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Abstract

In this paper we quantify the differences between market and regulatory assessments of bank portfolio risk, and thereby demonstrate that larger differences significantly reduce corporate lending rates. Specifically, to entice borrowers, banks reduce spreads by approximately 4.3% following a one standard deviation increase in our measure for bank asset-risk differences. This is equivalent to an interest income loss of USD 2.03 million on a loan of average size and duration. The separate effects of market and regulatory risk are much less potent. Our study reveals a disciplinary-competition effect in favor of corporate borrowers when there is information asymmetry between investors and bank regulators.

Keywords: bank portfolio risk; markets vs. regulators; syndicated loans; cost of credit; market discipline; competition

JEL classification: G21, G34, G33, G2

1. Introduction

Financial markets and bank regulators monitor the solvency of banks, disclose information, and discipline misconduct in an effort to enhance banking and financial stability. Despite markets and regulators being the two most important banking disciplinary mechanisms, their assessments on bank (solvency) risk levels may diverge significantly, implying a significant source of asymmetric information (Vallascas and Hagendorff, 2013). This type of asymmetric information, and the resulting differences in risk perceptions, creates uncertainty for the players that participate in bank lending, especially in the case of large systemic banks where the size of loans may be substantial. The aforementioned raises a number of pertinent questions: is this uncertainty systematically priced or accounted for in bank loan contracting, and does it affect the sustainability of bank-firm relationships? This paper seeks to answer these questions by focusing on large corporate loan deals made in syndicated loan markets around the world.

Markets use all available information (including that disclosed by bank regulators) to form perceptions of overall bank risk. Regulators, on the other hand, focus on accounting-based measures and other operational reports obtained directly from the banks under their supervision to establish bank supervisory ratings, and also use auditing and market-based measures, which they do so more and more frequently. Where low information asymmetry prevails, markets and regulators should, in principle, agree in their evaluations of healthy and transparent banks. Conversely, relatively high levels of information asymmetry, whether due to forces endogenous or exogenous to bank operations, may give rise to strong disagreement between markets and regulators. This would seem to imply a higher degree of uncertainty regarding the financial health of a bank.

The syndicated loan market is an excellent laboratory for any examination of the potential effects of different risk perceptions of market and regulators on bank lending behavior. Where differential perceptions of bank risk exist, the syndicate's lead bank (the one

making the important decisions regarding lending, including finding borrowers and participant lenders and setting the lending terms) might need to exert additional effort to "convince" corporate borrowers and participant lenders to actively engage. This holds true, especially when the assessments of the market on its risk level is higher than that of the regulator. We hypothesize that the additional effort required results in an observable outcome for the banks under scrutiny, i.e., banks offers more competitive (lower) loan spreads to assure the borrowing firm(s) its interests are being served.

To test this hypothesis, we first calculate the difference between the market and regulatory estimates of bank portfolio risk, hereinafter referred to as "portfolio risk differences." For market risk we use the volatility of bank asset returns derived from option pricing theory (e.g., Ronn and Verma, 1986; Flannery and Rangan, 2008; Vallascas and Hagendorff, 2013). For regulatory risk we use the risk-based capital ratio, which bank regulators most often examine because it reflects a bank's portfolio risk vis-à-vis the capital available to support the bank's risk-related choices. This ratio is jointly determined by the bank and its supervisors and is subject to supervisory approval even in cases where the bank's economic capital exceeds regulatory capital requirements (Basel Committee on Banking Supervision, 2017). Subsequently, we estimate the differences in portfolio risk between the two measures from the residuals of their bivariate regression, and use these residuals to explain lending terms, namely the loan spread over LIBOR to assess the direct effects on firm financing costs.

Our dataset includes more than 40,000 syndicated loan deals from 2002–2016. In addition to the theoretical advantage of using syndicated loans to test our central hypotheses, there are at least two practical advantages. First, most of the banks participating in this market are listed, allowing for the market-based measure of portfolio risk. Second, the loan-level data

allow the use of several layers of information, for banks, firms, and loans in our tests, making it easier to identify causal effects.

We recognize that the uncertainty resulting from the divergence between the market-based and regulatory estimates of portfolio risk is just one of many sources of information asymmetry that shapes bank-lending decisions. An additional source includes asymmetric information arising from a bank's overall or idiosyncratic exposure to firm credit risk, which is usually evident in the formation of a syndicate and the loan share of its lead bank (Sufi, 2007; Ivashina, 2009). Since our aim is to identify a causal effect between portfolio risk differences and bank loan terms, proper identification rests on correctly addressing this alternative source of information asymmetry.

We achieve this using several tests. Importantly, the loan-level data and the observation of repeated lending to the same firm within a given year allow using firm times year fixed effects. The latter control for any alternative time-varying demand (firm) side explanations for our findings. We also control for certain loan characteristics, including the number of lenders in a syndicate, the number of participant banks, and the syndicate's concentration, all of which capture information asymmetry within the syndicate (see Sufi, 2007). In even more stringent specifications, we control for general evolving economic conditions alongside other conditions in the countries of both lenders and borrower. We do this via lender's and borrower's country times year fixed effects, as well as quarter effects to control for common global effects on all banks and firms. We conduct several additional tests, including the use of Heckman-type models to account for selection issues between banks and firms, and use of alternative measures of portfolio risk differences.

We find that, *ceteris paribus*, loan spreads on drawn funds decrease by an economically significant 4.3%, or 11.6 basis points, in response to a one standard deviation increase in our measure of portfolio risk differences (market risk above regulation risk). This amounts to

approximately USD 0.41 million less in annual interest income for a loan of average size, increasing to USD 2.03 million over the loan's duration for a loan of average size and duration. Given that each lead bank in our sample extends approximately 26 loans per year while retaining a 24% loan share, the mean annual foregone interest rises significantly to USD 2.57 million.

Notably, we find that the negative effect of these risk differences is mainly concentrated in banks perceived by the markets to be riskier, while banks perceived to be riskier by the regulators do not experience a significant effect on their loan spreads. We attribute this to the sharper increases in market assessment (compared to regulatory assessment), the inattention of lending participants to regulatory risk assessment when bad news hits the markets, and the unenforceability of market risk assessment (as opposed to the enforceability of regulatory assessment that must yield a decrease in risk-weighted assets/increase in capital). The key finding of our paper highlights the operative and disciplinary role of market forces in banking supervision, which materialize when there are conflicting bank risk estimates between investors and supervisors. Put simply, we demonstrate that the difference between risk perceptions is that which has the greatest effect, and not the two perceptions separately.

We further enhance our identification approach for a supply-side effect of portfolio risk differences by investigating bank heterogeneity with respect to financial health. We thus hypothesize that the negative effect of portfolio risk differences should be less potent for more financially sound banks. We examine this hypothesis using models with interaction terms between our measure of portfolio risk differences and measures of banks' financial health. Besides highlighting relevant heterogeneity in the results, these models further enhance our identification of a supply-side mechanism driving our findings (e.g., Jiménez, Ongena, Peydro, and Saurina, 2014). Indeed, we find this to be the case for more profitable banks, with better credit ratings, and lower levels of non-performing loans. We also show a more muted role for

portfolio risk differences in explaining loan spreads when there is a recently established bank–firm relationship.

Our analysis ultimately traces the implications of the market-regulatory information asymmetry for the sustainability of bank-firm relationships. We note that higher relevant informational asymmetries might increase the probability of ending a lending relationship. This is costly to banks but also costly to borrowing firms, who must then initiate a new lending relationship with another bank. However, if this is an option to the borrowers and banks are unable to reduce spreads, we should also observe an increase in the probability of ending lending relationships. We show that this is indeed also the case. On the same front, we find that the probability of ending a relationship is higher for loans of shorter maturities and higher upfront fees. Similarly, relationships are more likely to end for highly valued and profitable firms.

Previous literature also measures information asymmetry using disagreement between rating agencies (e.g., Morgan, 2002) or between regulators and markets (e.g., Vallascas and Hagendorff, 2013). This literature establishes that agency disagreement in evaluating risk is a valuable measure of information asymmetry and shows that regulatory estimates of bank portfolio risk are inconsistent with market-based estimates. Several other studies recognize the shortcomings of the Basel framework to accurately reflect the degree of risk attached to bank portfolios (Kim and Santomero, 1988; Avery and Berger, 1991; Jones, 2000; Hellwig, 2010). This literature has different objectives, as it does not look at the supply-side loan pricing decisions of banks as a function of disagreement and associated information asymmetry between different external stakeholders (in our context, market participants and regulators).

In particular, our study relates to two additional strands of literature. Early evidence by Hubbard, Kuttner and Palia (2002) shows that low-capital banks charge higher loan rates. More recent studies indicate that well-capitalized banks typically supply more expensive loans

(Dell'Ariccia, Laeven, and Marquez, 2014; Dell'Ariccia, Laeven, and Suarez, 2017), especially those with higher liquidity risk (Acharya and Naqvi, 2012). Santos (2011) shows that higher credit risk following the eruption of the subprime crisis in 2008 obliged the banks to increase loan spreads to the same firm. Moreover, our paper relates to the literature on asymmetric information in the syndicated loans market. Sufi (2007) shows that information asymmetry between lenders and borrowers increases the share of the lead arrangers in order to improve monitoring intensity. Ivashina (2009) shows that information asymmetry between members of the loan syndicate yields larger loan shares by lead banks and lower loan spreads.

By anchoring bank capital and/or risk-weighted assets (the predominant regulatory-based perception of bank risk) to market-based estimates of bank risk (as in Vallascas and Hagendorff, 2013), we assert that portfolio risk differences carry greater weight in the bank's loan pricing decision compared to the level terms of risk-weighted assets or market risk. Our study is the first to uncover this important supply-side effect on loan pricing.

The rest of the paper proceeds as follows. Section 2 describes the conceptual framework and places our study within the existing literature. We develop two testable hypotheses on the effect of portfolio risk differences on loan spreads and how this effect can be heterogeneous with respect to lead banks' financial characteristics and relationship lending. Section 3 presents our dataset and discusses our identification strategy. Sections 4 to 6 report and discuss the empirical results. Section 7 concludes the paper.

2. Conceptual Framework and Hypotheses Development

Our basic premise is that portfolio risk differences reflect asymmetric information between the two key players identifying bank portfolio risk, namely markets and regulators. Markets use all available information to infer bank portfolio risk and the outcome of this information yields asset volatility as the key market-based measure of risk. In turn, regulators focus on measures

of risk-weighted assets (inclusive or not of capital), as reflected on a bank's balance sheet (book value of asset risk), supervise banks concerning this risk, and ultimately adopt the book values or ask for revisions via informal and formal enforcement actions remaining bound to these measures (e.g., Acharya, Engle, and Pierret, 2014; Flannery, 2014). However, a loss of equity market value is not necessarily reflected in book equity measures, which impedes the supervisors' ability to require a bank to augment its capital due to a significant loss. Given this, the supervisory metric for judging sufficient capital is disassociated from that of the market (Flannery, 2014).

We contend that our measure captures a general form of information asymmetry. The idea backing our measure is simple: if bank portfolio risk is harder to observe and measure, markets and regulators (supervising the accounting-based measure) should disagree more often about the true level of bank portfolio risk. Such disagreement can ultimately affect the way a bank organizes its lending arrangements (i.e., the supply-side lending decisions of banks). An increase in asymmetric information regarding the true level of banks' portfolio risk creates a reputational disadvantage, thereby increasing pressure on the banks to make sound lending choices.

We expect this effect to be particularly potent when market-based estimates of bank portfolio risk exceed the regulatory estimates. Firstly, this can be explained partly by the fact that markets react more quickly to negative developments causing sharp increases in their valuation of risky assets, and a positive difference between market and regulatory assessment of bank portfolio risk. In contrast, there is some delay in regulatory supervision and assessment to take effect because of limited resources and the related difficulty in onsite supervision of banks, as well as a lengthy supervision process when excessive risks are identified. Besides, regulators tend to be conservative in their risk assessment (asking banks to hold an increasing volume of lower risk-weighted assets in the balance sheets), so that a negative value on the

difference between market and regulatory risk might be the norm, making the lending participants (borrowers and banks) inattentive. Secondly markets exert only a disciplining effect on riskier banks, although as opposed to the regulators they do not enforce this effect. Given that banks are not obliged to lower asset risk in order to ease market concerns, they can further increase the true risk evidenced in their portfolios and can be more severely affected during unexpected shocks (Vallascas and Hagendorff, 2013; Acharya, Engle, and Pierret, 2014), causing sharp increases in portfolio risk differences.

