TÜRKİYE CUMHURİYET MERKEZ BANKASI

Exchange Rate Driven Balance Sheet Effect and Capital Flows to Emerging Market Economies

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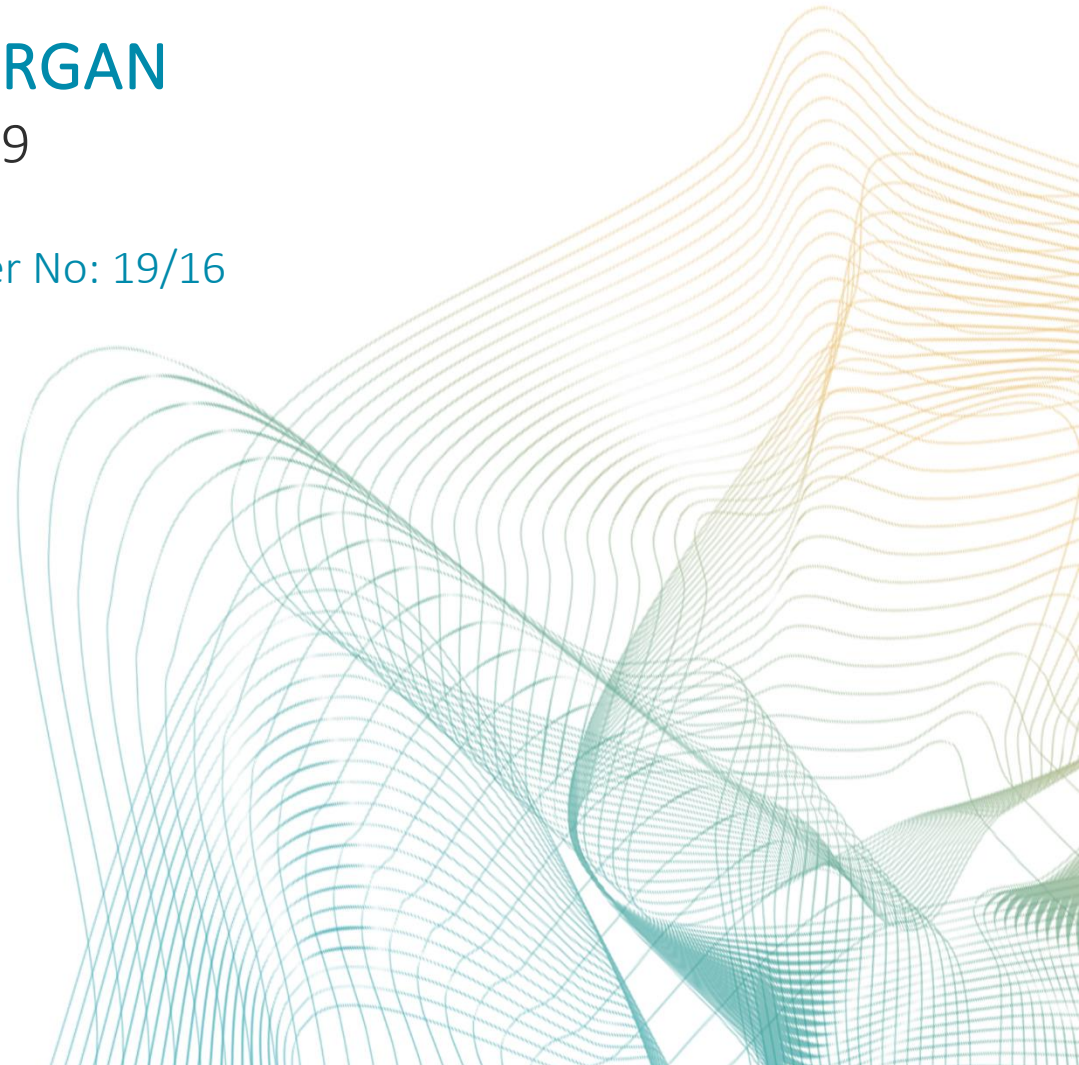

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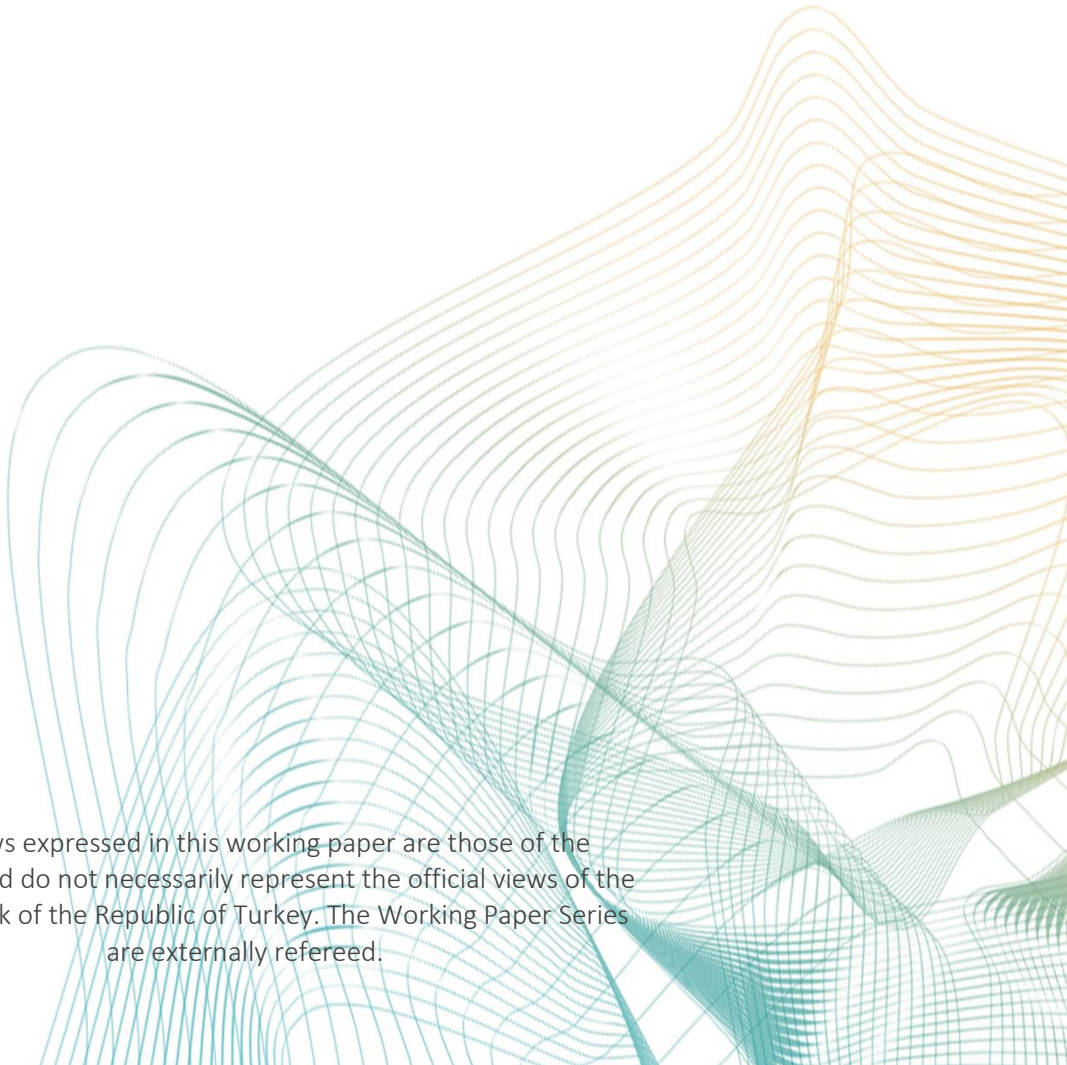

Exchange rate driven balance sheet effect and capital flows to emerging market economies

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Abstract

Turkish firm-level data suggests that firms borrowing from domestic banks have, on average, a higher degree of currency mismatch than firms with direct access to international financial markets. Higher FX exposure for the former group implies that their balance sheet are more likely to deteriorate when the local currency depreciates. This risk might in turn spillover onto creditors, potentially affecting the financial health of domestic banks. In a set of emerging market economies, I indeed find that when global liquidity tightens, domestic banks are more adversely affected by the above described channel, than firms with direct access to international financial markets. When the US$ index is countercyclical over the global credit cycle, countries whose foreign currency liabilities are heavily weighted in US$ experience a larger valuation effect. Using this variation to identify the exchange rate driven balance sheet effect, I find that banking sectors in countries heavily indebted in US$ have more difficulties accessing foreign funds when global liquidity tightens. In the same countries, this additional hindrance is however absent for firms with direct access to international financial markets. I develop a partial equilibrium model whose predictions are consistent with these results. The results favor the implementation of FX-related macro prudential policies during periods of abundant global liquidity. These policies should reinforce the financial stability of the banking system at a potential reversal of global funds.

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Non-Technical Summary

Following the Great Recession, low interest rates have rendered investment opportunities in Emerging Market Economies (EMEs) attractive. Amid these favorable global funding conditions, liquidity has flown to non-financial private sector balance sheets in EMEs. As advanced economies normalize their monetary stance, FX debt buildup in emerging market firms represents a threat to financial stability in EMEs. Turkish firm-level data suggests that firms borrowing from domestic banks have, on average, a higher degree of currency mismatch than firms with direct access to international financial markets. Higher FX exposure for the former group implies that their balance sheet are more likely to deteriorate when the local currency depreciates. This risk might in turn spillover onto creditors, potentially affecting the financial health of domestic banks.

In a set of emerging market economies, I indeed find that when global liquidity tightens, domestic banks are more adversely affected by the above described channel, than firms with direct access to international financial markets. Particularly, the exchange rate driven balance sheet effect of ultimate corporate borrowers impedes the access of domestic banks to foreign funds when global liquidity tightens. As to the firms with direct access to international financial markets, this channel has a limited effect on their access to foreign funds. Overall, the results highlight systemic risk as exchange rate fluctuations adversely affect domestic banks through corporate borrowers. The results further indicate a vicious cycle: Balance sheet adjustments by banks --- acting upon deteriorating corporate balance sheets --- generate fewer capital inflows, and further currency depreciation. The results favor the implementation of FX-related macro prudential policies during periods of abundant global liquidity. These policies should reinforce the financial stability of the banking system at a potential reversal of global funds.

1 Introduction

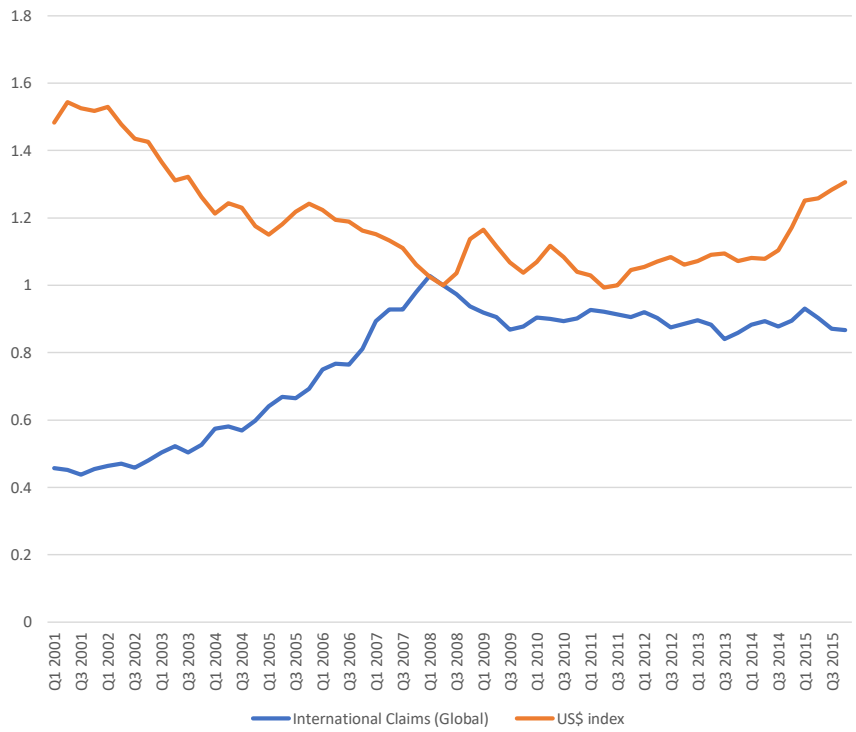
Following the Great Recession, interest rates kept near the zero lower bound in developed countries have rendered investment opportunities in Emerging Market Economies (EMEs) attractive. Amid these favorable global funding conditions, further reinforced by large scale asset purchase programs in developed countries, liquidity has flown to non-financial private sector balance sheets in EMEs (Avdjiev et al, 2014; Chui et al, 2016), rising the portion of debt denominated in foreign currency (Chui et al, 2014). Emerging market policy makers are worried about the Fed and central banks of other advanced economies reverting their monetary stance back to normal levels since that could trigger a tightening in global financial conditions. Particularly, a large local currency depreciation could magnify the upward pressure on the default risk of corporate borrowers subject to currency mismatch. In this paper, I investigate the importance of exchange rate driven balance sheet effect as a transmission channel of global liquidity. In a panel data set covering 16 EMEs, I use a novel strategy to disentangle the exchange rate driven balance sheet effect on subsequent aggregate capital inflows, thereby capturing the reaction of foreign lenders. I enrich the framework by exploring whether the effect differs by borrowing sector (i.e. cross border claims on the banking sector, and cross border claims on the corporate sector). This distinction provides an additional layer of identification since the ultimate corporate borrowers differ in terms of currency risk management. Particularly, firm level balance sheet information from Turkey indicates that the average ratio of export revenues to foreign currency liabilities is higher for firms with direct access to international financial markets than for firms borrowing exclusively from domestic banks. In the first part of the paper, I lay out a partial equilibrium model that takes into account this balance sheet difference of ultimate borrowers. Model simulations indicate that cross-border claims on banks are more sensitive to global liquidity conditions (via the accompanying local currency fluctuation) than cross-border claims on the corporate sector. In the empirical part, I find that the results are consistent with the predictions of the model.

It is difficult to know whether currency movements are the cause or the effect of capital inflows as they are jointly determined. The main contribution of this paper is to provide an identification strategy that teases out the exchange rate driven balance sheet effect on capital inflows, thereby overcoming the endogeneity between exchange rate movements and capital inflows.

