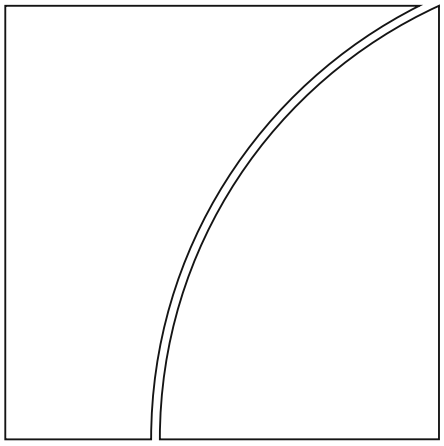
BANK FOR INTERNATIONAL SETTLEMENTS



BIS Working Papers

No 912

Regulatory capital, market capital and risk taking in international bank lending

by Stefan Avdjiev and Jose Maria Serena

Monetary and Economic Department

December 2020

JEL classification: G21, G32.

Keywords: Interest rates, bank capital, risk taking, international leveraged loans.

BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The papers are on subjects of topical interest and are technical in character. The views expressed in them are those of their authors and not necessarily the views of the BIS.

This publication is available on the BIS website (www.bis.org).

ISSN 1020-0959 (print)
ISSN 1682-7678 (online)

Regulatory capital, market capital and risk taking in international bank lending*

Stefan Avdjiev† Jose Maria Serena‡

December 2020

Abstract

We investigate the links among US monetary policy, bank capital, and risk taking in international bank lending. Using syndicated loan data, we find that low US interest rates spur the origination of risky dollar-denominated international loans through two distinct mechanisms. First, consistent with the existence of a regulatory capital channel, banks with higher levels of regulatory capital originate riskier loans when interest rates decline. Second, banks with low levels of market capital have a higher propensity to extend riskier loans in response to falling interest rates. This finding implies the existence of a market capital channel, which operates in the opposite direction to the regulatory capital channel.

Key words: Interest rates; bank capital; risk taking; international leveraged loans
JEL: G21, G32

*We are grateful for comments, suggestions, and discussions to Claudio Borio, Stijn Claessens, Leonardo Gambacorta, Linda Goldberg, Gabriel Jimenez, Catherine Koch, Patrick McGuire, Benoit Mojon, Hyun Shin and participants at the 16th Annual NBP-SNB Joint Seminar. The views expressed are those of the authors and not necessarily those of the Bank for International Settlements.

†Bank for International Settlements, Basel, Centralbahnplatz 2, Switzerland. E-mail: Stefan.Avdjiev.org

‡Bank for International Settlements, Basel, Centralbahnplatz 2, Switzerland. E-mail: Jose.Serena@bis.org

1 Introduction

When falling interest rates compress returns, banks tend to chase yield by switching to riskier loans (Borio and Zhu [2012]). This switch is a manifestation of the risk taking channel of monetary policy. It is present both at a domestic level (Jimenez et al. [2014], Dell'Ariccia et al. [2017]) and at an international level (Lee et al. [2019], Brauning and Ivashina [2019], Albrizio et al. [2020]).

The existing literature has demonstrated that the intensity of risk-taking depends on bank capital. Most empirical research in that area has focused on regulatory capital, showing that banks with higher ratios of Tier 1 capital to risk-weighted assets (RWA) take on more risk when interest rates are low (Dell'Ariccia et al. [2017], Lee et al. [2019]). This body of evidence supports the existence of a "regulatory capital channel", underscoring that banks' risk-taking propensity increases when the likelihood of costly supervisory intervention falls and vice versa.

In this paper, we demonstrate that the level of market capital also has a significant impact on risk-taking by banks. The value of shareholders' stake in a bank, or "franchise value", is best measured by the bank's market capitalisation (Schwert [2018]). Due to limited liability, low market capital levels imply that shareholders have relatively little "skin in the game". Empirically, market capital often deviates substantially from regulatory capital (Figure 1) and could thus affect bank risk taking independently through what we call the "market capital channel".

We examine two main hypotheses. First, we investigate if banks with *high* regulatory capital are more likely to increase the riskiness of their international loans in response to a fall in US interest rates. This would be consistent with the "regulatory capital channel", which operates through the threat of a bank breaching its regulatory capital requirement. Second, we test if banks with *low* market capital are more likely to increase the riskiness of

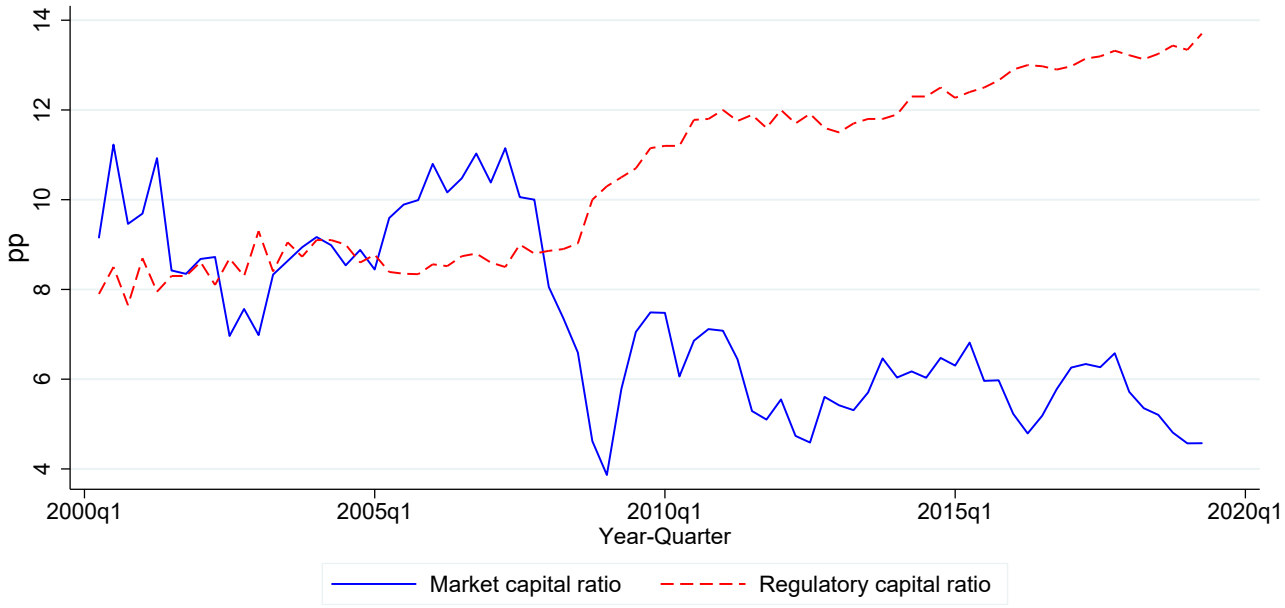


Figure 1: **Regulatory and market capital ratios:** Regulatory capital is the ratio of Tier 1 to RWA. Market capital is the ratio of the market capitalisation to quasi-market assets (book liabilities plus market capitalisation). Median of a sample of 117 large banks, period 2004-2018.

their international loans when US interest rates decline. This would support the existence of a "market capital channel", operating through bank shareholders' risk-taking incentives. It would be consistent with the view that shareholders' "skin in the game" is best captured by market capital.

We test the above hypotheses using a novel granular (borrower-lender-loan) dataset on US dollar-denominated international syndicated bank loans.[1] We construct our dataset by combining Refinitiv SDC syndicated loan data with borrowing firm- and bank-level information in order to map each syndicated loan into multiple bilateral loans. We focus on lead arrangers, which act as a "relational bank" (Gadaneczand McCauley [2006]) in charge of monitoring the borrower and attracting investors (Sufi [2007]).

Our baseline empirical model relates the risk classification attached to loans by lenders

[1]We define a loan as international if the ultimate parent of the lender is from a different country than the ultimate parent of the borrower.

to a number of bank-level characteristics, and other demand- and supply-side determinants of loan credit quality. Our dependent variable is categorical, taking four values: highly leveraged (riskiest), leveraged, near investment grade, or investment grade (safest) loans. In our benchmark analysis, we focus on term loans denominated in US dollars. We measure regulatory capital with the ratio of Tier 1 to RWA and market capital with the market capital ratio, defined as the ratio of market capitalisation to quasi-market assets (market capitalisation plus book debt). In all specifications, we control for a variety of global factors, as well as for a number of borrower-country and and bank-specific characteristics.

We find three main sets of results. First, low US interest rates spur the origination of risky (ie highly leveraged) international loans. This result underscores that US interest rate spillovers go beyond their impact on quantities, and is consistent with existing findings that low rates are associated with a deterioration in the quality of overseas borrowers. Second, banks with higher regulatory capital originate riskier international loans and are more likely to do so in response to low US interest rates. This provides evidence for the existence of a "regulatory capital channel" of monetary policy in international bank lending. Third, banks with low market capital tend to originate riskier international loans, and are more likely to do so in response to low US interest rates. These findings provide evidence for the existence of a "market capital channel" of monetary policy in international bank lending.

Our key results are robust to a number of alternative specifications. For example, they hold when we gauge banks' franchise value using the price-to-book ratio (Bogdanova et al. [2018]) or the book capital ratio. Similarly they are robust to alternative measures of US interest rates, and to the inclusion additional controls.

Our findings contribute to three strands of literature. First, we contribute to the literature examining the links between monetary policy, bank capital and risk-taking (Jimenez et al. [2014]). More concretely, we are the first to demonstrate that two separate and distinct channels are simultaneously at work along the above nexus. We first expand on the results

of Dell'Ariccia et al. [2017] by documenting the existence of the regulatory capital channel in an international (as opposed to a domestic) setting. We then demonstrate that a separate, market capital channel also has a significant impact on the sensitivity of banks' risk-taking to monetary policy. We thus reconcile an apparent puzzle in the existing literature, which has reached seemingly contradicting conclusions on the role of bank capital.[2] Namely, we document that regulatory capital and market capital both have significant effects that work in opposite directions.

Second, we contribute to the literature on the importance of shareholders' incentives in bank decisions (Demsetz et al. [1996], Keeley [1990] or Peydro et al. [2020]). So far, the literature had only examined the dual impact of market capital and regulatory capital on bank lending volumes and funding (Gambacorta and Shin [2018]). We extend this analysis of the dual role of market and regulatory capital to the impact of monetary policy on bank risk taking.

Finally, our paper also contributes to the literature on US monetary policy spillovers through international bank lending, which had so far focused primarily on lending volumes (Bruno and Shin [2015], Koepke [2019] and Avdjiev et al. [2020])[3]. Previous research has also documented a link between loose US monetary policy and a deterioration in the risk profile of borrowers (Lee et al. [2019], Brauning and Ivashina [2019]). We add to the existing literature by showing that US monetary policy has a significant impact not only on the volume, but also on the riskiness of international loans.

The remainder of the paper is organised as follows. Section 2 describes the data. Section 3 presents our main hypotheses. In Section 4, we describe the benchmark empirical model.

[2]Specifically, Jimenez et al. [2014] has found support for risk-shifting motives using a non-regulatory capital ratio - the book capital ratio. Other recent research (cited above) has found the opposite result using regulatory capital.

