International Spillovers and Local Credit Cycles*

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Abstract

This paper studies the transmission of the Global Financial Cycle (GFC) to domestic credit market conditions in a large emerging market, Turkey, over the years 2003–13. Matching administrative data covering the universe of corporate loan transactions to bank balance sheets, we document four facts: (1) an easing in global financial conditions leads to lower borrowing costs and an increase in local lending; (2) domestic banks that are more exposed to international capital markets transmit the GFC locally; (3) the fall in borrowing costs is driven by a failure in uncovered interest rate parity (UIP), where the UIP risk premium comoves with the GFC over time; (4) data on posted collateral for new loan issuances show that collateral constraints do not relax during the boom phase of the GFC.

JEL Classification: E0, F0, F1

Keywords: Global Financial Cycle, Bank Credit, Non-core Funding, Risk Premium, Collateral Constraints

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1 Introduction

This paper studies how the Global Financial Cycle (GFC) spills over to domestic credit market conditions at the *microeconomic level* for a large emerging market economy, Turkey. The GFC is characterized by synchronized surges and retrenchments in gross capital flows and booms and busts in risky asset prices and leverage (Rey, 2013), and has a strong common component that comoves with VIX,[1] which is related to US monetary policy and to changes in risk aversion and uncertainty (Bekaert et al., 2013; Bruno and Shin, 2015a; Miranda-Agrippino and Rey, 2018). Although the majority of research has focused on understanding the aggregate impacts and sources of the GFC, little is known about how it transmits to countries' economies and financial sectors.

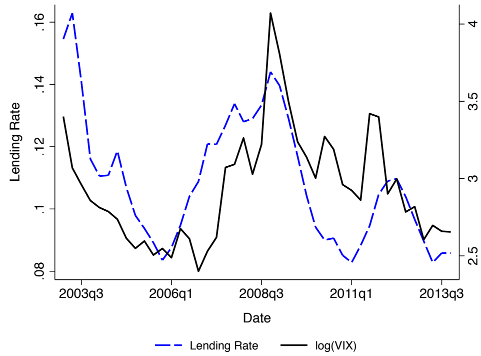
We provide a granular view of how the GFC affects local credit conditions by exploiting data on the universe of loan transactions, including loan-level interest rates and posted collateral, between banks and firms for Turkey over the period from 2003 to 2013, combined with bank balance sheet information. Using these detailed data that cover the entire non-financial corporate sector, we trace out the relationship between the GFC and domestic lending patterns between banks and firms.

We make two main contributions. Our starting point is Figure 1a, which shows a strong comovement between VIX and the average Turkish bank lending rate. This relationship motivates us to provide evidence on the impact of the GFC on domestic borrowing costs and credit growth at the *firm-bank* level, controlling for both firm- and bank-level characteristics, which is our first contribution. Micro-level regressions uncover economically significant relationships between the GFC and domestic credit market conditions. We find a baseline micro estimate of the elasticity of domestic loan growth with respect to changes in the VIX equal to -0.067. This *micro* estimate implies that fluctuations in VIX can explain, on average, 43 percent of the observed cyclical loan growth of the *aggregate* corporate sector over the sample period.The micro estimate of the elasticity of the interest rate with respect to changes in the VIX in our core specification is 0.019, implying a 1 percentage point fall in the borrowing costs for the average firm during the boom phase of the GFC.

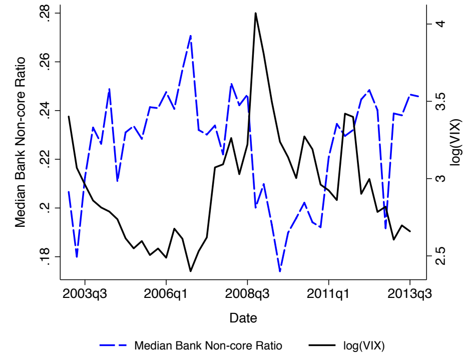
Our second contribution is to provide novel evidence about the channels through which the GFC is transmitted to the domestic credit market by exploiting both bank and loan-level heterogeneity. We first document that domestic banks that are more exposed to international capital markets

[1] The VIX is a forward-looking volatility index of the Chicago Board Options Exchange. It measures the market's expectation of 30-day volatility, and is constructed using the implied volatilities of a wide range of S&P 500 index options.

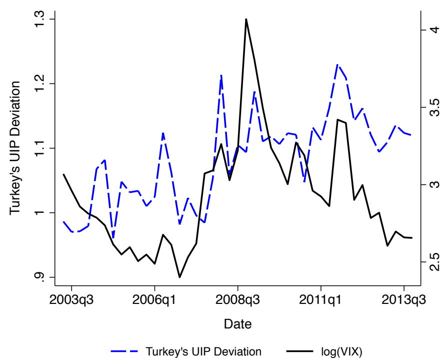
Figure 1. The Global Financial Cycle and the Local Credit Market: Motivating Evidence



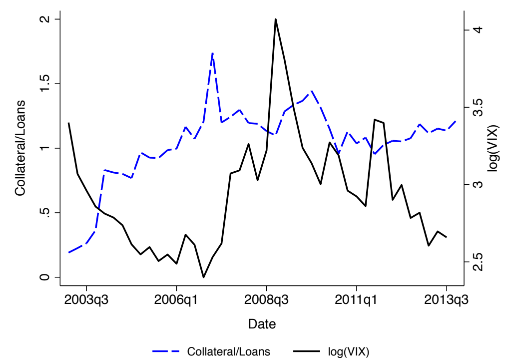
(a) GFC and Lending Rates
$\rho = 0.52$



(b) GFC and Non-Core Liabilities
$\rho = -0.51$



(c) GFC and UIP
$\rho = 0.61$



(d) GFC and Collateral
$\rho = 0.01$

Notes: This figure plots the following Turkish time series along with log(VIX), our proxy for the GFC: (a) aggregate bank lending rate; (b) the median bank's non-core liabilities ratio; (c) the UIP deviation from the US dollar defined as $\left(\frac{1+i^{TRY}}{1+i^{USD}}\right)\frac{S}{E(S')}$, where i^{TRY} is the 12-month Turkish deposit rate, i^{USD} is the 12-month US deposit rate, S is the spot Turkish lira/USD exchange rate, and $E(S')$ is the expected 12-month ahead Turkish lira/USD exchange rate; and (d) the aggregate collateral-to-loan ratio. Sources: CBRT and author's calculations.

play a key role in transmitting the GFC locally, where we proxy this exposure by banks' *non-core liabilities* to total liabilities ratio. Non-core liabilities are considered non-traditional (or wholesale) forms of bank funding and are important sources of funding for fast-growing emerging markets (Hahm et al., 2013). As Figure 1b shows, the median Turkish bank's non-core liabilities ratio comoves with the GFC over the sample period capturing the cyclicality in domestic banks' access to non-core funding from global capital markets. Our regression identification strategy exploits the differential impact of banks' reliance on *non-core* funding on their lending behavior over the GFC. The bank heterogeneity-based difference-in-differences methodology that we use is common in the literature (e.g., Khwaja and Mian, 2008; Chodorow-Reich, 2014; Jiménez et al., 2014) and enables us to explicitly control for time-varying firm demand using firm×quarter fixed effects. We find that banks with high non-core liabilities ("high non-core banks") cut lending rates and lend more during the boom phase compared those with low non-core liabilities ("low non-core banks"), and vice versa during GFC downturns.[2]

We next document that the fall in borrowing costs is driven by a failure in uncovered interest rate parity (UIP), where the UIP risk premium comoves with the GFC over time, making local currency borrowing cheaper relative to foreign currency borrowing during boom phases of the GFC. Figure 1c highlights this cyclicality at the aggregate level by plotting the VIX along with deviations from UIP, which is calculated the standard way using Turkish and of U.S. deposit rates of the same maturity together with the spot and expected Turkish lira/U.S. dollar exchange rates. The UIP deviations are also present at the firm-bank level even after controlling for time-varying macroeconomic/exchange rate risk (via time fixed effects). Further investigation shows that firm credit risk and bank heterogeneity in access to international non-core funding are key drivers of the UIP deviations at the micro level. After controlling for these factors, we show that UIP deviations disappear for the same firm borrowing from the same bank in multiple currencies.

We study the cyclicality in the micro-level UIP violation by interacting an indicator variable for the currency composition of the loan with the VIX in a difference-in-differences framework. Although borrowing in foreign currency is always cheaper on average, the regression reveals that the cost of local currency loans fall more relative to foreign currency borrowing when the VIX is low and vice versa, as indicated in Figure 1c. Moreover, we show that this differential is driven by high non-core banks over the cycle. Given that only half of the domestic credit supply is in foreign currency and the other half is in local currency, such cyclicality in the UIP risk premium leads to an increase in local currency borrowing during the boom phase of the GFC. To the best of our knowledge, this empirical result is novel and is inconsistent with existing models that assume an exogenous country-level UIP violation (see Gopinath and Stein, 2017, for a recent contribution that endogenizes this violation for a representative bank/firm).

Finally, using monthly loan-level data on collateral posted for new loan issuances and motivated by the acyclicality of the aggregate collateral-to-loan ratio vis-à-vis the VIX (see Figure 1d), we

[2] Baskaya et al. (2017) show that during capital inflow episodes into Turkey, banks that fund themselves internationally expand their credit supply. These banks are both large and have a high non-core liabilities ratio, which is shown to be largely composed of foreign liabilities and thus is tightly correlated with capital flows into the banking sector. In this paper, we provide the novel result that banks with a high non-core liabilities ratio reduce their *lending rates* relatively more during periods when the VIX is low, since the importance of international funding in their liability structure exposes them relatively more to the GFC than other domestic banks.

study whether borrowing constraints are relaxed during the boom phase of the GFC via a "collateral channel." Regressions reveal that there is no relation between loan amounts and posted collateral in general and in addition loan amounts do not respond to changes in the collateral ratio during high- or low-VIX episodes. This is a strong result that survives even after we account for time varying firm and bank factors, such as credit demand and firm default risk, and focus on the same firm borrowing from the same bank. This is important because, as Guerrieri and Lorenzoni (2017) show, in a heterogeneous agent environment, shocks to agents' borrowing capacity affect both borrowers' demand for loans and lenders' supply of loans, and we want to solely focus on the supply side.

Although we do not find any relation between posted collateral and loan amounts, we uncover a strong relation between loan *rates* and posted collateral. Conditional on time-varying bank factors, the loan rate is lower for a higher level of posted collateral on that loan. This negative relation between the loan rate and loan collateral strengthen when the VIX is high and weakens when VIX is low. When we consider the same firm borrowing from the same bank, the negative relation between the loan rate and collateral no longer changes with fluctuations in the VIX. These results further support our key message that irrespective of collateral values, firms are able to borrow more as a result of lower interest rates, which increase firms' ability to repay their loans. In fact, when we compare the effects of collateral and interest rates on credit growth in the same regression, we find that lower interest rates are more important for credit expansion than higher collateral values.

We consider other possible channels through which the GFC may impact the domestic credit market, as well as run numerous robustness checks. We first explore whether high non-core banks alter their risk profile by changing the average maturity of loans they issue over the GFC, and find that these banks do indeed increase their risk by issuing longer maturity loans during the boom phase of the GFC. Another possible channel we investigate is the role of exchange rate fluctuations on balance sheet strength. Banks balance sheets are required to be hedged for foreign currency exposure in Turkey by law, so we study the effects of possible firm balance sheet mismatches on credit outcomes. Focusing on bank-firm pairs, we do not find any effect of exchange rate fluctuations on credit outcomes for firms with a currency mismatch on their balance sheets, who borrow from highly leveraged banks. This result is consistent with our finding that higher collateral values play no role in loan outcomes over the GFC. Even if firm balance sheets get a positive net worth (collateral) shock with an appreciation of the local currency vis-à-vis the U.S. dollar, leading to higher credit demand, on the supply side, banks do not seem to change their pricing for such firms and/or provide more credit to these firms.

Section 2 presents a summary of the literature that our paper contributes to. Section 3 describes the data. Section 4 presents the identification methodology and our four main empirical facts. Section 5 concludes.

2 Related Literature

Our paper relates to several strands of the literature. First, we contribute to the literature that has so far focused on the effects of GFC (as proxied by movements in the VIX) on cross-border capital flows, asset prices, and credit growth using *aggregate* cross-country data (e.g., Forbes and Warnock, 2012; Cerutti et al., 2015; Jordà et al., 2017; Fratzscher et al., 2018; Miranda-Agrippino and Rey, 2018). This literature is silent on the evidence regarding the transmission mechanism, and in particular at the bank and firm levels. Our evidence on the transmission channel is complementary to models that emphasize the risk-taking channel of monetary policy. These models emphasize that during the boom phase of the GFC, low interest rates in the U.S. create abundant liquidity in dollar funding markets (Bruno and Shin, 2015a). Global banks provide more dollar funding across borders with low U.S. rates and low VIX episodes. We drill down one more layer and argue that domestic banks, that obtain dollar funding from global banks, in turn provide more funding to domestic firms at a lower cost; a pass-through mechanism for lower-cost of international funding to the domestic economy.[3]

Second, our finding on the increasing share of local currency borrowing vis-à-vis foreign currency borrowing in the aggregate data is consistent with the fall in the UIP risk premium we show and consistent with the models that endogenize the UIP deviations over time to external shocks, such as Salomao and Varela (2016). Such models predict a fall in the UIP risk premium and a rise in the share of local currency borrowing for a favorable shock. The macro evidence in Kalemli-Özcan and Varela (2019) and Kalemli-Özcan (2019) show that in emerging markets the UIP risk premium moves with interest rate differentials, due to country risk, and not with exchange rate fluctuations, which is also consistent with our findings.

Third, the evidence on the transmission mechanism we provide speaks to how financial constraints relax during the GFC. We find that the main mechanism underlying the relaxation of financial constraints is rather different than the standard "higher asset prices–higher collateral–

[3]In fast growing bank-based emerging markets, domestic bank intermediation of capital inflows is typical since domestic deposits are not large enough to fund banks who in turn finance growth. See Reinhart and Rogoff (2009) and Hahm et al. (2013).

more borrowing" channel. This channel rests on models where the liquidation value of physical assets serve as the collateral that determines the amount of borrowing by firms, and this collateral value may fluctuate with aggregate shocks that affect asset prices (e.g., see Bernanke et al., 1999; Kiyotaki and Moore, 1997; Bernanke and Gertler, 1989; Calvo, 1998; Caballero and Krishnamurthy, 2001; Mendoza, 2010). Our results on the relaxation of financial constraints through lower interest rates is important in helping to identify two alternative margins of adjustment in the domestic credit market: it is possible for firms to borrow at lower rates on average, while their "hard" collateral constraints do not change much over the boom part of the cycle. Thus, collateral-constrained firms are still allowed only to borrow some fraction of their capital stock, and this amount may not change if the value of the capital stock does not change much when capital flows into the banking sector as oppose to the corporate sector (see Fostel and Geanakoplos, 2015, for a theoretical contribution that rationalizes this channel).