For capital inflows, I use cross-border claims of global banks from publicly available Bank of International Settlements (BIS) data. Almost all cross-border claims on EMEs are in foreign currency, consisting exclusively of the US$, Euros, UK Pound, JPY, and CHF. The identification strategy uses country level differences in the foreign currency decomposition of claims, a layer of information recently made public by the BIS. The sample period (from 2007 through 2015) has been largely characterized by a negative relationship between the value of US$ and global liquidity conditions. Figure 1 depicts the US$ index along with international claims of BIS reporting banks on a global scale. US$ tends to appreciate during global financial downturns and tends to depreciate during upturns (A decrease in the real exchange rate is a real depreciation of the US$.) Bruno and Shin (2015a) relate this empirical regularity to US monetary spillovers on international financial markets. They find that a tightening shock to US monetary policy is followed

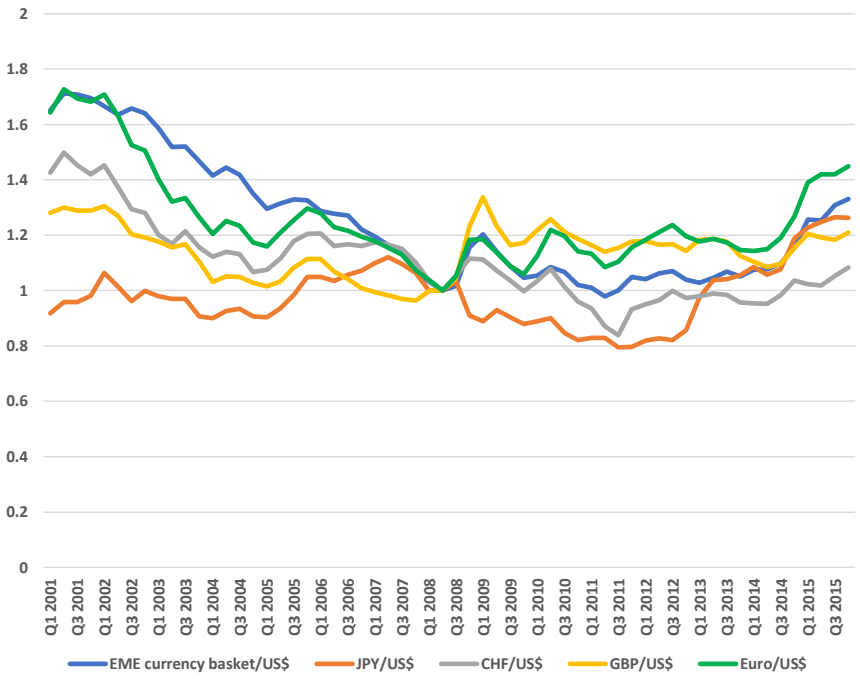
by a drop in cross-border banking sector flows as well as by the appreciation of the US$. Figure 2 shows the exchange rates of major currencies (i.e.,Euros, UK Pound, JPY, and CHF) as well as of emerging market currencies against the US$. The strong comovement of exchange rates implies that emerging market currencies will generally depreciate (appreciate) *more* against the US$ *than* against other major currencies when global liquidity tightens (expands) since other major currencies also depreciate (appreciate) against the US$. The valuation effect for liabilities should therefore be amplified in countries whose claims have a high share of US$. If the currency composition of the asset side of these borrowers do not match the liability side (i.e. if borrowers majorly hold local currency denominated assets), the amplification by a higher US$ share only happens on the liability side and leads to higher default risk. As a consequence, when global liquidity tightens, if ultimate borrowers are subject to currency mismatch, one should expect further retrenchment of foreign lending in countries whose foreign currency claims have a higher share of US$, due to higher corporate default risk. Indeed, cross-border claims on the banking sector are more sensitive to global liquidity conditions in these countries, thereby suggesting a strong exchange rate driven balance sheet effect for emerging market firms borrowing from domestic banks. In contrast, this effect is not significant in cross-border claims on the corporate sector. This difference is consistent with the predictions of the model where the currency composition of corporate balance sheets by lender type relied on firm level data from Turkey.

Figure 1: Global liquidity and US$ index



Notes: The US$ Index and International Bank Claims in Foreign Currency are scaled to 1 in 2008Q2. International Bank Claims in

Figure 2: Real exchange rates against the US$



Notes: Real exchange rates are scaled to 1 in 2008Q2.

The empirical part uses quarterly panel data covering 16 EMEs from 2007 to 2015. In order to capture the exchange rate driven balance sheet effect, I investigate the interaction effect between growth rate of global liquidity and the share of US$ denominated claims in total foreign currency claims. The identification scheme associates the importance of this interaction term in explaining subsequent capital inflows with the reaction of foreign lenders to default risk variations induced by exchange rate driven balance sheet effect. Controlling for *push* and *pull* factors[1], in a global liquidity tightening associated with a 1% hike in the federal funds rate[2], I find that a country with only US$ liabilities is expected to experience an additional 11% drop in cross-border flows to the banking sector relative to a country whose foreign currency liabilities are all denominated in other major currencies (i.e. Euros, UK Pound, JPY, and CHF). While this interaction effect is statistically significant across different specifications, the fact that cross-border credit growth has a standard deviation of 12.2% suggests that the exchange rate balance sheet effect is an important driver for cross-border flows.

The identification strategy assumes that US$ shares in foreign currency liabilities affects the sensitivity to global liquidity conditions *only* through the exchange rate driven balance sheet channel. The foreign currency choice when borrowing from international

[1] *Push* factors refer to supply-related determinants of capital inflows common to all EMEs whereas *pull* factors refer to demand-related determinants originating from country-specific fundamentals.

[2] For periods during which the federal funds rate is equal to zero (bound by the zero lower bound) I use the shadow federal funds rate estimated by Wu and Xia (2015).

markets might depend on time variant factors. If these time variant factors are related to capital inflows through another channel, it might render the identification spurious. One such potential channel is that wholesale funding market transactions are in US$ which could lead to a positive correlation between the US$ supply (and thus US$ shares) and global liquidity. Given the countercyclical value of US$, another potential channel is that a rational forward looking borrower might want to hold a higher (lower) US$ share ex ante global financial upturns (downturns). The fact that the US$ share seems to vary little within countries appeases these concerns. I however make the US$ share time invariant to eliminate any bias. More specifically, I divide the sample in five-year windows and use the share from the year before the initial year for that five year window. Another source of concern is whether there are country specific factors related to the US$ share that affect sensitivity to global liquidity conditions. For instance, there is a strong pattern in the currency composition of claims that can be attributed to regional proximity. EMEs close to Europe are more likely to borrow from European banks in Euros. This makes sense for hedging purposes as well since their exported goods are more likely to be priced in Euros. To account for these region specific differences in bank funding and in exports market, I control for interaction effects between region of the country and growth rate of global liquidity.

There are several transmission channels of international financial spillovers. Beyond the interest rate channel (i.e. through borrowing costs), the impact of external factors on domestic financial conditions can manifest in financial frictions either on the credit supply side (bank lending behavior) or on the credit demand side. On the demand side, asset price driven valuation effects can change the net worth of firms, in turn affecting borrowing constraints. I, on the other hand, focus on exchange rate driven valuation effects for corporate borrowers with a currency mismatch in the balance sheet. It is difficult to disentangle these transmission channels from one another while assessing their relative importance. Baskaya et al (2018) overcomes this challenge by using bank-firm-loan level (including balance sheet information) data from Turkey. They find that banks who are more exposed to foreign funding, charge relatively lower interest rates during episodes of low global uncertainty due to cheaper funding cost. While they show this 'interest rate channel' to be the main driver of aggregate credit movements, they find that the exchange rate driven balance sheet channel is still in works. Similarly, Hardy (2018) uses bank-firm-loan level (including balance sheet information) for listed firms in Mexico. He controls the interest rate channel using bank time fixed effects, and finds that smaller firms, who have low net worth and currency mismatch in the balance sheet, are the most vulnerable during an episode of large depreciation. The vulnerability of smaller firms is consistent with my findings (i.e. stronger exchange rate driven balance sheet effect for firms borrowing from domestic banks relative to firms borrowing directly from international markets) given that large corporations have access to international markets while firms that borrow from domestic banks tend to be smaller. These papers focus on individual countries and benefit from a bank-firm-loan level identification. My contribution is to maintain an identification for the exchange rate driven balance sheet effect while widening the question to a large set of EMEs. On that regard, the identification strategy relies on the fact that borrowers in countries whose foreign currency claims have a larger US$ share experience larger exchange rate driven valuation effects. Even though there is no particular reason why borrowers in

the same countries would also have lower net worth or would be more exposed to foreign funding, I control for the latter (i.e. the interest rate channel) in a way that is similar to Baskaya et al (2018). I take the ratio of foreign currency liabilities in total liabilities for financial intermediaries to capture country level differences in exposure to foreign funding, and interact it with the change in shadow federal funds rate. My results are robust to the inclusion of this interaction term.

Much of the analysis in this paper builds upon the seminal work in Bruno and Shin (2015b) . They lay out the theoretical framework for the transmission channel emphasized in this paper (i.e. through the exchange rate driven balance sheet effect of local firms); when the local currency depreciates, domestic banks are exposed to riskier local corporate borrowers subject to currency mismatch, which in turn lowers domestic banks' borrowing capacity from international financial markets. In a set of similar EMEs, they find that lagged real depreciation of the local currency is followed by a drop in cross-border claims on the banking sector. While consistent with the balance sheet effect, this correlation might admit another interpretation; a depreciation of the local currency could be associated with a subsequent drop in capital inflows through an announcement of future unloading of LSAP in advanced nations. The identification strategy I use removes this bias, and reiterates the same result (i.e. strong exchange rate driven balance sheet effect for claims on the banking sector). In addition, I extend the scope of Bruno and Shin (2015b) by adding cross-border claims on the corporate sector into the analysis, both in the model and empirically. Another extension is that I further validate the balance sheet channel by analyzing Turkish firm level balance sheet information. Consistent with the assumption in the model and with empirical results, this analysis suggests that Turkish firms borrowing exclusively from domestic banks have, on average, a relatively higher degree of currency mismatch than the ones borrowing directly from international financial markets.

The impact of currency fluctuations on capital inflows channeled by domestic banks not only sheds light on the balance sheet effect but also has important implications on financial stability. The reduction in foreign currency lending by risk elastic banks — acting upon deteriorating corporate balance sheets — imply fewer capital inflows, which in turn can lead to additional depreciation. This mechanism may trigger a dangerous feedback loop between capital flows and exchange rate variations, through the balance sheet effect (Bruno and Shin, 2015b). My paper provides a quantitative understanding of these risks and should inform policymakers on to what extent they should be concerned about a potential reversal of global funds and the concomitant feedback loops highlighted in the theoretical literature.

Overall, the foreign currency credit built up by the corporate sector causes concern for policy makers in EMEs. The exposure of international banks to EME assets could potentially disrupt financial stability on a global scale as financial markets are more integrated than ever, (CIEPR, 2015). The results suggest that the risk sensitive lending behavior of banks plays an important role in the propagation of exchange rate fluctuations. The main finding is that foreign currency loans channeled through domestic banks are more prone to default risk during episodes of large depreciation. This has important implications for policymakers in EMEs. They should further strengthen the prudential oversight of domestic banks by closely monitoring their clients' foreign currency exposure. In addition, capital controls on the foreign credit channel of the banking sector during

global financial upturns might pave the way to financially stable transitions when the global liquidity tightens.

Section 2 reviews further related literature. Section 3 describes the model with its key predictions. Finally, section 4 presents the empirical specification, the results, and its interpretations.

2 Other Related Literature

Consistent with the gradual integration of financial markets in recent decades, Calvo et al. (1996), and, Forbes and Warnock (2012) find that global ease of financing (also described as *push* factors, or credit supply) explains variations in capital inflows significantly better than domestic fundamentals (also described as *pull* factors, or credit demand). On the other hand, country-specific factors seem to grow in importance after the global financial crisis (Fratzcher, 2012; Cerutti et al, 2019; Amiti et al, 2018). Despite the mixed evidence, financial conditions across EMEs remain highly synchronized. Furthermore, the positive correlation between credit growth and current account deficits suggests that capital flows drive domestic credit cycles (Jorda et al., 2011). A surge in capital flows, domestic credit expansion, and the real appreciation of the local currency are robust ex-ante indicators of financial crises in Emerging Market Economies (Gourinchas and Obstfeld, 2012; Jorda et al, 2014). Beyond linking these indicators, the main finding of this paper (i.e. strong exchange rate driven balance sheet effect for the ultimate borrowers of capital inflows channeled through domestic banks) provides a story where they reinforce each other through a feedback loop; A global abundance of funds accompanied by the appreciation of local currency improves local corporate balance sheets. Domestic banks, faced with lower default risk, leverage up, and borrow more from foreign lenders (who are willing to lend given lower risks). An increase in capital inflows appreciates the local currency further, which in turn starts over the cycle, paving the way for a credit boom.

Problems that come with excessive foreign currency borrowing by EMEs are not new and the inability of these countries to borrow abroad in local currency has been termed *original sin* (Eichengreen and Hausmann, 1999). Eichengreen et al (2005) find that currency mismatches have significant effects on the real economy. As a result, this is not the first paper to imply that banks should strengthen their prudential oversight. Goldstein and Turner (2004), for instance, recommends banks in EMEs to effectively monitor their client's foreign currency exposures and to apply tighter credit limits on foreign currency denominated loans to customers that do not generate foreign currency revenues.

Exchange rate induced risk exists to the extent that there is a currency mismatch in balance sheets. Even though firms in financially developed industrialized countries can easily borrow in local currency, they can still suffer from a mismatch problem with foreign currency revenues, particularly exporting firms. There is a strand of literature that measures firm exposures to exchange rate induced risk in developed economies. Dominguez and Tesar (2006), Dominguez (1998) and Ito et al (2015) assess firm exposures by investigating the sensitivity of stock returns to currency fluctuations. This method, relying on the efficient market hypothesis, implicitly assumes that market agents are accurately

informed about firms' exchange rate exposure, and the sample is restricted to firms listed on the stock market. Results show that firms that do not use financial hedging are more exposed.

As for the methodology, the use of country heterogeneity in the currency composition of liabilities to identify the exchange rate driven balance sheet effect is reminiscent of Kashyap and Stein (2010) where they use bank heterogeneity in ratios of securities to assets to evaluate the bank lending channel of monetary transmission.