Unexpected (negative) developments regarding perceptions of a bank's asset risk increase asymmetric information, and consequently may raise market concerns about the bank's ability to conduct business. Banks that experience widening risk perceptions are likely to succumb to borrower demands in their attempt to ease concerns regarding solvency when negotiating the syndication of a new loan. This additional effort might take the form of competitive loan terms, primarily reflected in lower loan spreads and secondarily in non-price terms such as reduced collateral requirements, higher loan amounts, or longer maturities. Simple measures of bank portfolio risk or opacity cannot capture the effect of this type of disagreement and corresponding information asymmetry on the lending terms (e.g., Morgan, 2002). This leads us to propose our first hypothesis (Hypothesis 1):

H1: *When market perceptions of lead banks' portfolio risk exceed regulatory risk assessments, loan syndicates will offer cheaper loans to corporate borrowers.*

Further, when market risk perceptions exceed regulatory risk assessments, we expect the downward adjustment of loan spreads to be contingent on the characteristics of the lending bank. Hence, for large, profitable lenders with limited exposure to non-performing loans the adjustment should be less sizeable – or even reversed. Large institutions have distinct structural

characteristics and corporate governance schemes compared to small institutions, which often means that they process the same economic news and developments differently (Chan and Chen, 1991). In addition, large, sophisticated lenders might have more efficient credit risk departments for monitoring overall credit risk exposure and counterparty risk, rendering these banks less susceptible than smaller, less sophisticated lenders to adverse information stemming from market-based estimates.

The existence of a prior lending relationship between the lead bank and the borrowing firm further emerges as an additional mechanism for minimizing uncertainty regarding a bank's ability to serve a loan. Typically, these relationships convey information to banks that firms are unable to communicate to the capital markets with any credibility. Notwithstanding, they also work in the opposite direction, as firms can obtain valuable information from banks in excess of that available to the markets (Kang and Stulz, 2000; Bharath, Dahiya, Saunders, and Srinivasan, 2009). Either party can capitalize on this relationship in bad times, with banks in particular able to increase their bargaining power during the loan negotiation process, which limits the effects of increased portfolio risk differences (Bolton, Freixas, Gambacorta, and Mistrulli, 2016).

Where the above mechanisms pertain, we expect to observe a reversal in the sign on portfolio risk differences for loans granted by well-managed lenders with a prior relationship with the borrower compared to poorly managed first-time lenders. This leads to our second hypothesis (Hypothesis 2):

H2: *The pressure to reduce loan spreads when market portfolio risk perceptions exceed regulatory risk assessments is ameliorated for well-performing lenders with a prior banking relationship with the borrower compared to poorly performing first-time lenders.*

3. Data and Empirical Methodology

Syndicated loans from DealScan provide us with information on the loan pricing of those banks with actively traded stocks and, by extension, measurable market-based portfolio risk. We consider only loans with information on loan spreads, which eliminates all types of Islamic finance and very specialized credit lines. Our dataset covers the 2002–2016 period and the number of loan facilities in our baseline specifications ranges from 42,857 to 52,038 in total, depending on the control variables used. These 42,857 loans are drawn from 364 lead banks headquartered in 41 countries and granted to 10,230 borrowers operating in 102 countries.

We match the loans with bank- and firm-specific information, although in most of our analyses we use firm × year fixed effects that render firm-year characteristics redundant. In a third round of data collection we match the resulting dataset with macroeconomic and institutional (country-year) variables from several freely available sources. Again, the specifications using lender's country × year fixed effects and borrower's country × year fixed effects render the effects of country-year characteristics redundant. We provide variable definitions and sources in Table 1 and basic summary statistics in Table 2.

Further, in Table A1 we report the number of loans and the mean and standard deviation of *Portfolio risk differences* by lender country. In loans granted by U.S. lenders, which represent about half of our sample, *Portfolio risk differences* ranges from -0.31 to 0.09. The phenomenon is even more pronounced in the Eurozone countries where *Portfolio risk differences* is persistently negative, pointing to more conservative regulator estimates.

[Insert Tables 1 and 2 here]

3.1. Empirical Model and Key Variables

The baseline form of our empirical model is:

$$Cost\ of\ credit_{lt} = a_0 + a_1 Portfolio\ risk\ differences_{bt} + a_2 Controls_{kt} + u_{lt}. \quad (1)$$

The outcome variable *Cost of credit* is the all-in spread drawn (*AISD*) of loan facility l originated at time t. *AISD* equals the spread of the loan facility over LIBOR plus any facility fees. The main coefficient of interest in Equation (1) is a_1, which indicates the effect of portfolio risk differences on the cost of credit. In line with Hypothesis 1, we expect a_1 to be negative if the differences between the market and regulator estimations of risk increase market discipline, imposing a competition effect and thus lowering the cost of credit offered by banks to borrowing firms.

Portfolio risk differences for each lender b at time t are the (standardized) residuals e of the OLS regression of a lender's asset volatility (*Bank asset volatility*) on the lender's ratio of capital to risk-weighted assets (*RBC ratio*), or:

$$Bank\ asset\ volatility_{bt} = a_0 + a_1 RBC\ ratio_{bt} + e_{bt}. \quad (2)$$

The residuals from Equation (2) capture components of the market perception of lender risk that are not embedded in the regulatory measure of lender risk, with results reported in Table A2 (columns (1)-(2)). A positive (negative) residual means that the assessment of a bank's portfolio risk according to the market is higher (lower) than the assessment made by regulatory authorities. This is our primary measure for asymmetric information between markets and regulators regarding bank portfolio risk.

We include capital in our original measure because markets observe bank capitalization in formulating their own bank risk assessment.[1] Thus, in line with increasing capital stringency

[1] The bank's regulatory capital is composed of Core Tier 1 (common equity, retained earnings, minority interests, some preference shares), Additional Tier 1 (some preference shares, hybrid capital), and Tier 2 (e.g., undisclosed

during our sample period, holding low capital buffers gives a poor signal to markets. However, using the RBC ratio to estimate *Portfolio risk differences* can also lead to two different explanations of our findings. First, there might be a capital arbitrage effect, whereby good banks strategically manage their capital buffers allowing these banks to offer more competitive lending terms. Second, a lower RBC ratio might signal an excessive risk-taking story, triggered by a lending expansion.

To exclude these alternative explanations, we also use the ratio of risk-weighted assets to total assets (*RWA ratio*) in order to estimate *Portfolio risk differences* instead of the RBC ratio. Then, controlling for the RWA ratio, must fully account for the capital arbitrage story (capital is not part of *Portfolio risk differences* anymore) and the excess risk-taking story (the excess risk-taking is controlled by the RWA ratio). To construct the RWA-based *Portfolio risk differences*, we estimate Equation (2) by replacing *RBC ratio* with *RWA ratio*; we report results in columns (3)-(4) of Table A2.

The correlation between *Bank asset volatility* and *RBC ratio* in our sample is low and equal to negative 3%. On the other hand, *Bank asset volatility* has a strongly positive correlation with *RWA ratio*, equal to 44%; this value is in line with Vallascas and Hagendorff (2013). The correlation between our RBC-based *Portfolio risk differences* and *RBC ratio* is negative, equal to 43%, and highly significant, whereas that of the RWA-based *Portfolio risk differences* and *RWA ratio* is positive and equal to 60%. Clearly, *RBC ratio* and *RWA ratio* do not move hand in hand. This largely owes to the fact that banks have some discretion in setting the regulatory capital buffers.

Accordingly, we adopt two baseline specifications: the first includes our initial portfolio risk differences measure (the residuals of the regression of *Bank asset volatility* on *RBC ratio*).

reserves, subordinated debt). Core Tier 1 and Additional Tier 1 must be at least 4% of risk-weighted assets (2% each), while Tier 2 must be at least 4%, resulting in a minimum total capital of 8% of the bank's risk-weighted assets. Following the implementation of Basel III (scheduled for January 1, 2023), Core Tier 1 must be at least 4.5%, Additional Tier 1 must be at least 1.5%, and Tier 2 at least 2%, for a total capital of 8.5%.

In the second specification we replace the RBC-based measure with the RWA-based measure (i.e., the residuals of the regression of *Bank asset volatility* on *RWA ratio*). We run all the models twice and include the constituents of *Portfolio risk differences* as control variables.

The suitability of asset volatility as a measure for bank portfolio risk stems from its ability to reflect asset value changes, liability value changes, and other developments in off-balance items and operating efficiency. To derive a bank's asset volatility, we follow prior literature (e.g., Ronn and Verma, 1986; Flannery and Sorescu, 1996; Flannery and Rangan, 2008; Vallascas and Hagendorff, 2013) and use the Black-Scholes-Merton option pricing model. Specifically, bank equity (V_T) at time T is modeled as a call option on bank assets with strike price equal to the promised debt payment (i.e., the bank's total liabilities L_T):

$$V_T = \max[V_T - L_T, 0]. \tag{3}$$

Therefore, the market value of bank equity ($V_{E,t}$) at time t (with $t < T$) is expressed as a function of the (unobservable) market value of bank assets ($V_{A,t}$), satisfying:

$$V_{E,t} = V_{A,t}N(d_{1,t}) - L_t e^{-r_f T} N(d_{2,t}), \tag{4}$$

with

$$d_{1,t} = \left[\ln\left({}^{V_{A,t}}/_{L_t}\right) + \left(r_{f_t} + \frac{1}{2}\sigma_{A,t}\right)T\right] / \sigma_{A,t}T, \tag{5}$$

and

$$d_{2,t} = d_{1,t} - \sigma_{A,t}T. \quad (6)$$

Based on Merton (1974), the value of bank equity is a function of the value of bank assets and time so that the volatility of bank equity ($\sigma_{E,t}$) is related to the volatility of bank assets ($\sigma_{A,t}$):

$$\sigma_{E,t} = \frac{V_{A,t}}{V_{E,t}} N(d_{1,t})\sigma_{A,t}. \quad (7)$$

In Equation (4), the term $N(d_{1,t})$ can be interpreted as the factor by which the present value of the contingent receipt of bank assets (discounted at risk-free rate $r_f T$) exceeds the current value of bank assets, while $N(d_{2,t})$ reflects the probability of the (bank closure) option being exercised.

By simultaneously solving Equations (4) and (7) and setting $T = 1$, we extract $\sigma_{A,t}$ for each bank annually. Similarly to Vallascas and Hagendorff (2013), we employ as starting values for $\sigma_{A,t}$ the historical annualized yearly standard deviation of bank equity returns, multiplied by the ratio of the market value of bank equity to the sum of the market value of bank equity and the book value of bank total liabilities; that is:

$$\sigma_{A,t} = \sigma_{E,t} V_{E,t} / (V_{E,t} + L_t). \quad (8)$$

Through an iterative process we use a Newton search algorithm to calculate the (implied) yearly values for bank asset volatility ($\sigma_{A,t}$) and bank asset value ($V_{A,t}$). The resulting measure ($\sigma_{A,t}$) is our preferred market-based measure for bank risk and we use it as the

dependent variable in Equation (2). For our sample of banks, the mean (median) bank asset volatility, expressed in percentages, is 2.42 (1.89).

3.2. Identification, Controls, and Fixed Effects

The key aim of our empirical analysis is to identify the causal effect of *Portfolio risk differences* on the *Cost of credit*. Simultaneity and reverse causality are not the main identification problems because bank capital and risk are predetermined when new loan decisions are made. For us, the main problem is omitted-variable bias, especially in distinguishing between loan supply and loan demand.

Consistent with related studies (e.g., Sufi, 2007; Ivashina, 2009; Delis, Hasan, and Ongena, 2020), we control for the log of the loan amount, loan maturity (in months), the number of participant banks in a syndicate, dummies for performance-pricing provisions and collateral, and the total number of covenants. We also conduct sensitivity tests without loan control variables to confirm that our model is not subject to a "bad controls" problem. We further control for bank characteristics, such as bank size, return on assets, and non-performing loans; likewise, our set of firm-level controls include firm size, firm return on assets, and firm Tobin's Q. Consistent with the literature (e.g., Ivashina, 2009; Acharya, Eisert, Eufinger, and Hirsch, 2019), all bank controls and firm controls are lagged. We provide exact definitions of these variables in Table 1 and summary statistics in Table 2. As seen in Table 2, *Portfolio risk differences* assumes more often negative values, which is expected because regulatory capital is designed to be a buffer against potential adverse shocks. Positive values would imply an inherent deficiency in the regulators' methodology to create a buffer. Thus, under normal circumstances, we expect the markets to be less strict in their assessment of bank portfolio risk.

To maintain a high level of variation in *Portfolio risk differences* we initially consider a specification with a very simple set of fixed effects – namely, loan type and purpose, year-,

bank-, firm-, and lender's country-level effects – allowing us to estimate the coefficient on our portfolio risk differences measure for the largest possible number of banks and firms in our sample. However, since our basic hypothesis is that the interest rate response to changes in our risk differences measure is supply-driven, we adopt more restrictive fixed effects in subsequent specifications.

Importantly, we use firm × year fixed effects to control for time-varying firm-side (demand-side) explanations for our findings such as firm-year changes in risk, changes in loan demand, and borrowers' corporate governance, etc. This means that to estimate Equation (1) we obtain identification from firms with at least two loan facilities extended within the same year. Moreover, the inclusion of lender's country × year fixed effects shields our specification from country-year (macroeconomic) developments in the lender's country. The regression still yields results on the main coefficient of interest because there are multiple loan facilities from the same country within a year, with the inclusion of borrower's country × year fixed effects as an additional sensitivity test serving the same purpose for the borrower's country. Furthermore, country-pair fixed effects control for exchange rate dynamics and trade balance dynamics between the given pair of lender and borrower countries. Our last set of fixed effects includes those at the quarter level, which eliminates any undesired variation beyond the quarterly frequency not absorbed by our remaining fixed effects.