Finally, we contribute to the literature on the international transmission of shocks, most of which focuses on the role of foreign banks (e.g., Cetorelli and Goldberg, 2011). Recently, this literature also emphasized the role of U.S. monetary policy in channeling bank flows across borders, as in the work of Bräuning and Ivashina (2018) and Ivashina et al. (2015). The latter paper, much like our own, focuses on the effect of the supply of dollar funding in global markets on foreign banks' lending elsewhere.

3 Data Description

We merge two large micro-level panel data sets that are official registers. All data are administrative and obtained from the Central Bank of Republic of Turkey (CBRT). Specifically, we merge bank-level balance sheets with individual loan-level data between banks and firms using unique bank and firm identifiers. We further augment this data set with Turkish and world macroeconomic and financial data. The final data set for all existing loans is at the quarterly frequency and covers the universe of loans and every balance sheet item in the banks' regulatory filings. We transform all loan and bank variables to real values, using 2003 as the base year for inflation adjustment. We further clean and winsorize the data in order to eliminate the impact of outliers.[4] We create a monthly data set based on new loan issuances using credit register data, which we also merge with bank characteristics in order to study the collateral channel in our last set of results. We discuss

[4]We winsorize loan and bank variables at 1 percent.

the characteristics of each data set in this section.

3.1 Credit Register

The detailed monthly loan transaction-level data are collected by the Banking Regulation and Supervision Agency (BRSA), and provided to us by the CBRT. Banks have to report outstanding loans at the level of firms and individuals monthly to the BRSA at the transaction level.[5] For instance, if a firm has five loans with different maturities and interest rates one branch of a bank and two additional loans at another branch of the same bank, the bank then has to report all seven loans separately as long as the outstanding amount of each loan is above the bank-specific reporting cutoff level. If a loan's outstanding amount is below the bank's reporting cutoff then the bank may aggregate such small loans at the branch level and report the aggregated amounts.

This data set provides the same information as found in credit register data in other countries, but contains a more comprehensive list of variables. In particular, besides providing the amount of a loan outstanding between a given individual (household, firm, government) and a bank, the data set provides several other key pieces of information, such as the (i) interest rate; (ii) maturity date as well as extended maturity dates if relevant; (iii) collateral provided; (iv) credit limit (only beginning in 2007); (v) currency of loan; (vi) detailed industry codes that classify the activity for which the loan is extended, as well as a breakdown of consumer loan usage (e.g., credit card, mortgage); and (vii) bank-determined loan risk measures.

The data are cleaned at the loan level before we aggregate up to the firm-bank-currency denomination level for our regression analysis. Note that we will refer to this level of aggregation as the firm-bank level for ease of exposition in the remainder of the paper. The data cleaning is extensive and there are unique features of the Turkish data that must be described in brief. First, we use cash loans in terms of outstanding principal because credit limit data are not available for the full sample period. Moreover, these loans naturally map into the data used to measure aggregate credit growth. Second, a significant component of lending in Turkey takes place in foreign currency (FX).[6] We clean the data to deal with exchange rate issues as follows. There are two types of FX loans, which banks report differently in terms of Turkish lira (TRY) each month. The first type of FX loan is indexed to exchange rate movements. This type of loan is reported based on its initial TRY value each period, and thus is not adjusted by banks for exchange rate movements (of course, the

[5]Banks do not have to report the individual transactions of less than 500 lira.
[6]Generally USD or euro.

value of these types of loans may still change if borrowers pay back some of the loan, for example). The second type of FX loan is issued in foreign currency. The TRY value of this type of loan is adjusted each period to account for exchange rate movements. This naturally creates a *valuation effect*, which we need to correct for in order to not under or overstate the value of the TRY loan in the period following the initial loan issuance. For example, imagine that over a month there are no new loans issued and no repayments made. A depreciation of the TRY against the U.S. dollar (USD) would appear to increase total loans outstanding for all existing FX loans issued in dollars. This valuation effect would in turn manifest itself as an expansion of credit when measured in TRY, but this expansion would solely have been due to a currency depreciation, rather the issuance of new loans. We adjust for this valuation effect using official end-of-period exchange rates, before summing the data over firm-bank pairs for FX and TRY loans, summing all FX loans (expressed in TRY).

We then adjust the individual loans for inflation to ensure comparability over time. The baseline regressions pool loans regardless of their maturity. Roughly half of the loans have maturities of less than or equal to one year.[7]

3.1.1 Outstanding Loans Data

We use end-of-quarter data for a given firm-bank pair. The key reason for doing so is that capital flows and other macro/global variables are in quarterly terms. The final, cleaned data set, before aggregation to the firm-bank level for a given quarter, contains roughly 53 million loan records over the December 2003–December 2013 period. Figure A1 compares the growth rate of the aggregated loans in our data set ('Firms') to aggregate credit growth for the whole economy ('Firms + Non-Firms'). The two series track each other very closely, with a correlation of 0.86.[8] Further, as Figure A2 shows, the majority of loans between firm-bank pairs in a given quarter (in terms of value) are continuing loans (i.e., loans on the intensive margin).[9]

Table 1 presents annual information and summary statistics on the share of FX loans in terms of total loans for (1) all banks, (2) domestic banks, and (3) foreign banks.[10] In looking at the

[7] We therefore run regressions with the sample split at the one-year mark, separating loans with short and long maturities, in our robustness checks.

[8] The two series are not as strongly correlated at the beginning of the sample due to the aftermath of the crisis in 2001, which was driven by corporate and government debt and fixed exchange rate. This in turn implies that corporate and household debt growth diverged in the 2003–05 period.

[9] A continuing loan (intensive margin) is a new loan for a given firm-bank relationship that, from one quarter to another, already had a loan relationship. A new loan (extensive margin), on the other hand, is the appearance of a new firm-bank relationship for the first time in that quarter.

[10] Note that the number/composition of domestic and foreign banks changes over time given closures and consoli-

Table 1. Share of FX to Total Loans by Bank Type

	(1) All Banks	(2) Domestic Banks	(3) Foreign Banks
2003	0.557	0.553	0.596
2004	0.469	0.449	0.760
2005	0.512	0.510	0.752
2006	0.534	0.542	0.611
2007	0.506	0.514	0.489
2008	0.558	0.584	0.504
2009	0.504	0.540	0.422
2010	0.480	0.515	0.352
2011	0.512	0.543	0.375
2012	0.446	0.462	0.373
2013	0.473	0.490	0.410
Mean	0.505	0.518	0.513
Std. Dev.	0.036	0.040	0.148
Min.	0.446	0.449	0.352
Max.	0.558	0.584	0.760

Notes: This table presents annual summary statistics of the credit register coverage of loans, over the 2003–13 period, using end-of-year data. Columns (1)-(3) present the FX share of loans within the data sample: column (1) presents the overall share, while columns (2) and (3) break down the share between domestic and foreign banks. The bottom panel presents summary statistics over the eleven years of data. Source: CBRT and authors' calculations.

summary statistics, we see that on average, all types of banks have an approximately even split between FX and TRY over the sample period. However, the share of FX loans in foreign banks' portfolios actually declined over the sample period, whereas the share for domestic banks remained more stable.

Table 2 reports summary statistics for all banks (domestic and foreign), firms, and firm-bank pairs in Turkey's credit register. Column (1) shows that the number of banks in our sample varies over time, with domestic banks outnumbering foreign ones. Further, most firms borrow from domestic banks (column (2)). We next turn to the bilateral relationships between banks and firms in columns (3)-(5). We see in column (3) that on average about 44 percent of firms borrow from more than one bank, but that this lending makes up a large proportion of the total value of loans – 75 percent for all banks, 73 percent for domestic banks, and 82 percent for foreign banks, on average, according to column (4). Finally, column (5) shows that the average number of relationships that

dation.

Table 2. Credit Register Sample Coverage of Firm-Bank Relationships

	(1)	(2)	(3)	(4)	(5)
			Multiple Firm-Bank Share		Av. No. Rel.
	Banks	Firms	Number	Value	per firm
All Banks					
Mean	38.6	302,839	0.438	0.745	2.834
Min.	35.0	30,983	0.358	0.680	2.674
Max.	43.0	670,033	0.468	0.809	3.032
Domestic Banks					
Mean	24.8	236,223	0.433	0.734	2.823
Min.	22.0	29,742	0.359	0.672	2.657
Max.	29.0	509,908	0.465	0.799	3.024
Foreign Banks					
Mean	13.8	66,616	0.472	0.818	3.009
Min.	8.0	1,241	0.334	0.757	2.642
Max.	21.0	160,125	0.621	0.867	3.232

Notes: This table presents annual summary statistics, over the 2003–13 period, on the frequency of different types of firm-bank relationships within the credit register using end-of-year data for all, domestic, and foreign banks. Columns (1) and (2) list the number of banks and firms, respectively; columns (3) and (4) presents the share of loans (relative to total) from firms with multiple bank relationships, in terms of loan number and loan value, respectively; and column (5) presents the average number of multiple banking relationships a firm has in a given year. Source: CBRT and authors' calculations.

a firm has with banks (domestic or foreign) in a given quarter is approximately three.

Table 3 presents summary statistics for the credit register data on outstanding loans for firm-bank pairs each quarter. The table pools all the loans, regardless of currency of denomination, in panel A, while panels B and C present statistics on TRY and FX loans separately (i.e., the unit of observation is firm-bank-denomination in all panels). The table reports summary statistics for (i) loans outstanding in thousands of 2003 TRY, (ii) the nominal interest rate, and (iii) the remaining maturity (in months). These are the data that form the basis for our regression samples when we are not focusing on new loan issuances.[11] As one can see, there is a lot of heterogeneity in the size of loans, as well as borrowing rates. In comparing panels B and C, one also sees that FX loans are on average larger and cheaper than TRY loans. This fact motivates us to always include a

[11] The min-max values are similar across panels due to winsorization.

currency denomination dummy variable in our pooled regressions, as well as to further investigate whether the differential between FX and TRY interest rates and the rate of loan growth vary over the course of the GFC.

Note that since we are aggregating over several potential loans between a given firm-bank pair in a given time period, we need to take into account the size of the individual loans in calculating an "effective" interest rate and maturity for the firm-bank pair. We do this by creating weighted averages based on a loan's share of total loans between each firm-bank pair in a given period. We allow the weights to vary depending on the unit of analysis we consider, and they also vary over time. Larger loans' interest rates get a bigger weight.[12] We want the weights to be time-varying to capture the time variation in the interest rates of the loan portfolio of a given firm-bank pair. Therefore, in panel A, when we pool the TRY and FX loans, the weight's numerator is simply the value of an individual loan, while its denominator is the sum of all TRY and FX loans between a firm-bank pair in a given period. In panels B and C, the weight's numerator is again the individual loan value, while the denominator is total TRY loans in panel B, and in panel C the denominator is total FX loans.[13]

3.1.2 New Loan Issuances Data

Table 4 presents the summary statistics for data on new loan issuances, which we use in our collateral channel regressions below. Unlike the summary statistics presented in Table 3, the underlying data of Table 4 are at the *individual loan level* rather than being aggregated up to the firm-bank (currency denomination) level. Therefore, there is no need to construct weighted variables based on loan values. Besides presenting information on the size of the loan, interest rate, and maturity, we also present summary statistics on the collateral-to-loan ratio for a given loan. This variable can vary quite a bit across loans with some loans having either (i) zero collateral posted or (ii) very little credit drawn for a given amount of collateral posted. Given issue (ii), we winsorize the collateral-to-loan ratio at 2 in order to deal with outliers.[14] We further drop all

[12] We follow the same strategy in calculating weighted averages across different maturities.

[13] Formally, for a loan i between bank b and firm f in time t and denomination type $d = \{ALL, TRY, FX\}$, in panel A: $w^{ALL}_{i,f,b,t} = Loan_{i,f,b,t} / \sum_{i \in I^{ALL}_{f,b,t}} Loan_{i,f,b,t}$; panel B: $w^{TRY}_{i,f,b,t} = Loan_{i,f,b,t} / \sum_{i \in I^{TRY}_{f,b,t}} Loan_{i,f,b,t}$; panel C: $w^{FX}_{i,f,b,t} = Loan_{i,f,b,t} / \sum_{i \in I^{FX}_{f,b,t}} Loan_{i,f,b,t}$, where $I^{d}_{i,f,b,t}$ is the set of loans based on currency types between the firm-bank pair in a given quarter.

[14] Note that the collateral-to-loan ratio can be greater than one for several reasons. First, banks may ask for more collateral than the loan value, since the collateral may also include liquidation costs or legal costs, or other risks attached to the collateral. Second, depending on the type of collateral posted, such as residential property, banks require collateral up to 200 percent of the loan value. Third, firms must post collateral for the whole credit line (or multiple credit lines) requested, even if the initial loan withdrawal is less than amount. Also note that book and

Table 3. Credit Register Quarterly Summary Statistics, Firm-Bank Level

Panel A. All Loans

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Loan	18,345,853	148.8	21.88	402.6	5.011	3,478
Interest rate	18,345,853	0.138	0.082	0.090	0.001	0.540
Maturity	18,345,853	19.17	6.000	17.10	0.000	82.69

Panel B. TRY Loans

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Loan	17,086,409	105.2	21.12	272.5	5.011	3478
Interest rate	17,086,409	0.144	0.097	0.090	0.001	0.540
Maturity	17,086,409	19.51	6.243	17.09	0.000	82.69

Panel C. FX Loans

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Loan	1,259,444	740.9	90.35	988.7	5.011	3,478
Interest rate	1,259,444	0.059	0.045	0.029	0.001	0.540
Maturity	1,259,444	14.55	4.000	16.58	0.000	82.69

Notes: This table presents summary statistics using quarterly data for aggregate firm-bank transactions over the 2003–13 period. The sample includes loans for all firm-bank pairs reported in the data set. Panel A presents data based on pooling all FX and TRY transactions at the firm-bank-quarter level; Panel B considers only Turkish lira loans, and Panel C considers only FX loans (expressed in Turkish liras). Loan is the end-of-quarter total outstanding principal for all loans between a firm-bank pair, in thousands of Turkish lira and adjusted for inflation; Interest Rate is the weighted average of the nominal rates, reported for loans between a firm-bank pair, where the weights are constructed based on loan shares between a firm-bank pair in a given quarter, and are based on either all, TRY, or FX loans for Panels A-C, respectively; Maturity is the weighted average of the initial time to repayment reported for loans of a firm-bank pair, which is measured in months, and where the weights are constructed based on loan shares between a firm-bank pair in a given quarter, and are based on either all, TRY, or FX loans for panels A-C, respectively. Source: CBRT and authors' calculations.

loans with zero collateral posted for this part of the analysis, since we are using the collateral as a measure of financial constraints and these zero-collateral loans are generally given to very large multinationals or for loan amounts that are very small compared to firm value. Dropping these observations decreases the sample by approximately 30 percent.

