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Do FX Interventions Lead to Higher FX Debt? Evidence from Firm-Level Data

Prepared by Minsuk Kim, Rui C. Mano, and Mico Mrkaic[1]

Authorized for distribution by Rupa Duttagupta and Thomas Helbling

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Abstract

Central banks often buy or sell reserves-—-so called FX interventions (FXIs)---to dampen sharp exchange rate movements caused by volatile capital flows. At the same time, these interventions may entail unintended side effects. In this paper, we investigate whether FXIs incentivize firms to take on more unhedged FX debt, thereby increasing medium-term corporate vulnerabilities. Using a novel dataset with close to 5,000 nonfinancial firms across 19 emerging markets covering 2002--2017, we find that the firm-level share of FX debt rises following intensive use of FXIs, particularly for non-exporting firms in shallow financial markets with no FX debt to begin with. The magnitude of this effect is economically significant, with one standard deviation increase in FXI leading to an average 2 percentage points increase in the FX debt share. For reference, the median share of FX debt in the sample is zero.

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Author's E-Mail Address: mkim@imf.org; rmano@imf.org; mmarkaic@imf.org.

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1 Introduction

FX intervention (FXI) constitutes an integral part of policymakers' toolkit in emerging markets (EMs) and small open advanced economies. Many EM central banks use FXI extensively to dampen sharp exchange rate movements or influence the level of the exchange rate, typically in response to large fluctuations in capital flows or movements in terms-of-trade, and with the objective of maintaining price stability or preventing adverse financial spillovers (Patel and Cavallino, 2019). Financial spillovers can transmit through the risk-taking channel. Exchange rate depreciations weaken balance sheets of banks and firms carrying large unhedged FX debt, leading to a higher risk premium and reduced lending by international lenders (Céspedes and others, 2004; Bruno and Shin, 2015). The resulting contractionary effects on real activity can be further magnified if the depreciation is accompanied by a sudden tightening of global financial conditions and in the presence of domestic financial frictions. This adverse financial channel may even dominate any gains from more competitive net exports due to a depreciated currency—the so called expenditure switching channel.

Despite the potential merits of FXI under these circumstances, a concern has lingered over its prevalent use: namely, that FXI could generate an unintended side-effect of incentivizing firms and households to take on more unhedged FX debt by reducing the associated FX risks. The resulting increase in FX-denominated vulnerabilities in turn reinforces the need to resort to FXI later on, thereby creating an undesirable feedback loop between FXI and balance sheet FX vulnerabilities over the medium term.[1]

This paper aims to explore the quantitative evidence of this unwelcome side-effect using a novel firm-level dataset, which comprises accounting information for a panel of 4,790 nonfinancial firms from 19 major EMs over the period of 2002 to 2017. The dataset, constructed in Kim (2019) using the Capital IQ database from S&P Market Intelligence, contains information on the directly recorded, not imputed, currency composition of outstanding debt for individual firms. To the best of the authors' knowledge, this is the largest international firm-level dataset with this important piece of information, covering EMs from all major regions of the world.

The results show that firms tend to hold higher shares of FX debt following intensive use of FXIs, especially those in non-exporting industries and in underdeveloped financial markets. Moreover, the

[1] IMF (2019) find evidence on one side of this loop—that is, FXI is used with more intensity precisely in less-developed financial markets and when FX liabilities are larger and unhedged in a sample of Asian EMs.

magnitude of this effect is economically significant, with one standard deviation increase in FXI leading to an average 5-10 percentage point increase in the FX debt share, depending on whether we take results based on uninstrumented or instrumented FXI. On the contrary, exporting firms in developed financial markets do not seem to react to more intensive FXIs. These main results hold under a number of robustness checks.

Our results imply that the short-term gains of market stabilization associated with FXIs need to be weighed against the medium-term buildup of vulnerabilities to FX shocks, and that promoting financial development can help ease this trade-off.

Organization. The remainder of the paper is organized as follows. In Section 2, we discuss related literature; Section 3 lays out key features of the dataset we use in the empirics discussed in Section 4. Section 5 concludes.

2 Related Literature

This paper builds on the strand of the empirical literature that investigates the relationship between exchange rate regimes and economic vulnerabilities. Using a sample of 50 EM economies over 1980-–2011, Ghosh and others (2015) show that macroeconomic and financial vulnerabilities are significantly greater under less flexible exchange rate regimes. Under these regimes, credit expansion and foreign borrowing by banks tend to be larger while the likelihoods of a sovereign debt crisis and growth collapse are higher. Similarly, Magud and others (2014) use a sample of 25 EM economies to show that both bank credit growth and the share of foreign-currency-denominated bank credit are significantly higher in economies with less flexible exchange rate regimes, even after controlling for the fact that these economies tend to attract more capital inflows. Mendoza and Terrones (2012) identify 70 credit boom episodes using data for 61 emerging and industrial countries over the 1960-2010 period and show that credit booms are far more common with managed than flexible exchange rate arrangements. Several studies also find evidence that less flexible exchange rate regimes are associated with higher likelihoods of a banking crisis (Domaç and Martinez Peria, 2003; Ghosh and others, 2003; Angkinand Prabha and Willett, 2011). Recently, Csonto and Gudmundsson (2020) adopt a difference-in-difference approach to analyze 26 episodes of shifts toward more flexible exchange rate regimes and find evidence of significant declines in external FX debt in these episodes.

The link between EMs' use of FX debt and exchange rate flexibility has been extensively studied in the literature. Eichengreen and others (2005) and Hausmann and Panizza (2011) found that EMs tend to reduce their FX debt shares during times of high exchange rate fluctuations, which they interpret as a result of the higher cost of hedging where domestic financial markets are shallow. By contrast, Mishkin (1996), Obstfeld (1998), and Burnside and others (2001) show how pegged exchange rate regimes could encourage currency risk-taking by firms and banks by reducing their incentive to hedge. In a later generation of models, the share of FX debt held by individual households and firms are determined by the trade-off between exchange rate risk and other types of risk, such as domestic inflation risk (Ize and Yeyati, 2003; Jeanne, 2003) or foregone growth opportunity (Salomao and Varela, 2018). Conversely, Reinhart (2000) and Calvo and Reinhart (2001, 2002) document a pervasive *fear of floating* among EMs, which they viewed as a possible repercussion of liability dollarization in these economies. Recent work by Luigi Bocola (2020) suggests that FX borrowing arises because of the desire of households to insure and save in FX. In this case, it could be that greater FX accumulation by the public sector would substitute for such an insurance need and actually reduce FX borrowing.

A few papers have used firm-level data to examine how exchange rate regimes or fluctuations influence EM firms' foreign currency exposures. Due to the limited availability of direct information on firms' balance sheet currency exposures, one strand of this literature relies on firms' stock market return data to estimate their sensitivity to exchange rate movements (Parsley and Popper, 2006; Patnaik and Shah, 2010; Ye and others, 2014), following the approach pioneered by Adler and Dumas (1984). Ye and others (2014) conduct a pooled cross-sectional analysis using a sample of 627 firms from 13 EMs during the period of December 1999 to December 2010 and find evidence that a non-floating exchange rate regime significantly magnifies firms' existing FX exposures. Patnaik and Shah (2010) use a sample of 100 Indian firms during 1993–2008 to show that firms held higher FX exposures in the sub-periods when the exchange rate was less volatile. Another group of studies use actual firm-level balance sheet data, overwhelmingly from Latin American economies (see Galindo and others (2003) for a survey). Martinez and Werner (2002) find that Mexico's transition from a fixed to a floating exchange rate regime in 1994 was followed by a significant fall in sample firms' dollar exposures, while Cowan and others (2005) find a similar evidence for Chile. Kamil (2012) uses a dataset for over 1,800 nonfinancial firms from six Latin American economies over the period of 1992–2005, which notably contains information on the currency composition of both liabilities and assets, as well as foreign sales.

