheses.

*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.8: Basel III and SMEs' access to finance: Firm size and age effects

VARIABLES	(1)	(2)	(3)	(4)	(5)
			Access to finance as a constraint		
Basel Dummy Gest	-0.468***	-0.423**	-0.461***	-0.210	-0.473**
	(0.160)	(0.168)	(0.172)	(0.167)	(0.227)
Basel and firm size interaction	0.014		0.104	0.055	0.176
	(0.099)		(0.155)	(0.209)	(0.295)
Basel and firm age interaction		-0.108	-0.019	-0.066	0.099
		(0.118)	(0.161)	(0.182)	(0.190)
Basel and firm size and firm age interaction			-0.186	-0.062	-0.435
			(0.218)	(0.356)	(0.398)
Observations	2,808	2,808	2,808	1,391	1,417
Countries	20	20	20	20	20
Pseudo R-squared	0.152	0.152	0.152	0.152	0.164

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit for the panel sample. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. The regressions also include an interaction term between the Basel III implementation dummy and above/below (0/1) median firm size (age) dummy, and an interaction term between the Basel III implementation dummy and above/below (0/1) median firm size (age) dummy. Standard errors clustered at the country level are in parentheses.

*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.9: Basel III and SMEs' access to finance: The role of bank capitalization

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
			Access to finance as a constraint			
Sample	Repeated Cross-Sections	Repeated Cross-Sections	Panel (nonlinked)	Panel (nonlinked)	Panel (linked)	Panel (both)
Basel Dummy Gest	-0.752*	-0.516	-0.273***	-0.346*	0.286	-0.479***
	(0.413)	(0.416)	(0.029)	(0.208)	(0.300)	(0.177)
Basel and bank CAR interaction	2.657		0.026			
	(2.342)		(0.048)			
Basel and bank capital to total assets interaction		-1.293		-0.322**	-0.068	0.045
		(3.282)		(0.159)	(0.247)	(0.145)
Observations	16,462	15,890	2,604	2,558	726	2,808
Countries	20	19	18	17	12	20
Pseudo R-squared	0.047	0.039	0.159	0.159	0.152	0.153

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit for the panels and repeated CS samples. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. The regressions also include an interaction term between the Basel III implementation dummy and above/below (0/1) median bank capital to risk-weighted assets dummy, and an interaction term between the Basel III implementation dummy and above/below (0/1) median bank capital to total assets dummy. Standard errors clustered at the country level are in parentheses.
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.10: Basel III and SMEs' access to finance: The role of bank liquidity

VARIABLES	(1)	(2)	(3)	(4)
		Access to finance as a constraint		
Sample	Repeated cross-sections	Panel (nonlinked)	Panel (both)	Panel (linked)
Basel Dummy Gest	-0.576	-0.230***	-0.868***	-1.112**
	(0.417)	(0.053)	(0.227)	(0.495)
Basel and bank LCR interaction	0.868	-0.032		
	(0.863)	(0.057)		
Basel and bank liquid assets to total assets interaction			0.615***	0.538***
			(0.213)	(0.195)
Observations	16,462	2,604	2,699	575
Countries	20	18	19	10
Pseudo R-squared	0.049	0.159	0.156	0.143

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit for the panels and repeated CS samples. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. The regressions also include an interaction term between the Basel III implementation dummy and above/below (0/1) median bank liquidity coverage ratio (LCR) dummy, and an interaction term between the Basel III implementation dummy and above/below (0/1) median liquid assets to total assets dummy. LCR is expressed as the ratio of liquid assets to short-term liabilities. Standard errors clustered at the country level are in parentheses.
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.11: Basel III and SME access to finance: Repeated cross-sections—Transitioning from Basel 2 versus Basel 2.5