The majority of loans (roughly 90 percent) are denominated in TRY. However, as with the summary statistics using loans aggregated up to the firm-bank level, new loan issuances in TRY

market value of the collateral is the same since we observe each loan and collateral posted only once in a given month given our focus on new issuances.

Table 4. Credit Register Quarterly Summary Statistics for New Loan Issuances

Panel A. All Loans

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Loan	10,016,550	0.115	29.24	1.210	0.005	752.0
Interest rate	10,016,550	0.138	0.128	0.094	0.001	0.618
Maturity	10,016,550	16.19	10.00	18.86	0.000	118.0
Collateral/Loan	10,016,550	1.166	1.000	0.450	0.0001	2.000

Panel B. TRY Loans

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Loan	9,048,643	0.080	26.61	0.655	0.005	572.0
Interest rate	9,048,643	0.147	0.134	0.095	0.001	0.618
Maturity	9,048,643	16.70	10.00	19.14	0.000	118.0
Collateral/Loan	9,048,643	1.175	1.000	0.454	0.0001	2.000

Panel C. FX Loans

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Loan	967,907	0.446	92.31	3.320	0.005	752.0
Interest rate	967,907	0.060	0.060	0.024	0.001	0.618
Maturity	967,907	11.42	6.00	15.11	0.000	118.0
Collateral/Loan	967,907	1.082	1.000	0.408	0.0001	2.000

Notes: This table presents summary statistics using monthly data for new loan issuances over the 2003–13 period. The sample includes loans for all firm-bank pairs reported in the data set. Panel A presents data based on pooling all FX and TRY transactions at the firm-bank-quarter level; Panel B considers only Turkish lira loans, and Panel C considers only FX loans (expressed in Turkish liras). Loan is the outstanding principal of the new loan, in thousands of Turkish lira and adjusted for inflation; Interest Rate is the loan's nominal lending; Maturity is the initial time to repayment reported for the new loan, which is measured in months; Collateral/Loan is the collateral post to outstanding principal of the new loan. Source: CBRT and authors' calculations.

are considerably smaller and more expensive than FX loans. Furthermore, the average TRY loan's maturity is approximately five months longer than that of the average FX loan (the differential at the firm-bank level of aggregation is only two months). Interestingly, the average collateral-to-loan ratio is higher for TRY-denominated loans, but this differential is not large: 1.175 for TRY versus 1.082 for FX.

3.2 Bank-Level Data

Turkey, like many major emerging markets, has a bank-dominated financial sector: in 2014, banks held 86 percent of the country's financial assets and roughly 90 percent of total financial liabilities. The past decade has witnessed a doubling of bank deposits and assets, while loans have increased fivefold. Our baseline analysis uses quarterly bank balance sheet data from Turkey for the 2003–13 period. The data are collected at the monthly level, and we use March, June, September, and December reports. All banks operating within Turkey are required to report their balance sheets as well as extra items to the regulatory and supervisory authorities – such as the CBRT and the Banking Regulation and Supervision Agency (BRSA) – by the end of the month.

Table 5 presents summary statistics based on end-of-year values for all banks (Panel A), domestic banks (Panel B), and foreign banks (Panel C). Looking at the full banking sector in panel A, we see that on average over the sample period the sector's assets represented approximately 78 percent of GDP, loans 38 percent, and deposits 46 percent. Looking at the same statistics in panels B and C, we see that domestic banks account for a much greater share of overall banking activity than foreign banks. This is an important fact to note, as it makes Turkey different than other large emerging markets (e.g., Mexico), where foreign banks often play a larger role in the banking sector. Since we focus only on banks that are active in the corporate loan market, the number of institutions in our sample varies between thirty-five and forty-three throughout the course of the sample period. Over the 2003–13 period there are forty-five banks, of which twenty-eight are commercial banks (domestic and foreign), fourteen are investment and development banks, and five are branches of foreign banks.[15]

Table 6 presents summary statistics based on end-of-quarter values for all banks (Panel A), domestic banks (Panel B), and foreign banks (Panel C), and summarizes the banking variables we include in our regressions. These variables, like others used in the paper, are winsorized at the 1 percent level. There is quite a bit of variation in bank size (as measured by total assets), the capital ratio, the leverage ratio, the non-core ratio, the liquidity ratio, and the return on assets (ROA) across banks and over time. In comparing domestic and foreign banks, we see that domestic banks are larger on average as well as having a larger leverage ratio. Meanwhile, foreign banks have larger non-core, liquidity, and capital ratios on average. It is also instructive to look at the standard

[15] Note that in the aftermath of the 2001 crisis, the weak capital structure of the Turkish banks resulted in a number of takeovers. As a result, in 2000–04 period, a total of twenty-five banks were taken over by Deposit-Insurance Fund, SDIF. Our sample begins at the end of this period, where the majority of takeovers were completed.

Table 5. Banking Sector Quarterly Summary Statistics, Based on Official Bank-Level Balance Sheet Data

Panel A. All Banks

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Assets/GDP	11	0.775	0.744	0.189	0.548	1.105
Loans/GDP	11	0.377	0.368	0.167	0.146	0.668
Deposits/GDP	11	0.461	0.458	0.095	0.342	0.603

Panel B. Domestic Banks

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Assets/GDP	11	0.683	0.650	0.127	0.532	0.901
Loans/GDP	11	0.321	0.312	0.128	0.140	0.544
Deposits/GDP	11	0.410	0.407	0.060	0.334	0.492

Panel C. Foreign Banks

	Obs.	Mean	Median	St.Dev.	Min.	Max.
Assets/GDP	11	0.092	0.094	0.064	0.013	0.205
Loans/GDP	11	0.056	0.056	0.040	0.006	0.124
Deposits/GDP	11	0.051	0.051	0.036	0.007	0.112

Notes: This table presents summary statistics on bank-level variables using quarterly data pooled over the 2003–13 period for all banks (Panel A), domestic banks (Panel B), and foreign banks (Panel C). The ratios are based the banking sectors total assets, loans, and deposits relative to GDP, respectively. The sector variables are created by aggregating the official bank balance sheet data for the end of year. Source: CBRT and authors' calculations.

deviations of the bank variable across both bank groups, which reveal that the distributions of the various bank characteristics overlap across the domestic and foreign bank groups.

Finally, we compare bank-level variables across "low" and "high" non-core banks in Table 7. We do this as the non-core variable is our key variable to proxy access to international markets, which will be used in our difference-in-differences regressions below. In particular, we construct a non-core liabilities ratio, in which the denominator is total liabilities, defined as deposits (core funding) + non-core funding. Non-core liabilities equals Payables to money market + Payables to securities + Payables to banks + Funds from Repo + Securities issued (net). We then create a time-invariant dummy variable that splits banks into low and high non-core groups, with the dummy defined by comparing a bank's average non-core ratio to median ratio for the overall sample. A low non-core

Table 6. Bank-Level Quarterly Summary Statistics

Panel A. All Banks

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
log(Total Real Assets)	1,685	14.40	14.47	2.230	8.466	18.33
Non-core Ratio	1,685	0.298	0.226	0.224	0.000	0.907
Liquidity Ratio	1,685	0.400	0.335	0.217	0.017	0.960
Capital Ratio	1,685	0.145	0.138	0.044	0.064	0.198
Leverage Ratio	1,685	0.776	0.862	0.198	0.007	0.984
ROA	1,685	0.012	0.010	0.010	0.000	0.033

Panel B. Domestic Banks

	Obs.	Mean	Median	St.Dev.	Min.	Max.
log(Total Real Assets)	1,092	14.79	14.76	2.222	10.19	18.33
Non-core Ratio	1,092	0.260	0.212	0.194	0.000	0.907
Liquidity Ratio	1,092	0.353	0.315	0.189	0.017	0.960
Capital Ratio	1,092	0.141	0.130	0.044	0.064	0.198
Leverage Ratio	1,092	0.776	0.870	0.206	0.038	0.984
ROA	1,092	0.012	0.010	0.010	0.000	0.033

Panel C. Foreign Banks

	Obs.	Mean	Median	St.Dev.	Min.	Max.
log(Total Real Assets)	593	13.70	13.71	2.066	8.466	17.15
Non-core Ratio	593	0.368	0.277	0.257	0.000	0.907
Liquidity Ratio	593	0.485	0.448	0.238	0.055	0.948
Capital Ratio	593	0.153	0.153	0.043	0.064	0.198
Leverage Ratio	593	0.776	0.847	0.183	0.007	0.964
ROA	593	0.012	0.010	0.010	0.000	0.033

Notes: This table presents summary statistics on bank-level variables using quarterly data pooled over the 2003–13 period for all banks (Panel A), domestic banks (Panel B), and foreign banks (Panel C). Total Assets are in nominal terms; the Non-core Ratio is non-core liabilities over total liabilities; the Liquidity Ratio is liquid assets over total assets; the Capital Ratio is equity over total assets; the Leverage Ratio is total liabilities over total assets; and ROA is return on total assets. Non-core liabilities = Payables to money market + Payables to securities + Payables to banks + Funds from Repo + Securities issued (net). Source: CBRT and authors' calculations.

bank has a mean below the sample median, while a high non-core bank has a mean greater than or equal to the median. As can be seen in Figure 2, banks with high non-core liabilities are the ones that borrow internationally since a large part of these liabilities are in foreign currency.[16]

[16] Turkish banks' liabilities to each other are in TRY.

Table 7. Bank-Level Summary Statistics by Non-Core Grouping

	Panel A. Low Non-core			**Panel B.** High Non-core		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
log(Total Real Assets)	721	15.40	2.189	964	13.66	1.952
Non-core Ratio	721	0.157	0.085	964	0.404	0.237
Liquidity Ratio	721	0.346	0.185	964	0.440	0.230
Capital Ratio	721	0.130	0.039	964	0.157	0.044
Leverage Ratio	721	0.817	0.192	964	0.745	0.197
ROA	721	0.011	0.009	964	0.013	0.011

Notes: This table presents summary statistics on bank-level variables using quarterly data pooled over the 2003–13 period for "low" non-core banks (Panel A) and "high" non- banks (Panel B. A low non-core bank has a mean non-core ratio below the sample median, while a high non-core bank has a mean greater than or equal to the median.Total Assets are in nominal terms; the Non-core Ratio is non-core liabilities over total liabilities; the Liquidity Ratio is liquid assets over total assets; the Capital Ratio is equity over total assets; the Leverage Ratio is total liabilities over total assets; and ROA is return on total assets. Non-core liabilities = Payables to money market + Payables to securities + Payables to banks + Funds from Repo + Securities issued (net). Source: CBRT and authors' calculations.

Note that both the high and low non-core groups can contain both domestic and foreign banks.[17] Comparing the two groups in Table 7, it is interesting to first note that the low non-core banks are larger on average, as well as having larger leverage ratios than the high non-core bank sample.[18] This fact in part motivates some further robustness regressions, which we run below. Meanwhile, high non-core banks have somewhat larger liquidity and capital ratios than the low non-core sample, and the ROA is about the same across both groups on average. What is important for our purposes is the time series relation between non-core liabilities and foreign financing (capital flows). As shown in Figures 3 and 4, domestic banks' non-core liabilities move together with capital flows (both total and banking sector), whereas foreign banks' do not.

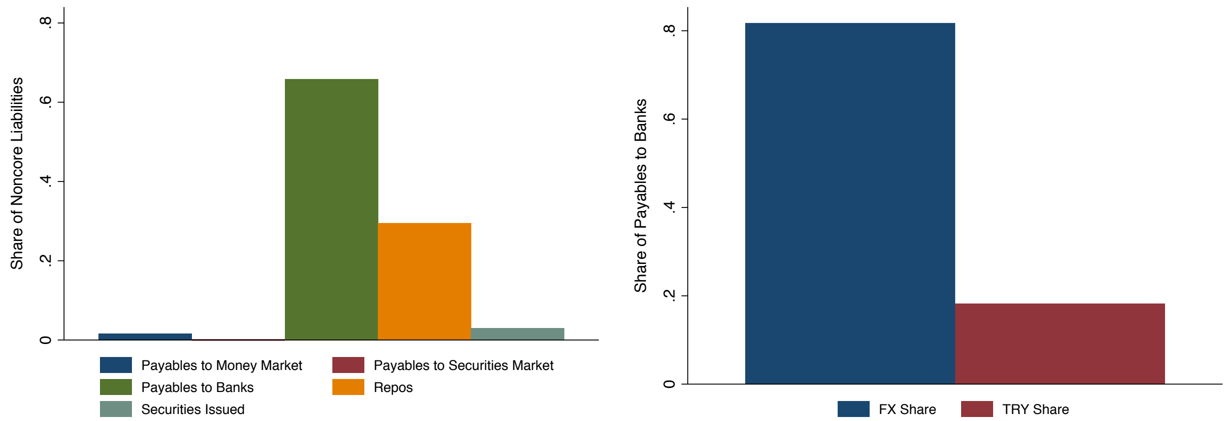
3.3 Macro-Level Data

Figure 6 plots Turkey's credit growth (Loans/GDP growth) and current account position (CA/GDP) against log(VIX) and Turkish capital inflows in panels (a) and (b), respectively. Movements in the VIX tend to be negatively correlated with Turkey's credit growth, and positively correlated with the current account balance (a fall in the current account implies an *increase* in net capital inflows).

[17] The two non-core groups are quite balanced along the domestic/foreign bank split, with the low non-core sample having 63 percent of the banks being domestic, while the high non-core sample is composed of 64 percent of domestic banks.

[18] Notice that leverage ratios are based on total liabilities and high non-core banks can have high leverage in terms of short-term liabilities since non-core funding is mostly short-term.