The study not only finds evidence of a sustained decline in firms' FX debt after the adoption of a floating exchange rate regime, but also show that it is the firms with lower foreign sales or FX assets that reduce their FX debt relatively more. These results are consistent with the main findings in this paper. Sebnem Kalemli-Ozcan and Shim (2018) use a large firm-level dataset consisting of 1,661,677 firm-year observations from 10 Asian EMs during 2002–2015, in which the share of FX debt for each firm is estimated from country-level FX debt statistics, and show that exchange rate appreciations increase disproportionately the leverage of firms with higher pre-appreciation shares of FX debt, with stronger effects for firms in the nontradable sector. Finally, Kim (2019) uses accounting information of over 9,000 nonfinancial firms across 21 major EMs (including seven from Asia) during 2009–2017, and finds that while exchange rate volatility is negatively associated with firms' dollar debt shares, this relationship gradually loses statistical significance with financial deepening, eventually becoming insignificant beyond a certain threshold level of financial depth. This paper also finds evidence in line with this result.

Another important related topic is the effectiveness of FXI. Several recent empirical studies find evidence that FX interventions by EM central banks have persistent effects on exchange rate movements, going beyond intra-day or daily windows[2]. As the decision to intervene tends to be endogenous, these studies often use instrumental variables to capture exogenous variations of FX interventions, such as global capital flows (Blanchard and others, 2015), the change in M2-to-GDP ratio (Daude and others, 2016), and import coverage and the interaction between VIX and financial dollarization (Adler and others, 2019). The estimated size of the initial impacts were also economically significant, with FX interventions amounting to one percent of GDP leading to about 1.4–1.7 percent changes (Blanchard and others, 2015; Adler and others, 2019).

Finally, some recent studies investigate the impacts of FX interventions on other domestic variables, such as domestic credit growth (Hofmann and Shin, 2019), corporate leverage (Tong and Wei, 2019), and current accounts (Bayoumi and others, 2015). Using firm-level data from 23 EMs, Tong and Wei (2019) find an increase in a country's FX reserves-to-GDP ratio leads to a significant increase in the leverage of firms in that country.

[2]A recent study by Fratzscher and others (2019) covering 33 economies show that FX interventions were especially effective tools for smoothing the path of exchange rates over a one-week horizon.

3 Data

This section describes the data used in our econometric analysis. We merge two types of data, firm- and country-level. We describe key features and variables in what follows and reserve further details for Appendix A.

Our final sample comprises about 38,500 firm-year observations (or 4,790 firms) during the period of 2002–2017. Firms from the following 19 economies on the basis of their main headquarters' locations are covered: Argentina, Brazil, Chile, Colombia, Czech Republic, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Peru, the Philippines, Poland, Romania, Russia, South Africa, Thailand, and Turkey. We excluded economies with a pegged exchange rate for a significant portion of the time frame considered.

3.1 Firm-Level Data

The firm-level dataset comes from Kim (2019), which is constructed using accounting information from the Capital IQ database provided by S&P Global Market Intelligence. Compared with other international firm-level databases such as Worldscope and ORBIS, Capital IQ has one crucial advantage for the purpose of this study: the availability of information on the currency composition of outstanding debt of individual firms. This information is collected from annual financial reports of companies filed to national regulatory agencies, typically found in the supplementary note accompanying the main financial statements. While credit registries in some countries provide this type of information and cover a much larger pool of firms, they are generally available only for select countries and years,[3] and do not allow for cross-country comparisons due to different accounting standards. Furthermore, compared with firm-level datasets that rely on international debt issuance data to proxy firms' foreign currency exposures, this balance-sheet-based dataset provides more direct and accurate information on firms' total foreign currency liabilities, including FX loans from domestic banks.

The sample includes both listed and nonlisted firms.[4] The accounting information is on a consolidated basis at the ultimate corporate parent level and converted from local currency to millions of U.S. dollars by using the exchange rate at the end of each financial year. The currency breakdown

[3] A firm-level database provided by the Inter-American Development Bank uses national credit registries and other data sources for 10 Latin American countries for the period of 1990–2002. The country-wide outstanding dollar debt-to-total debt ratios in 2002 for Argentina (55 percent) and Brazil (20 percent) are comparable to ours (43 percent for Argentina and 21 percent for Brazil).

[4] The share of nonlisted firms is rather small, however, accounting for about 7 percent of sample firm-year observations.

of outstanding total debt is obtained by aggregating the information on individual debt instruments. The value of the aggregated debt amount across all currencies is then cross-checked against the total amount due reported on the firm's balance sheet. We discard the top and bottom 1 percent of the firm-year observations for each firm-level explanatory variable. Appendix A provides additional details on the dataset, including a comparison with macro-level statistics and the data cleaning procedures.

An important independent variable in our analysis is a dummy variable ("Trade") indicating whether a firm belongs to an exporting industry (Trade=1) or not (Trade=0). To construct this variable, we collect information on the geographical sources of firms' revenue from Capital IQ. As this information is only available for a very small share of sample firms, we calculate the average foreign revenue-to-total revenue ratio at the industry level from the subsample and define an industry as an exporting industry if the share is above a certain threshold value (0.7). Appendix A provides a further description of this dummy variable.

3.2 Country-Level Data

The main independent variable of interest is the intensity of FX interventions. In our preferred specification, we proxy the intensity of FX interventions of country c at time t, denoted by $FXI_{c,t}$, with:

$$FXI_{c,t} = \frac{\sigma(fxi_{c,t}/GDP^{3yr}_{c,t})}{\sigma(fxi_{c,t}/GDP^{3yr}_{c,t}) + \sigma(dln(ER_{c,t}))} \quad (1)$$

where $fxi_{c,t}$ is a proxy of monthly FX interventions in U.S. dollars based on the changes of the stock of reserves adjusted for valuation, income and other central bank balance sheet transactions in foreign currency with both non-residents and residents, see Adler and others (Forthcoming); $GDP^{3yr}_{c,t}$ is the three-year backward-averaged Gross Domestic Product in U.S. dollars; $dln(ER_{c,t})$ is the log-change of end-of-period local currency-to-U.S. dollar nominal exchange rate, from month $t-1$ to month t; and $\sigma(x)$ is a function that computes the standard deviation of x using 2-year backward windows. This volatility ratio proxies for the intensity of FXI, as greater values signal greater willingness to smooth a given level of exchange rate volatility.

The volatility ratio defined in equation (1) correlates with the exchange rate regime of a country (larger volatility ratio correlates to less flexible regimes), as shown in Figure A1. We interpret this as evidence that the volatility ratio is a good proxy for the intensity of FX interventions. This relationship

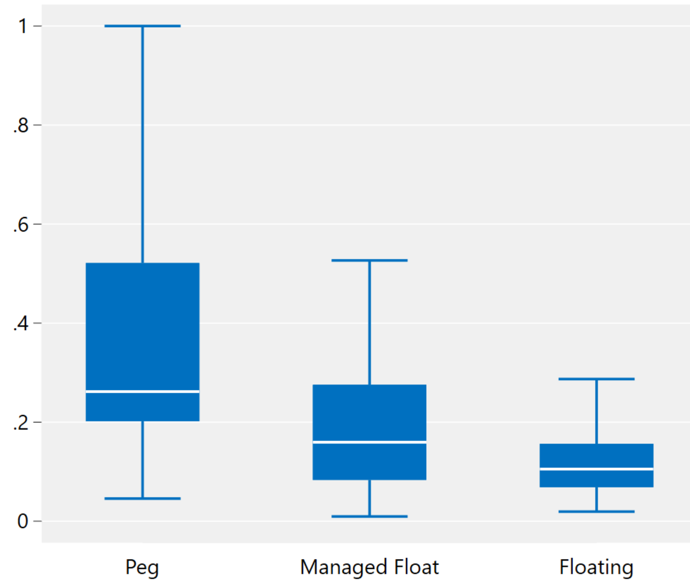


Figure 1: FXI Intensitiy By Exchange Rate Regime

also underscores the importance of using country-fixed effects in the panel regressions we run in Section 4.

