International Spillovers and Local Credit Cycles: What do firm-bank-loan level data tell us?*

Yusuf Soner Başkaya[1] Julian di Giovanni[2] Şebnem Kalemli-Özcan[3]
José-Luis Peydro[2,4] Mehmet Fatih Ulu[1]

[1]Central Bank of the Republic of Turkey [2]UPF, BGSE, CREI, and CEPR
[3]University of Maryland, CEPR, and NBER [4]ICREA

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*The views expressed are those of the author and do not represent official views of the CBRT

Big Picture

- Historically, many countries have experienced credit cycles, associated with:
  - Boom-bust episodes
  - Systemic risk and financial crises
- Capital flows have been highlighted as the key driver of these cycles in *emerging market economies* (EMEs)
- Policymakers face a difficult environment in preventing excessive credit buildup in a small open economy (EMEs)
  - $\Rightarrow$ "Leaning-against the wind" by raising interest rates may attract more capital flows, which feed into more domestic credit growth
  - $\Rightarrow$ Need other policy tools in addition to interest rates given the multiple objectives

Right policy response to capital flows in EMs?

A general debate on whether:

Macroprudential policy for financial stability; Monetary policy for price/output stability

vs. Monetary policy can be used for both—NOT easy for EMs

Financial globalization worsens the tradeoffs monetary policy faces in achieving multiple objectives—(Obstfeld, 2014)

Important to know the extent of:

1. International spillovers—the role of US monetary policy
2. Effect of EM policy response
3. Both are hard to identify and quantify in cross-country aggregate data

Research Agenda

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   - Domestic credit volume and price?
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2. If so what is effect of this exogenous capital flows on EME's
   - Domestic credit volume and price?
   - Real outcomes (output, employment, investment, etc.) through the *international credit channel*?
3. What are the effects of a set of policies taken to manage capital flows?
   - Macroprudential/Non-conventional monetary policy
   - Capital controls
   - FX intervention

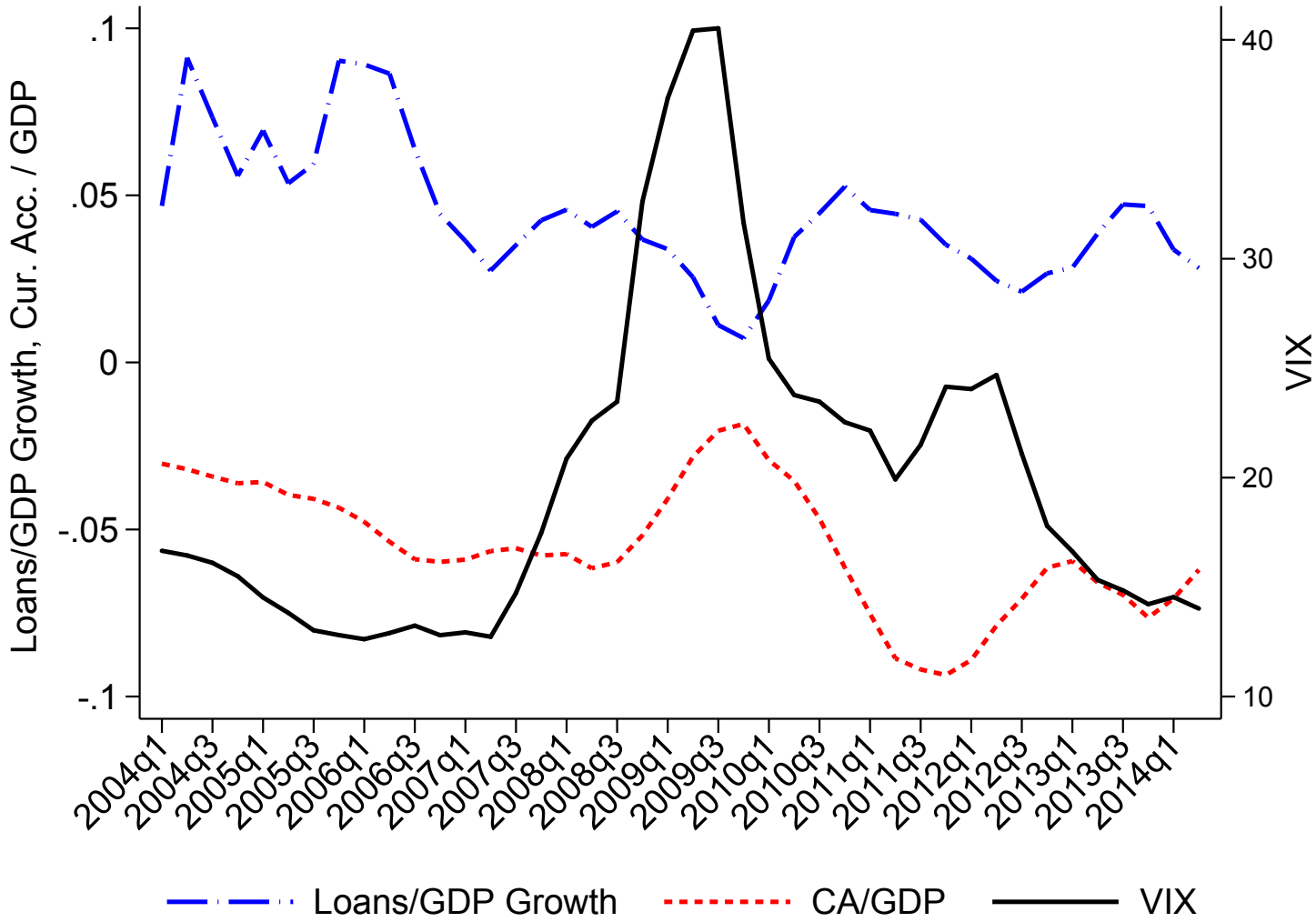
Issues Faced in Answering Questions: Identification