[3]The existing literature has also focused on the interaction of US monetary policy with the monetary policy stances of other large advanced economies (Avdjiev et al. [2018a]), and with the prevailing capital flows regime (Avdjiev et al. [2018b])

Section 5 presents the key results of the paper. We test the robustness of our main results in Section 6. Section 7 concludes.

2 Data

We construct a loan-bank-borrower dataset gathering data from Refinitiv.[4] We retrieve data on the global syndicated loan market from Refinitiv Securities Data Company (SDC) Platinum, and combine it with firm (borrower) and bank (lender) information from Refinitiv Eikon.

In the sample of syndicated loans, we keep all the loans granted to non-financial firms that are recorded as closed or completed during the period 1983-2019. We exclude bridge loans. This results in a sample that consists of 242,155 loans, 93% of which are syndicated (ie involve more than one lender). Since our unit of observation is at the loan-lender level, we map each syndicated loan into bilateral loans, considering each member of the syndicate as an individual lender to the respective borrower firm.

Next, we match loans to firm and lender reference data and financial statements, obtained from Refinitiv Eikon. The Data appendix provides a description of the variables used in the paper, and summary statistics. In this preliminary sample, we have 1,465,169 lender-firm bilateral loans, granted by 6,411 lenders incorporated in 146 countries. On the borrower side, our sample includes 28,563 firms, incorporated in 106 countries.

We then narrow down the sample in two steps. First, we drop loans granted by non-banks to focus exclusively on loans granted by banks. Following Lim et al. [2014], we define

[4]Following the existing literature, we use the term "syndicated loan" to refer to all the deals in the sample, including bilateral loans. Not all loans are syndicated, as 20,896 are classified as club syndicate loans (where the loan is arranged by a small number of participants), and 13,881 are bilateral loans. Furthermore, we treat each facility as a loan (facilities differ in the terms and conditions, despite being arranged in a given day). Tables 1 and 2 in the Data appendix provide descriptive statistics, and list all the variables used in the paper.

banks as all deposit-taking institutions according to the NAICS (code 5221, for depository credit intermediation), or according to the Thomson Reuters business classification. We conduct this classification on a consolidated basis. To identify the ultimate parent company of each lender, we use information on banks' corporate structure.[5] All in all, the banks in our sample cover all the syndicated loan lenders subject to bank capital regulatory requirements (including the major US investment banks).

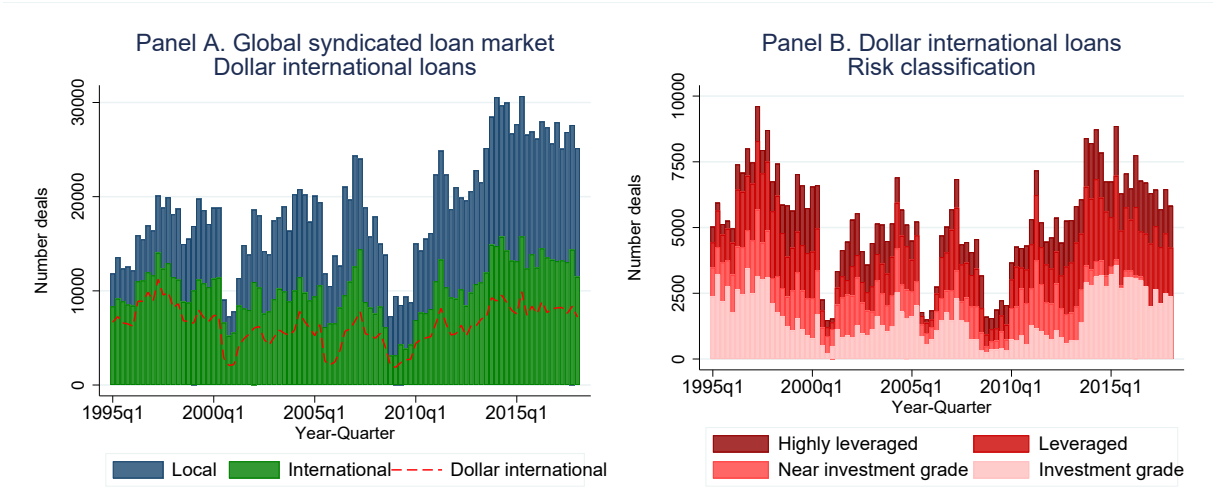


Figure 2: **Dollar international loans in the global syndicated loan market:** Panel A shows the total number of local and international loans. The latter are the transactions in which the ultimate parent country of the (NFC) borrower differs from the ultimate parent country of the lender. If loans are syndicated, we split them into several individual loans. Panel B breaks down dollar international loans according to their risk: investment grade, near investment grade, leveraged, and highly leveraged. See also Table 3 in the Data appendix.

Second, we focus exclusively on the subset of the loans in which a bank acted as a lead arranger. The reason is that the lead arranger is the bank that de-facto monitors the borrower (Gadanecz and McCauley [2006] and Sufi [2007]), while the rest of loan participants can be considered as investors. Furthermore, to attract other participants, the lead arranger typically acquires a larger exposure and assumes higher risk. In our benchmark empirical analyses, we examine US dollar-denominated international syndicated loans, which account

[5]We consolidate up to the ultimate parent, unless that is the government or a holding company involved in the management of companies and enterprises. We use the current corporate structure, and adjust it backwards to account for all major mergers and acquisitions.

for one third of all loans (Figure 2, Panel A). We define a loan as international if the country of the (NFC) borrower's ultimate parent differs from the country of the lead arranger's ultimate parent. International loans account for more than half of all deals in our database.

To assess international syndicated loans' ex-ante credit risk, we use lenders' own classifications. Specifically, we exploit that lenders classify each international syndicated loan (at origination) in one of four buckets (listed from riskiest to safest): highly leveraged, leveraged, near investment grade, and investment grade loans. The number of risky and safe international dollar loans is roughly similar (Figure 2, Panel B), although their relative importance fluctuates over time.

Table 1: **Characteristics of market participants' loan risk classification:** Results of an ordered logit model in which the dependent variable is the loan risk classification attached by lenders. The loan risk classification has four categories, attached at origination. From riskiest to safest: highly leveraged, leveraged, near investment grade, and investment grade loans. Loan characteristics are: the spread, the amount, the original maturity. As borrower characteristics, we include the Altman score - a composite indicator introduced in Altman (1966) - (higher values mean less risk), and the borrower 5-year EDF (higher values reflect more risk). Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II	III	IV	V
Loan: Spread	0.644***	0.660***	0.833***	6.462***	6.287***
	(0.01)	(0.01)	(0.01)	(0.07)	(0.07)
Loan: Amount	−0.118***	−0.088***	−0.088***	−0.158***	−0.185***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)
Loan: Original maturity	0.033***	0.047***	0.052***	0.115***	0.111***
	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)
Borrower: Altman score				−0.052***	−0.176***
				(0.01)	(0.01)
Borrower: EDF (5-Year)					0.090***
					(0.01)
Observations	386327	381041	195105	59694	47797
Adjusted R-squared	0.142	0.163	0.194	0.497	0.491
Borrower country controls	Yes	Yes	Yes	Yes	Yes
Year FE		Yes	Yes	Yes	Yes
Type	All	All	Int	Int	Int

In order to examine how this ranked classification aligns with other common measures of

ex-ante credit risk, we regress it on the amount, maturity, and spread of the loan, and the borrower's Altman score.[6] Since higher values of the risk classification variable are associated with riskier loans, results in Table 1 show that highly leveraged loans tend to be smaller, pay higher spreads, and have longer maturities. This holds for the full sample of loans (columns I-II), and the subset of international loans (III-V). Additionally, they are granted to borrowers which are risky, both when we measure them with financial metrics (ie low values of Altman score, in column IV), and market data (ie high EDF, in column V).

The loan risk classification depends on its terms and conditions, as well as on borrower's financial health. Terms and conditions change from deal to deal (eg longer-term loans are riskier; credit risk increases if covenant protection is weak and decreases if there are credit enhancements). These features affect the way lenders classify loans, so a company can raise loans of distinct risk in a short period of time.[7]

It is also worth noting that the dataset includes both term loans and credit lines. The former are the most relevant segment of the market for investigating bank risk taking, as these lending relationships are weaker. Credit lines are often revolving facilities – easy to renew, and much less sensitive to market wide conditions, or changes in bank and firm attributes. Further only term loans imply an effective disbursement. Credit lines are rarely drawn at origination, so banks do not take on credit risk immediately.

As discussed above, we examine two measures of bank capital - regulatory capital and market capital. In line with previous research, we measure regulatory capital with the ratio of Tier 1 capital to RWA (Dell'Ariccia et al. [2017]). We assess market capital with the ratio of market capitalisation to quasi-market assets (book liabilities plus market capitalisation).[8]

[6]The Altman z-score is a measure of firms' creditworthiness, which is a linear combination of several financial metrics gauging profitability, liquidity, market valuation, or sales).

[7]For example, Petrobras obtained a leveraged revolving line facility in May 2014; soon after, in August 2014, it obtained an investment grade term loan from a Japanese bank. The risk classification of the latter was better since it had a credit enhancement by the export credit agency of Japan.

[8]More formally, the regulatory capital of bank j at year y, $rc_{j,y}$ is $Tier_{j,y}/RWA_{j,y}$, where $Tier_{j,y}$ is Tier 1 capital, and $RWA_{j,y}$ risk-weighted assets. The market capital of a bank j $mc_{j,y}$ is $MC_{j,y}/(MC_{j,y}+BL_{j,y})$,

3 Hypotheses

Bank capital and market capital differ both in theory and in practice. Conceptually, regulatory capital is linked to the book value of equity, which reflects past profits and losses (as well as paid-in capital). By contrast, market capital is a function of the present discounted value of expected future dividends. Hence, it depends on banks' (perceived) ability to generate profits, and on the discount rate applied to those expected future profits. As noted by Schwert [2018], an important informational advantage of market capital is that it depends on current prices. Cross-sectional differences in market capital typically reflect the distinct value of intangibles, such as lending relationships, expected business opportunities and the level of unrecognised losses (Calomiris and Nissim [2014]).

Regulatory and market capital also differ empirically, as demonstrated by the correlations in Table 2. Specifically, regulatory capital (eg the Tier 1 to RWA ratio) is unrelated to traditional measures of shareholder value, such as the market capital. While this holds in the full time window we examine, the post-crisis period has seen a widening of the divergences between regulatory and market capital (Panel C and Figure 1; see also Sarin and Summers [2019]). This reflects that after the Great Financial Crisis (GFC) banks have built capital buffers to meet regulatory requirements. In contrast, their market capitalisation has remained relatively low, as profitability is dragged down by legacy issues and low interest rates (Claessens et al. [2018]).

Against this backdrop, we examine two main hypotheses that are related to the two main channels we investigate - the regulatory capital channel and the market capital channel.

The "regulatory capital channel" works through the link between the level of regulatory capital and the riskiness of loans. Bank capital regulation sets minimum capital requirements. Since banks are risk-averse with respect to breaching the regulatory threshold (Borio

where $MC_{j,y}$ is the market capitalisation of a bank, and $BL_{j,y}$ denotes book liabilities.