Another variable of interest is the degree of financial development ("Financial Depth")[5] in a country, which we capture using the ratio of total credit from the private sector to GDP obtained from the Global Financial Development Database from the World Bank. As a country's financial market develops, firms gain more opportunities to hedge their FX exposures and at lower costs. As a result, their debt currency decision is likely to be less influenced by exchange rate fluctuations and, consequently, the intensity of FX interventions.

All other variables are defined and their sources given in Appendix A.

4 Econometric Analysis

In this section, we use our panel of firms in 19 emerging markets over 2002-2017 to assess whether more active FX interventions had an impact in firms' decisions to borrow in U.S. dollars.

[5]In this paper, we use financial development and financial depth interchangeably.

4.1 Baseline Uninstrumented Tobit Regressions

As the dependent variable is the share of USD-denominated debt in total debt, which is bounded between zero and one and has a large mass at zero, we follow much of the literature by running the following Tobit specification[6]:

$$FXshare_{i,t} = \begin{cases} \alpha_{s,c,t} + \beta FXI_{c,t} + \theta FXI_{c,t} I_{s/c,t} + \gamma X_{i/c,t} + \epsilon_{i,t} \equiv \mathbf{y}, & \text{if } \mathbf{y} \in (0,1) \\ 0, & \text{if } \mathbf{y} \leq 0 \\ 1, & \text{otherwise} \end{cases} \tag{2}$$

where i denotes a firm, t a year, s an industry and c a country. $FXshare_{i,c,t}$ is the share of USD-denominated debt in total debt. The key independent variable of interest is the intensity of FX interventions, denoted by $FXI_{c,t}$, which we proxy using the ratio of volatility of FX interventions to the sum of the volatility of FX interventions and the volatility of changes in the USD-local currency exchange rate.[7] Greater values of this ratio signal greater willingness to smooth a given level of exchange rate volatility, with the value of one indicating a hard peg. X is a set of firm- or country-level controls[8], and $\alpha' s$ are industry, country and time fixed-effects.[9]

Note that FXI is also interacted with a set of variables $I_{s/c,t}$, which comprises a measure of the financial development of the country and tradedeness, which is a dummy variable indicating whether the firm is in an industry that produces exportable goods (see more details in Section 3). These interactions aim at capturing whether firms are encouraged to take on more risk in the presence of more active FX interventions. Financial depth captures the availability of financial hedging and of a deep domestic debt market. Tradedness captures the extent to which firms have natural hedges. Presumably, if FXI encourages non-exporting firms in shallow domestic markets to borrow more in

[6] A linear specification would not be appropriate, as many firms would be predicted to have a negative share of USD debt. Tobit specifications have been widely used in studies using similar dependent variables, for example in Allayannis and others (2003), Eichengreen and others (2005), and Bruno and Shin (2017).

[7] See more details in Section 3, particularly equation (1) and the discussion thereafter.

[8] The controls include the annualized volatility of yoy CPI inflation over the past 12 months, the real exchange rate appreciation against the USD, lagged assets, lagged leverage, lagged fixed assets, Return-On-Assets, exports to GDP ratio, the composite risk rating from the International Country Risk Guide Database, the differential between the local short-term interest rate and 3-month USD LIBOR rate, CPI inflation percent (end-of-period), lagged GDP per capita, financial depth to GDP, and the tradedness dummy. We do not control for regulatory limits to external or FX borrowing which could be relevant for some countries.

[9] While the bounded nature of the dependent variable, $FXshare_{i,c,t}$, necessitates the use of a nonlinear specification such as Tobit, the incidental parameter problem associated with this family of models prevents the use of firm-level fixed effects. To mitigate this problem, we use granular industry fixed effects consisting of 154 industries, following Capital IQ's proprietary classification system.

Table 1: Baseline Regression

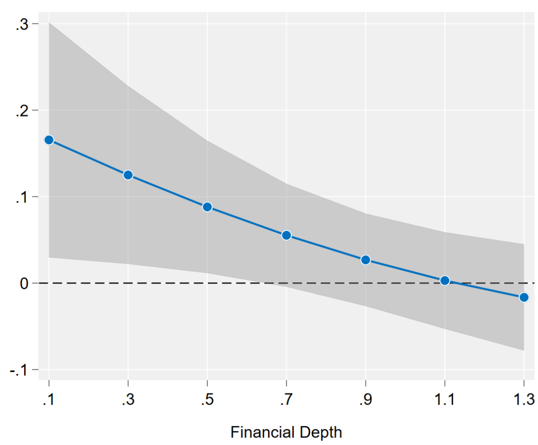
This table presents results from uninstrumented Tobit regressions using the ratio of U.S. dollar debt to total debt as the dependent variable. The displayed explanatory variables are defined as follows: *FXI* is a proxy for the intensity of FX interventions in each country (see Section 3.2 for more details); *Trade(=1)* is a dummy variable that takes a value of 1 if a firm belongs to an exporting industry and 0 otherwise; and *Financial depth* is the ratio of private credit to GDP. Many control variables are included but not shown to save space, namely: inflation volatility, real exchange rate depreciation, interest differential, CPI inflation, exports-to-GDP ratio, the logarithm of real GDP per capita, the composite country risk rating from the International Country Risk Guide Database, the logarithm of total assets, debt-to-total assets ratio, tangible assets-to-total assets ratio, return on assets, as well as country, year, and industry fixed effects. The interaction of financial depth and trade has a very high p-value of 0.9 and its point estimate is minute and thus was excluded from the regressions. The standard errors, shown in brackets, are robust to clustering at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1)	(2)	(3)	(4)
FXI	−0.085*	0.058	−0.005	0.361**
	[0.048]	[0.072]	[0.100]	[0.146]
FXI × Trade(=1)		−0.195***		−0.541***
		[0.073]		[0.156]
FXI × Financial depth			−0.097	−0.320**
			[0.116]	[0.158]
FXI × Financial depth × Trade(=1)				0.360**
				[0.158]
Financial depth	−0.244***	−0.249***	−0.224***	−0.240***
	[0.050]	[0.050]	[0.056]	[0.056]
Trade(=1)	0.019	0.062	0.020	0.075
	[0.191]	[0.194]	[0.191]	[0.197]
Number of observations	38,465	38,465	38,465	38,465
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

FX, that is more worrisome from a macro-level risk management perspective. The concern would be much less acute if it is exporting firms in deep markets that increase their FX debt the most following active FX interventions.

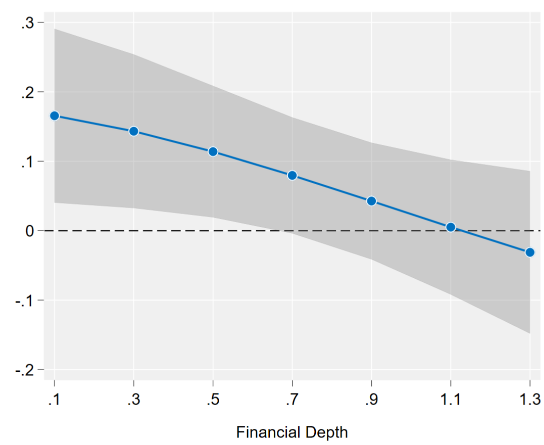
Table 1 investigates the link between more intensive FX intervention and subsequent increases in firm's reliance on FX debt. In column 1, we run equation (2) without interactions on FXI. Interestingly, FX intervention is not significant at the 5 percent significance level on its own. In column 2, we add the interaction with tradedness, which appears crucial. Firms in traded industries behave very differently from those in nontraded industries in response to more intense FXI, with the former tending to switch to FX debt by a much smaller degree than the latter. In column 3, we add the interaction with financial depth to find that firms in deeper financial markets tend to switch less to FX debt in the presence of more active FX interventions, although the coefficient in this column is not statistically significant. Column 4 uses all interactions and the results become statistically significant and clear—firms in nontraded industries in countries with less developed financial markets seem to increase their FX borrowing the most in response to more intensive FX interventions.

