FSB | FINANCIAL STABILITY BOARD

Evaluation of the effects of financial regulatory reforms on small and medium-sized enterprise (SME) financing

Technical Appendix to the empirical analysis

29 November 2019

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Background

In the aftermath of the financial crisis, the G20 launched a comprehensive programme of financial reforms to increase the resilience of the global financial system, while preserving its open and integrated structure. The FSB, in close collaboration with the standard-setting bodies and informed by work carried out by its members and other stakeholders, has developed a framework for the post-implementation evaluation of the effects of the G20 financial regulatory reforms (Framework).[1] One of the first two evaluations under the Framework is an examination of the effects of the G20 regulatory reforms on financial intermediation.[2] The evaluation consists of two parts: the first part involved an evaluation of the effects of reforms on the financing of infrastructure investment (delivered to the Argentine G20 Summit in November 2018);[3] and the second part involved an evaluation of the effects of reforms on the financing of small and medium-sized enterprises (for delivery to the Japanese G20 Presidency in 2019). The motivation for this evaluation stems from the need to better understand the effects of the post-crisis reforms on the financing of real economic activity and their contribution to the G20 objective of strong, sustainable, balanced and inclusive economic growth.

This Technical Appendix complements the evaluation report that focuses on the effects of reforms on the financing of small and medium-sized enterprises (SMEs) by providing a detailed description of the analytical approaches, data sources and results of the empirical analysis.

1.   Introduction to the empirical approaches

What is the impact of the G20 regulatory reforms on SMEs' financing, and their business in general? This document lays out the empirical procedures and findings to examine this question with a particular focus on the initial Basel III reforms agreed in 2010. The main objective of these reforms has been to increase the resilience of banks and the financial system as a whole.[4] In their role as financial intermediaries, banks might have passed on the impact of regulatory changes to their customers, such as small- and medium-sized enterprises (SMEs).

SMEs form the economic backbone of many countries. As of 2017, SMEs accounted for about 60% of total employment in Organisation for Economic Cooperation and Development (OECD) countries, and more than half of their value added.[5] The extent to which SMEs could have been impacted by the reforms depends not only on their own financial conditions as more or less creditworthy borrowers, but also on banks' willingness and capacity to lend. More resilient banks with higher capital buffers, for example, might be more willing to continue accommodating the financial needs of their SME customers after the reforms entered into force.

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[1]   *Framework for Post-implementation Evaluation of the Effects of the G20 Financial Reforms* (July 2017).

[2]   The other initial evaluation under the Framework examined the effects of post-crisis reforms on *incentives to centrally clear OTC derivatives* (November 2018).

[3]   *Evaluation of the effects of financial regulatory reforms on infrastructure finance* (November 2018).

[4]   *Implementation and Effects of the G20 Financial Regulatory Reforms: Fifth Annual Report* (October 2019).

[5]   See http://www.oecd.org/industry/financing-smes-and-entrepreneurs-23065265.htm.

The following core questions guide the different pieces of the analysis. Did SME lending by the most affected banks slow in the aftermath of the Basel III reforms (Q1)? Did the reforms have a stronger effect on the financing of SMEs relative to that of larger, non-financial companies (Q2)? Did the terms of SME financing -- like maturity, collateral requirements and costs (interest rates) -- tighten after reform implementation (Q3)? And did the allocation of SME credit change across banks or firms after the reforms came into effect (Q4)?

This study draws on 15 different datasets to shed light on these questions from two different angles, from a top-down "bird's eye view" and from a bottom up "grassroots" perspective. . First, from atop down perspective, a host of different *cross-country* analyses compare different jurisdictions covered in individual datasets. The underlying datasets range from broad survey aggregates to individual bank and firm balance sheets. Second, from a bottom up perspective, *individual FSB member jurisdictions* conduct their own country-specific 'satellite' analyses while following a common analytical protocol. Their analyses draw on confidential datasets like credit registers at the bank-firm level, or supervisory bank-level reports on balance sheets and income statements.

Econometric identification is key to isolate the impact of regulatory reforms. Appropriate econometric strategies paired with the most granular data available not only allow a proper identification, but they also provide the most insightful analytical results. The analyses exploit *cross-sectional heterogeneity* at the jurisdiction, bank and SME borrower level as a key identification device. Further, credit register data at the level of individual bank-firm relationships allow for a separation of demand and supply effects. Using such granular data and controlling for demand, can help identify the *relative* effects of reforms. However, as aggregate SME lending in the post-reform period might be confounded with other macroeconomic drivers (such as monetary policy), the *absolute* effects of these reforms cannot be identified.

Overall, results do not reveal a one-size-fits-all pattern – reality is more complex and nuanced. The main conclusion of the evaluation is that, for the reforms in scope, the analysis does not identify material and persistent negative effects on SME financing in general, although there is some differentiation across jurisdictions. There is some evidence that the more stringent risk-based capital (RBC) requirements under Basel III slowed the pace of SME lending growth at the most "affected" banks (i.e. those least capitalised ex ante) relative to other banks (Q1). Some jurisdictions also exhibit tighter credit conditions in the post-reform period (Q3). These effects are not homogeneous across jurisdictions and they are generally found to be temporary. This conclusion is consistent with the literature on the effects of bank capital regulations and with stakeholder feedback that SME financing is largely driven by factors other than financial regulation.

The evaluation also provides some evidence for a reallocation of bank lending towards more creditworthy firms after the reforms, but this effect is not specific to SMEs. Results obtained at the individual bank level point to a drop in the share of SME in total corporate lending for the most exposed banks (Q2). Cross-sectional analyses based on firm and bank firm-level data find some reallocation of lending towards more creditworthy SMEs and improved access to finance for financially stronger SMEs. For instance, the cross-sectional Capital IQ analysis suggests that, after the reforms were introduced, better capitalised and more profitable firms increased their long-term borrowing and investments relatively more than other firms (Q4). The European Central Bank's (ECB) analysis confirms this pattern based on survey data.

This is consistent with evidence of a credit reallocation by banks towards more creditworthy borrowers in some within-country studies, although this reallocation is not specific to SMEs.

The remainder of this section sets the stage for the different pieces of the analysis. First, it presents the various datasets used in the overall evaluation and explains how they can shed light on SME financing from different angles. It then describes the different implementation stages of the relevant Basel III reforms and illustrates their potential temporary or persistent impact. The last part of this section elaborates on the challenges faced by the evaluation when trying to provide empirically grounded answers to the four aforementioned core questions.

Section 2 presents all cross-country studies, starting with the most aggregate FSB survey data analysis and proceeds to a firm-level analysis based on commercial data provided by Capital IQ. It then turns to the individual firm- and bank-level analyses conducted by the Basel Committee for Banking Supervision (BCBS) and the ECB on their proprietary data.

Section 3 describes the common research protocol for the within-country studies and compares their results. The first part presents six analyses based on bank-firm level data of the effect of tighter capital requirements on the pace of SME lending growth. The second part compares the effects on lending growth and portfolio shares at the level of individual banks.

1.1   Datasets that reflect two different angles

This evaluation examines SME financing both from a top down and a bottom up perspective. The datasets used in the empirical analysis differ in terms of their coverage and granularity, which shape the set of analytical options needed to identify properly the reform effects. The spectrum of data granularity ranges from outstanding lending volumes split by maturity for each *bank-firm relationship*, to *individual* accounts (balance sheets, financial statements) filed by *banks* and *firms*, to arrive at the aggregated level of macroeconomic time series on SME financing for individual *jurisdictions*. In terms of coverage, the datasets capture either various entities in one jurisdiction (*within country analysis*) or multiple jurisdictions (*cross-country analyses*) over time.

Complementary pieces of the overall evaluation draw on a rich variety of cross-country and jurisdiction-specific data sets. Figure 1 shows the multinational datasets that are used in the cross-country analyses in green, while national studies are described with white two-letter country codes. At the national level, satellite teams in Brazil, France, Germany, Italy, Mexico and Spain used their credit register data to conduct the analyses at the individual bank-firm relationships. Satellite teams in Germany, Hong Kong, Japan, Singapore and the United States explored bank-level datasets. At the multinational level, the ECB used firm-level survey data from various euro area countries to examine whether firms feel constrained in their access to bank funding. The BCBS drew on supervisory bank-level reports submitted by member countries to analyse extended SME loan volumes and the individual bank's compliance with regulatory standards as they were fully implemented. Another multinational exercise used firm-level data from Capital IQ, a commercial data provider, to analyse corporate balance sheets and track the reform effect to real economic outcomes. Finally, the FSB conducted a survey of its member jurisdictions on aggregate outstanding credit volumes to SMEs and other corporates that was used in the most aggregate, cross-country analysis from a top down perspective.
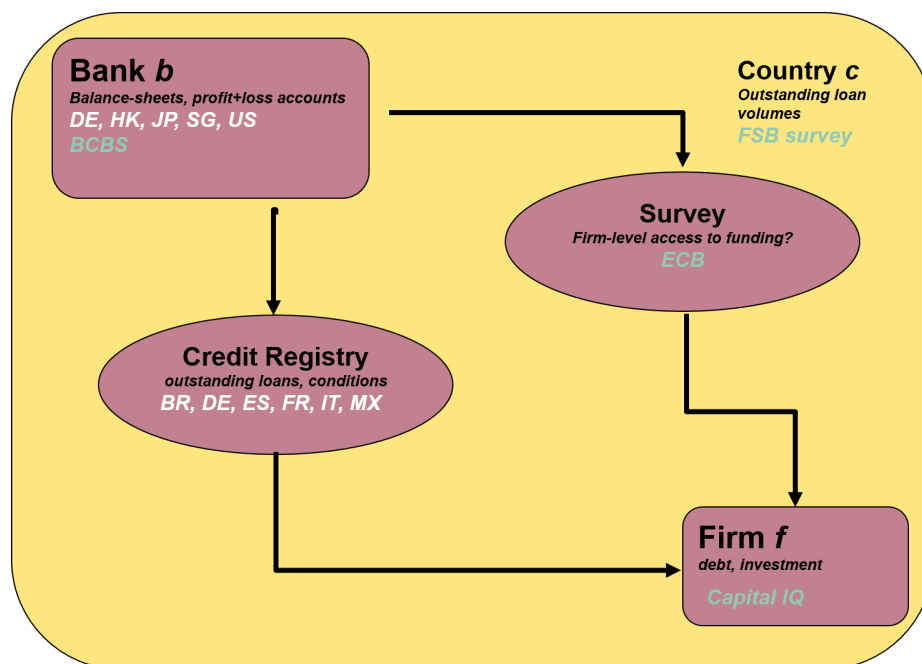
1.2   Basel III reforms and their implementation

The evaluation focuses on two distinct implementation stages of five Basel III reforms: national announcement and legal framework. Based on comments from industry participants, academia, interviewed stakeholders, and authorities' responses to the FSB survey, it was found that the internationally agreed reforms that may affect SME financing are:

- RBC: Risk-based capital ratio

- G-SIB/D-SIB: Global- and Domestic- Systemically Important banks' higher loss absorbency requirements

- LCR: Liquidity coverage ratio

- LR: Leverage ratio

- NSFR: Net stable funding ratio

This selection of reforms is also consistent with last year's FSB evaluation of the effects of financial regulatory reforms on infrastructure finance. In what follows, the NSFR reforms are not considered as they were agreed later than the other reforms, so their announcement and implementation are too recent to yield reliable econometric results.

This analysis draws on the national *announcement* and *legal framework* implementation as key stages at the national level. The announcement of the Basel III reform package took

place in December 2010. The subsequent BCBS implementation monitoring[6] features four steps that take place at the national level. This national implementation data was collected for the first time in Q3 2011, with the first reference date of June 2011.

Table 1

Basel III implementation stages

Value	Definition
1	**Draft regulation not published:** no draft law, regulation or other official document has been made public to detail the planned content of the <u>domestic</u> regulatory rules. This status includes cases where a jurisdiction has communicated high-level information about its implementation plans but not detailed rules.
2	**Draft regulation published:** a <u>draft</u> law, regulation or other official document is already publicly <u>available</u>, for example for public consultation or legislative deliberations. The content of the document has to be specific enough to be implemented when adopted.
3	**Final rule published:** the domestic <u>legal</u> or regulatory <u>framework</u> has been finalised and approved but is still not implemented by banks.
4	**Final rule in force:** the domestic legal and regulatory framework has been published and is <u>implemented</u> by banks.

Source: BCBS.

From this list, this evaluation selects two distinct implementation stages, namely the national **announcement** (stage 2 in the above table) and the publication of the national **legal framework** (stage 3 of the above table).

The evaluation aims to pick up the impact of the reforms in two different ways. First, there might be a *temporary* impact on banks' willingness to extend new lending to SMEs. Accordingly, the evaluation draws on the *growth rate of SME lending* to capture changes in the outstanding levels of SME financing. To map the *temporary* impact into the estimation framework, the evaluation uses a set of on/off dummy variables that individually assume the value of one for one particular period in the post-reform period, and zero otherwise. For each on/off dummy variable, this analysis estimates a specific coefficient. The estimation approach allows the effect to evolve over time--e.g. fade out, or gain in strength over the post-reform period. The analysis also considers the sum of all on-off estimates to assess whether there was a significant effect of the reform. Figure 2 illustrates this *temporary* impact of reforms for EU countries with individual dots for each on-off dummy. A red dot refers to the national announcement, a blue dot to the legal framework.

$\sum_{k=0}^{T} Reg_{t-k}^{temp}$	Sum of on/off regulation dummies, ranging from the contemporaneous (k=0) period until the end of the sample T.
$RegA_t^{pers}, RegL_t^{pers}$	Persistent dummy for the announcement (A) and legal framework (L) as stages of implementation, respectively.

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[6] This is based on information provided by individual member jurisdictions as part of the BCBS Regulatory Consistency Assessment Programme (RCAP), and is available on the BCBS's website (https://www.bis.org/bcbs/publ/d452.htm).

Basel III reforms implementation stages: European Union   Figure 2
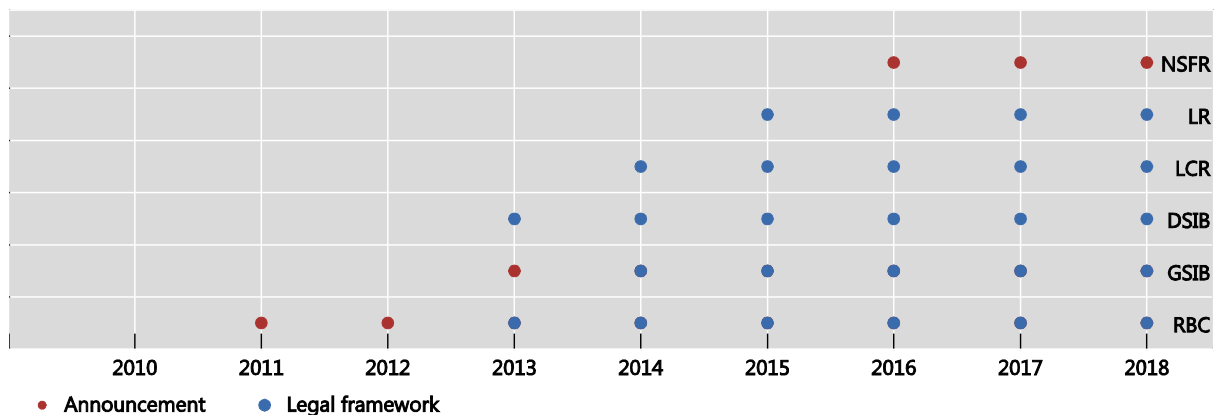
Note: This figure shows two of the national implementation stages as described in the BCBS' RCAP implementation assessment. The link to the underlying public reports is: https://www.bis.org/bcbs/publ/d452.htm.

Source: BCBS

Second, there might be a *persistent* effect on SME lending or on the composition of banks' SME loan portfolios. To map this persistent effect into the analysis, the analysis uses one dummy variable that takes the value of one over the entire post-reform period. As this procedure restricts the coefficient to be the same across periods, the persistent effect could be interpreted as an average effect on either growth rates or SME loans' portfolio shares. Figure 3 illustrates this persistent effect for a few jurisdictions.

Risk-based capital ratio (RBC) implementation stages: FSB jurisdictions   Figure 3
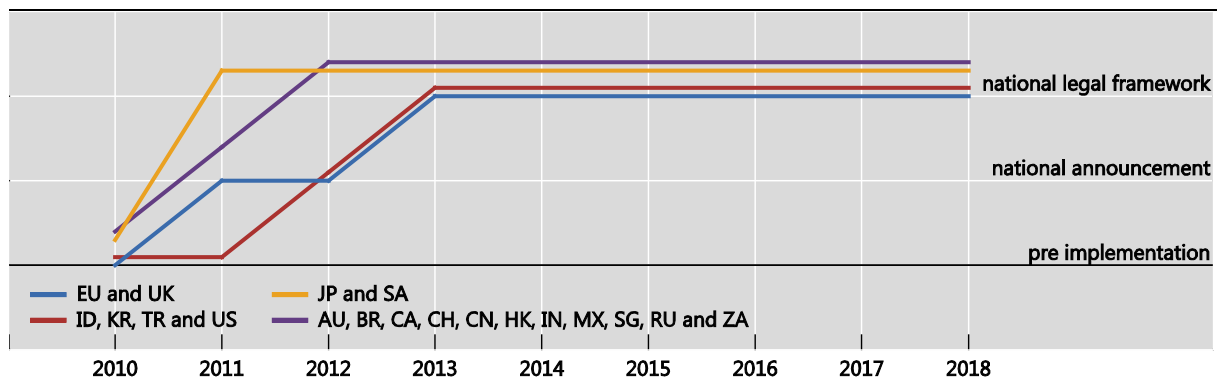
Note: This figure presents two of the national implementation stages as described in the BCBS' RCAP implementation assessment. The link to the underlying public reports is: https://www.bis.org/bcbs/publ/d452.htm.

Source: BCBS

The main conclusions focus on the RBC reform results for several reasons. First, RBC announcement and implementation initiated the sequence of Basel III reforms. Banks might have significantly increased their capital ratios to comply with higher RBC requirements relatively early over the 2011 to 2018 period. In order to meet additional requirements of the other capital-related reforms, like the LR and G-SIB capital surcharge introduced later, few

additional adjustments might have been necessary. Second, before liquidity-related reforms had been announced, several jurisdictions already had in place similar regulations, and this might have reduced the additional adjustments needed to comply with the LCR.

1.3   Identification is a challenge

Cross-sectional heterogeneity and data granularity as the key identification drivers in the analyses. In order to properly identify the reform effects, the empirical analyses must meet a twofold challenge. First, they must be able to *separate bank supply* from SMEs' *demand* effects. Second, they must be able to *isolate reform effects* from other, potentially confounding developments. The core questions that guide the empirical analyses are listed below. Table 2 summarises how the individual analyses can address these questions based on their coverage, data structure and identification strategies either from cross-country or from a single country perspective.

Q1: SME lending by the most affected banks

- Did the relatively more affected banks cut their SME lending in response to the reforms compared to other banks?
- Did those banks reduce their SME loan issuance only temporarily or persistently over the entire post reform period?

Q2: SME vs large firms

- Did the reform effects play out stronger for lending to SMEs than for lending to large non-financial companies?

Q3: Terms and conditions of SME lending

- Did more affected banks re-structure their SME loan portfolio towards longer or shorter maturities?
- Did more affected banks require more *collateral* after reform implementation?
- Did the *costs* of SME financing change?

Q4: Reallocation effects

- Did the composition of borrowing SMEs change over time, e.g. in that relatively more credit was extended to more creditworthy borrowers?

Table 2

Key dimensions and identification tools of the empirical analyses

	Coverage of the estimation sample	**Unit of observation**	**SME outcome variable of interest**	**Demand absorbed by**	**Heterogeneity to proxy reform exposure**
Cross-country analyses					
FSB survey	13 AEs+ 8 EMDEs 2010-2017	Country-time	Aggregate bank lending to SMEs	Macro control variables at the country-time level Separate country and time fixed effects.	Banking system characteristics at the country-time level
Capital IQ	9 AEs+EMDEs 2010-2017	Firm-time	SME debt (total, short term, long term) and investment	Country-by-time fixed effects and firm fixed effects.	Time-varying firm characteristics. Flesh out most affected firms within each country.
ECB SAFE survey	8 euro area members 2010-2016	Firm-time Bank-firm time	SMEs reply being "credit-constrained"	Firm-level control variables and fixed effects (country-by-time or separate country and time).	Time-invariant bank characteristics. Flesh out most affected banks at the euro area level.
BCBS	18 AE+EMDE members 2011-2018	Bank-time	Individual banks' SME loan portfolio	Macroeconomic control variables	At the individual lending bank's exposure to the reforms. Flesh out particularly affected banks at the country level.

AE: Advanced economies

EMDE: Emerging markets and developing economies

Individual country analyses

Supervisory bank reports[7]	Bank-time	Individual banks' SME loan portfolio (total, long term, short term)	Macroeconomic control variables, bank and time fixed effects or bank and region-by-time fixed effects	Individual lending bank's exposure to the reforms
Credit registers	Bank-firm-time	Bank-firm loan relationships (total, short term, long term, collateralised, indicative or charged interest rates)	bank-by-firm fixed effects, and sector-by-time fixed effects	Individual lending bank's exposure to the reforms

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[7]   One within-country analysis used commercial data.

To separate supply and demand factors, the empirical analyses use control variables, fixed effects or an appropriate combination of both absorb the demand side. At the *most aggregate* level, the FSB survey analysis combines macroeconomic control variables with separate country and time fixed effects to control for demand effects. At the *most granular* bank-firm relationship level, fixed effects at the sector-by-time level absorb sector-specific demand effects that vary over time, while bank-firm fixed effects absorb any time-invariant aspects that are unique to a particular bank-customer relationship. Figure 4 illustrates this identification strategy. If two banks are affected differently by the reforms, absorbing any customer-specific demand effects implies that different lending outcomes can be attributed to the reforms.