Table 2: **Correlation of bank capital measures:** Regulatory capital is the ratio of Tier 1 capital to RWA; book capital is the ratio of book equity to total assets; market capital is the ratio of market capitalisation to quasi-market assets (market capitalisation plus book value of liabilities); price-to-book is the ratio of market capitalisation to book equity.

Panel A. Full sample

	Regulatory capital	Book equity	Market capital	Price-to-book
Regulatory capital	1			
Book equity	0.27	1		
Market capital	-0.09	0.49	1	
Price-to-book	-0.05	0.52	0.83	1

Panel B. 2003-2008

	Regulatory capital	Book equity	Market capital	Price-to-book
Regulatory capital	1			
Book equity	0.40	1		
Market capital	0.34	0.69	1	
Price-to-book	0.36	0.57	0.86	1

Panel C. 2009-2019

	Regulatory capital	Book equity	Market capital	Price-to-book
Regulatory capital	1			
Book equity	-0.02	1		
Market capital	0.01	0.53	1	
Price-to-book	-0.02	0.68	0.81	1

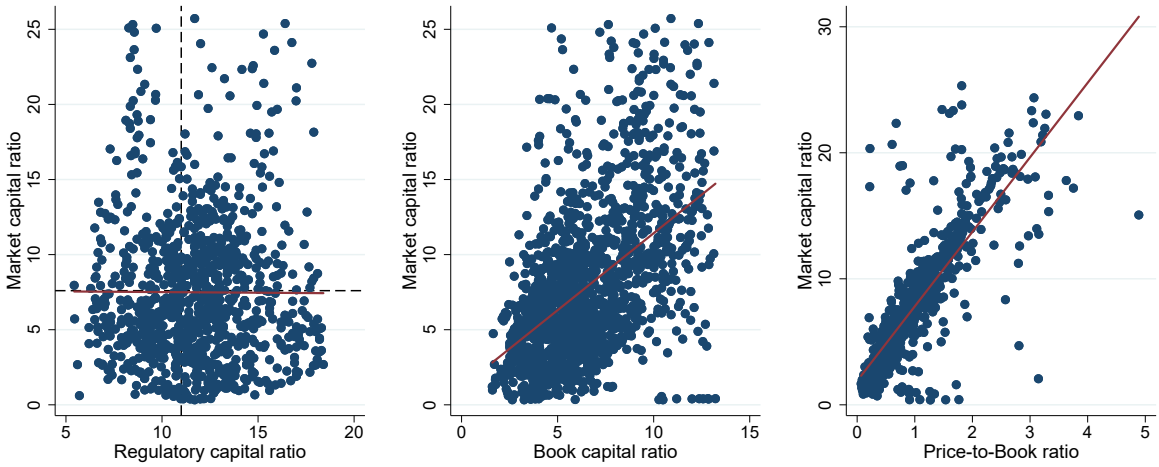


Figure 3: **Bank capital measures:** Each dot represents a bank-year observation. Sample of 117 large banks, period 2004-2018.

and Zhu [2012]) and issuing equity is costly (den Heuvel [2005]), banks wishing to hold riskier portfolios have to hold higher levels of regulatory capital. This is reinforced by the fact that capital regulation imposes higher risk weights on risky loans, so originating highly leveraged (higher-risk) loans consumes more regulatory capital than arranging investment grade (lower-risk) deals.[9] For both of those reasons, banks with higher regulatory capital could afford to originate more leveraged loans. Correspondingly, the search for yield triggered by low interest rates would be stronger for banks with higher levels of regulatory capital. This would be the case despite the fact that banks tend to hold levels of regulatory capital in excess of regulatory minima (den Heuvel [2005]). This reasoning leads to two testable hypotheses:

Hypothesis 1a: Banks with higher regulatory capital originate riskier loans.

Hypothesis 1b: The impact of US interest rates on the origination of riskier loans is greater for banks with higher regulatory capital.

The "market capital channel" works through the risk-shifting incentives of shareholders. Since banks operate under limited liability, their shareholders have incentives to take on more risk than socially optimal. Such risk-taking incentives are inversely related to the level of market capital, which is the value shareholders would lose in the event of a bank failure (aka the franchise or charter value). Consequently, high market capital has a disciplining effect on banks (Demsetz et al. [1996]): it signals that shareholders have substantial skin-in-the-game (Keeley [1990]) and little incentive to engage in excess risk-taking. This reasoning suggests that market capital represents a risk-taking determinant that is distinct from regulatory capital. It leads to two additional testable hypotheses:

Hypothesis 2a: Banks with lower market capital originate more leveraged loans.

[9] Cost differences may be significant. For instance, under the standardised approach to credit risk in Basel III, risk-weights are: 20% (ratings A to AA-), 50% (BBB+ to BB-), 100% (below BB-), and 150% (unrated).

Hypothesis 2b: The impact of US interest rates on the origination of leveraged loans is greater for banks with lower market capital.

Recent papers on risk-taking have gauged risk-shifting incentives using the regulatory capital ratio. For example, Dell'Ariccia et al. [2017] use the ratio of Tier 1 to RWA. This metric has a low correlation with market capital. This may have obscured the negative link between risk-shifting incentives and bank risk-taking, since regulatory capital is empirically unrelated to the value of the bank for the shareholders (as shown above). Jimenez et al. [2014] assesses risk-shifting incentives with a risk-insensitive book capital ratio. This measure has moderately positive correlation with market capital (Figure 3).

By using market capital to gauge risk-shifting motives, our paper relates to an older strand of literature that had used market capital to document a strong link between low skin-in-the-game by shareholders and risk taking.[10] Despite documenting how the market value of capital affected banks' risk taking behaviour, these papers had not analysed any links with interest rates.

Our implicit assumption is that banks assume credit risk when they originate a loan. This implies that banks hold at least a fraction of the loans they originate, and do not immediately package and distribute the whole loan to investors. This is not a strong assumption since previous research shows that lead arrangers retain a significant fraction (on average: around one-third) of the loan (Irani et al. [2020]) (Ivashina and Scharfstein [2010]).

[10]Keeley [1990] assesses "skin-in-the-game" incentives using the market-to-book asset value (market value of capital divided by the market value capital plus book value of liabilities). Demsetz et al. [1996]) used adjusted Tobin's q –market capitalisation plus book value of liabilities, divided by total assets minus goodwill.

4 Empirical strategy

4.1 Econometric Model

Our dataset is at the loan-level, and includes information on (lead arranger) bank characteristics, loan attributes, and borrower attributes - including home country variables. Each loan is recorded at the date of origination. In order to exploit these dimensions, we estimate several versions of a baseline empirical model that relates the credit risk of the bank loan to a number of supply and demand determinants of loan credit quality, and bank-level determinants of risk-taking:

$$Loan^{risk}_{c,j,y,t} = \alpha + \gamma_y + f(x_{c,y-1}) + g(p_{y-1}) + h(z_{j,y-1}) + \beta_1 ff_t + \beta_2 bc_{j,y-1} + \beta_3 ff_t * bc_{j,y-1} + \epsilon_{c,j,y,t} \tag{1}$$

where c refers to the country of incorporation of the borrower, j to the bank, y to the origination year, and t to origination date. The dependent variable $Loan^{risk}_{c,j,y,t}$ is a categorical variable with the classification attached to loans by market participants. It takes four values: highly leveraged (4, riskiest, HL), leveraged (L), near investment grade (NIG), or investment grade loans (1, safest, IG). Following existing research on the topic (Brauning and Ivashina [2019], Dell'Ariccia et al. [2017], Lee et al. [2019]), we use the Federal Funds target rate as our benchmark interest rate measure.

The key coefficients of interest for us are those on the bank capital measure ($bc_{j,y-1}$) and on its interaction with the Federal Funds rate.

We test our two main hypotheses by examining two alternative measure of bank capital, $bc_{j,y-1}$. To explore the regulatory capital channel, we define the following measure of banks'

regulatory capital $rc_{j,y-1}$:

$$bc_{j,y-1} \equiv rc_{j,y-1} = Tier_{j,y-1}/RWA_{j,y-1}) \tag{2}$$

where $Tier_{j,y-1}$ is Tier 1 capital, and $RWA_{j,y-1}$ risk-weighted assets (of bank j, at year y-1).

To examine the market capital channel, we define the following measure of the bank market capital $mc_{j,y-1}$:

$$bc_{j,y-1} \equiv mc_{j,y-1} = MC_{j,y-1}/(MC_{j,y-1} + BL_{j,y-1}) \tag{3}$$

where $MC_{j,y-1}$ is the market capitalisation, and $BL_{j,y-1}$ denotes book liabilities; further we include the interaction between bank capital and the Fed funds target rate.

In order to test whether both of the above channels operate simultaneously, we also estimate a specification that includes both measures of bank capital:

$$\begin{aligned} Loan^{risk}_{c,j,y,t} = \alpha + \gamma_y + f(x_{c,y}) + g(p_{y-1}) + h(z_{j,y-1}) + \beta_1 ff_t + \beta_2 rc_{j,y-1} + \\ + \beta_3 ff_t * rc_{j,y-1} + \beta_4 mc_{j,y-1} + \beta_5 ff_t * mc_{j,y-1} + \epsilon_{c,j,y,t} \end{aligned} \tag{4}$$

Vectors $f(x_{c,y})$, $g(p_{y-1})$ and $h(z_{j,y-1})$ include, respectively, (home) country, global, and bank-level determinants of loans ex-ante credit risk which help us to isolate the variables of interest, from other determinants.

4.2 Identification

Our first identification challenge is to isolate the impact of US interest rates on loan credit quality (β_1) from its other country-level and global determinants.

To this end we include in vector $f(x_{c,y})$ a number of country-level characteristics that can impact loan credit quality by affecting the pool of borrowers. Specifically, we include real GDP growth, the ratio of current account to GDP, sovereign rating, the Chinn-Ito capital openness index, domestic short-term rates and the domestic 10-year government bond rate. This allows us to account for the fact that subdued GDP growth, decreasing sovereign creditworthiness, a widening of the current account deficit, or a reduction in financial openness may be associated with a deterioration in the credit quality of the pool of borrowers. By including short and long-term domestic interest rates we control for the possibility that (conventional and unconventional) domestic monetary policy could impact on borrowers' net worth. In particular, low home rates can strengthen the balance-sheet of firms by boosting the value of assets and reducing interest expenses (Bernanke and Gertler [1995]). Consequently, a loosening of domestic monetary policy (a decrease in short or long-term rates) could boost the net worth of potential borrowers and improve their credit quality.

The quality of the pool of international borrowers can also be affected by global factors, which we include in vector $g(p_{y-1})$. Specifically we control for the possibility that the average credit quality of borrowers may be affected by global economic growth, inflation expectations, and risk aversion. To this end, we include global GDP growth and US inflation expectations as potential explanatory variables. We measure global risk appetite with the Merrill-Lynch spread. To further control for shifts in the net worth of potential borrowers, we construct a measure of the market-wide 5-year Expected Default Frequency (EDF) and include it in our benchmark econometric specification.[11] The market-wide EDF is the average EDF across all

[11] We obtain firm-level EDFs from Moody's, which are tightly linked to firms' net worth. Specifically, EDFs depend negatively on the market value of assets but positively on the quantity debt and on the volatility of

firms that have ever obtained a syndicate loan. In our setup, a higher a market-wide 5-year EDF would signal that the pool of borrowers is worse, and should therefore be associated with a stronger likelihood of riskier (leveraged) loan issuance.

