Is Foreign Exchange Risk Priced in Bank Loan Spreads?

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ABSTRACT

This study investigates the effects of foreign exchange (FX) exposure on bank loan spreads. Syndicated bank loans are major form of corporate financing and critical components of loan pricing. However, the *international* component of credit risk and foreign exchange risk analysis, has been largely ignored. Holding firm- and loan-level characteristics constant, our results show that firm-level FX exposures are positively related to loan spreads. Lenders appear to price borrowing firms FX exposure driven from cash flow volatility and internationalization. The results are robust with different measures of FX exposures, firm fixed effects, cash flow volatility, and other confounding factors controlled.

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1. Introduction

Bank loans are a major form of debt financing for domestic (DCs) and multinational corporations (MNCs). Syndicated bank loans represent an important and fast-growing source of financing for both domestic and multinational corporations, with $2.1 trillion in such loans issued during the first half of 2015, according to Thomson Reuters' *Global Syndicated Loans Review*. Prior studies on foreign exposure with bank loan pricing are limited because measurement errors of foreign exposure puzzle and they assume that cash flows of borrowing firms are insensitive to cash flow volatility associated with foreign exchange (FX) exposure. Using various measures of FX exposure and large sample of bank loan data, we examine whether lenders perceive FX exposure of borrowing firms as additional risk factor in bank loan pricing.

In this paper, we focus on private bank loan with FX exposure. For corporate managers, two types of financing are available when external financing is necessary — public debt and private debt. Unlike public debt where ownership is diffusely spread to numerous investors, private debts such as syndicated loans are concentrated on a few lenders. In this setting, ex ante loan evaluation and ex post monitoring for borrowers are critical components of loan pricing. In academic studies, Diamond (1991) theorizes that bank loans are special because lenders have incentive to monitor the borrowers closely, in contrast to diffusely owned public debts. In an empirical setting, Chava and Roberts (2008) shows banks loans are restructured due to technical default or violation of bank loan covenants. Both theoretical and empirical studies provide a direct evidence of the benefits of close monitoring. Lenders price moral hazard problem and also price borrower's credit risk that is function of firms' operations.

Another strand of literature in international finance raises question why FX exposure is associated with cash flow volatility. For example, Minton and Schrand (1999) find that the cost of accessing external capital is positively related to cash flow volatility. This argument is based on the idea that FX related shocks, mainly through adverse effects on a firm's cash flows, can lead to financial distress, even bankruptcy. Adverse effects of FX shocks on firm's cash flows are documented throughout the international finance literature. For example, Bergbrant and Hunter (2012) document a positive relation between FX exposure and bank lending standards using a sample of 4,452 U.S. firm. Their results directly emphasize the important relation between FX exposure and firm's cash flow volatility. In addition to current empirical studies, anecdotal evidence (e.g. Sercu, 2009) illustrates how firms can become financially troubled as a result of FX shocks.

Moreover, unexpected FX rate changes can force firms into distress by magnifying leverage such as corporations that borrow in a foreign currency. Although issuing foreign currency denominated debt can be used as FX hedge (Aabo, 2006; Allayannis and Weston, 2001), corporations often do so in order to take advantage of lower interest rates which is tantamount to speculation (Keloharju and Niskanen, 2001). Even if the risks of foreign debts are generally related to emerging countries, Rosenberg and Tirpak (2008) document disconcerting new trends in new member states in the European Union. Borrowing in foreign currencies can be very risky and in combination with FX rate shocks often lead to financial distress and bankruptcy. Since FX exposure is related to bankruptcy cost, it should be priced in loans when lenders are concerned about credit risks. In addition, since cash flows are affected by FX exposure and cash flow variability can affect future loan repayments, lenders are concerned about exchange rate movements. Empirically, we find that syndicated lenders perceive FX exposure as an additional

risk factor above and beyond default risk. Results show that, controlling for firm-and loan-level characteristics, FX exposure is positively related to loan spreads.

On the other hand, earlier empirical studies find that the effect of FX exposure using market return on firm value is economically and statistically not significant (Adler and Dumas, 1984, Jorion, 1990; Griffin and Stulz, 2001; Bartram, 2008) although FX exposure is very important to both corporate managers and investors. However, in a recent paper by Bartram (2008) FX exposure is measured by using corporate cash flow to capture the effect of FX exposure independent of the perception of market participants and show operating cash flows are significantly related FX exposure. The measurement issue in FX exposure can be a factor when we examine in bank loan pricing. In this paper, we use both cash flow exposure and traditional market exposure to examine the impact of FX exposure on bank loan spread.

Also, international asset pricing literature argues that FX exposure should be priced in equity returns (Sercu, 1980; Solnik, 1974; Stulz, 1981). Francis et al. (2008) report that foreign exchange (FX) risk is priced in all of 36 U.S. industries and makes an average absolute difference of 247 basis points in firm's cost of equity. Other empirical studies concluding that FX risk is priced (Dumas and Solnik, 1995; De Santis and Gerard, 1998; Kolari et al., 2008). These research findings suggest that managers explicitly adjust for FX risk when estimating cost of equity. This point is further strengthened by analytical literature in international finance that describes the link between FX rate changes, firm-level cash flow volatility, and value of the firm (e.g., Dumas, 1978; Flood and Lessard, 1986; Shapiro, 1975).

Our study proceeds as follows: Section 2 describes related literature and develops the research hypotheses; Section 3 describes sample selection and the empirical methodology used in

our study. In Section 4 we present our empirical analysis and discuss our main results. Section 5 concludes our study.

2. Related literature and hypotheses

Syndicated loans represent an important and fast-growing source of financing for multinational corporations (MNCs). Chui et al. (2010) reported that global syndicated loan volume is more than the total value of corporate borrowing in the global bond markets. Domestically, secondary loan trading in the country also exceeded $600 billion in 2014. Of the 500 largest firms in the Compustat database, majority of firms have obtained syndicated loans (Sufi, 2007).

International diversification reduce the firm's total risk as well as systematic risk (Michel and Shaked, 1986), which can be viewed as positive force from the lender's perspective. Conversely, risk-increasing effects of corporate international diversification are documented by Reeb et al. (1998), who show that firms with higher foreign sales and foreign asset ratios have higher CAPM betas. This finding is largely confirmed by Olibe et al. (2008), who expand the analysis to include geographical segment data. A more complex relation between corporate international diversification and risk is illustrated by Kwok and Reeb (2000). Their study finds that international diversification is risk-increasing when firms from more developed markets invest in less developed markets. The opposite holds true when firms from less developed markets make investments in more developed markets international corporate diversification potentially reduces the probability of bankruptcy (Michel and Shaked, 1986) in a fashion that is analogous to corporate conglomeration (Lewellen, 1971). Potentially, there may be several arguments supporting: (1) International operations may increase a firm's risk, thus lenders penalize firms with higher FX

exposures (Reeb et al., 1998); (2) Higher FX exposures are associated with higher expected bankruptcy cost (Kim and Krapl, 2016; Wei and Starks, 2013); (3) Higher FX exposure increases cash flow volatility (Krapl, 2015). The impact of cash flow volatility on discretionary investment and the costs of debt and equity financing is documented by Minton and Schrand (1999). This leads to first hypothesis: *The bank views the borrower's FX exposure as a risk and raises loan spreads when the firm has a high FX exposure.* We call this FX risk pricing hypothesis.

Conversely, there is evidence that (1) International diversification reduces firm risk (Fatemi, 1984; Hughes et al., 1975; Michel and Shaked, 1986). Since corporate international diversification is positively related with FX exposure magnitudes (Allaynnis and Weston, 2001; Geczy, Minton, Schrand, 1997; Krapl, 2015), loans with a higher FX exposure will get a lower spread. This leads to our alternative hypothesis: *The bank views corporate international diversification as risk-reducing and thus will charge lower loan spreads.* We call international diversification hypothesis. It is interesting to examine whether banks price on FX risk as additional credit risk or international diversification benefits.

3. Data and methodology

3.1. Loan data

Our bank loan data come from the Thomson Reuters LPC DealScan database, and our information on financial characteristics and stock returns collected from Compustat and the Center for Research in Security Prices (CRSP), respectively. We match the DealScan dataset with the Compustat dataset using the list of identifiers constructed by Chava and Roberts (2008). Our sample excludes financial and regulated utility industry and non-U.S. borrowers. The final sample

includes 19,106 loans with available financial and stock information over 1990-2011. We report summary statistics in Table 1.