Identification strategy

Reforms differentially affect banks that show heterogeneous ex-ante exposures.   Figure 4
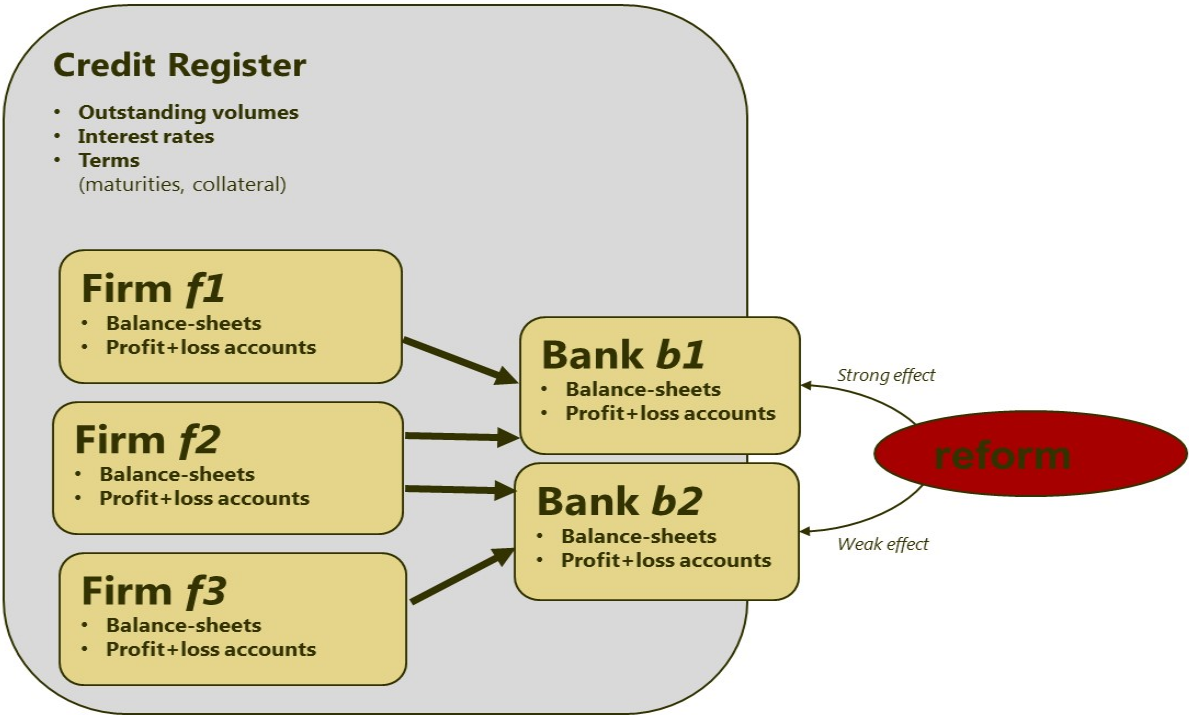
With respect to credit register analyses, firms might have single or multiple customer relationship with banks. To accommodate those single customer relationships that are more prevalent in emerging markets, the common research protocol suggests using sector-by-time fixed effects in order to absorb time-varying demand effects. With respect to balance sheet analyses at the bank level, identification exploits the differential bank exposures and draws on macroeconomic variables and time fixed effects to absorb the demand side.

Source: Authors' illustration

To identify the reform effects, the evaluation looks at different measures of bank's exposure to the reforms. The more granular analyses performed by *individual* jurisdictions draw on bank-level exposures to the reform. To flesh out particularly affected banks, these analyses rank banks by their exposure measure in the pre-reform period and uses a dummy variable to indicate whether a particular bank belonged to the lowest quartile (p25) of the distribution of banks' capital at the national level.

Cross-country studies follow a similar approach. Based on individual bank data, the BCBS analysis ranks banks across countries using the entire cross section. The ECB explores both types of rankings, highlighting particularly exposed banks within and across countries. The FSB survey analysis draws on country-level data and banking system characteristics and ranks banking systems across the FSB jurisdictions covered by the survey. Finally, the analysis based on Capital IQ data constructs proxies of firm-level creditworthiness to highlight those firms most likely to be affected by changes in banks' SME lending behaviour.

The definition of the "exposure measure" based on key characteristics of the banks is used to separate relatively more from relatively less-exposed banks. This is a key part of the evaluation analysis, given that a proper control group of banks that are unaffected by the Basel III reform does not exist. The set of Basel III reforms being examined can covers capital and liquidity requirements. For all bank-level studies, reform-specific balance sheet measures help to disentangle the effects of these different requirements. For instance, Table 3 shows that, to analyse the effects of the RBC reform, the analysis looks at to the ratio of Tier 1 capital over risk-weighted assets.

Table 3

Exposure measures addressing individual Basel III reforms

Reform	$Bank(0/1)_{b,pre}$ exposure variable based on
RBC	Tier1 capital*/RWA
LCR	(Cash + central bank accounts + liquid securities)/TA
G-SIB/D-SIB	Bank assigned as D-SIB or G-SIB
LR	Tier1 capital*/Total Assets

*Note: Some countries use CET1 instead of Tier1 if the data coverage is better.

To sum up, an important caveat to the analysis is that there is no natural control group of completely unaffected entities. Basel III reforms typically apply to all banks in a jurisdiction,[8] which rules out a simple difference-in-difference approach. We address this concern by distinguishing those banks that had been particularly affected by the reforms according to their pre-reform exposure and comparing them to relatively less-affected banks. In addition, it is impossible to pin down an "absolute" reform effect since post-reform trends comingle banks' adjustments with other economic phenomena to which banks respond differently. The empirical analysis can only identify relative effects across banks. Put differently, an insignificant effect for the more exposed banks only indicates that their response was not significantly different from the response of the rest of the banking population, assumed to be "less exposed".

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[8]   In Japan and the US, not all Basel III reforms applied to all banks. Individual satellite analyses take this into account.

2. Cross-country studies

From a top down perspective, four cross-country studies analyse the impact of reforms on SME finance. They draw on multinational data at the country-level (FSB survey); at the firm level (Capital IQ); at the bank-level (BCBS), and at the firm-by-bank-level (ECB), to identify the reform effects. The breadth (number of jurisdictions) and depth (granularity of information) of these studies vary and therefore, taken together, they provide a broad view on SME financing. This will be further complemented by the evidence from individual-country analyses.

2.1 Analysis based on FSB aggregated survey data

For the purpose of this evaluation exercise, a unique dataset on SME financing in 24 jurisdictions has been created.[9] The FSB asked member jurisdictions to provide data on national SME financing characteristics, trends, and drivers based on the SME definition that prevails in their respective jurisdiction. The empirical analysis can handle these systematic differences in coverage and characteristics as long as they are either time-invariant, or correlated with other macroeconomic control variables.

By pooling data from FSB members, this analysis exploits country-level heterogeneity across several dimensions. It exploits heterogeneity in the implementation of reforms, in banking-system characteristics and in macroeconomic and financial conditions to identify the impact of the reforms on SME financing. More specifically, the dataset allows the analysis to shed light on SMEs' access to finance, the maturity structure and price of their borrowing

2.1.1 Data description

The FSB Survey contains annual data for 24 jurisdictions over the 2000-17 period. It describes aggregate bank lending to SMEs with breakdowns by different maturities and average interest rates. It also captures information on total corporate lending.

The FSB dataset is complemented with data on macroeconomic developments and banking system characteristics for each jurisdiction. Nominal effective exchange rates (NEER) and credit-to-GDP gaps are obtained from the BIS, real GDP growth rates from the IMF World Economic Outlook, and aggregate banking system characteristics collected by the Committee on the Global Financial System (CGFS).[10] For countries not included in the CGFS dataset, jurisdiction-level aggregates have been constructed based on bank-level data from the commercial provider SNL-S&P.

After taking heterogeneous reporting practices and data gaps into account, a panel with data for up to 22 jurisdictions that ranges from 2010-17 is used in the empirical analysis[11] (see Table 4).

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[9]   Ultimately, two countries (CN and SA) were dropped as no corresponding banking system control variables seemed to be available.

[10]   CGFS, *Structural changes in banking after the crisis* (January 2018).

[11]   This in an unbalanced panel since not all jurisdictions have information on dependent and control variables in every year.

2.1.2 Adjustments and data cleaning procedure

The variable reported by most jurisdictions is the total of "outstanding bank loans to SMEs" (Table 4). For a subset of countries, it is possible to separate short-term from long-term lending, and to examine other measures of SME financing at the aggregate country level. The empirical analysis below focuses on the full sample of jurisdictions that reported on SME lending. It then looks at a subset of 12 jurisdictions[12] featuring both advanced economies (eight jurisdictions) and emerging markets (four jurisdictions) that reported the short-term and long-term split (the balanced sample). Restricting the sample allows to analyse how the different tenors of SME lending have changed for the set of jurisdictions that provide this data.

Variables have been winsorised at the 5% level in each tail in order to reduce the sensitivity of the regressions to outliers. Nominal amounts were converted into constant US dollars before computing the national growth rates of various SME lending aggregates.

Table 4

FSB survey jurisdictions that are covered by the analysis

Number of countries	2010	2011	2012	2013	2014	2015	2016	2017
Total SME lending	20	21	22	23	24	24	23	21
Total corporate lending	20	21	21	21	22	22	21	19
Short-term SME lending	9	11	10	11	12	12	11	10
Long-term SME lending	9	11	10	11	12	12	11	10
Interest rate-SMEs	14	15	15	16	17	17	18	17
Interest rate-large firms	13	14	14	14	15	15	15	14

For most countries, Figure 5 suggests an increase in the total amount of outstanding SME bank lending between 2002 and 2017. This holds across most advanced and developing countries with the exceptions of Germany and Italy in Europe, for instance. However, when considering SME lending as a share of banks' total corporate loan portfolios (Figure 6), most countries in Europe and Asia-Pacific exhibit constant or slightly declining ratios, while jurisdictions in the Americas show more divergent patterns.

SME lending rates have followed the overall decline in interest rates in most jurisdictions, although they remain consistently above the corresponding rates for larger firms. For a more detailed description of the trends, see section 2 of the consultation report (see Graphs 4 and 5 in the consultation report).

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[12] Not all 21 jurisdictions are included in each analysis. Advanced economies (AU, CA, CH, DE, ES, FR, HK, IT, JP, KR, NL, SG, UK and US); emerging markets and developing economies (AR, BR, ID, IN, MX, RU, TR, ZA). The 12 countries that provided maturity breakdowns are: 4 EMDEs (AR, BR, ID, MX) and 8 AE (DE, ES, FR, IT, JP, KR, NL, SG).

Outstanding bank loans to SMEs

By region, index 2010=100   Figure 5
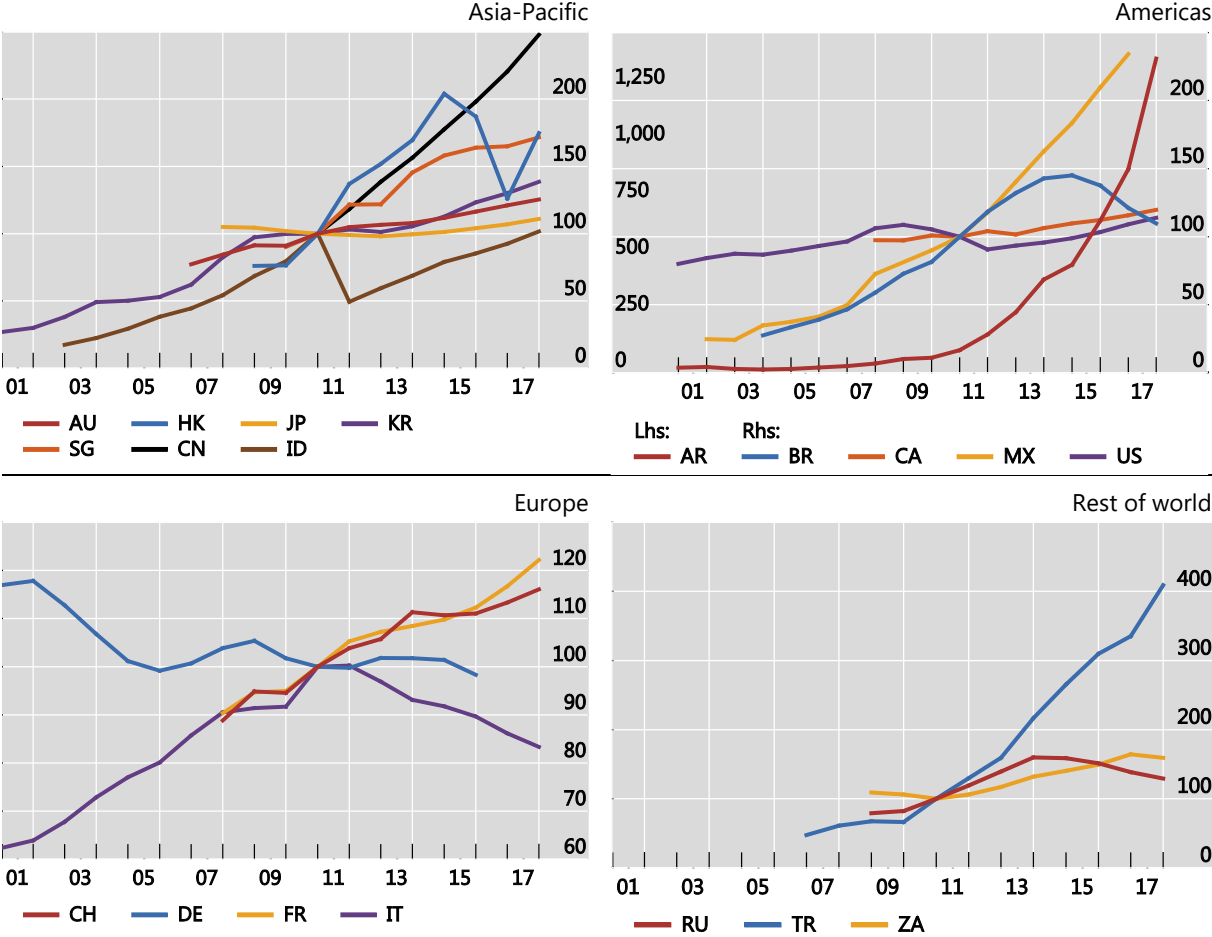
Note: For IT, the SME aggregate refers to bank loans to firms with <20 employees.

Source: FSB questionnaire on SME financing.

Total bank business loans SME/total bank business loans by region

By region, in percent
Figure 6
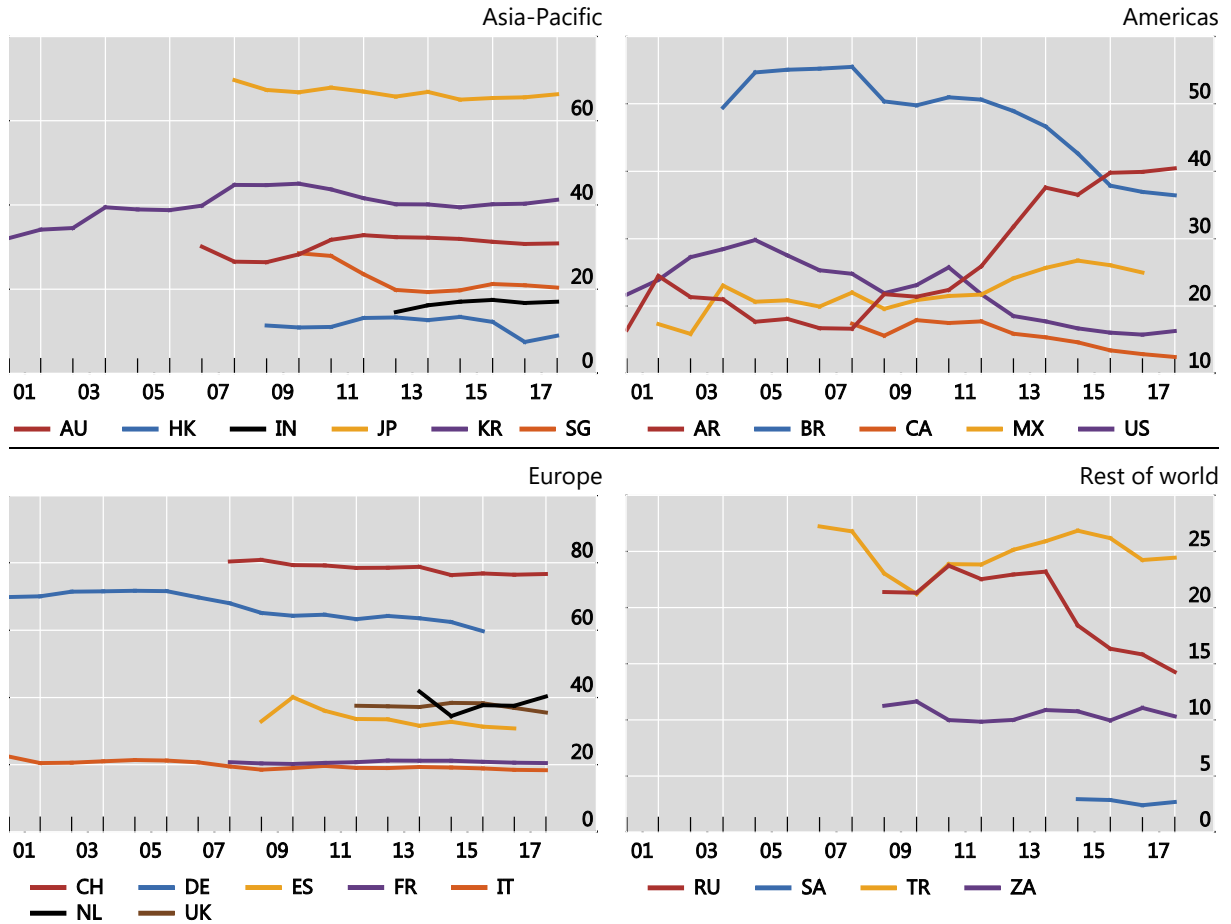
Note: For IT, the SME aggregate refers to bank loans to firms with <20 employees.

Source: FSB questionnaire on SME financing.

2.1.3 *Empirical specification*

Identification challenges are mitigated by exploiting heterogeneity in the jurisdictions' reforms implementation schedules and their different exposures to the reforms. Equations (FSB 1) to (FSB 3) allow for the possibility of reforms having either temporary or persistent effect on SME financing, while comparing jurisdictions classified <u>a priori</u> as more exposed to the reforms relative to less exposed jurisdictions.

$$
\begin{aligned}
\Delta y_{c,t} = & \gamma_B C\_Bank_{c,t-1} + \gamma_C C\_Econ_{c,t-1} + \sum_{k=0}^{2}\left(\beta_{Rk}^{A} RegA_{c,t-k}^{temp}\right) \\
& + \sum_{k=0}^{2}\left(\beta_{RBk}^{A} RegA_{c,t-k}^{temp} * Bank(0/1)_{c,pre}\right) + FE(c,t) + \varepsilon_{c,t}
\end{aligned} \tag{FSB 1}
$$

$\Delta y_{c,t}$	$\Delta\%$ of total, short-term and long-term SME lending, total corporate lending
$Bank(0/1)_{c,pre}$	Indicator of banking system c's pre-reform average exposure measure is **≤ p50**
$C\_Bank_{c,t-1}$	Banking system control variables: bank assets/GDP, liquidity, deposit, capitalization and internationalisation ratio
$C\_Econ_{c,t-1}$	BIS financial cycle and real GDP growth
$RegA_{c,t-k}^{temp}$	On/off reform announcement indicator for lagged period t-k
$FE(c,t)$	Separate country and time fixed effects

In specification (FSB 1), the analysis estimates the effect of regulation on the growth rate of total, short-term and long-term SME lending by banks. To contrast SME lending with total corporate lending, the analysis also explores the reform effects on the growth rate of corporate bank lending (i.e., credit to both SMEs and large firms). Macroeconomic and financial control variables are used to absorb distorting demand effects in each jurisdiction (by using, for instance, the BIS financial cycle measured by the credit-to-GDP and real GDP growth rates), and to control for other banking-system characteristics (bank assets to GDP, aggregate liquidity and international operations of banks). Separate country and time fixed effects pick up time-invariant country specificities and global trends.[13] All results are reported using robust standard errors clustered by jurisdiction.

By fleshing out the temporary effects of regulation, the coefficients of interest β_{rbk}^{A} (k=0, 1, 2) compare the more exposed banking systems with less exposed banking systems. These coefficients are associated with the interaction of two indicator variables: $RegA_{c,t-k}^{temp}$ and $Bank(0/1)_{c,pre}$ that refer to the current announcement period plus lags to highlight jurisdictions that are supposed to be more exposed to the regulation, as illustrated in Figure 2.

For example, in the case of risk-based capital reforms, $Bank(0/1)_{c,pre}$ identifies the most exposed jurisdictions as those with an <u>average aggregate</u> Tier 1 capitalisation ratio during the pre-announcement period that is below the median.[14]

To investigate persistent effects, specification (FSB 2) introduces a set of two persistent dummy variables indicating the national announcement ($RegA_{c,t}^{pers}$) and the publication of the national legal framework ($RegL_{c,t}^{pers}$).[15] Figure 2 illustrates these persistent effects for a set of countries. As relevant outcome variables, specification (FSB 2) considers the relative importance of SME lending (as a share of total credit), the maturity structure of SME lending (long-term lending as

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[13] This precludes us from including the exposed banking system indicator on a standalone basis.

[14] This aggregate capitalisation ratio (tier 1 capital / risk weighted assets) is equivalent to computing the weighted average capitalisation ratio of all banks within a jurisdiction, where the weight for each bank is given by its share of aggregate risk weighted assets. This analysis used p50 as it could only draw on a sample of only up to 22 entities.