Our second identification challenge is to isolate the impact of bank capital from that of other bank-level characteristics that may determine lending decisions. Hence, we include the following additional bank-level factors (in vector $h(z_{j,y-1})$): a measure of balance sheet liquidity (liquid assets ratio), funding stability (deposit ratio), and size (the log of total assets). We do not include a profitability measure (such net income) in our benchmark model since this information should be embedded in market capital, which is a function of the present discounted value of future income streams.

Since loans are recorded at the origination date, we effectively lag borrower country variables included in vector $f(x_{c,y-1})$ and the global factors in vector $g(p_{y-1})$ by using their values at the end of the previous calendar year. Using the same strategy, we lag by one year the bank-specific controls in $h(z_{j,y-1})$, and the the bank capital measures $bc_{j,y-1}$, which are also annual and retrieved at the end-of calendar year.

We include the current Fed Funds target rate ff_t on the date when the loan was originated. This ensures that the Fed target rate is exogenous to the unobserved, contemporaneous determinants of loan credit quality included in $\epsilon_{c,j,y,t}$. This is due to the fact that the FOMC meets only eight times per year, so the current Fed Funds target rate is effectively backward looking (with a lag which depends on the distance between the loan origination date, and the last FOMC meeting). Such a lag ensures that the level of interest rates is exogenous to loan credit quality.[12]

the market value of assets.

[12]That is, if a loan was originated on 25 March 2017, we include the country, global, and bank-level variables measured as of December 2016; the current Fed target rate is effective since 14 March 2017, when the last FOMC was held.

4.3 Estimation

We estimate an ordered logit model, since our dependent variable is categorical, taking on four ranked values. The ordered logit model links the probability of observing each of the loan ratings, to a linear function of the covariates. Its main advantage relative to the linear regression model is that the predicted probabilities of each outcome are bounded between 0 and 1 and the sum of probabilities adds to 1.

The log-likelihood is given by:

$$lnL = \sum_{l=1}^{Ł} \sum_{s=1} d_{l,s} * ln(Prob(Y_l = s)/X) \tag{5}$$

where l denotes each of the L loans in the sample, and s each of the four possible loan risk categories, and the vector X includes all the covariates described in subsection 4.1.[13]

Since the model is nonlinear, the impact of a covariate on the dependent variable (ie on the credit quality of the originated loan) differs from the coefficient. Thus, in order to interpret the results, we need to compute the marginal effect of the covariates on the dependent variable. This is particularly important due to the conditional effects we obtain, as the impact of the Fed Funds target rate ff_t varies with the level of bank capital.

We compute standard errors robust to heteroskedasticity and autocorrelation. All the covariates are winsorized at 1% and 99%. Since we are including interaction terms of the monetary policy measures, we use deviations of those variables from their respective means. To ease interpreting the results, the units of monetary policy measures are 25 basis points (bps). The rest of the variables are standardized, by subtracting their respective means and

[13]The probabilities $ln(Prob(Y_l = j))$ that loan l is of category s, where s is an investment grade (IG), near investment grade (NIG), leveraged (L), or highly leveraged loan (HY) are the following: Prob(Y_l = $IG/X) = \Phi(-X'\beta); Prob(Y_l = NIG/X) = \Phi(\mu_1 - X'\beta) - \Phi(-X'\beta); Prob(Y_l = L/X) = \Phi(\mu_2 - X'\beta) - \Phi(\mu_1 - X'\beta); Prob(Y_l = HL/X) = 1 - \Phi(\mu_2 - X'\beta)$

dividing by their respective standard deviations.

5 Benchmark results

5.1 The regulatory capital channel

In our first empirical exercise, we examine the regulatory capital channel by using regulatory capital as the bank capital measure in our benchmark specification (ie by setting $rc_{j,y-1} = bc_{j,y-1}$ in equation (1)).

In columns I and II in Table 3, we examine all loans (credit lines and term loans). In columns III and IV, we analyse exclusively term loans. We expect term loans to be more sensitive to US monetary policy, since the origination of credit lines often reflects a renewal, extension, or amendment of a pre-existent commitments. Thus, we hypothesize, as Dell'Ariccia et al. [2017], that the origination of pre-committed loans is less sensitive to monetary policy. In all specifications, we include borrower country fixed effects, plus a number of potential country-level determinants of loan credit quality, which we do not show due to space constraints.[14]

Two key results emerge from the ordered logit results shown in Table 3. Banks with high regulatory capital (i) originate riskier loans and (ii) react more to US monetary policy. The first result is statistically significant in all specifications we examine. The second result is strongly statistically significant for term loans, which are less under commitment. The interaction term turns to be negative and statistically significant when we estimate the model for the subset of term loans (not under commitment). This holds both in the model without (column III) and with year fixed effects (column IV). This confirms that highly capitalised

[14]These control variables are: domestic short-term rates, the 10-year government bond rate, real GDP growth, the current account balance (as a ratio of GDP), sovereign credit rating, and the Chinn-Ito capital openness index.

Table 3: **US interest rates, risk-taking, and regulatory capital:** This table reports ordered logit estimates of the loans' risk rating attached by market participants. The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To test the existence of the risk-taking "regulatory capital channel", we include the demeaned Fed target rate, the Tier 1/ RWA ratio, and an interaction between both terms. In all models we include the borrower country short term rate, 10 year government bond, real GDP growth, the current account to GDP, the Chin-Ito index, and the sovereign rating (coefficients not shown). Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II	III	IV
Fed target rate	−0.039***	−0.198***	−0.104***	−0.389***
	(0.01)	(0.03)	(0.02)	(0.05)
Bank Tier1/RWA	0.351***	0.401***	0.109***	0.222***
	(0.02)	(0.02)	(0.03)	(0.03)
Bank Tier1/RWA*Fed target rate	−0.002	−0.006	−0.085***	−0.067***
	(0.01)	(0.01)	(0.01)	(0.01)
Bank liquidity ratio	−0.151***	−0.149***	−0.062***	−0.057***
	(0.01)	(0.01)	(0.02)	(0.02)
Bank deposit ratio	−0.229***	−0.212***	−0.250***	−0.229***
	(0.01)	(0.01)	(0.02)	(0.02)
Bank size	−0.396***	−0.355***	−0.378***	−0.285***
	(0.02)	(0.02)	(0.03)	(0.03)
Global GDP growth	−0.082***	−0.100***	−0.144***	−0.205***
	(0.01)	(0.02)	(0.02)	(0.04)
Merril Lynch spread	0.141***	−0.016	−0.004	0.049
	(0.01)	(0.03)	(0.02)	(0.05)
Global inflation expectations	0.069***	0.017	0.119***	0.122***
	(0.01)	(0.01)	(0.02)	(0.02)
Market-wide 5 year EDF	−0.131***	−0.040	0.140***	−0.148**
	(0.02)	(0.03)	(0.03)	(0.06)
Observations	50106	50106	20247	20247
Adjusted R-squared	0.089	0.093	0.142	0.150
Borrower country FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Country controls	Yes	Yes	Yes	Yes
Type loans	All	All	Term	Term

banks react more to monetary policy, when loans are not under previous commitment. These results are in line with our hypotheses (1a and 1b) about the role of regulatory capital in bank risk taking. Namely, higher levels of regulatory capital give banks more freedom to engage in risk-taking, especially in a low-interest rate environment.

The rest of the results in Table 3 underscore the importance of global determinants of loan credit quality. As expected, the Fed target rate is negatively associated with the origination of risky loans, and the link becomes stronger when we include year fixed effects. This suggests that a loosening of monetary policy spurs the origination of riskier international syndicated loans. Subdued global growth and high inflation expectations are associated with a greater origination of leveraged loans. The positive link between the Merril-Lynch credit spread index and the origination of leveraged loans fades when we include year fixed effects (column II), as it is absorbing part of the time variation. Importantly, by including the global and country-level factors we are controlling for other supply and demand determinants of loan credit quality.

Turning to the impact of other (non-capital) bank-level variables, our results suggest that banks with higher deposit ratios, more liquid assets, and larger size are less likely to originate leveraged loans. That pattern holds when we include year fixed effects.

5.2 The market capital channel

We test for the importance of shareholders' incentives by using market capital as the bank capital measure in our benchmark specification (ie by setting $rc_{j,y-1} = mc_{j,y-1}$ in equation (1)).

All specifications include the full set of bank attributes, global, and borrower-country factors, including the country fixed-effects. We also include regulatory capital. The number

of observations marginally diminishes, since the market capital is missing in some instances. Table 4 shows the results. As in the previous sub-section, the results using all loans are reported in columns I and II (with and without year fixed effects, respectively), while we analyze term loans in columns III and IV (with and without year fixed effects, respectively).

The key result that emerges from that table is that banks' market capital is a key determinant of their risk-taking propensity. Consistent with the results in Table 3, the Fed target rate has a negative impact on risk-taking. Furthermore, the estimated coefficient on market capital is negative and statistically significant, implying that banks with lower franchise values are more likely to extend riskier syndicated loans. Additionally, for the subset of term loans (columns I and II) the estimated coefficients on the interaction term between the market capital and the Fed Funds rate suggests that the banks with low levels of market capital are more likely to extend riskier (US dollar-denominated) international loans when US monetary policy is loose.

The estimated impact of most control variables remains broadly unchanged (relative to the specifications using regulatory capital). The estimated signs of all global variable remain the same. The estimated impact of regulatory capital on the origination of risky loans also remains positive. The most notable difference relative to the results from the previous subsection is that the bank liquidity ratio becomes statistically insignificant when we look at term loans including year fixed effects. The estimated impacts of the rest of the bank-level variables remain qualitatively the same.

Once again, both of the key results are in line with the hypotheses (2.1 and 2.2) we outlined in Section 2. Namely, banks with low charter values (i) have a higher propensity to extend riskier international syndicated loans and (ii) are more likely to do that when interest rates are low.