Figure 2. Composition of Non-Core Liabilities of Banks



(a) Non-core Liabilities Breakdown

(b) Currency Breakdown of Payables to Banks

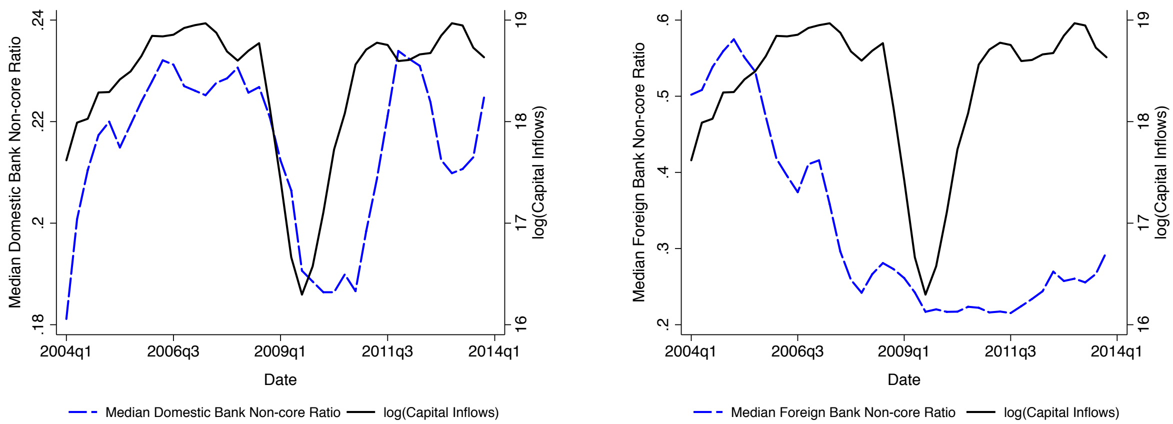
Notes: This figure plots the break down of non-core liabilities of the Turkish banking sector using pooled quarterly data over 2004–13. Panel (a) presents the breakdown across five sub-groups: (i) payables to the money market, (ii) payables to banks, (iii) securities issued, (iv) payables to the securities market, and (v) Repos. Panel (b) further breaks down payables to banks (ii) by currency shares. Source: CBRT and authors' calculations.

Loan-to-GDP growth fluctuates between 5 and 10 percent quarterly during our sample. Looking at a more direct measure of capital inflows to Turkey, we see that this measure is positively correlated to Turkey's credit growth, while negatively correlated with its current account. These correlations are consistent with the role of the VIX as established in the introduction.

Firms' direct external borrowing is very limited in Turkey and hence banks are the key intermediary of capital flows. As Figure 7 shows, external corporate bond issuance is negligible as a percentage of GDP, whereas banks' external borrowing is as high as 40 percent of GDP at the end of our sample period.

Table A1 presents summary statistics for the quarterly macroeconomic and financial variables that we use as controls in our regressions, as well as measures of global financial conditions. All real variables are deflated using 2003 as the base year. The Turkish macroeconomic data are taken from the CBRT. The VIX and the Turkish overnight rate are quarterly averages. There is substantial quarterly variation in all these variables over the sample period, which is crucial for our identification strategy.

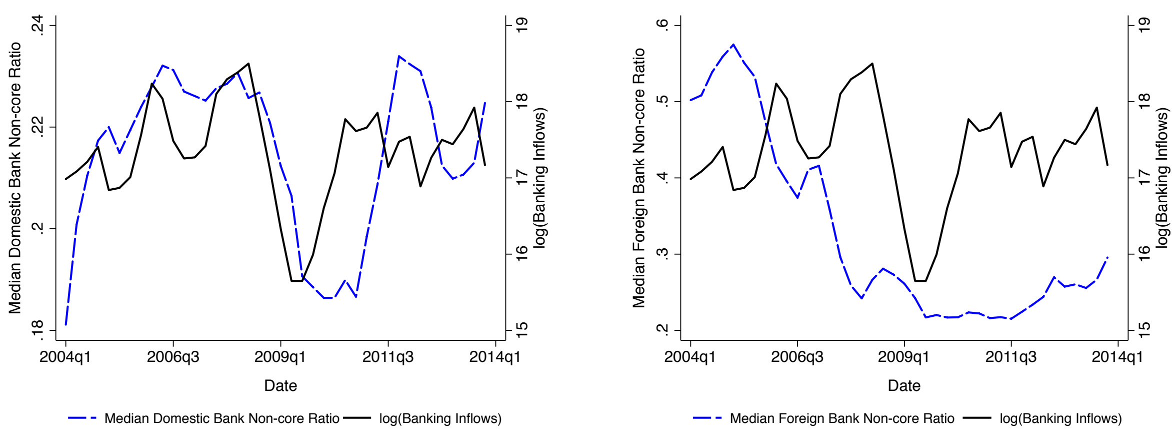
Figure 3. Capital Inflows and Non-Core Liabilities



(a) Domestic Banks **(b)** Foreign Banks

Notes: This figure plots the median bank non-core ratio and logarithm of total capital inflows over the 2004–13 period, where panel (a) presents the median domestic bank and panel (b) presents the median foreign bank. Source: CBRT and authors' calculations.

Figure 4. Banking Inflows and Non-Core Liabilities



(a) Domestic Banks **(b)** Foreign Banks

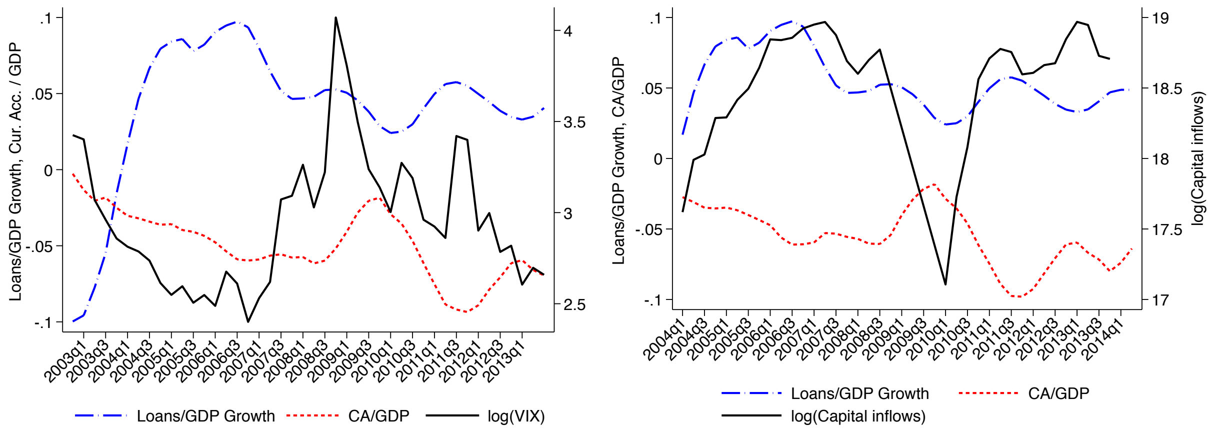
Notes: This figure plots the median bank non-core ratio and logarithm of banking inflows over the 2004–13 period, where panel (a) presents the median domestic bank and panel (b) presents the median foreign bank. Source: CBRT and authors' calculations.

4 Empirical Facts

4.1 Fact 1: The GFC Strongly Comoves with Local Credit Conditions

We begin with "macro" regressions, which regress the nominal interest rate (i) and the loan principal outstanding (Loan) on our measure of the GFC, log(VIX). Regressions are weighted-least squares,

Figure 6. Capital Flows, VIX, and Credit Growth in Turkey



(a) log(VIX) **(b)** Capital Inflows

Notes: These figures plot Turkey's Loans/GDP and CA/GDP ratios over 2003–13 with (a) log(VIX) and (b) Turkish capital inflows (in 2003 TRY). Four-quarter moving averages are plotted for all variables but log(VIX), which is the period average. Source: CBRT and authors' calculations.

where weights are the natural logarithm of the log of bank's total assets.[19] The standard errors are double clustered at the firm and time levels.[20] We run

$$\log \mathrm{Y}_{f,b,d,q} = \alpha_{f,b} + \lambda \mathrm{Trend}_q + \beta \log \mathrm{VIX}_{q-1} + \delta \mathrm{FX}_{f,b,d,q} + \Theta_1 i_{q-1} + \Theta_2 \Delta \log(\mathrm{GDP}_{q-1}) + \Theta_3 \mathrm{Inflation}_{q-1} + \Theta_4 \Delta \log(\mathrm{XR}_{q-1}) + \Theta_5 \mathbf{Bank}_{b,q-1} + \varepsilon_{f,b,d,q}. \quad (1)$$

where $\mathrm{Y}_{f,b,d,q}$ is either $\mathrm{Loans}_{f,b,d,q}$ or one plus the nominal interest rate $(1 + i_{f,b,d,q})$, for a given firm-bank $(f,\ b)$ pair in a given currency denomination (d) and quarter (q), $\alpha_{f,b}$ is a firm×bank fixed effect, which controls for unobserved firm- and bank-level time-invariant heterogeneity, and Trend_q is a linear trend variable. FX is a dummy variable that is equal to 1 if the firm-bank loan observation is in foreign currency, and 0 if it is in Turkish lira. We use the VIX index in logs as the proxy for GFC. Using firm×bank fixed effects allows us to identify from within firm-bank variation comparing given firm-bank pairs over time.

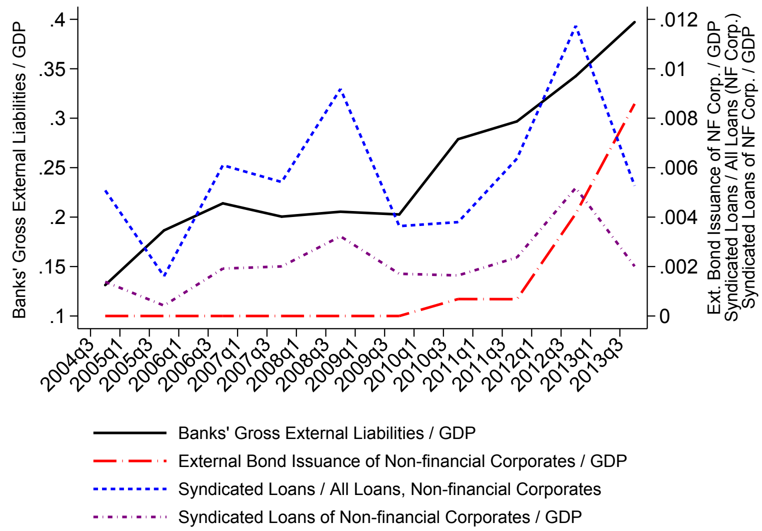
Firm-bank level interest rates will be a function of the domestic policy rate (i_{q-1}) plus the firm risk premium.[21] If UIP holds, the domestic policy rate is equal to the sum of the foreign interest rate

[19] We also run regressions using OLS and results are similar to the WLS ones.

[20] Petersen (2009) shows that the best practice is to cluster at both levels, or if the number of clusters is small in one dimension, then use a fixed effect for that dimension and cluster on the other dimension, where more clusters are available.

[21] We will explicitly control time varying firm risk premium in our difference-in-differences framework below; here only the average level of firm riskiness is controlled through the use of firm fixed effects.

Figure 7. External Borrowing by Banks and Firms



Notes: This figure plots the external liabilities of banks and external corporate bond issuance as a ratio to GDP over the 2005–13 period. Source: CBRT and authors' calculations.

and the expected exchange rate change. We include the domestic policy rate directly, as we later document a gross UIP violation. We control for macro fundamentals in every specification, proxied by GDP growth, inflation and fluctuations in the exchange rate (XR). We also add, under **Bank**, a set of bank characteristics that control for bank heterogeneity, including log(assets), capital ratio, liquidity ratio, non-core liabilities ratio, and return on total assets (ROA). These variables are standard in the literature and importantly include the inverse of banks' leverage (i.e., the capital ratio), which has been found to be sensitive to global financial conditions and wealth effects arising from exchange rate and asset price changes (e.g., Bruno and Shin, 2015a,b), thus allowing banks to expand their lending. We lag all the controls.

Table 8 presents the results for regression (1) for all firm-bank relationships, as well as splitting the sample between domestic and foreign banks. The estimated coefficient for the effect of the VIX on the interest rate in panel A for all banks, 0.019, for all banks implies a 1 percentage point fall in the average borrowing rate resulting from a fall in log(VIX) equal to its interquartile range over the sample period. The baseline micro estimates of the elasticity of domestic loan growth with respect to changes in the VIX is -0.067. We use this estimated VIX coefficient to quantify the effect of movements in the VIX on aggregate credit growth. Appendix A.1 provides an aggregation equation, which shows how to use the micro estimates to draw implications for *aggregate* credit growth over the cycle. We can explain on average 43 percent of observed cyclical *aggregate* loan

Table 8. The Global Financial Cycle, Borrowing Costs and Loan Volumes

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	Bank Sample			*Bank Sample*		
	All	Domestic	Foreign	All	Domestic	Foreign
	(1)	(2)	(3)	(4)	(5)	(6)
log(VIX)	0.019***	0.022***	0.012***	-0.067**	-0.073***	0.0365
	(0.003)	(0.003)	(0.003)	(0.027)	(0.024)	(0.040)
FX	-0.069***	-0.066***	-0.065***	0.575***	0.612***	0.368***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.013)	(0.025)
Domestic policy rate	0.213***	0.254***	0.145***	0.118	0.164	-0.504
	(0.026)	(0.031)	(0.028)	(0.301)	(0.297)	(0.318)
Δlog(GDP)	-0.062*	-0.059	-0.118***	0.196	0.195	0.704
	(0.035)	(0.042)	(0.042)	(0.319)	(0.317)	(0.489)
Δlog(XR)	-0.046***	-0.056***	-0.014	0.037	0.062	-0.274
	(0.010)	(0.013)	(0.016)	(0.124)	(0.130)	(0.141)
Inflation	-0.015	-0.019	-0.012	0.036	0.066	-0.073*
	(0.016)	(0.022)	(0.008)	(0.121)	(0.123)	(0.071)
Observations	18,345,853	13,490,892	905,024	18,345,853	13,490,892	905,024
R-squared	0.782	0.720	0.831	0.831	0.810	0.825
Macro controls & trend	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents results for regression (1) using quarterly data. Panel A, columns (1)-(3) use the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable for the full bank sample, domestic banks, and foreign banks, respectively. Panel B, columns (4)-(6) use the natural logarithm of total loans between a firm-bank as the dependent variable for the full bank sample, domestic banks, and foreign banks, respectively. VIX is the lagged quarterly average. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), the domestic rate is the quarterly average overnight rate, GDP growth is real quarterly, XR change is the quarterly Turkish lira/US dollar exchange rate change, and inflation is quarterly CPI changes. A linear time trend is also included as a regressor. Furthermore, the lagged values of the following bank-level characteristics are also controlled for (not reported): log(assets), capital ratio, liquidity ratio, non-core liabilities ratio, and return on total assets (ROA). Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

growth to the corporate sector.[22]

There are some interesting differences with respect to the estimated coefficients on log(VIX) in the domestic and foreign bank sub-samples. First, while the interest rate coefficients in panel A are positive and highly significant for both the domestic and foreign bank sub-samples, the

[22] We apply (A.4) using $\widehat{\beta} = -0.067$ and the observed change in log(VIX) to obtain predicted aggregate loan growth. We then divide this series by the linearly detrended series of *actual* aggregate credit growth, and take the average of this ratio to arrive at 43 percent.