[15] It is not always possible to include both dummies in all analyses. In some cases, there is no variation in announcement and publication of legal framework within the sample of jurisdictions that have the necessary data to estimate equations (FSB 2) or (FSB 3).

a share of total SME credit), and the spread of interest rate charged on SMEs relative to large firms.

$$y_{c,t} = \gamma_B C\_Bank_{c,t-1} + \gamma_C C\_Econ_{c,t-1} + \left(\beta_R^A RegA_{c,t}^{pers} + \beta_R^L RegL_{c,t}^{pers}\right)$$
$$+\left(\beta_{RB}^A RegA_{c,t}^{pers} + \beta_{RB}^L RegL_{c,t}^{pers}\right) * Bank(0/1)_{c,pre}$$
$$+FE(c,\ t) + \varepsilon_{c,t} \qquad\qquad\qquad\qquad\qquad\qquad \text{(FSB 2)}$$

$y_{c,t}$	Share of (i) total SME over corporate lending, (ii) long-term over total SME lending
	Spread of interest rate on SME and large firm lending
$Bank(0/1)_{c,pre}$	Indicator of banking system c's pre-reform average exposure measure is $\leq$ p50
$C\_Bank_{c,t-1}$	Banking system control variables: bank assets/GDP, liquidity, deposit, capitalization and internationalisation ratio
$C\_Econ_{c,t-1}$	BIS financial cycle and real GDP growth
$RegA_{c,t}^{pers}$	Persistent reform announcement indicator
$RegL_{c,t}^{pers}$	Persistent legal framework indicator
$FE(c,t)$	Country and time fixed effects

Finally, specification (FSB 3) draws on (FSB 1), but examines whether there was a *persistent* regulation effect on the growth rate of total, short-term and long-term SME lending. Furthermore, it compares SME lending with the growth rate of corporate bank lending.

$$\Delta y_{c,t} = \gamma_B C\_Bank_{c,t-1} + \gamma_E C\_Econ_{c,t-1} + \left(\beta_R^A RegA_{c,t}^{pers} + \beta_R^L RegL_{c,t}^{pers}\right)$$
$$+\left(\beta_{RB}^A RegA_{c,t}^{pers} + \beta_{RB}^L RegL_{c,t}^{pers}\right) * Bank(0/1)_{c,pre}$$
$$+FE(c,\ t) + \varepsilon_{c,t} \qquad\qquad \text{(FSB 3)}$$

To complement other analyses, this survey data contribution also focuses on the four core Basel III reforms, but it resorts to slightly different exposure measures. As described in Table 5, the analysis uses *aggregate* measures of liquidity, leverage, or the market share of the largest banks. In all cases, except for the G-SIB/D-SIB capital surcharge requirements, countries whose aggregate average indicator before the reform announcement was less than or equal to the median are considered as most-exposed countries. In the case of G-SIBs or D-SIBs, countries have been classified as most-exposed if the largest five banks had an average market share before the announcement higher than 60 percent. The underlying assumption is that these countries are most likely to be affected by the G-SIB or D-SIB capital surcharge than countries with less concentrated banking systems.

Table 5

Reform and exposure indicators

Reform	Exposure measures $Bank(0/1)_{c,pre}$ capturing:	Regulation dummies $(RegA_{c,t}^{pers}, RegL_{c,t}^{pers})$
RBC	Tier1 capital/Risk Weighted Assets	
G-SIB/D-SIB	Bank Concentration Ratio (CR5)	Overlaps in some jurisdictions
LCR	(Cash + central bank accounts + liquid securities)/Assets	Overlaps in some jurisdictions
LR	Tier1 capital/Assets	

Table 6

Descriptive statistics

	Mean	SD	Min	p50	Max	n	Countries
Dependent variables							
ΔTotal SME lending	7.0	13.9	-16.9	5.6	37.7	163	22
ΔTotal corporate lending	7.5	12.7	-13.8	6.7	33.7	162	21
ΔShort-term SME lending	2.1	15.8	-37.9	3.7	30.9	79	12
ΔLong-term SME lending	7.3	15.1	-16.8	6.4	47.1	79	12
Long-term SME lending / Total SME lending (share in %)	63.6	21.6	16.6	67.5	108.3	86	13
Total SME lending / Total corporate lending (share in %)	31.6	18.0	10.8	25.7	76.4	158	21
Interest rate spread [small – large firms] (in %)	2.3	2.9	0.1	1.7	11.9	110	15
Banking system controls							
Bank assets / GDP (%)	212.5	186.5	21.5	147.4	829.2	159	22
Bank liquid assets /Assets (%)	16.5	9.2	2.8	13.9	33.9	157	22
Deposit-to-assets ratio (%)	60.2	16.9	14.7	60.9	92.9	159	22

	Mean	SD	Min	p50	Max	n	Countries
Tier1 / Risk weighted assets (%)	13.1	2.3	7.0	12.9	19.4	156	22
Tier1 / Assets (%)	6.9	2.4	0.8	6.4	13.7	156	22
Bank foreign claims / Global foreign claims (%)	4.0	4.7	0.0	1.6	15.7	146	22
Macroeconomic controls							
Credit to GDP gap (%)	0.7	13.4	-51.1	2.2	38.6	176	22
Real GDP growth (%)	2.8	2.6	-3.5	2.4	15.2	176	22

Sources: FSB questionnaire on SME financing, BIS, CGFS, IMF WEO.

Differences in the relative importance and structure of SME financing reveals important cross-country variation that the empirical analysis seeks to exploit. Over the 2010-17 period, total SME and corporate loan issuance exhibit very similar characteristics (Table 6). Both grow at about 7-7.5% on average, with total SME lending revealing to be slightly more volatile. The share of SME lending in banks' total corporate portfolio reaches 32%, on average. Its vast range (11-76%) reflects substantial differences in the relative importance of SME lending across FSB jurisdictions. Within the SME lending segment, long-term lending seems to dominate in most jurisdictions, 64%, on average. Notably, banks charge higher interest rates on SMEs than on other corporate loans across all jurisdictions, with the SME premium ranging from 0.1 to almost 12% in the sample.

2.1.4   Overall Results

This analysis provides some weak evidence for a decline in SME lending growth for the most exposed jurisdictions after the introduction of RBC reforms, the first of the new Basel III regulations to be announced and implemented (see Table 7).

For G-SIB and D-SIB capital surcharges, the analyses considered as "most exposed" those jurisdictions characterised by highly concentrated banking systems. For these jurisdictions, the introduction of G-SIBs/D-SIBs surcharges are associated with an increase in the growth rate of SME lending. However, taking the net effect of the announcement and legal framework, the analysis does not find a significant impact on SME lending when considered as a share of total corporate lending. Likewise, the net effect on interest rates turns out to be insignificant.

Furthermore, this aggregate analysis does not provide conclusive evidence on the effect of the leverage ratio (LR), probably because other capital-related reforms had already induced banks to build up capital. With a stronger capital base, the most exposed banks had been better prepared to also comply with the LR reform, one of the latest in the sequence of all considered Basel III reforms.

Evidence on the LCR reform is also relatively weak, suggesting a temporary acceleration in the pace of short-term lending growth and a more permanent increase in the interest rate spread of SME over total corporate lending.

Table 7

Summary of the FSB survey analysis results

| | | FSB Survey | | | | | | |
| | | ΔTotal SME lending | ΔTotal SME lending | Of which ΔSME lending | Of which ΔSME lending (**long** term) | ΔTotal corporate lending | Total SME/total corporate (share) | SME LT-lending (share) | Interest Rate |
		All obs	Balanced sample	(**short** term)		All obs	All obs	All obs	All obs
RBC	Temporary		- - -²	- - -²	- -²				
	Persistent		- - (A)	- - - (A)	- (A)				
G-SIB	Temporary		-		-²	+²			
	Persistent	++(A)				+(A)²	++ (A) - - - (L)	+++ (A) - - - (L)	
LCR	Temporary			+²					
	Persistent								+(A)
LR	Temporary								
	Persistent								

Note: This overview table refers to specifications (FSB1) for *temporary* effects on growth rates, and (FSB3) for *persistent* effects on growth rates in columns 1-5. Columns 6-8 draw on specification (FSB2) reflecting *persistent* effects on shares. For the *temporary* estimates the following notation is used: "+" occurs if at least one estimated interaction coefficient is significant and positive, "++" if at least half of the estimated interaction coefficients is significant and positive, and "+++" if more than half of the estimated interaction coefficients is significant. Using "-", "--" and "---", respectively, proceeds in parallel for coefficient estimates that are less than zero. For the *persistent* effect analysis models, both Announcement (A) and Legal-Framework (L) are considered if both implementation stages do not coincide. Capital letters (A) or (L) in parenthesis next to the – or +signs indicate statistically significant interaction coefficients of the respective implementation stage.

[2] The sum of coefficients is statistically significant and different from zero.

RBC reforms

Results provide some weak evidence of a negative reform impact on SME lending growth in the most exposed banking systems. When considering the full sample of jurisdictions, the reforms are found to have no differential effects (neither temporary nor persistent) on the pace of SME or total corporate lending. However, when restricting the analysis to a balanced sample of 12 jurisdictions[16] that also reported information on the lending tenor, results suggest both a *temporary* (Table 8, column 2, Bank#Announcement) and *persistent* slowdown in SME lending growth for the most exposed countries (Table 9, column 2 Bank#Announcement). For these jurisdictions, short-term average lending growth (Table 9, column 3) declined relatively more than long-term lending growth (Table 9, column 4) when considering the persistent effect. However, this difference was not strong enough to affect the maturity composition of banks' SME loan portfolio over the post-reform period (Table 7, detailed results not shown). These findings, however, only apply to this particular subset of jurisdictions, featuring both advanced economies (8 jurisdictions) and emerging markets (4 jurisdictions).

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[16] The 12 countries that provided a maturity breakdowns are: 4 EMDEs (AR, BR, ID, MX) and 8 AE (DE, ES, FR, IT, JP, KR, NL, SG).

In addition, equations (FSB 2) and (FSB 3) have been estimated using only the dummy variable indicating the national announcement of the regulation. While the absolute values of coefficient estimates change slightly, the general finding of weak evidence of a decline in SME lending growth for the most exposed jurisdictions after the introduction of RBC reforms remains unchanged.

With respect to total corporate lending, there is no significant impact of the RBC reform. Both temporary (Table 8) and persistent (Table 9) interaction coefficients for total corporate lending growth are insignificant. In addition, the persistent effect on the share of SME lending in total corporate lending (not shown) turns out to be insignificant.

Analysing the spread of SME interest rates over rates charged on larger companies does not provide any significant results, either. The reason could be that both rates move in lockstep and the SME premium remained constant over the entire 2010-2017 period.

The estimated coefficients for the control variables are broadly align with expectations and the literature, thereby corroborating the findings. In particular, more retail-oriented banking systems with higher shares of bank deposit funding see, on average, higher SME lending growth. Also, economic upswings (GDP growth and financial cycle) accelerate the pace of SME financing. More internationalised banking systems see higher SME as well as total corporate lending growth.

Table 8

Temporary effects on growth rates of credit

Dependent Variable:	ΔSME lending (unbalanced)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal (corporate) lending
Announcement_t	-0.712	5.195	-6.811	-6.184	-3.410
	(6.071)	(15.563)	(15.346)	(6.697)	(5.286)
Announcement_t-1	-1.007	3.124	0.076	-5.696	1.301
	(4.975)	(10.833)	(11.017)	(8.913)	(4.482)
Announcement_t-2	-3.148	-3.835	-2.355	-5.854	-1.174
	(3.880)	(6.268)	(3.916)	(8.070)	(4.107)
Bank(0/1)*Announcement_t	-2.222	-12.810*	-16.554**	-7.550	-0.196
	(4.538)	(5.947)	(7.073)	(5.558)	(5.765)
Bank(0/1)*Announcement_t-1	0.090	-13.587*	-16.746*	-9.109*	-1.417
	(5.458)	(6.991)	(8.767)	(5.019)	(4.364)
Bank(0/1)*Announcement_t-2	-3.145	-18.311*	-18.930**	-20.689*	-4.653
	(7.615)	(8.885)	(6.292)	(10.765)	(6.211)
L.C_TA	-0.090***	0.070	0.082	0.100	-0.086**
	(0.025)	(0.083)	(0.063)	(0.097)	(0.031)
L.C_Deposit_Funding	-0.012	1.140*	1.639*	1.370*	-0.040
	(0.500)	(0.615)	(0.749)	(0.715)	(0.518)
L.C_Liquidity	-0.578	-0.547	0.547	-0.437	-0.525
	(0.488)	(0.458)	(0.833)	(0.723)	(0.529)
L.C_Internationalisation	3.131***	3.520***	4.996***	3.074**	3.081***
	(0.785)	(0.804)	(0.957)	(0.991)	(1.001)
L.C_Econ_Financial_Cycle	0.045	0.406***	0.437**	0.334*	-0.026
	(0.183)	(0.119)	(0.170)	(0.171)	(0.280)
L.C_Econ_GDP_Growth	0.919	0.822	0.827**	0.744	0.365
	(0.567)	(0.663)	(0.373)	(0.872)	(0.735)
Sum Coefficients	-5.277	-44.71	-52.23	-37.35	-6.266

Dependent Variable:	ΔSME lending (unbalanced)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal (corporate) lending
F-statistic (joint significance of the interaction terms)	0.153	7.825	8.860	8.379	0.207
(p-value)	0.700	0.0174	0.0126	0.0146	0.654
Observations	147	77	77	77	147
R-squared	0.557	0.693	0.681	0.693	0.532
Number of Countries	21	12	12	12	20

Note: This table shows the estimation results for specification (FSB 1) over the 2010-2017 period. All columns include separate time and country fixed effects, with standard errors being clustered at the country level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 9

Persistent effects on growth rates of credit

Dependent Variable:	ΔSME lending (unbalanced)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal (corporate) lending
Announcement_t	3.045	12.967	-7.770	0.866	2.431
	(7.913)	(17.620)	(11.509)	(6.233)	(6.378)
LegalFramework_t	-0.077	-8.180	-16.010**	-3.478	0.935
	(4.951)	(8.059)	(6.855)	(8.272)	(5.961)
Bank(0/1)*Announcement_t	-5.623	-17.137**	-23.363***	-13.703*	-6.097
	(6.721)	(6.377)	(6.116)	(6.749)	(5.677)
Bank(0/1)*LegalFramework_t	-2.293	14.254	12.049	4.951	-1.226
	(6.217)	(8.559)	(10.583)	(5.562)	(5.251)
L.C_TA	-0.094***	-0.238*	-0.226*	-0.119	-0.090*
	(0.032)	(0.129)	(0.120)	(0.126)	(0.049)
L.C_Deposit_Funding	0.081	1.027*	1.478*	1.240*	0.061
	(0.489)	(0.545)	(0.741)	(0.659)	(0.503)
L.C_Liquidity	-0.450	-0.460	0.658	-0.253	-0.509

Dependent Variable:	ΔSME lending (unbalanced)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal (corporate) lending
	(0.425)	(0.672)	(0.736)	(0.832)	(0.489)
L.C_Internationalisation	3.074***	2.786**	3.603**	2.827*	2.943***
	(0.748)	(1.207)	(1.172)	(1.321)	(0.892)
L.C_Econ_Financial_Cycle	-0.008	0.545***	0.506*	0.356**	-0.070
	(0.191)	(0.143)	(0.254)	(0.157)	(0.288)
L.C_Econ_GDP_Growth	0.757	0.754	0.828	0.667	0.158
	(0.603)	(0.962)	(0.625)	(1.229)	(0.789)
Sum Coefficients	-7.916	-2.883	-11.31	-8.752	-7.324
F-statistic (joint significance of the interaction terms)	1.761	0.0687	0.622	0.802	2
(p-value)	0.200	0.798	0.447	0.390	0.173
Observations	147	77	77	77	147
R-squared	0.555	0.639	0.652	0.621	0.524
Number of Countries	21	12	12	12	20

Note: This table shows the estimation results for specification (FSB 3) over the 2010-2017 period. All columns include separate time and country fixed effects, with standard errors being clustered at the country level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

A host of RBC-focused robustness checks explores whether jurisdictions that have been affected by a macroeconomic crisis exhibit any stronger reforms effects. Table 10 shows the list of robustness specifications controlling for adverse economic conditions, Table 11 outlines the respective findings, while Table 12 provides some selected interaction effects.

Table 10

List of robustness checks

I	**Full and balanced country samples (baseline) while excluding the most *Crisis-hit* countries. [17]**
II	Baseline, while adding a triple interaction of the crisis-hit countries, the regulation indicator and the banking system exposure dummy (Crisis-hit#Reg#Bank(0/1)).
III	Baseline, but substitute the (double) Bank(0/1)# Reg interaction with the (double) Crisis-hit#Reg interaction.
IV	Baseline, but substitute the (double) Bank(0/1)#Reg interaction with the interaction of lagged GDP growth and the regulation indicator.
V	Baseline with a triple interaction (Bank(0/1)#Reg#GDP(-1%)) that captures the potentially amplifying effect of negative GDP growth as signalled by a (time-varying) dummy variable that is one when the real annual GDP growth is -1% or less and zero in all other cases.
VI	Baseline with a triple interaction that captures a time-invariant dummy variable that indicates countries that are in the 50th percentile of real GDP growth for the 2010 to 2017, on average (Bank(0/1)#Reg#GDPp50).
VII	Specification VI, while only keeping the announcement dummies.

The set of robustness checks suggest that the reforms' effects might have been stronger in countries with adverse macroeconomic conditions.

When excluding jurisdictions undergoing a macroeconomic downturn from the balanced sample (specification I, Table 12, top panel), the *temporary* decline interactions for both ST and LT lending retain their significance. Estimating the persistent effects also replicates previous results (not shown).

When including a dummy for these countries (specification II), the main results remain unchanged, with some (weak) indication of an additional negative effect for these jurisdictions.

As a further robustness check, when replacing the banking system exposure by the rate of real GDP growth, a slowdown in SME lending growth emerges for countries with a negative rate of growth (specification IV, Table 12, second panel, GDP growth is however defined in positive terms). This finding suggests that a parallel macroeconomic driver could potentially reinforce the reforms' effect.

Another series of robustness checks further address the potentially reinforcing effect of adverse macroeconomic conditions by adding a triple interaction coefficient. Different indicators have been constructed and interacted. Results on the temporary effects for SME lending remain

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[17]   The selection of these countries is based on the fact that (i) these countries experienced less than -1% annual growth rates of GDP in at least two of the initial implementation periods (2011-2014), and (ii) experienced a banking or currency crisis in the period 2009-2014 as identified by Laeven and Valencia (2018).

unaffected and suggest a decline in SME lending growth after the announcement (specification V, Table 12, bottom panel, double interaction). On the smaller sample, the triple interaction results insignificant. Yet, for the full sample estimation of 21 countries, the temporary triple interaction coefficients (Table 12, bottom panel, first column) turn negative and statistically significant for the most exposed countries with GDP growth rates of -1% or less. In the most exposed jurisdictions where GDP declined over the previous period, the reduction in SME lending growth was hence even stronger. The findings suggest that these reinforcing macro effects are not unique to SME lending (Table 12, bottom panel, last column).

2.1.5 Conclusions

The cross-country analysis on FSB survey data finds some weak evidence of a temporary reduction of SME lending growth after the RBC reforms. The effects emerge for those banking systems which reported relatively lower aggregate capitalisation ratios (i.e. the most exposed banking systems) before the RBC reforms were implemented. The negative effect on lending growth rates is found for both long- and short- term maturities. Yet, the slowdown disappears in a larger sample including jurisdictions which do not provide the maturity breakdown of SME lending. The results show that there is no significant RBC impact on total corporate lending in general.

There are indications of potentially reinforcing effects of macroeconomic developments, in that the slowdown in SME lending growth appears to be more pronounced for those jurisdictions with the lowest GDP growth prior the implementation of RBC reforms. In addition, when explicitly letting the GDP-decline indicator interact with regulation and the pre-reform capitalisation of banking systems indicators, this analysis finds evidence of a reinforcing negative impact on SME lending. The negative impact is however also observable for total corporate lending during periods of negative economic growth rates.

Table 11

Summary of results: RBC reform

		FSB Survey[1]							
		ΔSME lending (unbalance)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal corporate lending	Total SME/total corporate (share) All obs	SME LT-lending (share) All obs	Interest Rate All obs
RBC baseline	Temporary		- - -²	- - -²	- -²				
	Persistent		- - (A)	- - - (A)	- (A)				
I. Excluding 3 crisis-hit countries.	Temporary			-	-				
	Persistent		- (A)	- - (A) + (L)	- (A)				+²
II. Dummy (AR,ES, IT)	Temporary		- - -²	- - -²	-²				
	Persistent		- - (L)	- - (A) ++ (L)					
	Trans-c Pers-c	-	-	-	-	-	+		
III. Dummy (AR,ES, IT)-No bank exposure	Temporary	-²	-²	-²	-²	-²			
	Persistent		- - (A)²	- - (A)²	- - (A)²				
IV.GDP	Temporary		+++²	++²	+²				
	Persistent		++ -	+++² - -				+++(A)²	
V. GDP (-1%)	Temporary		-²	- -²	-²				
	Persistent		- (A)	- (A)	- (A)		+		
	Trans-c	-				-			
	Pers-c		+ (A)		+ (A)				
VI. GDP (p50)	Temporary	-	- - -²	- - -²	- - -²				
	Persistent		- - (A) +++ (L)	- - - (A) +++ (L)	- - (A) +++ (L)		+²		+²
	Trans-c	+	- +	-	- - +				
	Pers-c	- - (A)	- - - (L)	- - - (L)	- - - (L)	- - (A)			
VII.	Temporary	-	- - -²	- - -²	- - -²				
	Persistent	+	- -	- - -	-		+		

GDP (p50) / L					
	Trans-c	+	- +	-	- - +
	Pers-c	- - -			- -

Table 12

RBC: Robustness to macroeconomic conditions (double and triple interactions)

		ΔSME lending (unbalance)	ΔSME lending (balanced)	Of which Δshort term SME lending	Of which Δlong term SME lending	ΔTotal (corporate) lending
I Excluding 3 crisis-hit countries	*Temporary*					
	Bank(0/1)*Announcement_t	-3.471	-10.342	- 27.507***	- 11.595**	2.984
		(5.865)	(6.844)	(7.613)	(5.027)	(7.127)
	Bank(0/1)*Announcement_t-1	-5.617	0.798	-11.945	-5.316	0.014
		(6.277)	(10.111)	(12.631)	(6.426)	(4.896)
	Bank(0/1)*Announcement_t-2	2.587	5.596	-6.361	5.626	0.583
		(6.066)	(10.235)	(12.645)	(11.118)	(5.585)
IV Real GDP growth	*Temporary*					
	L.GDP_Growth*Announcement_t	0.219	4.638**	5.200**	4.004*	1.303
		(1.052)	(1.750)	(1.897)	(1.953)	(1.237)
	L.GDP_Growth*Announcement_t-1	-0.091	1.987*	3.292	1.055	0.475
		(1.507)	(1.038)	(2.516)	(0.769)	(0.991)
	L.GDP_Growth*Announcement_t-2	1.522	3.174*	4.789***	3.264	1.691
		(1.572)	(1.667)	(1.133)	(2.554)	(1.539)
V. Real GDP growth dummy (-1%)	*Temporary*					
	Bank(0/1)*Announcement_t	-1.900	-10.220	-16.769*	-3.699	-0.154
		(4.755)	(7.080)	(7.911)	(7.020)	(5.902)
	Bank(0/1)*Announcement_t-1	-1.157	-14.160*	-15.498	-10.686*	-2.382
		(5.725)	(7.396)	(9.003)	(4.909)	(4.592)
	Bank(0/1)*Announcement_t-2	1.282	-15.749	-15.733**	-18.194	0.307
		(8.062)	(9.434)	(6.009)	(11.231)	(6.359)
	GDP(-1%, 0/1) *Bank(0/1)*Announcement_t-1	2.782	0.289	-4.115	2.740	4.257
		(5.208)	(5.238)	(6.783)	(6.955)	(6.060)
	GDP(-1%, 0/1) *Bank(0/1)*Announcement_t-2	-20.869**	-7.701	-8.799	-7.736	-17.163**
		(7.403)	(7.509)	(5.885)	(10.491)	(7.145)

Note: This table shows the estimation results for robustness checks presented in Table 10. It only presents the interaction effects. All columns include separate time and country fixed effects, with standard errors being clustered at the country level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

2.2 Capital IQ Analysis

The analysis on Capital IQ (CIQ), a commercial data source, data complements the other analyses by looking at real sector outcomes in terms of debt and investment. SMEs facing financial constraints might have needed to adjust their business, cut investment and restructure their balance sheets when. These financial constraints might arise from a decline in banks' willingness to provide SME financing. The study adopts a cross-country perspective and considers different macroeconomic developments. As CIQ provides firm-level data on SMEs as well as larger companies, the analysis can compare real sector outcomes to analyse whether there was a unique SME effect in response to the Basel III bank regulation package. Identification is obtained by exploiting firm-level heterogeneity and cross-country differences in the implementation stages.