4. The Effect of Portfolio Risk Differences on the Cost of Credit

4.1. Baseline Results

We begin our analysis by horse racing our portfolio risk differences measures with their main terms, namely bank asset volatility, and the RBC and RWA ratios. For this reason, in Table 3 we sequentially include different combinations of our RBC-based *Portfolio risk differences* with its constituents (each of the regulatory- and market-based measures); in Table 4, we

replicate this analysis for the RWA-based measure. This will allow us to isolate the effect of *Portfolio risk differences* from its components and further identify whether the disciplining effect exerted by portfolio risk differences is market- or regulatory-driven. Table 3 reports the results of the estimation of Equation (1) including the coefficient estimates and t-statistics obtained from standard errors clustered by lender's country and bank.[2] Our preferred specification includes loan type and purpose, bank, firm × year, and lender's country × year fixed effects. We choose the given set of fixed effects as they control to a reasonable extent for time-varying loan-demand forces and macroeconomic fundamentals without being overburdened by fixed effects, thereby allowing for sufficient variation in our variable of interest.

In the first two columns of Table 3 (Table 4), *Portfolio risk differences* is interacted with *Bank asset volatility* and *RBC ratio* (*RWA ratio*), respectively. The coefficient on *Portfolio risk differences* is negative and statistically significant in both specifications, ranging between 8.5 and 11.4 basis points in response to a one standard deviation increase in the RBC-based measure (=42.5 basis points × 0.20 and 57 basis points × 0.20 respectively in Table 3) and between 7.9 and 10.2 basis points for the RWA-based measure (Table 4). The effect of *Bank asset volatility* is picked up by *Portfolio risk differences* in column (1) of either table, while the regulatory measure appears significant for syndicated loan spreads in column (2). The effect of each of our regulatory measures of bank portfolio risk on loan spreads is consistent with prior studies (e.g., Hubbard, Kuttner, and Palia, 2002; Santos and Winton, 2019). In specific, a one standard deviation increase in *RBC ratio* decreases *AISD* by 6.2 basis points (=2.2 basis points × 2.8 in Table 3), whereas the same increase in *RWA ratio* raises spreads by 23.8 basis points (=1.1 basis points × 21.1 in Table 4). However, the effect of the regulatory estimates is

[2] In the last row of each table, we report the number of banks and firms from which we obtain identification in the corresponding estimations.

independent of the effect exerted by the risk differences measures, with either *RBC ratio* or *RWA ratio* failing to absorb the size and significance of the coefficient on *Portfolio risk differences*.

[Insert Tables 3 and 4 about here]

Presenting the individual components of our *Portfolio risk differences* in column (3), we observe the relative dominance of regulatory risk estimates over market-based estimates. *RBC ratio* comes with a negative and non-statistically significant value (Table 3), while *RWA ratio* is positive and statistically significant (Table 4); *Bank asset volatility* does not affect loan spreads in either case. When including all of our measures concurrently in column (4) of Tables 3 and 4, *Bank asset volatility* and *RBC ratio* retain their non-statistically significant coefficients, while *RWA ratio* remains positive and statistically significant. In both cases, our risk differences measures retain their negative and statistically significant sign. It appears that although regulatory estimates have a relatively greater impact than their market-based counterparts, it is also the difference between the two (and the relevant information asymmetry) that exerts a disciplining (negative) effect on bank loan spreads.

Based on specification (4) of Table 3, the main coefficient of interest, a_1, reveals that a one standard deviation increase in *Portfolio risk differences* decreases *AISD* by an average of 11.6 basis points (=58.1 basis points × 0.20). Economically, this is a sizeable effect, equal to a 4.3% (=11.6 basis points ÷ 272.1 basis points) decrease for the average loan amount in our sample. Given that the average loan size is USD 352 million, banks with increased asset volatility relative to the regulatory estimation of their portfolio risk lose approximately USD 0.41 million (=USD 352 million × 11.6 basis points) per year in foregone interest revenue. For

an average loan maturity of 5.0 years, this represents approximately USD 2.03 million in interest losses over the loan's duration.[3]

However, this forms only part of the picture: each lead bank in our sample grants on average 26.1 loans per year, while the average bank share for the available observations is 24.0%. Assuming that the loan share figure is representative of the average lender in our sample, the overall annual cost arising from the lender's total loan operations within a given year increases to USD 2.57 million (=USD 0.41 million × 26.1 loans × 24.0% share).[4]

In Tables 5 and 6 we consider different sets of fixed effects in the regressions for the RBC-based and the RWA-based measure respectively. In column (1) of each table, we start with our less demanding specification where we include loan type and purpose, year, bank, firm, and lender's country fixed effects. In column (2) we add firm × year fixed effects, controlling for loan-demand forces for each firm-year. In column (3) we add lender's country × year fixed effects that control for time-varying macroeconomic conditions in the bank's country along with borrower's country, and country-pair fixed effects. Specification (4) is even more demanding, as we add borrower's country × year fixed effects, controlling for the macroeconomic environment in the borrowing firm's country, while our last specification (column 5) introduces quarter fixed effects, which control for any remaining variations at the quarterly level. Across all specifications we find that larger *Portfolio risk differences* exert a negative, statistically significant effect on loan spreads. Across these specifications the coefficients on *Portfolio risk differences* are consistently negative and statistically significant at all conventional levels.

[Insert Tables 5 and 6 about here]

[3] Assuming five annual payments and LIBOR as the discount rate, the increase in interest expense equals USD 1.92 million for the average 12-month LIBOR rate of 2.1% during our sample period (for similar calculations, see Ivashina and Sun, 2011).

[4] Bank share is only reported for 6,252 of the 42,857 loan facilities in our sample. Generalizing this average to apply to all loan facilities is a plausible assumption, since it is not very different from the average loan share values reported in previous studies (e.g., Sufi, 2007; Ivashina, 2009).

We consequently examine any asymmetric effects exerted by our risk differences measure on loan spreads. To this end we interact *Portfolio risk differences* with an indicator for the group of banks with *Portfolio risk differences* above our sample mean. Since the average *Portfolio risk difference* in our sample is -0.18, a one standard deviation increase in this measure (raising the mean value by 0.20) will automatically move the average bank into the positive risk differences group, wherein its market risk is deemed higher than its regulatory risk (or increase the risk differences value of banks with already positive *Portfolio risk differences* yet further). We present results for our RBC- and RWA-based measures in Table 7 (columns 1 and 2 respectively).

[Insert Table 7 about here]

In either case, *Portfolio risk differences* has a positive, statistically significant coefficient, with the significance of our risk differences measures being picked up by our interaction term (the coefficient on *Portfolio risk differences* × *Positive risk differences*). These results reveal that the (negative) effect of portfolio risk differences on loan spreads is not symmetric across all banks, but is instead focused in banks considered higher risk by markets than by regulators. Banks with negative risk differences are affected the least, if at all, suggesting that a higher regulatory assessment acts as a safeguard against lending cost.

Based on our estimates in Tables 3–7, and consistent with Hypothesis 1, we can infer that wider differences between regulatory and market-based measures of bank portfolio risk substantially decrease the cost of loans offered by banks, *ceteris paribus*. We illustrate the implications of this estimate by considering the example of a prominent U.S. bank, Bank of America Merrill Lynch. During our sample period, the average *Portfolio risk differences* value for Bank of America is -0.12, meaning that the market-based assessment of its portfolio risk is lower than the regulatory assessment. Furthermore, the average *AISD* on the loan facilities granted by Bank of America when its *Portfolio risk differences* is below its mean value is

280.19 basis points, approximately 19% higher than the above-mean value of 235.02 basis points. Looking at specific sub-periods, from 2013 to 2016, Bank of America's average *Portfolio risk differences* is -0.31, the average *AISD* on its loans is 267.23 basis points, and the average amount of each loan is USD 392 million. However, during the 2002–2005 period the mean value for Bank of America's *Portfolio risk differences* is 0.09, the average *AISD* is 231.51 basis points, and the average loan amount is less than half of its amount nearly a decade later: USD 176 million. Similar examples exist for other leading banks predominantly based in countries with developed economies.

In Table A3 of the Appendix, we examine the sensitivity of our estimates to the "bad controls" problem by interchangeably excluding loan-level control variables from our specifications.[5,6] Irrespective of the specifications used, the coefficient on *Portfolio risk differences* retains its negative, statistically significant value, ranging between 8.1 and 10.8 basis points per one standard deviation increase. We further run a seemingly unrelated regression (SUR) model that accounts for the simultaneous setting of the price and non-price loan terms by the lending banks at the time of the loan origination (Gropp, Gruendl, and Guettler, 2014). In this setting we estimate a system of regressions where, in addition to *AISD*, a number of different loan terms, namely *Loan amount*, *Maturity*, *Collateral*, and *Number of lenders*, and the components of our portfolio risk differences measures (*Bank asset volatility*, *RBC ratio*, and *RWA ratio*) are regressed on the same set of regressors in our baseline equation (including the *AISD*). Results in Table A4 confirm the robustness of our baseline OLS

[5] Since the "bad controls" problem is due to differences in the composition of loans to a given firm, in an alternative sensitivity test, we include weights based on the number and amount of loans received by each firm (results available upon request).

[6] The replacement (or addition) of *Number of covenants* with the number of financial covenants or net covenants leaves our results unchanged.

estimates; in fact, the results of our baseline models appear to be considerably conservative compared to those under the SUR framework.[7]

The size and magnitude of the coefficients on the control variables in Tables 3–7 are generally in line with the prior works of Bae and Goyal (2009), Ivashina (2009), Cai, Eidam, Saunders, and Steffen (2018), and Delis, Hasan, and Ongena (2020). In particular, loan spreads decrease with loan amount and increase with maturity as well as being more competitively priced when collateral and more performance provisions are included in the spread. The role of bank-characteristics is also largely anticipated, with greater return on assets associated with decreasing *AISD* while increased non-performing loans are associated with higher loan spreads. Moreover, either of our regulatory estimates of bank risk exert an independent and statistically significant effect, as lower levels of regulatory capital and higher levels of risk-weighted assets increase loan spreads (which is consistent with, among others, Hubbard, Kuttner, and Palia, 2002; Santos and Winton, 2019).

4.2. Controlling for market information asymmetry

Thus far our results show that greater information asymmetry between markets and regulators with regards to bank portfolio risk exerts a significant effect on bank loan spreads over and above that exerted by the individual market and regulatory measures of bank risk. However, information asymmetry might also be present between market participants themselves, owing to the inherent opacity of banks. Moreover, this market information asymmetry might coexist with the market-regulatory information asymmetry in shaping bank loan spreads.

In this regard, this section introduces a measure of the relative opacity of banks, based on the disagreement of the major credit rating agencies (Moody's and Standard and Poor's) as

[7] For expositional purposes, we only report estimates from the regressions where the dependent variable is *AISD*. The estimates from the other equations in the model are available on request.

a proxy for uncertainty (see Morgan, 2002). We include this proxy (*Split rating*), along with one of the agencies' rating (*Bank rating*) in our regressions for the RBC- and RWA-based portfolio risk measures in Table 8 (columns 1 and 2 respectively). In either specification, our rating disagreement measure, although positive, exerts a non-statistically significant effect on loan spreads. This is not the case for the individual credit rating, an increase of which (suggesting a deterioration in the bank's rating) results in lower spreads. For what matters, the coefficient on *Portfolio risk differences* is consistently negative and statistically significant (largely exceeding our baseline estimates), indicating that what matters is the discrepancy between the market and book value of risk and not disagreement between rating agencies.

[Insert Table 8 about here]

4.3. Additional Sensitivity Tests

In Table A5, we test our results' sensitivity to the type of standard error clustering. We initially consider our RBC-based portfolio risk differences measure: column (1) features clustering by lender country *and* year, column (2) by bank *and* year, while in column (3) we adopt even more demanding clustering, such as lender's country *and* bank *and* year.[8] In columns (4)-(6) we adopt the same clustering for the regressions of our RWA-based measure. Across all specifications, the coefficient on *Portfolio risk differences* is similar to that of our baseline specification. We next re-estimate our baseline specification by employing different versions of our original portfolio risk differences measure and report the results in Table A6. Specifically, we use a common risk-free rate for all EMU countries in Equation (4) (columns (1) and (4)), and estimate Equation (2) without a constant (columns (2) and (5)), and for each bank separately (columns (3) and (6)).

[8] In unreported regressions we further adopted less demanding clustering, namely at the loan-level, the bank-level, the firm-level, and at the lender's country-level.

So far, we have assumed that all loans enter the model weighted equally. While the fixed effects in Tables 5-6 provide a safeguard against cross-country variation, we nevertheless acknowledge that our empirical specification might be open to criticism that borrower countries receiving more or fewer loans could disproportionately affect our results. To this end, in Table A7 we use weighted least squares and several different weights based on the proportion of loans between a given bank-firm pair or country-pair to the total number of loans in our sample, retaining the same set of fixed effects. Our results are very similar to the baseline.