coefficient estimated in the domestic bank sample is almost twice as large as that estimated in the foreign bank sample, 0.22 versus 0.12. Therefore, it appears that Turkish domestic banks are more responsive to the GFC than foreign banks operating in Turkey. This difference is even more striking when turning to the loan-VIX elasticities estimated in panel B. Here, the coefficient on log(VIX) is negative and strongly significant for domestic banks, while it's actually slightly positive and statistically insignificant for foreign banks. These results point to the crucial role that *domestic* banks play in transmitting the GFC to the Turkish credit market, a result that differs drastically from the literature that focuses on the role of foreign banks in transmitting foreign monetary policy (e.g., Morais et al., 2019).[23]

Demand and Supply Factors: Capital Inflows and the GFC

The GFC, as proxied by the VIX, is strongly correlated with Turkish capital inflows as Figure 6 depicts. A natural question then arises as to whether the correlation between the VIX and capital inflows is picking up demand, supply, or both. The regressions in Table 8 control for macro demand factors, such as domestic GDP growth. However, it is also insightful to look at the log(VIX) coefficient in the interest rate regressions. If movements in the VIX were in fact picking up local demand factors, we would expect loan interest rates to be *negatively* correlated with the VIX. For example, imagine that the VIX falls as global conditions improve and Turkish firms react by beginning to demand more credit (which banks in part finance by borrowing from abroad), we would then expect there to be upward pressure on lending rates given increased demand, holding banks' supply constant. This would generate a negative correlation between rates and the VIX, which is counterfactual to our regression results. If, on the other hand, a fall in the VIX is associated with an improvement in global financial conditions and allows Turkish banks to access foreign capital more cheaply, these banks can then offer loans at a lower interest rate in the domestic credit market. This in turn implies a *positive* correlation between the VIX and lending rates as we find in panel A of Table 8. Note that under both a demand or supply scenario we would expect the VIX coefficient in the loan volume regressions to have the same sign – negative, as our regressions show. Following this logic, our first set of regressions therefore point to the GFC impacting the domestic credit

[23] The VIX responds to U.S. monetary policy (Bekaert et al., 2013), and U.S. monetary policy can affect exchange rates and on asset prices abroad. Therefore, we have also run regressions including both the VIX and measures of U.S. monetary policy shocks (Gertler and Karadi, 2015) in Table A2. The regressions show that the coefficients on log(VIX) remain strongly significant. Further, the coefficients on the US monetary policy shocks, FF4 or MP1, in the interest rate regressions are either barely significant or not significant at all. Meanwhile, the coefficients for these variables in loan volume regressions are highly significant and of the expected sign. This suggests that U.S. monetary policy does not have an independent effect on pricing once the effect of VIX is taken into account, whereas, it can have an independent effect on quantities through other channels.

market from the supply side, as domestic banks tap global capital markets to finance domestic lending at lower costs.[24]

The estimation of (1) may still suffer from omitted demand variables, especially at the firm level, and thus be biased. We therefore next turn to exploiting bank heterogeneity in access to foreign capital in a difference-in-differences regression setup, which allows us to explicitly control for time-varying firm demand and firm credit risk.[25]

4.2 Fact 2: High Non-core Banks Transmit the GFC to Local Firms

To identify the spillovers from global financing conditions into the domestic credit market via supply-driven capital inflows, we explore the variation in banks' exposure to international financial markets and how this exposure affects the *pricing* of loans, fully accounting for firm time-varying characteristics and demand for credit. To focus on how the difference in banks reliance on financing via non-traditional (or wholesale) funding impacts their behavior over the GFC, we use banks' non-core liabilities. We construct a non-core ratio – non-core liabilities divided by total liabilities – where non-core liabilities are defined in Section 3. We estimate

$$\log \mathrm{Y}_{f,b,d,q} = \alpha_{f,b} + \alpha_{f,q} + \zeta(\text{Non-core}_b \times \log \mathrm{VIX}_{q-1}) + \delta_1 \mathrm{FX}_{f,b,d,q} + \epsilon_{f,b,d,q}, \tag{2}$$

where $\alpha_{f,q}$ is a firm×quarter fixed effect, controlling for firms' credit demand. Non-core$_b$ is a time-invariant dummy variable, indicating whether or not a bank has a high non-core liabilities ratio: a bank is assigned a 1 for "high" if its average non-core ratio over time is larger than the median of all banks' non-core ratios over the sample; otherwise, the banks receives a zero as a "low" non-core

[24]We have also run a regression of Turkish capital inflows on log(VIX) and the macroeconomic variables used in regression (1), augmented for Turkish consumer confidence, which is available from 2004 onwards – the regression thus uses thirty-nine observations in total. This estimated coefficient on log(VIX) is -1.493 and significant at the 1 percent level. Meanwhile, although the coefficient on consumer confidence is positive, as would be expected for a capital inflows demand variable, it is not significant, nor are the rest of the macroeconomic variables.

[25]We have also explored the sensitivity of our baseline estimates to firms' direct exposure to the global economy by running regressions splitting the sample between exporters and non-exporters in regression Table A3. The interest rate-VIX elasticity is indeed smaller for exporters, and larger for the loan volume regressions pointing to potential demand effects being picked up by the VIX. However, note that the coefficients remain strongly significant and are the same sign as for the non-exporters regressions. Furthermore, exporters make up less than 10 percent of our sample of loans. We also explore sensitivity of the VIX coefficient across sectors in Table A4. The coefficients on log(VIX) do not vary very much across sectors. Finally, we have run our baseline regressions given different sample cuts and other robustness check. Table A5 presents the VIX coefficient across different sample cuts as well as OLS and WLS regression specifications. Table A6 runs the baseline regression (i) using an extracted risk-aversion of VIX, (ii) on short- or long-maturity loan samples, (iii) dropping the crisis period where VIX spiked, and (iv) on the sample including only private banks . All results are robust.

Table 9. The Role of High Non-Core Banks in Transmitting the GFC

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	(1)	(2)	(3)	(4)	(5)	(6)
log(VIX)	0.014***	0.015***		-0.051*	-0.085***	
	(0.003)	(0.002)		(0.026)	(0.024)	
Non-core×log(VIX)	0.019***	0.015***	0.014***	-0.067***	-0.040***	-0.037**
	(0.004)	(0.003)	(0.003)	(0.016)	(0.014)	(0.017)
FX	-0.069***	-0.070***	-0.069***	0.575***	0.577***	0.601***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.011)	(0.012)
Observations	18,345,853	8,573,782	8,573,782	18,345,853	8,573,782	8,573,782
R-squared	0.783	0.760	0.856	0.831	0.806	0.871
Macro controls & trend	Yes	Yes	No	Yes	Yes	No
Bank controls	Yes	Yes	No	Yes	Yes	No
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm×quarter F.E.	No	No	Yes	No	No	Yes

Notes: This table presents results for regression (2) using quarterly data for all loans. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. Non-core is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their average non-core liabilities ratio over the sample period. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), and firm×quarter effects are included in all specifications. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

bank.[26]

Table 9 shows that banks with high non-core liabilities respond more to movements in the VIX in their loan pricing and also in loan issuance. During periods when the VIX is low, high non-core banks decrease their borrowing rates relatively more than low non-core banks: the estimated coefficient on the interaction between the VIX and the non-core dummy is 0.013 when including firm×quarter effects in column (2), which is almost as large as the estimated elasticity of 0.019 between the interest rate and the VIX in the macro regression of Table 8. Therefore, the relative differential in changes in interest rates for high non-core banks given movements in the GFC is economically large, and high non-core banks are responsible for a significant part of the aggregate effect.

We further run the interaction regression including the VIX on its own without firm×quarter

[26]We have also run regressions allowing for the slope on the trend variable to be heterogeneous across groups and results are robust.

effects in order to recover the VIX-only coefficient in column (1). In this case, the estimated coefficient on the VIX is slightly lower (0.015) than the one in the macro regressions, while the coefficient on the interaction between the non-core dummy and the VIX is almost the same (0.015) as in the regression with firm×quarter effects. Given this regression, the estimated interest rate-VIX elasticity for high non-core banks is double ($0.015 + 0.015 = 0.03$) that of low non-core banks (0.015). We can use the estimated coefficients for the loan volume regressions and the aggregation accounting exercise as described in Appendix A.1 to gauge the importance of high non-core banks in explaining aggregate credit growth over the sample period. Specifically, we take the ratio of the calculated average aggregate loan growth – using the coefficients for the VIX and the interacted non-core coefficient for high non-core banks – to the average aggregate loan growth calculated for all banks, and find this ratio to be 0.95.[27]

The role of bank heterogeneity in driving *aggregate* credit market conditions has recently been shown to be important in the closed-economy literature by Coimbra and Rey (2017). Their model emphasizes that heterogeneity in bank leverage can create systemic risk when there is a funding cost shock to banks. We therefore also run horse race regressions including banks' non-core and leverage ratios, as well as bank size, interacted with log(VIX) in Table 10 for nominal interest rates (Panel A) and loan volumes (Panel B), including firm×quarter fixed effects. The leverage and size variables are based on dummy variables, which like the non-core dummy, we define as low and high based on the level of each variable relative to the sample median.

First, columns (1) and (4) include the non-core and leverage variables together and show that the non-core interaction remains strongly significant while the leverage ratio interaction is insignificant. Second, columns (2) and (5) include the non-core and bank size variables together and show that the non-core coefficients remain significant. The size interaction is also significant and indicates that larger banks decrease lending rates more than smaller banks during periods when the VIX is low (column (2)), and offer larger loans during these period as well (column 5).[28] Finally, columns (3) and (6) include all three bank variables interacted with log(VIX). Results are similar to the other estimation results. The coefficient on the leverage-VIX interaction term for the interest rate regressions in column (3) is now positive and significant, indicating that once we control for both the non-core ratio and bank size, banks with higher leverage decrease rates relative to low leveraged banks during the boom phase of the GFC. Since high non-core liabilities will be strongly correlated

[27] This number drops to approximately 0.86 if we use the (smaller) sample that contains only multiple firm-bank observations, as in column (4) of Table 9.

[28] The bank size-loan volume result is consistent with results in Baskaya et al. (2017).

Table 10. The Role of High Non-Core Banks in Transmitting the GFC: Horse Race with Bank Leverage and Size

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	(1)	(2)	(3)	(4)	(5)	(6)
Non-core×log(VIX)	0.014***	0.015***	0.016***	-0.038**	-0.040**	-0.041**
	(0.003)	(0.004)	(0.004)	(0.018)	(0.017)	(0.017)
Leverage×log(VIX)	0.003		0.011***	-0.023		-0.042
	(0.002)		(0.003)	(0.030)		(0.027)
Size×log(VIX)		0.014***	0.015***		-0.033*	-0.036**
		(0.004)	(0.004)		(0.018)	(0.017)
FX	-0.069***	-0.069***	-0.069***	0.601***	0.601***	0.601***
	(0.003)	(0.003)	(0.003)	(0.012)	(0.012)	(0.012)
Observations	8,573,782	8,573,782	8,573,782	8,573,782	8,573,782	8,573,782
R-squared	0.856	0.857	0.857	0.871	0.871	0.871
Macro controls & trend	No	No	No	No	No	No
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm×quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents results for regression (2) using quarterly data for all loans and augmented with further bank variable interactions. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. Non-core is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their average non-core liabilities ratio over the sample period. Leverage is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their leverage ratio over the sample period. Size is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their size as measured by log(assets) over the sample period. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), and the macroeconomic controls and time trend of Table 8 are included in columns (1)-(2) and (4)-(5) when firm×quarter effects are excluded, and the bank-level characteristics of Table 8 are included. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

with short-term debt based leverage, this is not a surprising result. The leverage coefficients for the loan volume regressions are negative, indicating that banks that are more highly leveraged would increase lending during boom phases, but the coefficients are not significant. The robustness of the non-core results points to a new source of heterogeneity to consider for open-economy models.

To summarize, internationally exposed banks (as proxied by by high non-core liabilities ratios) play a dominant role in explaining our overall aggregate results. This result is based on the fact that we control for time-varying firm characteristics (including firms' credit demand and credit risk), and hence identifies the supply-side effect. Of course, even with firm×quarter effects supply side identification can be challenged if the match between firms and banks is not random. We will come back to this issue in section 4.5 when we control the non-random nature of the firm-bank match. Overall these results give us confidence that the macro regressions above are capturing the causal impact of the GFC on the domestic credit market.

4.3 Fact 3: The Failure of UIP at the Macro and Micro Levels

In the previous tables, we have shown that FX loans have a large price differential over local currency loans, 7 percentage points on average, as given by the estimated coefficient on the FX dummy. We next ask whether this price differential also moves with the GFC using a difference-in-differences regression setting. We run the following for regression for interest rates and loan volumes:

$$\log \mathrm{Y}_{f,b,d,q} = \alpha_{f,b,q} + \rho(\mathrm{FX}_{f,b,d,q} \times \log \mathrm{VIX}_{q-1}) + \delta \mathrm{FX}_{f,b,d,q} + u_{f,b,d,q}. \tag{3}$$

Table 11 presents the results for these regressions, . We include the following time-varying fixed effects on top of firm×bank in order from column (1) to column (4): no time effects (columns 1 and 2), firm×quarter, and firm×bank×quarter. First, in looking at panel A, in all the specifications, the average price differential between FX and local currency loans remains at 7 percentage point when evaluated at the sample mean of log(VIX). Second, and more interestingly, during high-VIX episodes, this differential gets larger – FX loans are 8 percentage points cheaper during high-VIX episodes, whereas they are only 6 percentage point cheaper during low-VIX episodes based on the interquartile range of log(VIX). This result implies that local currency borrowing becomes *relatively* cheaper during low-VIX episodes relative to the average differential between FX and local currency loans.

However, in looking at columns (3) and (4) of panel A, we also see that the average effect of FX becomes less significant. First, when we control for time-varying firm demand and risk via firm×quarter effects in column (3), the significance of the FX coefficient drops to 10 percent. Second, when we include bank×firm×quarter effects in column (4), the coefficient becomes insignificant. The cyclical effect captured by the variable FX×log(VIX) becomes borderline significant. This specification in column (4) reduces the sample size considerably given that identification of the FX coefficients is now only coming from firm-bank pairs that borrow in multiple currencies in a given quarter. That is, for the same firm borrowing from the same bank over time in different currencies, there is no UIP deviation. These fixed effects also control for both bank and firm time-varying risk, supply/demand, as well as any time-varying unobserved heterogeneity, like firm-bank matching being non-random over the cycle.