3 Motivation and context

3.1 Balance sheet differences of ultimate borrowers by capital inflow recipient sector

Within the framework of this paper's research question, the ultimate borrowers at the receiving end of capital flows are firms. Emerging market firms obtain loans from global banks directly and/or indirectly through domestic banks. Differences in ultimate borrower characteristics of these loans provide valuable information about exchange rate induced balance sheet effect. Firms with direct access to global funds are generally large. During 2013, the median and average issue size for Indian firms' foreign borrowing of 20 MN and 68 MN US$ respectively,[3] validate the size of firms borrowing directly from global banks. It is commonly known that most of exported goods and services are produced by large firms. By providing cash flows in foreign currency, exports counterweight the adverse balance sheet effect during the depreciation of the local currency. As international banks tend to follow their customers around the globe, it would be reasonable to think of these large firms as multinational corporations. With the help of subsidiaries, they naturally hedge with a well diversified income basket denominated in several currencies. In addition, easy access to financial instruments allows these large corporations to hedge against currency fluctuations, thereby reducing currency exposure. In contrast to firms with direct access to international markets, firms that borrow exclusively from domestic banks are probably smaller in size and might not be as connected with international markets. Admittedly it is not a clean cut, since firms tapping into international financial markets get funding from domestic banks as well. Using firm characteristics associated with size have suggestive information about currency mismatch. A further examination is however due in order to make claims about currency mismatch. I explore this thoroughly in the next section using firm level balance sheet information in Turkey.

Firm level balance sheet information in Turkey I merge three large micro data sets, all provided by Central Bank of Republic of Turkey (CBRT). The credit registry data collected by Banking Regulation and Supervision Agency (BRSA) provides various loan characteristics at the bank-firm-loan level, including the currency denomination of the loan. It also conveniently indicates whether the foreign currency loan is obtained from international financial markets. These direct loans from abroad are included in the

[3]Source: Summary statistics from External Commercial Borrowing Data shared on the RBI site

credit registry since domestic banks provide mediation services during the transaction. I match the credit registry data with firm level balance sheet data as well as a data set including firm level export revenues. The merged data set allows a detailed balance sheet comparison between firms that exclusively borrow from domestic banks and the ones with direct access to international financial markets.

The initial characterization of firms with direct access to international financial markets as larger firms with more export revenues is supported by firm level data in Turkey. While total assets of the median firm with direct access to international financial markets (out of 903 firms) is worth 55.9M US$, the median firm that exclusively borrows from domestic banks (out of 9726 firms) has a lower amount of total assets 14.1M US$. In addition, median annual export revenues are 0.4M US$ and 5.6M US$ for the former and the latter type, respectively. Consistent with these numbers, the majority of firms with direct access to international financial markets are exporters (89.8%) while the share of exporters is lower (68.2%) for firms that exclusively borrow from domestic banks.

While these statistics are insightful, balance sheet characteristics, FX bank loans and export revenues matched at the firm level allow a deeper analysis to investigate the extent of currency mismatch in corporate balance sheets. Since the balance sheet data does not inform on the currency denomination of firm assets and liabilities, I use firm level export revenues and FX bank liabilities as proxies, respectively. I put forth three indicators to capture the currency mismatch in corporate balance sheets. The first two, the exports to sales and the exports to total liabilities ratios, allow the comparison of the importance of exports across different sized firms. The last indicator, exports to FX liabilities ratio, proxies the coverage of foreign currency liabilities by foreign currency assets. FX bank loans should approximate foreign currency liabilities rather well since domestic banks provides around 80% of all credit used by the non-financial sector in Turkey[4]. In all three of the indicators, I compute the weighted average of the respective ratio across firms where firm weights are given by the firm's share in total bank credit given to firms of that type. These weights are meant to capture the credit allocation of firms as the ultimate objective is to assess the portfolio risk induced by exchange rate fluctuations. The following equation describes the construction the indicators where i denotes the firm and j denotes the firm type.

$$\text{Indicator}_j = \sum_{i=1}^{n} w_{ij} \cdot \text{ratio}_{ij}$$

$$\text{where } w_{ij} = \frac{\text{Foreign Currency Bank Credit of Firm } i \text{ of type } j}{\text{Total Foreign Currency Bank Credit of all Firms of type } j}$$

$$\text{where } j = \{\text{Firms with direct access to international financial markets;}$$
$$\text{Firms that exclusively borrow from domestic banks}\}$$

Table 1 compares firms that exclusively borrow from domestic banks with the ones with direct access to international financial markets using the indicators. The latter group of firms are relatively more export-oriented in sales as expected. Exports to total liabilities ratio describes the importance of exports relative to the size of the firm's balance sheet.

[4]Source: BIS and own calculations

As with the previous ratio, this indicator implies that exports constitute a relatively more important role for firms with direct access to international financial markets. Finally, the indicator that captures currency mismatch in balance sheets, exports to FX liabilities ratio, suggests that firms with direct access to international financial markets seem to match most of their foreign currency denominated liabilities with foreign currency assets. In contrast, the balance sheets of firms that borrow exclusively from domestic banks appear to be significantly more exposed to currency mismatch as exports make up only 51.7% of foreign currency bank liabilities.

Table 1

	Firms that exclusively borrow from domestic banks	Firms with direct access to international financial markets
Exports to Total Sales ratio (in%)	13.5	17.7
Exports to Total Liabilities ratio (in%)	22.4	36.7
Exports to FX Bank Liabilities ratio (in%)	51.7	86

3.2 The role of domestic banks in EMEs

Table 2 gives us two key insights on the role of domestic banks in providing foreign currency loans in EMEs. First, domestic banks are the major source of credit in EMEs. Second, the share of foreign currency loans in total bank credit is non-trivial.

Table 2

Average across EMEs	2013	2014	2015
Domestic bank credit/Total credit (in%)	81.6	82.1	82
Foreign currency loans/Total bank loans (in%)	21.8	23.1	24.5

Source: IMF – Financial Soundness Indicators

Notes: Total credit aggregates all lenders. Other than domestic banks, lenders include non-financial corporations, general government, central bank, households, and the rest of the world including internationally active banks. The ratio in second row uses the foreign currency and foreign-currency-linked part of gross loans to residents and nonresidents as the numerator and total gross loans as the denominator. The sample of EMEs include Argentina, Brazil, Chile, Colombia, Croatia, Czech Republic, Indonesia, Israel, Mexico, Poland, South Africa, Turkey, Ukraine

4 Model

The model motivates the specification of the empirical model. It highlights the same global liquidity transmission channel as in Bruno and Shin (2015b) – through the exchange rate driven balance sheet effect of local firms. When the local currency depreciates, domestic banks are exposed to riskier local corporate borrowers subject to currency mismatch, which in turn lowers domestic banks' borrowing capacity from international financial

markets. I however extend the scope of Bruno and Shin (2015b) by allowing some firms to borrow directly from international financial markets without having to borrow from domestic banks. This addition allows me to incorporate the fact that firms borrowing exclusively from domestic banks are more exposed to currency mismatch than firms with direct access to international financial markets, as described in the previous section. Model simulations for cross-border claims on the non-banking sector and for cross-border claims on the banking sector are taken to data in the empirical part. The empirical comparison of the former and the latter provides an additional layer of identification for the exchange rate driven balance sheet effect.

4.1 Firms

I categorize firms in emerging countries into local and global ones. The latter type have direct access to global banks for funds. Local corporates, on the other hand, borrow foreign currency denominated loans through domestic banks. Figure 3 is a diagram that shows funding relationships between agents in the model. As previously discussed, global firms have more advantages in hedging their currency risk than local firms. This is reflected in the model by local firms dealing with currency mismatch while global firms have their foreign currency liabilities matched by foreign currency assets. The underlying currency assumptions of flows and of agents' balance sheets are depicted in Figure 4. Note that currency assumptions of balance sheets are simplified for practical purposes. For instance, banks are assumed to have no currency mismatch whereas, banks may hold, up to a certain fraction of their equity, net open FX position. Furthermore, local firms are assumed to have a complete mismatch while global firms have none. In reality, some local firms might not have currency mismatch while some global firms might have. By simplifying, I can, without complication, emphasize balance sheet differences between former and the latter type of firms suggested Turkish firm-level data.

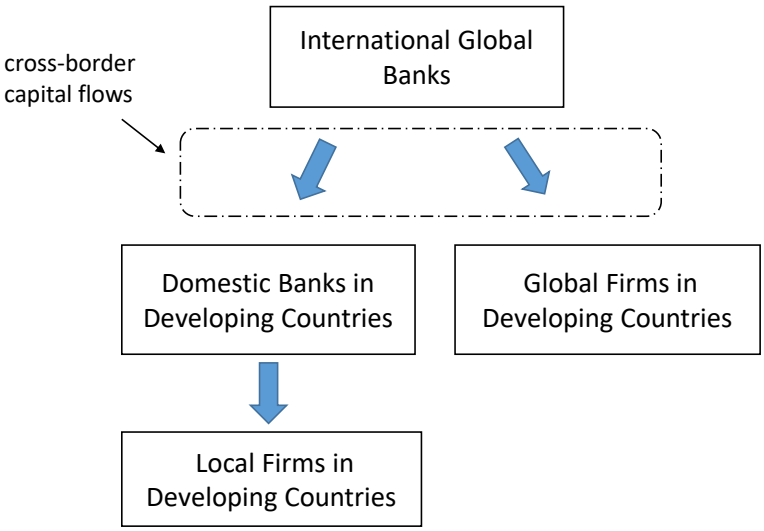
There is a continuum of local and global firms. r_{db} and r_{gb} denote interest rates charged by domestic and global banks, respectively. I assume that $r_{db} > r_{gb}$. A justifying microfoundation could be that domestic banks charge a premium for incurring costs in the process of channeling global funds. Because of cheaper funds, global firms always prefer to borrow from global banks. Local firms, on the other hand, only have access to domestic banks. This could be justified with a moral hazard story; The informational asymmetry between local firms and the global bank, as lender, is high to the point that local firms are not able to borrow from global banks. As a result, in equilibrium, domestic bank loans are exclusive to local firms while global banks non-banking sector loans are exclusive to global firms. An implicit assumption here is that global firms satisfy their demand for funds from global banks and do not need to borrow from domestic banks.

I denote aggregate credit demand by local and global firms by D_L and D_G, respectively. Aggregate credit demand for both firm types are ad hoc functions that are decreasing in the interest rate.

$$\frac{dD_L}{dr_{db}} < 0, \quad \frac{dD_G}{dr_{gb}} < 0$$

Each firm undertake a project with one unit of investment. The project gross returns

Figure 3: Flow of funds between agents in the model



depends on the type of firm. For a global firm i in country j, the gross return is

$$1 + x_{ij} = exp\{a - \frac{s^2}{2} + sw_{ij}\}$$

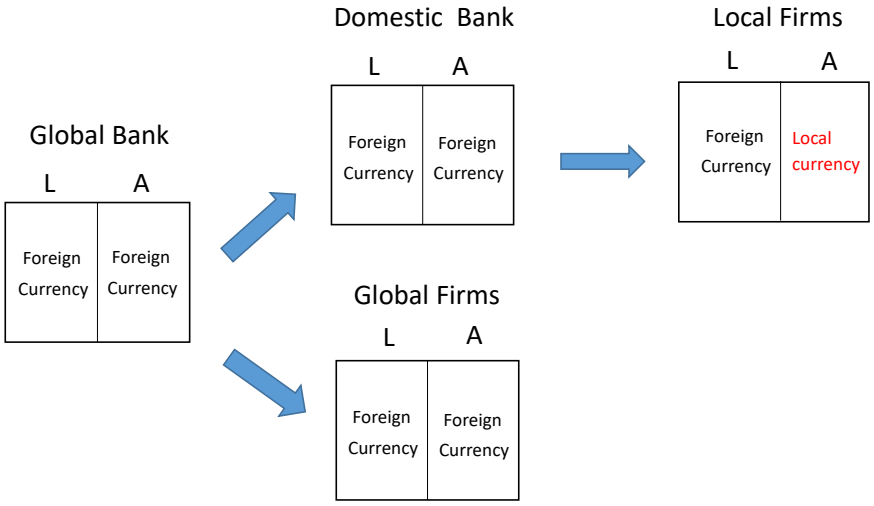
where x_{ij} denote the net project return in percentage point for global firm i in country j. $a - \frac{s^2}{2}$ is a constant term in the return, common to all firms. w_{ij}, the stochastic component of the return, is the aggregate shock. s is a parameter characterizing the standard deviation of w_{ij}.

For a local firm i in country j, the gross return is

$$1 + x_{ij} = exp\{a - \frac{s^2}{2} + sw_{ij} + \theta(r^w)\}$$

where x_{ij} denote the net project return in percentage point for local firm i in country j. $a - \frac{s^2}{2}$ is a constant term in the return, common to all firms. w_{ij}, the stochastic component of the return, is the aggregate shock. s is a parameter characterizing the standard deviation of w_{ij}. $\theta(r^w)$, the part of the return that depends on real exchange rate variations, is a function of r^w. r^w denotes the world interest rate at which the global bank funds itself and thus represents global liquidity conditions. As global liquidity tightening (expansion) is accompanied with the real depreciation (appreciation) of emerging market currencies, the model incorporates real exchange rate changes as a function of the world interest rate. For instance, $\theta(r^w)$ represents the impact of real exchange rate changes on local firm's balance sheet and is a function the world interest rate.

Figure 4: Currency of flows and balance sheets



The aggregate shock w_{ij} is decomposed in firm level, country level and global level shocks. The return distribution — division of the return to common and idiosyncratic parts — is similar to Vasicek (2002).

$$w_{ij} = \sqrt{\rho} y_j + \sqrt{1-\rho} v_{ij}$$

where

$$y_j = \sqrt{\beta} G + \sqrt{1-\beta} k_j$$

v_{ij} denotes firm level idiosyncratic shock for firm i in country j. k_j denotes the country level shock common to all firms in country j. G denotes the global shock common to all countries. v_{ij},k_j and G are mutually independent standard normal random variables.

4.2 Domestic bank

The balance sheet identity for domestic banks is given by the following equations, before and at maturity, respectively.

$$C_{db} = E_D + L$$
$$C_{db}(1 + r_{db}) = E'_D + L(1 + r^f)$$

On the asset side, C_{db} is the portfolio of loans to local firms. On the liabilities side, E_D and L denote equity and loans procured from the Global bank, respectively. The initial

equity, E_D is given exogenously. While the domestic bank borrows at a rate of r^f from the global bank, it lends to local firms at a rate of r_{db}. Let us define φ as debt to assets ratio at maturity. The higher φ is, the higher the leverage.

$$\varphi = \frac{L(1+r^f)}{C_{db}(1+r_{db})}$$

4.2.1 Credit risk for Domestic Bank and the bank's leverage decision

Local firms default when loan repayment exceeds project return. Let ϵ^L denote the probability of default for local firms.

$$\epsilon^L = \Phi\left(\frac{ln(1+r_{db}) - a - \theta(r^w) + \frac{s^2}{2}}{s}\right)$$

where $\Phi()$ is the cdf for standard normal distributions. Real appreciation of the local currency improves the project return in foreign currency units – shown in the above equation with an increase in $\theta(.)$ – and thus lowers the default probability.