4.4. Accounting for Sample Selection Bias

In this section we consider whether our results are affected by selection bias if the effect of *Portfolio risk differences* on *AISD* is due to firms borrowing from relatively riskier banks in order to obtain more favorable loan terms. To exclude this possibility we follow Dass and Massa (2011) in employing Heckman's (1979) two-stage model. In the first stage we estimate a probit model of the probability of a firm borrowing from the given bank. We then calculate Heckman's lambda (inverse Mills ratio) and include it as an additional control variable in the second-stage OLS estimation of Equation (1). We include all syndicated loan facilities in DealScan, providing enough information for the first-stage probit to estimate the determinants of a firm's decision to borrow from a given lead bank. Similar to Dass and Massa (2011), we assume that a firm's decision to obtain a syndicated loan is a function of the main determinants of its decision to borrow in general. These determinants consist of a set of loan, bank and firm characteristics, and loan type and purpose, year, firm, and borrower's country dummies.

We report the results in Table A8. According to the probit estimates in columns (1)-(4) of Panel A, the larger the Tobin's Q and leverage of a firm, the more likely it is to complete a syndicated loan deal. Unsurprisingly, firms opt for syndicate financing when seeking loans with longer maturity; however, these loans require increasing amounts of collateral. Most

importantly, the estimates from the second-stage regressions in columns (1)-(4) of Panel B confirm the strong negative effect of *Portfolio risk differences* on *AISD*. In fact, this effect is significantly larger than in our baseline estimations, amounting to 9.3–13 basis points per one standard deviation increase in our risk differences measures.

5. The Role of Bank Characteristics and Lending Relationships

The previous section documents how greater differences between the markets and the regulators in their assessments of bank portfolio risk lead to lower loan spreads. This section builds on our findings that the effect of portfolio risk differences is supply-driven and examine whether the effect of differences in portfolio risk varies across different bank types and bank financial health. To allow the direct interpretation of the coefficient estimates on both the interaction term and the main terms, we mean-center the variables included in the interaction terms. We present the results in Table 9, with each column including the interaction of *Portfolio risk differences* with a different bank-level characteristic.

[Insert Table 9 about here]

We first consider banks' financial health (variables that proxy for bank performance and credit risk), expecting that more profitable, better-managed banks might have less need to establish their creditworthiness. According to the estimates in columns (1) and (4) the effect of *Portfolio risk differences* relates inversely to a bank's return on assets, suggesting that stronger bank performance acts as a counterforce to cutting loan spreads. Specifically, banks achieving an additional 2.2% return on their assets are able to contain their interest loss by approximately 9.7-12% (the coefficients on the interaction terms). This is expected because stronger performance favorably affects private agent expectations. Moreover, columns (2) and (5) show that banks completely offset the discount in their offered loan rates by limiting the proportion of non-performing loans in their portfolio. Specifically, a decrease of one standard deviation in

Bank NPLs brings an increase in *AISD* of more than 2.3 basis points, reversing by almost 17-21.5% the initial interest rate discount (coefficients on *Portfolio risk differences* × *Bank NPLs*).

In columns (3) and (6) we consider the role of bank credit ratings, which are frequently employed by market participants and regulatory authorities as general measures of creditworthiness, although these ratings are more static and less responsive to various systematic and idiosyncratic events than our principal risk differences measure. A downgrade in the bank's risk-weighting category has a negative effect on loan spreads, with the coefficient on the interaction between *Portfolio risk differences* and *Bank category downgrade* being negative and statistically significant. Importantly, the downgrade event is not able to absorb the negative and strongly significant effect of our portfolio risk differences measures, which is even stronger relative to our baseline.

Relationship lending (where each counterparty acquires valuable information on the other counterparty's operations and credit risk) is another important source of heterogeneity in the effect of *Portfolio risk differences* on bank lending. Due to the resulting reduction of information asymmetry and their private information on relationship customers, it is possible that banks do not provide the same discounts on loans offered to repeat borrowers compared to those for new borrowers. In Table 10, we use measures that reflect the existence and intensity of a prior bank–firm lending relationship (as in Bharath, Dahiya, Saunders, and Srinivasan, 2009). Our basic measure is the existence of a prior loan between a given bank–firm pair within a five-year period (columns (1) and (4)). We observe that the lead bank is able to recover approximately 4.8-5 basis points or 37-48.1% of the initial interest loss due to *Portfolio risk differences* (the coefficients on the interaction terms). We consequently employ alternative measures based on the number (amount) of loans between a given bank–firm pair as part of the total number (amount) of loans received by the firm within the five-year period: columns (2)-

(3) and (5)-(6) confirm that this effect further depends on the intensity and magnitude of the lending relationship.

[Insert Table 10 about here]

Overall, and consistent with Hypothesis 2, the analysis in this section shows that the effect of portfolio risk differences is contingent on a lending bank's performance and management practices as well as prior transactions with the borrowing firm.

6. Enticing the borrowing firm

Having analyzed the mechanisms for reducing the cost of information asymmetry, a natural question arising is what enables borrowers to extract concessions from banks via a lower loan spread. We expect this bargaining power of the borrowers to stem primarily from the sustainability of the lending relationship per se. Arguably, there are qualitative and quantitative costs associated with the decision to end the lending relationship (Ongena and Smith, 2001; Farinha and Santos, 2002). The potential break in the lending relationship can be costly to the bank, both in monetary terms (in the form of increasing monitoring costs) and in terms of reputation, especially if other banks infer that this is due to negative private information about the firm revealed to the distressed lender.

We examine this premise in columns (1) and (6) of Table 10, where we examine the effect of our RBC- and RWA-based portfolio risk differences measures on the probability of ending the lending relationship. Indeed, our estimates show that a rise in bank portfolio risk compromises the viability of the lending relationship. *Portfolio risk differences* exhibits a positive and statistically significant relationship with the probability that the borrowing firm will not borrow from the given bank in the following 2-year period.[9] We further trace whether the probability of ending a bank-firm relationship is contingent on certain loan and firm traits.

[9] In Table A9 we replicate this exercise by employing alternative estimation methods.

In this regard, all subsequent specifications include the interaction of our portfolio risk differences measure with a number of loan and firm characteristics.

[Insert Table 11 about here]

Due to lower information asymmetries, the cost of providing loans is lower for a relationship lender, which enables borrowers to gain access to more favorable financing terms relative to those offered under transactional borrowing (Bharath, Dahiya, Saunders, and Srinivasan, 2009; Dass and Massa, 2011). Intuitively, favorable loan terms matter more for firms dependent on long-term financing; we therefore expect loan maturity to exert a differential negative impact on the probability of ending the existing relationship. The negative and statistically significant coefficients on *Portfolio risk differences* × *Maturity* in columns (2) and (7) confirm this conjecture.

We further expect that firms paying higher upfront fees are reluctant to maintain their relationship with a riskier bank. For term loans, the upfront fee is conceptually the same as the original issue discount (OID), i.e., the borrower receives the notional reduced by the upfront fee/OID. As a result, lenders must hand over less than the full face value at origination, while spreads and principal repayments are calculated on the basis of the full face value (Berg, Saunders, and Steffen, 2016; Bruche, Malherbe, and Meisenzahl, 2020).[10] It seems plausible that the higher the fee, the greater the incentive to withdraw from the relationship in the near future. In columns (3) and (7), we find that the probability of ending a relationship is indeed higher for loans with higher upfront fees.

Moreover, a stronger bank-firm relationship might imply better firm governance, which in turn should lead to higher valuation (Dass and Massa, 2011). We therefore, expect that firms with high Tobin's Q and profitability indicators have less to gain from the preservation of the lending relationship. We examine this premise by distinguishing between firms located in the

[10] Credit lines do not have an OID as they are not fully funded at origination.

top 25th percentile of our sample in terms of their Tobin's Q (columns (4) and (9)) and return on assets (columns (5) and (10)) levels. Our estimates reveal that the probability of a break in the lending relationship increases for highly valued and profitable firms.

7. Conclusions

In this paper we note observable differences between risk perceptions of financial markets and regulators with regards to banks. We maintain that they proxy the degree of information asymmetry between regulators and markets pertaining to bank portfolio risk. We examine the effect of such information asymmetry on the loan pricing decisions of banks, using data from the syndicated loan market.

Our baseline specification shows that a one standard deviation increase in our measure of portfolio risk differences reduces loan spreads by more than 11 basis points (equivalent to a 4.3% increase), rendering banks subject to a loss of about USD 2.03 million in interest revenue over the duration of the average loan. Considering that the average lead bank extends approximately 26 loan facilities per year, in which it retains an average 24% stake, the annual cost increases to USD 2.57 million. These results persist in an array of sensitivity exercises and alternative estimation methods, and are most significant when portfolio risk differences are positive (i.e., market estimations of bank risk are higher than regulatory estimations). Importantly, the separate effects of market and regulatory risk (i.e., not their difference) are less potent.

We further show that the effect of portfolio risk differences is heterogeneous to the financial health of banks. For banks with higher profitability ratios, better credit ratings and lower levels of non-performing loans, the negative effect of portfolio risk differences is much less potent, if at all present. Even for banks exposed to this negative effect, the formation of

strong bank-firm relationships can reduce the adverse effects of information asymmetries between markets and regulators on their loan spreads.

Finally, we examine the implications of the market-regulatory information asymmetry for the sustainability of bank-firm relationships. Ending a lending relationship is costly to both banks and firms. However if the bank is unable to offer better loan spreads, we find that the higher informational asymmetry surrounding the lead bank's stability makes an imminent termination to the bank-firm relationship a credible and viable threat which the borrower can exploit. Thus, we find that the probability of ending a relationship is higher for loans of shorter maturities and higher upfront fees. Similarly, relationships are more likely to end for highly valued and profitable firms.

Our findings offer an important first step in the direction of future research focused on the influence of the stability of the banks on their lending decisions and the information disclosure reforms needed to close the information gaps between markets and bank regulators in order to improve credit allocation decisions.

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Table 1. Variable definitions and sources

Variable	Description	Source
A. Dependent variables in main specifications		
AISD	All-in-spread-drawn, defined as the sum of the spread over LIBOR plus any facility fee.	DealScan
B. Main explanatory variables: Difference between market-based and regulatory measure of bank risk		
Portfolio risk differences	The residuals from the regression of *Bank asset volatility* on *RBC ratio*. The RWA-based measure is the residuals from the regression of *Bank asset volatility* on *RWA ratio*.	Own estimations
Positive risk differences	A binary variable equal to one for values of *Portfolio risk differences* above our sample mean, and zero otherwise.	Own estimations
C. Explanatory variables: Loan characteristics		
Loan amount	Log of the loan facility amount in USD.	DealScan
Maturity	Loan duration in months.	DealScan
Collateral	A binary variable equal to one if the loan is secured with collateral, and zero otherwise.	DealScan
Number of lenders	The number of banks involved in the syndicated loan (lead and participant banks).	DealScan
Performance provisions	A binary variable equal to one if the loan has performance pricing provisions, and zero otherwise.	DealScan
Number of covenants	The total number of covenants in the loan contract.	DealScan
Number of participants	The number of participant banks involved in the syndicated loan.	DealScan
Upfront fee	The one-time fee paid by the borrower to lender(s) at the loan closing date as a percentage of the loan facility amount (%).	DealScan
Loan type	A series of dummy variables indicating loan type (e.g., term loans, revolvers, etc.).	DealScan
Loan purpose	A series of dummy variables indicating loan purpose (e.g., corporate purpose, debt repay, etc.).	DealScan
Relationship lending	A binary variable equal to one for a prior loan facility between the lender and the borrower in the 5-year period before the loan facility's origination year, and zero otherwise.	DealScan
Relationship lending number	The ratio of the number of prior loan facilities between the lender and the borrower in the 5-year period before the loan facility's origination year to the total number of loans received by the borrower during the same period.	DealScan
Relationship lending amount	The ratio of the amount of prior loan facilities between the lender and the borrower in the 5-year period before the loan facility's origination year to the total amount of loans received by the borrower during the same period.	DealScan
Break in relationship lending	A binary variable equal to one if the borrower receives a loan in the 2-year period following the loan facility's origination year but not from the given lender, and zero otherwise.	DealScan own estimations
D. Explanatory variables: Lender characteristics		
Bank asset volatility	The volatility of bank assets estimated via option pricing theory (%).	Datastream own estimations
RBC ratio	The ratio of bank capital to risk-weighted assets (%).	Compustat
RWA ratio	The ratio of risk-weighted assets to total bank assets (%).	Compustat
Bank size	The log of total bank assets.	Compustat
Bank ROA	The return on total bank assets (%).	Compustat
Bank NPLs	The ratio of non-performing loans to total loans (%).	Compustat
Split rating	A binary variable equal to one if the bank's credit rating assigned by S&P is different than the credit rating assigned by Moody's, and zero otherwise. The variable is only available for a subsample of U.S. banks.	Fixed Income Securities Database
Bank rating	The bank's numerical credit rating assigned by S&P. The variable assumes values from 1 (corresponding to AAA rating) to 22 (corresponding to D/SD rating).	S&P Capital IQ
Bank category downgrade	A binary variable equal to one for a downgrade in the bank's risk-weighting category, and zero otherwise.	S&P Capital IQ
E. *Explanatory variables: Borrower characteristics*		

Firm size	The log of total firm assets.	Compustat
Firm ROA	The return on total firm assets (%).	Compustat
Firm Tobin's Q	The log of firm's Tobin's Q.	Compustat
Firm leverage	The firm's leverage (%).	Compustat

F. *Explanatory variables: Lender's country characteristics*

GDP growth	The difference in annual GDP growth rate (%) between the lender's and the borrower's countries.	WDI
GDP per capita	The difference in annual GDP per capita in constant prices between the lender's and the borrower's countries.	WDI
Stock market capitalization	The difference in stock market capitalization between the lender's and the borrower's countries. Stock market capitalization is measured as the total value (in USD) of all listed shares in the borrower's country stock market as a percentage of GDP.	WDI
Interbank rate	The difference in the interbank rate between the lender's and the borrower's countries.	WDI

Table 2. Summary statistics

Variable definitions are in Table 1.