2.2.1 Data description

The CIQ dataset contains balance-sheet information of firms located in different countries for the period 2002 to 2017. In order to avoid distorting effects from the crisis period, the estimation sample is restricted to the years 2010-2017.

2.2.2 Adjustments and data cleaning procedure

The coverage of firms, in particular SMEs, varies across jurisdictions. Some jurisdictions reported less than 50 SMEs per year on average. Hence, constructing the sample implies trading off the benefits from a larger overall sample with more observations against the representativeness of the national firm-level data. In the end, the sample captures only those jurisdictions with at least 100 SMEs per year. In doing so, the retrieved sample of 22 jurisdictions reduces to a sample of nine countries. Table 13 presents the number of firms per country that enter the analysis in each year.

Table 13

Capital IQ firm-level coverage by country

Country	2010	2011	2012	2013	2014	2015	2016	2017	Full period
CA	135	145	141	130	123	138	133	115	1060
DE	1006	1161	1125	1105	1065	842	727	223	7254
ES	16385	17818	16322	15888	15873	15837	14702	6537	119362
FR	403	785	1676	7011	7443	7693	6188	3660	34859
GB	4253	5349	5643	5865	6008	6012	5577	3895	42602
IT	19385	21057	19999	19457	17333	18867	18087	14134	148319
US	330	379	357	357	348	318	292	247	2628
JP	30	38	39	16627	38420	41995	42443	38565	178157
KR	2687	3127	3309	3301	2086	2361	4068	3626	24565
Total	44614	49859	48611	69741	88699	94063	92217	71002	558806

Source: Capital IQ.

As CIQ's coverage of firms still varies substantially, the empirical analysis uses a weighted regression method. The idea is to reduce the weight of the data from firms from well-covered

countries and give more prominence to firms in less well-covered countries. Further, the analysis restricts the sample to those firms that provide breakdowns of their debt into a long-term and a short-term component, and which reveal information on their total fixed assets, in order to capture investment.

The following steps prepare the data for the empirical analysis. First, in order to avoid distorting effects from exchange rate fluctuations and inflation rates, all balance-sheet items are converted into USD using the average effective exchange rate between the local currency and USD over the year 2007 as collected by the BIS.[18] Then, to account for varying inflation rates across countries, these values are deflated using the GDP deflator provided by the IMF[19] for a broad set of countries. Firms report balance sheets variables on an annual basis; log changes are computed to obtain annual growth rates, used in the empirical analysis.

Second, in order to reduce the sensitivity of the regressions to outliers, the dependent as well as the explanatory variables are winsorised. All observations for which percentage changes (based on log-differences) of the dependent variable (total debt, long-term debt, short-term debt, total fixed assets) exceed 100% in absolute value are set to 100%; ratios of long-term debt in total debt exceeding 100% are dropped. Then, the explanatory variables are winsorised at the 2.5% level in each tail. Finally, this analysis keeps only firms in the sample that report figures for all variables in at least three consecutive years.[20]

For each country, Figure 7 shows the evolution of the median firm's total debt and total fixed assets, respectively. Overall, no clear patterns emerge, which points to the need of a more sophisticated empirical analysis. Note that significant changes from one period to the next, like in the case of Japan, may originate from changes in the underlying firm sample.

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[18]　The database is available at https://www.bis.org/statistics/eer.htm.

[19]　The IMF World Economic Outlook Database is available at https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index.aspx.

[20]　This means that all variables for firm f at time t report values that are within the corresponding boundaries.

EU

Non-EU

USD mn

USD mn

EU

Non-EU
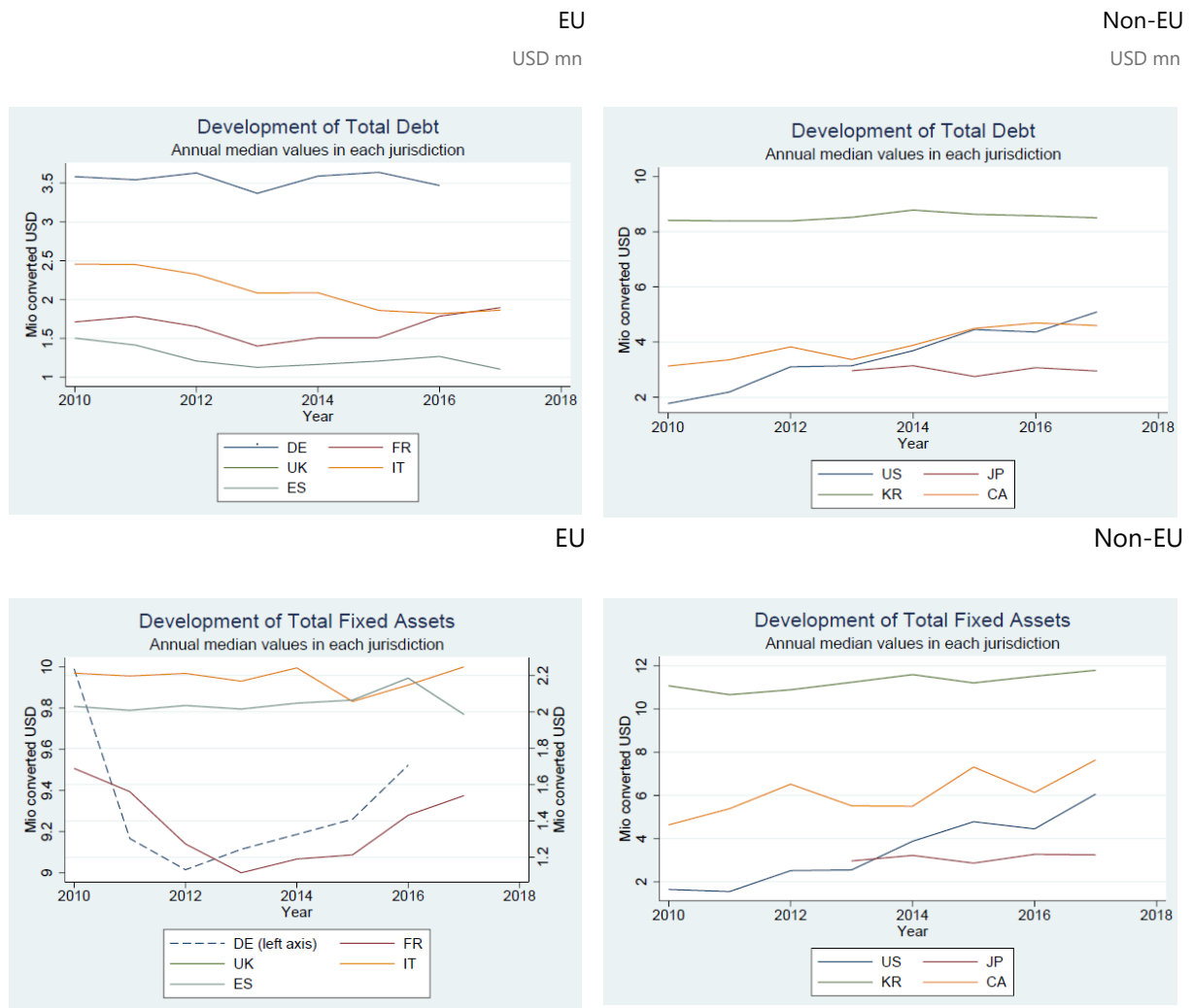
Source: Capital IQ

2.2.3 *Empirical Specification*

The baseline specification (CIQ 1) exploits heterogeneity across firms and countries to identify the impact of regulatory reforms on SME financing.

$$Y_{f,c,t} = \beta \ \ Firm(0/1)_{f,c,t-1} + \left(\beta_{RF}^A RegA_t^{pers} + \beta_{RF}^B RegL_t^{pers}\right) * Firm(0/1)_{f,c,t-1}$$

$$+\beta_F C\_Firm_{f,c,t-1} + FE(f,c\#t) + \varepsilon_{f,c,t} \qquad\qquad \text{(CIQ 1)}$$

With

$Y_{f,c,t}$	Δln in total, short-term and long-term debt, total fixed assets (in %)
	Long-term debt ratio (long-term debt to total debt)
$RegA_t^{pers}$	RBC, LCR, LR and G-SIB, persistent announcement indicator
$RegL_t^{pers}$	RBC, LCR, LR and G-SIB, persistent legal framework indicator
$Firm(0/1)_{f,c,t-1}$	Above-median indicators of firm characteristics at the country-year level.
$C\_Firm_{f,c,t-1}$	ln size, current ratio, equity ratio, ROE as continuous controls
$FE(f, c\#t)$	Firm and country-by-time firm fixed effects

The dependent variable captures changes in total debt, long-term debt, short-term borrowing, and tangible fixed assets, as well as the ratio of long-term debt to total debt.

We construct several indicator variables $Firm(0/1)_{f,c,t-1}$ that switch to the value of one if a firm exhibits, for instance, a profitability level above the median of its country-level peers in a given year. These firm characteristics include logged total assets and measures of firm liquidity (ratio of current assets to current liabilities), leverage (ratio of equity to total assets) and profitability (the ratio of earnings before taxes to equity).

The interaction terms of these firm indicators with the regulation dummies serve as the key identification strategy. In order to assess whether the effect of regulation is significant, while taking into account that the regulatory impact might play out differently for different firms, the analysis focuses on the coefficient estimates of β_{rf}. Unless they coincide, this approach takes both implementation stages (announcement and legal framework) into account.

We add a parallel set of lagged firm-level control variables $C\_Firm_{f,c,t-1}$. It is important to note that they are not collinear. While the indicator $Firm(0/1)_{f,c,t-1}$ fleshes out specific firms at the country-time level with a relevant borrower characteristic, $C\_Firm_{f,c,t-1}$ controls for remaining individual firm-level characteristics. Including them jointly in the specification takes potential non-linearities of the covariates into account. Further, the analysis interacts the firm indicator $Firm(0/1)_{f,c,t-1}$ with the reform dummy to facilitate the interpretation of post-reform effects.

We add firm fixed effects to absorb time-invariant firm heterogeneity, and country-by-time fixed effects to absorb any country-specific macroeconomic variation. These country-by-time fixed effects do not allow for a joint inclusion of the regulation indicator. In all specifications, this analysis clusters standard errors at the country-by-sector level.

Table 14 provides some descriptive statistics on the estimation sample. The figures provide an indication that long-term debt is the dominating financing source for SMEs. On average, the amount of outstanding long-term is 50% higher than the amount of outstanding short-term borrowing. In the sample period, short-term borrowing experiences higher growth rates than long-term debt, indicating that short-term loans might have become more important for the SMEs included in the estimation sample.

Table 14

Descriptive statistics

	Description	N	Mean	Sd	Min	Max
Dependent Variables						
Long-Term Debt	Outstanding long-term debt in US$ mn	558,806	2.726	10.896	0.00001	3149.65
Short-Term Borrowing	Outstanding short-term borrowing in US$ mn	558,806	1.789	5.099	0.000	2098.42
Total Debt	Outstanding total debt in US$ mn	558,806	4.620	13.380	0.00001	3161.825
Total Fixed Assets	Total fixed assets in US$ mn	558,806	5.942	34.693	0.000	17514.52
ΔY_LTD	Growth of long-term debt in % (log changes)	558,806	13.731	54.661	-100	100
ΔY_STD	Growth of short-term debt in % (log changes)	558,806	32.708	55.434	-100	100
ΔY_TDebt	Growth of total debt in % (log changes)	558,806	7.955	43.754	-100	100
Y_LTDRatio	Share of long-term debt in total debt	558,806	57.892	32.137	0.0001	100
ΔY_TotalFA	Growth of total fixed assets in % (log changes)	558,806	5.830	29.544	-100	100
Firm Controls						
Ln(TA)	log of Total Assets in US$	558,806	15.966	0.902	3.689	23.619
Firm_Current_Ratio	Ratio of current assets to current liabilities in %	558,806	1.735	1.444	0.003	57.775
Firm_Equity_Ratio	Equity ratio in %	558,806	29.009	22.774	-100	97.028
Firm_ROE	Profit before taxes over equity in %	558,806	0.082	0.406	-8.570	9.247

Source: Capital IQ.

2.2.4   Results

This analysis studies the persistent effects of Basel III regulatory reforms on SME financing and investment. The analysis focuses on four Basel III reforms: RBC, G-SIB/D-SIB capital surcharges, LCR, and LR.

In principle, the analysis considers persistent effects of two main implementation steps: the national announcement and the publication of the country-specific legal framework. Among the reforms and countries considered, only for the RBC there is sufficient variation in thee implementation stages for the empirical analysis to yield meaningful results (Figure 2). Further, the RBC reform was the first to be implemented and it is possible that the persistent effects for the RBC captures also the effects of reforms announced and implemented at later stages. The

focus is hence on the RBC effects, implicitly acting as a proxy for the full set of Basel III reforms. Table 15 summarises the results for all considered reforms.

Table 15

Summary of Capital IQ analysis results

		Long-Term Debt	**Short-Term Borrowing**	**Total Debt**	**Long-Term Debt Ratio**	**Total Fixed Assets**
Full Sample						
RBC	Announcement	ns	ns	ns	ns	ns
	Legal Framework	Liquidity: - Capital: + Profits: +	ns	Capital: +	Size: +	ns
G-SIB	Announcement	ns	ns	ns	ns	ns
LCR	Announcement	ns	ns	Capital: +	ns	ns
LR	Announcement	ns	Size: +	ns	Capital: +	Profits:+
EU Sample						
RBC	Announcement	Profits: -	Capital: +	Capital: +	Liquidity: -	Size: - Liquidity: +
	Legal Framework	Capital: + Profits: +	ns	Capital: + Profits: +	Size: +	Capital: + Profits: +
G-SIB	Announcement	Capital: + Profits: +	Profits: +	Capital: + Profits: +	Size: +	Capital: + Profits: +
LCR	Announcement	Capital: +	Size: + Profits: +	Capital: + Profits: +	Size: +	Capital: + Profits: +
LR	Announcement	Size: + Capital: +	Size: +	Capital: +	Size: + Liquidity: -	Liquidity: + Capital: + Profits: +

Note: This table summarises the findings based on specification (CIQ 1) across all reforms and outcome variables at the firm level. It considers both *persistent* effects of the announcement and legal framework implementation stages. Only the estimates on the interaction coefficients with firm characteristics (like liquidity, capitalisation and profitability) are presented. Both samples cover the 2010-17 period. All columns include separate firm and country-by-time fixed effects, with standard errors being clustered at the country-by-sector level. "ns" means that the result is not statistically significant at the usual confidence levels. The table should be interpreted as follows: e.g. "Liquidity: –" in the "RBC – Legal framework" row, "Long-Term Debt" column, means that after the legal framework for RBC was implemented, the most liquid SMEs experienced a decrease in long term debt, after controlling for confounding factors.

RBC Reforms

The results provide evidence that after the RBC reforms the beneficial effects - in terms of access to financing - of specific SME characteristics are stronger. Before the reforms, the firm indicator variables suggest that better-capitalised firms borrow more in general. Further, more liquid assets (higher current ratio) go together with more investment, higher short-term and lower long-term growth rates of debt, although these firms, on average, still exhibit higher long-term debt ratios. More profitable SMEs in terms of ROE also tend to invest more.

Table 16

Estimation Results on the RBC reform

VARIABLES	Baseline					EU (DE,ES,FR,IT,UK)				
	ΔLTD	ΔSTD	ΔTdebt	LTD Ratio	ΔTFA	ΔLTD	ΔSTD	ΔTdebt	LTD Ratio	ΔTFA
Reform#Firm(0/1)										
ANN(0/1)*F_lnTA(0/1)	7.930	1.811	2.127	2.147**	-0.842	2.198	-0.768	1.326	0.796	-1.708**
	(5.152)	(3.662)	(4.280)	(0.851)	(1.560)	(1.756)	(1.273)	(1.598)	(0.602)	(0.748)
ANN(0/1)*F_CurrRatio(0/1)	-2.242	1.511	-0.593	-1.317	1.164	1.117	1.814	-0.446	-1.538**	1.643***
	(2.281)	(1.504)	(3.171)	(1.214)	(1.858)	(1.725)	(1.067)	(1.342)	(0.660)	(0.534)
ANN(0/1)*F_Equity(0/1)	-4.176	0.546	-1.577	-0.024	-0.325	1.188	1.930*	3.108***	-0.360	0.873
	(4.649)	(2.130)	(2.840)	(0.797)	(1.691)	(1.538)	(1.077)	(1.049)	(0.355)	(0.807)
ANN(0/1)*F_ROE(0/1)	-4.602	1.844	0.437	0.689	0.150	-3.325*	-0.443	-0.537	-0.513	0.410
	(3.901)	(2.397)	(2.629)	(1.244)	(1.744)	(1.856)	(0.874)	(1.138)	(0.552)	(1.346)
LEG(0/1)*F_lnTA(0/1)	1.089	-0.024	1.512	1.139**	-0.038	0.211	0.881	-0.058	0.548	-0.190
	(2.905)	(1.669)	(2.339)	(0.476)	(1.412)	(0.933)	(0.954)	(1.208)	(0.341)	(0.697)
LEG(0/1)*F_CurrRatio(0/1)	-4.350*	1.518	-2.343	-0.872	0.987	-2.420	-0.775	-1.417	-0.354	0.588
	(2.319)	(1.962)	(1.703)	(0.867)	(0.976)	(1.457)	(0.844)	(1.330)	(0.511)	(0.736)
LEG(0/1)*F_Equity(0/1)	3.793*	-0.977	3.918**	-0.334	2.140	5.013***	0.331	3.117**	0.046	1.488***
	(2.007)	(1.752)	(1.905)	(0.661)	(1.370)	(1.231)	(0.985)	(1.132)	(0.332)	(0.515)
LEG(0/1)*F_ROE(0/1)	3.761**	-1.860	1.871	0.005	0.326	2.973***	1.850	1.946**	-0.073	1.206*
	(1.670)	(2.219)	(1.516)	(0.574)	(1.106)	(0.739)	(1.089)	(0.879)	(0.285)	(0.685)
Firm										
F_lnTA	-13.742***	-5.362**	-16.889***	-1.110	-17.967***	-18.168***	-14.384***	-21.231***	-1.090	-18.363***
	(1.684)	(2.004)	(1.399)	(0.725)	(1.589)	(1.361)	(1.467)	(1.740)	(1.095)	(1.581)
F_CurrRatio	-0.938*	1.018**	0.560*	0.462	2.230***	-4.534***	0.022	-0.616	0.776***	1.764***
	(0.544)	(0.409)	(0.289)	(0.291)	(0.350)	(0.590)	(1.132)	(0.587)	(0.239)	(0.375)

VARIABLES	Baseline					EU (DE,ES,FR,IT,UK)				
	ΔLTD	ΔSTD	ΔTdebt	LTD Ratio	ΔTFA	ΔLTD	ΔSTD	ΔTdebt	LTD Ratio	ΔTFA
F_Equity	0.914***	0.333	1.290***	-0.013	0.551***	70.696***	33.873***	68.477***	0.052	13.683***
	(0.198)	(0.256)	(0.194)	(0.210)	(0.095)	(9.534)	(7.633)	(9.504)	(2.941)	(2.803)
F_ROE(0/1)	-0.234	-0.251	-0.170	-0.044	0.597	0.408	1.405*	0.855	0.093	1.102***
	(0.596)	(0.326)	(0.768)	(0.214)	(0.683)	(0.984)	(0.767)	(0.535)	(0.169)	(0.264)
Firm(0/1)										
F_lnTA(0/1)	-9.281	-5.674	-5.494	-2.883**	-2.929	-3.377*	-2.405*	-3.784**	-1.677***	0.761
	(5.903)	(3.525)	(4.635)	(1.098)	(2.387)	(1.825)	(1.276)	(1.697)	(0.540)	(0.839)
F_CurrRatio(0/1)	-9.073***	7.035**	3.678	4.479***	5.021*	-14.562***	0.353	-2.718	3.732***	2.115**
	(2.422)	(2.778)	(2.398)	(1.560)	(2.822)	(2.892)	(3.089)	(1.981)	(0.796)	(0.819)
F_Equity(0/1)	17.411**	5.771**	16.008***	-0.700	1.395	-2.687	-1.222	-3.019*	0.478	-2.144**
	(6.565)	(2.584)	(3.841)	(0.697)	(2.479)	(2.050)	(1.065)	(1.475)	(0.462)	(0.986)
F_ROE(0/1)	5.258	3.183	2.213	-0.189	3.471**	5.472***	2.625***	4.398***	1.161**	3.147***
	(4.280)	(2.872)	(2.446)	(1.515)	(1.701)	(1.393)	(0.819)	(1.175)	(0.417)	(0.963)
Observations	558,806	558,806	558,806	558,806	558,806	352,396	352,396	352,396	352,396	352,396
R-squared	0.407	0.529	0.396	0.770	0.434	0.446	0.443	0.397	0.816	0.434
Countries	9	9	9	9	9	5	5	5	5	5

Note: This table shows the estimation results for specification (CIQ 1) over the 2010-2017 period for the RBC reform. It considers both *persistent* effects of the announcement and legal framework implementation stages. Δ*LTD* (Δ*STD)* refers to the growth rated of long-term (short-term) debt, while Δ*Tdebt* indicates the growth rate of total debt. *LTD ratio* is used for the long-term debt ratio on levels and Δ*TFA* is the growth rate of total fixed assets, our proxy for investment. All columns include separate firm and country-by-time fixed effects, with standard errors being clustered at the country-by-sector level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Overall, the RBC effect seems to unfold only after the legal framework was published in individual countries (Table 16). By contrast, the announcement hardly reveal any significant effects. The firm*reform interaction coefficients show that more profitable and better capitalised firms raise their long-term funding faster after the reforms where implemented. In the case of better capitalised firms, the increase in long-term debt is reflected in that of total debt. There is no equivalent rise in short-term borrowing, while the long-term debt ratio remains unaffected. The results also show that firms with more liquid assets (higher current ratio) cut their long-term borrowing in the aftermath of the RBC implementation.