Statistical and economic significance of the effects of FXI Non-exporting firms in countries with relatively shallow domestic financial markets tend to borrow more in FX following more intense use of FXI. Figure 2a shows the marginal effects of FXI on the *observed* share of FX debt of non-exporting firms, which become positive and significant at a financial depth below 0.7 ≈ 58th percentile.[10] At the 20th percentile of financial depth (≈ 0.35), the effect is 0.12.[11] That means an increase in the intensity of FXI by one standard deviation (which is ≈ 0.17) translates into a rise in the share of USD debt of 2 percentage points (0.12*0.17). To put this value in perspective, note that the mean USD debt ratio over the whole sample is 16 percentage points, 14 for non-traded firms, and that the median is zero. Moreover, the probability that a non-exporting firm starts borrowing in FX is also more prevalent in shallower financial markets (see Figure 2b).



(a) On the Observed Share of FX Debt

Note: This figure presents the marginal effect of FXI on the observed share of FX debt estimated using the tobit model of equation (2) for non-exporting firms (Trade=0) depending on their country's degree of financial depth and measured at the median of FXI (≈0.2).



(b) On the Probability of Borrowing in FX

Note: This figure presents the marginal effect of FXI on the probability of having FX debt between 0 and 1 estimated using the tobit model of equation (2) for non-exporting firms (Trade=0) depending on their country's degree of financial depth and measured at the median of FXI (≈0.2).

Figure 2: Marginal Effects of FX Interventions

These effects are mainly driven by the extensive margin, i.e. by changes in the probability of borrowing any FX debt. We use the decomposition in McDonald and Moffitt (1980) to shed light on

[10]The sum of coefficients in Table 1 involving FXI for firms in deep domestic financial markets or those in traded industries are small, often negative, and typically insignificant. On the other hand, the sum of coefficients for firms in non-traded industries in countries is positive and significant if domestic financial markets are shallow. These effects become significant at a financial depth below 0.7 ≈ 58th percentile (see Appendix Figure B1). However, the coefficients shown in Table 1 overestimate the marginal effect of FXI on the actual observed share of FX debt, which is bounded between 0 and 1.

[11]This is calculated at the median of FXI intensity. In general, tobit marginal effects depend on the level of covariates as well. We find though that in our application, the effect is relatively flat across the distribution of FXI.

the relative factors determining the marginal effects of FXI reported above. In particular, we use:

$$\frac{\partial \mathbb{E}[y]}{\partial x} = \mathbb{P}\left(0 < y < 1\right) \frac{\partial \mathbb{E}[y|0 < y < 1]}{\partial x} + \mathbb{E}[y|0 < y < 1] \frac{\partial \mathbb{P}\left(0 < y < 1\right)}{\partial x} + \frac{\partial \mathbb{P}\left(y = 1\right)}{\partial x} \tag{3}$$

where in our case $y = FXshare$ and $x = FXI$. Equation (3) decomposes the overall marginal effect into two main parts: the first term on the right-hand side captures the effects of FXI on the intensive margin, i.e. effects on the FX debt share conditional on already borrowing in FX, while the second and third terms on the right hand side capture the effects of FXI on the extensive margin, i.e. effects on the probability of having positive FX debt. We compute the share that either part contributes to the overall effect by dividing through by $\frac{\partial \mathbb{E}[y]}{\partial x}$. We find that about 72 percent of the marginal effect we report above for non-exporting firms in shallow markets comes from the extensive margin.[12]

The fact that the effect of FXI comes mostly from changes in the decision to start borrowing in FX gives both credence to the non-linear methodology followed here and signals that FXI may indeed be related to higher risk-taking. Firms that do not typically borrow in FX are not likely to have either natural hedging or knowledge and access to financial hedging instruments.

4.2 Instrumented Tobit Regressions

The main advantage of using firm-level data is that it alleviates concerns about reverse causation, particularly in the presence of extensive country-, industry- and time-fixed effects. In investigating whether FXI incentivizes firms to switch to FX debt, a key concern of reverse causality needs to be addressed. Reverse causation arises if the central bank uses FXI as a reaction to changes in aggregate corporate FX debt. Firm-level data offers the comfort that the analysis is centered on individual firms. This however, may be a false sense of comfort if firms react similarly to the same country-level conditions, in which case individual firm behavior would be similar to aggregate firm behavior.

To allay reverse causality concerns, we run instrumental variables (IV) Tobit regressions, in which we instrument the intensity of FXI based on Adler and others (2019). There, FX intervention is instrumented using 4 variables: the change in M2 to GDP; the net foreign asset (NFA) position of the central bank to imports and M2; and the interaction of financial dollarization with the VIX. Among these, the first three, which are related to precautionary motives to intervene, can be argued to be exogenous to changes in FX debt. Movements in M2 are related to local monetary conditions, and

[12] This share does not vary significantly across the distribution of financial depth.

Table 2: Instrumented Tobit Regression

This table presents results from instrumented Tobit regressions using the ratio of dollar debt to total debt as the dependent variable. Column (1) reproduces the baseline specification from Table 1 for easier reference. Columns (2) and (3) show the Tobit IV regression results in which FXI is instrumented using the following four variables that aim to capture precautionary motives: the change in M2 to GDP; the net foreign asset (NFA) position of the central bank to imports and M2; and the interaction of financial dollarization with the VIX. Column (2) shows the results using all instruments except financial dollarization and the VIX, and column (3) shows the results using all of the four IVs. All other control variables are identical to Table 1, including country, year, and industry fixed effects, although not shown to conserve space. The standard errors, shown in brackets, are robust to clustering at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Baseline	(2) IV (excl. dollarization)	(3) IV (incl. dollarization)
FXI	0.361**	0.874**	0.863**
	[0.146]	[0.339]	[0.336]
FXI × Trade(=1)	−0.541***	−0.606***	−0.706***
	[0.156]	[0.227]	[0.220]
FXI × Financial depth	−0.320**	−0.764**	−0.758**
	[0.158]	[0.356]	[0.354]
FXI × Financial depth × Trade(=1)	0.360**	0.332*	0.373**
	[0.158]	[0.191]	[0.190]
Number of observations	38,465	38,177	38,174
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Wald test p-value	NA	0.331	0.211

can be thought of as the size of domestic financial liabilities that could potentially be converted into foreign currency (Obstfeld and others, 2010), and the NFA ratios are standard reserve coverage ratios (International Monetary Fund, 2013). However, the interaction of financial dollarization with the VIX is much less clearly exogenous, as it relates to balance sheet vulnerabilities which could reflect changes in corporate FX debt. For example, an increase in local USD bank lending to firms could prompt local banks to offer better rates on deposits and hence create an increase in financial dollarization. Thus, we instrument the volatility ratio using only the first three instruments and then also check whether including the interaction of financial dollarization and the VIX makes a difference. [13]

Table 2 summarizes the main results using instrumental variables. Column 1 reproduces the baseline specification from Table 1 for easier reference. The Tobit IV regression using all instruments except financial dollarization and the VIX (Column 2) delivers coefficients that are similar if not larger in size than those in the baseline. Encouragingly, the signs of the 4 key variables are consistent, and are all significant at the 5 percent level except the triple interaction which is significant at 10 percent confidence level. Appendix Table B1 shows the first stage regression and confirms that the instruments

[13] International Monetary Fund (2018) finds that more credible IT regimes intervene less and have more scope for stable monetary policy which allays concerns about a possible endogeneity due to an interaction between monetary policy and FXI. Moreover, changes in monetary policy policy are controlled for in our regressions by the short-term money market interest rate differential.

are highly correlated with each instrumented variable, and thus we reject that our instruments are weak. Under such conditions, the Wald test of exogeneity is reliable. We present its p-value in the last row of Table 2, We cannot reject that instruments are exogenous in either column 2 or 3. These standard statistics give us confidence about the instrumentation. Column 3 is very similar to column 2, signaling that the exclusion of the interaction of financial dollarization and VIX is not crucial.