The domestic bank lends to a continuum of local firms. Credit risk is characterized as in Vasicek (2002). By the law of large numbers, domestic bank's portfolio diversifies away from idiosyncratic shocks at the firm level. The domestic bank is however exposed to the common risk factor in firms' returns, y_j. Since banks have no recovery value when firms default, the realized value of the loan portfolio is simply equal to the share of firms that have not defaulted.

Let ω, a random variable, denote the realised value of a loan portfolio with face value of 1 dollar. It is a function of y_j.

$$\omega(y_j) = \Phi\left(\frac{\sqrt{\rho}y_j - \Phi^{-1}(\epsilon^L)}{\sqrt{1-\rho}}\right)$$

The initial equity, E_D is given exogenously. I calibrate the model parameters such that bank's expected profit is increasing in loans intermediated to borrowers (L). The bank would preferably leverage its capital infinitely.

The debt-to-assets ratio, φ, or equivalently the leverage $1/(1-\varphi)$, is constrained by the Value-at-Risk rule. Value-at-Risk rule, herein after denoted VaR, consists of keeping the leverage so that the bank's probability of default on its liabilities does not exceed a fixed probability, α. Given α, ρ and ϵ^L, VaR rule pins the leverage (φ) down by the following equation[5];

$$\varphi = \Phi\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha) - \Phi^{-1}(\epsilon^L)}{\sqrt{1-\rho}}\right) \tag{1}$$

The debt-to-assets ratio is decreasing in ϵ^L, which is consistent with procyclical leverage. The higher default probability of local firms, the lower the leverage of domestic banks is.

[5]The derivation of Equation (1) is shown step by step in Appendix A.

4.3 Global Bank

The balance sheet identity for global banks is given by the following equations, before and at maturity, respectively.

$$C_{gb} + C_f = E_G + M$$
$$C_{gb}(1 + r_{gb}) + C_f(1 + r^f) = E'_G + M(1 + r^w)$$

On the asset side, the portfolio of loans is allocated between global firms, C_{gb} and domestic banks, C_f. On the liabilities side, E_G and M denote equity and loans procured from wholesale funds market, respectively. The initial equity, E_G is given exogenously. The global bank borrows at a rate of r^w from wholesale funds market. It lends to domestic banks at a rate of r_{gb} and to global firms at a rate of r^f. Let us define ψ as debt to assets ratio of global banks at maturity.

$$\psi = \frac{M(1 + r^w)}{C_{gb}(1 + r_{gb}) + C_f(1 + r^f)}$$

4.3.1 Credit risk for Global Bank's portfolio

Global bank's portfolio consists of domestic banks and global firms. Credit risk is first analytically found for each borrowing sector. The implied credit risk for the combined portfolio is shown subsequently.

Credit risk of domestic banks The VaR rule implies that the default probability of domestic banks is fixed to α. The global bank lends to a continuum of domestic banks, each in a separate country. By the law of large numbers, global bank's portfolio diversifies away from idiosyncratic shocks at the country level, k_j. The global bank is however exposed to the common global risk factor, G. Since global banks have no recovery value when regional banks default, the realized value of the loan portfolio is simply equal to the share of regional banks that do not default.

The share of regional banks that do not default, $\omega_f(G)$, is a function of the global risk factor, G.

$$\omega_f(G) = \Phi\left(\frac{\sqrt{\beta}G - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right)$$

Credit risk of global firms Global firms default when loan repayment exceeds project return. Let ϵ^G denote the probability of default for global firms.

$$\epsilon^G = \Phi\left(\frac{ln(1 + r_{gb}) - a + \frac{s^2}{2}}{s}\right)$$

Note that global firms do not have the component in the return that depends on currency movements, $\theta()$. The global bank lends to a continuum of global firms in a continuum

of countries. By the law of large numbers, global bank's portfolio diversifies away from idiosyncratic shocks at both firm and country level. The global bank is however exposed to the common global risk factor, G. Since there is no recovery value when firms default, the realized value of the loan portfolio for the part that is allocated to the global firms is simply equal to the share of firms that have not defaulted.

Let $\omega_g(G)$, a random variable, denote the realised value of the loan portfolio for the part that is allocated to the global firms, with face value of 1 dollar. It is a function of G.

$$\omega_g(G) = \Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}G - \Phi^{-1}(\epsilon^G)}{\sqrt{1-\rho\beta}}\right)$$

Credit risk of the combined portfolio The share of loans that do not default in the aggregate portfolio is a linear combination of $\omega_f(G)$ and $\omega_g(G)$. Let us denote the face value shares of loans to domestic banks and to global firms in the aggregate portfolio λ and $1-\lambda$,respectively.

Let ω_g, a random variable, denote the realised value of the aggregate portfolio with face value of 1 dollar.

$$\omega_g(G) = \lambda'\Phi\left(\frac{\sqrt{\beta}G - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda')\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}G - \Phi^{-1}(\epsilon^G)}{\sqrt{1-\rho\beta}}\right)$$

4.3.2 Global bank leverage

The initial equity, E_G is given exogenously. I calibrate the model parameters such that bank's expected profit is increasing in loans intermediated to borrowers (C). The bank would preferably leverage its capital infinitely. However, the global bank, similar to domestic banks, follows the VaR rule, and thus keeps its leverage so that the bank's probability of default on its liabilities does not exceed a fixed probability, α_g. Given α,α_g, ρ,β and ϵ^G, VaR rule pins the leverage (ψ) down[6];

$$\psi = \lambda'\Phi\left(\frac{\sqrt{\beta}\Phi^{-1}(\alpha_g) - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda')\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}\Phi^{-1}(\alpha_g) - \Phi^{-1}(\epsilon^G)}{\sqrt{1-\rho\beta}}\right) \tag{2}$$

For the special case where $\alpha = \alpha_g$

$$\psi = \lambda'\Phi\left(\frac{\left(\sqrt{\beta}-1\right)\Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda')\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}\Phi^{-1}(\alpha) - \Phi^{-1}(\epsilon^b)}{\sqrt{1-\rho\beta}}\right) \tag{3}$$

The debt-to-assets ratio, ψ, or equivalently the leverage $1/(1-\psi)$, is decreasing in ϵ^G and α, which is consistent with procyclical leverage.

4.4 Equilibrium

Global bank's portfolio is allocated between global firms and domestic banks, with face value shares of $1-\lambda$ and λ, respectively. Let us denote global bank's net returns to

[6]The derivation of equations (2) and (3) is shown step by step in Appendix A.

lending to global firms and to domestic banks by π_f and π_{gb}, respectively. At the optimal allocation, the global bank is indifferent to lending to either borrower[7]. Furthermore, interest rates r_{db},r_{gb},r^f adjust and clear the financial markets. In equilibrium, the following conditions are satisfied.

$$C_{db} = D_L$$

$$C_{gb} = D_G$$

$$C_f = L$$

$$\pi_f = \pi_{gb}$$

4.5 Model Simulation: Behaviour of cross-border flows amid changing global liquidity conditions

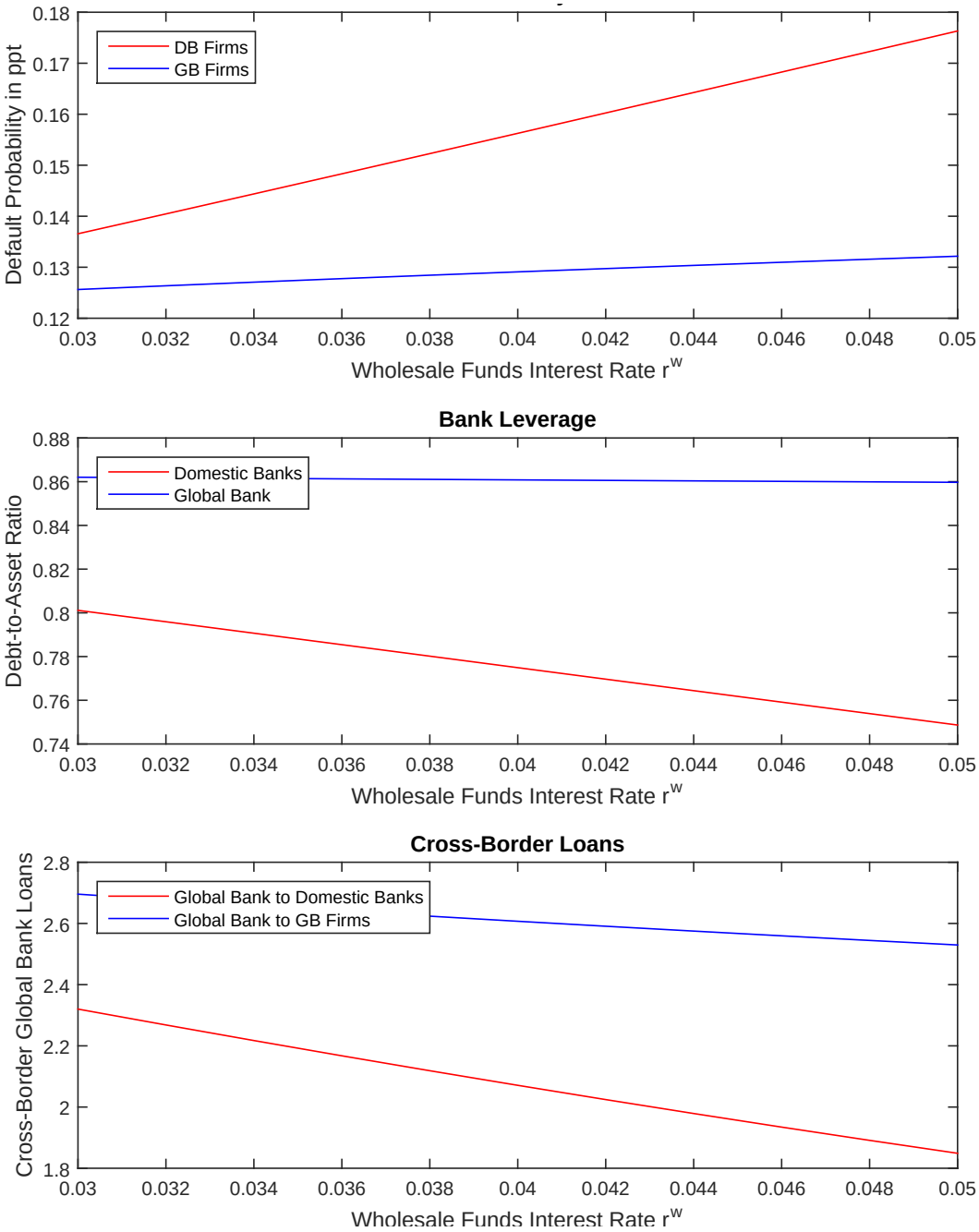
The world interest rate, r^w, reflects global liquidity conditions. An increase in the world interest rate results in less funds available for domestic banks and global firms, putting an upward pressure on interest rates they get charged. A rise in r_{gb} and r_{db}, in turn, make firms more likely to default. This mechanism is highlighted with the positive slope on default probability curves for both local and global firms in the upper panel of Figure 5. The relative steepness of the default probability curve for local firms comes from the exchange rate driven balance sheet effect. Since local firms are exposed to currency mismatch, the depreciation of the local currency against foreign currencies causes a larger increase in the default probability of local firms during a global financial downturn.

VaR rule followed by banks requires deleveraging as their portfolio gets riskier. The middle panel illustrates the deleveraging process of both domestic banks and the global bank. While the formers' portfolio is composed of local firms, the latter lends to a combination of global firms and domestic banks. The additional sensitivity of local firms – because of the exchange rate driven balance sheet effect – causes domestic banks to deleverage more than the global bank when the global liquidity tightens.

Finally, changes in leverage have a quantitative impact on loans coming in and out of banks. Domestic banks deleverage in order to keep its own default probability fixed, as implied by the VaR rule. This leads to a significant decrease in demand of loans from the global bank. As a result, when r^w goes up, the reduction of cross-border loans from the global bank is greater for domestic banks than for global firms. In other words, currency fluctuations in tandem with global credit cycles magnify the relative drop in cross-border bank-to-bank flows.

[7]Appendix A show the analytical formulas for the corresponding net returns.

Figure 5: Changing global liquidity conditions



5 Empirical analysis

5.1 Identification strategy

Given the recent build up of foreign currency credit by emerging market firms, this paper investigates exchange rate risks induced by currency mismatches in corporate balance sheets. The depreciation of the local currency accompanying a drop in capital inflows will

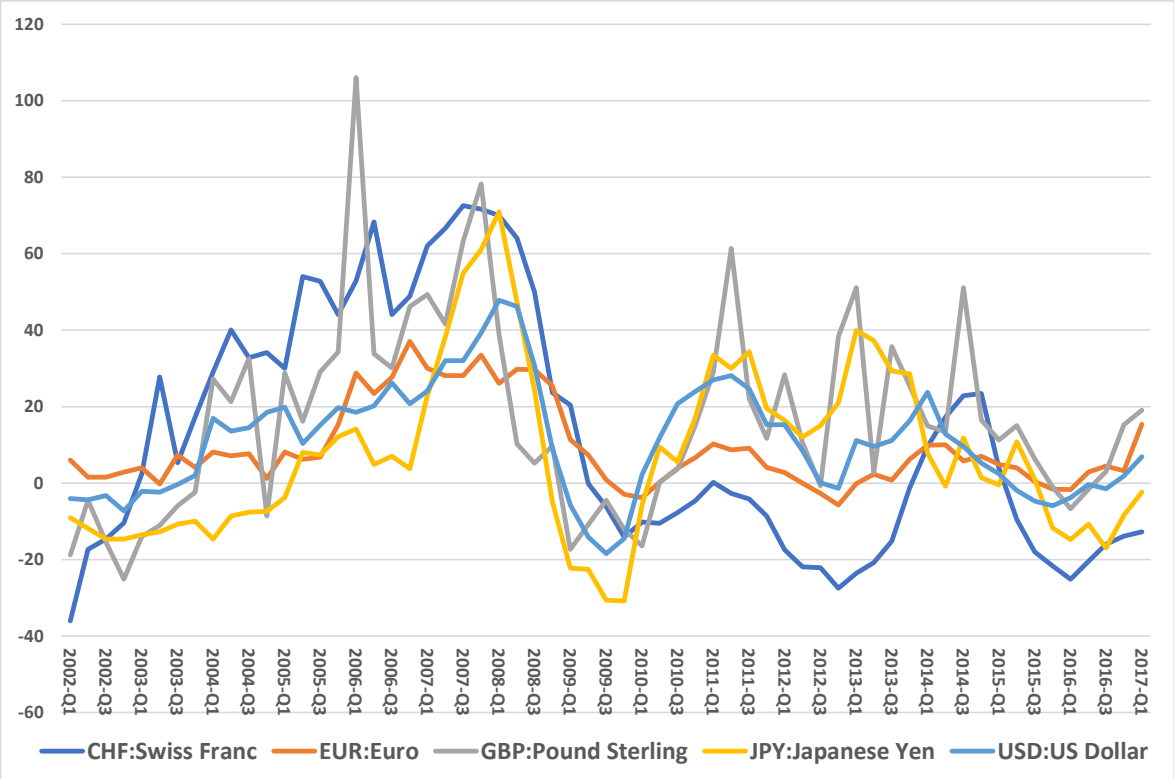
cause an upward pressure on the default risk of corporate borrowers subject to currency mismatch (i.e. borrowers whose liabilities are denominated in foreign currency and assets in local currency). The main contribution of this paper is to disentangle the exchange rate driven balance sheet effect on capital inflows. Dealing with deteriorating balance sheets of ultimate borrowers, this paper thereby captures whether foreign investors (global banks in this case) amplify their response, that is whether they reduce loans even further when global liquidity tightens.