EU-member countries clearly drive the aggregate results before and after the reform. Specifically, in the post-reform period, better-capitalised and more profitable borrowers raise their long-term borrowing faster. Total fixed assets also grow at a faster pace, suggesting that more creditworthy borrowers use long-term funds to fund investments.

When turning to non-EU countries (Canada, Japan, Korea, US), the previous findings disappear. It is however worth noting, that Japan and the US did not adopt Basel III reforms for all banks in their banking system. By contrast, all EU countries in the sample apply Basel III reforms to their entire bank population.

When adding large firms to the estimation sample, the results on the creditworthiness hardly change. Estimations on this extended sample, however, suggest that firms with more liquid assets borrow less from banks after reforms entered into force.

In sum, the comparison suggests that the Basel III effects played out similarly for both SMEs and larger companies and that the EU countries in the sample are driving the overall results.

LCR reforms

For the LCR, in many of the countries considered the announcement and the legal framework publication coincided, both taking place after the RBC implementation stages. Probably also for this reason, the findings on the LCR effects partly replicate the effects found for the RBC.

After the LCR announcement, better-capitalised firms exhibit more borrowing relative to their other firms. Again, EU countries drive this finding. For firms in these countries, there is a positive impact of firm capitalisation on long-term and total borrowing, which is also reflected in higher investment rates. For more profitable firms, short-term funding seems more important, also boosting overall debt growth and investment. However, other confounding factors like the ECB's unconventional monetary policy measures (or the SME supporting factor) might contribute to this finding.

Again, for the set of non-EU countries no significant patterns emerge (Table 17).

Table 17

Estimation results on the LCR reform

VARIABLES	Baseline					EU (DE,ES,FR,IT,UK)				
	LTD	STD	Tdebt	LTD Ratio	TFA	LTD	STD	Tdebt	LTD Ratio	TFA
Reform#Firm(0/1)										
ANN(0/1)*F_lnTA(0/1)	0.044	1.165	-1.785	0.982*	-0.840	1.029	1.210*	0.372	0.818**	-0.504
	(1.602)	(0.844)	(1.417)	(0.581)	(1.383)	(0.887)	(0.591)	(0.947)	(0.319)	(0.536)
ANN(0/1)*F_CurrRatio(0/1)	-1.330	-0.528	-0.557	-0.717	1.304	-1.078	0.116	-1.741	-0.631	0.626
	(2.355)	(1.761)	(1.459)	(0.933)	(1.308)	(1.860)	(0.893)	(1.209)	(0.401)	(0.600)
ANN(0/1)*F_Equity(0/1)	1.319	0.384	3.448*	0.273	0.126	4.579***	0.169	3.683***	0.502	2.012***
	(3.083)	(1.293)	(1.732)	(0.604)	(1.509)	(1.382)	(1.155)	(1.154)	(0.380)	(0.461)
ANN(0/1)*F_ROE(0/1)	0.458	-1.670	0.444	-0.058	0.391	1.699	1.368*	1.327**	-0.081	1.558***
	(3.007)	(1.895)	(1.594)	(0.777)	(0.716)	(1.224)	(0.726)	(0.642)	(0.389)	(0.473)
Firm										
F_lnTA	-13.910***	-5.382**	-16.875***	-1.145	-17.945***	-18.308***	-14.378***	-21.281***	-1.129	-18.347***
	(1.726)	(2.004)	(1.415)	(0.734)	(1.600)	(1.321)	(1.482)	(1.764)	(1.102)	(1.563)
F_CurrRatio	-0.923	1.021**	0.572*	0.467	2.235***	-4.557***	0.018	-0.616	0.774***	1.763***
	(0.554)	(0.406)	(0.288)	(0.289)	(0.352)	(0.599)	(1.131)	(0.587)	(0.237)	(0.371)
F_Equity	0.934***	0.337	1.293***	-0.010	0.554***	70.605***	33.909***	68.500***	-0.049	13.667***
	(0.204)	(0.254)	(0.194)	(0.209)	(0.096)	(9.458)	(7.620)	(9.465)	(2.972)	(2.839)
F_ROE(0/1)	-0.192	-0.252	-0.168	-0.047	0.594	0.459	1.412*	0.875	0.099	1.114***
	(0.625)	(0.317)	(0.761)	(0.201)	(0.685)	(0.983)	(0.762)	(0.530)	(0.170)	(0.269)
Firm(0/1)										
F_lnTA(0/1)	-1.994	-4.733***	-1.739	-0.843	-3.220	-1.797	-3.103***	-2.790***	-1.048**	-0.604
	(2.391)	(1.576)	(1.343)	(0.977)	(1.989)	(1.350)	(0.919)	(0.819)	(0.429)	(0.709)
F_CurrRatio(0/1)	-13.261***	9.618***	1.845	3.143***	5.968***	-14.571***	1.402	-3.150	2.479***	3.612***

	Baseline					EU (DE,ES,FR,IT,UK)				
VARIABLES	LTD	STD	Tdebt	LTD Ratio	TFA	LTD	STD	Tdebt	LTD Ratio	TFA
	(2.451)	(3.168)	(1.849)	(0.810)	(1.545)	(3.286)	(2.743)	(1.983)	(0.596)	(0.656)
F_Equity(0/1)	15.639***	5.428***	15.455***	-1.087**	2.482	-0.836	0.586	-0.189	-0.058	-1.456**
	(4.455)	(1.394)	(2.717)	(0.516)	(1.901)	(1.363)	(0.905)	(1.311)	(0.254)	(0.628)
F_ROE(0/1)	3.696	4.374**	3.664**	0.455	3.592***	3.579***	2.703***	4.477***	0.718***	3.491***
	(3.187)	(1.752)	(1.630)	(0.846)	(1.003)	(0.967)	(0.487)	(0.582)	(0.221)	(0.339)
Observations	558,806	558,806	558,806	558,806	558,806	352,396	352,396	352,396	352,396	352,396
R-squared	0.407	0.529	0.396	0.770	0.434	0.445	0.443	0.397	0.816	0.434
Countries	9	9	9	9	9	5	5	5	5	5

Note: This table shows the estimation results for specification (CIQ 1) over the 2010-2017 period for the LCR reform. It considers only the *persistent* announcement effect as announcement and legal framework (almost) coincide in many jurisdictions and did not provide a sufficient number of observations to estimate the effects. ΔLTD (ΔSTD) refers to the growth rated of long-term (short-term) debt, while $\Delta Tdebt$ indicates the growth rate of total debt. *LTD ratio* is used for the long-term debt ratio on levels and ΔTFA is the growth rate of total fixed assets, our proxy for investment. All columns include separate firm and country-by-time fixed effects, with standard errors being clustered at the country-by-sector level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

G-SIB-D-SIB higher loss absorbency requirements

Evidence on the full set of countries suggests that the announcement of the G/SIB-D/SIB capital surcharge framework did not have any significant effects on SME financing (Table 18). However, when dropping Japan and the US, significant effects emerge, again, in particular when studying EU countries in isolation. In fact, results on the EU subsample mirror the positive effect of creditworthiness on long-term borrowing and investment.

In the context of the G-SIB/D-SIB capital surcharge framework, structural differences in the banking systems across countries are likely to play an important role. Their market share in SME lending differs considerably (Refer to graphs 1 and 2 in the consultation report). The positive effect of firm profitability on borrowing, for instance, seems to be driven by Italian SMEs. Again, given the sequence of policy events, this analysis cannot fully address concerns that estimates may be co-driven by confounding factors.

The analysis based on the full set of firms in all countries suggest that the smaller firms drive the significant positive effects of creditworthiness on the ability to raise funding at a faster pace after the reform implementation. Further, in the full sample of small and large firms, firms with more liquid assets exhibit less short- and long-term borrowing.

Table 18

Estimation results on the G-SIB/D-SIB framework

VARIABLES	Baseline					EU (DE,ES,FR,IT,UK)				
	LTD	STD	Tdebt	LTD Ratio	TFA	LTD	STD	Tdebt	LTD Ratio	TFA
Reform#Firm(0/1)										
ANN(0/1)*F_lnTA(0/1)	-0.176	0.658	-2.112	0.977	-0.379	0.849	0.648	0.311	0.783**	-0.692
	(1.715)	(0.931)	(1.513)	(0.640)	(1.532)	(0.942)	(0.746)	(1.030)	(0.328)	(0.645)
ANN(0/1)*F_CurrRatio(0/1)	-1.648	-1.638	-0.294	-0.878	1.785	-2.051	-0.223	-1.559	-0.820	1.083
	(2.267)	(1.897)	(1.288)	(0.999)	(1.473)	(1.475)	(0.827)	(1.177)	(0.539)	(0.662)
ANN(0/1)*F_Equity(0/1)	1.295	1.620	3.023	0.328	-0.101	5.363***	0.898	4.048***	-0.048	1.740***
	(3.296)	(1.162)	(1.866)	(0.692)	(1.754)	(1.191)	(0.959)	(1.014)	(0.386)	(0.481)
ANN(0/1)*F_ROE(0/1)	0.408	-0.788	0.491	-0.153	0.513	2.009*	1.744*	1.831**	-0.233	1.336***
	(3.255)	(2.155)	(1.761)	(0.814)	(0.667)	(1.028)	(0.955)	(0.764)	(0.295)	(0.422)
Firm										
F_lnTA	-13.906***	-5.394**	-16.872***	-1.132	-17.949***	-18.299***	-14.388***	-21.293***	-1.114	-18.320***
	(1.723)	(2.008)	(1.421)	(0.735)	(1.593)	(1.317)	(1.474)	(1.739)	(1.095)	(1.571)
F_CurrRatio	-0.923	1.026**	0.574*	0.466	2.235***	-4.543***	0.019	-0.618	0.778***	1.764***
	(0.550)	(0.405)	(0.286)	(0.288)	(0.352)	(0.594)	(1.133)	(0.586)	(0.239)	(0.371)
F_Equity	0.934***	0.343	1.295***	-0.010	0.554***	70.549***	33.819***	68.408***	0.038	13.678***
	(0.205)	(0.254)	(0.196)	(0.211)	(0.096)	(9.449)	(7.608)	(9.442)	(2.951)	(2.826)
F_ROE(0/1)	-0.190	-0.272	-0.178	-0.047	0.596	0.429	1.403*	0.857	0.098	1.095***
	(0.606)	(0.327)	(0.757)	(0.209)	(0.691)	(0.986)	(0.767)	(0.531)	(0.170)	(0.266)
Firm(0/1)										
F_lnTA(0/1)	-1.866	-4.527***	-1.425	-0.902	-3.440	-1.837	-2.922***	-2.824***	-1.126**	-0.422
	(2.529)	(1.580)	(1.464)	(1.041)	(2.079)	(1.502)	(0.923)	(0.953)	(0.426)	(0.773)

F_CurrRatio(0/1)	-12.989***	10.295***	1.725	3.284***	5.602***	-13.832***	1.592	-3.028	2.677***	3.246***
	(2.334)	(3.166)	(1.849)	(0.887)	(1.686)	(3.161)	(2.756)	(2.090)	(0.663)	(0.807)
F_Equity(0/1)	15.577***	4.676***	15.492***	-1.122**	2.598	-1.900	0.107	-0.899	0.216	-1.531*
	(4.807)	(1.481)	(2.897)	(0.536)	(2.087)	(1.418)	(0.987)	(1.324)	(0.296)	(0.783)
F_ROE(0/1)	3.688	3.969*	3.599*	0.512	3.498***	3.151***	2.296***	3.986***	0.814***	3.423***
	(3.556)	(2.010)	(1.852)	(0.941)	(1.071)	(0.927)	(0.682)	(0.717)	(0.244)	(0.297)
Observations	558,806	558,806	558,806	558,806	558,806	352,396	352,396	352,396	352,396	352,396
R-squared	0.407	0.529	0.396	0.770	0.434	0.445	0.443	0.397	0.816	0.434
Countries	9	9	9	9	9	5	5	5	5	5

Note: This table shows the estimation results for specification (CIQ 1) over the 2010-2017 period for the G-SIB/D-SIB higher loss absorbency requirements. It considers only the *persistent* announcement effect as announcement and legal framework (almost) coincide in many jurisdictions and did not provide a sufficient number of observations to estimate the effects. ΔLTD (ΔSTD) refers to the growth rated of long-term (short-term) debt, while $\Delta Tdebt$ indicates the growth rate of total debt. *LTD ratio* is used for the long-term debt ratio on levels and ΔTFA is the growth rate of total fixed assets, our proxy for investment. All columns include separate firm and country-by-time fixed effects, with standard errors being clustered at the country-by-sector level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Leverage ratio

In mid-2015, the LR was almost jointly implemented across all sample countries except for Japan. There was no separate announcement stage and the late implementation stage may again suggests that part of its effects could have already been captured by the reaction to previous reforms.

Also in the case of LR, significant differences between EU and non-EU countries might explain why the full sample analysis is less conclusive (Table 19). Evidence on EU countries suggests that better capitalised SMEs obtained more long-term and hence total funding, which goes together with higher investment levels. Also, more profitable firms seem to invest more, a result that is now broadly shared across all EU countries. These behaviour is not confirmed for SMEs in non-EU countries.

The share of long-term debt in total debt increases for better-capitalised SMEs in Canada, Japan, Korea, US after the LR implementation. Interestingly, however, better capitalised SMEs in these countries invest relatively less, which contrasts with evidence from EU countries. When adding large firms to SMEs in the full country sample, the significance of these findings strengthens.

2.2.5   Conclusions

The findings of the analysis based on Capital IQ firm-level data suggest that the positive impact in terms of access to bank funding of specific SME characteristics—namely the creditworthiness of firms- is increased after Basel III reforms are implemented . From a cross-country perspective, the results show that more creditworthy borrowers exhibit higher growth rates of total bank debt and investment. In particular, better capitalised and more profitable firms find it easier to obtain long-term loans after the legal framework of the RBC reform had been nationally implemented. Further, when comparing SMEs with larger companies, the analysis finds similar effects. EU-member countries clearly drive the results.

Table 19

Estimation results on the Leverage ratio reform

VARIABLES	Baseline					EU (DE,ES,FR,IT,UK)				
	LTD	STD	Tdebt	LTD Ratio	TFA	LTD	STD	Tdebt	LTD Ratio	TFA
Reform#Firm(0/1)										
ANN(0/1)*F_lnTA(0/1)	2.403	2.446*	-0.780	0.996	-2.092	3.078***	1.772*	1.348	0.801*	-0.348
	(1.948)	(1.445)	(1.444)	(0.785)	(1.762)	(0.950)	(0.862)	(1.184)	(0.405)	(0.494)
ANN(0/1)*F_CurrRatio(0/1)	-0.769	0.145	-0.946	-1.108	2.646	-0.753	0.630	-1.306	-0.571*	1.520**
	(1.860)	(1.896)	(1.639)	(0.692)	(1.619)	(1.635)	(1.166)	(1.134)	(0.332)	(0.665)
ANN(0/1)*F_Equity(0/1)	-1.111	1.416	1.397	2.084**	-1.617	3.403**	-0.060	2.391**	0.646	1.097**
	(3.044)	(1.649)	(1.391)	(1.009)	(1.255)	(1.622)	(1.104)	(0.998)	(0.414)	(0.409)
ANN(0/1)*F_ROE(0/1)	-0.424	0.413	-0.679	0.386	1.510**	0.541	1.108	0.493	-0.125	1.675***
	(2.473)	(1.971)	(1.238)	(0.974)	(0.561)	(1.295)	(0.841)	(0.868)	(0.480)	(0.326)
Firm										
F_lnTA	-13.921***	-5.479***	-16.847***	-1.176	-17.920***	-18.224***	-14.363***	-21.220***	-1.132	-18.350***
	(1.726)	(1.994)	(1.405)	(0.726)	(1.589)	(1.324)	(1.481)	(1.799)	(1.112)	(1.577)
F_CurrRatio	-0.924	1.021**	0.571*	0.468	2.233***	-4.560***	0.010	-0.616	0.772***	1.753***
	(0.551)	(0.404)	(0.287)	(0.283)	(0.353)	(0.600)	(1.131)	(0.586)	(0.235)	(0.373)
F_Equity	0.930***	0.345	1.290***	-0.007	0.558***	71.000***	33.968***	68.776***	-0.050	13.778***
	(0.201)	(0.254)	(0.194)	(0.211)	(0.095)	(9.648)	(7.626)	(9.533)	(2.983)	(2.838)
F_ROE(0/1)	-0.182	-0.269	-0.169	-0.056	0.597	0.452	1.411*	0.867	0.098	1.127***
	(0.621)	(0.310)	(0.759)	(0.200)	(0.686)	(0.981)	(0.760)	(0.533)	(0.168)	(0.268)
Firm(0/1)										
F_lnTA(0/1)	-2.768	-5.012***	-2.372*	-0.664	-3.021	-2.385*	-3.156***	-3.072***	-0.935**	-0.734
	(2.178)	(1.631)	(1.289)	(0.840)	(1.838)	(1.373)	(0.933)	(0.746)	(0.396)	(0.650)

	Baseline					EU (DE,ES,FR,IT,UK)				
F_CurrRatio(0/1)	-13.663***	9.289***	1.899	3.128***	5.744***	-14.808***	1.248	-3.521*	2.380***	3.366***
	(1.948)	(2.916)	(1.833)	(0.524)	(1.389)	(3.000)	(2.791)	(1.858)	(0.573)	(0.671)
F_Equity(0/1)	16.780***	5.077***	16.867***	-1.683**	3.053**	0.183	0.688	0.755	-0.050	-0.901
	(3.793)	(1.666)	(2.536)	(0.718)	(1.405)	(1.443)	(0.786)	(1.378)	(0.203)	(0.604)
F_ROE(0/1)	4.030*	3.381**	4.072***	0.328	3.287***	4.197***	2.974***	4.934***	0.727***	3.639***
	(2.216)	(1.374)	(1.306)	(0.789)	(0.913)	(1.060)	(0.406)	(0.681)	(0.234)	(0.292)
Observations	558,806	558,806	558,806	558,806	558,806	352,396	352,396	352,396	352,396	352,396
R-squared	0.407	0.529	0.396	0.770	0.434	0.445	0.443	0.397	0.816	0.434
Countries	9	9	9	9	9	5	5	5	5	5

Note: This table shows the estimation results for specification (CIQ 1) over the 2010-2017 period for the LR reform. It considers only the *persistent* announcement effect as announcement and legal framework (almost) coincide in many jurisdictions and did not provide a sufficient number of observations to estimate the effects. ΔLTD (ΔSTD) refers to the growth rated of long-term (short-term) debt, while $\Delta Tdebt$ indicates the growth rate of total debt. *LTD ratio* is used for the long-term debt ratio on levels and ΔTFA is the growth rate of total fixed assets, our proxy for investment. All columns include separate firm and country-by-time fixed effects, with standard errors being clustered at the country-by-sector level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

2.3 ECB, SAFE data analysis

The cross-country analysis based on ECB survey data examines the perception of firms on access to bank funding. This analysis on the euro area is based on the "Survey on the Access to Finance of Enterprises (SAFE)" that is conducted on a bi-annual basis since 2009 by the ECB and the European Commission (EC). The survey covers developments in the financial situation of enterprises and trends in the need for and availability of external financing, asking enterprises a standardised set of questions on their funding needs and financial constraints during the six months under study. The sample is broken down by firm size, with each period including micro, small, medium-sized and large firms in the countries under consideration. Most of the firms are interviewed only once, but there is a subsample of firms present in several periods. Firm-level responses are complemented with firm-level and bank-level financial data and identification is based on firm- and bank-level heterogeneity.

2.3.1 Data description

The confidential non-anonymised ECB SAFE dataset at the firm-level is complemented with quantitative information on firm balance sheets and income statements included in the Amadeus dataset, which is a proprietary database maintained by Bureau van Dijk (BvD). This firm-level dataset is then augmented with bank-level information on the firm's main lender, obtained from three datasets: (1) confidential supervisory reporting data (2) public data available from the EBA transparency exercises and stress tests and (3) balance sheet and income statement information from BankFocus. An overview of the various data sets used for the analysis is provided in Table 20.

Table 20

Datasets used for ECB's the empirical analysis

Data Sources	Frequency	Period	SME Definition
SAFE matched with firm balance sheet information from BvD Amadeus	Semi-annual	2009H1-2016H2	Employees & Turnover
Supervisory data	Quarterly	2014Q1-2018Q2	-
EBA (public data from Transparency Exercise and Stress Test)	Semi-annual	12/2012-12/2013	-
BankFocus	Annual	2009-2018	-

The final sample for the empirical analysis contains information on 7,802 matched firm-bank observations, covering SMEs in eight euro area countries (Austria, France, Germany, Greece, Ireland, Netherlands, Portugal, and Spain). A breakdown of these observations by country is provided in Table 21. Remaining euro area countries were excluded from the analysis, either

because observations for those countries were only available in some but not all survey waves or because information on firms' lenders was not available.

Table 21

Number of observations in ECB estimation sample, by country (from 2011-2016)

Country	Firms	SMEs
AT	376	268
DE	923	663
ES	2,894	2,509
FR	2,557	2,185
GR	345	324
IE	216	201
NL	218	170
PT	1,622	1,482
Total	**9,151**	**7,802**

Source: ECB SAFE survey

Table 22 presents summary statistics for the dependent variable and the firm and bank controls in the estimation sample. The main sample includes 7,802 firm-year observations. This includes 3,195 unique SMEs (around half of all SMEs were observed more than once in the survey). The dependent variable in the empirical analysis, *Credit Constrained*, is a binary variable equal to 1 if either of the following four conditions applies: (1) the firm's application for a bank loan or a credit line in the past 6 months was denied; (2) the firm received less than 75% of the amount it requested; (3) the firm refused the loan offer because the rate was too high; (4) the firm did not apply for a loan or credit line because it feared a rejection. The variable is equal to zero if none of the aforementioned conditions applies for the firm. As illustrated in Figure 8, 13% of the firms in the sample were credit constrained on average. Moreover, Figure 8 shows that overall access to finance for SMEs has significantly improved in the past few years, with the share of constrained firms declining from around 17.5% in June 2012 to around 9 % in December 2016.