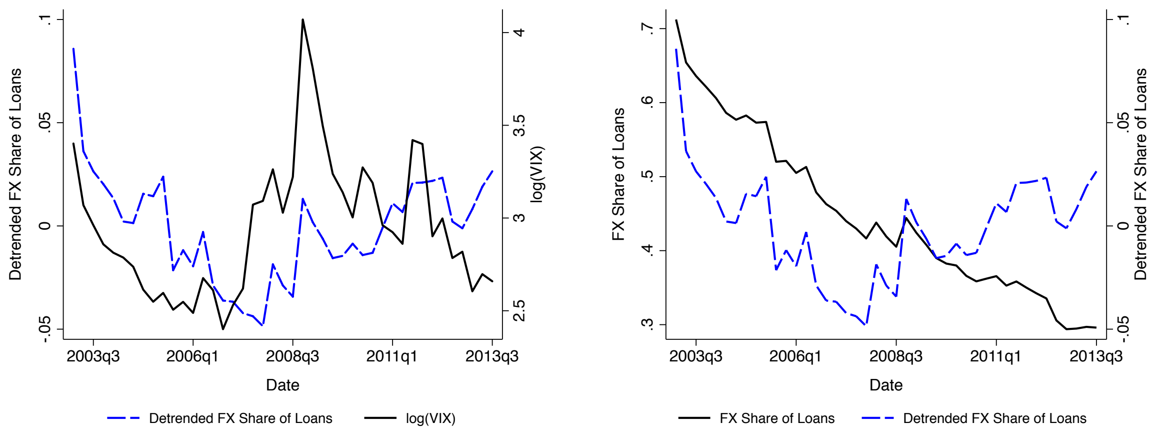
Although this sample is restrictive, it is the ideal sample to test for UIP at the micro level. In theory, it is possible that a given firm can default on its FX loan obligations and not on its Turkish lira loans upon a depreciation of the Turkish lira. In the data, it seems to be the case that a *given* bank does not price this risk differentially at the loan level for a *given firm* over time. This result shows the critical role of firm risk and bank heterogeneity, which are not allowed to play any role in this specification of column (4).

The loan volume results in panel B differ from the interest rate regressions. In particular, while the FX coefficient remains significant throughout – indicating the fact that loans in foreign currency are in larger amounts on average – the interaction of FX and log(VIX) is insignificant throughout. This is surprising because one might expect that firms would take advantage of relatively lower rates on TRY-denominated loans during the boom phase of the GFC and increase their Turkish lira borrowing.

One potential explanation is the following: during the boom phase of the GFC, Turkish banks are able to more cheaply fund themselves in FX and therefore would have an incentive to increase lending in FX. At the same time, as we show above, there is a falling risk premium on the Turkish lira, which implies that banks can offer TRY loans with better terms. Thus, banks also have an incentive to increase lending in domestic currency. Once we go down to the micro data, our results show that these two effects offset each other so that the loan composition does not change at the firm-bank level over the GFC.

In the aggregate data, however, we observe that the share of foreign currency loans falls and the share of Turkish lira loans rises during the boom phase of GFC as Turkish lira loans become cheaper, consistent with a declining UIP risk premium. The comovement of the FX share and the GFC is shown in Figure 8a, which plots the detrended share of FX loans together with log(VIX). This relationship does not appear in our micro estimates in Table 11, but can be rationalized in the aggregate. Although the two offsetting effects we mention above – Turkish banks borrowing in FX and lending in FX and also lending in TRY due to a declining UIP risk premium – are both present in the aggregate data, there are also firms that borrow only in local currency in the aggregate data. These firms make up 63 percent of the sample. In the difference-in-differences regressions that use the FX dummy to identify the differential pricing and amounts, the interest rates and loan volume of these firms will not provide any information to identify a differential effect over the cycle because they always borrow only in one currency. In fact, if we plot the (aggregate) level of FX share of loans (instead of the detrended share), as shown in Figure 8b, this share declines over time during our sample period because most of our sample period coincides with the boom phase of the GFC, when borrowing in TRY was cheaper.

Figure 8. The Comovement between the Global Financial Cycle and the Aggregate FX Loan Share



(a) Detrended FX and VIX

(b) FX Share: Level and Detrended

Notes: This figure plots the aggregate FX share of loans and our proxy for the GFC over time: (a) the detrended FX share and log(VIX), and (b) the detrended and levels of the FX share. Source: CBRT and authors' calculations.

To understand what type of bank heterogeneity is driving the UIP deviations, we run another difference-in-differences regression. In Table 12 we interact the FX dummy with a dummy that differentiates between high and low non-core banks to see the role played by bank heterogeneity. We see that high non-core banks play a key role in the differential pricing of FX and Turkish lira loans. These banks price FX loans higher during low-VIX periods and lower during high-VIX periods, driving the UIP deviations at the firm and loan levels. The differential pricing by non-core banks again disappears when we focus on the variation within the same bank-same firm pair in the last column of this table. When we calculate the total effect of FX dummy and/or the non-core variable, we find again the quantitative importance of non-core banks in differential pricing and supply of credit as before. Overall, these results suggest that a given high non-core bank does not price currency risk differentially for a given client, but high and low non-core banks price the currency risk differently as this pricing depends on their access to international markets.

Table 11. The Failure of UIP at the Loan Level

Panel A. Nominal Interest Rate

	(1)	(2)	(3)	(4)
log(VIX)	0.019***	0.022***		
	(0.003)	(0.003)		
FX×log(VIX)	-0.012***	-0.014***	-0.013**	-0.012*
	(0.004)	(0.004)	(0.006)	(0.007)
FX	-0.033***	-0.028**	-0.031*	-0.034
	(0.012)	(0.013)	(0.017)	(0.020)
Observations	18,345,853	8,573,782	8,573,782	832,138
R-squared	0.785	0.759	0.858	0.749
Macro controls & trend	Yes	Yes	No	No
Bank controls	Yes	Yes	Yes	No
Bank×firm F.E.	Yes	Yes	Yes	Yes
Firm×quarter F.E.	No	No	Yes	No
Bank×firm×quarter F.E.	No	No	No	Yes

Panel B. Loan Volume

	(1)	(2)	(3)	(4)
log(VIX)	-0.066**	-0.096***		
	(0.028)	(0.026)		
FX×log(VIX)	-0.013	-0.001	-0.002	0.0001
	(0.020)	(0.021)	(0.024)	(0.028)
FX	0.611***	0.579***	0.602***	0.626***
	(0.061)	(0.065)	(0.074)	(0.088)
Observations	18,345,853	8,573,782	8,573,782	832,138
R-squared	0.832	0.806	0.871	0.714
Macro controls & trend	Yes	Yes	No	No
Bank controls	Yes	Yes	Yes	No
Bank×firm F.E.	Yes	Yes	Yes	Yes
Firm×quarter F.E.	No	No	Yes	No
Bank×firm×quarter F.E.	No	No	No	Yes

Notes: This table presents results for regression (3) using quarterly data for all loans. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), and the macroeconomic controls and time trend of Table 8 are included in columns (1)-(2) when firm×quarter effects are excluded, and the bank-level characteristics of Table 8 are included in columns (1)-(3) when bank×quarter effects are excluded. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 12. The Failure of UIP at the Loan Level and the Role of High Non-Core Banks

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	(1)	(2)	(3)	(4)	(5)	(6)
log(VIX)	0.015***			-0.049*		
	(0.003)			(0.027)		
FX×Non-core×log(VIX)	-0.017***	-0.012***	-0.008*	0.038**	-0.020	-0.072**
	(0.004)	(0.003)	(0.004)	(0.015)	(0.017)	(0.031)
FX×log(VIX)	-0.009**	-0.010	-0.0098	-0.019	0.006	0.0206
	(0.004)	(0.006)	(0.007)	(0.021)	(0.025)	(0.031)
Non-core×log(VIX)	0.021***	0.016***		-0.071***	-0.034*	0.000
	(0.004)	(0.004)		(0.016)	(0.019)	
FX×Non-core	0.048***	0.031***	0.018	-0.148***	0.034	0.192**
	(0.013)	(0.011)	(0.014)	(0.048)	(0.052)	(0.095)
FX	-0.043***	-0.040**	-0.038*	0.642***	0.591***	0.571***
	(0.012)	(0.018)	(0.022)	(0.062)	(0.080)	(0.097)
Observations	18,345,853	8,573,782	832,138	18,345,853	8,573,782	832,138
R-squared	0.783	0.856	0.750	0.831	0.871	0.714
Macro controls & trend	Yes	No	No	Yes	No	No
Bank controls	Yes	Yes	No	Yes	Yes	No
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm×quarter F.E.	No	Yes	No	No	Yes	No
Bank×firm×quarter F.E.	No	No	Yes	No	No	Yes

Notes: This table presents results for regression (3) using quarterly data for all loans. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. Non-core is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their average non-core liabilities ratio over the sample period. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), and the macroeconomic controls and time trend of Table 8 are included in columns (1)-(2) when firm×quarter effects are excluded, and the bank-level characteristics of Table 8 are included in columns (1)-(3) when bank×quarter effects are excluded. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

4.4 Other Channels

Before moving on to study the collateral channel at the loan level, we consider other possible channels through which the GFC may impact domestic credit market conditions. The first set of regressions, presented in Table 13, examines whether high non-core banks affect lending conditions via some form of maturity transformation. In particular, we augment our baseline non-core regression specification (2) with a further interaction with a dummy variable based on the maturity of loans, called ST. This variable is assigned a value of 1 if loans mature in less than one year, and a value of 0 otherwise. Given that we are interested in investigating maturity transformation, we construct firm-bank-quarter measures of interest rates and loan volumes based only on *new loan issuances* over a given quarter rather than using the stock of all existing loans like all the regressions we have run. This is important as maturity at *origination* is the key variable to determine whether or not there is any maturity transformation over the GFC.

Table 13 presents two specifications in panels A and B: one with only bank×firm fixed effects, and then one augmented with firm×quarter fixed effects. First, in looking at the coefficients on ST in columns (1) and (3), we see that short-term loans have higher interest rates and are for smaller amounts on average. However, these differentials disappear once we control for the time-varying firm-level fixed effects in columns (2) and (4), as these effects pick up firm risk. Second, we focus on the potential of maturity transformation over the cycle by looking at the differential impacts in loan growth in panel B. In particular, regardless of the specification, we see that high non-core banks issue fewer short-term loans on average than low non-core banks (the Non-core×ST coefficient is negative), and that this differential becomes larger during boom phases of the GFC: a positive coefficient on the Non-core×ST×log(VIX) variable implies that when the VIX falls, high non-core banks provide even fewer short-term loans (or more short-term loans during high-VIX episodes). This result can be interpreted to mean that high non-core banks take more "risk" by providing more long-term loans during the boom phase of the GFC as such loans carry higher default risk. Notice that, in terms of pricing, high non-core banks offer lower rates for loans of any maturity, which is why there is no differential price effect between short-term and long-term loans.

Finally, we explore the possibility for an alternative channel driving our main findings. Recent work has pointed to the role of global financial intermediaries in driving credit cycles of domestic economies via the "risk-taking channel," whereby fluctuations in the exchange rate affect the net worth of borrowers and relax the leverage constraint of lenders (e.g., Bruno and Shin, 2015b). In particular, an appreciation of the domestic currency vis-à-vis the U.S. dollar improves domestic firms' balance sheets, enabling lenders to lend more to these borrowers.[29]

The mechanism is relevant for domestic firms that have debt in U.S. dollars because the shock is on the nominal exchange rate. We control for exchange rate fluctuations in our regressions, but there might still be an interaction effect whereby such fluctuations affect certain banks and firms as envisioned by the models. Although these models include firms directly borrowing from global banks, we can still test for this possible channel in our set up, in which firms borrow from domestic

[29]The mechanism can also work via lenders balance sheet by increasing lending capacity. However, in our case, there is no currency mismatch on Turkish banks' balance sheets.

Table 13. The Role of High Non-Core Banks Transmitting the GFC via Maturity Transformation

	Panel A. Nominal Interest Rate		**Panel B.** Loan Volume	
	(1)	(2)	(3)	(4)
log(VIX)	0.022***		-0.146***	
	(0.006)		(0.024)	
Non-core×log(VIX)	0.034***	0.012*	-0.092***	-0.245***
	(0.005)	(0.006)	(0.033)	(0.043)
Non-core×ST×log(VIX)	0.0002	0.006	0.138***	0.264***
	(0.008)	(0.008)	(0.051)	(0.063)
ST×log(VIX)	-0.008	0.003	0.030	-0.014
	(0.009)	(0.011)	(0.025)	(0.038)
Non-core×ST	0.010	-0.008	-0.285***	-0.690***
	(0.025)	(0.025)	(0.165)	(0.206)
ST	0.059*	0.021	-0.321***	-0.194
	(0.031)	(0.035)	(0.078)	(0.117)
FX	-0.079***	-0.076***	0.554***	0.523***
	(0.004)	(0.004)	(0.013)	(0.016)
Observations	7,246,294	3,452,343	7,246,294	3,452,343
R-squared	0.642	0.778	0.719	0.817
Bank×firm F.E.	Yes	Yes	Yes	Yes
Macro controls & trend	Yes	No	Yes	No
Bank controls	Yes	No	Yes	No
Firm×quarter F.E.	No	Yes	No	Yes

Notes: This table presents results for regression (2) using quarterly data for all *new loan issuances* and augmented with an interaction for the maturity of loans. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. Non-core is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their average non-core liabilities ratio over the sample period. ST is a 0/1 dummy indicating whether a the loans between a firm-bank pair is short-term (= 1) or long-term (= 0), a loan is is short-term if it's i maturity is less than one year in the given quarter. We aggregate all new loan issuances based on this criteria between a firm-bank pair in a quarter to create the dependent variables. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0), and the macroeconomic controls and time trend of Table 8 are included in columns (1) when firm×quarter effects are excluded, and the bank-level characteristics of Table 8 are included. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

banks, which in turn borrow from international markets, since firms can also borrow in foreign currency from domestic banks.[30]

We run a triple interaction specification that interacts a dummy variable, indicating whether a bank is either a low- or a high-leverage bank on average throughout the sample, with a measure of

[30] As discussed above, Turkish corporate borrowing from foreign banks inside or outside the country and firms' direct external bond issuance are minimal.