The identification strategy exploits heterogeneous responses coming from country level differences in the US$ weight in the currency composition of foreign currency liabilities. The value of US$ against *all* currencies, including other major foreign currencies (i.e. Euros, UK Pound, JPY, and CHF), is generally countercyclical over global credit cycles. This implies that when global liquidity tightens, emerging market currencies depreciate even more against the US$ than against other major foreign currencies. From the perspective of firms with foreign currency liabilities and local currency assets, a higher US$ share in foreign currency liabilities amplifies the valuation effect in the liabilities side (i.e. more positive during global financial upturns, and more adverse during downturns).

Despite US$ being the predominant currency in global markets, non-US$ foreign currencies hold a non-trivial share in cross-border claims on emerging economies. The average shares in the sample (16 EMEs from 2007 to 2015) for Euros, JPY, CHF and UK Pound denominated claims are approximately 18%, 7%, 2%, and 1%, respectively, while the remaining 72% of cross border claims are denominated in US$. Note that a very small amount of cross-border claims on emerging economies are denominated in the local currency of the host country.

Figure 6 illustrates annual growth rates of cross-border claims on developing countries by currency. Aggregate loans denominated in different currencies have conspicuously similar trends. When claims on developing countries tighten, they do in all currencies. It appears as global liquidity conditions spill over across loans denominated in different currencies. This could be explained as such; a global abundance of US$ liquidity should initially push the interest rate of US$ loans down. The resulting interest rate gap should then push arbitrageurs to borrow in US$ and lend in other currencies. This arbitrage, by lowering the interest rate gap, should in turn propagate the abundance of liquidity to all currencies.

Figure 6: Y-o-Y Growth rate of cross-border claims on developing countries by currency



While loan quantities to EMEs do not seem to behave differently by currency, US$ diverges from other currencies when it comes to exchange rate. Figure 1 shows that the value of the US$ is countercyclical over global credit cycles. Beyond the information provided by a weighted average (the US index), Figure 2 informs us that the countercyclicality of US$ holds against individual currencies. To further reinforce this observation, high positive correlations in Table 3 highlights the strong comovement of real exchange rates against the US$. Furthermore, Figure 11 in the appendix shows how these variables relate to each other using an alternative global liquidity indicator (i.e. Global international bank claims to world GDP ratio). By investigating whether their growth is positive or negative over time, it further reiterates the countercyclicality of the US$. During periods of global liquidity expansion, EME currencies, Euros, UK Pound, JPY, and CHF all tend to appreciate against the US$ while they depreciate during episodes of global liquidity tightening. From the perspective of emerging market currencies, they depreciate and appreciate more against the US$ over cycles than they do against other major foreign currencies. The identification is based on this regularity as it explains why a high US$ share amplifies the valuation effect in foreign currency liabilities. If there is exchange rate driven balance sheet effect, it should thus be stronger for countries whose foreign currency liabilities have a higher US$ share.

Table 3: Correlations of real exchange rate growth rates

	US$ Index	$\Delta RER^{US\$}_{CHF}$	$\Delta RER^{US\$}_{GBP}$	$\Delta RER^{US\$}_{€}$	$\Delta RER^{US\$}_{JPY}$
$\Delta RER^{US\$}_{EME}$	0.973	0.666	0.596	0.837	0.346

In the model, global liquidity is captured by the world interest rate. Particularly, abundant global liquidity conditions – expressed with a low world interest rate – leads to a surge in capital flows to emerging market economies. The world interest rate is commonly proxied by the US federal funds rate. However, when constrained by the zero lower bound, the federal funds rate fails to capture variations in global liquidity. In order to overcome this issue, shadow federal funds rate is used instead. The strong correlation between cross-border global claims on EMEs and the shadow federal funds rate in Figure 7 validates the choice of the latter as the global liquidity indicator. The corresponding negative correlation, shown in Table 4, remains as high as -0.57. Table 4 puts the positive correlation between the shadow federal funds rate and the US$ index to as high as 0.606. Figure 8 illustrates this correlation and thus highlights that the countercylicality of the US$ is at its highest during the selected periods. Carrying out the empirical investigation in these periods would therefore strengthen the identification channel.

Figure 7: Global liquidity indicator for EMEs: Shadow Federal Funds Rate

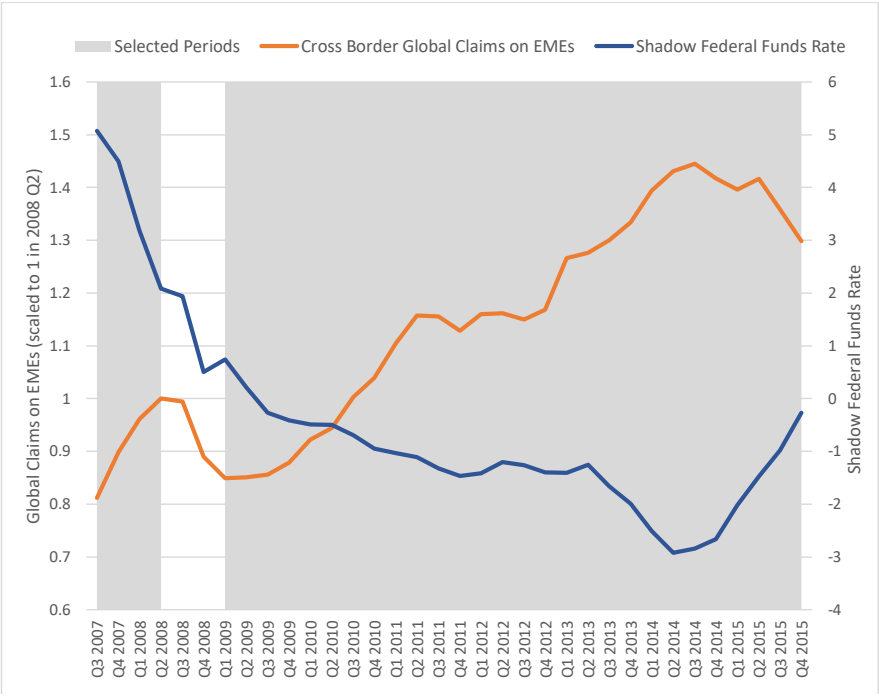


Figure 8: Shadow Federal Funds Rate and US$ index

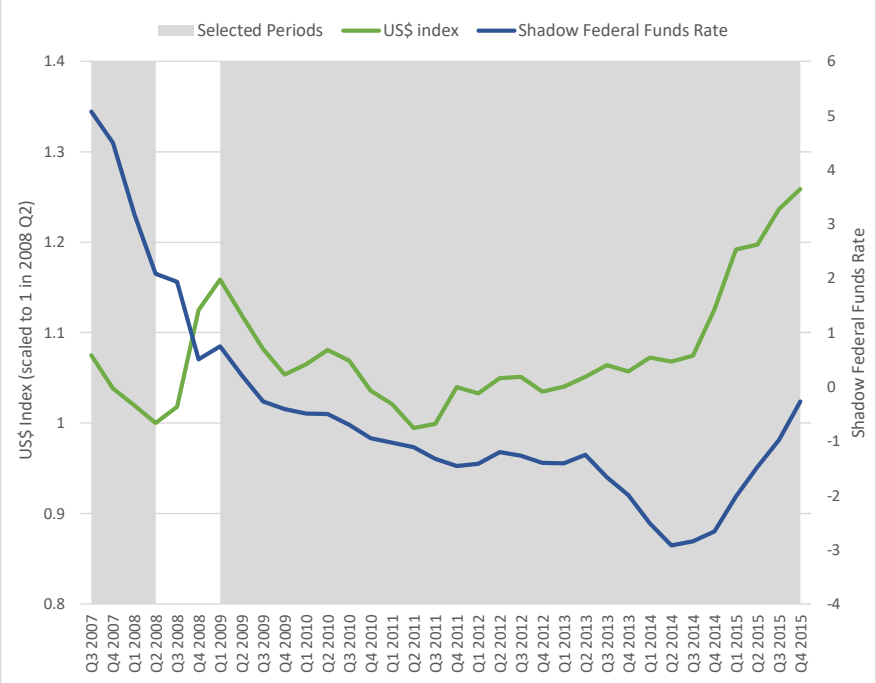


Table 4: Global Liquidity indicator and the countercyclicality of the US$

	Δ Cross-Border Claims on EMEs	US$ Index
$\Delta r^w(\Delta r_{us}^{sha})$	-0.57	0.606

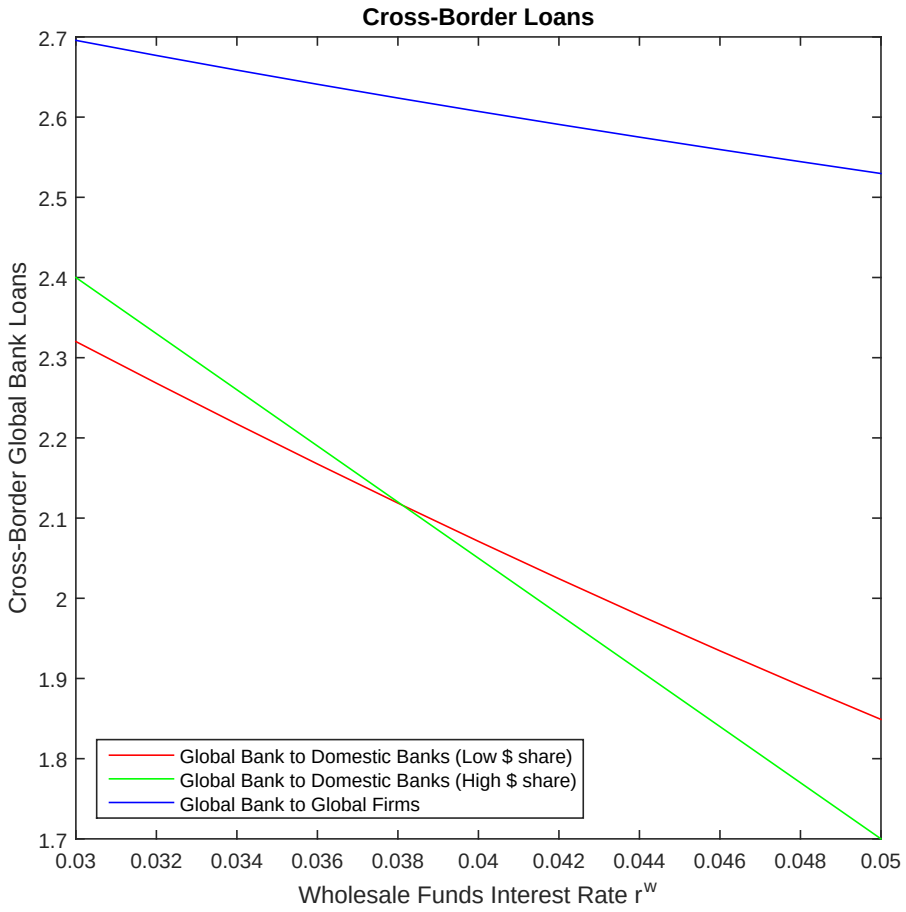
5.2 Model Implications

To better understand the identification strategy, this section explains its concept within the framework of the model. Below is the formula for the default probability of local firms (ϵ^L) taken from the model.

$$\epsilon^L = \Phi\left(\frac{ln(1+r_{db}) - a - \theta(r^w) + \frac{s^2}{2}}{s}\right)$$

Local firm's default risk depends on r_{db}, the loan interest payment to domestic bank, and on other terms relating to the project return of the local firm. $\theta(r^w)$ is the term representing the valuation of foreign currency liabilities with respect to local currency denominated project return. This term is a function of r^w, the world interest rate, since the exchange rate depends on capital inflows, which in turn depends on global liquidity conditions. An episode of global financial downturn (i.e. a hike in the world interest rate)

Figure 9



depreciates the local currency leading to an adverse valuation effect.

$$\frac{d\theta(r^w)}{dr^w} < 0$$

The identification strategy exploits cross-country differences in the currency decomposition of foreign currency liabilities. As shown in the previous section, a higher US$ share in the composition of foreign currency liabilities (denoted by $w^{\$}$) magnifies the valuation effect.

$$\frac{d^2\theta(r^w)}{dr^w dw^{\$}} < 0$$

As to the implications for capital inflows, model simulations in Figure 9 highlight heterogeneous responses in countries with different US$ shares. Varying degrees of currency exposure in aggregate balance sheets result in relatively more sensitive cross-border claims on domestic banks in the country with the higher US$ share. Note that the balance sheets of global firms are not exposed to currency mismatch. That is why the responses of countries with different US$ shares do not differ for cross-border claims on the corporate sector.

5.3 Endogeneity concerns

The identification strategy assumes that US$ shares in foreign currency liabilities affects the sensitivity to global liquidity conditions *only* through the exchange rate driven balance sheet channel. One source of concern is whether there are other channels linked with the US$ share that might influence a country's sensitivity to global liquidity conditions. Figure 10 scatter plots the share of US$ in the currency composition of BIS reporting global banks' cross-border claims by counterparty country. The scatter plot subgroups countries by region and by period. The first striking feature is that US$ shares are clustered by region. For instance, the majority of claims on Latin American countries are denominated in US$. On the other hand, EMEs in Asia Pacific and other parts of the world tend to borrow less in US$. EMEs close to Europe are more likely to export goods and services to European Union. Strong trading relations, caused by geographical and/or cultural proximity, might further be reinforced by economic partnership agreements. The heavy use of Euros in transactions in turn rationalizes borrowing in Euros (probably from European banks due to regional proximity) for hedging purposes. This might potentially be a problem if some regions are structurally more vulnerable to global liquidity conditions. In order to remove any region related bias in the empirical specification, I interact region with global liquidity growth. The downside of adding this interaction term is that it captures the part of the balance sheet effect explained by regional differences in the US$ share, thereby weakening the identification channel. In the specification that includes this interaction term, the balance sheet effect is thus identified from within region variations in the US$ share. Even after controlling for regional factors, there might still be fundamental differences in the financial integration between countries relying on US$ and those relying on other foreign currencies, that are not accounted for. For instance, if lenders who lend more in US$ are systematically negatively impacted following a US$ appreciation period, the balance sheet effect can not be fully identified using US$ shares. It is unfortunately quite difficult to control for such supply effects in a cross-country setting.