DealScan collects loan-level data, mostly on syndicated loans, from various sources including annual reports, reports from loan originators, and Securities and Exchange Commission (SEC) filings. Syndicated loans are medium- or large-sized loans extended to firms by a group of lenders. In a typical syndicated loan contract, a small number of lenders, called lead lenders or arrangers, head up a group of participating banks that jointly issue a relatively large loan package to share the risk and meet capital requirements. The role of the lead lenders is to serve as a bridge between borrowers and participating banks. They serve both sides of the table: for the borrower, the lead bank secures financing, and for the participating banks, it performs credit-screening on borrowers through due diligence and then offers ex-post monitoring. Our research variable is the all-in-drawn spread (spread) for syndicated loans, which, according to the DealScan definition, is the total annual cost in basis points paid over the London Interbank Offered Rate (LIBOR) for each dollar used under the loan commitment.

3.2. Estimating FX exposures

We estimate FX exposure measures for each firm using 5-Year rolling period windows. We follow convention and use monthly frequency data for all firms traded on Nasdaq, Amex, and the NYSE from 1985 through 2011.[1]

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[1] We also try alternative choices of 3 year rolling windows and different market index returns. The results are qualitatively similar to the result reported in the paper.

Theoretically, FX exposure can affect firms in the short-run through transaction exposure or in the long-run through economic exposure.[2] Although short-term FX exposure can be different from long-term FX exposure (e.g., Chow et al., 1997), it is difficult at best to empirically distinguish between the two measures. In our study, we are primarily interested in short to medium term FX exposure effects on firm-level cash flows since we believe that these exposures are more likely to be priced in bank loan spreads than long-term FX equity exposures. Unfortunately, it is difficult to estimate meaningful short-term FX cash flow exposures due to noise and measurement errors (e.g., Bartram, 2007, 2008; Martin and Mauer, 2003). Facing this empirical challenge we estimate two different types of FX exposure measures. Our first type of exposure measure attempts to estimate FX cash flow exposure directly by using two different accounting-based cash flow proxies as the dependent variables of choice. The second type is a version of the more commonly used FX equity exposure, which is uses equity returns as a cash flow proxy.

Measuring FX cash flow exposure directly has several distinct advantages. First, it will more likely enable us to detect short to medium run FX exposures. More conventional equity return-based FX exposure measures are by definition smoothed, which leads to FX exposure estimates that more closely reflect long run exposures rather than short run sensitivities. Conceptually, direct FX cash flow exposures capture the sensitivity of realized cash flows, whereas FX equity exposures capture the sensitivity of future expected cash flows (Martin and Mauer, 2003). Second, although equity returns are commonly used as proxies for cash flows, they are comprised of two separate effects: a cash flow effect and a discount rate effect (Bartram and Bodnar, 2012; Bodnar and Wong, 2003; Bredin and Hyde, 2011). The FX exposure of the first

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[2] Transaction exposure describes the uncertainty in the domestic currency cash flows that results from unexpected changes in FX rates between the time the FX transaction is entered into the system and when it is settled. Economic exposure describes effects of unexpected changes in FX rates on long-term cash flows of the firm (Shapiro, 2009).

effect would likely capture long run FX cash flow exposure but conventional FX equity exposures also contain FX discount rate exposure, which is the sensitivity of future expected stock returns to unexpected changes in FX rates. Potentially FX equity exposure measures could obfuscate a relation between short run FX cash flow exposures and loan spreads.

Similar to FX equity exposure (the sensitivity of stock returns to changes in FX rates), FX cash flow exposure typically is estimated using linear regressions (e.g., Bartram, 2008; Martin and Mauer, 2003; Oxelheim and Wihlborg, 1995). We use the following models, adapted from Bartram (2008) to estimate FX cash flow exposures:

$$\Delta CF_{i,t} = \alpha_i + \delta_i^B R_{X,t}^B + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + \varepsilon_{i,t} \tag{1}$$

$$\Delta CF_{i,t} = \alpha_i + \delta_i^D R_{X,t}^D + \delta_i^E R_{X,t}^E + \phi_{1,i} R_{ST,t} + \phi_{2,i} R_{DS,t} + \varepsilon_{i,t} \tag{2}$$

where ΔCF_i is the quarterly change in cash flow measure of firm i. We focus on two different FX cash flow exposures: ΔCF_i^O are the quarterly changes in operating cash flows scaled by the number shares outstanding. ΔCF_i^N are quarterly changes in net income scaled by the number of shares outstanding. Operating cash flows are estimated based on Minton and Schrand (1999). Changes in net income are based on quarterly net income reported in the Compustat database. Both variables are scaled by the number of shares outstanding.[3] Scaling the cash flow variables by shares outstanding allows for ad-hoc comparisons with FX exposure measures based on stock returns.[4]

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[3] In untabulated tests alternative scaling variables were used such as stock price, total assets, and sales. The choice of scaling variable has no significant effect on the reported results.

[4] Oxelheim and Wihlborg (1995) apply this approach in their study. Alternative choices of cash flow variables are also popular. For example Garner and Shapiro (1984) use cash flow levels. Martin and Mauer (2003) employ

The model expressed in Eq. (1) has one FX component, while the second model has two FX components. R_X^B are inflation-adjusted quarterly returns of the broad currency index; R_X^D and R_X^E are inflation-adjusted quarterly returns of the developed market and emerging market currency indices.[5] A popular choice among studies (e.g., Carrieri et al., 2006; Chaieb and Mazzotta, 2013; Francis et al., 2008) is to include both, the Major Currency Index (MCI) and the Other Important Trading Partner Index (OITP).[6] δ_i^D and δ_i^E are the FX cash flow exposures of firm i to the developed market and emerging market currency indices. Bartram (2008) suggests the use of two interest rate-based macroeconomic control variables. In Eqs. (1) and (2), R_{ST} and R_{DS} are short-term interest rate and term-spread variables which are defined as: $R_{ST} = \Delta SR/(1 + LR)$ and $R_{DS} = \Delta (LR - SR)/(1 + LR)$ where Δ denotes a one-period change, SR is the short-rate (1-Year US Treasury yield), and LR is the long-rate (10-Year US Treasury yield).

Original work defines FX exposure as the elasticity of corporate cash flows to unexpected changes in FX rates (e.g., Adler and Dumas, 1984). Our second type of FX exposure measure uses stock returns as the dependent variable within commonly-used regression frameworks. Although FX equity exposure focuses more on the long run, it is subject to less noise than direct measures of FX cash flow exposure. Moreover, it allows us to observe whether the sensitivity of stock returns is priced in loan spreads rather than FX cash flow exposure.

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normalized unanticipated operating income, and Bartram (2008) analyzes scaled versions of annual changes in several different cash flow variables.

[5] Researchers that includes returns of emerging country currencies prefer using inflation-adjusted currency indices (e.g., Carrieri et al., 2006; Chaieb and Mazzotta, 2013; Francis et al., 2008).

[6] We follow convention used in international asset pricing literature and express R_X^D and R_X^E as percentage changes in the value of the foreign currency baskets. Thus a positive (negative) δ estimate indicates that the cash flow increases (decreases) with the value of the foreign currencies contained in the basket.

We estimate FX exposure measures based on a model popularized by Adler and Dumas (1984) and Jorion (1990), but for sake of consistency with our FX cash flow exposure measures, we use the same interest-rate based control variables as Bartram (2008) instead of an equity market index or no control variable. We estimate FX equity exposures based on Eqs. (1) and (2) but replace the accounting-based cash flow proxies with R_i, which are monthly stock returns of firm i.

3.3. Model description: Estimating the impact of FX exposure on loan spreads

Theory tells us that information asymmetry between lenders and borrowers is a key factor in driving loan terms, which attempt to deal with adverse selection and moral hazard problems (Diamond, 1984). Informed ownership can serve as a signal that mitigates the costs of information asymmetry (Brealey et al., 1977), and prior research has demonstrated that such asymmetry can influence the structure and pricing terms of syndicated loans (Dennis and Mullineaux, 2000; Ivashina, 2009; Knyazeva and Knyazeva, 2012; Sufi, 2007).

We use the logarithm of spread (Spread) as the measure of loan spread, similar to other studies in the banking literature (see for example, Graham et al. (2008)), in all regressions.

$$Spread = \alpha + \beta_1 FX_{Exposure} + \beta_2 Loan_{Controls} + \beta_3 Firm_{Controls} + \beta_4 Macro_{Controls}$$
$$+ YearIndustryLoanDummies + \varepsilon \qquad (3)$$

Loan characteristics include loan size, maturity, secured status, while firm characteristics include firm size, market-to-book ratio, leverage, and credit ratings. Finally, year dummies are used to control for year fixed effects over the 1990-2011 sample period, and industry dummies are employed to control for industry fixed effects and represent one-digit SIC codes, spanning ten industries.