Table 14. Exchange Rates and Risk Taking over the GFC

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	(1)	(2)	(3)	(4)	(5)	(6)
Leverage$_b$×FXshare$_f$ × Δlog(XR)	0.009			0.054		
	(0.008)			(0.098)		
Leverage$_b$×FXshare$_f$×Depreciation		0.002			0.025	
		(0.001)			(0.019)	
Leverage$_b$×FXshare$_f$×Appreciation			0.001			0.018
			(0.001)			(0.021)
FX	-0.070***	-0.070***	-0.070***	0.603***	0.603***	0.603***
	(0.003)	(0.003)	(0.003)	(0.012)	(0.012)	(0.012)
Observations	8,573,712	8,573,712	8,573,712	8,573,712	8,573,712	8,573,712
R-squared	0.884	0.884	0.884	0.872	0.872	0.872
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Firm×quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Bank×quarter F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents results for the risk-taking channel regressions, following the setup of regression (2), with an additional interaction term, using quarterly data for all loans. Panel A uses use the natural logarithm of the weighted average of nominal real interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. Leverage is a 0/1 dummy indicating whether a bank is in the "low" (= 0) or "high" (= 1) bin of banks defined by their leverage ratio over the sample perio. FXshare$_f$ is a 0/1 dummy variable indicating whether a firm is in the "low" (= 0) or "high" (= 1) bin of firms defined by their share of loans in foreign currency denomination over the sample period. Log(XR) is the log level of the lagged TRY/US dollar nominal exchange rate; δlog(XR) is the lagged log change of the TRY/US dollar nominal exchange rate; Depreciation is 0/1 dummy variable indicating whether the period is a depreciation episode (= 1) or not (= 0), where a depreciation period is one where the exchange rate change is in the top quartile of the distribution over the sample; and Appreciation is 0/1 dummy variable indicating whether the period is a depreciation episode (= 1) or not (= 0), where an appreciation period is one where the exchange rate change is in the bottom quartile of the distribution over the sample. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

the FX share of a firm's liabilities, and (i) the log change of the Turkish lira-U.S. dollar exchange rate, or (ii) a dummy variable for a depreciation episode of the lira vis-à-vis. the US dollar, or (iii) a dummy variable for an appreciation episode of the lira vis-à-vis the U.S. dollar.[31]

Because the firm-level balance sheet data are not broken down by currency, we construct a proxy for the FX share using the currency composition of firms' loans in the credit register. In particular, we calculate the FX share of loans for each firm over the sample, and divide firms into low and high FX-share bins, based on the median in the entire sample of firms. Therefore, a firm with an average FX share of loans that is greater than the sample median is assigned a 1, while a

[31] A depreciation period is one in which the exchange rate change is in the top quartile of the distribution over the sample. An appreciation period is one in which the exchange rate change is in the bottom quartile of the distribution over the sample.

firm with a smaller share is assigned a 0.

Table 14 presents results for these regressions using quarterly data. We use aggregate loans for a given firm-bank pair in a quarter as in our benchmark regressions. We present specifications that control for both firm×quarter and bank×quarter effects. Panel A presents results for the nominal interest rate, and panel B for loan volumes. Looking across all specifications we never see a significant coefficient. Therefore, the exchange rate risk-taking channel cannot explain the reduction in borrowing costs and increased lending we have see in our above regressions. One potential reason for this non-result is that net worth shocks work from firm demand side, which we control fully. Another explanation is the fact that the changes in the exchange rate were not very large during our sample period.

4.5 Fact 4: The Non-Effect of Collateral Constraints over the GFC

We want to understand how financial constraints relax during the boom phase of the GFC and tighten during the bust. In our data we observe the posted collateral so rather than proxying for financial constraints by a firm's net worth as is common in the literature,[32] we can use the actual collateral posted for a loan at its issuance, and measure whether its relationship with loan pricing and volume moves with the GFC. The collateral measure also helps us to link our results to the theoretical literature on firm heterogeneity and collateral constraints.

We estimate a loan-level version of our previous regressions using monthly data on *new* loan originations. These regressions enable us to control for all time-varying heterogeneity at the bank and firm levels, including the possibility of a non-random match between firms and banks with the help of firm×bank×month fixed effects. The regression specification is

$$\begin{aligned}\log \mathrm{Y}_{f,b,l,m} = \varrho_{f,b,m} + \beta_1 \mathrm{Collateral}_{f,b,l,m} + \beta_2(\mathrm{Collateral}_{f,b,l,m} \times \log \mathrm{VIX}_{m-1}) \\ + \beta_3 \mathrm{FX}_{f,b,l,m} + e_{f,b,l,m},\end{aligned} \tag{4}$$

where we change the q subscript to m for variables that vary at a monthly level, and focus on both loan volume and the interest rate as the endogenous variables for a given loan l. $\mathrm{Collateral}_{f,b,l,m}$ measures the collateral-to-loan ratio at the issuance of the loan, and $\varrho_{f,b,m}$ is a firm×bank×month effect that captures time-varying firm- and bank-level unobserved factors at the monthly level. Notice that with these fixed effects, the estimated coefficients are solely identified from changes in

[32]See for example Cooley et al. (2004); Khan and Thomas (2013); Gopinath et al. (2017).

the amount of new loans and their interest rates for a given firm-bank pair. Hence, in our most stringent specification we do not allow firms to switch banks and vice versa for banks. This helps assuage the concern of biased results due to time-varying selection effects at the firm-bank level. Because we use data on *new* loan issuances to run these regressions, we only see each loan once and thus exploit changes in rates and volume of each new loan from month to month to identify the impact of loan riskiness/collateral, conditional on all other time-varying firm and bank factors.

Table 15 presents our regression results, which we obtained by first demeaning both the collateral ratio and log(VIX) before running the regressions. As shown in panel A, the collateral ratio coefficient is significant and has a negative sign in all columns; that is, there is a negative relationship between the collateral ratio and the price of a loan. To the best of our knowledge, although there are theories that predicts a negative relationship between posted collateral and the loan rate,[33] our paper is the first to provide evidence about this relationship. It is also interesting to note that this relationship does not vary with the VIX once we control for the unobserved time-varying firm-bank effects in column(4). In other words, once we focus on the same firm borrowing from the same bank over time, the relationship between the collateral posted and a loan's interest rate does not respond to the GFC, as proxied by movements in log(VIX).

In panel B, we investigate whether or not collateral constraints relax during episodes of low VIX (thus high capital inflows). We do not find that there is significant relationship between the collateral-to-loan ratio and loan volumes in all columns. Furthermore, we also find no relationship between collateral ratio and credit volumes during high- and low-VIX episodes. These results suggest that credit growth during low VIX episodes is driven by low interest rates, regardless of collateral values.

To test whether or not credit growth is mainly driven by lower rates or higher collateral values, we regress loan volumes on both interest rates and posted collateral in the same regression. This regression enables us to examine the correlation between loan volumes, interest rates and the collateral ratio jointly. Table 16 presents these results. The coefficient on the interest rate is negative and strongly significant, as we would expect given previous results. In particular, we would expect lower rates to be associated with loan growth because the fall in rates is being fueled by supply-driven GFC capital inflows that lower the risk premium faced by domestic banks, which pass through lower rates to firms. Meanwhile, the coefficient on the collateral ratio is never

[33] See for example Fostel and Geanakoplos (2015).

Table 15. The Effects of Collateral Constraints over the GFC

Panel A. Nominal Interest Rate

	(1)	(2)	(3)	(4)
log(VIX)	0.036***			
	(0.004)			
Collateral/Loan	-0.011	-0.012***	-0.019***	-0.020***
	(0.003)	(0.003)	(0.005)	(0.005)
Collateral/Loan×log(VIX)	-0.026***	-0.012***	-0.013***	-0.002
	(0.003)	(0.003)	(0.002)	(0.004)
FX	-0.073***	-0.075***	-0.069***	-0.070***
	(0.002)	(0.002)	(0.002)	(0.002)
Observations	10,016,550	10,016,368	6,383,626	5,358,324
R-squared	0.654	0.743	0.885	0.898
Bank×firm F.E.	Yes	Yes	Yes	No
Bank×month F.E.	No	Yes	No	No
Firm×month F.E.	No	No	Yes	No
Bank×firm×month F.E.	No	No	No	Yes

Panel B. Loan Volume

	(1)	(2)	(3)	(4)
log(VIX)	-0.075***			
	(0.015)			
Collateral/Loan	0.017	-0.007	0.023	0.041
	(0.014)	(0.017)	(0.032)	(0.030)
Collateral/Loan×log(VIX)	0.013	0.039	0.045*	0.061
	(0.025)	(0.026)	(0.023)	(0.041)
FX	0.404***	0.396***	0.405***	0.458***
	(0.012)	(0.012)	(0.022)	(0.024)
Observations	10,016,550	10,016,368	6,383,626	5,358,324
R-squared	0.679	0.684	0.798	0.806
Bank×firm F.E.	Yes	Yes	Yes	No
Bank×month F.E.	No	Yes	No	No
Firm×month F.E.	No	No	Yes	No
Bank×firm×month F.E.	No	No	No	Yes

Notes: This table presents results using monthly data on new loan issuances for regression (4). All variables are measured at the loan level, VIX is the lagged end-of-month value. The Collateral/Loan variable is the collateral posted at the time of issuance of the new loan. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0). We demean both the collateral ratio and log(VIX). Panel A presents results for the nominal interest rate. Panel B presents results for the natural logarithm of loan value. Column (1) includes the standard macroeconomic controls and a time trend, column (2) includes bank×month fixed effects, column (3) includes firm×month fixed effects, and column (4) includes bank×firm×month fixed effects. The regressions further include fixed effects for (i) bank defined risk weights, (ii) sectoral activity of loan, and (iii) maturity levels. Standard errors are double clustered at the firm and month levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table 16. Collateral Constraints versus Borrowing Costs in New Loan Issuance Growth

	(1)	(2)	(3)	(4)
log(1+i)	-1.937***	-2.346***	-2.510***	-2.449***
	(0.075)	(0.074)	(0.121)	(0.135)
Collateral/Loan	0.002	-0.036***	-0.025	-0.011
	(0.010)	(0.012)	(0.018)	(0.018)
FX	0.263***	0.220***	0.232***	0.287***
	(0.013)	(0.013)	(0.021)	(0.022)
Observations	10,016,550	10,016,368	6,383,626	5,358,324
R-squared	0.684	0.690	0.801	0.809
Bank×firm F.E.	Yes	Yes	Yes	No
Bank×month F.E.	No	Yes	No	No
Firm×month F.E.	No	No	Yes	No
Bank×firm×month F.E.	No	No	No	Yes

Notes: This table presents results using monthly data on new loan issuances for regression (4). All variables are measured at the loan level, where log(1+i) is the loan nominal interest rate, the Collateral/Loan variable is the collateral posted at the time of issuance of the new loan; FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0). We demean both the collateral ratio. Column (1) includes the standard macroeconomic controls and a time trend, column (2) includes bank×month fixed effects, column (3) includes firm×month fixed effects, and column (4) includes bank×firm×month fixed effects. The regressions further include fixed effects for (i) bank defined risk weights, (ii) sectoral activity of loan, and (iii) maturity levels. Standard errors are double clustered at the firm and month levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

significant once we control for time-varying firm-level fixed effects.[34]

5 Conclusion

The results in this paper provide evidence of an important (yet overlooked) transmission mechanism for domestic regulators to consider when designing macro prudential policies: it is not enough to limit the foreign currency borrowing for agents in an economy by imposing a capital control. Lower borrowing costs also fuel *local currency* borrowing if domestic banks can fund themselves cheaply in the international financial markets. Lower borrowing costs can drive a credit boom in spite of the collateral constraints staying intact during capital inflows.

Our result on collateral constraints being insensitive to GFC sheds light on the need of new

[34]Note that banks may ask higher collateral when they have a lot of NPLs on their balance sheets. During our period of study NPLs are not very high. We also do not find a strong correlation between the NPL ratio and the contemporaneous value of VIX: −0.1331. Given the fact that NPL ratios may take time to show up following a boom in lending, we also correlate the NPL ratio with VIX lagged by one, two, three, and four quarters. The resulting correlations are all weak −0.0063, 0.0808, 0.1351, and 0.1514, respectively.

macro models. The perspective of traditional macro-finance models is one in which shocks affect the collateral constraint and propagate to the economy. Our evidence shows that shocks affect risk premia and then propagate to the economy bypassing collateral constraints. This finding requires another class of macroeconomic frameworks that model risk premia seriously to help better understand the transmission of financial shocks.

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Appendix A Regression Details

A.1 Aggregate Implications of Reduced-Form Regressions

There is a natural aggregation exercise to undertake in order to examine the economic significance of our micro estimates on overall credit growth. In particular, ignoring the other control variables and intercept coefficients (i.e., fixed effects), we can write the VIX-predicted Loan variable from estimating regression (1) as

$$\log(\widehat{\text{Loan}_{f,b,d,q}}) = \widehat{\beta}\log(\text{VIX}_{q-1}), \tag{A.1}$$

where $\widehat{\beta}$ is the estimated coefficient. First, differentiate both sides of (A.1), and then multiply this equation by $w_{f,b,d,q-1}$, which is a firm-bank-denomination loan share vis-à-vis total loans in a given lagged quarter, such that $\sum w_{f,b,d,q-1} = 1$ by definition. These manipulations yield

$$w_{f,b,d,q-1}\text{dlog}(\widehat{\text{Loan}_{f,b,d,q}}) = w_{f,b,d,q-1}\widehat{\beta}\text{d}\log(\text{VIX}_{q-1}), \tag{A.2}$$

so,

$$w_{f,b,d,q-1}\left(\widehat{\frac{\Delta\text{Loan}}{\text{Loan}}}\right)_{f,b,d,q} = w_{f,b,d,q-1}\widehat{\beta}\left(\frac{\Delta\text{VIX}}{\text{VIX}}\right)_{q-1}, \tag{A.3}$$

where (A.3) comes from rewriting the change in logs from (A.2) as a growth rate, and $\left(\widehat{\frac{\Delta\text{Loan}}{\text{Loan}}}\right)_{f,b,d,q}$ is the predicted growth rate in Loan between quarter $q-1$ and q, while $\left(\frac{\Delta\text{VIX}}{\text{VIX}}\right)_{q-1}$ is the growth rate of VIX between quarter $q-2$ and $q-1$. Second, summing (A.3) over $\{f, b, d\}$ in a given quarter q, we have

$$\left(\frac{\Delta\widehat{\text{Agg. Loan}}}{\text{Agg. Loan}}\right)_q = \widehat{\beta}\left(\frac{\Delta\text{VIX}}{\text{VIX}}\right)_{q-1}, \tag{A.4}$$

which yields a relationship between aggregate credit growth (Agg. Loan), the growth rate of the VIX variable and the estimated micro estimate $\widehat{\beta}$.