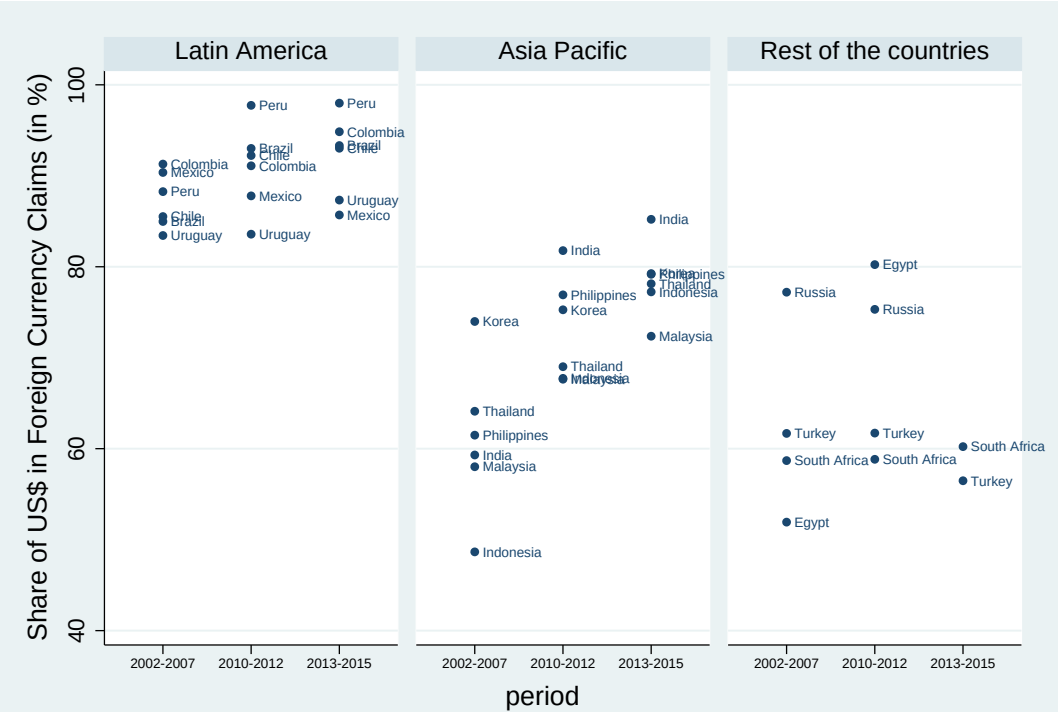
In addition, the US$ share in foreign currency liabilities might depend on time variant factors. If these factors are in turn related to capital inflows through channels other than the exchange rate driven balance sheet effect, the identification might be biased. One such channel is the fact that wholesale funding transactions are in US$ which could create a positive correlation between the global US$ supply (and thus country specific US$ shares) and global liquidity. Given the countercyclical value of US$, another potential channel is that a rational forward looking borrower might want to hold a higher (lower) US$ share ex ante global financial upturns (downturns). The fact that the US$ share seems to vary little within countries appeases these concerns. I however make the US$ share time invariant to eliminate any bias. More specifically, I divide the sample in five-year windows and use the share from the year before the initial year for that five year window.

5.4 Panel Regressions

The sample for the regression covers periods where the value of the US$ is highly countercyclical. The selected periods, shown in Figure 8, are 2007Q3-2008Q2, 2009Q1-2015Q4. There are 16 emerging economies in the sample (Brazil, Chile, Colombia, Egypt, Indone-

sia, India, South Korea, Mexico, Malaysia, Peru, Philippines, Russia, Thailand, Turkey, Uruguay, and South Africa).

Figure 10: Share of US$ in foreign currency claims by region and by period



The ratio of number of foreign-owned banks to total number of banks[8] is high in these countries. This highlights the economical importance of the results as high foreign bank penetration often comes with large cross-border flows to the banking sector. The sample excludes countries with fixed exchange rate regime since there cannot be a valuation effect without any change in the real exchange rate. Countries under fixed exchange rate regime for only a part of the sample period are included in the sample when they are under flexible exchange rate regime. Lack of data availability, removal of observations when a country is in conflict or in a banking/financial crisis[9] make the panel data unbalanced as well. The dynamics between variables might be different during financial crises due to outlying observations and non-linear relationships. Finally, the sample excludes EMEs from Central and Eastern Europe. Following the great recession, these countries /— who either joined or are in the process of joining the European Union /— have been greatly affected by tighter banking regulations imposed by the European Union. These tighter regulations led European banks to substantially deleverage, a trend observed for domestic banks within these EMEs as well as for global banks headquartered in other European countries lending to these EMEs. I believe that the tightening in cross-border loans caused by tighter banking regulations is strong enough to blur the exchange rate driven balance sheet effect in EMEs in Central and Eastern Europe. Furthermore, most of these EMEs (i.e. Bulgaria, Romania, Estonia, Latvia, Lithuania, Slovakia and Slovenia) have either

[8]from Claessens and Van Horen database on bank ownership

[9]Examples of banking/financial crises are 2001-Turkey and 2002-Uruguay.

adopted Euro or pegged their currency to Euro, which complicates the implementation of the identification strategy.

The regression specification is as follows;

$$\begin{aligned}\Delta L^{i}_{j,t} =& \alpha_j + \beta_G X^{global}_{t-1} + \beta_L X^{local,i}_{j,t-1} + \beta_C X^{other}_{j,t-1} \\ &+ \beta_1 \Delta r^{w}_{t-1} + \boldsymbol{\beta_S} Share^{US\$}_{j} \cdot \Delta r^{w}_{t-1}\end{aligned}$$

Subscripts j and t denote the borrowing country and the quarter, respectively. The dependent variable, $\Delta L^{i}_{j,t}$, denotes growth of cross-border claims on country j from quarter $t-1$ to quarter t. The superscript $i = \{b, nb\}$ indexes the borrowing sector in country j, where b and nb denote claims vis-a-vis domestic banks and vis-a-vis the non-bank sector, respectively. This data is taken from BIS locational banking statistics where claims are taken into account when the lender global bank (headquarter or subsidiary) reside outside the borrowing host country. The summation of claims with different currencies on a given country requires their conversion into a common currency. The exchange rates used in the process are fixed to the average of 2008Q1 for the whole sample. As a result, the growth rate of cross-border claims is valuation adjusted (i.e. free of valuation effect). It is also winsorized at 0.5% at both ends.

Control variables are grouped into three categories. Global (i.e. *push*) variables are placed into X^{global}_{t-1}. Local (i.e. *pull*) variables are placed into $X^{local}_{j,t-1}$. $X^{other}_{j,t-1}$ includes the remaining control variables. r^{w}_{t-1} denotes the world interest rate proxied by the shadow federal funds rate. The shadow rate is preferred over the regular rate since the shadow rate can quantify the US monetary policy stance when the regular federal funds rate is constrained by the zero lower bound. I use estimates from the Wu and Xia (2015) model of the shadow rate. This $Share^{US\$}_{j}$ denotes the share of US$ in cross-border claims on country j, and its interaction with the global liquidity indicator is key to identifying the exchange rate driven balance sheet effect. Accordingly, the magnitude and statistical significance of $\boldsymbol{\beta_S}$ describes the reaction of foreign lenders to this effect.

The control variables are listed with their description. Data sources are in the appendix.

Global variables (X^{global}) Global variables — also referred to as *push* factors — are common to all the countries, and consist of supply driven factors that affect cross-border capital inflows to EMEs. Note that the global liquidity indicator (i.e. VIX) is not listed here since I present it separately in the empirical specification.

Δ*Global Leverage*, YoY quarterly change in the leverage of global banks: It represents the leverage of the dealer broker sector in US and serves as a proxy for the leverage of global banks. It is shown to be an important determinant of cross-border flows by Bruno and Shin (2015a).

Δ*GlobalBankEquity*, YoY quarterly growth rate of total equity of the largest global banks: They are the largest by the size of their balance sheet. The list includes BNP Paribas, Credit Agricole, ING Group, Societe Generale, HSBC, and Mitsubishi UFJ Financial Group. This is a structural variable from the model, and affects cross-border flows.

Local variables (X^{local}) Local variables — also referred to as *pull* factors — are country-specific demand related factors that affect cross-border capital inflows to EMEs.

$\Delta M2$, quarterly growth rate of real money supply: There is an increasing trend for multinational corporations to do carry trade (i.e., to borrow in foreign currency abroad and to make local currency deposits in domestic banks)(Shin, 2013). As these deposits would appear in the money supply, this variable is included to capture the variations in cross-border bank flows explained by this channel. Annual growth rate of real money supply is deseasonalized and winsorized at 0.5% at both ends.

$\Delta PublicDebt/GDP$, YoY quarterly change in public debt to GDP ratio: The solvency of the government could affect the country's overall risk perception.

ΔGDP, quarterly growth rate of GDP: It is supposed to capture loan demand conditions driven by domestic fundamentals. Annual growth rate of GDP is deseasonalized and winsorized at 0.5% at both ends.

$\Delta Inflation$, change in inflation: It is also supposed to capture loan demand conditions by domestic fundamentals, where higher inflation is associated with stronger demand.

$\Delta Interest\ spread$, YoY quarterly change in the real interest rate spread: It is the change in the spread between real US Fed funds rate and real short term corporate loan rate in the respective emerging economy. A higher spread should raise capital inflows by attracting foreign investors looking for a higher yield.

$\Delta local\ bankequity$, YoY quarterly growth rate of equity of local banks: It is the growth rate of the domestic banking system's total equity. This is a structural variable from the model, and affects cross-border flows.

ΔRER^{US}, quarterly growth rate of the local currency real exchange rate against the US$: Real exchange rate is computed by subtracting the inflation difference of the respective country from the nominal exchange rate. Annual growth rate of weighted real exchange rate is winsorized at 0.5% at both ends.

Other control variables (X^{other}) The other control variables consider alternative channels that might influence the sensitivity of country j to global liquidity conditions.

$REGION_j \cdot \Delta r^w$, the interaction of the shadow federal funds rate change with the region of country j reduces endogeneity concerns induced by the regional pattern in US$ shares.

$Share_j^{FX} \cdot \Delta r^w$, the interaction of the shadow federal funds rate change with the ratio of foreign currency liabilities in total liabilities for financial intermediaries in country j. As the ratio captures country level differences in exposure to foreign funding, this interaction term controls for the interest rate channel depicted by Baskaya et al (2018).

Table 5 provides the results for the regression on cross-border claims vis-á-vis domestic banks. An increase in Δr^w – that can be interpreted as tightening global liquidity conditions – lowers cross-border claims on emerging market domestic banks. The exchange rate driven balance sheet effect is identified through the emboldened interaction term (i.e. the interaction of the world interest rate change with the share of US$ in foreign currency

cross-border liabilities). The negative coefficient of the emboldened interaction term implies that the drop in cross-border inflows – due to tightening global liquidity conditions – is amplified in countries whose foreign currency cross-border liabilities have a higher US$ share.

This is consistent with global banks (i.e. foreign lenders) reducing their exposure further to banking systems whose portfolio include corporate borrowers with relatively more deteriorated balance sheets because of higher US$ share. The identification scheme therefore suggests a strong exchange rate driven balance sheet effect. Glancing over columns of Table 5, the statistical significance of this reaction is quite robust to different specifications. The significance after controlling for region interaction effect (in column 2) is particularly comforting given the regional patterns in US$ shares. The funding cost of a banking system with more foreign credit is more dependent on external factors. Higher elasticity of the funding cost to global liquidity should in turn appear on interest rates on the credit side of domestic banks. To account for this channel, the interaction of the global liquidity indicator with the ratio of foreign currency liabilities in total liabilities for financial intermediaries is added in column 3. The results suggest that the "interest rate channel" is weak while the exchange rate driven balance sheet effect remains strong. While the identification predicts smoother valuation effect for countries whose foreign currency liabilities have less US$ and more Euros denomination, these countries might sometimes be experiencing large absolute currency fluctuations against foreign currencies in general. Furthermore, real exchange rate changes might affect corporate borrowers and domestic banks through other means. For instance, a large depreciation can lead to higher inflation, in turn deteriorating investments because of the accompanying uncertainty. For these reasons, the specification in column 4 adds the growth rate of the real exchange rate of the local currency against the US$. While this variable appears to be an important predictor of subsequent capital flows, the main results are robust to this addition.

Equity growth of the local banking sector is a robust predictor of cross-border claims on the banking sector. Change in the leverage of global banks is also a robust predictor, as found in Bruno and Shin (2015a). Δr_{us}^{sha}, the global liquidity indicator, is often statistically significant. Joint significance tests however indicate that *push* factors are important. Overall, *push* factors seem to better predict subsequent capital inflows than *pull* factors. While consistent with Calvo et al. (1996) and, Forbes and Warnock (2012), this finding is in contrast with *pull* factors growing in importance after the global financial crisis (Fratzcher, 2012; Cerutti et al, 2019; Amiti et al, 2018).

Table 6 provides regression results on cross-border claims vis-à-vis the non-banking sector. The emboldened interaction term, key to the identification, is statistically not different than zero. This implies that the balance sheet effect is not apparent on this type of cross-border flows. In other words, for firms that are able to borrow directly from global banks, the exchange rate driven valuation effect does not seem to affect their default risk, at least not enough for foreign lenders to reduce their exposure significantly. This finding is robust to different specifications. The contrast in response between claims vis-à-vis the banking sector and vis-à-vis the corporate sector is consistent with the model's predictions. Turkish firm-level data suggests that firms that borrow directly from domestic banks have a higher degree of currency mismatch in comparison to firms that borrow directly from international markets. The incorporation of this difference in the model is the underlying

feature that leads to higher elasticity of cross-border claims vis-à-vis the banking sector to global liquidity conditions. The validation of these predictions with panel regression results suggests that the firm heterogeneity that we see in Turkish firm-level data can be generalized to emerging market economies.