4. Empirical Results and Discussion

Sections 4.1 and 4.2 present empirical results on the relation between the FX exposure and credit spread. Section 4.3 provides robustness checks of the analyses.

4.1. Sample characterization and univariate analysis

We report summary statistics in Table 1. Panel A shows statistics across the loan-specific variables, along with the estimated firm-level FX exposures. All continuous variables are winsorized at the top and bottom 1 percent to avoid the effects of extreme outliers. Syndicated loans are issued as a package deal, with each deal possibly comprising multiple revolvers (or credit lines) and term loans (or installment loans). Loan-level presentation provides a good picture of our sample because revolvers and term loans contain different loan specifications. Our sample comprises 19,106 loans over the 1990-2011 period.

The average loan spread is about 130 basis points above the LIBOR. A majority of loans are syndicated (88%). Approximately 54% of the loans were issued for the purpose of maintaining general corporate operations with additional 17% of loans were issued for working capital management. On average, the book value of the sample borrowing firms is approximately $6.9 billion, with a leverage level of 32%, but about half of all loans (46%) were secured with some form of collateral. Approximately 61% of loans are revolvers, and 25% are term loans, and the average maturity is about 44 months. Three measures of FX exposures are shown in Panel A of Table 1. Panel B, C, and D show descriptive statistics by credit ratings. About 24% of loans were obtained by investment-grade firms (with long-term credit ratings of BBB or above), and the rest were by either speculative-grade firms (with long-term credit ratings below BBB) or firms that do

not have a credit rating. Across credit rating variations, the magnitude of FX exposures is increase as credit rating becomes worsening. Panel E shows summary statistics by industry.

[Insert Table 1 approximately here]

Table 2 shows that loan spreads monotonically increases as the level of FX exposure increase, when shown in quintile analysis. Table 3 show correlation matrix where all-in-spread drawn (AISD) are weakly related to FX exposures.

[Insert Tables 2 and 3 approximately here]

4.2 Multivariate analysis: FX exposure and loan spread

The goal of this paper is to understand whether a group of lenders perceive the FX exposure as additional component of credit risk. There are several reasons why banks view foreign exchange volatility as additional credit risk. First, banks face regulatory lending restrictions aimed to reduce bank's portfolio credit risk. Capital requirements for each loan issue is one example for limiting bank solvency risk. A higher level of the borrower's cash flow volatility makes loan riskier; in turn, banks are required to set aside more capital for riskier loans. Second, bank credit availability is highly dependent on macro-economic conditions. A worsening of macroeconomic conditions leads to bank credit contraction. This in turn can also affect FX exposures of firms — studies by Wei and Starks (2013) and Bergbrant and Hunter (2012) show that corporate FX exposures increase as access to external funding and internal liquidity decline.

Using the commonly-used regression framework, we estimate FX exposures that enter into our loan pricing models, while controlling for firm-and loan-level characteristics. Table 4 shows these results. Estimates of Model (3) illustrate the effects of FX exposure to a broad index (bi) of

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foreign currencies on loan credit spreads. In these models loan credit spreads are a response variable that is measured by the log of loan spread over LIBOR. A statistically positive coefficient of FX exposure suggests that, holding other factors constant, exposures to the broad currency index is positively related to loan spread. We also observe that FX exposures to the Major Currency Index (MCI) and the Other Important Trading Partner Index (OITP), result in the same positive relation. A positive coefficient of the FX exposure variable suggests that exchange rate movements increase the volatility of internally generated cash flows for firms that have significant exchange rate exposure. Therefore, conditional on their internal liquidity and other firm characteristics, cash flow volatility increases the likelihood of costly external financing to support their core operations.

While initial results suggest that FX exposure is positively related to higher loan spreads, the Table 4 also shows that other systematic differences in loan and firm characteristics exist upon loan contracting. The coefficients on the control variables which control for other factors that potentially affect spreads, are consistent with the notion that spreads are a function of borrower and loan risk. Loan maturity (*Maturity*) is measured in months. Long-term debt is more likely to be used by larger, less risky firms with relatively poor growth opportunities (Stohs and Mauer, 1996), and that "bad" firms are screened out of the long-term debt market because of the prospect of asset substitution problem (Diamond, 1984, 1991). This implies that there will be a negative relationship between maturity and credit spreads. Larger loan facilities (*LOG_FacilityAmt*) with more syndicate members tend to be less risky and therefore have lower spreads. Secured facilities (*Collateral*) tend to be more risky, and thus have higher spreads. Revolvers (*Revolver_loan*) are lines of credit that can be drawn on demand. Revolvers are typically priced higher than term loans for the *same* borrower because of the flexibility that they provide to the borrower, and the uncertainty of cash requirements for the lender. However, an average load spread of term loans

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(*Term_loan*) across borrowers is higher than that that of revolver loans, reflecting that term loans are lower in payment priority during default-related liquidations and have on average longer maturities. Size is measured as log of total assets. *Market to Book* is used as proxy for a firm's growth potential and its coefficient is negatively related. Leverage is measured as total debt to total assets and its coefficient is positively related. Coefficients on credit rating variables (AAA, AA, A, BBB, BB) are consistent with those of prior studies.

[Insert Table 4 approximately here]

In Table 5, we use alternative FX exposure measures based on international finance literature. *Abs_bi_total60* are the magnitudes (absolute values) of FX equity exposures to the broad index based on the Adler and Dumas (1984)model; abs_bi_mad60 are the absolute values of market-adjusted FX equity exposures to the broad index based on the Jorion (1991) model; *absrealcash1_bi* are the magnitudes of FX operating cash flow exposures to the broad index (BI), and *absrealcash2_bi* are the magnitudes of FX cash flow exposures to the broad index (BI). We also report the absolute values of FX exposures to the major currency index (MCI) and the other important trading partner index (OITP). The results are consistent with those of the base model. All coefficients of such FX exposure measure show a positive relation with loan spread.

[Insert Table 5 approximately here]

One can argue that the level of firm's internationalization varies across sample firms. We measure the degree of the firm's internationalization by capturing the level of foreign sales, foreign assets, and the number of geographic segments that the firm operates in according to the Compustat Geographic Segments database. These results are presented in Table 6. Interestingly, as the firm become more internationally diversified, measured by the number of geographic segments

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(*Total_segments)*, lenders charger a higher loan spreads. More importantly, the FX exposures are still positively significant, controlling for corporate internationalization, suggesting that FX exposure is priced, even when controlling for the level of international diversification of the firm. The results remain consistent when internationalization is measured by foreign sales and foreign asset ratios. The results of Table 6 show total-segments being positive and statistically significant across 4 different model settings. Lenders seem to perceive that the risks of corporate international diversification outweigh the benefits. Such a finding is consistent with several papers that argue the overall risk-increasing effects of corporate international diversification (Krapl, 2015; Olibe et al., 2008; Reeb et al., 1998). Perhaps, international diversification may increase cash flow volatility that may hamper loan repayment.

[Insert Table 6 approximately here]

4.3 Robustness Checks

Simultaneity and endogeneity problems can be encountered in evaluating the price effect of information asymmetry in syndicated loans (Sufi, 2007). In addition, whereas exchange rate shocks are likely exogenous, it is possible that the borrowing firm may have some characteristics that jointly influence FX exposure and bank loan contracting terms. If both exchange rate movement and loan spreads are determined jointly by unobservable omitted variables, the OLS regression estimates may be unreliable. In this subsection we address the omitted variable concern.

Another issue is a possibility for simultaneity. Some studies argue that there is a relation between FX exposure and financial distress, and that this relation is possibly bidirectional (Kim and Krapl, 2016). The latter is related to credit spreads in debt market. Whereas Kim and Krapl (2016) show that FX exposure has a significant impact on financial distress risk, Wei and Starks

(2013) find that distress risk is a major determinant of FX exposure. We use seemingly unrelated regressions (SUR) and two-stage SLS (2-SLS) models to analyze the simultaneous relation between FX exposure and credit spread and estimate the following model:

$$Spread = \alpha + \beta_1 FX\_Exposure + \beta_2 Loan\_Controls + \beta_3 Firm\_Controls$$
$$+ \beta_4 Macro\_Controls + YearIndustryLoanDummies$$
$$+ \varepsilon \qquad\qquad (4A)$$

$$FX_{Exposure} = \alpha + \beta_1 Spread + \beta_2 Firm_{Controls} + \beta_3 Macro_{Controls}$$
$$+ YearIndustryLoanDummies$$
$$+ \varepsilon \qquad\qquad (4B)$$

In Table 7, the SUR result shows that FX exposure and loan spread are positive and bidirectional, controlling for credit rating and other controls. Two-stage SLS regression results are presented in Tables 8. The results remain the same in 2SLS and are consistent with argument set forth by (Wei and Starks, 2013) who posit that FX exposure are partially determined by financial distress probabilities.