	Obs.	Mean	Std. dev.	Min.	Max.
AISD	42,857	272.07	176.84	1.00	1,750.00
Portfolio risk differences	42,857	-0.18	0.20	-1.82	2.12
Positive risk differences	42,857	0.40	0.49	0.00	1.00
Portfolio risk differences (RWA-based)	42,857	-0.17	0.20	-2.17	2.14
Positive risk differences (RWA-based)	42,857	0.41	0.49	0.00	1.00
Loan amount	42,857	18.50	1.58	10.88	24.62
Maturity	42,857	59.50	34.22	1.00	540.00
Collateral	42,857	0.53	0.50	0.00	1.00
Number of lenders	42,857	7.46	7.74	1.00	161.00
Performance provisions	42,857	0.15	0.36	0.00	1.00
Number of covenants	42,857	0.54	1.10	0.00	7.00
Number of participants	42,857	4.53	6.70	0.00	159.00
Upfront fee	4,432	0.95	0.98	0.00	10.00
Relationship lending	42,857	0.28	0.45	0.00	1.00
Relationship lending number	42,857	0.18	0.34	0.00	1.00
Relationship lending amount	42,714	0.19	0.35	0.00	1.00
Break in relationship lending	42,857	0.07	0.26	0.00	1.00
Bank asset volatility	42,857	2.42	1.93	0.07	18.39
RBC ratio	42,857	13.89	2.79	1.10	30.48
RWA ratio	42,857	54.45	21.08	0.05	168.48
Bank size	42,857	12.02	1.53	5.67	19.55
Bank ROA	42,857	0.90	2.17	-1.75	30.12
Bank NPLs	42,857	2.08	2.32	0.01	34.31
Split rating	18,788	0.61	0.49	0.00	1.00
Bank rating	18,788	4.71	2.53	1.00	19.00
Bank category downgrade	36,557	0.07	0.26	0.00	1.00
Firm size	42,821	7.29	1.95	0.03	24.13
Firm ROA	42,791	10.73	6.48	-50.22	30.88
Firm Tobin's Q	42,855	5.06	0.20	3.68	6.21
Firm leverage	42,834	38.57	14.54	0.00	197.47
GDP	41,840	20.53	157.11	-1,323.45	2,558.56
GDP per capita	41,846	-2,072.89	11,954.36	-86,860.58	100,538.20
Stock market capitalization	39,315	0.83	90.99	-1,158.55	1,201.18
Interbank rate	39,335	-0.10	1.07	-33.53	6.77

Table 3. Portfolio risk differences (RBC-based). Market-based vs. regulatory measures

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different combination of the market-based, the regulatory-based, and the market-regulatory differences measures. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In all specifications, *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Portfolio risk differences	-42.532*	-57.037***		-58.074***
	[-1.875]	[-4.460]		[-2.741]
Bank asset volatility	-0.642		-3.359	0.143
	[-0.166]		[-1.366]	[0.041]
RBC ratio		-2.207**	-0.820	-2.228***
		[-2.093]	[-0.706]	[-2.854]
Loan amount	-9.486***	-9.485***	-9.483***	-9.485***
	[-8.218]	[-8.215]	[-8.225]	[-8.213]
Maturity	0.946***	0.946***	0.946***	0.946***
	[4.279]	[4.277]	[4.277]	[4.277]
Collateral	-15.459***	-15.487***	-15.536***	-15.487***
	[-3.310]	[-3.305]	[-3.315]	[-3.307]
Number of lenders	-1.228	-1.218	-1.179	-1.218
	[-1.563]	[-1.557]	[-1.550]	[-1.534]
Performance provisions	-20.717***	-20.743***	-20.785***	-20.742***
	[-6.670]	[-6.713]	[-6.697]	[-6.704]
Number of covenants	1.902	1.935	1.916	1.934
	[0.634]	[0.639]	[0.642]	[0.646]
Number of participants	0.466	0.452	0.422	0.452
	[0.511]	[0.495]	[0.474]	[0.490]
Bank size	-0.450	-0.454	-0.448	-0.454
	[-1.268]	[-1.278]	[-1.262]	[-1.281]
Bank ROA	-1.039***	-1.039***	-1.040***	-1.039***
	[-6.519]	[-6.527]	[-6.520]	[-6.528]
Bank NPLs	1.407***	1.409***	1.406***	1.409***
	[4.452]	[4.459]	[4.444]	[4.459]
Constant	405.899***	432.348***	431.420***	432.111***
	[22.153]	[18.449]	[18.170]	[18.368]
Observations	42,857	42,857	42,857	42,857
Adj. R-squared	0.788	0.788	0.788	0.788
Loan type	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y
Number of banks	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230

Table 4. Portfolio risk differences (RWA-based). Market-based vs. regulatory measures

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different combination of the market-based, the regulatory-based, and the market-regulatory differences measures. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In all specifications, *Portfolio risk differences* refers to the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
Portfolio risk differences	-39.239*	-50.793***		-45.406*
	[-1.836]	[-4.277]		[-1.832]
Bank asset volatility	-0.835		-3.673	-0.847
	[-0.214]		[-1.394]	[-0.213]
RWA ratio		1.128**	1.078**	1.128**
		[2.511]	[2.298]	[2.503]
Loan amount	-9.486***	-9.495***	-9.492***	-9.495***
	[-8.219]	[-8.256]	[-8.260]	[-8.253]
Maturity	0.946***	0.945***	0.945***	0.945***
	[4.279]	[4.282]	[4.282]	[4.282]
Collateral	-15.460***	-15.639***	-15.703***	-15.644***
	[-3.310]	[-3.322]	[-3.332]	[-3.325]
Number of lenders	-1.227	-1.249	-1.199	-1.244
	[-1.562]	[-1.629]	[-1.607]	[-1.592]
Performance provisions	-20.718***	-20.809***	-20.873***	-20.820***
	[-6.665]	[-6.687]	[-6.710]	[-6.668]
Number of covenants	1.900	1.794	1.816	1.807
	[0.633]	[0.580]	[0.598]	[0.593]
Number of participants	0.465	0.487	0.444	0.483
	[0.510]	[0.545]	[0.510]	[0.534]
Bank size	-0.450	-0.447	-0.444	-0.447
	[-1.267]	[-1.255]	[-1.247]	[-1.256]
Bank ROA	-1.039***	-1.042***	-1.042***	-1.042***
	[-6.519]	[-6.571]	[-6.565]	[-6.571]
Bank NPLs	1.407***	1.407***	1.406***	1.407***
	[4.451]	[4.446]	[4.439]	[4.446]
Constant	407.372***	342.378***	362.435***	345.316***
	[22.120]	[8.990]	[10.207]	[11.874]
Observations	42,857	42,857	42,857	42,857
Adj. R-squared	0.788	0.788	0.788	0.788
Loan type	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y
Number of banks	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230

Table 5. Portfolio risk differences (RBC-based). Different fixed effects

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In all specifications, *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Portfolio risk differences	-59.286***	-38.594*	-56.612***	-56.612***	-51.130***
	[-4.479]	[-1.808]	[-2.998]	[-2.998]	[-3.614]
Loan amount	-2.978***	-9.953***	-9.470***	-9.470***	-9.357***
	[-4.113]	[-9.184]	[-8.300]	[-8.300]	[-8.369]
Maturity	0.082	0.998***	0.958***	0.958***	0.968***
	[0.920]	[3.826]	[4.243]	[4.243]	[4.257]
Collateral	17.373***	-15.204***	-16.947***	-16.947***	-16.832***
	[15.012]	[-3.477]	[-3.556]	[-3.556]	[-3.710]
Number of lenders	2.127*	-1.528	-2.081**	-2.081**	-1.929**
	[1.977]	[-1.196]	[-2.535]	[-2.535]	[-2.105]
Performance provisions	-20.152***	-20.678***	-20.999***	-20.999***	-20.260***
	[-13.123]	[-6.176]	[-6.574]	[-6.574]	[-6.744]
Number of covenants	-1.948	1.875	1.209	1.209	0.941
	[-1.565]	[0.630]	[0.364]	[0.364]	[0.271]
Number of participants	-2.638**	0.779	1.344	1.344	1.176
	[-2.486]	[0.556]	[1.506]	[1.506]	[1.202]
Bank asset volatility	8.352***	1.070	-0.025	-0.025	-0.830
	[15.475]	[0.876]	[-0.008]	[-0.008]	[-0.317]
RBC ratio	6.829***	-1.598	-1.562**	-1.562**	-1.504*
	[3.887]	[-1.493]	[-2.139]	[-2.139]	[-1.905]
Bank size	-0.655***	-0.442	-0.455	-0.455	-0.462
	[-3.416]	[-1.121]	[-1.302]	[-1.302]	[-1.304]
Bank ROA	-0.756***	-1.069***	-1.042***	-1.042***	-1.049***
	[-11.888]	[-6.715]	[-6.450]	[-6.450]	[-6.315]
Bank NPLs	0.603***	1.518***	1.406***	1.406***	1.385***
	[3.234]	[4.040]	[4.447]	[4.447]	[4.393]
Firm size	-88.902***				
	[-37.425]				
Firm ROA	-2.598***				
	[-10.295]				
Firm Tobin's Q	-115.197***				
	[-8.441]				
GDP growth	-0.034***	-0.001			
	[-3.133]	[-0.041]			
GDP per capita	0.000	-0.005			
	[0.138]	[-0.993]			
Stock market capitalization	0.059	-0.107			
	[0.799]	[-0.397]			
Interbank rate	5.912*	0.921			
	[1.891]	[0.389]			
Constant	1,439.699***	431.464***	426.248***	426.248***	425.478***
	[12.767]	[12.562]	[23.017]	[23.017]	[21.661]
Observations	51,929	37,189	42,812	42,812	42,812
Adj. R-squared	0.858	0.778	0.789	0.789	0.789
Loan type	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y
Year effects	Y	N	N	N	N
Quarter effects	N	N	N	N	Y
Bank effects	Y	Y	Y	Y	Y
Firm effects	Y	N	N	N	N

Firm × year effects	N	Y	Y	Y	Y
Lender's country effects	Y	Y	N	N	Y
Lender's country × year effects	N	N	Y	Y	Y
Borrower's country effects	N	N	Y	N	N
Borrower's country × year effects	N	N	N	Y	Y
Country-pair effects	N	N	Y	Y	Y
Number of banks	289	267	364	364	364
Number of firms	11,228	8,782	10,230	10,230	10,230

Table 6. Portfolio risk differences (RWA-based). Baseline results with different fixed effects

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In all specifications, *Portfolio risk differences* refers to the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)
Portfolio risk differences	-79.583***	-38.529*	-47.966**	-47.966**	-42.930***
	[-13.544]	[-1.873]	[-2.276]	[-2.276]	[-2.922]
Loan amount	-2.822***	-9.954***	-9.479***	-9.479***	-9.365***
	[-3.184]	[-9.185]	[-8.331]	[-8.331]	[-8.403]
Maturity	0.084	0.997***	0.958***	0.958***	0.967***
	[0.882]	[3.825]	[4.246]	[4.246]	[4.259]
Collateral	17.306***	-15.225***	-17.060***	-17.060***	-16.948***
	[15.024]	[-3.478]	[-3.566]	[-3.566]	[-3.724]
Number of lenders	2.558*	-1.517	-2.101**	-2.101**	-1.948**
	[1.853]	[-1.178]	[-2.585]	[-2.585]	[-2.145]
Performance provisions	-20.571***	-20.711***	-21.044***	-21.044***	-20.292***
	[-13.773]	[-6.202]	[-6.583]	[-6.583]	[-6.756]
Number of covenants	-2.126*	1.854	1.116	1.116	0.850
	[-1.772]	[0.620]	[0.334]	[0.334]	[0.243]
Number of participants	-3.089**	0.769	1.366	1.366	1.198
	[-2.223]	[0.546]	[1.549]	[1.549]	[1.236]
Bank asset volatility	9.628***	0.858	-0.704	-0.704	-1.481
	[23.370]	[0.674]	[-0.208]	[-0.208]	[-0.517]
RWA ratio	-1.479***	0.272	0.873***	0.873***	0.859***
	[-7.621]	[1.110]	[3.949]	[3.949]	[3.354]
Bank size	-0.682***	-0.441	-0.451	-0.451	-0.458
	[-4.000]	[-1.117]	[-1.284]	[-1.284]	[-1.289]
Bank ROA	-0.769***	-1.068***	-1.043***	-1.043***	-1.051***
	[-13.399]	[-6.699]	[-6.479]	[-6.479]	[-6.338]
Bank NPLs	0.640***	1.517***	1.405***	1.405***	1.384***
	[3.528]	[4.038]	[4.445]	[4.445]	[4.392]
Firm size	-89.011***				
	[-38.577]				
Firm ROA	-2.582***				
	[-9.817]				
Firm Tobin's Q	-115.663***				
	[-9.874]				
GDP growth	-0.011	-0.004			
	[-1.100]	[-0.132]			
GDP per capita	-0.004	-0.005			
	[-1.624]	[-0.919]			
Stock market capitalization	-0.020	-0.102			
	[-0.191]	[-0.378]			
Interbank rate	6.417*	0.677			
	[1.812]	[0.276]			
Constant	1,608.902***	417.557***	361.055***	361.055***	361.643***
	[17.254]	[10.558]	[19.959]	[19.959]	[15.862]
Observations	51,929	37,189	42,812	42,812	42,812
Adj. R-squared	0.858	0.778	0.789	0.789	0.790
Loan type	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y
Year effects	Y	N	N	N	N
Quarter effects	N	N	N	N	Y
Bank effects	Y	Y	Y	Y	Y
Firm effects	Y	N	N	N	N