- The macroeconomics literature has tried to answer these questions, but face identification problems:
  - How much of capital flows into EM are due to "push" or "pull" factors?
  - Is domestic credit growth being driven by demand for credit or supply for credit?
  - What are the effects of these capital flows on
    - Domestic credit volume and price?
    - The real economy?

Issues Faced in Answering Questions: Policy

- Measuring impact of policies has especially been difficult since
  - Policy is there to manage capital flows
  - Policy is anticipated
  - Many policies and fundamentals are correlated with each other at country-time level

VIX, CA/GDP, and Domestic Credit



Sources: CBRT and CBOE

Strategy

- Use Turkey, a major EME, as an excellent laboratory to analyze the impact of capital flows and policy
- Exploit credit register data *matched* to detailed bank- and firm-level data over 2003Q1–2013Q4
  - Every business loan in the economy: principal outstanding, interest rates, maturity, collateral, and various characteristics (e.g., currency denomination, risk level)
  - Firm-level income statement and balance sheet data
  - Bank-level supervisory balance sheet data

This Paper: Identifies and quantifies international credit channel

- Exploits the rich data set to identify the causal effect of "global cycle" driven capital flows on domestic credit growth and the real economy
- Focuses on overall effects and heterogeneity across different dimensions
  - Currency denomination of loan: FX vs. TL
  - Maturity
  - Bank size
  - Firm size
- Important to understand the magnitude and direction of global financial cycle transmission to be able to design the right macroprudential policies.

Preview of Results: "Macro"

1. Isolate effects of supply ("push") driven and demand ("pull") driven capital inflows
2. When global liquidity is abundant, global uncertainty is low, and risk appetite is high:
   - Capital inflows into Turkey
   - This generates a decrease in the borrowing costs
   - ..and an increase in the credit volume
3. Quantitatively Important
   - Elasticity of –0.1 for the effect of VIX on domestic loan growth: a 50 percent decrease in VIX (IQD) $\Rightarrow$ increase loan growth by 5 percent domestically
   - Elasticity of 0.02 for the effect of VIX on interest rate: a 1 percent decrease in the interest rate due to a 50 percent increase in global liquidity
   - Similar magnitudes for capital inflows

Preview of Results: Heterogeneity

1. Borrowing in foreign currency and domestic currency increases together, though foreign currency borrowing is relatively cheaper
2. Large banks lend more in domestic currency relative to foreign currency at a lower price, as opposed to small banks which do reverse (also at a lower price)
3. Small firms pay less and borrow more than large firms both in domestic currency and foreign currency

Literature

- Many papers on the transmission of VIX/US Policy on aggregate asset prices but less so on domestic credit volumes and real outcomes at micro level
- Not clear whether VIX/US Policy drives capital inflows into EM (or what type of flows): importance of frequency of data
  - Works based on annual capital flows data find mixed results; works with quarterly bank flow data or monthly emerging market fund data find procyclical effects
  - Ahmed and Zlate (2014), Fratzscher et al (2013), Bruno and Shin (2015)

Empirical Strategy: Credit Register

- Analyze impact of external world wide macro time-varying variables, such as VIX, global liquidity, and capital flows to EMEs (correlated to US variables, such as FED balance sheet expansion, FED funds rate..)
- Analyze impact on credit variables, both volume and price
- As controls we can include individual time-varying firm and bank variables, and bank$\times$firm fixed effects
- To control demand for credit: add firm$\times$time fixed effects

$\Rightarrow$ Analyze the same firm with two different banks at the same time.... (Khwaja and Mian, 2008)

"Macro" Regressions

$$\log(\text{Loan}^{d}_{b,f,t}) = \alpha_{b,f} + \beta \text{Global}_{t-1} + \gamma \mathbf{Bank}_{b,t-1} + \varepsilon_{b,f,t} \quad (1)$$

$$\log(1 + r^{d}_{b,f,t}) = \alpha_{b,f} + \beta \text{Global}_{t-1} + \gamma \mathbf{Bank}_{b,t-1} + \nu_{b,f,t} \quad (2)$$

- **Global**: VIX, US MP variables, Turkish inflows instrumented by VIX
- **Bank**: log(Assets), capital ratio, CAR, liquidity ratio, noncore liability ratio, and ROA
- **Macro controls**: (lagged) Turkish GDP growth and inflation

ADD firm×quarter effects to control for demand for credit when VIX is at monthly level.