Table 4: **US interest rates, risk-taking, and bank market capital:** This table reports ordered logit estimates of the loans' risk rating attached by market participants. The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To test the existence of the "market capital channel", we include the demeaned Fed target rate, the bank market capital, and an interaction between both terms. Following Schwert [2018] we define the bank market capital as the ratio of market capitalisation to quasi-market assets. In all models we include the borrower country short term rate, 10 year government bond, real GDP growth, the current account to GDP, the Chin-Ito index, and the sovereign rating (coefficients not shown). Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II	III	IV
Fed target rate	−0.029***	−0.187***	−0.029*	−0.335***
	(0.01)	(0.03)	(0.02)	(0.05)
Bank Tier1/RWA	0.393***	0.452***	0.276***	0.352***
	(0.01)	(0.02)	(0.02)	(0.02)
Bank market capital	−0.091***	−0.081***	−0.077***	−0.054*
	(0.02)	(0.02)	(0.03)	(0.03)
Bank market capital*Fed target rate	0.007	0.005	0.039***	0.033***
	(0.01)	(0.01)	(0.01)	(0.01)
Bank liquidity ratio	−0.117***	−0.114***	−0.028*	−0.019
	(0.01)	(0.01)	(0.02)	(0.02)
Bank deposit ratio	−0.245***	−0.228***	−0.245***	−0.236***
	(0.01)	(0.01)	(0.02)	(0.02)
Bank size	−0.496***	−0.449***	−0.470***	−0.367***
	(0.02)	(0.02)	(0.03)	(0.03)
Global GDP growth	−0.064***	−0.090***	−0.123***	−0.193***
	(0.01)	(0.02)	(0.02)	(0.04)
Merril Lynch spread	0.165***	−0.002	0.030	0.091*
	(0.01)	(0.03)	(0.02)	(0.05)
Global inflation expectations	0.068***	0.017	0.122***	0.121***
	(0.01)	(0.01)	(0.02)	(0.02)
Market-wide 5 year EDF	−0.135***	−0.036	0.136***	−0.168***
	(0.02)	(0.04)	(0.03)	(0.06)
Observations	48632	48632	19701	19701
Adjusted R-squared	0.090	0.094	0.144	0.153
Borrower country FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Country controls	Yes	Yes	Yes	Yes
Type loans	All	All	Term	Term

5.3 Do the two key channels operate simultaneously?

Next, we test if the two mechanisms are at work simultaneously. We do that by including in a single specification regulatory capital, market capital and their respective interactions with the Fed Funds target rate. All specifications include the full set of bank characteristics, global factors, borrower-country controls and country fixed-effects.

$$\text{Loan}^{risk}_{c,j,y,t} = \alpha + +\gamma_y + f(x_{c,y}) + g(p_{y-1}) + h(z_{j,y-1}) + \beta_1 ff_t + \beta_2 rc_{j,y-1} + \beta_3 ff_t * rc_{j,y-1} + \beta_4 mc_{j,y-1} + \beta_5 ff_t * mc_{j,y-1} + \epsilon_{c,j,y,t}$$

Table 5 reports the results from those combined specifications. The structure of the table replicates Table 3 and 4, so results using all loans are reported in columns I and II (with and without year fixed effects, respectively), and term loans in columns III and IV (with and without year fixed effects, respectively). For the sake of brevity, we only report the coefficients on the key variables of interest.[15]

The results from the specifications that include simultaneously the two key variables of interest (regulatory capital and market capital) are fully in line with the results obtained when those variables are estimated in separate specifications. Once again, the Fed Funds rate has a negative impact on loan riskiness. The stand-alone coefficient on regulatory capital is positive. The coefficient on its interaction with the Fed Funds rate is negative. Both sets of coefficients are strongly statistically significant.

Similarly, the results for the impact of the banks' market capital are fully in line with their counterparts from Table 4. The interaction with the Fed Funds rate is positive, and highly statistically significant. The stand-alone coefficient is not significant in the results obtained on the subset of term loans (columns III and IV). Since all the variables are demeaned, this signals that market capital has a negligible impact on risk taking when the Fed target rate is

[15] All other estimated coefficients are available upon request.

Table 5: **Two channels simultaneously at work:** This table reports the results of a joint examination of the risk-taking "regulatory capital channel" and the "market capital channel", displaying the results of ordered logit estimates of the loans' risk rating attached by market participants. The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To test the existence of the "market capital channel", we include the demeaned Fed target rate, the bank market capital, and an interaction between both terms. Following Schwert [2018]) we define the bank market capital as the ratio of market capitalisation to quasi-market assets. To test the existence of the risk-taking "regulatory capital channel", we include the demeaned Fed target rate, the Tier 1 to RWA ratio, and an interaction between both terms. We include, but do not report, the borrower country controls, and the global, and bank-specific controls listed in Tables 3 and 4. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II	III	IV
Fed target rate	−0.036***	−0.203***	−0.100***	−0.398***
	(0.01)	(0.03)	(0.02)	(0.05)
Bank Tier1/RWA	0.380***	0.430***	0.122***	0.234***
	(0.02)	(0.02)	(0.03)	(0.03)
Bank Tier1/RWA*Fed target rate	−0.009	−0.021***	−0.099***	−0.093***
	(0.01)	(0.01)	(0.01)	(0.01)
Bank market capital	−0.087***	−0.078***	−0.044	−0.036
	(0.02)	(0.02)	(0.03)	(0.03)
Bank market capital*Fed target rate	0.007	0.008	0.046***	0.046***
	(0.01)	(0.01)	(0.01)	(0.01)
Observations	48632	48632	19701	19701
Adjusted R-squared	0.091	0.094	0.146	0.154
Borrower country FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Country controls	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes
Global controls	Yes	Yes	Yes	Yes
Type loans	All	All	Term	Term

at its average value (equivalent to 180 bps). Risk-shifting incentives activate when interest rates go up or down.

Thus, the results from all benchmark specifications we examine point in the same direction. Namely, in a manifestation of the regulatory capital channel, banks with higher levels of regulatory capital tend to originate more leveraged loans and are more sensitive to interest rates. At the same time, the results also provide empirical support for the existence of the market capital channel by documenting that banks with low levels of market capital tend to engage in more risk-taking, especially when interest rates are low.

5.4 Discrete analysis

As an additional exercise to further explore if low interest rates foster risk-taking simultaneously through the regulatory capital channel and the market capital channel, we modify the baseline model (which includes the set of country-specific, global, and bank-specific variables) with a set of categorical variables $I(rc, mc)_{j,y-1}$, classifying banks into four groups, depending on whether they have high (low) regulatory capital and high (low) market capital.

Furthermore, we interact the categorical variables with the Fed target rate: $ff_t * I(rc, mc)_{j,y-1}$. As in previous exercises, the dependent variable is ordinal, taking a value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans.

$$\text{Loan}^{risk}_{l,c,j,t} = \alpha + \gamma_y + f(x_{c,y}) + g(p_y) + h(z_{j,t}) + \beta_1 ff_t + \sum_{s=1} \beta^A_s I(rc, bc)^s_{j,y-1} +$$
$$+ \sum_{s=1} \beta^B_s ff_t * I(rc, bc)^s_{j,y-1} + \epsilon_{l,c,j,t}$$

The results from this empirical exercise are reported in Table 5. Column I reports the estimated coefficients using all loans, while column II reports the coefficients for term loans only. To ease the interpretation, we drop the Fed Funds rate. Risk-taking is highest for the group of banks with high regulatory capital, and low market capital. In the sub-sample

Table 6: **Interplay between regulatory and market capital:** This table reports the results of an additional examination of the links between interest rates, and the "regulatory capital channel" and the "market capital channel". To this end we expand the baseline model (which includes the set of borrower country, global, and bank-specific variables, not reported) with a set of categorical variables classifying banks into four groups, depending on whether they have high (low) regulatory capital and high (low) market capital. Further we interact the categorical variables with the Fed target rate. As in previous exercises, the dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To ease the interpretation we drop the demeaned Fed target rate. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II
High Tier1/RWA - Low market capital	0.508***	−0.154
	(0.07)	(0.10)
Low Tier1/RWA - Low market capital	0.214***	0.139***
	(0.03)	(0.04)
High Tier1/RWA - High market capital	0.527***	0.182***
	(0.03)	(0.05)
High Tier1/RWA - Low market capital*Fed target rate	−0.104***	−0.364***
	(0.03)	(0.04)
Low Tier1/RWA - Low market capital*Fed target rate	−0.053***	−0.046***
	(0.01)	(0.02)
High Tier1/RWA - High market capital*Fed target rate	0.040***	−0.101***
	(0.01)	(0.02)
Low Tier1/RWA - High market capital*Fed target rate	0.021**	0.042***
	(0.01)	(0.01)
Observations	48632	19701
Adjusted R-squared	0.049	0.093
Borrower country FE	Yes	Yes
Year FE	Yes	Yes
Country controls	Yes	Yes
Bank controls	Yes	Yes
Global controls	Yes	Yes
Type loans	All	Term

consisting solely of term loans (column II), the above coefficient is three times larger than for the group of banks with high regulatory capital, and high market capital.

5.5 Economic impact

Our results imply that the links between risk taking and low interest rates have strengthened after the GFC, through two distinct channels. For one, the bank regulatory channel should be stronger as post-GFC regulatory capital ratios have gone up (Figure 4, Panel A). Meanwhile, market capital ratios have decreased well below the pre-GFC levels, strengthening the market capital channel.

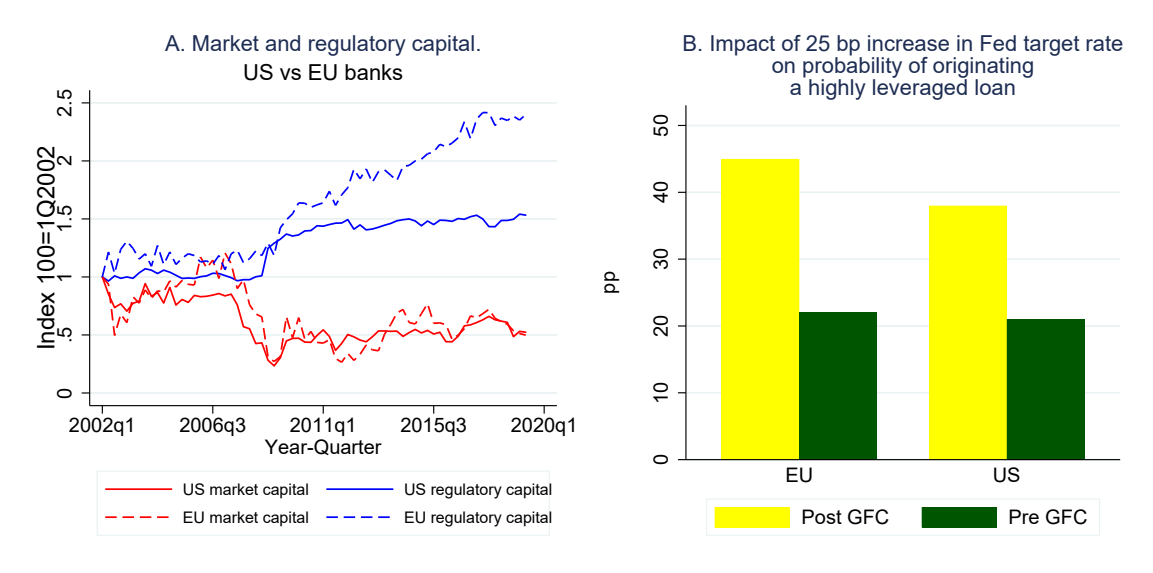


Figure 4: **Risk taking incentives over time:** Panel A plots the regulatory and the market capital ratios over time for the the subset of EU and US banks. Panel B plots the impact of 25 bp decrease of the Fed target rate on the the probability that banks originate highly leveraged loans. Marginal effects are estimated using the results of column IV in Table 5, and the average values of regulatory and market capital in the post and pre-GFC period.The post-GFC refers to the 2010-2018 average impact, while the pre-GFC refers to the 2007 impact.