In order to reduce the sensitivity of the regressions to outliers, the explanatory firm-specific variables are winsorised at the 1% level in each tail. We hence assign all values to the 1 and 99-percentile of the individual distribution, if the values lie either above the upper, or below the lower threshold in the distribution of all firms. Firm-specific control variables include the firm's total assets, the current ratio (Current Assets/Current Liabilities), the return on equity, the debt to equity ratio and the interest coverage ratio (EBIT/interest paid). Moreover, to control for differences across banks the analysis includes the bank's total assets, the bank's ROE, the equity/assets ratio, the Tier 1 ratio and the liquid assets/ total assets ratio.

Descriptive Statistics

	N	mean	min	max	sd
Dependent Variable					
Credit constrained %	7802	13	0	100	33
Firm Controls					
Current ratio	7802	1.99	0.08	25.03	2.21
ROE %	7802	5.34	-376.92	250	51.67
Debt/Equity %	7802	143.91	0.08	3901.37	375.81
Log(Total Assets)	7802	8.33	3.75	12.70	1.47
Interest Coverage Ratio	7802	15.59	-95	652.25	68.00
Bank Controls					
Equity/Assets %	7802	6.03	-3.9	66.70	2.62
Tier1 Ratio %	7802	12.16	-6.0	68	2.37
Liquid Assets/Total Assets %	7802	19.15	0.2	53.65	14.15
ROE %	7802	2.23	-266.6	4704.64	78.62
Log(Total Assets)	7802	12.52	4.4	14.59	1.61

Sources: ECB SAFE survey and supervisory bank-level data, BvD Amadeus database, EBA, Bank Focus.

SMEs reporting to be credit-constrained, out of all SMEs surveyed, in percent   Figure 8
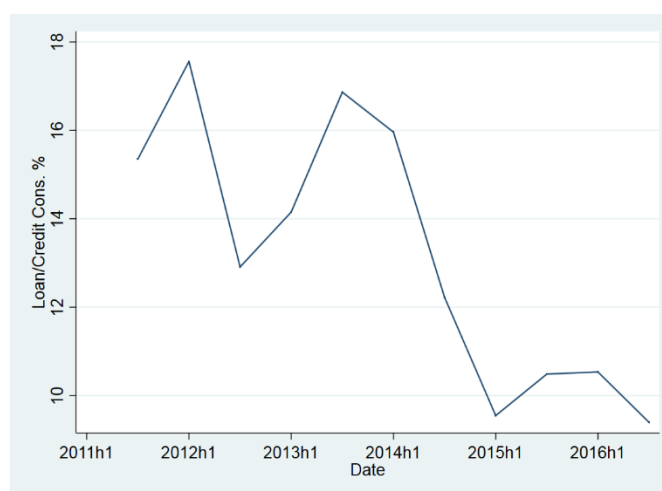
In %

Source: ECB SAFE.

Considered Reforms

The analysis considers the effects of the implementation of the RBC reforms, the introduction of the LR, the LCR and finally the G-SIB. The analysis of the announcement of RBC reforms (2011h1) and the NSFR (2016) is not possible, as the dataset is not long enough before and after the announcement, respectively. Moreover, the D-SIB framework in the EU was implemented at the same time as the G-SIB framework and is therefore not analysed separately.

For each of these reforms, dummy variables are created that switch from 0 to 1 in the period where the reforms were either announced or fully implemented. Figure 9 provides an overview of the relevant dates.

Risk-based capital ratio (RBC) implementation stages: European Union

Figure 9
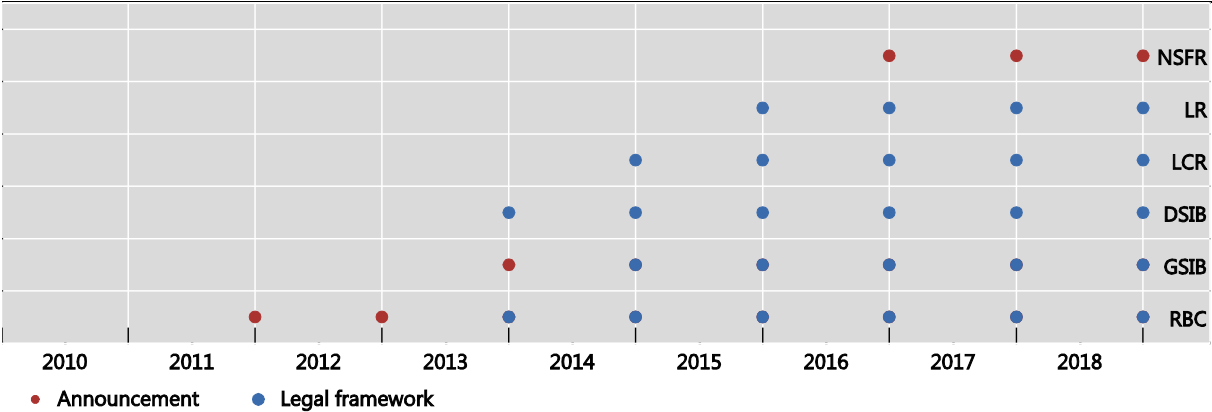
Note: This figure shows two of the national implementation stages as described in the BCBS' RCAP implementation assessment. The link to the underlying public reports is: https://www.bis.org/bcbs/publ/d452.htm.

Source: BCBS

2.3.2 Empirical Specification

The identification strategy employed for the analysis of the SAFE data is similar to the other centralised and satellite analyses in the report, apart from the difference in the dependent variable. In particular, banks are grouped into those that were more and those that were less affected by a specific reform (based on their initial balance sheet characteristics), and the analysis tests whether access to finance for firms borrowing from either group was differentially affected by the reform. For example, for the risk-based capital reforms, relatively weakly capitalised banks are assumed to be more affected by the reform. To identify these more affected banks, banks were sorted by their pre-reform capital positions relative to their peers in the euro area, and those belonging to the lower end of the distribution were considered as being more affected.

In particular, to test whether there was a stronger effect of the reforms on firms borrowing from banks that were relatively more affected by the reforms, regressions of the following type are estimated:

Persistent effects on SME access to finance

$$Y_{f,t} = \beta \, Bank(0/1)_{b,pre} + \beta_{RB}\big(Bank(0/1)_{b,pre} * PostReg_t\big) + \beta_F C\_Firm_{f,t-1} + \beta_B C\_Bank_{b,t-1} + FE(c,t) + \varepsilon_{f,t} \qquad \text{(ECB 1)}$$

where a description of all variables is included in the box below. The variable of interest in the regression is the interaction between the post-reform dummy (PostReg) and the dummy variable indicating bank exposure to the reforms. The latter is equal to one whenever the Tier1 / RWA (for RBC reforms), the ratio of liquid assets/total assets (for LCR) and the Tier 1 capital/total assets (for the LR) are in the bottom decile, quartile or half of the distribution, or when the firm's lender is a G-SIB (for G-SIB capital surcharges).

In addition, to investigate whether the effects of the reforms are temporary or persistent, regressions of the following type are also estimated:

Temporary effects on SME access to finance

$$Y_{f,t} = \beta\, Bank(0/1)_{b,pre} + \sum_{k=0}^{K}\left(\beta_{RBk}^{A} Reg_{t-k}^{temp} * Bank(0/1)_{b,pre}\right) + \beta_F C\_Firm_{f,t-1} +$$
$$\beta_B C\_Bank_{b,t-1} + FE(c,t) + \varepsilon_{f,t} \qquad\qquad\text{(ECB 2)}$$

where the $PostReg_{t-k}^{temp}$ dummy is equal to 1 only in period t-k and zero in every other period.

In the first specification, the coefficient β_{RB} captures the average effect of the reform in the post-reform period (since the $PostReg_t$ dummy is equal to 1 for the post-reform period). By contrast, in the second specification, the coefficient β_{RBk}^{A} captures the impact of the reform only in period t-k.

$Y_{f,t}$	constrained dummy for firm f
Reg_t	regulation dummy (LR, LCR, RBC, GSIB)
$\sum Reg_{t-k}$	lagged regulation dummy (LR, LCR, RBC, GSIB)
$Bank(0/1)_{b,pre}$	bank b's characteristics targeted by regulation, dummy fixed pre-regulation
$C\_Firm_{f,t-1}$	ln size, current ratio, equity ratio, ROE as continuous controls, lagged by 1 year
$C\_Bank_{b,t-1}$	ln size, ROE, equity/assets, tier 1 ratio, liquid assets/total assets as continuous controls lagged by 1 year
$FE(c,t)$	Separate country and time fixed effects
$FE(c\#t)$	Country-by-time fixed effects

2.3.3   Results

The following tables present an overview of the results of the cross-country analysis on ECB survey data. For the regulations studied, coefficients for the interaction term between the reform dummy and the bank exposure variable are significant for only some specifications for the RBC reforms. In particular, the first two columns of Table 23 show that firms borrowing from the most affected banks (i.e., those in the bottom decile of the initial capital ratio distribution) are

more likely to be credit constrained after the reform (as shown by the positive coefficient), relative to firms borrowing from less affected banks. Results become insignificant when defining the most affected banks as those in the lowest quartile (p25) or half (p50) of the capital ratio distribution (see Table 23, columns 3-6). Moreover, Table 24 shows that the relative slowdown in access to credit for firms borrowing from the most constrained banks is temporary, i.e. only present in the first two years after reform implementation (columns 1-2). In subsequent years there is no significant difference between firms borrowing from more or less affected banks; moreover, there is no significant difference when considering different definitions of bank exposure (columns 3-6).

To note, regression coefficients for the firm and bank control variables are in line with expectations and in some cases significant. In particular, firms with higher ROE ratios and interest coverage ratios are less likely to be credit constrained, while firms with higher debt/equity ratios are more likely to be constrained. Moreover, firms borrowing from more profitable banks (higher ROE) are also less likely to be credit constrained. These results are very stable across the different specifications and reforms analysed.

Coefficients for the interaction terms are mostly insignificant for the other reforms that have been analysed, which indicates that these reforms did not have a differential impact on firms borrowing from banks regardless of whether they were more or less affected by the respective reform. In particular, the interaction terms in all of the specifications testing for persistent effects are insignificant.

Table 23

Results for the persistent effect of RBC with "initial" exposures, for different bank rankings

VARIABLES	p10		p25		p50	
	(1) Credit Constr.	(2) Credit Constr.	(3) Credit Constr.	(4) Credit Constr.	(5) Credit Constr.	(6) Credit Constr.
Bank(0/1)*LegalFramework_t	0.145***	0.219***	0.028	0.023	-0.024	-0.034
	(0.045)	(0.076)	(0.025)	(0.023)	(0.022)	(0.024)
Bank(0/1)	-0.118*	-0.146*	-0.049	-0.046	0.017	0.029
	(0.062)	(0.082)	(0.030)	(0.028)	(0.023)	(0.025)
FIRM CONTROLS						
Curr Ratio	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ROE	-0.051***	-0.048***	-0.051***	-0.048***	-0.050***	-0.048***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Debt/Equity	0.010***	0.011***	0.010***	0.011***	0.010***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log(TotalAssets)	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Interest Coverage	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
BANK CONTROLS						
Log(TotalAssets)	0.423	0.448	0.109	0.139	0.324	0.416
	(0.545)	(0.604)	(0.634)	(0.714)	(0.578)	(0.630)
ROE	-0.004***	-0.003**	-0.003**	-0.002**	-0.003**	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Equity/Assets	-0.344	-0.533	-0.158	-0.524	-0.079	-0.520
	(0.491)	(0.518)	(0.434)	(0.495)	(0.430)	(0.497)

VARIABLES	p10		p25		p50	
	(1) Credit Constr.	(2) Credit Constr.	(3) Credit Constr.	(4) Credit Constr.	(5) Credit Constr.	(6) Credit Constr.
Tier 1 Ratio	-0.340	0.066	-0.290	0.052	-0.283	0.057
	(0.373)	(0.319)	(0.367)	(0.296)	(0.412)	(0.362)
Liquid/Total	0.155*	0.168*	0.178*	0.184*	0.184**	0.176*
	(0.085)	(0.087)	(0.089)	(0.094)	(0.090)	(0.094)
Observations	7,117	7,117	7,117	7,117	7,117	7,117
R-squared	0.064	0.076	0.064	0.075	0.064	0.075
Time FE	YES	NO	YES	NO	YES	NO
Country FE	YES	NO	YES	NO	YES	NO
Country*Time FE	NO	YES	NO	YES	NO	YES

Note: This table shows the estimation results for specification (ECB 1) over the 2011-2016 period for the RBC reform. Columns 1, 3 and 5 include separate country and time fixed effects, while columns 2, 4 and 6 draw on country-by-time fixed effects. Standard errors are clustered at the country level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 24

Results for the temporary RBC effect with "initial" exposures, for different bank rankings

VARIABLES	p10		p25		p50	
	(1) Credit Constr.	(2) Credit Constr.	(3) Credit Constr.	(4) Credit Constr.	(5) Credit Constr.	(6) Credit Constr.
Bank(0/1)*LegalFramework_t	0.144***	0.265***	0.016	-0.012	-0.045	-0.075**
	(0.035)	(0.059)	(0.031)	(0.025)	(0.027)	(0.036)
Bank(0/1)*LegalFramework_t-1	0.156**	0.210**	0.043	0.023	-0.021	-0.046
	(0.068)	(0.085)	(0.038)	(0.037)	(0.028)	(0.028)
Bank(0/1)*LegalFramework_t-2	-0.091	-0.052	0.016	0.038*	-0.020	0.005
	(0.074)	(0.084)	(0.024)	(0.019)	(0.021)	(0.022)
Bank(0/1)*LegalFramework_t-3	0.043	0.165*	0.036	0.044	-0.013	-0.026
	(0.104)	(0.091)	(0.038)	(0.040)	(0.021)	(0.027)
Bank(0/1)	-0.110	-0.147*	-0.050*	-0.046	0.016	0.031
	(0.067)	(0.082)	(0.028)	(0.028)	(0.023)	(0.025)
FIRM CONTROLS						
Curr Ratio	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
ROE	-0.051***	-0.049***	-0.051***	-0.048***	-0.050***	-0.047***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Debt/Equity	0.011***	0.011***	0.010***	0.011***	0.011***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Log(TotalAssets)	-0.004	-0.004	-0.004	-0.004	-0.004	-0.004
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)

Interest Coverage	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
BANK CONTROLS						
Log(TotalAssets)	0.411	0.430	0.127	0.143	0.311	0.404
	(0.553)	(0.609)	(0.643)	(0.718)	(0.582)	(0.631)
ROE	-0.004***	-0.003**	-0.003**	-0.002**	-0.003**	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Equity/Assets	-0.374	-0.551	-0.203	-0.519	-0.082	-0.495
	(0.549)	(0.518)	(0.481)	(0.498)	(0.435)	(0.512)
Tier 1 Ratio	-0.348	0.088	-0.314	0.046	-0.287	0.162
	(0.391)	(0.325)	(0.376)	(0.294)	(0.429)	(0.348)
Liquid/Total	0.154*	0.168*	0.174*	0.180*	0.181*	0.171*
	(0.087)	(0.087)	(0.092)	(0.094)	(0.090)	(0.095)
Observations	7,117	7,117	7,117	7,117	7,117	7,117
R-squared	0.064	0.076	0.064	0.075	0.064	0.076
Time FE	YES	NO	YES	NO	YES	NO
Country FE	YES	NO	YES	NO	YES	NO
Country*Time FE	NO	YES	NO	YES	NO	YES

Note: This table shows the estimation results for specification (ECB 2) over the 2011-2016 period for the RBC reform. Columns 1, 3 and 5 include separate country and time fixed effects, while columns 2, 4 and 6 draw on country-by-time fixed effects. Standard errors are clustered at the country level. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

<u>Robustness and further tests</u>

Apart from the baseline specifications reported above, a number of additional tests and robustness checks are also performed. The first one is to split the sample into commercial and non-commercial banks based on Bank Focus categorisation. In this case, the RBC results for commercial banks are similar to those in the baseline specification while there are no significant effects for non-commercial banks.

A second split of the sample is into crisis and non-crisis countries, where crisis countries are those severely affected by the sovereign debt crisis and non-crisis countries, those that were less affected. The negative impact of the RBC reform on firms borrowing from the most affected banks relative to firms borrowing from less affected banks is observed only in the crisis countries. Furthermore, the effect vanishes completely if specific crisis-hit jurisdictions are excluded from the analysis.

For baseline specifications constrained banks are defined relative to their peers in the whole sample, i.e. defined as constrained when they are in the bottom quartile of the distribution for all eight countries. In an alternative specification, banks' reform exposure is defined relative to the other banks within the same country (that is, with respect to country-specific rather than sample-wide distributions). Using this alternative exposure definition, regression coefficients for the interaction term on RBC, LR and LCR reforms are mostly insignificant.

Finally, the ECB analysis tests whether firms with different characteristics were affected differently by the reforms, similar to what has been done in the Capital IQ analysis (see Section 2.2). Findings do not indicate any differential impact of the implementation of the RBC legal framework on credit access by SMEs that differ in terms of profitability, size, leverage, current ratio or interest coverage ratio.

2.3.4   *Conclusions*

For the regulations studied (RBC, LR, G-SIB capital surcharge, LCR) the analysis does not identify any significant negative persistent impact of the reforms on SME access to finance. In a few cases, there is a significant temporary effect for firms borrowing from the most affected banks; however, this finding is not robust. In particular, for the RBC reforms, SMEs borrowing from banks in the bottom decile of the initial capital ratio distribution become more constrained in the first two years after the reforms, relative to firms borrowing from better capitalised banks. This effect disappears, however, when looking at the bottom quartile or the bottom half of the capital ratio distribution. Moreover, it also vanishes when defining constrained banks relative to their peers within the same country, rather than at the euro- area level.

For the other reforms under consideration, i.e. the LR, the LCR and the G-SIB capital reforms, the analysis does not reveal any significant difference in the impact on the access to finance for firms borrowing from banks that were more or less affected by the reforms.

2.4 Analysis on BCBS Quantitative Impact Study data

Based on data collected from the Basel Committee's quantitative impact studies (QIS), the BCBS analysed the effect of recently implemented regulatory reforms on SME lending.

This cross-country study complements the FSB analysis along two dimensions using the BCBS QIS data. As its first key contribution, this analysis uses information on banks' capital shortfall and capital surplus from QIS data as the relevant measure of bank's ex ante exposure to the Basel III reforms. Second, it is a cross-country study at the level of individual banks. Empirical work focuses on the largest banks in each Basel Committee member jurisdiction and hence draws inference from a sample of internationally active banks that are all subject to the Basel regulatory standards and exposed to a variety of macroeconomic conditions.

This reform exposure measure differs from the balance sheet characteristics explored elsewhere in the FSB report. It reflects the additional capital a bank would need (or has in excess) in order to fully comply with all Basel III reforms in the future and any national reforms that go beyond the internationally agreed minimums. Thereby, it captures how risk weighted assets (RWAs) are calculated, new definitions of eligible capital, increases in minimum capital requirements, G-SIB capital buffers, targeted capital conservation buffers, the LR requirements and the output floor.

The identification of reform effects first draws on differences in the reform implementation status across countries, and, second, on differential exposures at the individual bank level. Country-by-time fixed effects absorb potentially confounding demand effects.

Relative to the exposure measures used elsewhere in the report, this exposure measure can consider excessive RWA variability. In fact, identifying the relevant group of the potentially most exposed banks plays an important role in the assessment of how reform effects play out. A comparison group of completely unaffected banks is not available in any case. As in other parts of the FSB analysis, the group of most exposed banks is identified based on their pre-reform exposure measure and kept constant over the post reform period. The legal framework implementation of the RBC reform features as the relevant proxy for the overall impact of Basel III reforms.

This analysis does not find evidence that the RBC reform adversely affected SME lending. The RBC reform acts as a proxy that also covers the G-SIB capital surcharge and the recently implemented LR requirements. Reform effects on both SME lending growth rates and the share of SME lending[21] are insignificant from a transitory or persistent perspective.

2.4.1 *Basel framework SME definition*

The Basel framework defines small and medium-sized entities as firms with reported annual sales of less than or equal to €50 million for the most recent financial year. Loans that meet

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[21] The QIS definition is "exposures", which activities beyond lending. For example, exposures includes any SME guarantees, lines of credit or other extension or supports for credit activities. In order to maintain consistency with other parts of the report, "lending" will be used instead of "exposures" in this section. For further information about QIS collections, see https://www.bis.org/bcbs/qis/.

both the retail and SME definitions are designated SME retail loans;[22] otherwise, they are treated as SME corporate loans.[23]

Jurisdictions have the option to exercise national discretion in defining SMEs. In some jurisdictions (e.g. emerging economies), national supervisors might deem it appropriate to define SMEs in a more conservative manner (i.e. with a lower level of sales).[24] Also subject to national discretion, supervisors may allow banks to substitute total assets of the consolidated group for total sales in calculating the SME threshold and the firm-size adjustment. However, total assets should be used only when total sales are not a meaningful indicator of firm size.[25]

A summary of the SME criteria and associated risk-weights is illustrated in the flowchart below (Figure 10). Under Basel III, SME lending is separated into corporate, retail, and real estate lending. Based on annual sales criteria, regulatory retail criteria, and regulatory approaches, SME loans receive different risk weights.

QIS SME flowchart

Figure 10
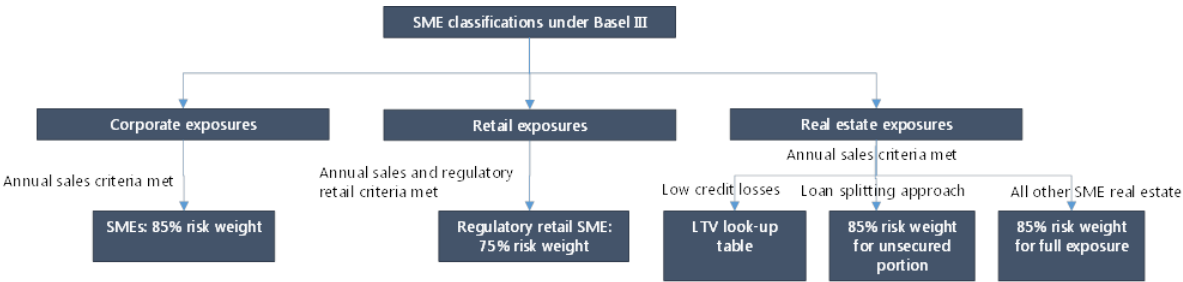
Source: BCBS.