Bank-Level Heterogeneity Regression

$$\log(\text{Loan}^{d}_{b,f,t}) = \alpha_{b,f} + \alpha_{f,t} + \beta \log(\text{Bank Assets}_{b,t-1}) \times \text{Global}_{t-1} + \gamma \mathbf{Bank}_{b,t-1} + \varepsilon_{b,f,t} \tag{3}$$

$$\log(1 + r^{d}_{b,f,t}) = \alpha_{b,f} + \alpha_{f,t} + \beta \log(\text{Bank Assets}_{b,t-1}) \times \text{Global}_{t-1} + \gamma \mathbf{Bank}_{b,t-1} + \nu_{b,f,t} \tag{4}$$

- Note that firm×time effects control for demand and remove need for macro controls

Firm-Level Heterogeneity Regressions

$$\log(\text{Loan}^{d}_{b,f,t}) = \alpha_{b,f} + \alpha_{b,t} + \beta \log(\text{Firm Assets}_{f,t-1}) \times \text{Global}_{t-1} + \gamma \mathbf{Firm}_{f,t-1} + \varepsilon_{b,f,t}, \tag{5}$$

$$\log(1 + r^{d}_{b,f,t}) = \alpha_{b,f} + \alpha_{b,t} + \beta \log(\text{Firm Assets}_{f,t-1}) \times \text{Global}_{t-1} + \gamma \mathbf{Firm}_{f,t-1} + \nu_{b,f,t}, \tag{6}$$

- Note that bank×time effects control for supply and remove need for macro controls

Data: Merging Three Large Datasets over 2003–13

- Credit register data has information on households and firms
  - Number of (cash) loans: 114 million
  - Number of loans to firms: 57 million
  - Number of bank-firm pairs: 3.3 million
- We collapse credit register at firm-bank-quarter level going from 57 to 20.9 million observations (46 banks)
  - Multiple loans to a firm by a bank in a given period
  - Currency composition: majority of loans in TL (count), but 2/3rd value in FX
  - Interest rate, maturity, collateral, risk measures

Data: Merging Three Large Datasets over 2003–13

- Bank data capture all the balance sheet items and portfolio items for 46 banks
- Firm data capture 70 percent of the real economy
  - Annual data
  - Balance sheet and income statement data
- Core dataset has 26 commercial banks $\Rightarrow$ 13.3 million observations, where matched "with firms" sample has 1.7 million at bank-firm level ▸ Sample comparison

Macro Regression: Total Loans

Similar results with bank-firm fixed effects

	$\log(\text{Loans}_t)$		$\log(1+r_t)$	
	(1)	(2)	(3)	(4)
$\log(\text{VIX}_{t-1})$	-0.135[a]		0.017[a]	
	(0.006)		(0.0003)	
K Inflows$_{t-1}$		0.958[a]		-0.028[a]
		(0.043)		(0.002)
Inflation$_{t-1}$	0.100	0.476[a]	0.134[a]	0.087[a]
	(0.063)	(0.063)	(0.004)	(0.004)
GDP growth$_{t-1}$	0.221[a]	0.247[a]	-0.331[a]	-0.402[a]
	(0.060)	(0.066)	(0.0003)	(0.003)
trend	0.012[a]	0.012[a]	-0.002[a]	-0.001[a]
	(0.0004)	(0.0004)	(1.99E-05)	(2.00e-05)
Observations	1,705,468	1,705,468	1,705,468	1,705,468
R-squared	0.007	0.007	0.081	0.074

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level. ▸ Whole Credit Register

Macro Regressions: TL Loans

	$\log(\text{Loans}_t)$				$\log(1+r_t)$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(\text{VIX}_{t-1})$	-0.088[a]	-0.085[a]			0.023[a]	0.024[a]		
	(0.004)	(0.004)			(0.0003)	(0.0003)		
K Inflows$_{t-1}$			0.911[a]	0.757[a]			-0.029[a]	-0.074[a]
			(0.031)	(0.031)			(0.002)	(0.002)
Observations	1,317,022	1,305,268	1,317,022	1,305,268	1,317,022	1,305,268	1,317,022	1,305,268
R-squared	0.703	0.704	0.703	0.704	0.601	0.617	0.592	0.608
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls & trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level.