VARIABLES	(1)	(2)	(3)	(4)
	Access to finance as a constraint			
Basel Dummy Gest	-0.948**	-0.963**	-1.235***	-0.536
Basel 2.5 interaction	-0.021	0.016	0.177	0.251
First period dummy	-1.061***	-1.066***	-1.155***	-0.703***
ES gap	-0.156*	-0.158*	-0.334***	-0.333***
Employees		0.002***	0.002***	0.002***
Age		0.003	0.004**	0.004***
Foreign owners share (%)		0.004***	0.005***	0.005***
Government-owned share (%)		0.001	0.001	0.001
Direct exports share (%)		0.001	-0.000	-0.001
Annual sales paid after delivery (%)		-0.001	-0.002**	-0.002***
Log of GDP per capita (constant 2005 US$)			-0.126	-0.031
Log of population			0.053	-0.011
Ease of Doing Business			-0.002	0.003
Getting Credit			0.029***	0.020**
Enforcing Contracts			-0.851***	-1.013***
Financial Crisis Dummy				-0.026***
Bank return on equity (%, after tax)				-0.020
Credit to government and state-owned enterprises to GDP (%)				-0.090***
Bank nonperforming loans to gross loans (%)				-0.000
Bank credit to bank deposits (%)				0.060***
Bank regulatory capital to risk-weighted assets (%)				-0.569
Lerner index				-0.002***
Liquid assets to short-term liabilities (%)				-0.333***
Observations	16,462	16,462	16,462	16,462
Countries	20	20	20	20
Pseudo R-squared	0.025	0.027	0.045	0.049
Selection equation	Basel III Implementation			
Log of GDP (current US$)	1.083**	1.083**	1.083**	1.083**
Foreign bank assets among total bank assets (%)	-0.020	-0.020	-0.020	-0.020
G20 Developing Dummy	1.322	1.322	1.322	1.322
Observations	16,462	16,462	16,462	16,462
Countries	20	20	20	20
Pseudo R-squared	0.555	0.555	0.555	0.555

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit and for the cross-sectional sample. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. Standard errors clustered at the country level are in parentheses.

*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.12: Basel III and SMEs' access to finance: Panel of firms—Transitioning from Basel 2 versus Basel 2.5

VARIABLES	(1)	(2)	(3)	(4)
Basel Dummy Gest	-0.172	-0.154	-0.467***	-0.476***
Basel 2.5 interaction	0.056	0.050	-0.498**	-0.248
Initial conditions	-1.065***	-1.079***	-1.124***	-1.131***
ES gap	-0.264**	-0.272**	-0.134	-0.120
Employees		0.002***	0.002***	0.002***
Age		-0.000	-0.000	-0.000
Foreign owners share (%)		0.002	0.002*	0.002
Government-owned share (%)		-0.001	-0.003	-0.003
Direct exports share (%)		-0.000	-0.001	-0.001
Annual sales paid after delivery (%)		0.001	0.000	-0.000
Log of GDP per capita (constant 2005 US$)			0.413***	0.382**
Getting Credit			-0.006*	-0.005*
Enforcing Contracts			0.035***	0.035***
Financial Crisis Dummy			-0.296***	-0.431***
Bank capital to total assets (%)				0.037**
Bank overhead costs to total assets (%)				-0.022
Bank return on equity (%)				-0.006
Bank loan loss reserves to total assets (%)				-0.003
Observations	2,808	2,808	2,808	2,808
Countries	20	20	20	20
Pseudo R-squared	0.141	0.143	0.151	0.152
Selection equation				
Log of GDP (current US$)	0.941	0.941	0.941	0.941
Foreign bank assets among total bank assets (%)	-0.002	-0.002	-0.002	-0.002
G20 Developing Dummy	1.900	1.900	1.900	1.900
Observations	2,808	2,808	2,808	2,808
Countries	20	20	20	20
Pseudo R-squared	0.422	0.422	0.422	0.422

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit and for the bank-firm linked and unlinked panel samples. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. Standard errors clustered at the country level are in parentheses.
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A.13: Basel III and SMEs' access to finance: Panel of firms linked to banks