As for other variables, the equity of the global banking sector seems to be a relatively strong determinant for subsequent cross-border claims on the non-banking sector. Overall *push* factors however seem to have less explanatory power for claims on the non-banking sector than for claims on the banking sector.

Table 5: Regression on cross-border claims vis-à-vis domestic banks

Dependent variable:$\Delta L^b_{j,t}$				
$\Delta GDP_{j,t-1}$	0.298*	0.297	0.301	0.165
	(0.168)	(0.171)	(0.194)	(0.165)
$\Delta Inflation_{j,t-1}$	-0.049	0.088	0.071	0.082
	(0.508)	(0.521)	(0.495)	(0.458)
Δ*local bank equity*$_{j,t-1}$	3.204***	3.341***	3.496***	3.07**
	(1.096)	(1.087)	(1.11)	(1.176)
$\Delta M2_{j,t-1}$	0.075	0.067	0.066	0.126
	(0.118)	(0.115)	(0.114)	(0.119)
$\Delta PublicDebt/GDP_{j,t-1}$	-0.26	-0.257	-0.247	-0.197
	(0.164)	(0.169)	(0.163)	(0.17)
$\Delta Interest\ spread_{j,t-1}$	0.154	0.152	0.163	0.159
	(0.428)	(0.42)	(0.441)	(0.415)
$\Delta GlobalBank\ Equity_{j,t-1}$	0.394**	0.391**	0.392**	0.181
	(0.14)	(0.141)	(0.142)	(0.173)
$\Delta Global\ Leverage_{t-1}$	0.423***	0.42***	0.42***	0.275***
	(0.084)	(0.083)	(0.082)	(0.09)
Δr^w_{t-1}	-5.291	-11.234*	-12.521*	-12.861**
	(6.05)	(5.826)	(6.045)	(5.772)
$\boldsymbol{Share^{US\$}_j \cdot \Delta r^w_{t-1}}$	**-0.06***	**-0.099****	**-0.102****	**-0.11****
	(0.033)	**(0.043)**	**(0.044)**	**(0.042)**
$LATAM_j \cdot \Delta r^w_{t-1}$		-7.191**	-7.767**	-8.06**
		(3.108)	(3.457)	(3.48)
$ASIAP_j \cdot \Delta r^w_{t-1}$		-3.98**	-3.766***	-3.634***
		(1.016)	(1.081)	(1.217)
$Share^{FX}_j \cdot \Delta r^w_{t-1}$			0.039	0.038
			(0.075)	(0.076)
$\Delta RER^{US}_{j,t-1}$				-0.317***
				(0.102)
N	505	505	505	505
R^2	0.0921	0.0970	0.0975	0.1095

Standard errors are clustered within countries. Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Regression on cross-border claims vis-à-vis the non-banking sector

Dependent variable:$\Delta L^{nb}_{j,t}$				
$\Delta GDP_{j,t-1}$	0.145	0.087	0.083	0.059
	(0.238)	(0.231)	(0.234)	(0.242)
$\Delta Inflation_{j,t-1}$	0.438	-0.527	0.406	0.407
	(0.476)	(0.423)	(0.483)	(0.48)
$\Delta M2_{j,t-1}$	0.129	0.327	0.129	0.139
	(0.109)	(0.479)	(0.092)	(0.096)
$\Delta PublicDebt/GDP_{j,t-1}$	-0.188 *	-0.141	-0.133	-0.123
	(0.09)	(0.078)	(0.081)	(0.077)
$\Delta Interest\ spread_{j,t-1}$	0.128	0.106	0.102	0.103
	(0.282)	(0.299)	(0.290)	(0.288)
$\Delta GlobalBank\ Equity_{j,t-1}$		0.196*	0.196*	0.159
		(0.097)	(0.1)	(0.114)
$\Delta Global\ Leverage_{t-1}$		0.147	0.15**	0.123
		(0.064)	(0.064)	(0.072)
Δr^{w}_{t-1}	0.972	-0.291	-6.059	-6.211
	(2.342)	(2.325)	(4.245)	(4.157)
$\boldsymbol{Share^{US\$}_{j} \cdot \Delta r^{w}_{t-1}}$	**-0.01**	**0.005**	**0.109**	**0.113**
	(0.033)	**(0.033)**	**(0.071)**	**(0.07)**
$LATAM_j \cdot \Delta r^{w}_{t-1}$			-5.087	-5.168*
			(2.942)	(2.933)
$ASIAP_j \cdot \Delta r^{w}_{t-1}$			-1.884	-1.876
			(1.61)	(1.629)
$\Delta RER^{US}_{j,t-1}$				-0.0553
				(0.051)
N	505	505	505	505
R^2	0.0352	0.0444	0.05	0.051

Standard errors are clustered within countries. Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Both in the model and the empirical part, firms are differentiated by the ability of the firm to access international financial markets. In the model, I identify firms with cross-border liabilities global firms while the ones that borrow from domestic banks are named local firms. Turkish firm-level data indicates that firms with direct access to international financial markets are larger, and have a higher ratio of export revenues to FX bank liabilities, thereby suggesting that a higher share of their assets are denominated in foreign currencies – all firm characteristics that can be associated with global firms. Overlapping networks through foreign subsidiaries are likely to expand the relationship between multinational corporations and global banks across countries. On that note, global firms can get credit from global banks in two modes. First one is through cross-border liabilities, which I have captured by cross-border claims on the non-banking sector.

The second mode is to borrow from the global bank's local branch. Various papers[10] empirically show that foreign banks (within the domestic financial system) have larger and more foreign owned customers, consistent with global banks following their customers around the globe.

This begs the question whether the exchange rate driven balance sheet effect is still insignificant for local global bank claims on the non-financial corporate sector, as it is for cross-border claims on the non-banking sector since both modes attract firms with similar characteristics (i.e. global firms). Table 7 in the appendix provides regression results for this complementary analysis. For this purpose, I use consolidated global bank claims on the non-financial corporate sector (local claims in foreign currency + cross-border claims) from the publicly available BIS data set. The emboldened interaction term is statistically not different than zero, thereby implying a weak exchange rate driven balance sheet effect as expected. This finding is robust to different specifications. In addition, *pull* factors seem to have more explanatory power for consolidated global bank claims in comparison to cross-border claims.

6 Conclusion

Following the Great Recession, the excessive credit buildup of corporate sector in emerging economies causes concern for policy makers. The increased share of corporate liabilities denominated in foreign currency may worsen the solvency of these firms at a potential reversal of global funds since local currencies tend to depreciate during tightening global liquidity conditions. This is currently happening as the Fed, and central banks of other advanced economies are in the process of reverting their monetary stance back to the normal levels, leading investors to withdraw funds from EMEs. I investigate the exchange rate driven balance sheet effect on capital inflows to evaluate the reaction of foreign lenders.

The risk induced by foreign currency liabilities exists to the extent that firms do not match these liabilities with foreign currency assets. Turkish firm-level balance sheet information indicates that firms with direct access to international financial markets have more exports and a higher share of foreign currency assets than firms that only borrow from domestic banks. Incorporating this feature into a partial equilibrium model, simulations show that cross-border claims on the banking sector are more sensitive to global liquidity conditions than cross-border claims on the non-banking sector (i.e. non-financial corporate sector). I test this hypothesis with a panel regression on a set of EMEs. I disentangle the exchange rate driven balance sheet effect by exploiting the fact that US$ liabilities have larger valuation effects than other types of foreign currencies in periods where the US$ is highly countercyclical over the global credit cycle. I indeed find that cross-border claims on the banking sector whose foreign currency liabilities have a higher share of US$ are more sensitive to global liquidity conditions, thereby suggesting a strong exchange rate driven balance sheet effect for the ultimate borrowers of capital inflows channeled through domestic banks. In contrast, I find no effect on cross-border claims

[10] Giannetti and Ongena (2012); Mian (2006); Berger et al (2001); Berger et al (2008)

on the non-banking sector. Both results are consistent with the predictions of the model built upon Turkish firm-level evidence.

Beyond its implication on systemic risk, the results highlight the importance of the bank leverage cycle in the propagation of exchange rate fluctuations; Tightening global liquidity conditions accompanied by the depreciation of the local currency puts upward pressure on the default risk of local firms with currency mismatch. The reduction of exposure to riskier corporate borrowers may lead banks to look for less foreign funding, accelerating the drop in capital inflows. This propagation mechanism can severely disrupt the financial system in the form of a dangerous feedback loop. Policymakers in EMEs should therefore further strengthen the prudential oversight of domestic banks by closely monitoring their clients' foreign currency exposure.

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Appendix

Derivation of the realized value of domestic banks loan to local firms The following iterations give the analytical solution to the realized value of the loan portfolio. Conditional on y_j, the share of local firms that do not default is given by the following condition.

$$\sqrt{\rho}y_j + \sqrt{1-\rho}v_{ij} > \Phi^{-1}(\epsilon^s)$$

$$v_{ij} > \frac{\Phi^{-1}(\epsilon^s) - \sqrt{\rho}y_j}{\sqrt{1-\rho}}$$

Let ω, a random variable, denote the realised value of a loan portfolio with face value of 1 dollar. This random variable is a function of y_j.

$$\omega(y_j) = \Phi\left(\frac{\sqrt{\rho}y_j - \Phi^{-1}(\epsilon^L)}{\sqrt{1-\rho}}\right)$$

Derivation of the realized value of global bank's loan to domestic banks Domestic banks default when the realized value of their loan portfolio at a face value of 1 dollar comes short of the debt-to-asset ratio, φ.

$$z < \varphi$$

$$\omega^{-1}(z) < \omega^{-1}(\varphi)$$

$$y_j < \omega^{-1}(\varphi)$$

VaR rule implies the probability of default of a regional is pinned to α.

$$F(y_j < \omega^{-1}(\varphi)) = \Phi(\omega^{-1}(\varphi)) = \alpha$$

$$\omega^{-1}(\varphi) = \Phi^{-1}(\alpha)$$

Thus domestic bank in country j defaults when

$$y_j < \Phi^{-1}(\alpha)$$

$$\sqrt{\beta}G + \sqrt{1-\beta}k_j < \Phi^{-1}(\alpha)$$

$$k_j < \frac{\Phi^{-1}(\alpha) - \sqrt{\beta}G}{\sqrt{1-\beta}}$$

The share of regional banks that do not default, $\omega_f(G)$, is a function of the global risk factor, G.

$$\omega_f(G) = 1 - \Phi\left(\frac{\Phi^{-1}(\alpha) - \sqrt{\beta}G}{\sqrt{1-\beta}}\right) = \Phi\left(\frac{\sqrt{\beta}G - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right)$$

Derivation of the realized value of global bank's loan to global firms The following iterations give the analytical solution to the realized value of the loan portfolio for the part that is allocated to the global firms. Conditional on G, the share of big firms that do not default is given by the following condition[11].

$$\sqrt{\rho}y_j + \sqrt{1-\rho}v_{ij} > \Phi^{-1}(\epsilon^G)$$

$$\sqrt{\rho}\left(\sqrt{\beta}G + \sqrt{1-\beta}k_j\right) + \sqrt{1-\rho}v_{ij} > \Phi^{-1}(\epsilon^G)1$$

$$\sqrt{\rho}\sqrt{1-\beta}k_j + \sqrt{1-\rho}v_{ij} > \Phi^{-1}(\epsilon^G) - \sqrt{\rho}\sqrt{\beta}G$$

$$v_{ij} > \frac{\Phi^{-1}(\epsilon^G) - \sqrt{\rho}\sqrt{\beta}G}{\sqrt{1-\rho\beta}}$$

The share of global firms that do not default, $\omega_g(G)$, is a function of G.

$$\omega_g(G) = 1 - \Phi\left(\frac{\Phi^{-1}(\epsilon^G) - \sqrt{\rho}\sqrt{\beta}G}{\sqrt{1-\rho\beta}}\right) = \Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}G - \Phi^{-1}(\epsilon^G)}{\sqrt{1-\rho\beta}}\right)$$

Derivation of $\varphi(\alpha, \rho, \epsilon^s)$ in Equation (1) (Regional bank VaR rule)

$$\omega(y_j) = \Phi\left(\frac{\sqrt{\rho}y_j - \Phi^{-1}(\epsilon^s)}{\sqrt{1-\rho}}\right) = z$$

where z denotes the value of the loan portfolio with face value of 1 dollar. Rearranging the equation above, we get

$$y_j = \omega^{-1}(z) = \frac{\sqrt{1-\rho}\Phi^{-1}(z) + \Phi^{-1}(\epsilon^s)}{\sqrt{\rho}}$$

The cdf of z then is

$$F(\omega(y_j) < z) = F(y_j < \omega^{-1}(z)) = \Phi\left(\frac{\sqrt{1-\rho}\Phi^{-1}(z) + \Phi^{-1}(\epsilon^s)}{\sqrt{\rho}}\right)$$

VaR rule consists of keeping the leverage so that the probability of default on its liabilities does not exceed a fixed probability, α. φ is the leverage implied by the VaR rule where the probability of default to the creditors is equal to α;

$$F(\omega(y_j) < \varphi) = \Phi\left(\frac{\sqrt{1-\rho}\Phi^{-1}(\varphi) + \Phi^{-1}(\epsilon^s)}{\sqrt{\rho}}\right) = \alpha$$

We then rearrange the equation to solve for φ

$$\varphi = \Phi^{-1}\left(\frac{\sqrt{\rho}\Phi^{-1}(\alpha) - \Phi^{-1}(\epsilon^s)}{\sqrt{1-\rho}}\right)$$

[11] The sum of two independent normally distributed random variables is normal, with its mean being the sum of the two means, and its variance being the sum of the two variances.