Firm × year effects	N	Y	Y	Y	Y
Lender's country effects	Y	Y	N	N	Y
Lender's country × year effects	N	N	Y	Y	Y
Borrower's country effects	N	N	Y	N	N
Borrower's country × year effects	N	N	N	Y	Y
Country-pair effects	N	N	Y	Y	Y
Number of banks	289	267	364	364	364
Number of firms	11,228	8,782	10,230	10,230	10,230

Table 7. Distinguishing between positive and negative portfolio risk differences

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), the RBC-based *Portfolio risk differences* is interacted with *Positive risk differences*, i.e., a binary variable equal to one for values of the RBC-based *Portfolio risk differences* above our sample mean, and zero otherwise. In specification (2), we replicate the estimation in specification (1) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Portfolio risk differences	74.645	22.733
	[1.040]	[0.652]
Portfolio risk differences × Positive risk differences	-29.446***	-14.005*
	[-3.042]	[-2.005]
Positive risk differences	-133.006***	-84.613**
	[-3.528]	[-2.599]
Loan amount	-9.475***	-9.487***
	[-8.197]	[-8.236]
Maturity	0.946***	0.945***
	[4.275]	[4.280]
Collateral	-15.546***	-15.652***
	[-3.313]	[-3.315]
Number of lenders	-1.219	-1.235
	[-1.555]	[-1.586]
Performance provisions	-20.704***	-20.812***
	[-6.702]	[-6.702]
Number of covenants	1.911	1.815
	[0.638]	[0.597]
Number of participants	0.447	0.467
	[0.491]	[0.517]
Bank asset volatility	-0.255	-0.277
	[-0.066]	[-0.068]
RBC ratio	-0.177	
	[-0.157]	
RWA ratio		1.000**
		[2.206]
Bank size	-0.452	-0.450
	[-1.276]	[-1.266]
Bank ROA	-1.040***	-1.041***
	[-6.567]	[-6.599]
Bank NPLs	1.409***	1.408***
	[4.459]	[4.451]
Constant	440.308***	368.542***
	[18.256]	[11.445]
Observations	42,857	42,857
Adj. R-squared	0.788	0.788
Loan type	Y	Y
Loan purpose	Y	Y
Bank effects	Y	Y
Firm × year effects	Y	Y
Lender's country × year effects	Y	Y
Number of banks	364	364
Number of firms	10,230	10,230

Table 8. Portfolio risk differences vs. credit ratings disagreement

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by bank. Each specification includes a combination of the market-regulatory differences measures and the credit ratings differences measure. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), the RBC-based *Portfolio risk differences* is included alongside *Split rating*, i.e., a binary variable equal to one if the bank's credit rating assigned by S&P is different than the credit rating assigned by Moody's (and zero otherwise), and alongside *Bank rating*, i.e., the bank's numerical credit rating assigned by S&P which assumes values from 1 (corresponding to AAA rating) to 22 (corresponding to D/SD rating). In specification (2), we replicate the estimation in specification (1) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. Each estimation is conducted for a subsample of loans granted from U.S. lenders. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)
Portfolio risk differences	-101.622***	-95.715***
	[-4.178]	[-4.678]
Split rating	4.197	4.040
	[1.012]	[0.980]
Bank rating	-0.706*	-0.690*
	[-1.760]	[-1.730]
Loan amount	-6.793**	-6.813**
	[-2.290]	[-2.302]
Maturity	1.004**	1.003**
	[2.520]	[2.523]
Collateral	-12.636	-12.651
	[-0.730]	[-0.728]
Number of lenders	0.645	0.579
	[0.467]	[0.405]
Performance provisions	-21.072***	-21.326***
	[-4.070]	[-4.128]
Number of covenants	4.169	3.635
	[0.517]	[0.435]
Number of participants	-2.306	-2.245
	[-1.570]	[-1.469]
Bank asset volatility	14.993	27.561
	[0.538]	[1.195]
RBC ratio	-4.412	
	[-1.172]	
RWA ratio		2.111
		[1.496]
Bank size	-0.228	-0.225
	[-0.526]	[-0.519]
Bank ROA	-1.334**	-1.326**
	[-2.373]	[-2.345]
Bank NPLs	1.979***	1.972***
	[3.016]	[3.005]
Constant	187.773	-152.014
	[0.528]	[-0.574]
Observations	18,788	18,788
Adj. R-squared	0.733	0.733
Loan type	Y	Y
Loan purpose	Y	Y
Bank effects	Y	Y
Firm × year effects	Y	Y
Number of banks	291	291
Number of firms	5,285	5,285

Table 9. Portfolio risk differences and bank characteristics

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), the RBC-based *Portfolio risk differences* is interacted with *Bank ROA*, i.e., the return on total bank assets. In specification (2), the RBC-based *Portfolio risk differences* is interacted with *Bank NPLs*, i.e., the ratio of non-performing loans to total loans. In specification (3), the RBC-based *Portfolio risk differences* is interacted with *Bank category downgrade*, i.e., a binary variable equal to one for a downgrade in the bank's risk-weighting category, and zero otherwise. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-58.820***	-60.384***	-63.483***	-45.827***	-47.076***	-47.840***
	[-2.727]	[-2.840]	[-3.779]	[-2.819]	[-2.885]	[-2.852]
Portfolio risk differences × Bank ROA	2.626***			2.534***		
	[4.219]			[4.325]		
Portfolio risk differences × Bank NPLs		-4.415***			-4.360***	
		[-4.276]			[-4.361]	
Portfolio risk differences × Bank category downgrade			-64.660*			-56.897*
			[-1.866]			[-1.867]
Observations	42,857	42,857	36,557	42,857	42,857	36,557
Adj. R-squared	0.788	0.788	0.779	0.788	0.788	0.779
Full set of controls	Y	Y	Y	Y	Y	Y
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Number of banks	364	364	159	364	364	159
Number of firms	10,230	10,230	8,750	10,230	10,230	8,750

Table 10. Lending relationships

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we interact the RBC-based *Portfolio risk differences* with *Relationship lending*, i.e., a binary variable equal to 1 for a prior lending relationship between the lender and the borrower during the previous 5-year period, and zero otherwise. In specification (2), we interact the RBC-based *Portfolio risk differences* with *Relationship lending number*, i.e., the ratio of the number of prior loans between the lender and the borrower during the previous 5-year period to the total number of loans received by the borrower during the same period. In specification (3), we interact the RBC-based *Portfolio risk differences* with *Relationship lending amount*, i.e., the ratio of the amount of prior loans between the lender and the borrower during the previous 5-year period to the total amount of loans received by the borrower during the same period. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-64.629***	-56.338**	-56.484***	-52.201***	-42.863***	-42.274***
	[-2.873]	[-2.625]	[-2.771]	[-2.969]	[-2.691]	[-2.863]
Portfolio risk differences × Relationship lending	23.888**			25.126***		
	[2.687]			[2.786]		
Portfolio risk differences × Relationship lending number		39.802***			40.282***	
		[3.125]			[3.152]	
Portfolio risk differences × Relationship lending amount			31.237**			31.944**
			[2.025]			[2.035]
Observations	42,857	42,857	42,714	42,857	42,857	42,714
Adj. R-squared	0.788	0.788	0.788	0.788	0.788	0.788
Full set of controls	Y	Y	Y	Y	Y	Y
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,213	10,230	10,230	10,213

Table 11. Probability for break in relationship lending

The table reports coefficients and t-statistics (in brackets). The dependent variable is *Break in relationship lending* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we include the main term of the RBC-based *Portfolio risk differences*. In specification (2), the RBC-based *Portfolio risk differences* is interacted with *Maturity*, i.e., the loan duration (in months). In specification (3), the RBC-based *Portfolio risk differences* is interacted with *Upfront fee*, i.e., the one-time fee paid by the borrower to lender(s) at the loan closing date as a percentage of the loan facility amount. In specification (4), the RBC-based *Portfolio risk differences* is interacted with *Firm ROA 75th*, i.e., a binary variable equal to one if the firm's return on assets (*Firm ROA*) is in the top 25th percentile of our sample, and zero otherwise. In specification (5), the RBC-based *Portfolio risk differences* is interacted with *Firm Tobin's Q 75th*, i.e., a binary variable equal to one if the firm's Tobin's Q (*Firm Tobin's Q*) is in the top 25th percentile of our sample, and zero otherwise. In specifications (6)-(10), we replicate the estimations in specifications (1)-(5) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Portfolio risk differences	0.121***	0.118***	0.310**	0.127***	0.107***	0.132***	0.125***	0.310**	0.130***	0.116***
	[3.250]	[3.399]	[2.493]	[3.676]	[3.202]	[3.776]	[3.567]	[2.490]	[3.574]	[3.476]
Portfolio risk differences ×		-0.001*					-0.001*			
Maturity		[-1.690]					[-1.684]			
Portfolio risk differences ×			0.060***					0.050**		
Upfront fee			[2.950]					[2.587]		
Portfolio risk differences ×				0.019*					0.020*	
Firm ROA 75th				[1.684]					[1.681]	
Portfolio risk differences ×					0.025**					0.026**
Firm Tobin's Q 75th					[2.158]					[2.168]
Observations	42,857	42,857	4,394	42,791	42,855	42,857	42,857	4,394	42,791	42,855
Adj. R-squared	0.930	0.930	0.979	0.929	0.928	0.930	0.930	0.979	0.929	0.928
Full set of controls	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan type	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Number of banks	364	364	148	362	364	364	364	148	362	364
Number of firms	10,230	10,230	1,498	10,230	10,230	10,230	10,230	1,498	10,230	10,230

Internet Appendix

Abstract

The first section includes additional summary statistics. The second section reports (i) estimates from the regression for the construction of our market-regulatory portfolio risk differences measure, (ii) estimates from our baseline regressions with different assumptions about standard error-clustering, (iii) results from specifications with alternative portfolio risk differences measures, (iv) weighted regressions, (v) estimates from the Heckman regressions, and (vi) results from MLE estimations.

Table A1. Number of loans and mean and standard deviation of Portfolio risk differences by lender's country
The table reports the number of observations (loan facilities), and the mean and standard deviation of *Portfolio risk differences* by lender's country.