Macro Regressions: FX Loans

	$\log(\text{Loans}_t)$				$\log(1+r_t)$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(\text{VIX}_{t-1})$	-0.076[a]	-0.061[a]			0.005[a]	0.005[a]		
	(0.006)	(0.006)			(0.0002)	(0.0002)		
K Inflows$_{t-1}$			0.670[a]	0.435[a]			-0.009[a]	-0.023[a]
			(0.042)	(0.040)			(0.001)	(0.001)
Observations	587,882	581,490	587,882	581,490	587,882	581,490	587,882	581,490
R-squared	0.802	0.804	0.802	0.804	0.474	0.483	0.472	0.481
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Macro controls & trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level.

Bank Size and Firm Size Interactions: VIX

Bank Size Interaction

	(1) Total	(2) TL	(3) FX
$\log(\text{Loans}_t)$	-0.002	-0.021[a]	0.019[a]
	(0.003)	(0.003)	(0.006)
$\log(1+r_t)$	0.005[a]	0.008[a]	-0.088[b]
	(0.0002)	(0.0002)	(0.040)

Firm Size Interaction

	(1) Total	(2) TL	(3) FX
$\log(\text{Loans}_t)$	0.015[a]	0.024[a]	0.014[b]
	(0.004)	(0.005)	(0.007)
$\log(1+r_t)$	-0.002[a]	-0.0002	-0.001[a]
	(0.0002)	(0.0002)	(0.0002)

- Large banks lend more in TL at a lower price during low VIX
- Small banks lend more in FX at a lower price during low VIX
- Small firms pay less and borrow more than large firms both in TL and FX

Notes: Bank controls and firm×time, or firm controls and bank×time effects included. Standard errors clustered at firm level. 'a', 'b' indicate significance at the 1% and 5% level, respectively. ▸ Capital Flows interactions

Interest Rate Channel

At monthly (t) level for loans (l):

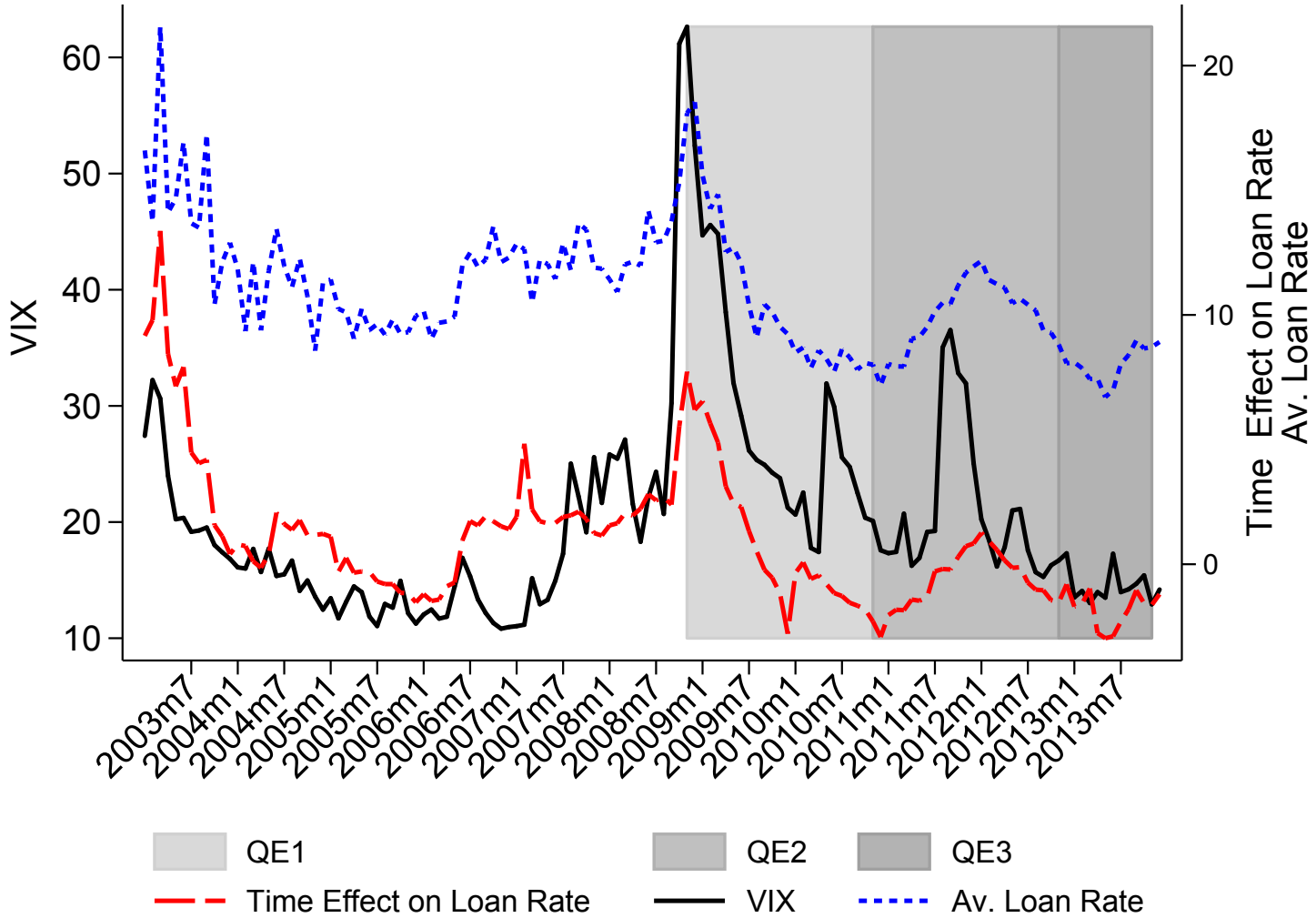
$$\begin{aligned}\log(1 + r_{b,f,l,t}) = \alpha_{b,f} + \alpha_{f,q} + \alpha_t + \alpha_{RW} + \alpha_{MAT} \\ + \alpha_{SEC} + \beta_1 \log(\text{Loan}_{b,f,l,t}) \\ + \beta_2(\text{Col/Loan})_{b,f,l,t} + \beta_3 \text{FX}_{b,f,l,t} + \varepsilon_{b,f,t}\end{aligned} \tag{7}$$