Economic significance To compare columns 1 and 2, we sum the the relevant coefficients for a non-exporting firm in a country with shallow financial markets (20th percentile=0.35) to get 0.87-0.76*0.35 = 0.6. This is more than twice the same calculation under the baseline which is 0.25, pointing to if anything larger marginal effects of FXI under the instrumented Tobit specification. Given the larger standard errors around the IV estimated coefficients, we see the instrumentation as broadly consistent with our baseline regressions, which is re-assuring. [14]

4.3 Robustness

Definition of FXI Appendix Table B2 shows that the baseline coefficients have the same signs using different definitions of FX intervention, although coefficients tend to be imprecisely estimated when using such alternative definitions. Column 2 shows results if the volatility ratio is defined in a 3-year window instead of the baseline's 2 years. Note that the longer window makes FXI more similar to the country fixed effects which diminishes the significance of coefficients. Column 3 uses the level of FX intervention to GDP over the past 2 years instead of the volatility ratio over the same period. Column 4 uses the level of the absolute value of FXI to GDP and column 5 uses the volatility of FXI. Note that the signs of the 4 coefficients of interest are consistent across all columns, but their magnitude is quite different because the independent variables themselves have quite different scales. In general, the significance of coefficients is weaker, but we interpret these results as broadly consistent with those

[14] Computing marginal effects from the instrumented Tobit specification is technically challenging. Unlike in the uninstrumented Tobit, evaluating results when $Trade = 0$ is not straightforward because instrumented interactions involving tradedness may actually be different from zero even if tradedness itself is zero. One can compute a marginal effect focusing only on two effects of FXI, the unconditional effect and that conditional on financial depth, and ignoring interactions involving tradedness. Such marginal effect of FXI on the *observed* share of FX debt is 0.27, at the median of instrumented FXI and the 20th percentile of financial depth. To calculate this effect, we take the first stage estimates from the instrumented Tobit for each instrumented variable, divide the instrumented interaction of financial depth with FXI by the fitted value of FXI, include that term as an interaction in the second stage Tobit and use the Stata command "margins". This marginal effect means that an increase of 1 standard deviation in the intensity of FXI (which is 0.2) translates into a rise in the share of USD debt by 5 percentage points (0.27*0.2), an even larger point estimate than the baseline calculation of 2 percentage points. This procedure though does not fully account for effects of FXI in interactions incolving tradedness even for non-exporting firms, as explained, and its standard errors do not take into account that variables involving FXI have been instrumented.

in Table 1. These results though point to the importance of appropriately measuring the intensity of FXI. The level of FXI is a very different concept, and even the volatility or the abolute level of FXI do not capture the fact that interventions are always relative to the shock that they aim to lean against. The volatility ratio is the variable most capable of capturing that idea.

Alternative Specifications Our baseline table uses a Tobit specification to keep close to most of the literature, even though in reality the data is not censored but rather bounded. Column 2 of Appendix Table B3 shows results applying a more appropriate fractional regression (see Papke and Wooldridge, 2008) which exactly deals with bounded data that may have a cluster of observation around the boundaries. Results are consistent both in terms of the signs, magnitude and significance of coefficients with those in the baseline regression, reproduced in Column 1. Finally, column 3 uses a two-step procedure where the extensive margin, i.e. the decision to borrow at all in FX, and the intensive margin, the decision of how much to borrow in FX conditional on borrowing a non-zero amount in FX, are modeled separately. "First Stage (0/1)" shows results for the extensive margin, in which in general coefficients tend to be less significant than in the baseline except the interaction of FXI and Tradedness but of the same sign. In "Second Stage" though, the intensive margin results are much more reliably significant.

Further Robustness Checks Appendix B presents the results from additional robustness tests. The baseline results are found be robust to a number of tests including: lagging the FXI variable (column 2), excluding the GFC years (column 3), and including the VIX instead of time fixed effects (column 4). Finally, we also check whether the effects of FXI are asymmetric by using only observations with a majority of purchases in the past 24 months. The results for this restricted sample (column 5) are broadly consistent with the baseline and thus we find no evidence of asymmetric effects.

5 Concluding Remarks

FX intervention is well understood to have several benefits, particularly when leaning against short-term fluctuations in exchange rates. These are especially poignant in emerging markets or small open advanced economies that are subject to large and volatile capital flows and whose firms or banks may have currency mismatches in their balance sheet. Allowing sharp movements in the exchange under such conditions could create a self-fulfilling crisis.

On the other hand, a full evaluation of the usefulness of FXI requires that its costs are also well understood and documented. More attention has been devoted to the quasi-fiscal costs of FXI, either realized or in terms of opportunity costs, see Adler and Mano (2018). But longer-term costs, such as reputational[15] or increased financial vulnerabilities, that may follow certain interventions are harder to identify and quantify.

This paper's findings make a contribution to our understanding of longer-term costs of FXI. We find that more intensive use of FXIs tends to lead to increases in corporate FX debt of non-exporting firms in countries with shallow financial markets. Such an increase in the share of FX debt is likely associated with more risk, given the type of firms involved and that the effects are chiefly driven by the extensive margin, i.e. firms that start to borrow in foreign currency. For context, most firms in the dataset have zero USD debt. The increases are both statistically and economically meaningful, with a one standard deviation increase in FXI intensity leading to 2 percentage points of additional USD debt of firms in markets with depth at the 20^{th} percentile. Instrumented results are if anything larger. These results suggest that FXI's short-term gains in terms of exchange rate stabilization need to be weighed against the medium-term costs associated with FX leverage buildup, and that promoting financial development could help ease this trade-off.

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A Data Appendix

This appendix provides additional details on the firm-level data from Capital IQ, the data cleaning procedures, description of firm-level and a comparison with datasets used in other studies. It also presents details on variables not explained in Section 3.

Capital IQ Data

The list of sample firms is downloaded from Capital IQ's online platform (https://www.capitaliq.com) using its company screening tool. To restrict the list to nonfinancial sector firms, we rely on Capital IQ's proprietary industry classification system and define nonfinancial firms as those whose primary industry is not "Financials." Financial firms, especially banks, are generally subject to regulatory limits on their net open FX positions, which makes them less relevant for the purpose of this study. We also exclude state-owned firms from the sample, which are identified as firms that have "Government Institution," "Sovereign," or "Supranational" as their current ultimate corporate parents. This is considering that FX borrowing decisions of state-owned firms are likely influenced by implicit or explicit guarantees by the government, in addition to FXIs, which is beyond the scope of this paper.

The sample includes both listed and nonlisted private companies, which are obtained using the "Company Type" filter in the website. Given the need for detailed information on outstanding company debt in this paper, the sample of nonlisted private firms is restricted to company types defined as "Private Company with Public Debt," "Companies with Public Financials," or "Private Companies with Financial Statements," which are generally large in terms of the asset size. In the sample used for regressions, nonlisted private firms accounted for about 6.6 percent of the sample with an average asset size of US$1.4 billion, compared with US$1.0 billion for listed public firms.

Financial information of sample firms comes from their consolidated financial statements. While Capital IQ offers the option to choose between consolidated and unconsolidated statements, the majority of firms in our sample economies only report financial statements on a consolidated basis. To address the issue of double counting, the sample only comprises firms that are ultimate corporate parents, which ensures that a sample firm is not a direct subsidiary of another sample firm. Furthermore, all statements filed before July 1 in any given calendar year are reassigned to the previous calendar year, and those filed after June 30 are assigned to the same calendar year in which they are filed to minimize the timing mismatch between macroeconomic and firm-level variables.

Finally, it is worth briefly discussing how Capital IQ collects financial statement information of individual companies and especially the information on their outstanding debt at instrument level. Unlike other data providers, where a single analyst or team processes a company's entire annual report, S&P Capital IQ employs different teams of research analysts with relatively narrow specializations that work in parallel on different sections of the same document (for example, main tables and supplemental information sections). This approach allows S&P to collect a rich set of information on individual debt instruments, such as the currency of denomination, debt type, interest rate, and maturity date, to the extent available in the annual statements and in a consistent manner across all firms.

Regarding the currency of denomination of each debt instrument, Capital IQ collects information according to the following criteria: (1) If a company explicitly reports the repayment currency of a debt instrument, Capital IQ reports the same currency; (2) if a company reports the repayment currency as either "foreign currency" or "multiple currency," Capital IQ reports the currency information as unavailable; and (3) if a company does not state any specific repayment currency, Capital IQ assigns the financial statement's reporting currency as the repayment currency, which is usually the company's local currency. In this paper, these unspecified foreign currency liabilities are treated as a part of dollar debt.