Back-of-the-envelope calculations using the results in column IV of Table 5 suggest that the post-GFC increase in risk taking is economically significant (Figure 4, Panel B). In the

US, the likelihood of banks' originating highly leveraged loans in response to a decrease in US interest rates has increased by 80%. The response of EU banks has doubled between 2007 and 2018.

The above set of results could provide a potential explanation for the results of Avdjiev et al (2020), who document that the sensitivity of international loan flows to US monetary policy rose considerably after the GFC. Those findings could be driven by the combination of the dynamics of the two types of capital and the two channels examined in our paper. Namely, the higher regulatory capital (though the regulatory capital channel) and the lower market capital (through the market capital channel) both led to a greater sensitivity of international bank loan flows to US monetary policy.

6 Robustness checks

Next, we test the robustness of our main results by re-estimating our benchmark specifications while employing alternative measures of the franchise value, interest rates, and estimation methods.

6.1 Shareholders skin-in-the-game

So far we have used the market capital to assess shareholders' incentives. Now we check if our results on the "market capital channel" are robust to alternative ways of gauging their skin-in-the-game. We first use the price-to-book ratio (market capitalisation to book equity), which is a common measure of franchise value (Bogdanova et al. [2018]). A ratio above one reflects that shareholders value the bank more than its historical cost driven by the expectation of high profits. Second, we use the book equity ratio, defined as book value of common equity to total assets. The book equity ratio is a less accurate measure of shareholders' investments

as records it at historical prices; however, it has also been used to document the importance of risk-shifting incentives (Jimenez et al. [2014]]).

Table 7: **Alternative measures of shareholders' skin-in-the-game:** The table reports ordered logit estimates of the loans' risk rating attached by market participants, exploring alternative measures of bank franchise value: price-to-book (column I and II) and book equity ratio (column III and IV). The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To test the existence of the risk-taking regulatory capital channel, we include the demeaned Fed target rate, the Tier 1 to RWA ratio, and an interaction between both terms. We include, but do not report, the borrower country controls, and the global, and bank-specific controls listed in Tables 3 and 4. Columns II and IV include year fixed effects. All regressions focus on term loans. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I	II	III	IV
Fed target rate	−0.099***	−0.398***	−0.060***	−0.344***
	(0.02)	(0.05)	(0.02)	(0.05)
Bank Tier1/RWA	0.123***	0.237***	0.148***	0.240***
	(0.03)	(0.03)	(0.03)	(0.03)
Bank Tier1/RWA*Fed target rate	−0.098***	−0.092***	−0.091***	−0.075***
	(0.01)	(0.01)	(0.01)	(0.01)
Price-to-Book	−0.064**	−0.061*		
	(0.03)	(0.03)		
Price-to-Book*Fed target rate	0.044***	0.043***		
	(0.01)	(0.01)		
Book equity ratio			−0.081**	−0.038
			(0.04)	(0.04)
Book equity ratio*Fed target rate			0.082***	0.080***
			(0.01)	(0.01)
Observations	19701	19701	20098	20098
Adjusted R-squared	0.146	0.154	0.144	0.151
Borrower country FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Country controls	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes
Global controls	Yes	Yes	Yes	Yes
Type loans	Term	Term	Term	Term

The results, shown in Table 7, confirm that our conclusions on the "market capital channel" are robust. Namely, in the baseline model the estimated stand-alone coefficient on the price-to-book measure (column I) is negative and statistically significant, while the estimated

coefficient on the interaction with the Fed Funds rate is positive and highly statistically significant. Both results hold when we include year fixed effects (column II). The book equity ratio has a negative impact on loan riskiness (column III), which however fades when we include year fixed effects (column IV). The interaction is positive and statistically significant in both the baseline, and the model with year fixed effects.

6.2 Alternative interest rates measures

Table 8 reports robustness checks using alternative interest rate measures. Columns I (baseline model) and II (with year fixed effects) show the results when we use the Xia and Wu [2016] shadow interest rate, which summarizes the effects of unconventional monetary policy. They are fully in line with the benchmark results. Namely, the stand-alone coefficients on regulatory capital are positive, while the coefficients on their interactions with the shadow policy rate are negative. Meanwhile, the stand-alone coefficients on market capital are negative, although not statistically significant when we include year fixed effects. Their interactions with the alternative US monetary policy measure are positive and statistically significant.

Next we instrument the Fed target rate with the Gertler and Karadi [2015] monetary policy surprises on the three-month ahead futures rate. These surprises are the changes in the three-month ahead futures rate in a short window after the announcement. The surprises are exogenous with respect to economic and financial variables, since future rates discount the expected reaction of the Federal Reserve. By using them we make sure that the impact of interest arte changes on the riskiness of bank loan origination is not confounded with economic and financial aspects.

The results, shown in columns III and IV of Table 8, are reassuring. Once we include year fixed effects to account for unobserved global factors (column IV), the impact of the

Table 8: **Alternative interest rates measures :** The table reports ordered logit estimates of the loans' risk rating attached by market participants, exploring alternative measures of US monetary policy. Specifically, in columns I-II we use the demeaned Xia and Wu [2016] shadow interest rate. In columns III-IV we instrument the Fed target rate with the demeaned cumulated sum of the Gertler and Karadi [2015] monetary policy shocks. The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. To test the existence of the "market capital channel", we include the monetary policy measures, market capital, and an interaction term. The bank market capital is the market capitalisation to quasi-market assets ratio. To test the existence of the "regulatory capital channel", we include the monetary policy measures, the Tier 1 to RWA ratio, and an interaction between both terms. We include, but do not report, the country-specific, supply, and bank-specific variables listed in Tables 3 and 4. Columns II and IV include year fixed effects. All regressions focus on term loans. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	Shadow-Rate		Gertler-Karadi	
	I	II	III	IV
US monetary policy	−0.065***	−0.248***	0.084	−2.127***
	(0.01)	(0.03)	(0.15)	(0.40)
Bank Tier1/RWA	0.122***	0.252***	0.150**	0.028
	(0.03)	(0.03)	(0.06)	(0.07)
Bank Tier1/RWA*US monetary policy	−0.071***	−0.053***	−0.321***	−0.667***
	(0.01)	(0.01)	(0.08)	(0.10)
Market capital	−0.050*	−0.044	−0.116***	−0.071*
	(0.03)	(0.03)	(0.04)	(0.04)
Market capital*US monetary policy	0.030***	0.021**	0.099*	0.296***
	(0.01)	(0.01)	(0.06)	(0.07)
Observations	19701	19701	12124	12124
Adjusted R-squared	0.147	0.154	0.131	0.138
Borrower country FE	Yes	Yes	Yes	Yes
Year FE		Yes		Yes
Country controls	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes
Global controls	Yes	Yes	Yes	Yes
Type loans	Term	Term	Term	Term

Fed target rate is negative and statistically significant. This confirms that low interest rates foster risk-taking, beyond other economic and financial aspects. Further, we find that both interaction terms between the Fed target rate and the regulatory and market capital exhibit the expected signs, and are strong and statistically significant. This signals that risk-taking is stronger for banks with high regulatory capital and low market capital. Due to the inclusion of the year fixed-effect, the size and the statistical significance of regulatory and market capital diminishes.

This confirms us that we are capturing the impact of interest rate shifts on banks' risk taking, and not their reactions to changes in the economic outlook.

6.3 Alternative estimation methods

We explore alternative estimation methods to relax the assumptions of the ordered logit. By estimating this model we implicitly assumed that the coefficients in the three potential bivariate estimations (IG vs NIG; NIG vs L; L vs HL) are equivalent, the so called parallel regression assumption. The assumption is convenient as minimizes the number of parameters to be estimated, but it may be potentially restrictive. For example, it means that the impact of the Fed target rate ff_t on the probability of shifting from an IG to a NIG loan is the same as the impact on the probability of shifting from a L to a HL loans.

Both the multinomial logit and the generalized ordered logit relax this assumption, but in our case none are good alternatives. A multinomial logit with no parameter restrictions is not tractable, as largely multiplies the number of paramenters to be estimated. Furthermore it is also inadequate as implies the independence of irrelevant assumptions (IIA). The IIA assumption is clearly restrictive in our setup as implies for example that if the "highly leveraged" bucket disappears, the observations will be equally split across the three remaining categories; it is intuitive to assume that they should be classified as "leveraged" loans. A

generalized ordered logit would also relax the parallel regression assumption only for some variables. Hence, it could have been a compromise between a fully unresticted multinomial logit and the ordered logit we use. However, the relevant tests to impose parameter restrictions are unreliable in our case as the models include many covariates (Long and Freese [2014]).

Table 9: **Alternative estimation methods:** Column I reports the results of a bivariate logit model, after collapsing the market participants' loan risk classification into a binary variable taking value 1 for leveraged and highly-leveraged loans, and 0 for investment and near-investment grade loans. Columns II report panel regressions (OLS) of the loans' risk rating attached by market participants using the bivariate dependent variable. To test the existence of the "market capital channel", we include the monetary policy measures, market capital, and an interaction term. To test the existence of the "regulatory capital channel", we include the monetary policy measures, the Tier 1 to RWA ratio, and an interaction between both terms. We include, but do not report, the country-specific, supply, and bank-specific variables listed in Tables 3 and 4. All regressions focus on term loans. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	I-Logit	II-OLS
Fed target rate	−0.361***	−0.054***
	(0.06)	(0.01)
Bank Tier1/RWA	0.435***	0.050***
	(0.05)	(0.01)
Bank Tier1/RWA*Fed target rate	−0.066***	−0.008***
	(0.02)	(0.00)
Bank market capital	−0.101***	−0.015**
	(0.04)	(0.01)
Bank market capital*Fed target rate	0.038***	0.005**
	(0.01)	(0.00)
Observations	19644	19701
R-squared		0.322
Adjusted R-squared	0.277	
Loan risk categories	2	2

,

Hence, we collapse the four loan risk categories into two: a first one, comprising the subset of risky loans - leveraged and highly-leveraged transactions; the second, comprising the safe loans - investment and near-investment grade transactions. The results, shown in Table 9, hold when we estimate the model using a bivariate logit (column I). Additionally

we use the binary dependent variable and estimate the model using panel regression (column II).

6.4 Additional results

We conduct two additional checks. First we make sure that our results hold when we include an interaction term between banks' liquidity and the Fed target rate. To this end we measure bank liquidity with the ratio of current assets to total assets. The exercise is important, in so far banks' liquidity exerts a significance influence on how they react to monetary policy Kashyap and Stein [2000]. Further, it has been shown that the regulatory capital channel holds even controlling for the potential impact of liquidity (Dell'Ariccia et al. [2017]). In columns I and II of Table 10 we report the results of re-estimating our model including this additional control.

Our main results hold both in the baseline model (column I), and when we add the year fixed effect (column II). This finding reinforces the conclusion that a high level of regulatory capital, and a low level of market capital, foster risk-taking. It is also worth mentioning that the interaction between banks' liquidity ratio is positive and statistically significant. This signals that the banks that are more liquidity constrained take on more risk in international markets, when US monetary policy is loosened.