[Insert Tables 7 through 8 approximately here]

In Table 9, we use firm-year fixed effect model rather than facility level OLS regression in order to reduce the concern on unobservable omitted variables. Also we include cash flow volatility measure used in Minton and Schrand (1999) in this regression. We find consistent positive coefficient in FX exposure measures with firm and year fixed effect model. In addition, we find strong positive relation with cash flow volatility of the firm. We also test with alternative measure of cash flow volatility and 2 stage least square model in Table 10.

In Table 11, we examine the effect of FX exposure on bank loan pricing during the Asian crisis and financial crisis period. Our results are not driven by subsample periods and still consistently positive during the Asian and financial crisis period. We also test for the sample with strong and weak dollar period but the results are not driven by sample periods.

5. Conclusion

This study investigates the effects of FX exposure on syndicated loan spreads. We find that FX exposures are positively related to loan spreads, controlling for firm and loan characteristics. Results implied that, holding other loan- and firm characteristics constant, syndicated loan lenders view FX exposure as an additional risk factor that can impede future loan repayment. In addition, results are consistent with findings of prior international finance studies that document a positive relation between firm-level cash flow volatility and FX exposure. Holding internal cash flow constant, increase in cash flow volatility from foreign operations force borrowing firms to rely on costly external debt, and thus increases the costs of external capital. The study also addresses potential simultaneity issues using seemingly unrelated regressions and simultaneous equation models. Results remain robust after controlling for simultaneous issue and omitted variable issue with firm and year fixed effect. Also, the results are still remain with different sample period with Asian, and financial crisis periods.

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Table 1 Summary statistics

Panel A: Whole sample

Variable	N	Mean	SD	P25	Median	P50
LOG_Spread	19,106	4.864	0.902	4.248	5.011	5.541
Maturity	18,445	44.096	23.942	24.000	48.000	60.000
LOG_Facility	19,106	18.455	1.759	17.371	18.644	19.673
Collateral	19,106	0.463	0.499	0.000	0.000	1.000
Syndication	19,106	0.881	0.323	1.000	1.000	1.000
TERM_Loan	19,106	0.249	0.432	0.000	0.000	0.000
REVOLVER_Loan	19,106	0.613	0.487	0.000	1.000	1.000
FACILITY_364	19,106	0.116	0.321	0.000	0.000	0.000
CORPORATE~Control	19,106	0.166	0.373	0.000	0.000	0.000
CORPORATE_~Purpose	19,106	0.540	0.498	0.000	1.000	1.000
Debtrepay	19,106	0.169	0.375	0.000	0.000	0.000
Project loan	19,106	0.003	0.058	0.000	0.000	0.000
Size	19,106	6.898	1.939	5.515	6.938	8.287
Market to Book	19,106	2.571	3.853	1.214	1.956	3.175
Leverage	19,106	0.318	0.201	0.181	0.303	0.425
ROA	19,106	0.032	0.112	0.007	0.042	0.082
Absrealcash2_bi	19,106	2.541	2.818	0.670	1.641	3.446
Absrealcash2_mci	19,106	1.916	2.114	0.499	1.246	2.598
Absrealcash2_oitp	19,106	2.917	3.710	0.684	1.725	3.779

Panel B: Firms with investment grade ratings

Variable	N	Mean	SD	P25	Median	P50
LOG_Spread	5,579	4.004	0.802	3.401	3.912	4.605
Maturity	5,388	38.308	24.818	12.000	36.000	60.000
LOG_Facility	5,579	19.826	1.183	19.114	19.807	20.723
Collateral	5,579	0.076	0.266	0.000	0.000	0.000
Syndication	5,579	0.971	0.168	1.000	1.000	1.000
TERM_Loan	5,579	0.101	0.302	0.000	0.000	0.000
REVOLVER_Loan	5,579	0.550	0.498	0.000	1.000	1.000
FACILITY_364	5,579	0.310	0.463	0.000	0.000	1.000
CORPORATE_~control	5,579	0.127	0.333	0.000	0.000	0.000
CORPORATE_~purpose	5,579	0.505	0.500	0.000	1.000	1.000
Debtrepay	5,579	0.092	0.288	0.000	0.000	0.000
Project loan	5,579	0.004	0.064	0.000	0.000	0.000
Size	5,579	8.783	1.156	7.901	8.735	9.685
Market to Book	5,579	3.240	3.598	1.639	2.336	3.656
Leverage	5,579	0.296	0.130	0.205	0.294	0.378
ROA	5,579	0.059	0.068	0.029	0.053	0.088
Absrealcash2_bi	5,579	2.519	2.563	0.754	1.747	3.504
Absrealcash2_mci	5,579	1.881	1.845	0.591	1.359	2.542
Absrealcash2_oitp	5,579	3.013	3.651	0.738	1.924	4.040

Table 1 Summary statistics (Continued)

Panel C: Firms with non-investment grade ratings

Variable	N	Mean	SD	P25	Median	P50
LOG_Spread	4,838	5.351	0.532	5.011	5.416	5.704
Maturity	4,681	53.909	22.424	36.000	60.000	65.000
LOG_Facility	4,838	18.910	1.227	18.198	18.980	19.742
Collateral	4,838	0.681	0.466	0.000	1.000	1.000
Syndication	4,838	0.962	0.192	1.000	1.000	1.000
TERM_Loan	4,838	0.381	0.486	0.000	0.000	1.000
REVOLVER_Loan	4,838	0.568	0.495	0.000	1.000	1.000
FACILITY_364	4,838	0.026	0.159	0.000	0.000	0.000
CORPORATE_~control	4,838	0.228	0.420	0.000	0.000	0.000
CORPORATE_~purpose	4,838	0.521	0.500	0.000	1.000	1.000
Debtrepay	4,838	0.188	0.391	0.000	0.000	0.000
Project loan	4,838	0.005	0.069	0.000	0.000	0.000
Size	4,838	7.366	1.194	6.513	7.292	8.122
Market to Book	4,838	2.143	4.542	1.006	1.765	2.946
Leverage	4,838	0.449	0.218	0.299	0.428	0.564
ROA	4,838	0.013	0.101	-0.016	0.023	0.058
Absrealcash2_bi	4,838	3.248	3.439	0.928	2.250	4.349
Absrealcash2_mci	4,838	2.525	2.663	0.697	1.776	3.420
Absrealcash2_oitp	4,838	3.409	4.312	0.849	2.032	4.205

Panel D: Firms with no-investment grade ratings or missing ratings

Variable	N	Mean	SD	P25	Median	P50
LOG_Spread	13,527	5.219	0.674	4.828	5.298	5.704
Maturity	13,057	46.486	23.155	33.000	48.000	60.000
LOG_Facility	13,527	17.890	1.643	16.811	18.133	19.114
Collateral	13,527	0.622	0.485	0.000	1.000	1.000
Syndication	13,527	0.844	0.363	1.000	1.000	1.000
TERM_Loan	13,527	0.310	0.462	0.000	0.000	1.000
REVOLVER_Loan	13,527	0.639	0.480	0.000	1.000	1.000
FACILITY_364	13,527	0.036	0.187	0.000	0.000	0.000
CORPORATE_~control	13,527	0.183	0.387	0.000	0.000	0.000
CORPORATE_~purpose	13,527	0.555	0.497	0.000	1.000	1.000
Debtrepay	13,527	0.201	0.401	0.000	0.000	0.000
Project loan	13,527	0.003	0.056	0.000	0.000	0.000
Size	13,527	6.120	1.640	5.000	6.158	7.243
Market to Book	13,527	2.295	3.921	1.059	1.770	2.946
Leverage	13,527	0.327	0.223	0.164	0.309	0.456
ROA	13,527	0.021	0.124	-0.008	0.036	0.078
Absrealcash2_bi	13,527	2.550	2.917	0.642	1.594	3.415
Absrealcash2_mci	13,527	1.930	2.215	0.467	1.191	2.638
Absrealcash2_oitp	13,527	2.878	3.734	0.655	1.645	3.687

Table 1 Summary statistics (Continued)