- $\alpha_{f,q}$: firm×quarter dummy—control demand
- α_{RW}: (bank-defined) risk-weight dummy
- α_{MAT}: maturity dummy

$\beta_3 < 0$: $-9pp$

VIX and Borrowing Costs, 2003-13

Estimated time effect and VIX have a correlation of over 0.9



Source: authors' calculations. ▸ Loan Growth and Exchange Rate

Role of Macroprudential Policy

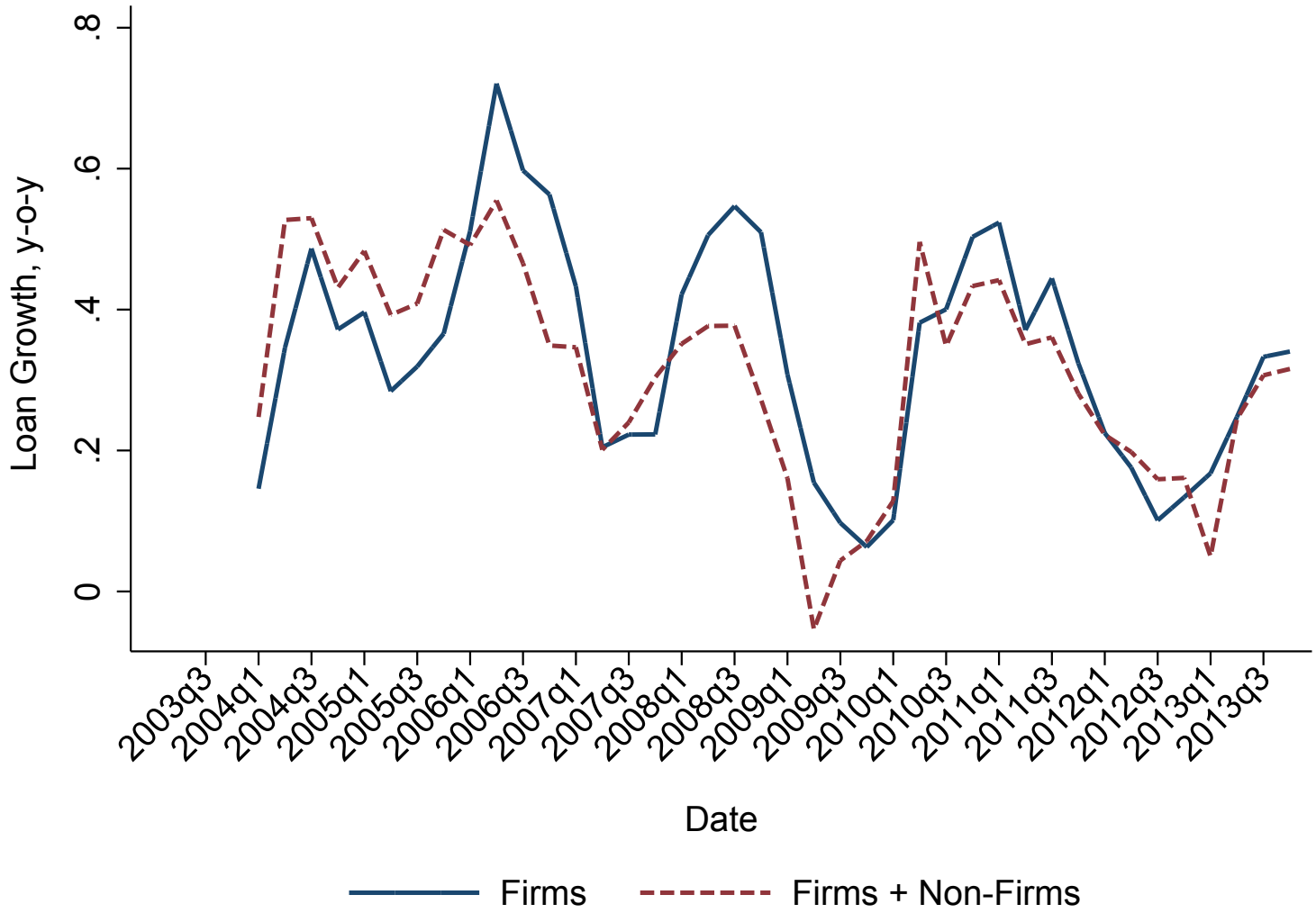
- Reserve Option Mechanism (ROM) introduced by the CBRT in September, 2011.
- Banks can voluntarily hold a certain fraction of their domestic-currency required reserves in foreign currency.
- To what extent the banks will use ROM depends on the relative cost.
- The cost depends on relative price of FX vs. TL funding.