It is important to note that SME retail refers to business lending (and not to credit to individuals), even though they are managed as retail loans. However, for QIS purposes these are classified as other retail SME. Also, there are likely SME loans that end up in other loan types, such as residential real estate lending, which cannot be readily identified as SME loans.

2.4.2 Data description

This analysis draws on 94 banks in 18 jurisdictions, which are considered to be representative of the largest banks in each of these countries. The dataset[26] covers the period of 2011-18, as

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[22] The retail definition has three criterion: product, low value of exposures, and granularity. See Basel 2 paragraph 70 and Basel III paragraph 55.

[23] In Basel II, "standardised retail" uses the term "small business" but does not define it; for "standardised corporate", there is no SME definition. In Basel II, SME is defined in the IRB section. Under Basel III, SME is defined in the IRB section, and the standardised approach points to the IRB SME definition. There are no changes in the definition of SME in Basel III from Basel II.

[24] This is new to the Basel III text; see paragraph 54, footnote 31.

[25] See Basel II, paragraph 274 and Basel III, paragraph 55.

[26] QIS data that is collected from BCBS member jurisdictions on a biannual basis. Due to confidentiality agreements, individual banks cannot be identified in the data.

data on SME credit was not readily available before 2011. Data on corporate SME lending was collected from a larger sample of banks than retail SME loans; therefore this study focuses on corporate SME lending.

A summary of these data, which includes retail SME loans, is provided in Table 25. The simple average across jurisdictions for the share of SME lending (retail lending plus corporate lending) in total credit amounts to around 10%, while that for corporate SME lending is about 5%.

Table 25

Shares of SME lending relative to total credit (in %)*

	Corporate		Retail	
Country	**2011-2012**	**2013-2018**	**2011-2012**	**2013-2018**
Australia	7.8	6.1	1.9	2.1
Belgium	7.9	9.2		6.8
Brazil		1.4		0.6
Canada	4.0	4.8	1.1	0.7
China		9.7		
France	3.7	3.7	5.6	6.0
Germany	2.9	3.9	1.3	1.5
Italy		10.8	5.7	5.3
Japan	4.3	1.8		
Netherlands	9.0	7.8	4.8	4.4
Singapore		2.9		1.4
South Africa		7.2		4.9
Spain	4.2	4.2	1.2	3.1
Sweden		12.9		2.3
Turkey		9.2		6.5
United Kingdom		1.7	0.8	1.1
United States**	3.5	3.2		

Source: BCBS.
Note: for confidentiality reasons, Luxembourg is not shown.
* Shares of SME lending represent the average of SME lending of the selected international banks (including lending to non-residents) in particular country weighted by the banks' total credit. For the US, the average is weighted by total lending.
** SME lending for the US is proxied by the amount of small loans (under $ 1 million) that banks provided to corporates.

2.4.3 Adjustments and data cleaning procedure

Several steps were taken to prepare the QIS data for the empirical analysis. Banks that did not report information for three consecutive time periods were dropped from the sample. To ensure cross-border and time consistency in the variables, nominal variables were deflated by the GDP deflator of the bank's respective country. Further, corporate SME lending has been winsorised at the 5% level, while all other variables have been winsorised at the 1% level in each tail. In a limited number of cases, some bank-level observations have been linearly interpolated to fill in missing values.

2.4.4 Empirical Specification

The empirical analysis tests whether the cohort of banks that was most exposed to the RBC reform ex ante reduced SME lending (either total SME lending or as a share of total credit) after the reform's implementation. Specification (BCBS1) considers the *transitory* effects with b representing the individual bank, t time and c the country, respectively.

$$y_{c,b,t} = \alpha + \sum_{k=0}^{5} \beta_k^{trans} \left(Post(0/1)_{t-k,c}^{trans} \times Bank(0/1)_{b,pre} \right)$$
$$+ \gamma\, Controls_{b,t-1} + FE(c\#t) + FE(b) + \varepsilon_{c,b,t} \qquad (BCBS1)$$

Specification (BCBS2) estimates potential *persistent* effects

$$y_{b,c,t} = \alpha + \beta^{pers} \left(Post(0/1)_{c,t}^{pers} \times Bank(0/1)_{b,pre} \right)$$
$$+ \gamma\, Controls_{b,t-1} + FE(c\#t) + FE(b) + \varepsilon_{c,b,t} \qquad (BCBS2)$$

$y_{c,b,t}$	Dependent variable for bank b that is located in country c at time t. The dependent variable is either (i) SME lending growth or (ii) SME lending as a share of total credit.
β^{pers}	Coefficient estimate that reflects the persistence differences exhibited by the most reform-exposed banks after RBC implementation.
$Post(0/1)_{c,t}^{pers}$	Persistent RBC indicator function for country c at time t. The indicator switches to one for all periods after the legal framework implementation.
$Post(0/1)_{t-k,c}^{trans}$	Transitory RBC indicator function. The indicator switches to one if the legal framework hat been implemented in period t-k for country c.
$Bank(0/1)_{b,pre}$	Indicator function for the most exposed banks, defined as banks whose capital shortfall measure falls in the highest quartile before reform implementation on average. 23 banks are included in this group.
$\gamma\, Controls_{b,t-1}$	Lagged bank control variables (e.g. log of size, loan-to-asset, deposit-to-asset, NPL ratio, RBC and LCR ratio, ROE, operating income etc.)
$FE(c\#t)$	Country-by-time fixed effects.

FE(b)	Bank fixed effects

Differences across individual country's RBC implementation schedules, and heterogeneity in banks' capital shortfall measure (as a proxy for their ex ante reform exposure) serve as key tools in the identification strategy. To disentangle demand and supply effects, country-by-time fixed effects are used, which also absorb any potentially confounding macro factors.

Summary statistics for the empirical dataset are presented in Table 26. The median SME credit growth rate is 1.6% and the median share of SME lending in total corporate credit is around 5%.

Table 26

Summary statistics for the analysis data set

Variables	Observations	Mean	Standard Deviation	Median
SME lending growth	988	1.6	9.6	1.0
SME lending to total corporate credit	1004	7.1	6.2	5.2
RWA density	1082	35.0	11.6	34.4
LCR	1082	133	70	124
NSFR	1082	105	17	105
ROA	1082	0.31	0.33	0.26
Log of LR exposure	1082	13.6	2.1	13.6

Note: observations are expressed in percent, except for the LR exposure.
Source: BCBS.

2.4.5 Results

Results suggest that there was no significant impact for the most exposed banks as defined by their ex ante *capital shortfall* measure (Table 27). Neither the persistent nor transitory effects yield significant results. This analysis does not find evidence that the recently implemented Basel III set of regulations (including the G-SIB surcharge), which is proxied by RBC reforms in this analysis, adversely affected SME lending at the most exposed banks.

Table 27

Effect of the RBC reform on SME lending

Dependent variable	SME exposure growth		SME share to total credit
Model specification	Persistent	Transitory	Persistent
Interaction effects			
Persistent effect	-2.025		-1.735
	(-0.74)		(-1.62)
Transitory effect			
1 year past implementation		-5.561	
		(-1.17)	
2 years past implementation		4.778	
		(1.51)	
3 years past implementation		-0.101	
		(-0.03)	
4 years past implementation		0.616	
		(0.32)	
5 years past implementation		1.705	
		(0.93)	
Bank specific controls			
RWA density (t-1)	0.259**	0.265**	0.054**
	(2.28)	(2.18)	(2.24)
Return on assets (t-1)	-2.225	-1.886	-1.162
	(-0.76)	(-0.67)	(-1.05)
LCR (t-1)	0.008	0.008	0.002
	(1.61)	(1.61)	(0.81)
NSFR (t-1)	0.041	0.034	0.012
	(0.8)	(0.69)	(1.45)
Log of LR exposure (t-1)	1.242	1.689	-4.416*
	(0.3)	(0.41)	(-1.92)
Joint test of transitory effect coefficients (transitory model specification)			
F-test		0.91	
p-value		0.48	
Statistics			
Number of observations	988	988	1004
R2	0.112	0.105	0.039

This table shows the estimation results for specifications (BCBS 1) in column 2 and specification (BCBS 2) in columns 1 and 3, respectively. The estimates draw on the 2011-2018 period based on semi-annual data. All columns include separate country-by-time fixed effects, with standard errors being clustered at the country level. T-statistics are shown in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

3.   Within-country analyses

Ten jurisdictions contribute with country-specific analyses based on their proprietary micro data. These "satellite" studies follow the same methodological approach and a common research protocol, while using confidential supervisory datasets. The ten jurisdiction form two distinct groups. At the most granular level, the first satellite group of six jurisdictions run the analysis on credit register data with details on individual bank-firm relationships. The second satellite group consists of six studies conducted at the bank level[27] using bank balance sheet data.

The analytical setup tries to strike the balance between accommodating country specificities and pursuing a common approach, in order to attain comparability of outcomes across countries. The participating satellites' banking systems differ along several dimensions. To the extent possible, the analysis takes those differences into account by adding country-specific control variables in order to tailor the common approach to the unique characteristics of the individual jurisdictions. In some cases, like for the EU's SME Supporting Factor,[28] the research protocol explicitly addresses the region-specific feature as a control variable for the relevant subset of satellites.

Notably, for all credit register satellites, a replication of their analysis by aggregating the data at the bank level can serve as an important crosscheck and builds the bridge to the satellite group of bank balance sheet analyses. The reason lies in the "extensive margin" problem, which implies that the entry and exit of customers cannot properly be captured, in particular when studying the growth rates of SME lending.[29] This *extensive margin* issue essentially applies to very short-term loans, which are not rolled over, and to SMEs that frequently enter and exit the sample more in general. Two out of six credit register analyses are undertaken by emerging market economies for which the extensive margin issue is relatively more pronounced. For this reason, aggregating bank-firm level data across all borrowers allows to capture total outstanding loans on banks' balance sheets. These enables to address the extensive margin issue while allowing comparability with the satellites on bank-level data. However, aggregating credit register data comes at a cost, as it entails losing the possibility to most accurately control for demand-side characteristics.

For the six jurisdictions with bank-firm level information, a balanced panel of firms that borrow both short and long term was used where possible. When using this balanced panel, for four jurisdictions the findings suggest a temporary decline in SME lending growth that also persist on average in the observed implementation period for the most exposed banks after the RBC implementation. Evidence on lending to non-SMEs is more

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[27]   Two jurisdictions participated with two studies, respectively, for a total of twelve studies

[28]   For a description of the SME Supporting Factor in the EU, see Box 3 of the main report [LINK]

[29]   For the credit register analyses, firm-bank relationships that last less than 3 years had to be dropped for data cleaning purposes when computing growth rates of bilateral lending. On aggregating all bank-firm relationships to the bank level these loans are included and growth rates can be computed at the bank level.

mixed. It should be noted, however, that these effects only reflect changes along the *intensive margin*[30] of SME lending for a subset of firms that take out both short and long term loans.

To assess the full impact of the reforms on *total* SME lending, the bank-firm level analysis has been complemented by conducting studies at the bank level, thereby including those SMEs that frequently enter and exit bank-firm relationships, or that borrow only at very short maturities. Hence, when considering the extensive margin, the results slightly change.

Results from the twelve studies[31] at the bank level indicate that persistent effects on growth rates of SME lending at the most exposed banks are rare. However, about half of the studies show a persistent fall in banks' portfolio share of SME loans in total corporate loans.

3.1 Bank-firm level analysis using credit register data

Bank-firm relationship data allows to better disentangle demand from supply effects. Participating satellites merge credit register data with supervisory bank-level reports and, to the extent possible, with firm-level information. Figure 4 illustrates bank-customer relationships and the included datasets. Firms might interact with only one bank, or they might have multiple customer relationships with different banks.

The identification of reform effects rests on two pillars: first, demand effects are absorbed by a combination of firm-specific characteristics and sector-by-time fixed effects, and, second, heterogeneous bank exposures are exploited. To accommodate single customer relationships that are more prevalent in emerging markets, the common research protocol suggests using sector-by-time fixed effects in order to absorb time-varying demand effects. To take into account possible distorting factors that arise from distinct, time invariant bank-customer relationships, the analysis uses bank-by-firm fixed effects. Finally, some specifications control for individual borrower characteristics. What remains can plausibly be attributed to changes in bank behaviour and hence reflects affected banks' responses to regulatory changes. Further, considering that banks are affected differently by the reforms given their heterogeneous exposures to reform measures, the analysis compares credit to the same customer extended by *more* to *less* exposed banks, before and after the reform.

Findings at the bank-firm level point to a temporary decline in SME lending growth for the most exposed banks after RBC implementation. For some jurisdictions, lending to non-SMEs seems to evolve in parallel, but the evidence is more mixed.

Remaining caveats when comparing the results

First, different *reporting thresholds* and *definitions* exist across the different credit registers. In some jurisdictions, smaller loans with an exposure above €25,000 are included, while in other countries, the analyses are based on loans with a total exposure above €1 million. Furthermore, SME owners can borrow as private individuals, or as incorporated entities. The analysis focuses on incorporated entities controlling to the extent possible for the differences in

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[30] The "*intensive margin*" of SME lending focuses on changes in the more permanent bank-customer relationships and disregards the entry and exit of borrowers.

[31] Six studies based on bank balance sheet data, and six studies based on aggregated credit register data. For one jurisdiction, data limitations only allowed to consistently estimate the SME share.

reporting thresholds. For instance, to make European jurisdictions' studies comparable, the reporting threshold was raised in one case.

Second, firms *entering and exiting* the sample affect the bank-firm level setup (the "extensive margin" problem). Baseline results at the bank-firm level rely on changes in firms' outstanding borrowing and thus on the *intensive* margin of a bank-firm relationship. In addition, in order to analyse changes in the maturity structure of SME lending, baseline results focus on a balanced sample of firms that take out both short- and long-term loans. However, especially in emerging markets the extensive margin issue is particularly relevant as many firms only take out a single loans from only one bank over a short period.[32] To address this problem, the common protocol provides for credit register satellites to aggregate the data at the bank level and replicate the bank-level approach (see paragraph 3.2). Differences in the results can be insightful as they tell about both the role of very short-term credit to SMEs and the entry and exit of borrowers.

Third, some jurisdictions experienced a significant macroeconomic downturn during the period analysed in this evaluation, while SMEs in others saw very favourable economic conditions. To the extent that overall economic conditions differentially affect both SMEs and their lender banks, the analysis cannot perfectly control for this. The research protocol tries to mitigate this concern by using sector-by-time fixed effects.

Fourth, a bank's exposure to the reforms is based on its ranking among competitor banks *before* the reforms had been announced in the jurisdiction. On the one hand, this implies that the inference relies on a group of banks that is tracked over time – in most cases a fourth of the bank population. Depending on the number of banks operating within one jurisdiction, *idiosyncratic* effects of banks can affect the analysis. On the other hand, the group exhibiting the lowest levels of capitalisation might change over time. The current version of the analysis does not allow banks to rotate in and out of this group of banks considered "most exposed" to the reforms.

Fifth, there are substantial differences across the banking systems of participating jurisdictions. These differences relate to the relative importance of banks as a source of SME funding, the average size and concentration of banks, as well as the more or less pronounced differences across different banking groups within a country.

3.1.1 *Common empirical specifications for credit register analyses*

Different specifications are used to shed light on the reform effects from different angles. The empirical specifications distinguish between *temporary* and *persistent* effects, and they allow reforms to have an impact on *changes in outstanding volumes,* as well as on the *maturity structure* of a banks' loan portfolio. Section 1.3 provides more details, and it illustrates the *persistent* and *temporary* effects. The corporate loan portfolio consists of lending to SMEs and to non-SMEs. The analyses are run at the bank-firm level to examine temporary (CRE 1 and CRE 3) and persistent (CRE 2) effects on growth rates.

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[32] A substantial share of short-term lending that is extended for only one period (or very few periods) and that is not rolled over to another period would hence drop out of the sample when calculating loan growth rates at the individual firm level.

Temporary and persistent effects on growth rates

The analyses consider growth rates of total, short-term and long-term lending to SMEs. It then compares them to growth rates of loans extended to non-SMEs at the bank-firm level. Finally, it takes all firms into account and estimates the transitory and persistent effects on total corporate lending.

It is important to note at this stage that changes in short-term lending at the bank-firm level only capture repeated short-term lending (loans with a maturity of up to one year). As the analyses draws on data at an annual frequency, year-on-year growth rates compare outstanding levels of extended loans to a particular borrower at the end of each year. Hence, for an accurate comparison across maturities, specifications (CRE 1) and (CRE 2) are run on a balanced sample of SMEs borrowing both short-term and long-term loans.[33]

Equation (CRE 1) specifies the SME outcome variable as a growth rate in percentage changes (Δy_{bft}) and regresses it on a set of temporary reform indicators denoted as $\sum_{k=0}^{K} Reg_{t-k}^{temp}$.

$$\Delta y_{b,f,t} = \gamma_F C\_Firm_{f,t-1} + \gamma_B C\_Bank_{b,t-1}$$
$$+\sum_{k=0}^{K}\left(\beta_{RBk}^{A} RegA_{t-k}^{temp} * Bank(0/1)_{b,pre}\right) + FE(b\#f, t\#sector) + \varepsilon_{b,f,t} \quad \text{(CRE 1)}$$

Equation (CRE 2) keeps the SME outcome variable in growth rates, but it takes into account, that reforms might have a *persistent* effect on changes in lending volumes over the observed post-reform sample period.

$$\Delta y_{b,f,t} = \gamma_F C\_Firm_{f,t-1} + \gamma_B C\_Bank_{b,t-1}$$
$$+\left(\beta_{RB}^{A} RegA_t^{pers} + \beta_{RB}^{L} RegL_t^{pers}\right) * Bank(0/1)_{b,pre}$$
$$+FE(b\#f, t\#sector) + \varepsilon_{b,f,t} \quad \text{(CRE 2)}$$

To test whether the difference in lending growth to SMEs and non-SMEs is significant, specification (CRE 3) adds a triple interaction term. A time-invariant dummy indicates whether a firm is considered as an SME, *SMEf*. As the analysis includes bank-by-firm fixed effects, as well as sector-by-time fixed effects, some standalone and double interactions drop out. Only the interaction with the time regulatory indicators can be estimated.

$$\Delta y_{b,f,t} = \gamma_F C\_Firm_{f,t-1} + \gamma_B C\_Bank_{b,t-1}$$
$$+\sum_{k=0}^{K}\left(\beta_{RBk}^{A} RegA_{t-k}^{temp} * Bank(0/1)_{b,pre}\right) + \sum_{k=0}^{K}\left(\beta_{RFk}^{A} RegA_{t-k}^{temp} * SME_f\right)$$
$$+\sum_{k=0}^{K}\left(\beta_{RFk}^{A} RegA_{t-k}^{temp} * SME_f * Bank(0/1)_{b,pre}\right) + FE(b\#f, t\#sector) + \varepsilon_{b,f,t}$$
$$\text{(CRE 3)}$$

Standard errors are either clustered at the bank or firm level depending on the jurisdiction which is running the analysis.

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[33]   In one case, information on the maturity of loans was not available. All loans were considered in this case.

3.1.2   *Comparing the satellites' results: credit register analyses*

Results suggest a temporary decline of SME loan issuance by the ex-ante most exposed banks after RBC implementation in four of the six different credit register analyses. In most jurisdictions, SME credit growth falls in the immediate post-reform period (Figure 11, top left-hand panel).

The range of this decline varies considerably, but the negative effects are significant in most cases. In the subsequent period (t+1), results suggest another significant drop in SME lending growth rates relative to the previous period, although the range of declines across countries narrows. Results in the second period after the implementation (t+2) reveal another drop for most jurisdictions. However, the spread widens again and might start picking up further RBC implementation stages or other reforms. In some cases (especially in the euro area), this period coincides with the legal framework implementation (Figure 3). In subsequent periods, the findings are less conclusive and probably mingle delayed RBC effects with other reforms like the LR.[34]

When separating long-term from short-term lending by the most affected banks, divergent patterns emerge for some countries. To recall, in order to distinguish between different maturities and draw inference on the same type of borrowers, the analysis is restricted to those SMEs that take out long- and short- term loans during the sample period. The benefit from this approach is that the analysis can more effectively compare short and long term lending. However, as a side effect, borrowers are more similar in terms of their characteristics, which means that the sample might be biased towards larger and more creditworthy SMEs.

Long-term loans could be driving the overall temporary SME decline in a few cases. The evolution of long-term credit extension (Figure 11, bottom, left-hand panel) broadly replicates the patterns of total SME lending growth for two (out of five) countries and can hence be identified as the driving force in these cases.

Estimates on the short-term transitory effects are a little less conclusive (Figure 11, bottom right-hand panel). Different countries show significant estimates in different periods. One reason for this might be that short-term lending is more volatile in general. Another reason might be that the analysis focuses on a subset of borrowers that keep renewing their short-term loans. In particular, growth rates are based on changes in the outstanding level of loans at the bank-firm level with credit register data collected at an annual frequency. To track growth rates for the same borrower, very short-term loans that are not renewed essentially drop from the sample, and so does a borrower which only takes out that kind of loan.

Results on the persistent effect on growth rates over the post Basel III period show a reduction in the pace of SME lending growth that mirrors the sequence of initial transitory declines (Figure 12). The persistent effect can be considered an average effect across the observed sample period (in most cases until 2017). The lagged RBC effect might comingle to some extent with the effects other Basel III reforms that only enter into force later, in particular those targeting capital.

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[34]   It is important to note that the G-SIB/D-SIB capital surcharge requirements also overlap with the RBC reform for some jurisdictions in 2012.

Evidence on lending to non-SMEs is more mixed. For some jurisdictions, credit to non-SMEs seems to exhibit similar results, but there is more heterogeneity across the studies. (Figure 11, top right hand panel). A more diverse picture is confirmed by the results on *persistent* effects (Figure 12, right-hand panel). As non-SMEs might substitute bank loans by other funding sources, declining demand might also contribute to this finding.