Panel E: FX exposures by industry				
Industry	Statistic	absrealcash2_bi	absrealcash2_mci	absrealcash2_oitp
Mining	N	1,452	1,452	1,452
	Mean	2.770	1.861	3.297
	Median	1.695	1.305	2.143
Construction	N	3,330	3,330	3,330
	Mean	2.365	1.780	2.514
	Median	1.468	1.173	1.435
Manufacturing	N	5,592	5,592	5,592
	Mean	2.422	1.891	2.909
	Median	1.603	1.208	1.653
Transportation and Utilities	N	2,647	2,647	2,647
	Mean	3.043	2.287	3.282
	Median	2.167	1.602	2.172
Retail Trade	N	2,826	2,826	2,826
	Mean	2.551	1.820	3.053
	Median	1.635	1.185	1.894
Finance and Insurance	N	450	450	450
	Mean	2.861	2.270	2.793
	Median	1.701	1.413	1.861
Services	N	1,909	1,909	1,909
	Mean	2.177	1.711	2.573
	Median	1.460	1.063	1.543
Public Administration	N	879	879	879
	Mean	2.646	2.102	3.160
	Median	1.317	1.066	1.541

Note: This table reports summary statistics for the sample data. Panel A reports summary statistics for the whole sample; Panel B presents summary statistics for firms with investment grade debt ratings; Panel C presents statistics for firms with non-investment grade ratings; and Panel D summarizes statistics for firms with non-investment grade ratings or missing ratings. Summary statistics of FX exposures are presented by industry in Panel E. We report statistics for the following variables: absrealcash2_bi are the magnitudes (absolute values) of FX cash flow exposures to the broad index (BI); absrealcash2_mci and absrealcash2_oitp are the magnitudes of FX cash flow exposures to the major currency index (MCI) and the other important trading partner index (OITP).

Table 2 Credit spread across FX quintiles

Variable	FX1 (Low)	FX2	FX3	FX4	FX5 (High)
Absrealcash2_bi	0.253	0.833	1.667	3.023	6.930
LOG_spread	4.839	4.848	4.862	4.872	4.900
Maturity	43.619	44.006	43.651	43.808	45.410
LOG_facility	18.192	18.203	18.468	18.628	18.784
Collateral	0.474	0.454	0.463	0.455	0.468
Syndication	0.847	0.862	0.879	0.900	0.919
TERM_LOAN	0.238	0.255	0.240	0.247	0.265
REVOLVER_Loan	0.627	0.617	0.629	0.597	0.593
FACILITY_364	0.110	0.115	0.118	0.128	0.111
CORPORATE_~control	0.162	0.162	0.172	0.165	0.171
CORPORATE_~purpose	0.530	0.559	0.555	0.534	0.522
Debtrepay	0.171	0.173	0.148	0.164	0.189
PROJECT_finance	0.004	0.003	0.004	0.004	0.002
Size	6.514	6.620	6.897	7.204	7.254
Market to Book	2.784	2.693	2.464	2.500	2.413
Leverage	0.296	0.292	0.311	0.332	0.358
ROA	0.041	0.039	0.033	0.028	0.019

Note: This table reports average credit spreads in basis points across FX exposure quintiles. FX1 contains firms with low-magnitude (absolute values) of FX exposures to the broad currency index (BI). FX5 contains firms with the highest levels of FX exposures to the broad currency index. The top row shows average FX exposures to the broad index for each FX quintile.

Table 3 Correlations for key variables

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
LOG_ALLIND~N [1]	1.000											
Absreal~2_bi [2]	0.034	1.000										
Absrea~2_mci [3]	0.057	0.707	1.000									
Absre~2_oitp [4]	0.008	0.428	0.350	1.000								
Maturity [5]	0.091	0.031	0.043	0.005	1.000							
LOG_FACI [6]	-0.484	0.105	0.098	0.063	0.114	1.000						
Collateral [7]	0.566	0.014	0.027	-0.013	0.139	-0.358	1.000					
Syndication [8]	-0.186	0.066	0.065	-0.001	0.130	0.498	-0.126	1.000				
Size [9]	-0.506	0.105	0.108	0.059	0.034	0.838	-0.427	0.437	1.000			
Market to book [10]	-0.166	-0.054	-0.052	-0.019	-0.031	0.083	-0.099	0.024	0.087	1.000		
Leverage [11]	0.216	0.129	0.158	0.085	0.168	0.086	0.164	0.079	0.073	-0.108	1.000	
ROA [12]	-0.277	-0.058	-0.073	-0.063	0.051	0.152	-0.212	0.086	0.150	0.154	-0.217	1.000

Note: This table reports correlation coefficients for key variables. Where absrealcash2_bi are the magnitudes (absolute values) of FX cash flow exposures to the broad index (BI); absrealcash2_mci and absrealcash2_oitp are the magnitudes of FX cash flow exposures to the major currency index (MCI) and the other important trading partner index (OITP);

Table 4 FX cash flow exposures and credit spreads

Model	[i]	[ii]	[iii]	[iv]	[v]
Absrealcash2_bi	0.012***				
	(8.25)				
Absrealcash2_mci		0.015***		0.012***	0.010***
		(8.22)		(6.15)	(5.04)
Absrealcash2_oitp			0.008***	0.006***	0.004***
			(6.74)	(4.65)	(3.65)
Maturity	-0.003***	-0.003***	-0.003***	-0.003***	-0.002***
	(-7.78)	(-7.80)	(-7.79)	(-7.77)	(-7.29)
LOG_FACILITYAMT	-0.099***	-0.099***	-0.099***	-0.099***	-0.128***
	(-18.95)	(-18.85)	(-18.96)	(-18.99)	(-21.20)
Collateral	0.417***	0.416***	0.418***	0.416***	0.406***
	(41.85)	(41.76)	(41.97)	(41.78)	(37.28)
Syndication	-0.095***	-0.095***	-0.094***	-0.095***	0.027
	(-5.64)	(-5.62)	(-5.57)	(-5.66)	(0.40)
TERM_LOAN	0.061**	0.060**	0.062**	0.062**	0.070***
	(2.27)	(2.24)	(2.30)	(2.29)	(2.67)
REVOLVER_LOAN	-0.193***	-0.194***	-0.193***	-0.192***	-0.203***
	(-7.76)	(-7.78)	(-7.75)	(-7.72)	(-7.88)
FACILITY_364	-0.469***	-0.469***	-0.469***	-0.467***	-0.471***
	(-18.99)	(-18.96)	(-18.98)	(-18.89)	(-16.48)
CORPORATE_CONTROL	0.269***	0.271***	0.272***	0.273***	0.289***
	(15.78)	(15.86)	(15.93)	(16.00)	(16.36)
CORPORATE_PURPOSE	0.120***	0.121***	0.123***	0.122***	0.123***
	(8.31)	(8.40)	(8.54)	(8.50)	(8.25)
Debtrepay	0.148***	0.149***	0.150***	0.150***	0.161***
	(8.67)	(8.76)	(8.83)	(8.82)	(8.77)
PROJECT_FINANCE	0.259***	0.262***	0.263***	0.267***	0.268***
	(3.54)	(3.55)	(3.56)	(3.62)	(3.29)
Size	-0.034***	-0.035***	-0.033***	-0.035***	-0.007
	(-6.69)	(-6.77)	(-6.43)	(-6.82)	(-1.27)
Market to Book	-0.006***	-0.006***	-0.006***	-0.006***	-0.008***
	(-5.53)	(-5.61)	(-5.81)	(-5.65)	(-6.91)
Leverage	0.640***	0.637***	0.643***	0.633***	0.651***
	(29.25)	(29.05)	(29.38)	(28.92)	(27.05)
AAA	-0.959***	-0.956***	-0.971***	-0.954***	-0.977***
	(-10.87)	(-10.85)	(-10.96)	(-10.79)	(-10.20)
AA	-1.024***	-1.024***	-1.029***	-1.021***	-1.057***
	(-31.37)	(-31.26)	(-31.35)	(-31.11)	(-31.55)
A	-0.779***	-0.777***	-0.781***	-0.775***	-0.797***
	(-39.39)	(-39.19)	(-39.45)	(-39.13)	(-39.67)
BBB	-0.260***	-0.261***	-0.264***	-0.261***	-0.279***
	(-17.31)	(-17.34)	(-17.56)	(-17.34)	(-18.13)
BB	0.090***	0.090***	0.090***	0.090***	0.060***
	(7.71)	(7.70)	(7.73)	(7.71)	(5.16)

Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effect	Yes	Yes	Yes	Yes	Yes
Constant	7.492***	7.486***	7.484***	7.489***	7.711***
	(99.94)	(99.84)	(99.84)	(99.94)	(68.62)
Observations	18,445	18,445	18,445	18,445	14,214
R-squared	0.684	0.683	0.683	0.684	0.714

Note: This table reports results from the following model:

$$Spread = \alpha + \beta_1 FX_{Exposure} + \beta_2 Loan_{Controls} + \beta_3 Firm_{Controls} + \beta_4 Macro_{Controls}$$
$$+ YearIndustryLoanDummies + \varepsilon$$