We show that this policy leads to higher cost of FX lending and tilts the composition of borrowing from FX to TL during periods of low VIX. $\Rightarrow$ 9 pp interest rate differential goes down to 6 pp.

Conclusion

- Provide evidence on impact of global push factors on domestic loan growth in an important EME economy using micro data
- Impact via quantity and price, where price (borrowing cost) is the key channel
- Heterogeneous effects: role of smaller firms and smaller banks for FX lending/borrowing
- A specific macro-prudential policy in Turkey had impact on currency composition of lending $\Rightarrow$ "taming the cycle"

Loan Growth Comparison of Corporate Sector and Whole Economy, 2003–13



Notes: Firm matched sample and Whole CR growth rate of loans. Data

Macro Regression: Total Loans, Whole CR

	$\log(\text{Loans}_t)$		$\log(1+r_t)$	
	(1)	(2)	(3)	(4)
$\log(\text{VIX}_{t-1})$	-0.243[a]		0.027[a]	
	(0.002)		(0.0001)	
K Inflows$_{t-1}$		1.951[a]		-0.116[a]
		(0.015)		(0.001)
Inflation$_{t-1}$	-1.067[a]	-0.277	0.174[a]	0.076[a]
	(0.021)	(0.021)	(0.001)	(0.001)
GDP growth$_{t-1}$	-0.420[a]	-0.647[a]	-0.211[a]	-0.265[a]
	(0.021)	(0.021)	(0.002)	(0.001)
trend	-0.029[a]	-0.029[a]	-0.001[a]	-0.001[a]
	(0.0002)	(0.0002)	(8.11e-06)	(8.13e-06)
Observations	13,358,069	13,358,069	13,358,069	13,358,069
R-squared	0.031	0.031	0.027	0.019

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level. ◂ Matched Sample

Macro Regressions with BF Heterogeneity: Total Loans, Whole CR

	$\log(\text{Loans}_t)$				$\log(1+r_t)$			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\log(\text{VIX}_{t-1})$	-0.084[a]	-0.091[a]			0.018[a]	0.018[a]		
	(0.001)	(0.001)			(8.67e-05)	(9.08e-05)		
K Inflows$_{t-1}$			0.792[a]	0.631[a]			-0.0622[a]	-0.086[a]
			(0.007)	(0.007)			(0.0005)	(0.0005)
Inflation$_{t-1}$	-0.245[a]	-0.177[a]	0.060[a]	0.158[a]	0.117[a]	0.097[a]	0.049[a]	0.027[a]
	(0.012)	(0.013)	(0.011)	(0.012)	(0.001)	(0.001)	(0.001)	(0.0009)
GDP growth$_{t-1}$	-0.319[a]	0.051[a]	-0.536[a]	-0.170[a]	-0.179[a]	-0.162[a]	-0.211[a]	-0.168[a]
	(0.011)	(0.011)	(0.012)	(0.012)	(0.0008)	(0.0008)	(0.0008)	(0.0009)
trend	0.002[a]	-0.007[a]	0.002[a]	-0.005[a]	-0.001[a]	-0.001[a]	-0.001[a]	-0.001[a]
	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(8.95e-06)	(1.37e-05)	(8.80e-06)	(1.30e-05)
Observations	13,358,069	13,301,856	13,358,069	13,301,856	13,358,069	13,301,856	13,358,069	13,301,856
R-squared	0.873	0.874	0.873	0.874	0.790	0.794	0.787	0.792
Bank×firm F.E.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank controls	No	Yes	No	Yes	No	Yes	No	Yes