VARIABLES	(1)	(2)	(3)	(4)
Basel Dummy Gest	0.052	0.070	0.177	0.202
Initial conditions	-1.071***	-1.101***	-1.175***	-1.176***
ES gap	-0.074	-0.098	-0.049	-0.017
Employees		0.004***	0.005***	0.005***
Age		-0.001***	-0.001***	-0.001***
Foreign owners share (%)		0.001	-0.000	-0.000
Government owned share (%)		-0.035	-0.037	-0.036
Direct exports share (%)		-0.001	-0.002	-0.002
Annual sales paid after delivery (%)		-0.002	-0.001	-0.001
Log of GDP per capita (constant 2005 US$)			0.041	0.049
Getting Credit			-0.010	-0.007
Enforcing Contracts			0.039***	0.041***
Financial Crisis Dummy			-0.474***	-0.458***
Bank capital to total assets (%)				0.028
Bank overhead costs to total assets (%)				-0.000
Bank return on equity (%)				0.000
Bank loan loss reserves to total assets (%)				-0.005
Observations	747	747	747	747
Countries	12	12	12	12
Pseudo R-squared	0.136	0.142	0.151	0.153
Selection equation				
Log of GDP (current US$)	1.377**	1.377**	1.377**	1.377**
Foreign bank assets among total bank assets (%)	0.040	0.040	0.040	0.040
G20 Developing Dummy	-0.141	-0.141	-0.141	-0.141
Observations	747	747	747	747
Countries	12	12	12	12
Pseudo R-squared	0.441	0.441	0.441	0.441

Note: This table presents the estimates of the effect of Basel III implementation on firms' subjective assessments of access to finance, which were estimated with an ordered logit and only for the bank-firm linked panel sample. The models were estimated with the Heckman selection model—with the selection equation being estimated with a logit model. Standard errors clustered at the country level are in parentheses.
*** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

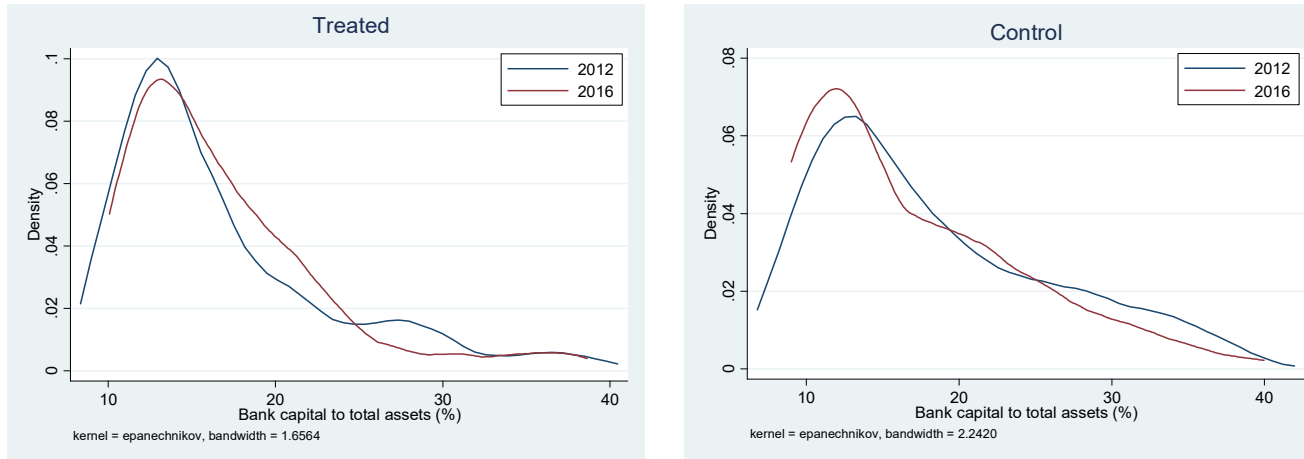Figure A.1: Higher Moments of bank capitalization: Treated versus control group