Where absrealcash2_bi is the magnitude (absolute value) of FX cash flow exposures to the broad index (BI). Similarly, absrealcash2_mci and absrealcash2_oitp are the absolute values of FX cash flow exposures to the major currency index (MCI) and the other important trading partner index (OITP). Results of model [v] exclude data from single lender firms. Robust T-statistics are reported in parentheses. Statistical significance for the correlation coefficients is indicated as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5 Alternative measures of FX exposure and additional control variables

Model	[i]	[ii]	[iii]	[iv]	[v]	[vi]	[vii]	[viii]
Abs_bi_total60	0.035***							
	(9.59)							
Abs_mci_total60		0.065***						
		(9.72)						
Abs_oitp_total60		0.016***						
		(5.45)						
Abs_bi_mad60			0.050***					
			(10.01)					
Abs_mci_mad60				0.066***				
				(9.33)				
Abs_oitp_mad60				0.026***				
				(5.85)				
Abs_FX_cash1_bi					0.004**			
					(2.19)			
Abs_FX_cash1_mci						0.007***		
						(2.61)		
Abs_FX_cash1_oitp						-0.000		
						(-0.08)		
Absrealcash2_bi							0.013***	
							(9.08)	
Absrealcash2_mci								0.013***
								(6.43)
Absrealcash2_oitp								0.004***
								(2.99)
Maturity	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-7.84)	(-7.83)	(-7.81)	(-7.84)	(-7.80)	(-7.80)	(-7.77)	(-7.81)
LOG_FACILITYAMT	-0.096***	-0.096***	-0.096***	-0.096***	-0.098***	-0.099***	-0.099***	-0.099***
	(-18.73)	(-18.73)	(-18.73)	(-18.71)	(-18.78)	(-18.80)	(-19.00)	(-18.90)
Collateral	0.416***	0.413***	0.417***	0.414***	0.418***	0.418***	0.416***	0.416***
	(42.47)	(42.24)	(42.62)	(42.36)	(41.98)	(41.95)	(41.82)	(41.77)
Syndication	-0.082***	-0.080***	-0.080***	-0.079***	-0.093***	-0.093***	-0.095***	-0.096***
	(-5.03)	(-4.92)	(-4.87)	(-4.81)	(-5.51)	(-5.54)	(-5.66)	(-5.71)
TERM_LOAN	0.058**	0.059**	0.056**	0.059**	0.060**	0.060**	0.061**	0.061**
	(2.20)	(2.26)	(2.15)	(2.25)	(2.23)	(2.23)	(2.28)	(2.27)
REVOLVER_LOAN	-0.198***	-0.196***	-0.199***	-0.196***	-0.195***	-0.195***	-0.193***	-0.193***
	(-8.17)	(-8.10)	(-8.21)	(-8.10)	(-7.82)	(-7.82)	(-7.75)	(-7.73)
FACILITY_364	-0.471***	-0.469***	-0.470***	-0.469***	-0.471***	-0.470***	-0.468***	-0.468***
	(-19.43)	(-19.34)	(-19.38)	(-19.34)	(-19.07)	(-19.03)	(-18.96)	(-18.92)
CORPORATE_CONTROL	0.268***	0.268***	0.268***	0.268***	0.268***	0.268***	0.269***	0.270***
	(16.04)	(16.04)	(16.03)	(16.05)	(15.70)	(15.70)	(15.74)	(15.84)
CORPORATE_PURPOSE	0.124***	0.124***	0.125***	0.124***	0.121***	0.121***	0.120***	0.121***
	(8.70)	(8.70)	(8.76)	(8.74)	(8.38)	(8.36)	(8.31)	(8.38)

Debtrepay	0.150***	0.150***	0.150***	0.151***	0.149***	0.148***	0.148***	0.149***
	(9.00)	(8.99)	(9.02)	(9.05)	(8.71)	(8.70)	(8.68)	(8.75)
PROJECT_FINANCE	0.208***	0.201***	0.206***	0.203***	0.254***	0.253***	0.258***	0.260***
	(2.87)	(2.78)	(2.83)	(2.81)	(3.45)	(3.43)	(3.52)	(3.55)
Size	-0.033***	-0.031***	-0.032***	-0.030***	-0.032***	-0.032***	-0.034***	-0.035***
	(-6.38)	(-6.06)	(-6.20)	(-5.94)	(-6.26)	(-6.28)	(-6.70)	(-6.78)
Market to Book	-0.007***	-0.007***	-0.006***	-0.007***	-0.006***	-0.006***	-0.006***	-0.006***
	(-5.98)	(-6.00)	(-5.87)	(-6.09)	(-5.77)	(-5.80)	(-5.47)	(-5.59)
Leverage	0.648***	0.644***	0.650***	0.647***	0.653***	0.652***	0.640***	0.638***
	(30.19)	(30.08)	(30.36)	(30.27)	(29.76)	(29.71)	(29.24)	(29.10)
AAA	-1.015***	-1.006***	-1.016***	-1.007***	-0.981***	-0.977***	-0.960***	-0.958***
	(-12.30)	(-12.15)	(-12.30)	(-12.20)	(-11.16)	(-11.12)	(-10.86)	(-10.84)
AA	-1.027***	-1.020***	-1.029***	-1.021***	-1.035***	-1.034***	-1.022***	-1.024***
	(-31.57)	(-31.39)	(-31.66)	(-31.40)	(-31.58)	(-31.57)	(-31.27)	(-31.27)
A	-0.767***	-0.762***	-0.769***	-0.762***	-0.784***	-0.784***	-0.778***	-0.776***
	(-39.02)	(-38.75)	(-39.17)	(-38.72)	(-39.58)	(-39.57)	(-39.37)	(-39.18)
BBB	-0.258***	-0.255***	-0.260***	-0.256***	-0.265***	-0.265***	-0.260***	-0.259***
	(-17.35)	(-17.18)	(-17.56)	(-17.29)	(-17.64)	(-17.61)	(-17.26)	(-17.22)
BB	0.089***	0.091***	0.089***	0.091***	0.090***	0.090***	0.090***	0.090***
	(7.83)	(7.96)	(7.79)	(7.95)	(7.71)	(7.69)	(7.71)	(7.69)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.370***	7.343***	7.378***	7.340***	7.481***	7.482***	7.495***	7.486***
	(99.01)	(98.44)	(99.49)	(98.60)	(99.58)	(99.58)	(99.96)	(99.84)
Observations	19,140	19,140	19,140	19,140	18,445	18,445	18,445	18,445
R-squared	0.682	0.683	0.683	0.683	0.682	0.682	0.684	0.684

Note: This table reports results from the following model:

$$Spread = \alpha + \beta_1 FX_{Exposure} + \beta_2 Loan_{Controls} + \beta_3 Firm_{Controls} + \beta_4 Macro_{Controls} + YearIndustryLoanDummies + \varepsilon$$

Where abs_bi_total60 are the magnitudes (absolute values) of FX equity exposure to the broad index based on the Adler and Dumas (1984) model; abs_bi_mad60 are the absolute values of market-adjusted FX equity exposures to the broad index based on the Jorion (1991) model; absrealcash1_bi are the magnitudes of FX operating cash flow exposures to the broad index (BI), and absrealcash2_bi are the magnitudes of FX cash flow exposures to the broad index (BI). We also report the absolute values of FX exposures to the major currency index (MCI) and the other important trading partner index (OITP). Robust T-statistics are reported in parentheses. Statistical significance for the correlation coefficients is indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 6 FX cash flow exposures and credit spreads – controlling for corporate internationalization