Last, but not least, we explore the role of long-term interest rates including the spread between the 10 and the 1 year interest rate, and the relevant interaction with the bank capital ratios. We find that risk-shifting motives only depend on short-term interest rates (as also found by Jimenez et al. [2014]), while the regulatory capital channel also hinges on long-term interest rates. Both results hold in the baseline (column III), and the model with year fixed effect (column IV).

Table 10: **Additional results:** In this table we report results checking the robustness of our results to the inclusion of bank liquidity measures (column I and II); and the inclusion of US long-term interest rates (III and IV). Bank liquidity is the deposits to total assets ratio. We measure long-term interest rates using the 10 year interest rate. The dependent variable is the ordinal scale taking value 4 for highly leveraged (riskiest) loans, and 1 for investment grade (safest) loans. We include, but do not report, the country-specific, supply, and bank-specific variables listed in Tables 3 and 4. Columns II and IV include year fixed effects. All regressions focus on term loans. Robust standard errors in parentheses. Statistical significance is denoted at 1% (***), 5% (**) and 10% (*).

	Bank-Liquidity		Long-term-Rates	
	I	II	III	IV
Fed target rate	−0.101***	−0.402***	−0.086***	−0.321***
	(0.02)	(0.05)	(0.02)	(0.05)
Bank liquidity ratio*Fed target rate	0.024***	0.026***		
	(0.01)	(0.01)		
Bank Tier1/RWA	0.123***	0.234***	0.109***	0.211***
	(0.03)	(0.03)	(0.03)	(0.03)
Bank Tier1/RWA*Fed target rate	−0.099***	−0.094***	−0.152***	−0.169***
	(0.01)	(0.01)	(0.02)	(0.02)
Bank market capital	−0.042	−0.034	−0.050*	−0.035
	(0.03)	(0.03)	(0.03)	(0.03)
Bank market capital*Fed target rate	0.048***	0.048***	0.052***	0.049**
	(0.01)	(0.01)	(0.02)	(0.02)
Bank liquidity ratio	−0.012	−0.002	−0.033**	−0.025
	(0.02)	(0.02)	(0.02)	(0.02)
10-1 yr spread			−0.042	−0.416***
			(0.07)	(0.10)
Bank Tier1/RWA*10-1 yr spread			−0.127***	−0.182***
			(0.03)	(0.04)
Bank market capital*10-1 yr spread			0.020	0.025
			(0.04)	(0.04)
Observations	19701	19701	18126	18126
Adjusted R-squared	0.147	0.155	0.144	0.153
Borrower country FE	Yes	Yes	Yes	Yes
Year FE	No	Yes	No	Yes
Country controls	Yes	Yes	Yes	Yes
Type loans	Term	Term	Term	Term

7 Conclusions

We investigate the link between US interest rates, bank capital, and international risk taking using a novel dataset that combines Refinitiv SDC syndicated loan data with borrower and bank-level information. Our main observational unit is at the borrower-loan-lender level, which allows us to map each syndicated loan into many individual bilateral loans. The empirical model relates the risk classification attached to loans by market participants, to a number of pull and push factors and bank-level characteristics.

We document several key sets of results. First, we confirm that low US interest rates spur the origination of risky international leveraged loans. This result suggests that US interest rate spillovers go beyond their impact on quantities. It is consistent with existing findings obtained in different settings (Brauning and Ivashina [2019], Lee et al. [2019]).

Second, we show that banks with higher regulatory capital tend to originate more US dollar-denominated international leveraged loans and are more likely to do so when US interest rates are low. This results is a manifestation of the "regulatory capital channel" of monetary policy in the international syndicated loan market.

Third, we show that banks with low market capital tend to originate more US dollar-denominated international leveraged loans, especially when US interest rates are low. These findings point to the existence of a "market capital channel" of monetary policy in international lending.

Last but not least, the banks that are most likely to search for yield are those that have a combination of high regulatory capital and low market capital. This finding underscores the significance of the interplay between the two main mechanisms documented in this paper – the regulatory capital channel and the market capital channel.

References

S. Albrizio, S. Choi, D. Furceri, and C. Yoon. International bank lending channel of monetary policy. *Journal of International Money and Finance*, 102, April 2020.

S. Avdjiev, M. Everett, P. R. Lane, and H. S. Shin. Tracking the international footprint of global firms. *BIS Quarterly Review, March 2018*, 2018a.

S. Avdjiev, C. Koch, P. McGuire, and G. von Peter. Transmission of monetary policy through global banks: Whose policy matters? *Journal of International Money and Finance*, 89: 67–82, December 2018b.

S. Avdjiev, L. Gambacorta, L. S. Goldberg, and S. Schiaffi. The shifting drivers of global liquidity. *Journal of International Economics*, 125:103–324, July 2020.

B. Bernanke and M. Gertler. Inside the black box: The credit channel of monetary policy transmission. *The Journal of Economic Perspectives*, 9(4):27–48, 1995.

B. Bogdanova, I. Fender, and E. Takáts. The ABCs of bank PBRs: What drives bank price-to-book ratios? *BIS Quarterly Review March 2018*, 2018.

C. Borio and H. Zhu. Capital regulation, risk-taking and monetary policy: a missing link in the transmission mechanism? *Journal of Financial Stability*, 8:236–251, 2012.

F. Brauning and V. Ivashina. U.S. monetary policy and emerging market credit cycles. *Journal of Monetary Economics*, 112:57–76, June 2019.

V. Bruno and H. Shin. Cross-border banking and global liquidity. *The Review of Economic Studies*, 82:535–564, 2015.

C. Calomiris and D. Nissim. Crisis-related shifts in the market valuation of banking activities. *Journal of Financial Intermediation*, 23:400–435, 2014.

M. Chinn and H. Ito. What matters for financial development? capital controls, institutions, and interactions. *Journal of Development Economics*, 81(1):163–192, October 2006.

S. Claessens, N. Coleman, and M. Donnelly. "Low-For-Long" interest rates and banks' interest margins and profitability: Cross-country evidence. *Journal of Financial Intermediation*, 35:1–16, 2018.

G. Dell'Ariccia, L. Laeven, and G. A. Suarez. Bank leverage and monetary policy's risk-taking channel: Evidence from the United States. *The Journal of Finance*, 72(2), 2017.

R. Demsetz, M. Saidenberg, and P. Strahan. Banks with something to lose: The disciplinary role of franchise value. *FRBNY Economic Policy Review*, 1996.

S. V. den Heuvel. The bank capital channel of monetary policy. *The Wharton School, University of Pennsylvania mimeo*, 2005.

B. Gadanecz and R. McCauley. Leveraged loans and asian financial integration: the case of casino financing. *BIS Quarterly Review, December 2006*, 2006.

L. Gambacorta and H. Shin. Why bank capital matters for monetary policy. *Journal of Financial Intermediation*, 35, Part B:17–29, July 2018.

M. Gertler and P. Karadi. Monetary policy surprises, credit costs, and economic activity. *American Economic Journal: Macroeconomics*, 7(1):44–76, 2015.

R. Irani, R. Iyer, R. Meisenzahl, and J.-L. Peydro. The rise of shadow banking: Evidence from capital regulation. *The Review of Financial Studies*, 106, September 2020.

V. Ivashina and D. Scharfstein. Loan syndication and credit cycles. *American Economic Review: Papers and Proceedings*, 100(2):1–8, May 2010.

G. Jimenez, S. Ongena, J.-L. Peydro, and J. Saurina. Hazardous times for monetary policy: what do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica*, 82(2), March 2014.

A. Kashyap and J. Stein. What do a million observations on banks say about the transmission of monetary policy? *American Economic Review*, 90:407–428, 2000.

M. Keeley. Deposit insurance, risk, and market power in banking. *American Economic Review*, 80(5):1183–1200, December 1990.

R. Koepke. What drives capital flows to emerging markets? A survey of the empirical literature. *Journal of Economic Surveys*, 33(2):516–540, April 2019.

S. J. Lee, L. Q. Liu, and V.Stebunovs. Risk-taking spillovers of US monetary policy i n the global market for US dollar corporate loans. *Journal of Banking and Finance*, 2019.

J. Lim, B. Minton, and M. Weisbach. Syndicated loan spreads and the composition of the syndicate. *Journal of Financial Economics*, 111:5–69, 2014.

J. S. Long and J. Freese. *Regression Models for Categorical Dependent Variables Using Stata*. Stata Press, 2014.

D. Nandy and P. Shao. Institutional investment in syndicated loans. *Unpublished working paper. Brandeis University*, 2010.

J.-L. Peydro, A. Polo, and E. Sette. Risk mitigating versus risk shifting: evidence from banks security trading in crises. *CEPR Working Paper 15474*, November 2020.

N. Sarin and L. Summers. On market-based approaches to the valuation of capital. *Handbook of Financial Stress Testing*, 2019.

M. Schwert. Bank capital and lending relationships. *The Journal of Finance*, 73:787–830, 2018.

A. Sufi. Information asymmetry and financing arrangements: Evidence from syndicated loans. *The Journal of Finance*, 62:629–668, 2007.

D. Xia and C. Wu. Measuring the macroeconomic impact of monetary policy at the zero lower bound. *Journal of Money, Credit, and Banking*, 48(2-3):253–291, 2016.

A Data appendix

Table 1: **Descriptive statistics:**

Variable	N	m	s	p25	p50	p75
			Panel A. Loan-level data			
Loan spread	133,921	231.8	232.7	100	200	300
Number lenders	242,163	8.5	9.2	3	5	10
Loan amount	241,866	38.9	126.6	4.5	12.5	33.3
Loan original maturity	222,328	9.9	7.5	6.0	10.0	12.0
Term loan	242,163	0.5	0.5	0.0	0.0	1.0
Revolving loan	242,163	0.4	0.5	0.0	0.0	1.0
US Dollar loan	242,163	0.6	0.5	0.0	1.0	1.0
Borrower Altman score	54,728	1.5	2.2	0.9	1.4	2.1
Borrower 5 year EDF	52,636	2.1	3.5	0.3	0.9	2.3
			Panel B. Bank-level data			
			(Subset of international dollar loans / shares)			
Net income	275,570	2.4	1.3	1.7	2.2	2.9
Bank charter value	446,319	8.8	7.4	4.2	7.3	11.1
Book equity ratio	465,367	90.7	0.7	90.4	90.6	90.8
Price-to-book ratio	446,316	1.1	1.6	0.5	0.8	1.3
Liquid assets ratio	448,447	7.2	7.6	1.7	4.8	10.1
Deposit ratio	442,373	56.7	15.6	44.6	60.5	67.1
Size (log-assets)	469,774	15.4	1.4	14.6	15.8	16.5
Regulatory capital ratio	384,775	10.9	3.6	8.1	11.1	13.0
			Panel C. Macro-variables			
			(Subset of international dollar loans / shares)			
Short-term rate	610,677	2.8	3.2	0.3	1.9	4.6
10 year government rate	683,215	4.3	2.3	2.4	4.2	5.7
Real GDP growth	779,677	3.1	3.0	1.4	3.0	4.5
Current account to GDP	752,839	−2.8	17.9	−12.3	−6.5	1.2
Sovereign rating	764,797	18.4	3.0	18.3	20.0	20.0
Chin-Ito financial opness index	743,284	0.9	0.2	1.0	1.0	1.0
Global GDP growth	1,214,893	3.8	1.0	3.3	3.7	4.5
Merril-Lynch index (spread)	937,990	435.9	137.1	337.3	425.2	535.0
US inflation expectation	1,214,893	3.0	0.5	2.7	2.9	3.2
Market-wide 5 year EDF	1,162,657	3.0	0.3	2.8	3.0	3.2