A.1.1 Importance of Internationally Connected Banks

To quantify the importance of large internationally connected banks in transmitting the GFC to the domestic credit market, we use the point estimates from Table 9, column (3), which is based on regression specification (2) where we drop the firm×quarter fixed effects, and use macro controls instead.[35] Ignoring these controls and the bank controls for brevity, the regression equation can be

[35] Note that the point estimates on the interaction between the non-core ratio and log(VIX) with and without fixed effects in column (3) and (4) are not statistically different.

summarized as:

$$\log \mathrm{Y}_{f,b,d,q} = \alpha_{f,b} + \lambda \mathrm{Trend}_q + \beta_1 \mathrm{VIX}_{q-1} + \beta_2(\mathrm{Noncore}_b \times \log \mathrm{VIX}_{q-1}) + \vartheta_{f,b,d,q}.$$

Given the estimates of β_1 and β_2, we then follow the same procedure as for the macro regression above, based on weights for high non-core banks (HNC) and low non-core banks (LNC). To begin, we predict individual loan growths based on bank type and weight these growth rates:

$$w_{f,b,d,q-1}\left(\widehat{\frac{\Delta \mathrm{Loan}}{\mathrm{Loan}}}\right)_{f,b,d,q} = w^{HNC}_{f,b,d,q-1}(\widehat{\beta}_1 + \widehat{\beta}_2)\left(\frac{\Delta \mathrm{VIX}}{\mathrm{VIX}}\right)_{q-1} + w^{LNC}_{f,b,d,q-1}\widehat{\beta}_1\left(\frac{\Delta \mathrm{VIX}}{\mathrm{VIX}}\right)_{q-1}.$$

We next sum over the $\{f, b, d\}$ in a given quarter q:

$$\left(\widehat{\frac{\Delta \mathrm{Agg.\ Loan}}{\mathrm{Agg.\ Loan}}}\right)_q = \sum w^{HNC}_{q-1}(\widehat{\beta}_1 + \widehat{\beta}_2)\left(\frac{\Delta \mathrm{VIX}}{\mathrm{VIX}}\right)_{q-1} + \sum w^{LNC}_{q-1}\widehat{\beta}_1\left(\frac{\Delta \mathrm{VIX}}{\mathrm{VIX}}\right)_{q-1}$$

to obtain the aggregate quarterly growth rate. We then repeat this aggregation using only the HNC bank sample, and take the average of this HNC growth rate over the sample to the average of the overall aggregate growth rate:

$$\frac{\mathrm{Avg}\left\{\sum w^{HNC}_{q-1}(\widehat{\beta}_1 + \widehat{\beta}_2)\left(\frac{\Delta \mathrm{VIX}}{\mathrm{VIX}}\right)_{q-1}\right\}}{\mathrm{Avg}\left\{\left(\widehat{\frac{\Delta \mathrm{Agg.\ Loan}}{\mathrm{Agg.\ Loan}}}\right)_q\right\}}.$$

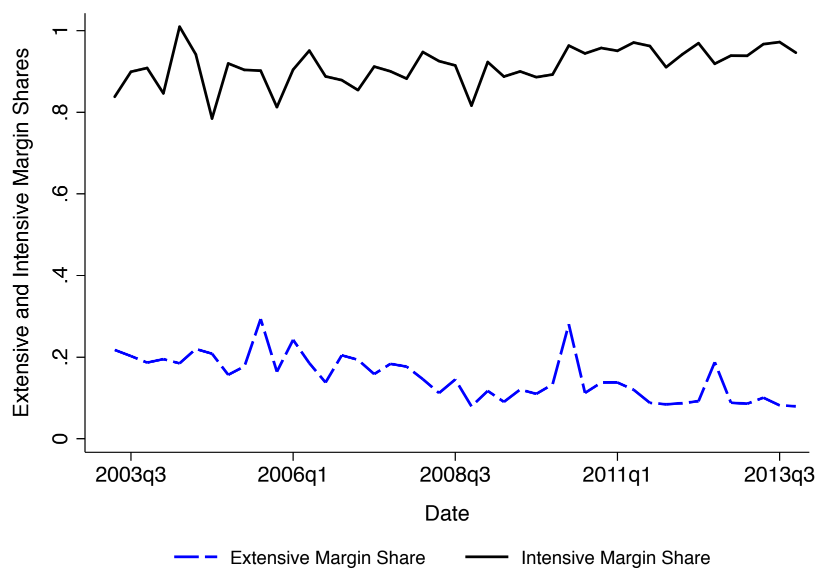
This ratio is equal to 0.95, thus highlighting the important contribution of internationally connected banks in transmitting the GFC to domestic credit market growth.[36]

[36]If we instead use the non-core interaction coefficient estimate for $\widehat{\beta}_2$ and firm-bank sample from column (4) for the fixed effects regression, the ratio drops to 0.86, which is still economically large.

Figure A1. Loan Growth Comparison of Corporate Sector and Whole Economy

Notes: This figure plots the year-on-year loan growth rate each quarter of our sample of firms ('Firms') with that of for the whole economy ('Firms + Non-Firms') over the 2003–13 period. All values are nominal. Source: CBRT and authors' calculations.

Figure A2. Extensive and Intensive Margins of Lending



Notes: This figure plots the share of loans due to Extensive (new loans) and Intensive (continuing loans) margins relative to total loans outstanding in a given period over the 2003–13 period. Source: CBRT and authors' calculations.

Table A1. Turkish and Foreign Macroeconomic and Financial Quarterly Summary Statistics

	Obs.	Mean	Median	Std. Dev.	IQR	Min.	Max.
log(VIX)	44	2.957	2.913	0.368	0.566	2.401	4.071
log(Capital inflows)	44	18.25	18.61	0.926	0.730	15.92	19.22
CA/GDP	44	-5.144	-5.379	2.227	2.637	-9.803	-1.303
Real GDP Growth (q-o-q)	44	0.012	0.012	0.022	0.017	-0.059	0.048
Inflation (q-o-q, annualized)	44	0.089	0.069	0.066	0.073	-0.013	0.322
$\Delta e_{TRY/USD,t}$ (q-on-q)	44	0.006	0.001	0.066	0.058	-0.104	0.271
CBRT overnight rate	44	0.188	0.183	0.113	0.118	0.067	0.517

Notes: This table presents summary statistics for quarterly Turkish and world macroeconomic and financial data over the 2003–13 period. All real variables are deflated using 2003 as the base year. =Turkish real GDP growth, inflation, and exchange rate changes vis-à-vis. the USD are all quarter-on-quarter. The VIX and the CBRT overnight rate are quarterly averages. 'IQR' stands for the interquartile range. Turkish capital inflows are in real Turkish lira. The CA/GDP variable measures the quarterly Turkish current account relative to GDP, while log(Capital inflows) is the natural logarithm of gross real capital inflows into Turkey in 2003 TRY. Source: CBRT and authors' calculations.

Table A2. The Global Financial Cycle and Monetary Policy Shocks, Borrowing Costs and Loan Volumes

	Panel A. Nominal Interest Rate		**Panel B.** Loan Volume	
	(1)	(2)	(3)	(4)
log(VIX)	0.020***	0.021***	-0.141***	-0.134***
	(0.003)	(0.003)	(0.027)	(0.025)
FF4 shock	-0.030*		-0.411***	
	(0.015)		(0.138)	
MP1 shock		-0.009		-0.159***
		(0.006)		(0.053)
FX	-0.074***	-0.074***	0.583***	0.583***
	(0.003)	(0.003)	(0.012)	(0.012)
Domestic policy rate	0.211***	0.208***	0.199	0.153
	(0.025)	(0.026)	(0.261)	(0.258)
Observations	13,445,548	13,445,548	13,445,548	13,445,548
R-squared	0.778	0.778	0.836	0.836
Macro controls & trend	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes
Bank×firm F.E.	Yes	Yes	Yes	Yes

Notes: This table presents results for the regressions including monetary policy shocks using quarterly data for all loans over the 2003–13 period. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. MP is a monetary policy shock based on current future contracts, FF4 is a monetary policy shocks based on future contracts that are 3-months out. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0). Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A3. The Global Financial Cycle, Borrowing Costs and Loan Volumes: Split by Exporters and Non-Exporters

	Panel A. Nominal Interest Rate			**Panel B.** Loan Volume		
	All	Exporters	Non-Exporters	All	Exporters	Non-Exporters
	(1)	(2)	(3)	(4)	(5)	(6)
log(VIX)	0.019***	0.013***	0.020***	-0.067**	-0.096***	-0.070**
	(0.003)	(0.002)	(0.003)	(0.027)	(0.019)	(0.027)
FX	-0.069***	-0.072***	-0.065***	0.575***	0.710***	0.395***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.014)	(0.011)
Domestic policy rate	0.213***	0.166***	0.221***	0.118	0.383**	0.151
	(0.026)	(0.025)	(0.032)	(0.301)	(0.152)	(0.337)
GDP growth	-0.062*	-0.124***	-0.054	0.196***	0.480**	0.197
	(0.035)	(0.043)	(0.039)	(0.319)	(0.234)	(0.327)
Inflation	-0.015	-0.008	-0.016	0.036	-0.015	0.040
	(0.016)	(0.012)	(0.019)	(0.121)	(0.087)	(0.124)
XR change	-0.046***	-0.028*	-0.047***	0.037	0.254***	0.037
	(0.010)	(0.016)	(0.011)	(0.124)	(0.086)	(0.127)
Observations	18,345,853	1,482,138	16,780,935	18,345,853	1,482,138	16,780,935
R-squared	0.782	0.687	0.790	0.831	0.705	0.824
Macro controls & trend	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	Yes	Yes	Yes	Yes	Yes	Yes
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table presents results for regression (1) split by exporting stats using quarterly data. Panel A uses the natural logarithm of one plus the weighted-average of nominal interest rates for loans between a firm-bank as the dependent variable. Panel B uses the natural logarithm of total loans between a firm-bank as the dependent variable. VIX is the lagged quarterly average. FX is a 0/1 dummy indicating whether a loan is in foreign currency (= 1) or domestic (= 0). Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A4. The Global Financial Cycle, Borrowing Costs and Loan Volumes: By Industry

	Panel A. Nominal Interest Rate		**Panel B.** Loan Volume	
	(1)	(2)	(3)	(4)
Industry	log(VIX)	log(VIX)×D_{sec}	log(VIX)	log(VIX)×D_{sec}
1A	0.021***	-0.015***	-0.071**	0.022
	(0.003)	(0.003)	(0.027)	(0.018)
2B	0.019***	-0.008***	-0.068**	0.030
	(0.003)	(0.002)	(0.027)	(0.031)
3C	0.019***	0.005***	-0.067**	-0.047***
	(0.003)	(0.001)	(0.027)	(0.014)
4D	0.019***	0.001	-0.057**	-0.041***
	(0.003)	(0.002)	(0.028)	(0.012)
5E	0.019***	-0.003*	-0.067**	-0.022
	(0.003)	(0.002)	(0.027)	(0.026)
6F	0.019***	0.003**	-0.066**	-0.023*
	(0.003)	(0.002)	(0.027)	(0.013)
10G	0.016***	0.010***	-0.059**	-0.030***
	(0.003)	(0.001)	(0.028)	(0.010)
11H	0.019***	0.005***	-0.068**	0.029
	(0.003)	(0.001)	(0.027)	(0.024)
12I	0.019***	0.002	-0.071***	0.050*
	(0.003)	(0.002)	(0.026)	(0.025)
13J	0.019***	0.003	-0.068**	0.035
	(0.003)	(0.002)	(0.027)	(0.022)
14K	0.019***	0.001	-0.068**	0.022*
	(0.003)	(0.001)	(0.027)	(0.013)
16L	0.019***	-0.004	-0.068**	0.256***
	(0.003)	(0.004)	(0.027)	(0.065)
17M	0.019***	0.002	-0.068**	0.043
	(0.003)	(0.001)	(0.027)	(0.027)
18N	0.019***	0.002**	-0.068**	0.023
	(0.003)	(0.001)	(0.027)	(0.021)
19O	0.019***	-0.003***	-0.069**	0.072***
	(0.003)	(0.001)	(0.027)	(0.021)
20P	0.019***	0.007***	-0.067**	0.015
	(0.003)	(0.002)	(0.027)	(0.024)
21Q	0.019***	0.008	-0.067**	-0.097
	(0.003)	(0.009)	(0.027)	(0.117)

Notes: This table presents results for regression (1) using quarterly data, including a sector dummy, D_{sec}, interacted with log(VIX) sector-by-sector. The sector codes refer to the following industries: 1A: Agriculture, hunting and forestry; 2B: Fishing; 3C: Mining and quarrying ; 4D: Manufacturing; 5E: Electricity, gas and water supply; 6F: Construction; 10G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; 11H: Hotels and restaurants; 12I: Transport, storage and communication; 13J: Financial intermediation; 14K: Real estate, renting and business activities; 16L: Public administration and defense; compulsory social security; 17M: Education; 18N: Health and social work; 19O: Other community, social and personal service activities; 20P: Activities of households; 21Q: Extra-territorial orgs. and bodies.

Table A5. The Global Financial Cycle, Borrowing Costs and Loan Volumes: Sample Splits and OLS versus. WLS

	Panel A. OLS		**Panel B.** WLS		
	log(1+i)	log(Loan)	log(1+i)	log(Loan)	
Sample	(1)	(2)	(3)	(4)	Observations
All loans	0.018***	-0.061**	0.019***	-0.060**	19,982,267
	(0.003)	(0.028)	(0.003)	(0.028)	
Loans>5K TRY	0.018***	-0.067**	0.019***	-0.067**	18,345,853
	(0.003)	(0.027)	(0.003)	(0.027)	
Loans>5K TRY &	0.019***	-0.095***	0.020***	-0.067**	8,573,782
Firm×quarter FE	(0.002)	(0.025)	(0.002)	(0.027)	
Loans>5K TRY &	0.013***	-0.095***	0.013***	-0.059**	832,138
Firm×bank×quarter FE	(0.002)	(0.025)	(0.002)	(0.024)	

Notes: This table presents results for regression (1) using quarterly data, either based on OLS (Panel A) or on WLS (Panel B) using the log of banks' total assets as weights. The only coefficient reported is for log(VIX). Regression samples are run as either: (i) All loans: 19,982,267 observations, (ii) truncating the sample at 5,000 Turkish lira (5K TRY): 18,345,853 observations; (iii) truncating the sample and restricting to firm-bank-quarter observations for firms that borrow from multiple banks in a given quarter: 8,573,782 observations, and (iv) truncating the sample and restricting to firm-bank-quarter observations for firm-bank pairs that have loans in both FX and TRY in a given quarter: 832,138 observations. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.

Table A6. The Global Financial Cycle, Borrowing Costs and Loan Volumes: Robustness Checks

	log(1+i)	log(Loan)
Robustness	(1)	(2)
Risk aversion VIX	0.011***	-0.050***
	(0.002)	(0.015)
Short Mat.	0.017***	-0.093***
	(0.002)	(0.019)
Long Mat.	0.021***	-0.044
	(0.004)	(0.029)
No Crisis	0.018***	-0.057**
	(0.003)	(0.028)
Private Banks	0.026***	-0.105***
	(0.003)	(0.026)

Notes: This table presents results for regression (1) using quarterly data for different robustness checks. The only coefficient reported is for log(VIX). The robustness checks are: (i) using the risk aversion component of VIX as extracted by Bekaert et al. (2013) – we would like to thank Marie Horoeva for providing us with an updated series; (ii) using short-term maturity (one year or less) loans; (iii) using long-term maturity (more than one year); (iv) dropping the crisis period from the regressions; (v) restricting the sample to firm-bank pairs for private banks only. Regressions are all weighted-least square, where weights are equal to the log of the bank's total assets, and standard errors are double clustered at the firm and quarter levels, and *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.