Model	[i]	[ii]	[iii]	[iv]
Absrealcash2_mci			0.010***	0.010***
			(5.03)	(5.03)
Absrealcash2_oitp			0.007***	0.007***
			(5.12)	(5.12)
Total_segments	*0.009****	*0.006****	*0.007***	*0.004**
	(3.98)	*(3.22)*	*(2.57)*	*(1.93)*
Forsale	*-0.035**		*-0.027*	
	(-1.80)		*(-1.12)*	
Forasset		*0.034*		*0.052***
		(1.62)		*(2.14)*
Maturity	-0.003***	-0.003***	-0.003***	-0.003***
	(-10.74)	(-10.74)	(-7.44)	(-7.44)
LOG_FACILITYAMT	-0.086***	-0.086***	-0.100***	-0.100***
	(-21.55)	(-21.47)	(-17.60)	(-17.56)
Collateral	0.425***	0.425***	0.425***	0.425***
	(52.57)	(52.65)	(39.59)	(39.64)
Syndication	-0.111***	-0.111***	-0.089***	-0.089***
	(-9.65)	(-9.64)	(-4.99)	(-4.97)
TERM_LOAN	0.047***	0.047***	0.068**	0.069**
	(2.60)	(2.61)	(2.38)	(2.40)
REVOLVER_LOAN	-0.198***	-0.198***	-0.189***	-0.188***
	(-11.88)	(-11.86)	(-7.11)	(-7.07)
FACILITY_364	-0.497***	-0.497***	-0.475***	-0.474***
	(-25.53)	(-25.50)	(-18.03)	(-18.00)
CORPORATE_CONTROL	0.155***	0.156***	0.277***	0.278***
	(12.45)	(12.49)	(14.98)	(15.02)
CORPORATE_PURPOSE	0.031***	0.031***	0.132***	0.133***
	(2.81)	(2.83)	(8.44)	(8.45)
Debtrepay	0.039***	0.039***	0.153***	0.153***
	(3.19)	(3.19)	(8.33)	(8.33)
PROJECT_FINANCE	0.020	0.021	0.239***	0.242***
	(0.31)	(0.32)	(3.10)	(3.15)
Size	-0.040***	-0.041***	-0.039***	-0.040***
	(-9.76)	(-10.05)	(-6.83)	(-7.05)
Market to Book	-0.004***	-0.004***	-0.005***	-0.005***
	(-5.80)	(-5.85)	(-4.56)	(-4.59)
Leverage	0.587***	0.589***	0.655***	0.658***
	(37.59)	(37.69)	(27.44)	(27.60)
AAA	-1.216***	-1.218***	-0.939***	-0.939***
	(-16.54)	(-16.58)	(-10.57)	(-10.58)
AA	-1.155***	-1.155***	-1.003***	-1.003***
	(-35.55)	(-35.56)	(-28.53)	(-28.50)
A	-0.866***	-0.868***	-0.754***	-0.757***
	(-46.99)	(-47.06)	(-35.50)	(-35.55)

BBB	-0.346***	-0.346***	-0.254***	-0.254***
	(-26.09)	(-26.09)	(-15.67)	(-15.68)
BB	0.049***	0.048***	0.097***	0.097***
	(5.15)	(5.12)	(7.69)	(7.65)
Constant	7.459***	7.457***	7.483***	7.479***
	(126.29)	(126.31)	(91.85)	(91.82)
Observations	28,926	28,926	16,311	16,311
R-squared	0.642	0.642	0.682	0.682

Note: This table reports results from the following model:

$$Spread = \alpha + \beta_1 FX_{Exposure} + \beta_2 Loan_{Controls} + \beta_3 Firm_{Controls} + \beta_4 Macro_{Controls} + YearIndustryLoanDummies + \varepsilon$$

Where absrealcash2_bi is the magnitude (absolute value) of FX cash flow exposures to the broad index (BI). Similarly, absrealcash2_mci and absrealcash2_oitp are the absolute values of FX cash flow exposures to the major currency index (MCI) and the other important trading partner index (OITP). Robust T-statistics are reported in parentheses. Statistical significance for the correlation coefficients is indicated as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 7 Bidirectional relation between FX exposure and credit spreads

Dependent Variable	[i] LOG_ALLINDRAWN	[ii] absrealcash2_bi
Absrealcash2_bi	0.014	
	9.380	
LOG_ALLINDRAWN		0.297
		8.540
Maturity	-0.004	-0.001
	-19.770	-1.220
LOG_FACILITYAMT	-0.095	0.117
	-20.120	5.130
Collateral	0.469	-0.049
	46.320	-0.930
Syndication	0.028	0.002
	1.860	0.030
TERM_LOAN	0.072	
	3.600	
REVOLVER_LOAN	-0.223	
	-11.570	
FACILITY_364	-0.535	
	-22.580	
CORPORATE_CONTROL	0.208	
	11.990	
CORPORATE_PURPOSE	0.193	
	12.940	
Debtrepay	0.033	
	1.860	
PROJECT_FINANCE	0.227	
	3.140	
Size	0.000	0.176
	0.020	7.760
Market to Book	-0.009	-0.026
	-8.160	-4.710
Leverage	0.572	1.117
	25.560	10.090
ROA		-0.908
Credit Rating	YES	YES
Constant	6.577	-2.385
	98.770	-6.170
Observations	18,445	18,445
R-squared	0.6047	0.0369

Note: This table reports results from the following two seemingly unrelated regressions (SUR) models:
In equation [i] the dependent variable is LOG_ALLINDRAWN which is the credit spread in basis points. In equation [ii] the dependent variable is absrealcash2_bi, the magnitude (absolute value) of FX cash flow exposures to the broad index (BI). Robust T-statistics are reported in parentheses. Statistical significance for the correlation coefficients is indicated as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 8 Two-stage regression model for Financial Distress and Loan Spread

VARIABLES	(1) LOG_ALLINDRAWN	(2) WPROB_DISTRESS	(3) LOG_ALLINDRAWN	(4) WPROB_DISTRESS	(5) LOG_ALLINDRAWN	(6) WPROB_DISTRESS
absreal60_bi	0.017***		0.019***		0.022***	
	(4.40)		(4.83)		(5.54)	
WABS_FX_FULL		0.009***				
		(4.00)				
fxfull_pred	1.652***					
	(15.76)					
fxmarket_pred			1.670***			
			(15.99)			
WABS_FX_MARKET				0.012***		
				(4.08)		
fxcash_pred					1.705***	
					(16.19)	
WABS_FX_CASH						0.003***
wsize	-0.014**	-0.010***	-0.014**	-0.010***	-0.012**	-0.011***
	(-2.40)	(-12.61)	(-2.41)	(-12.27)	(-2.05)	(-13.13)
Size		-0.109***		-0.108***		-0.108***
		(-8.79)		(-8.73)		(-8.32)
Working capital		-0.014***		-0.014***		-0.015***
		(-4.08)		(-4.17)		(-4.16)
Retained earnings		-1.376***		-1.373***		-1.365***
		(-18.28)		(-18.23)		(-17.63)
EBIT ratio		-0.000		-0.000		-0.000
		(-0.98)		(-1.04)		(-0.64)
Equity to Debt		0.041***		0.041***		0.041***
		(4.85)		(4.82)		(4.64)
Cash/TA		0.014		0.016		0.008
		(0.67)		(0.76)		(0.35)
Leverage	0.401***	0.133***	0.398***	0.132***	0.408***	0.127***
	(13.80)	(11.89)	(13.71)	(11.90)	(13.91)	(11.82)
Market to Book	-0.011***	0.005***	-0.011***	0.005***	-0.011***	0.005***
	(-7.83)	(5.68)	(-7.88)	(5.69)	(-8.01)	(5.60)
Maturity	-0.003***		-0.003***		-0.003***	
	(-6.16)		(-6.15)		(-6.01)	
LOG_FACILITYAMT	-0.097***		-0.097***		-0.099***	
	(-16.76)		(-16.75)		(-16.79)	
Collateral	0.381***		0.381***		0.381***	
	(33.82)		(33.77)		(33.38)	
Syndicationflag	-0.084***		-0.084***		-0.086***	
	(-4.46)		(-4.42)		(-4.42)	
TERM_LOAN	0.053*		0.053*		0.061**	
	(1.74)		(1.73)		(1.97)	
REVOLVER_LOAN	-0.190***		-0.190***		-0.181***	
	(-6.65)		(-6.65)		(-6.24)	
FACILITY_364	-0.459***		-0.458***		-0.450***	
	(-16.28)		(-16.27)		(-15.81)	
CORPORATE_CONTROL	0.265***		0.265***		0.272***	

	(1)	(2)	(3)	(4)	(5)	(6)
	(13.79)		(13.80)		(13.98)	
CORPORATE_PURPOSE	0.103***		0.103***		0.105***	
	(6.45)		(6.45)		(6.51)	
debtrepay	0.150***		0.150***		0.158***	
	(7.86)		(7.86)		(8.18)	
PROJECT_FINANCE	0.221***		0.220***		0.218***	
	(2.82)		(2.82)		(2.69)	
aaa	-1.018***		-1.017***		-1.007***	
	(-11.61)		(-11.57)		(-11.43)	
aa	-1.032***		-1.031***		-1.022***	
	(-27.28)		(-27.27)		(-26.79)	
a	-0.797***		-0.796***		-0.790***	
	(-36.60)		(-36.57)		(-36.17)	
bbb	-0.257***		-0.257***		-0.255***	
	(-15.31)		(-15.32)		(-15.07)	
bb	0.097***		0.098***		0.097***	
	(7.43)		(7.45)		(7.33)	
	(-25.81)		(-25.97)		(-25.73)	
YEAR	YES	YES	YES	YES	YES	
INDUSTRY	YES	YES	YES	YES	YES	
Constant	7.243***	0.084***	7.242***	0.083***	7.246***	0.090***
	(84.66)	(6.90)	(84.68)	(6.90)	(83.18)	(6.89)
Observations	14,064	19,156	14,064	19,156	13,713	18,561
R-squared	0.698	0.306	0.698	0.306	0.700	0.306

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 9. Firm and Year Fixed effect model

Model 1 and 2 are fixed effect model for our baseline regression in Table 4.