Country	Obs.	Mean of Portfolio risk differences	Std. Dev. Of Portfolio risk differences
Australia	943	-0.11	0.14
Austria	31	-0.25	0.08
Belgium	53	-0.23	0.10
Brazil	2	0.39	0.00
Canada	3,165	-0.25	0.07
China	208	-0.24	0.14
Czech Republic	4	0.44	0.09
Denmark	44	-0.35	0.10
Finland	7	-0.21	0.04
France	2,536	-0.29	0.07
Germany	2,832	-0.36	0.06
Greece	26	0.21	0.41
Hong Kong	345	-0.08	0.21
India	167	-0.10	0.19
Indonesia	2	2.12	0.00
Ireland	7	-0.46	0.08
Italy	281	-0.10	0.18
Japan	539	-0.29	0.08
Macau	5	-0.28	0.02
Malaysia	47	-0.12	0.16
Mexico	14	-0.13	0.09
Netherlands	410	-0.25	0.06
New Zealand	4	0.45	0.00
Norway	221	-0.24	0.10
Philippines	2	0.59	0.00
Poland	12	1.07	0.66
Portugal	6	-0.09	0.05
Russia	18	-0.34	0.09
Saudi Arabia	19	0.64	0.48
Singapore	147	-0.12	0.23
South Africa	2	-0.17	0.00
South Korea	25	-0.30	0.19
Spain	804	-0.15	0.17
Sweden	107	-0.33	0.10
Switzerland	2,571	-0.41	0.09
Taiwan	855	-0.22	0.11
Thailand	11	-0.04	0.08
Turkey	8	-0.11	0.23
United Arab Emirates	4	-0.35	0.00
United Kingdom	3,484	-0.21	0.18
United States of America	22,889	-0.11	0.20
Total	42,857		

Table A2. OLS of Bank asset volatility on RBC ratio and RWA ratio

The table reports coefficients and t-statistics (in brackets) from the regression of *Bank asset volatility* on *RBC ratio* and on *RWA ratio* at the bank-year level. In specifications (1) and (2), *Bank asset volatility* is regressed on *RBC ratio*. In specifications (3) and (4), *Bank asset volatility* is regressed on *RWA ratio*. In specifications (1) and (3), the estimation method is OLS with constant. In specifications (2) and (4), the estimation method is OLS without constant. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)
RBC ratio	0.027***	0.032***		
	-5.897	-18.336		
RWA ratio			5.293***	5.519***
			[12.955]	[42.749]
Constant	0.083		0.147	
	-1.185		[0.584]	
Observations	2,221	2,221	2,221	2,221
Adj. R-squared	0.015	0.131	0.094	0.532

Table A3. Different loan controls

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. Different specifications include different loan controls to show that the estimates on the variable *Portfolio risk differences* are not overly sensitive to the loan controls used. In specifications (1)-(3), *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (4)-(6), *Portfolio risk differences* refers to the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-52.372***	-54.014**	-50.232*	-42.756**	-44.740*	-40.587*
	[-2.754]	[-2.229]	[-2.005]	[-1.971]	[-1.809]	[-1.794]
Loan amount	-10.115***			-10.126***		
	[-8.704]			[-8.742]		
Maturity	0.942***			0.941***		
	[4.262]			[4.266]		
Collateral		-16.290***			-16.490***	
		[-3.810]			[-3.841]	
Number of lenders		-1.054***			-1.053***	
		[-4.446]			[-4.471]	
Performance provisions			-23.060***			-23.149***
			[-7.353]			[-7.311]
Number of covenants			0.489			0.358
			[0.153]			[0.110]
Number of participants			-0.933***			-0.929***
			[-3.603]			[-3.627]
Bank asset volatility	-0.410	0.066	-0.289	-1.203	-0.750	-1.121
	[-0.108]	[0.019]	[-0.091]	[-0.281]	[-0.194]	[-0.317]
RBC ratio	-1.743**	-1.786**	-1.856***			
	[-2.151]	[-2.479]	[-3.095]			
RWA ratio				0.972**	1.112**	1.121**
				[2.192]	[2.173]	[2.156]
Bank size	-0.486	-0.568*	-0.563*	-0.481	-0.562*	-0.557*
	[-1.400]	[-1.813]	[-1.791]	[-1.379]	[-1.787]	[-1.766]
Bank ROA	-1.054***	-1.065***	-1.040***	-1.056***	-1.068***	-1.042***
	[-6.833]	[-5.793]	[-5.698]	[-6.881]	[-5.848]	[-5.750]
Bank NPLs	1.415***	1.455***	1.473***	1.414***	1.454***	1.472***
	[4.438]	[4.321]	[4.344]	[4.429]	[4.312]	[4.335]
Constant	422.606***	308.182***	301.522***	349.777***	227.012***	218.883***
	[17.848]	[15.387]	[16.275]	[11.858]	[12.150]	[11.886]
Observations	42,857	42,857	42,857	42,857	42,857	42,857
Adj. R-squared	0.787	0.781	0.781	0.787	0.781	0.781
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230	10,230	10,230

Table A4. Seemingly unrelated regressions

The table reports coefficients and t-statistics [in brackets]. The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is FGLS. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. Different specifications include a system of regression equations to control for the simultaneous determination of loan terms in each loan facility (only the estimates from the regression where the dependent variable is *AISD* are reported). In each regression, the set of regressors is the same as in the regression for *AISD* (including *AISD* and excluding the variable that acts as regressand in the respective equation). In specification (1), three regression equations are estimated, where the dependent variable is *AISD*, *Bank asset volatility*, and *RBC ratio* respectively. In specification (2), five regression equations are estimated, where the dependent variable is *AISD*, *Loan amount*, *Maturity*, *Collateral*, and *Number of lenders* respectively. In specification (3), seven regression equations are estimated, where the dependent variable is *AISD*, *Loan amount*, *Maturity*, *Collateral*, *Number of lenders*, *Bank asset volatility*, and *RBC ratio* respectively. In specifications (1)-(3), *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences* and *RBC ratio* with *RWA ratio* in all regression equations. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-147.188***	-115.273***	-140.589***	-303.451***	-213.395***	-316.337***
	[-23.577]	[-18.310]	[-22.525]	[-53.040]	[-37.055]	[-55.295]
Loan amount	-12.173***	-18.767***	-19.722***	-10.516***	-16.619***	-17.187***
	[-22.149]	[-34.324]	[-36.075]	[-19.045]	[-30.230]	[-31.262]
Maturity	0.226***	0.006	0.071***	0.181***	-0.069***	0.001
	[9.791]	[0.268]	[3.079]	[7.739]	[-2.975]	[0.033]
Collateral	98.764***	172.860***	173.184***	94.205***	170.414***	167.465***
	[60.776]	[110.534]	[110.741]	[56.982]	[106.808]	[104.965]
Number of lenders	-4.633***	-6.248***	-6.487***	-4.535***	-5.895***	-6.131***
	[-18.668]	[-25.281]	[-26.252]	[-18.028]	[-23.528]	[-24.472]
Performance provisions	-55.213***	-47.752***	-47.388***	-54.032***	-48.465***	-47.316***
	[-21.549]	[-18.639]	[-18.497]	[-20.917]	[-18.763]	[-18.318]
Number of covenants	-5.329***	-14.246***	-14.233***	-4.433***	-13.870***	-13.296***
	[-6.392]	[-17.118]	[-17.102]	[-5.269]	[-16.513]	[-15.830]
Number of participants	1.680***	4.316***	4.834***	1.003***	3.471***	3.791***
	[6.001]	[15.461]	[17.319]	[3.554]	[12.339]	[13.475]
Bank asset volatility	24.672***	16.395***	24.807***	44.796***	23.778***	45.072***
	[43.612]	[28.642]	[43.853]	[86.989]	[45.198]	[87.524]
RBC ratio	15.384***	10.871***	16.175***			
	[47.752]	[33.313]	[50.208]			
RWA ratio				-1.022***	-0.236***	-0.788***
				[-22.087]	[-5.105]	[-17.047]
Bank size	-1.227**	-1.178**	-1.131**	-1.093**	-1.140**	-1.011**
	[-2.507]	[-2.406]	[-2.310]	[-2.216]	[-2.311]	[-2.050]
Bank ROA	-4.375***	-4.139***	-3.932***	-4.544***	-4.344***	-4.147***
	[-12.700]	[-12.013]	[-11.414]	[-13.090]	[-12.514]	[-11.946]
Bank NPLs	4.296***	3.912***	3.759***	4.317***	4.019***	3.825***
	[13.311]	[12.119]	[11.647]	[13.273]	[12.357]	[11.761]
Constant	178.781***	366.622***	280.541***	348.768***	463.679***	430.875***
	[15.131]	[31.113]	[23.820]	[28.878]	[38.480]	[35.775]
Observations	42,857	42,857	42,857	42,857	42,857	42,857
R-squared	0.218	0.187	0.170	0.188	0.177	0.147
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230	10,230	10,230

Table A5. Different clustering of standard errors

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS. The penultimate part of the table denotes the type of fixed effects used in each specification and the type of standard error clustering (LC&Y refers to Lender's country *and* Year, B&Y refers to Bank *and* Year, LC&B&Y refers to Lender's country *and* Bank *and* Year). The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specifications (1)-(3), *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-58.074**	-58.074*	-58.074**	-45.406*	-45.406*	-45.406*
	[-2.841]	[-2.122]	[-2.841]	[-1.893]	[-1.893]	[-1.893]
Loan amount	-9.485***	-9.485***	-9.485***	-9.495***	-9.495***	-9.495***
	[-9.962]	[-7.757]	[-9.962]	[-10.871]	[-8.263]	[-10.871]
Maturity	0.946***	0.946***	0.946***	0.945***	0.945***	0.945***
	[5.233]	[6.841]	[5.233]	[5.335]	[6.852]	[5.335]
Collateral	-15.487***	-15.487**	-15.487***	-15.644***	-15.644**	-15.644***
	[-3.253]	[-2.912]	[-3.253]	[-3.252]	[-2.955]	[-3.252]
Number of lenders	-1.218	-1.218	-1.218	-1.244	-1.244	-1.244
	[-1.352]	[-1.222]	[-1.352]	[-1.453]	[-1.224]	[-1.453]
Performance provisions	-20.742***	-20.742***	-20.742***	-20.820***	-20.820***	-20.820***
	[-4.856]	[-4.548]	[-4.856]	[-5.284]	[-4.604]	[-5.284]
Number of covenants	1.934	1.934	1.934	1.807	1.807	1.807
	[0.681]	[0.714]	[0.681]	[0.648]	[0.661]	[0.648]
Number of participants	0.452	0.452	0.452	0.483	0.483	0.483
	[0.443]	[0.399]	[0.443]	[0.501]	[0.421]	[0.501]
Bank asset volatility	0.143	0.143	0.143	-0.847	-0.847	-0.847
	[0.049]	[0.066]	[0.049]	[-0.303]	[-0.378]	[-0.303]
RBC ratio	-2.228**	-2.228**	-2.228**			
	[-2.359]	[-2.468]	[-2.359]			
RWA ratio				1.128**	1.128*	1.128**
				[2.322]	[2.100]	[2.322]
Bank size	-0.454	-0.454	-0.454	-0.447	-0.447	-0.447
	[-1.215]	[-1.381]	[-1.215]	[-1.225]	[-1.404]	[-1.225]
Bank ROA	-1.039***	-1.039***	-1.039***	-1.042***	-1.042***	-1.042***
	[-6.116]	[-4.755]	[-6.116]	[-5.362]	[-4.643]	[-5.362]
Bank NPLs	1.409***	1.409**	1.409***	1.407***	1.407***	1.407***
	[3.878]	[2.968]	[3.878]	[4.891]	[6.742]	[4.891]
Constant	432.111***	432.111***	432.111***	345.316***	345.316***	345.316***
	[72.704]	[24.105]	[72.704]	[12.696]	[8.701]	[12.696]
Observations	42,857	42,857	42,857	42,857	42,857	42,857
Adj. R-squared	0.788	0.788	0.788	0.788	0.788	0.788
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Clustering	LC&Y	B&Y	LC&B&Y	LC&Y	B&Y	LC&B&Y
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230	10,230	10,230

Table A6. Different Portfolio risk differences measures

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. Each specification includes a variation of *Portfolio risk differences*. *Portfolio risk differences (EMU-adjusted)* is the measure calculated when a common risk-free rate for all countries of the Economic and Monetary Union (EMU) is employed in Equation (4). *Portfolio risk differences (OLS w/o constant)* is the measure calculated when the OLS in Equation (2) is estimated without a constant. *Portfolio risk differences (OLS by bank)* is the measure calculated when the OLS in Equation (2) is estimated for each lender separately. In specifications (1)-(3), *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences (EMU-adjusted)	-58.072***			-47.624*		
	[-2.741]			[-1.926]		
Portfolio risk differences (w/o constant)		-46.157***			-37.859**	
		[-2.742]			[-2.027]	
Portfolio risk differences (OLS by bank)			-42.357***			-42.563***
			[-2.879]			[-2.803]
Loan amount	-9.485***	-9.485***	-9.484***	-9.495***	-9.495***	-9.495***
	[-8.213]	[-8.213]	[-8.214]	[-8.252]	[-8.252]	[-8.250]
Maturity	0.946***	0.946***	0.946***	0.945***	0.945***	0.945***
	[4.277]	[4.277]	[4.277]	[4.282]	[4.282]	[4.282]
Collateral	-15.487***	-15.487***	-15.490***	-15.644***	-15.644***	-15.650***
	[-3.307]	[-3.307]	[-3.309]	[-3.324]	[-3.324]	[-3.326]
Number of lenders	-1.218	-1.218	-1.226	-1.244	-1.244	-1.255
	[-1.534]	[-1.534]	[-1.546]	[-1.592]	[-1.592]	[-1.606]
Performance provisions	-20.742***	-20.742***	-20.746***	-20.820***	-20.820***	-20.825***
	[-6.704]	[-6.704]	[-6.712]	[-6.673]	[-6.673]	[-6.701]
Number of covenants	1.934	1.934	1.931	1.810	1.810	1.814
	[0.646]	[0.646]	[0.646]	[0.594]	[0.594]	[0.596]
Number of participants	0.452	0.452	0.460	0.482	0.482	0.492
	[0.490]	[0.490]	[0.499]	[0.533]	[0.533]	[0.543]
Bank asset volatility	0.143	0.143	-0.110	-0.721	-0.719	-0.364
	[0.041]	[0.041]	[-0.034]	[-0.182]	[-0.182]	[-0.102]
RBC ratio	-2.229***	-2.228***	-1.635*			
	[-2.855]	[-2.853]	[-1.941]			
RWA ratio				1.119**	1.119**	1.144**
				[2.461]	[2.461]	[2.586]
Bank size	-0.454	-0.454	-0.453	-0.447	-0.447	-0.448
	[-1.281]	[-1.281]	[-1.279]	[-1.257]	[-1.257]	[-1.260]
Bank ROA	-1.039***	-1.039***	-1.039***	-1.042***	-1.042***	-1.042***
	[-6.528]	[-6.528]	[-6.530]	[-6.571]	[-6.571]	[-6.574]
Bank NPLs	1.409***	1.409***	1.409***	1.408***	1.408***	1.408***
	[4.459]	[4.459]	[4.460]	[4.447]	[4.447]	[4.452]
Constant	432.128***	432.104***	434.313***	344.606***	344.593***	350.344***
	[18.369]	[18.368]	[18.629]	[11.867]	[11.867]	[11.057]
Observations	42,857	42,857	42,857	42,857	42,857	42,857
Adj. R-squared	0.788	0.788	0.788	0.788	0.788	0.788
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230	10,230	10,230