Results on the triple interaction provide no clear evidence. At most, two studies provide negative and insignificant estimates that might suggest that SME credit growth for the most exposed banks after the RBC implementation declined relatively more than credit growth to non-SMEs (Figure 12, left-hand panel).

RBC: Transitory effects based on credit registry data at the bank-firm level[1]

Percentage points   Figure 11
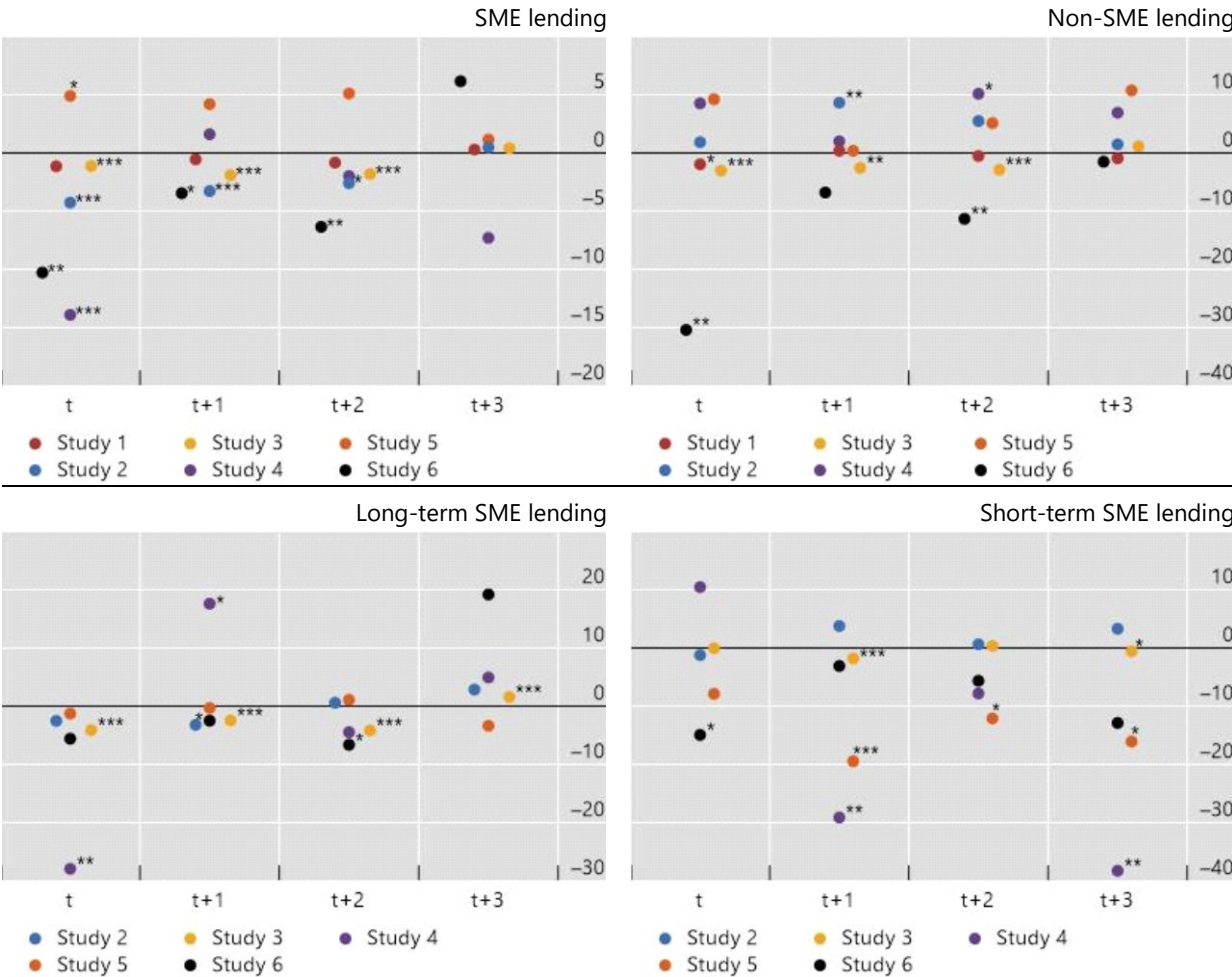
This table shows the estimation results for specification (CRE 1) with each dot representing one particular satellite study. The underlying data used by jurisdictions with credit register data is based on a balanced sample of firms that take out both short- and long-term loans over the estimation period. Corporate lending captures the sum of SME and Non-SME lending
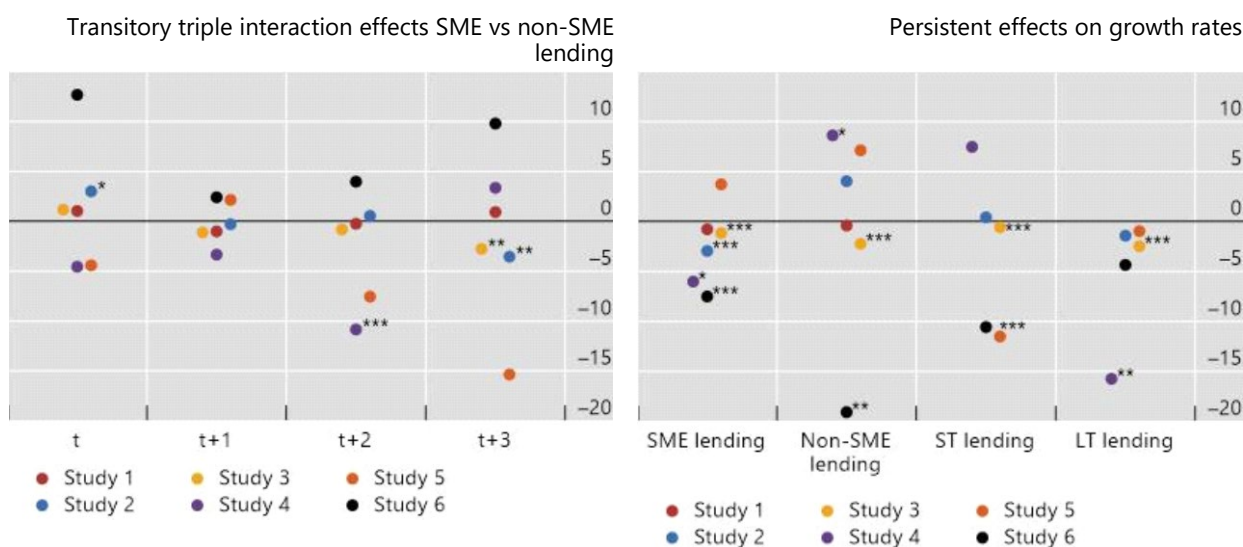
[1] ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

Sources: National credit registries and central banks.

RBC: effects based on credit registry data at the bank-firm level [1]

Percentage points   Figure 12

Transitory triple interaction effects SME vs non-SME lending

Persistent effects on growth rates

This table shows the estimation results for specifications (CRE 2) in the right-hand panel and (CRE 3) in the left-hand panel. Each dot represents one particular satellite study. The underlying data used by jurisdictions with credit register data is based on balanced sample of firms that take out both short- and long-term loans over the estimation period. Corporate lending captures the sum of SME and Non-SME lending.

[1] ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

Sources: National credit registries and central banks.

3.2   Bank-level portfolio analyses

The bank-level analyses consider changes in the banks' loan portfolio composition of banks and they provide an important complement to other pieces of the evaluation. In particular, bank level analyses cover all types of loans extended to all borrowers, even for very short-term maturities. Ten jurisdictions with 12 studies in total participate in this bank level analysis (six studies with bank balance sheet data and six with aggregated credit registry data). In terms of coverage, this analysis allows a comparison with the broadest range of results based on supervisory micro-level data.

The reform identification again rests on two pillars, now at the bank level. First, to absorb demand effects, macroeconomic control variables or time fixed effects[35] are included in the specifications. Second, heterogeneous reform exposures imply that banks are affected differently by the reforms. It is this differential impact that helps to identify the effects on banks' SME lending.

These bank-level analyses share several of the caveats identified for the credit register analyses, such as differences in the structure of the national banking systems, divergent macroeconomic developments, as well as the focus on a static sample of ex-ante exposed banks.

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[35]   In some cases location-by-time fixed effects have been used with the location referring to the banks' headquarters.

Nonetheless, the extensive margin problem can be addressed when aggregating data at the bank level; the analysis then covers the overall SME lending portfolio, including borrowers entering and exiting the loan pool and those taking very short term loans.

3.2.1 *Common empirical specifications*

Empirical specifications at the bank-level mirror those of the credit register analysis. They separately consider *temporary* and *persistent* effects, and they distinguish between reform effects on changes in outstanding volumes and on the composition of the banks' portfolios.

Equation (BNK 1) shows SME lending as a growth rate in percentage changes $\left(\Delta y_{bt}\right)$ and analyses the temporary effect of a series of reform indicators, described as $\sum_{k=0}^{K} \text{Reg}_{t-k}^{temp}$. More details on the temporary versus persistent effects and their illustration are provided in Section 1.3.

$$\Delta y_{b,t} = \gamma_B C\_Bank_{b,t-1}$$
$$+\sum_{k=0}^{K}\left(\beta_{RBk}^{A} RegA_{t-k}^{temp} * Bank(0/1)_{b,pre}\right) + FE(b,t) + \varepsilon_{b,t} \qquad \text{(BNK 1)}$$

Specification (BNK 2) also captures growth rates of SME lending, but it allows the reforms to have a persistent effect.

$$\Delta y_{b,t} = \alpha + \gamma_B C\_Bank_{b,t-1}$$
$$+\left(\beta_{RB}^{A} RegA_{t}^{pers} + \beta_{RB}^{L} RegL_{t}^{pers}\right) * Bank(0/1)_{b,pre} + FE(b,t) + \varepsilon_{b,t} \qquad \text{(BNK 2)}$$

Equation (BNK 3) turns to portfolio shares (such as the share of long term SME loans in total SME loans, or the share of SME loans relative to total corporate loans). Shares are regressed on a persistent reform indicator.

$$y_{b,t} = \gamma_B C\_Bank_{b,t-1}$$
$$+\left(\beta_{RB}^{A} RegA_{t}^{pers} + \beta_{RB}^{L} RegL_{t}^{pers}\right) * Bank(0/1)_{b,pre} + FE(b,t) + \varepsilon_{b,t} \qquad \text{(BNK 3)}$$

The following list describes the bank-level variables. Standard errors are either robust or clustered at the bank level, if enough clusters exist.

Δy_{bt}	Total SME or total non-SME lending by bank b, (log change in %)
y_{bt}	Total SME/total corporate lending (%)
$Bank(0/1)_{b,pre}$	Indicator, based on banks average exposure measure is **≤ p25, or p50**
$C\_Bank_{b,t-1}$	Lagged bank control variables (e.g. log total assets, loan-to-asset, deposit-to-asset, NPL ratio, RBC and LCR ratio, ROE, operating income etc.)
$FE(b,t)$	Separate bank and time fixed effects, in some cases region-by-time FE at the sub-national level according to bank's headquarters

3.2.2 *Comparing the satellites' results: analysis based on bank level data*

When looking at the bank-level analysis, evidence on a *temporary* decline in the growth rate of SME lending is limited to a subset of studies (four studies out of 11, Figure 13, left-hand panels). In the second period after reform implementation, the decline remains significant in only one jurisdiction. It is interesting to note that when aggregating granular bank-firm level data to the bank portfolio level, the *temporary* decline in SME lending growth rates disappears for two credit registers studies. Results can deviate from the bank-firm level analyses, as the aggregated sample now captures all bank-firm relationships including entry and exit of very short-term loans.[36] However, the aggregated sample allows for a less clean identification in comparison to the set of analyses in the previous section, since data at the bank-firm level is better suited to control for demand effects.

Persistent effects on the growth rates of SME lending are rare, essentially confirming previous conclusions. Results from only two jurisdictions suggest that the most exposed banks *persistently* cut their SME lending growth in the post reform period (Figure 14, left-hand panels). These two jurisdictions also counted among those that reported a significant temporary decline. Country-specific circumstances, which cannot be fully controlled for, might explain these lasting drop

Lending to non-SMEs by ex-ante most exposed banks reveals hardly any significant evidence at the bank level. An immediate drop in the lending growth rate occurs only for one jurisdiction, while one other jurisdiction reports a significant increase. For the remaining periods, these effects are mainly insignificant (Figure 13, right-hand panels). Related to the persistent effects, four out of eleven studies find weak evidence of a decline in non-SME lending. Out of these, only one jurisdiction reports significant *persistent* declines in lending growth to both, SMEs and non-SME (Figure 14, left-hand panels).

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[36]   The different result might suggest that there is a role played by short-term, one period loans that are not captured when looking at growth rates at the individual bank-firm level and are instead captured when looking at the bank portfolio. Differences in the reporting threshold may also add to differences in the results.

Although persistent effects on growth rates are rare, in about half of the studies there seems to be a *persistent* fall in the *share of SME relative in total corporate lending.* For three jurisdictions with credit registry data, the portfolio share of SME lending fell significantly. These declines range between 1.7 and 5.4 percentage points over the post-RBC period (Figure 14, bottom right-hand panel). For studies with bank balance sheet data, the share of SME in total corporate lending by the most exposed banks fell by about two percentage points in two jurisdictions, while one jurisdiction experienced a larger drop of 7.5 percentage points (Figure 14, bottom right-hand panel). For both groups, drops in the SME portfolio share reflect a net outcome that may result from different forces. In some cases, they might be explained by higher lending growth rates to non-SMEs borrowers rather than to a marked reduction in lending to SMEs.

RBC: Transitory effects at the bank level[1]

Percentage points   Figure 13
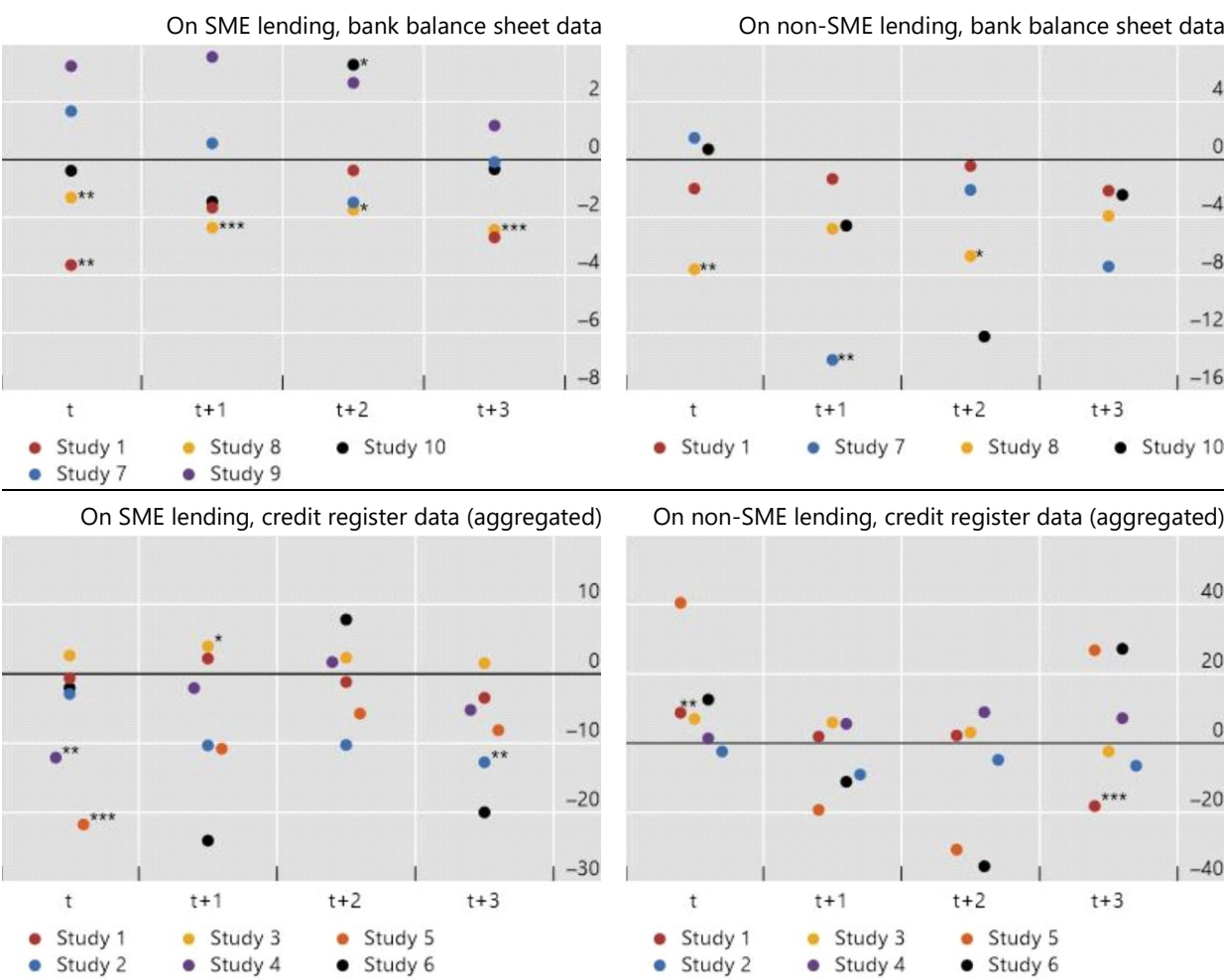
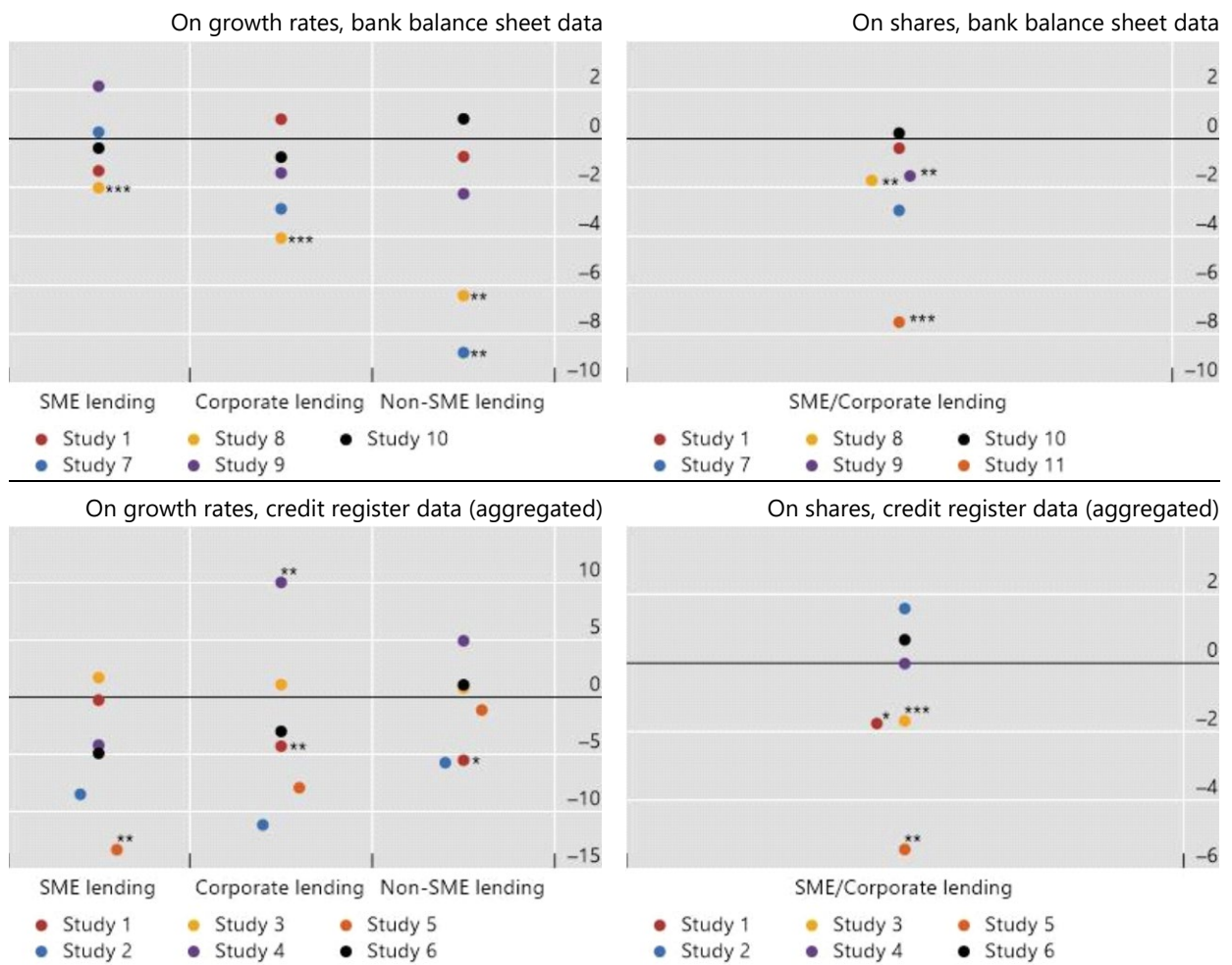This table shows the estimation results for specification (BNK 1) Each dot represents one particular satellite study. Corporate lending captures the sum of SME and Non-SME lending. For one jurisdiction, data limitations only allowed to consistently estimate the SME share.
[1] ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

Sources: National credit registries and central banks.

RBC: Persistent effects at the bank level[1]

Percentage points   Figure 14

On growth rates, bank balance sheet data

SME lending   Corporate lending   Non-SME lending

- Study 1   ● Study 8   ● Study 10
- Study 7   ● Study 9

On shares, bank balance sheet data

SME/Corporate lending

- Study 1   ● Study 8   ● Study 10
- Study 7   ● Study 9   ● Study 11

On growth rates, credit register data (aggregated)

SME lending   Corporate lending   Non-SME lending

- Study 1   ● Study 3   ● Study 5
- Study 2   ● Study 4   ● Study 6

On shares, credit register data (aggregated)

SME/Corporate lending

- Study 1   ● Study 3   ● Study 5
- Study 2   ● Study 4   ● Study 6

This table shows the estimation results for specifications (BNK 2) in the left-hand panels, and (BNK 3) in the right-hand panels, respectively
Each dot represents one particular satellite study. For one jurisdiction, data limitations only allowed to consistently estimate the SME share.
Corporate lending captures the sum of SME and Non-SME lending. ***, ** and * denote the significance levels of 1%, 5% and 10%, respectively.

Sources: National credit registries and central banks.