VARIABLES	(1) LOG_ALLINDRAWN	(2) LOG_ALLINDRAWN
absrealcash2_bi	0.007**	
	(2.31)	
absrealcash2_mci		0.009**
		(2.15)
absrealcash2_oitp		0.009***
		(3.84)
CV_cashflow1	0.001**	0.001**
	(2.39)	(2.39)
maturity	-0.002***	-0.002***
	(-9.62)	(-9.63)
LOG_FACILITYAMT	-0.091***	-0.091***
	(-17.57)	(-17.61)
collateral	0.289***	0.288***
	(24.36)	(24.36)
syndicationflag	-0.074***	-0.074***
	(-3.70)	(-3.72)
TERM_LOAN	0.045**	0.048**
	(2.16)	(2.29)
REVOLVER_LOAN	-0.158***	-0.156***
	(-7.90)	(-7.78)
FACILITY_364	-0.367***	-0.364***
	(-15.38)	(-15.24)
CORPORATE_CONTROL	0.248***	0.250***
	(13.60)	(13.71)
CORPORATE_PURPOSE	0.105***	0.107***
	(6.93)	(7.05)
debtrepay	0.120***	0.121***
	(6.57)	(6.64)
PROJECT_FINANCE	0.354***	0.351***
	(4.53)	(4.49)
wsize	-0.090***	-0.090***
	(-8.01)	(-8.00)
wmb	-0.005***	-0.005***
	(-3.42)	(-3.49)
wleverage	0.742***	0.740***
	(17.71)	(17.67)
wroa		
Observations	13,772	13,772
R-squared	0.816	0.816

t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Cashflow volatility using Minton and Schrand (1999) measure

VARIABLES	(1) LOG_ALLI NDRAWN	(2) LOG_ALLI NDRAWN	(3) LOG_ALLIN DRAWN	(4) LOG_ALLIND RAWN	(5) LOG_ALLIND RAWN
					2SLS (Prdicted Cashflow)
absrealcash2_bi	0.016***		0.017***		
	(10.51)		(10.71)		
absrealcash2_mci		0.019***		0.020***	
		(9.22)		(9.39)	
absrealcash2_oitp		0.007***		0.007***	
		(5.25)		(5.27)	
CV_cashflow1	0.001***	0.001***			0.117***
	(2.82)	(2.81)			(8.26)
CV_cashflow3			0.061***	0.060***	
			(3.30)	(3.26)	
maturity	-0.003***	-0.003***	-0.003***	-0.003***	-0.003***
	(-6.70)	(-6.68)	(-6.63)	(-6.61)	(-7.76)
LOG_FACILITYAMT	-0.099***	-0.099***	-0.099***	-0.099***	-0.099***
	(-18.47)	(-18.52)	(-18.50)	(-18.54)	(-18.89)
collateral	0.500***	0.498***	0.498***	0.496***	0.417***
	(49.82)	(49.70)	(49.48)	(49.37)	(41.82)
syndicationflag	-0.046***	-0.047***	-0.044**	-0.045***	-0.096***
	(-2.64)	(-2.69)	(-2.55)	(-2.60)	(-5.68)
TERM_LOAN	0.080***	0.080***	0.078***	0.079***	0.061**
	(2.80)	(2.82)	(2.76)	(2.78)	(2.25)
REVOLVER_LOAN	-0.211***	-0.210***	-0.212***	-0.210***	-0.193***
	(-7.98)	(-7.92)	(-8.00)	(-7.94)	(-7.73)
FACILITY_364	-0.601***	-0.597***	-0.601***	-0.597***	-0.469***
	(-22.27)	(-22.09)	(-22.28)	(-22.10)	(-18.96)
CORPORATE_CONTROL	0.387***	0.391***	0.387***	0.391***	0.269***
	(21.08)	(21.38)	(21.04)	(21.34)	(15.74)
CORPORATE_PURPOSE	0.225***	0.227***	0.225***	0.228***	0.120***
	(13.79)	(14.00)	(13.83)	(14.05)	(8.32)
debtrepay	0.264***	0.266***	0.264***	0.266***	0.147***
	(13.95)	(14.12)	(13.94)	(14.11)	(8.62)
PROJECT_FINANCE	0.390***	0.400***	0.390***	0.400***	0.259***
	(5.55)	(5.63)	(5.58)	(5.66)	(3.54)
wsize	-0.098***	-0.099***	-0.098***	-0.099***	0.079***
	(-19.76)	(-19.93)	(-19.72)	(-19.89)	(5.52)
wmb	-0.011***	-0.011***	-0.011***	-0.011***	-0.003***
	(-8.79)	(-8.87)	(-8.89)	(-8.97)	(-2.76)
wleverage	0.782***	0.770***	0.775***	0.763***	0.820***
	(33.05)	(32.48)	(32.71)	(32.14)	(26.76)
YEAR	YES	YES	YES	YES	YES
INDUSTRY	YES	YES	YES	YES	YES
Observations	18,275	18,275	18,275	18,275	18,414
R-squared	0.629	0.630	0.629	0.630	0.684

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 11. Robustness Tests for Asian crisis and Financial crisis period

VARIABLES	(1) LOG_ALLINDRAWN	(2) LOG_ALLINDRAWN	(3) LOG_ALLINDRAWN	(4) LOG_ALLINDRAWN
	ACRISIS =1	ACRISIS= 0	FINCRISIS=1	FINCRISIS=0
absrealcash2_bi	0.011**	0.012***	0.014***	0.015***
	(2.21)	(6.98)	(3.57)	(8.65)
CV_cashflow1	0.003	0.001***	0.001	0.001***
	(0.65)	(2.78)	(0.21)	(2.86)
maturity	-0.002**	-0.004***	-0.002**	-0.004***
	(-1.97)	(-9.89)	(-2.57)	(-9.42)
LOG_FACILITYAMT	-0.077***	-0.091***	-0.060***	-0.103***
	(-3.70)	(-15.51)	(-4.24)	(-17.19)
collateral	0.600***	0.565***	0.220***	0.597***
	(15.49)	(50.97)	(9.10)	(53.31)
syndicationflag	-0.042	0.140***	0.158	0.119***
	(-0.77)	(7.74)	(1.18)	(6.84)
TERM_LOAN	0.076	0.071**	0.113	0.066**
	(0.94)	(2.28)	(0.89)	(2.22)
REVOLVER_LOAN	-0.274***	-0.260***	-0.029	-0.275***
	(-3.43)	(-8.93)	(-0.23)	(-9.92)
FACILITY_364	-0.618***	-0.706***	-0.557***	-0.649***
	(-6.43)	(-23.33)	(-3.68)	(-22.43)
CORPORATE_CONTROL	0.113**	0.365***	0.350***	0.286***
	(1.98)	(17.96)	(4.23)	(14.68)
CORPORATE_PURPOSE	0.042	0.319***	0.153*	0.250***
	(0.71)	(18.36)	(1.93)	(14.99)
debtrepay	-0.018	0.179***	0.221**	0.134***
	(-0.31)	(8.70)	(2.27)	(6.89)
PROJECT_FINANCE	0.148	0.365***	0.499***	0.342***
	(0.60)	(4.71)	(3.58)	(4.37)
wsize	-0.145***	-0.075***	-0.035***	-0.089***
	(-8.11)	(-13.76)	(-2.88)	(-16.11)
wmb	-0.004	-0.016***	-0.003	-0.013***
	(-1.12)	(-11.02)	(-1.05)	(-9.39)
wleverage	0.981***	0.717***	0.670***	0.754***
	(11.47)	(27.48)	(11.26)	(28.94)
IND1	-0.123*	-0.249***	-0.069	-0.238***
	(-1.78)	(-11.52)	(-1.39)	(-11.21)
Constant	6.739***	6.711***	6.263***	6.965***
	(24.26)	(81.07)	(22.58)	(84.68)
Observations	1,519	16,756	1,741	16,534
R-squared	0.672	0.534	0.310	0.583

Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1