Table A7. Weighted regressions

The table reports coefficients and t-statistics (in brackets). The dependent variable is *AISD* and all variables are defined in Table 1. The estimation method is OLS with standard errors clustered by lender's country *and* bank. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we weight by the number of loans between the lender's country and the borrower's country to the total number of loans in our sample. In specification (2), we weight by the number of loans between the lender and the borrower's country to the total number of loans in our sample. In specification (3), we weight by the number of loans between the lender and the borrower to the total number of loans in our sample. In specifications (1)-(3), *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (4)-(6), we replicate the estimations in specifications (1)-(3) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Portfolio risk differences	-58.358***	-58.247***	-58.168***	-45.800*	-45.371**	-45.457**
	[-2.782]	[-2.780]	[-2.711]	[-1.862]	[-1.936]	[-1.899]
Loan amount	-9.488***	-9.489***	-9.485***	-9.499***	-9.499***	-9.496***
	[-8.230]	[-8.223]	[-8.212]	[-8.270]	[-8.262]	[-8.252]
Maturity	0.946***	0.946***	0.946***	0.945***	0.945***	0.945***
	[4.278]	[4.277]	[4.277]	[4.283]	[4.282]	[4.282]
Collateral	-15.535***	-15.595***	-15.525***	-15.695***	-15.746***	-15.683***
	[-3.318]	[-3.313]	[-3.294]	[-3.337]	[-3.330]	[-3.311]
Number of lenders	-1.238	-1.234	-1.176	-1.264	-1.259	-1.202
	[-1.561]	[-1.565]	[-1.523]	[-1.621]	[-1.624]	[-1.585]
Performance provisions	-20.723***	-20.707***	-20.746***	-20.801***	-20.786***	-20.824***
	[-6.728]	[-6.745]	[-6.709]	[-6.693]	[-6.708]	[-6.673]
Number of covenants	1.919	1.904	1.888	1.792	1.779	1.761
	[0.637]	[0.633]	[0.632]	[0.585]	[0.582]	[0.580]
Number of participants	0.473	0.465	0.408	0.505	0.495	0.438
	[0.515]	[0.508]	[0.455]	[0.560]	[0.552]	[0.500]
Bank asset volatility	0.158	0.132	0.131	-0.828	-0.866	-0.861
	[0.045]	[0.038]	[0.037]	[-0.208]	[-0.217]	[-0.214]
RBC ratio	-2.217***	-2.250***	-2.235***			
	[-2.881]	[-2.804]	[-2.831]			
RWA ratio				1.132**	1.121**	1.129**
				[2.497]	[2.499]	[2.500]
Bank size	-0.454	-0.453	-0.454	-0.447	-0.446	-0.447
	[-1.283]	[-1.283]	[-1.275]	[-1.258]	[-1.257]	[-1.250]
Bank ROA	-1.037***	-1.037***	-1.039***	-1.039***	-1.040***	-1.041***
	[-6.483]	[-6.482]	[-6.550]	[-6.527]	[-6.525]	[-6.593]
Bank NPLs	1.409***	1.408***	1.408***	1.408***	1.407***	1.407***
	[4.452]	[4.457]	[4.456]	[4.440]	[4.444]	[4.444]
Constant	436.808***	436.919***	430.703***	350.064***	350.049***	343.760***
	[19.389]	[17.303]	[18.693]	[13.332]	[12.653]	[11.942]
Observations	42,857	42,857	42,857	42,857	42,857	42,857
Adj. R-squared	0.788	0.788	0.788	0.788	0.788	0.788
Loan type	Y	Y	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y	Y	Y
Number of banks	364	364	364	364	364	364
Number of firms	10,230	10,230	10,230	10,230	10,230	10,230

Table A8. Heckman sample-selection model

The table reports coefficients and t-statistics (in brackets) from Heckman's (1979) sample-selection model. The dependent variable is in the second line of each panel and all variables are defined in Table 1. The estimation method in Panel A is maximum likelihood and in Panel B it is OLS with standard errors clustered by lender's country *and* bank. Specifications (1) and (2) of Panel A report the estimates from the first-stage probit model for the determinants of the firm's loan-taking decision. The lower part of Panel A denotes the dummy variables used in each specification. Panel B reports the estimates of the second-stage OLS regression for the effect of *Portfolio risk differences* on loan spreads. Each of the specifications in Panel B includes the inverse Mills ratio (Lambda) from the corresponding specification in Panel A. The penultimate part of Panel B denotes the type of fixed effects used in each specification. The lower part of Panel B denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specifications (1) and (2) of Panel B, *Portfolio risk differences* refers to the RBC-based *Portfolio risk differences*. In specifications (3) and (4) of Panel B, we replicate the estimations in specifications (1) and (2) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: The firm's loan-taking decision

	(1)	(2)	(3)	(4)
	Loan deal	Loan deal	Loan deal	Loan deal
Loan amount	-0.176***	-0.183***	-0.174***	-0.178***
	[-62.539]	[-64.645]	[-62.829]	[-63.707]
Maturity	0.001***	0.001***	0.001***	0.001***
	[9.379]	[6.634]	[8.439]	[6.561]
Collateral	0.164***	0.140***	0.148***	0.141***
	[20.288]	[17.069]	[18.275]	[17.336]
Number of lenders	-0.080***	-0.080***	-0.082***	-0.080***
	[-75.632]	[-75.151]	[-76.523]	[-74.259]
Performance provisions	-0.018	-0.018	-0.004	-0.008
	[-1.548]	[-1.543]	[-0.332]	[-0.690]
Number of covenants	-0.018***	-0.016***	-0.021***	-0.022***
	[-4.369]	[-3.864]	[-5.427]	[-5.628]
Number of participants	0.089***	0.090***	0.090***	0.088***
	[75.346]	[75.300]	[75.881]	[74.012]
Bank asset volatility		-0.054***		-0.049***
		[-27.757]		[-23.754]
RBC ratio	-0.010***	-0.005***		
	[-6.733]	[-3.129]		
RWA ratio			-0.002***	0.000**
			[-10.582]	[2.402]
Bank size	-0.001	-0.001	-0.001	-0.001
	[-0.229]	[-0.365]	[-0.440]	[-0.574]
Bank ROA	-0.005***	-0.005***	-0.004***	-0.005***
	[-3.018]	[-3.214]	[-2.832]	[-3.080]
Bank NPLs	0.001	0.002	0.001	0.001
	[0.930]	[1.150]	[0.643]	[0.909]
Firm size	-0.006***	-0.007***	-0.004*	-0.006***
	[-2.774]	[-3.379]	[-1.791]	[-2.698]
Firm ROA	-0.003***	-0.003***	-0.003***	-0.003***
	[-4.545]	[-4.877]	[-5.213]	[-5.190]
Firm Tobin's Q	0.056***	0.033*	0.078***	0.050***
	[3.084]	[1.817]	[4.329]	[2.776]
Firm leverage	0.003***	0.003***	0.002***	0.002***
	[10.651]	[10.870]	[8.648]	[9.352]
Constant	-20.937***	-4.242**	-30.224***	-19.725***
	[-10.100]	[-1.991]	[-16.729]	[-10.611]
Observations	179,590	175,947	184,612	180,891
Loan type dummies	Y	Y	Y	Y
Loan purpose dummies	Y	Y	Y	Y

Year dummies	Y	Y	Y	Y
Firm dummies	Y	Y	Y	Y
Borrower's country dummies	Y	Y	Y	Y

Panel B: The effect of Portfolio risk differences on loan spreads

	(1) AISD	(2) AISD	(3) AISD	(4) AISD
Portfolio risk differences	-46.605**	-62.553***	-64.811**	-53.547**
	[-2.161]	[-3.258]	[-2.540]	[-2.503]
Loan amount	301.767***	307.592***	270.388***	309.525***
	[11.298]	[11.941]	[9.876]	[11.405]
Maturity	-1.097***	-0.593***	-0.667***	-0.564***
	[-5.716]	[-3.457]	[-3.282]	[-3.251]
Collateral	-314.537***	-263.549***	-258.198***	-274.842***
	[-10.547]	[-10.906]	[-9.266]	[-10.451]
Number of lenders	164.928***	162.113***	151.391***	165.787***
	[11.573]	[12.268]	[10.324]	[11.726]
Performance provisions	13.539***	12.753***	-12.477***	-3.824
	[3.248]	[3.177]	[-4.306]	[-1.242]
Number of covenants	33.975***	29.540***	37.704***	42.590***
	[8.797]	[8.773]	[7.663]	[9.413]
Number of participants	-180.629***	-178.173***	-164.392***	-180.507***
	[-11.554]	[-12.271]	[-10.344]	[-11.724]
Bank asset volatility	-0.709	104.065***	1.354	97.770***
	[-0.192]	[9.921]	[0.385]	[9.291]
RBC ratio	16.055***	4.501***		
	[9.432]	[3.960]		
RWA ratio			7.247***	2.920**
			[4.989]	[2.536]
Bank size	0.433	0.959**	1.089**	1.857***
	[1.246]	[2.557]	[2.651]	[4.207]
Bank ROA	8.050***	8.489***	6.583***	8.269***
	[9.742]	[10.337]	[8.372]	[9.855]
Bank NPLs	-1.314***	-1.888***	-0.307	-1.269***
	[-4.009]	[-5.422]	[-1.013]	[-4.029]
Lambda	-2,500.030***	-2,453.699***	-2,247.789***	-2,519.777***
	[-11.558]	[-12.238]	[-10.004]	[-11.649]
Constant	-2,914.067***	-3,254.251***	-2,293.312***	-3,068.568***
	[-9.952]	[-10.696]	[-8.540]	[-10.141]
Observations	42,508	42,508	42,508	42,508
Adj. R-squared	0.830	0.835	0.817	0.828
Loan type	Y	Y	Y	Y
Loan purpose	Y	Y	Y	Y
Bank effects	Y	Y	Y	Y
Firm × year effects	Y	Y	Y	Y
Lender's country × year effects	Y	Y	Y	Y
Number of banks	362	362	362	362
Number of firms	10,171	10,171	10,171	10,171

Table A9. Probability for break in relationship lending (MLE estimations)

The table reports coefficients and t-statistics (in brackets). The dependent variable is *Break in relationship lending* and all variables are defined in Table 1. The estimation method is MLE with robust standard errors. Each specification includes a different set of fixed effects, as given in the penultimate part of the table. The lower part of the table denotes the number of unique lenders (Number of banks) and borrowers (Number of firms) entering each specification. In specification (1), we include the main term of the RBC-based *Portfolio risk differences*. In specification (2), the RBC-based *Portfolio risk differences* is interacted with *maturity*, i.e., the loan duration (in months). In specification (3), the RBC-based *Portfolio risk differences* is interacted with *Upfront fee*, i.e., the one-time fee paid by the borrower to lender(s) at the loan closing date as a percentage of the loan facility amount. In specification (4), the RBC-based *Portfolio risk differences* is interacted with *Firm ROA 75th*, i.e., a binary variable equal to one if the firm's return on assets (*Firm ROA*) is in the top 25th percentile of our sample, and zero otherwise. In specification (5), the RBC-based *Portfolio risk differences* is interacted with *Firm Tobin's Q 75th*, i.e., if the firm's Tobin's Q (*Firm Tobin's Q*) is in the top 25th percentile of our sample, and zero otherwise. In specifications (6)-(10), we replicate the estimations in specifications (1)-(5) by replacing the RBC-based *Portfolio risk differences* with the RWA-based *Portfolio risk differences*. The *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Portfolio risk differences	0.244***	0.253***	0.177*	0.229***	0.261***	0.241***	0.267***	0.269**	0.243***	0.271***
	[4.879]	[5.083]	[1.659]	[4.164]	[4.757]	[4.258]	[4.710]	[2.346]	[3.956]	[4.366]
Portfolio risk differences ×		-0.006***					-0.006***			
Maturity		[-4.644]					[-4.852]			
Portfolio risk differences ×			0.016*					0.016*		
Upfront fee			[1.673]					[1.879]		
Portfolio risk differences ×				0.090*					0.092*	
Firm ROA 75th				[1.681]					[1.756]	
Portfolio risk differences ×					0.110**					0.126*
Firm Tobin's Q 75th					[1.916]					[1.873]
Observations	42,857	42,857	9,174	42,791	42,855	42,857	42,857	9,174	42,791	42,855
Adj. R-squared	0.0246	0.0264	0.0171	0.0257	0.0260	0.0244	0.0264	0.0178	0.0256	0.0259
Number of banks	364	364	233	362	364	364	364	233	362	364
Number of firms	10,230	10,230	3,286	10,230	10,230	10,230	10,230	3,286	10,230	10,230