To double-check the quality and national representativeness of our sample, we compared the aggregated USD debt amount and the share in total nonfinancial corporate debt for each country with the FX debt estimates from Adler and others (2020) based on BIS statistics. As shown in Table A1, column (1), the total outstanding USD debt held by sample firms over the period of 2002–2017 accounted for about 21 percent of the nonfinancial corporate FX debt reported in the BIS statistics. In terms of the share in total nonfinancial corporate debt outstanding, as shown in columns (2) and (3), the two datasets appear generally comparable – for example, the total share of foreign debt is 26.2 in our sample while it is 27 percent using BIS aggregate data. We note though that our dataset includes only U.S. dollar debt and nonfinancial firms owned by the private sector and thus any country whose firms borrow extensively in other currencies or where state-owned enterprises are important foreign borrowers will be undersampled.[16] Furthermore, the correlation between the two ratios at the country-year level is reasonably high at 0.7 (Figure A1).

[16] This seems to be the case for Eastern European countries, where euro-denominated debt is more relevant. Our baseline result is robust to dropping the Czech Republic, Hungary, Poland, and Romania.

Table A1: Comparison with Country-Level Nonfinancial Corporate FX Debt Estimates

	(1) Sample USD Debt/NFC FX Debt	(2) Sample USD Debt Ratio	(3) NFC FX Debt Ratio
Argentina	20.8	41.2	30.1
Brazil	27.2	22.4	14.1
Chile	46.3	51.1	31.8
Czech Republic	1.2	5.0	21.1
Hungary	3.7	23.9	27.2
India	14.8	6.8	9.4
Indonesia	17.1	49.8	53.8
Korea	14.2	9.5	10.6
Malaysia	38.7	12.3	10.8
Mexico	16.2	43.6	59.3
Philippines	31.9	34.9	26.4
Poland	6.3	16.7	17.7
South Africa	58.3	20.9	16.0
Thailand	27.1	12.8	14.5
Turkey	5.8	32.1	48.7
Total	20.7	26.2	27.0

Note: This table compares the total amounts of sample USD-denominated debt by country with the nonfinancial corporate FX debt estimates from the BIS statistics for the period of 2002–2017. See Adler and others (2020) for further details on the latter. Column (1) shows the share of sample USD-denominated debt in the BIS nonfinancial corporate FX debt estimates, column (2) the share of total sample USD-denominated debt in total sample nonfinancial corporate debt, and column (3) the share of FX debt in total total nonfinancial corporate debt from the BIS statistics, all by country and in percent.

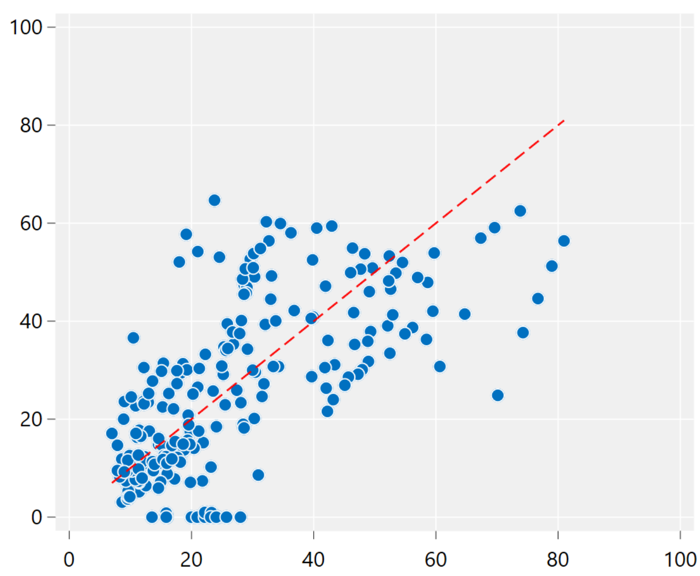

Figure A1: Correlation of Country-Year FX Debt Ratios

Data Cleaning

We cleaned the downloaded data by applying the following procedures:

- Drop all firm-year observations in which the difference between the sum of total liabilities and the equity and total assets is greater than US$10,000.
- Drop all firm-year observations in which the amount of cash and cash equivalents and that of tangible assets are greater than the total assets, respectively.
- Drop all firm-year observations with unexpected signs for capital expenditure, dividend payments, and interest payments, provided they have non-missing values[17].
- Drop all firms with a negative value for total assets in any given year.
- Drop all firms with no outstanding debt in any year.
- Drop all firm-year observations in which the difference between the sum of due amounts for individual debt instruments (downloaded from the Debt Capital Structure database) and the total principal due outstanding (downloaded from the main financial statements database) is greater than US$100,000.
- Drop all firm-year observations in which the outstanding debt denominated in individual currencies exceeds the total debt (for example, if the sum of U.S. dollar-denominated debt amount of a sample firm exceeds the firm's total debt amount).

Summary Statistics

Table A2 shows the summary statistics of the firm-level control variables used in our regression analysis. Two points are worth mentioning. First, with the minimum asset size of US$2 million, sample firms in this dataset are relatively large compared to other firm-level data used in the literature for studies on, for example, issues related to employment, investment, or other forms of corporate activity. This is not entirely surprising given the stringent reporting requirements on firms' outstanding debt for the purpose of this study. Second, the percentile statistics indicate that the majority of sample firms in fact do not hold any FX debt. The firms with no FX debt are likely to be small in size,

[17] In Capital IQ, these items are expected to have negative signs.

considering the fixed transaction costs associated with access to the dollar funding market and the information asymmetry problem facing small-size firms. Consistent with this prior, Figure A2 shows that larger firms hold higher shares of dollar-denominated debt in their balance sheets, and vice versa. This pattern hints that despite the relative small sample size, the dataset could be a representative sample for our purpose of understanding firms' debt currency decision, especially for firms already holding some FX debt.

Table A2: Summary Statistics: Firm-Level Variables

	Number of obs.	Min	Mean	25pct	Median	75pct	Max	Std.Dev.
Total assets (US, *millions*)	38,465	1.98	1,041.98	36.01	125.76	525.99	29,761.00	3,027.23
Total debt (US, *millions*)	38,465	0.01	319.80	5.62	26.95	133.44	16,834.18	1,051.77
Leverage (percent)	38,465	0.13	26.97	13.18	26.03	38.99	71.97	16.98
Tangibility (percent)	38,465	0.17	35.96	18.61	34.61	51.76	90.31	21.87
Return on assets (percent)	38,465	-11.77	4.54	1.68	4.19	7.16	20.94	4.73
USD debt/total debt (percent)	38,465	0.00	15.99	0.00	0.00	20.69	100.00	27.94

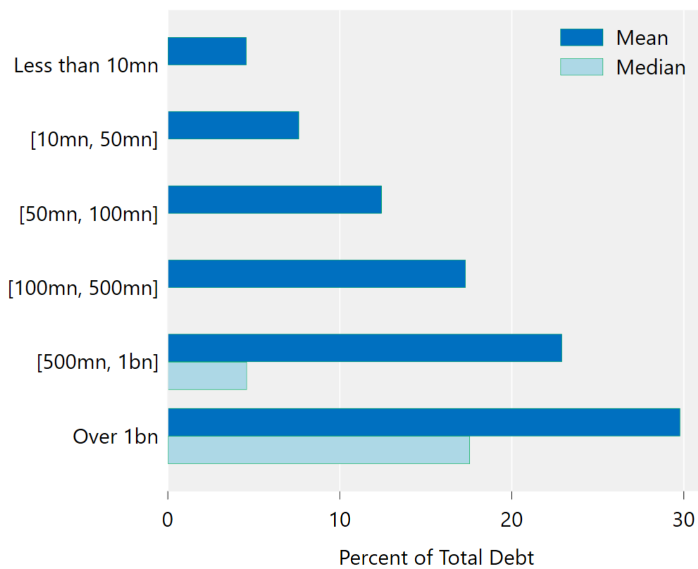

Figure A2: USD Debt Share By Asset Size

Details on Additional Variables

The list below provides further descriptions of firm-level and macroeconomic variables used in our regressions:

- *Tangibility.* Property, plant, and equipment, net of accumulated depreciation, divided by total assets. Source: Capital IQ.