Table 2: **Variables description:**

Variable	Definition	Source
	Panel A. Loan-level data	
Loan spread	Spread above LIBOR.	SDC
Number lenders	Number of members of the loan syndicate.	SDC
Loan amount	Principal amount.	SDC
Loan original maturity	Loan maturity at issuance, in years.	SDC
Term loan	Indicator, 1 for term loans.	SDC
Revolving loan	Indicator, 1 for credit lines.	SDC
US Dollar loan	Indicator, for dollar-denominated loans	SDC
Borrower Altman score	Altman z-score of the loan borrower.	SDC
Borrower 5 year EDF	Altman 5-year EDF of the loan borrower.	Moody's Fitch
International loan	Country of the borrower and lender differ	Eikon and SDC
Domestic loan	Country of the borrower and lender are the same.	Eikon and SDC
	Panel B. Bank-level data	
Net income	Net income to total assets.	Eikon.
Market capital ratio	Market capitalisation to quasi-market assets.	Eikon and Fitch.
Book equity ratio	Book equity to total assets.	Eikon and Fitch.
Price-to-book ratio	Market capitalisation to total assets.	Eikon, Dat. and Fitch.
Liquid assets ratio	Current assets to total assets.	Eikon.
Deposit ratio	Deposits to total assets.	Eikon.
Size (log-assets)	Logarithm of total assets.	Eikon.
Regulatory capital ratio	Tier 1 capital to risk-weighted assets.	Eikon and Fitch.
	Panel C. Macro level data	
Short-term rate		
Fed target rate	Federal funds target rate.	FRB
US shadow rate		Wu-Xia (2016).
10 year government rate		FRB
Real GDP growth	WEO Year-over-year GDP growth.	
Current account to GDP		WEO
Sovereign rating		Standard & Poor's
Financial opness index	Chin-Ito index	Chinn and Ito [2006]
Global GDP growth	Year-over-year global GDP growth.	WEO
Merril-Lynch index	Spread	
US inflation expectation	One-year inflation expectations.	
Market-wide 5 year EDF	Mean of all the loan borrowers	Moody's Fitch

Table 3: **Number loans by bank lead arrangers:** The table shows the number of loans arranged by banks, broken down between as international or domestic transactions; by currency (dollar-denominated and other currencies). Panel A reports all the loans, while Panel B and C report, respectively, term loans and credit lines.

Panel A. All loans

	International	Domestic	Total
Dollar	164,504	154,630	319,134
Other	79,998	49,167	129,165
Total	244,502	203,797	896,598

Panel B. Term loans

	International	Domestic	Total
Dollar	163,763	49,584	113,347
Other	39,793	25,550	65,343
Total	103,556	75,134	357,380

Panel C. Credit lines

	Domestic	Total	Total
Dollar	100,741	105,046	205,787
Other	40,205	23,617	63,822
Total	140,946	128,663	539,218

B Banks' regulatory and market capital: Stylized facts

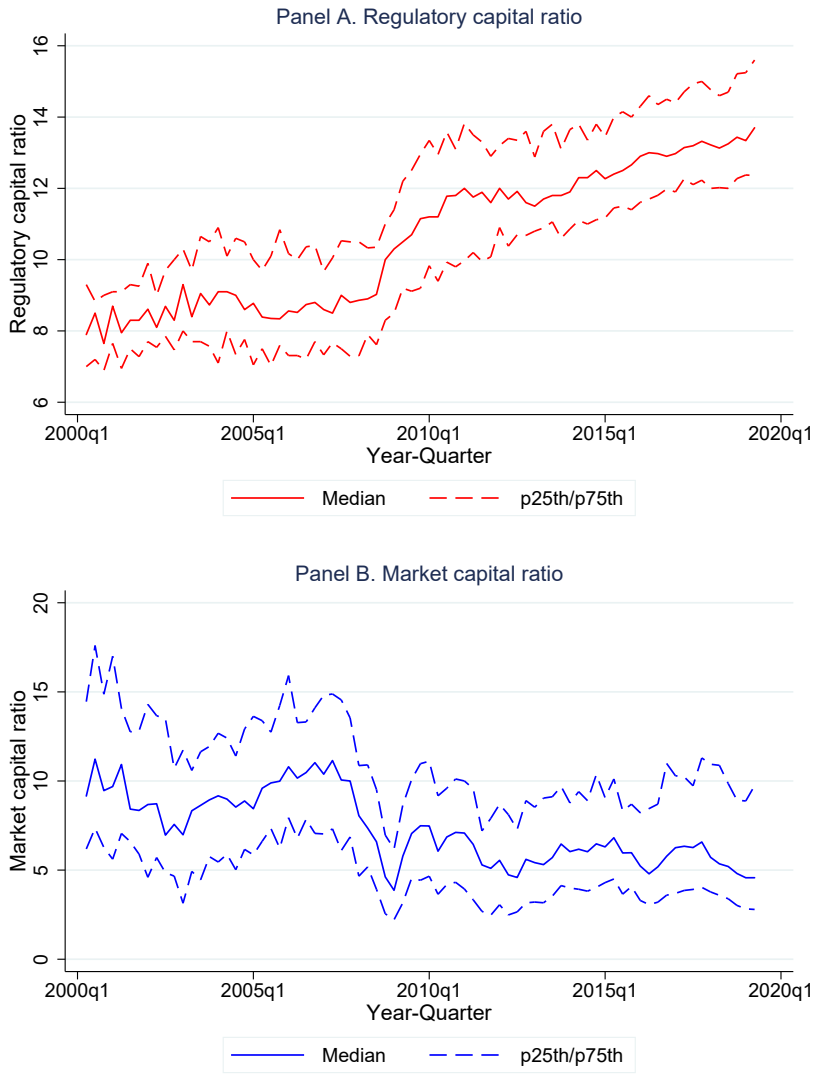


Figure A.3: **Bank market capital and regulatory capital, recent trends:** This graph plots the evolution of banks' regulatory capital and market capital, on a sample of large 147 banks. The Regulatory capital is defined as the ratio of Tier 1 to RWA, and its evolution is shown in Panel A. Bank market capital is plotted in Panel B, and defined the ratio of market capitalisation to quasi-market assets (book liabilities plus market capitalisation). Each panel plots the median, percentile 25th and 75th.

C Global loan market

- **Identifying bank loans:** we define bank loans as those granted by lenders classified as deposit-taking institutions under the NAICS, or as banks under the Thomson Reuters (Refinitiv) Business Classification. This encompasses US investment banks. Hence we depart from other research (Nandy and Shao [2010] and **?**) which consider - in a narrower sense- that bank loans are those labelled "Term A", and the credit lines. The reason is that we observe that many term loans (labelled as term B and higher) which are actually originated by banks, as also highlighted by Lim et al. [2014]. Figure A.3. provides an example of a syndicated loan with several banks, and one non-bank lenders.

- **International loans in the syndicated loan market:** we define international loans as those in which the (ultimate parent company of) the lender and the borrower differ. To identify the ultimate parent company we use the corporate structure provided by Refinitiv, which has three levels (entity, immediante and ultimate parent); and the sectoral classification of the lender/borrower and their immediate and ultimate parent. We consolidate entities up to the ultimate level entity, unless it is the government or a trust. If so we consolidate up to the second level. See example in Figure A.3.

Petrobras Oil & Gas BV Prices US$1,800M Revolving Credit Facility	
Loan Type	Revolving Credit Facility
Loan Syndicate Type	Syndicated
High Yield (Y/N)	N
Loan Yield Description	Investment Grade
Tranche Amount (MM)	1800
Host Currency	(US)
Loan Target Market	Europe Western Europe
Issue Date	04.12.2018
Closing Date	06.12.2018

Borrower	Petrobras Oil & Gas BV
Country	NL
Sector	Finance and Insurance
Industry	Other Financial Investment Activities

Borrower Ultimate Parent	Petroleo Brasileiro SA
Country	**BR**
Sector	Energy
Industry	Oil & Gas

Lender	Role	Location	Ultimate parent lender location
Credit Agricole CIB	Arranger	FR	**FR**
Natixis-Natixis Partners SA	Arranger	FR	FR
Societe Generale	Arranger	FR	**FR**
Standard Bank of S. Africa	Arranger	ZA	**UK**
Standard Chartered Bank PLC	Arranger	UK	**UK**
BankAmerica Corp	Arranger	US	**US**
First Rand Bank Limited	Arranger	ZA	**ZA**
Nedbank Ltd	Arranger	ZA	**ZA**
ABSA Bank Ltd	Lead	ZA	**ZA**
Barclays PLC	Lead	UK	**UK**
Sumitomo Mitsui Banking Corp	Lead	JP	**JP**

Figure A.3: **Mapping syndicated loans into bilateral bank loans:** The figure shows how we map syndicated loans arranged by a group of lender into bilateral bank loan observations. We use as example a revolving credit facility from Petrobras, arranged by a total of eleven lenders (with three lead arrangers). We map the transaction into eleven observations, ten of which (highlighted in red) involved a bank.

Previous volumes in this series

911 December 2020	Bilateral international investments: The Big Sur?	Fernando Broner, Tatiana Didier, Sergio L Schmukler and Goetz von Peter
910 December 2020	Recessions and mortality: a global perspective	Sebastian Doerr and Boris Hofmann
909 December 2020	Dealing with bank distress: Insights from a comprehensive database	Konrad Adler and Frederic Boissay
908 December 2020	Contagion Accounting	Iñaki Aldasoro, Anne-Caroline Hüser and Christoffer Kok
907 December 2020	Low price-to-book ratios and bank dividend payout policies	Leonardo Gambacorta, Tommaso Oliviero and Hyun Song Shin
906 November 2020	What share for gold? On the interaction of gold and foreign exchange reserve returns	Omar Zulaica
905 November 2020	Stablecoins: risks, potential and regulation	Douglas Arner, Raphael Auer and Jon Frost
904 November 2020	Housing booms, reallocation and productivity	Sebastian Doerr
903 November 2020	Bargaining power and the Phillips curve: a micro-macro analysis	Marco J Lombardi, Marianna Riggi and Eliana Viviano
902 November 2020	An early stablecoin? The Bank of Amsterdam and the governance of money	Jon Frost, Hyun Song Shin and Peter Wierts
901 November 2020	Inside the regulatory sandbox: effects on fintech funding	Giulio Cornelli, Sebastian Doerr, Leonardo Gambacorta and Ouarda Merrouche
900 November 2020	What can commercial property performance reveal about bank valuations?	Emanuel Kohlscheen and Előd Takáts
899 November 2020	The macro-financial effects of international bank lending on emerging markets	Iñaki Aldasoro, Paula Beltrán, Federico Grinberg and Tommaso Mancini-Griffoli

All volumes are available on our website www.bis.org.