Derivation of $\psi(\alpha, \rho, \beta, \epsilon^b, \alpha_g)$ in Equation (2) (Global bank VaR rule)

$$\omega_g(G) = \lambda\Phi\left(\frac{\sqrt{\beta}G - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda)\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}G - \Phi^{-1}(\epsilon^b)}{\sqrt{1-\rho\beta}}\right) = z_g$$

where z_g denotes the value of the loan portfolio with face value of 1 dollar. The cdf of z_g is

$$F(\omega_g(G) < z_g) = F(G < \omega_g^{-1}(z_g)) = \Phi\left(\omega_g^{-1}(z_g)\right)$$

VaR rule consists of keeping the leverage so that the probability of default on its liabilities does not exceed a fixed probability, α_g. ψ is the leverage implied by the VaR rule where the probability of default to the creditors is equal to α_g;

$$F(\omega_g(G) < \varphi) = F(G < \omega_g^{-1}(\psi)) = \Phi\left(\omega_g^{-1}(\psi)\right) = \alpha_g$$

We then rearrange the equation to solve for ψ

$$\omega_g^{-1}(\psi) = \Phi^{-1}(\alpha_g)$$

$$\psi = \omega_g\left(\Phi^{-1}(\alpha_g)\right)$$

$$\psi = \lambda\Phi\left(\frac{\sqrt{\beta}\Phi^{-1}(\alpha_g) - \Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda)\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}\Phi^{-1}(\alpha_g) - \Phi^{-1}(\epsilon^b)}{\sqrt{1-\rho\beta}}\right)$$

For the special case where $\alpha = \alpha_g$

$$\psi = \lambda\Phi\left(\frac{\left(\sqrt{\beta}-1\right)\Phi^{-1}(\alpha)}{\sqrt{1-\beta}}\right) + (1-\lambda)\Phi\left(\frac{\sqrt{\rho}\sqrt{\beta}\Phi^{-1}(\alpha) - \Phi^{-1}(\epsilon^b)}{\sqrt{1-\rho\beta}}\right)$$

Allocation of global bank funds between domestic banks and global firms
Global bank's net return of C_f (i.e. of lending to domestic banks)

$$\pi_f(\lambda) = (1 + r^f(\lambda)) \int_{\psi(\lambda)}^{1} (z - \psi(\lambda)) f_f(z) dz$$

Global bank's net return of C_{gb} (i.e. of lending to global firms)

$$\pi_{gb}(\lambda) = (1 + r^{gb}(\lambda)) \int_{\psi(\lambda)}^{1} (z - \psi(\lambda)) f_b(z) dz$$

Note that when the global bank defaults ($z < \psi$), creditors have no recovery value (limited liability). However, the bank does not get to keep the residual value z of the portfolio. Thus when the bank defaults, its net profit of the bank is nul. At the optimal allocation,λ^* the global bank is indifferent to lending to either borrower, as shown below.

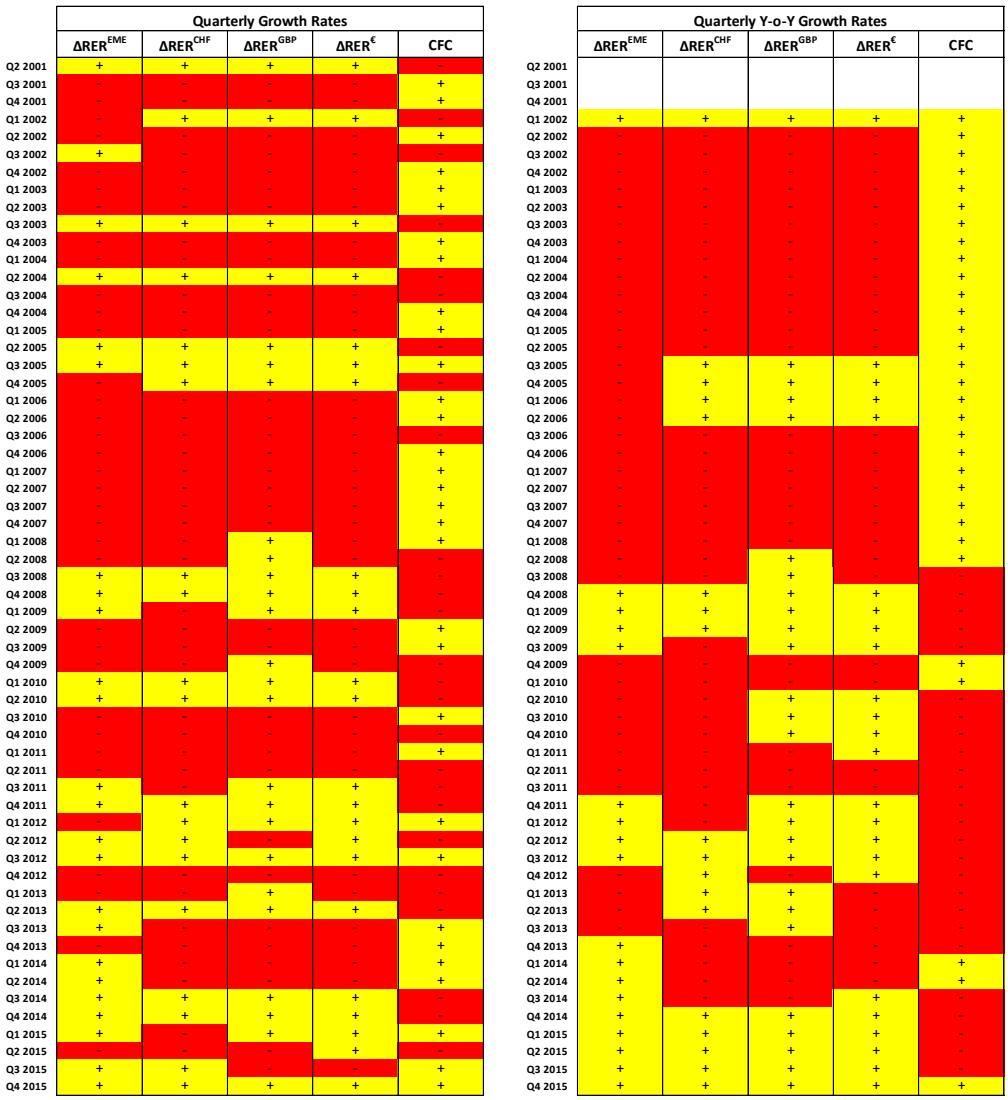
$$\pi_f(\lambda^*) = \pi_{gb}(\lambda^*)$$

Description of Turkish Firm-level data

The merged dataset extends for as long as 10 years (i.e. from 2006 to 2016) while some firms have information for a shorter time period. For the analysis, I average firm characteristics over time. The process of identifying firms that borrow directly from abroad is stringent. Only firms involved in two types of transaction with foreign lenders (i.e. transactions where domestic banks pledge a guarantee and transactions where domestic banks offer mediation services) are identified as firms directly borrowing from abroad. I impose this criteria since a diversity of transactions signals better access to international markets. The main results are robust on the identification criteria of firms with direct access to international financial markets. For instance, if I loosen the criteria to firms involved in *either* type of transaction (i.e. transactions where domestic banks pledge a guarantee *and/or* transactions where domestic banks offer mediation services), the indicators still suggest that balance sheets of firms with direct access to international financial markets have less currency mismatch than firms that exclusively borrow from domestic banks.

The combined data set contains 45049 firm-year observations which maps into 10629 firms once I take the average of firm characteristics over time. Out of 10629 firms with foreign currency loans, 9726 firms have exclusively borrowed from domestic banks. The remaining 903 firms have borrowed directly from abroad for at least one year for each type of transaction. Remember that firms borrowing directly from abroad are involved in both types of transactions with foreign lenders (i.e. when a domestic bank has pledged a guarantee and when a domestic bank has offered mediation services). Out of 903 firms that have borrowed from abroad, 865 firms have simultaneously held foreign currency loans from domestic banks. The aggregate foreign currency credit in domestic banks held by firms with direct access to international markets corresponds to only about one fifth of total foreign currency domestic bank credit. Therefore, balance sheet characteristics of domestic banks' foreign currency borrowers are still best represented by firms that exclusively borrow from domestic banks (i.e. firms that do not have direct access to international financial markets).

Figure 11



	Quarterly Growth Rates				
	ΔRER^{EME}	ΔRER^{CHF}	ΔRER^{GBP}	$\Delta RER^{€}$	CFC
Q2 2001	+	+	+	+	-
Q3 2001	-	-	-	-	+
Q4 2001	-	-	-	-	+
Q1 2002	-	+	+	+	-
Q2 2002	-	-	-	-	+
Q3 2002	+	-	-	-	-
Q4 2002	-	-	-	-	+
Q1 2003	-	-	-	-	+
Q2 2003	-	-	-	-	+
Q3 2003	+	+	+	+	-
Q4 2003	-	-	-	-	+
Q1 2004	-	-	-	-	+
Q2 2004	+	+	+	+	-
Q3 2004	-	-	-	-	-
Q4 2004	-	-	-	-	+
Q1 2005	-	-	-	-	+
Q2 2005	+	+	+	+	-
Q3 2005	+	+	+	+	+
Q4 2005	-	+	+	+	-
Q1 2006	-	-	-	-	+
Q2 2006	-	-	-	-	+
Q3 2006	-	-	-	-	-
Q4 2006	-	-	-	-	+
Q1 2007	-	-	-	-	+
Q2 2007	-	-	-	-	+
Q3 2007	-	-	-	-	+
Q4 2007	-	-	-	-	+
Q1 2008	-	-	+	-	+
Q2 2008	-	-	+	-	-
Q3 2008	+	+	+	+	-
Q4 2008	+	+	+	+	-
Q1 2009	+	-	+	+	-
Q2 2009	-	-	-	-	+
Q3 2009	-	-	-	-	+
Q4 2009	-	-	+	-	-
Q1 2010	+	+	+	+	-
Q2 2010	+	+	+	+	-
Q3 2010	-	-	-	-	+
Q4 2010	-	-	-	-	-
Q1 2011	-	-	-	-	+
Q2 2011	-	-	-	-	-
Q3 2011	+	-	+	+	-
Q4 2011	+	+	+	+	-
Q1 2012	-	+	+	+	+
Q2 2012	+	+	-	+	-
Q3 2012	+	+	+	+	+
Q4 2012	-	-	-	-	-
Q1 2013	-	-	+	-	-
Q2 2013	+	+	+	+	-
Q3 2013	+	-	-	-	+
Q4 2013	-	-	-	-	+
Q1 2014	+	-	-	-	+
Q2 2014	+	-	-	-	+
Q3 2014	+	+	+	+	-
Q4 2014	+	+	+	+	-
Q1 2015	+	-	+	+	+
Q2 2015	-	-	-	+	-
Q3 2015	+	+	-	-	+
Q4 2015	+	+	+	+	+

	Quarterly Y-o-Y Growth Rates				
	ΔRER^{EME}	ΔRER^{CHF}	ΔRER^{GBP}	$\Delta RER^{€}$	CFC
Q2 2001					
Q3 2001					
Q4 2001					
Q1 2002	+	+	+	+	+
Q2 2002	-	-	-	-	+
Q3 2002	-	-	-	-	+
Q4 2002	-	-	-	-	+
Q1 2003	-	-	-	-	+
Q2 2003	-	-	-	-	+
Q3 2003	-	-	-	-	+
Q4 2003	-	-	-	-	+
Q1 2004	-	-	-	-	+
Q2 2004	-	-	-	-	+
Q3 2004	-	-	-	-	+
Q4 2004	-	-	-	-	+
Q1 2005	-	-	-	-	+
Q2 2005	-	-	-	-	+
Q3 2005	-	+	+	+	+
Q4 2005	-	+	+	+	+
Q1 2006	-	+	+	+	+
Q2 2006	-	+	+	+	+
Q3 2006	-	-	-	-	+
Q4 2006	-	-	-	-	+
Q1 2007	-	-	-	-	+
Q2 2007	-	-	-	-	+
Q3 2007	-	-	-	-	+
Q4 2007	-	-	-	-	+
Q1 2008	-	-	-	-	+
Q2 2008	-	-	+	-	+
Q3 2008	-	-	+	-	-
Q4 2008	+	+	+	+	-
Q1 2009	+	+	+	+	-
Q2 2009	+	+	+	+	-
Q3 2009	+	-	+	+	-
Q4 2009	-	-	-	-	+
Q1 2010	-	-	-	-	+
Q2 2010	-	-	+	+	-
Q3 2010	-	-	+	+	-
Q4 2010	-	-	+	+	-
Q1 2011	-	-	-	+	-
Q2 2011	-	-	-	-	-
Q3 2011	-	-	-	-	-
Q4 2011	+	-	+	+	-
Q1 2012	+	-	+	+	-
Q2 2012	+	+	+	+	-
Q3 2012	+	+	+	+	-
Q4 2012	-	+	-	+	-
Q1 2013	-	+	+	-	-
Q2 2013	-	+	+	-	-
Q3 2013	-	-	+	-	-
Q4 2013	+	-	-	-	-
Q1 2014	+	-	-	-	+
Q2 2014	+	-	-	-	+
Q3 2014	+	-	-	+	-
Q4 2014	+	+	+	+	-
Q1 2015	+	+	+	+	-
Q2 2015	+	+	+	+	-
Q3 2015	+	+	+	+	-
Q4 2015	+	+	+	+	+

Regressions for consolidated global bank claims (cross-border claims + local claims in foreign currency)

Table 7: Regression on consolidated global bank claims (cross-border claims + local claims in foreign currency) vis-à-vis the non-financial corporate sector

Dependent variable:$\Delta IC^{nb}_{j,t}$				
$\Delta GDP_{j,t-1}$	0.271**	0.196**	0.193**	0.166
	(0.102)	(0.081)	(0.085)	(0.104)
$\Delta Inflation_{j,t-1}$	0.315	0.214	0.245	0.247
	(0.52)	(0.582)	(0.599)	(0.606)
$\Delta M2_{j,t-1}$	0.237**	0.251**	0.248**	0.26**
	(0.1)	(0.102)	(0.103)	(0.103)
$\Delta PublicDebt/GDP_{j,t-1}$	-0.354**	-0.293**	-0.286**	-0.275*
	(0.133)	(0.134)	(0.134)	(0.134)
$\Delta Interest\ spread_{j,t-1}$	0.009	-0.006	-0.008	-0.007
	(0.268)	(0.305)	(0.3)	(0.3)
$\Delta GlobalBank\ Equity_{j,t-1}$		0.301***	0.302***	0.261*
		(0.100)	(0.102)	(0.131)
$\Delta Global\ Leverage_{t-1}$		0.196***	0.199***	0.17**
		(0.053)	(0.054)	(0.07)
Δr^{w}_{t-1}	5.267	3.555	0.092	-0.074
	(3.232)	(3.369)	(4.701)	(4.72)
$\boldsymbol{Share^{US\$}_{j} \cdot \Delta r^{w}_{t-1}}$	**-0.063**	**-0.056**	**0.006**	**0.01**
	(0.045)	**(0.046)**	**(0.065)**	**(0.066)**
$LATAM_j \cdot \Delta r^{w}_{t-1}$			-2.471	-2.56
			(1.864)	(1.91)
$ASIAP_j \cdot \Delta r^{w}_{t-1}$			-0.554	-0.545
			(0.932)	(0.937)
$\Delta RER^{US}_{j,t-1}$				-0.06
				(0.07)
N	505	505	505	505
R^2	0.0813	0.1071	0.1088	0.11

Standard errors are clustered within countries. Standard errors in parentheses. Two-tailed test. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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