- *Leverage.* Total debt divided by total assets. Source: Capital IQ.

- *Financial depth.* The data come from the Global Financial Development Database, series GFDD.DI.12: "Private credit by deposit money banks and other financial institutions to GDP (%)," converted to decimal form by dividing the original series by 100. Sources: IMF, International Financial Statistics, and the World Bank.

- *Interest differential.* The difference between local currency short-term interest rates and the three-month US dollar LIBOR as of December of each year. The short-term interest rate for each country is presented in Table A3. If available, 90-day interbank rates are used first over money market rates, followed by T-bill rates and short-term deposit or saving rates. Sources: IMF, International Financial Statistics; Haver Analytics; and national sources.

- *Real exchange rate depreciation.* Calculated as the end-of-year change (y/y) of the US dollar per local currency nominal exchange rate multiplied by $CPI_{local}/CPI_{USA}C$. Thus, a negative value of exchange rate depreciation indicates local currency depreciation against the US dollar. Sources: IMF, World Economic Outlook; and IMF staff estimates for Argentina CPI.

- *CPI inflation.* Average monthly CPI inflation (y/y) in each year of the sample period. Sources: Sources: IMF, World Economic Outlook; and IMF staff estimates for Argentina CPI.

- *CPI inflation volatility.* Calculated as the annualized standard deviation of monthly CPI inflation (y/y) over 12 months.

- *Export-to-GDP ratio.* The ratio of national exports of goods and services to annual nominal GDP, provided by the World Bank, World Development Indicators Database (series code: NE.EXP.GNFS.ZS.A).

- *Composite country risk rating.* An index ranging between 0 and 1, with 1 indicating the lowest risk (rescaled from the original index between 0 and 100). Source: International Country Risk Guide Database.

- *Real GDP per capita.* In PPP 2011 international dollars. Source: IMF, World Economic Outlook.

- *Imports, Nominal GDP in local and foreign currency.* Source: IMF, World Economic Outlook.

- *Broad Money, M2.* Source: IMF, International Financial Statistics, retrieved through Haver.

- *Net Foreign Assets of the Central Bank, NFA*. Source: IMF, Monetary and Financial Statistics.

- *Financial dollarization.* Share of deposits in foreign currency out of total banking system depostics. Source: IMF, Monetary and Financial Statistics.

- *CBOE Volatility Index (VIX).* Market's expectation of 30-day forward-looking volatility derived from S&P 500 index options. Source: Haver.

Table A2 shows the summary statistics of firm-level variables used in the benchmark regression.

The trade dummy variable is defined at the "industry-sector" level of Capital IQ's proprietary classification system, which includes 27 industries in the sample (Table A4).[18] To determine whether an industry is an export industry, we first collect information on export receipt for each firm-year pair from Capital IQ. Export receipt is identified as the part of a firm's revenue that contains keywords such as "Exports," "Overseas," or "Abroad" in the description of the geographical source of the revenue.[19] However, the set of sample firms for which this export receipt information is available is very limited, accounting for only about 20 percent of the sample in 2015. To overcome this data limitation, we instead construct an industry-level dummy using the industry-level export receipt-to-total revenue ratio from the subsample and define an industry as an "export industry" if this ratio exceeds 0.7.[20]

[18] To clarify, the industry classification used for industry fixed effects in the regression analysis is much more granular, consisting of 154 industries.

[19] The full list of keywords is available upon request.

[20] The seemingly high threshold is considering that our sample comprises relatively large firms, which generally have higher tendencies to export than small firms. As a result, we cannot rule out the possibility that an industry with a moderately high sample export-to-revenue ratio actually consists mostly of non-exporting firms. The regression results, however, are robust to different choices of the threshold between 0.6 and 0.9.

Table A3: Short-Term Interest Rates

Economy	Interest Rate	Series Code (Source)
Argentina	Saving deposit rate, 30-59 days	N213RS30 (Haver)
Brazil	Money market rate	223FIMM_PA.M (IMF, IFS)
Chile	Money market rate	228FIMM_PA.M (IMF, IFS)
Colombia	Money market rate	233FIMM_PA.M (IMF, IFS)
Czech Republic	Money market rate	935FIMM_PA.M (IMF, IFS)
Hungary	T-bill rate	944FITB_PA.M (IMF, IFS)
India	91-day T-bill rate	N534RG3M (Haver)
Indonesia	3m interbank rate	R536I3M (Haver)
Korea	Money market rate	542FIMM_PA.M (IMF, IFS)
Malaysia	Money market rate	548FIMM_PA.M (IMF, IFS)
Mexico	Money market rate	273FIMM_PA.M (IMF, IFS)
Peru	interbank interest rate	C293RI (Haver)
Philippines	Money market rate	566FIMM_PA.M (IMF, IFS)
Poland	Money market rate	964FIMM_PA.M (IMF, IFS)
Romania	Money market rate	968FIMM_PA.M (IMF, IFS)
Russia	3m interbank credit rates	N922RC3M (Haver)
South Africa	Money market rate	199FIMM_PA.M (IMF, IFS)
Thailand	Money market rate	578FIMM_PA.M (IMF, IFS)
Turkey	Deposit rate	N186RD3M (Haver)

Table A4: USD Debt Share By Industry

Export Industries (Trade=1)	Number of obs.	Mean	Median	Std.Dev.
Automobiles and Components	1,420	16.20	0.00	26.37
Capital Goods	6,881	13.10	0.00	25.16
Consumer Discretionary	48	10.68	0.00	22.93
Consumer Durables and Apparel	3,304	13.48	0.00	25.42
Consumer Staples	41	21.38	9.77	26.88
Energy	1,059	33.68	20.14	36.15
Food, Beverage and Tobacco	3,147	18.61	0.00	30.69
Health Care Equipment and Services	632	10.16	0.00	22.80
Household and Personal Products	344	18.13	0.00	28.93
Industrials	70	38.58	16.27	41.81
Information Technology	11	3.82	0.00	8.03
Materials	7,188	19.61	0.00	29.76
Pharmaceuticals, Biotechnology and Life Sciences	1,335	14.32	0.00	24.14
Semiconductors and Semiconductor Equipment	607	17.50	0.00	27.98
Technology Hardware and Equipment	1,429	15.16	0.00	28.31
Sub-total	27,516	16.76	0.00	28.25
Domestic Industries (Trade=0)				
Commercial and Professional Services	652	7.31	0.00	19.34
Communication Services	30	14.14	0.00	23.76
Consumer Services	1,253	12.35	0.00	25.16
Food and Staples Retailing	337	13.26	0.00	25.38
Health Care	4	2.88	0.00	5.77
Media and Entertainment	933	10.83	0.00	24.36
Real Estate	2,106	8.52	0.00	21.94
Retailing	995	10.05	0.00	21.94
Software and Services	1,149	13.43	0.00	28.36
Telecommunication Services	548	26.62	11.46	31.48
Transportation	1,438	22.08	0.00	33.68
Utilities	1,504	19.22	1.40	28.94
Sub-total	10,949	14.05	0.00	27.05