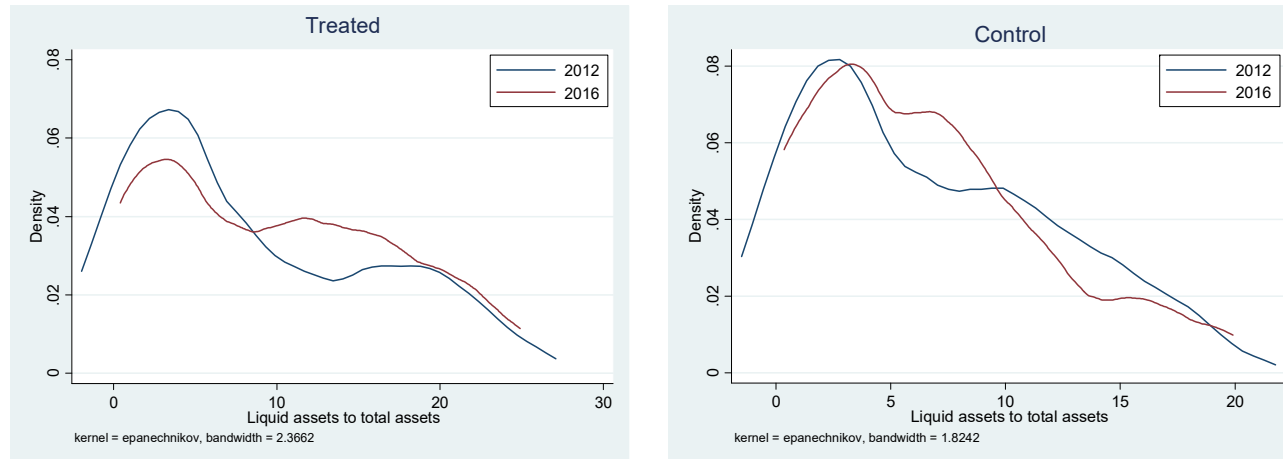Figure A.2: Higher moments of bank liquidity: Treated versus control group

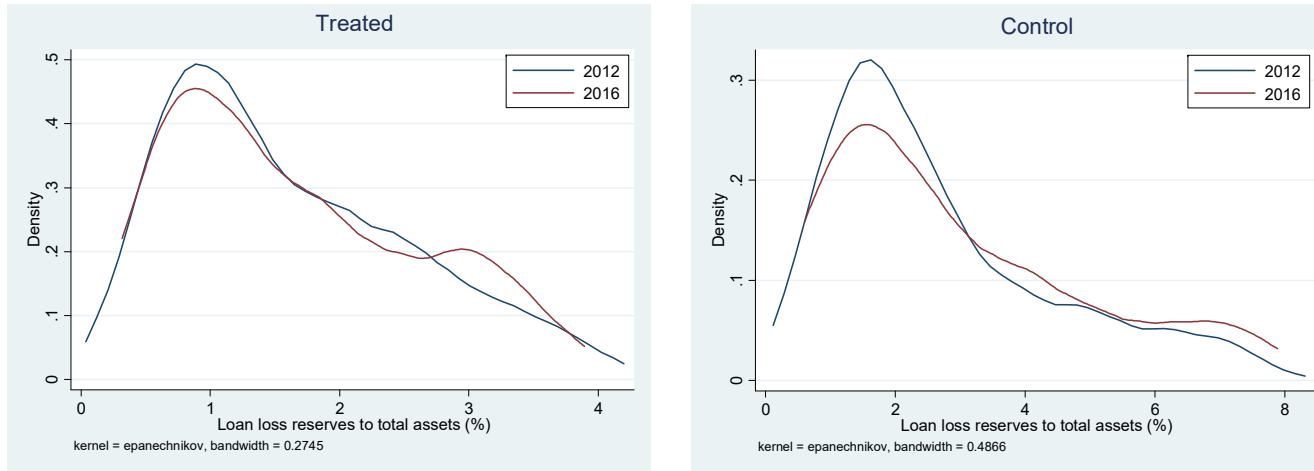Figure A.3: Kernel density estimation of banks' loan loss reserves: Treated versus control group

Figure A.4: Higher moments of bank profitability: Treated versus control group