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level. ◂ Matched Sample

IV Regressions with BF Heterogeneity: Total Loans, Whole CR

	$\log(\text{Loans}_t)$		$\log(1+r_t)$	
	(1)	(2)	(3)	(4)
K Inflows$_{t-1}$	1.611[a]	1.884[a]	-0.339[a]	-0.365[a]
	(0.021)	(0.025)	(0.001)	(0.002)
Observations	13,358,069	13,301,856	13,358,069	13,301,856
R-squared	0.873	0.873	0.775	0.782
Bank×firm F.E.	Yes	Yes	Yes	Yes
Bank controls	No	Yes	No	Yes
First-stage F-stat	14.06	14.06	14.06	14.06

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level. ◂ Matched Sample

Bank Size and Firm Size Interactions: Capital Inflows

Bank Size Interaction

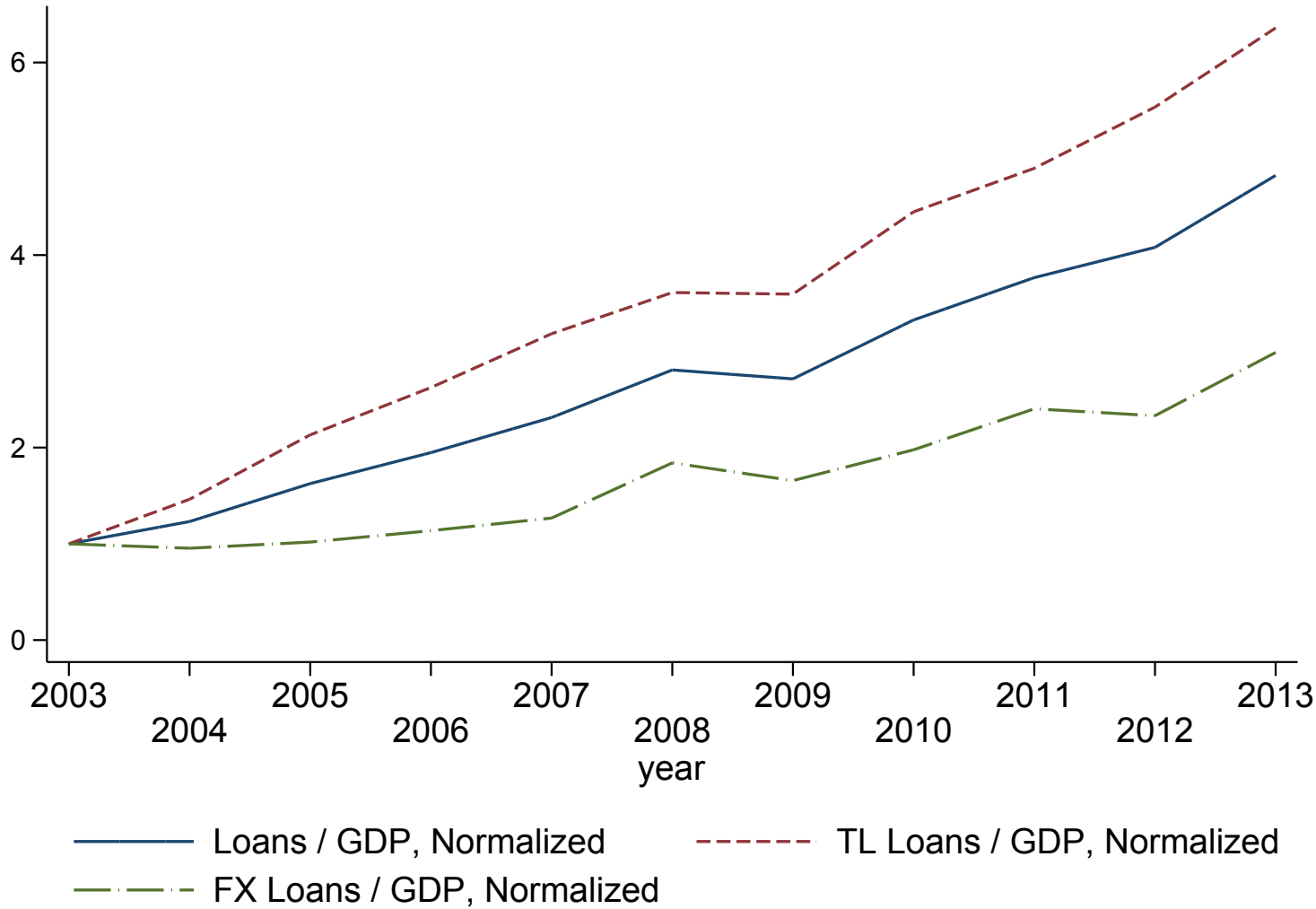
	(1) Total	(2) TL	(3) FX
$\log(\text{Loans}_t)$	0.080[a]	0.174[a]	0.0003[b]
	(0.022)	(0.026)	(0.0001)
$\log(1+r_t)$	-0.012[a]	-0.020[a]	0.001
	(0.001)	(0.001)	(0.001)