B Additional Tables and Figures

Table B1: First Stage of Instrumental Variable Regressions

This table presents the results of the first stage of the instrumental variable regressions in Table 2. The instrumented variables are FXI and all its interactions with financial depth and tradedness. The three exogenous variables are the ratio of the change in M_2 and GDP, the ratio of net foreign assets (NFA) to imports, the ratio of NFA to M_2. We also include all interactions of these variables with tradededness and financial depth. The row "F-test p-value" reports the p-values for the significance of the instruments. The p-value are close to zero, indicating that the instruments are overwhelmingly significant, and hence not weak. The standard errors, shown in brackets, are clustered at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) FXI	(2) FXI x Fin. Depth	(3) FXI x Trade	(4) FXI x Fin. Depth x Trade
ΔM_2/GDP	10.819***	16.942***	4.014***	11.027***
	[0.907]	[0.806]	[1.287]	[1.229]
ΔM_2/GDP x Financial Depth	−13.425***	−20.036***	−14.772***	−21.364***
	[0.790]	[0.728]	[1.421]	[1.439]
ΔM_2/GDP x Trade	−1.579**	−0.338	1.991*	−2.046*
	[0.755]	[0.694]	[1.173]	[1.084]
ΔM_2/GDP x Trade x Financial Depth	−0.404	−0.937	8.784***	12.006***
	[0.748]	[0.737]	[1.358]	[1.358]
NFA/Imports	0.032**	0.181***	−0.156***	−0.013
	[0.013]	[0.013]	[0.024]	[0.019]
NFA/Imports x Financial Depth	0.195***	0.032	0.620***	0.419***
	[0.019]	[0.020]	[0.037]	[0.032]
NFA/Imports x Trade	0.017	0.000	0.302***	0.219***
	[0.011]	[0.010]	[0.021]	[0.017]
NFA/Imports x Trade x Financial Depth	−0.033**	−0.009	−0.832***	−0.673***
	[0.016]	[0.016]	[0.039]	[0.035]
NFA/M_2	0.397***	−0.039*	0.443***	0.323***
	[0.024]	[0.023]	[0.043]	[0.034]
NFA/M_2 x Financial Depth	−0.229***	0.130***	−1.111***	−1.064***
	[0.037]	[0.037]	[0.077]	[0.070]
NFA/M_2 x Trade	−0.055***	−0.026*	−0.380***	−0.603***
	[0.017]	[0.016]	[0.035]	[0.030]
NFA/M_2 x Trade x Financial Depth	0.077***	0.042*	1.862***	2.079***
	[0.026]	[0.025]	[0.073]	[0.068]
Number of observations	38,177	38,177	38,177	38,177
F-test p-value	0.000	0.000	0.000	0.000
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Table B2: Robustness Test: Alternative Measures of FXI

This table presents Tobit regression results using the share of dollar debt in total debt as the dependent variable. Column (1) shows the results of the baseline regression in Table 1, column (4). Column (2) shows the results using an FXI intensity measure defined over a 3-year window instead of the baseline's two years; column (3) using the level of FXI to GDP instead of its volatility ratio; column (4) using the absolute level of FXI to GDP; and column (5) using the volatility of FXI. All other control variables are identical to Table 1, including the country, year, and industry fixed effects, although not shown to conserve space. The standard errors, shown in brackets, are clustered at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Baseline	(2) FXI (3y avg)	(3) FXI (level)	(4) FXI (abs. val, level)	(5) FXI (std)
FXI	0.361**	0.230	17.395**	7.712	0.919
	[0.146]	[0.165]	[6.863]	[6.467]	[5.257]
FXI × Trade(=1)	−0.541***	−0.544***	−16.581**	−17.102**	−12.471**
	[0.156]	[0.165]	[8.145]	[6.974]	[5.576]
FXI × Financial depth	−0.320**	−0.227	−15.046**	−6.149	−0.184
	[0.158]	[0.174]	[7.376]	[7.105]	[5.739]
FXI × Financial depth × Trade(=1)	0.360**	0.369**	9.419	13.176*	9.894
	[0.158]	[0.163]	[8.863]	[7.695]	[6.175]
Number of observations	38,465	38,465	38,465	38,465	38,465
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes

Table B3: Robustness Test: Alternative Specifications

This table presents regression results using the share of dollar debt in total debt as the dependent variable. Column (1) shows the results of the baseline regression in Table 1, column (4). Column (2) shows results applying a fractional probit regression (see Papke and Wooldridge, 2008), which deals with bounded but not truncated data as assumed in Tobit specifications. The two columns of (3) show results from a two-stage specification[21], where the first stage is a probit regression for the decision to borrow at all in FX (extensive margin) and the second stage a linear regression for the decision of how much to borrow in FX conditional on borrowing a non-zero amount in FX (intensive margin). All other control variables are identical to Table 1, including the country, year, and industry fixed effects, although not shown to conserve space. The standard errors, shown in brackets, are clustered at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Baseline	(2) Frac. Probit	(3) Two-Stage	
			First Stage (0/1)	Second Stage
FXI	0.361**	0.705**	0.656*	1.116**
	[0.146]	[0.301]	[0.398]	[0.520]
FXI × Trade(=1)	−0.541***	−1.176***	−1.117***	−1.891***
	[0.156]	[0.324]	[0.404]	[0.572]
FXI × Financial depth	−0.320**	−0.730**	−0.248	−1.460**
	[0.158]	[0.328]	[0.412]	[0.574]
FXI × Financial depth × Trade(=1)	0.360**	0.839**	0.695*	1.408**
	[0.158]	[0.327]	[0.401]	[0.574]
Number of observations	38,465	38,465	38,403	15,766
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Firm FE	No	No	No	No

Table B4: Further Robustness Tests

This table presents Tobit regression results using the share of dollar debt in total debt as the dependent variable. Column (1) reproduces the baseline specification from Table 1 for easier reference. Column (2) shows the results using FXI lagged by one year, column (3) using the observations excluding the GFC period, and column (4) using the VIX instead of year fixed effects. All other control variables are identical to Table 1, although not shown to conserve space. The standard errors, shown in brackets, are clustered at the firm level. The symbols ***, **, * denote statistical significance at the 1, 5, and 10 percent levels, respectively.

	(1) Baseline	(2) Lagged FXI	(3) Excl. GFC	(4) Incl. VIX	(5) Asymmetric FXI
FXI	0.361**	0.377**	0.321*	0.432***	0.394**
	[0.146]	[0.151]	[0.173]	[0.144]	[0.173]
FXI × Trade(=1)	−0.541***	−0.504***	−0.532***	−0.532***	−0.515***
	[0.156]	[0.157]	[0.169]	[0.155]	[0.167]
FXI × Financial depth	−0.320**	−0.370**	−0.279	−0.382**	−0.396**
	[0.158]	[0.164]	[0.179]	[0.155]	[0.189]
FXI × Financial depth × Trade(=1)	0.360**	0.377**	0.340**	0.357**	0.331**
	[0.158]	[0.161]	[0.168]	[0.158]	[0.160]
VIX				0.014	
				[0.051]	
Number of observations	38,465	28,182	28,513	38,465	23,560
Country FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes

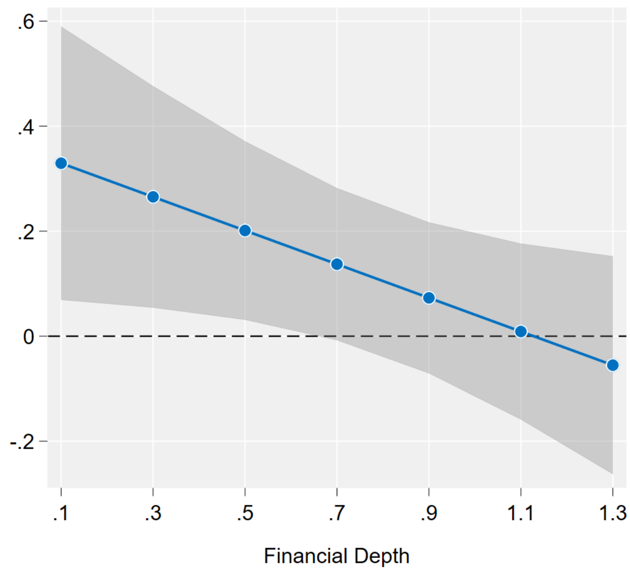

Figure B1: Marginal Effect of FXI on Latent Variable

Note: This figure presents the linear combination of coefficients involving FXI from Table 1 for non-exporting firms (Trade = 0) depending on their country's degree of financial depth, which represent the marginal effects of FXI on the latent variable in the tobit model of equation (2).