Firm Size Interaction

	(1) Total	(2) TL	(3) FX
$\log(\text{Loans}_t)$	0.015[a]	-0.138[a]	-0.009
	(0.004)	(0.039)	(0.043)
$\log(1+r_t)$	0.012[a]	0.010[a]	0.006[a]
	(0.001)	(0.002)	(0.001)

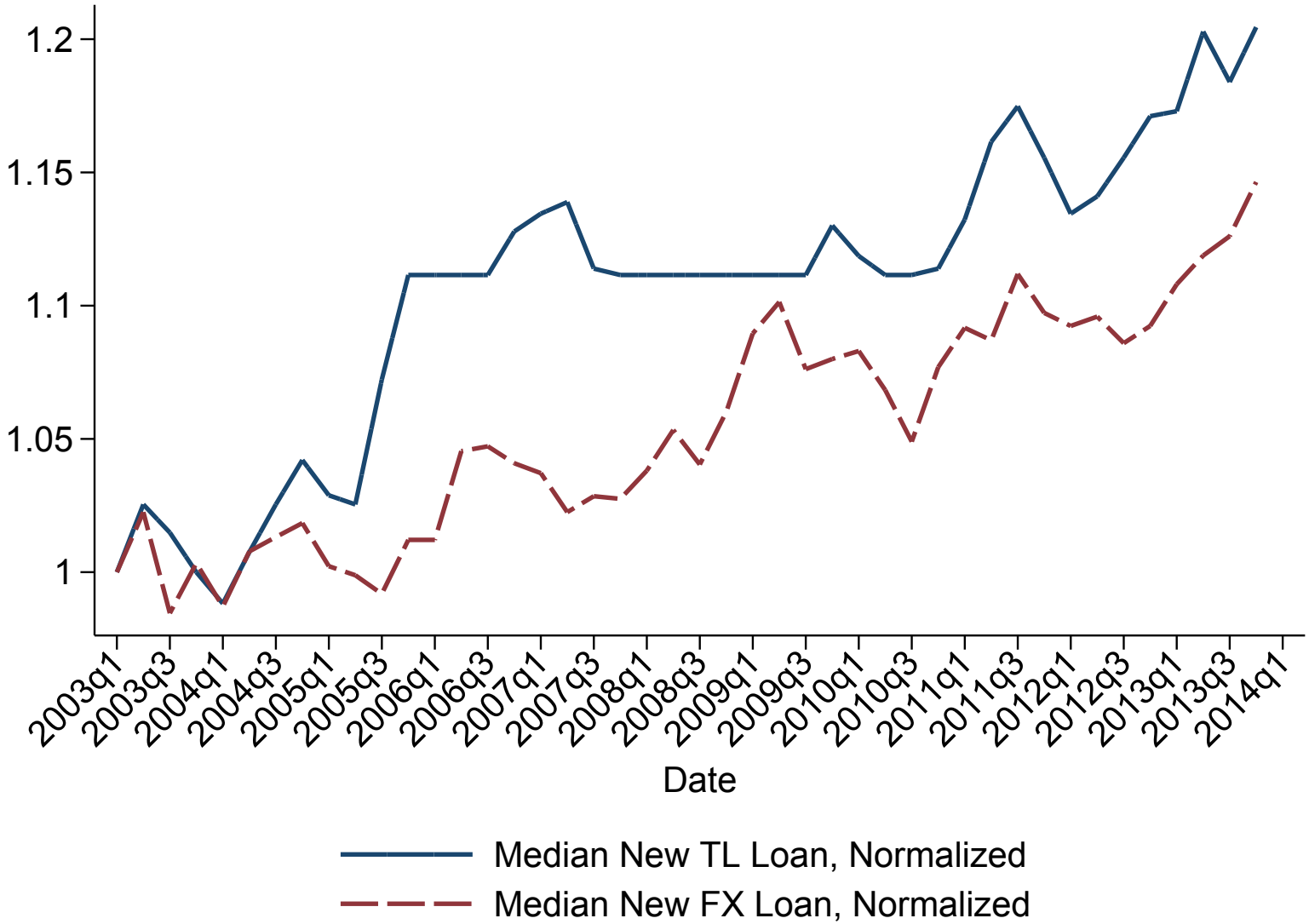
Notes: Bank controls and firm×time, or firm controls and bank×time effects included. Standard errors clustered at firm level. 'a', 'b' indicate significance at the 1% and 5% level, respectively. ◂ VIX interactions

Loan Growth, 2003–13



Source: authors' calculations.

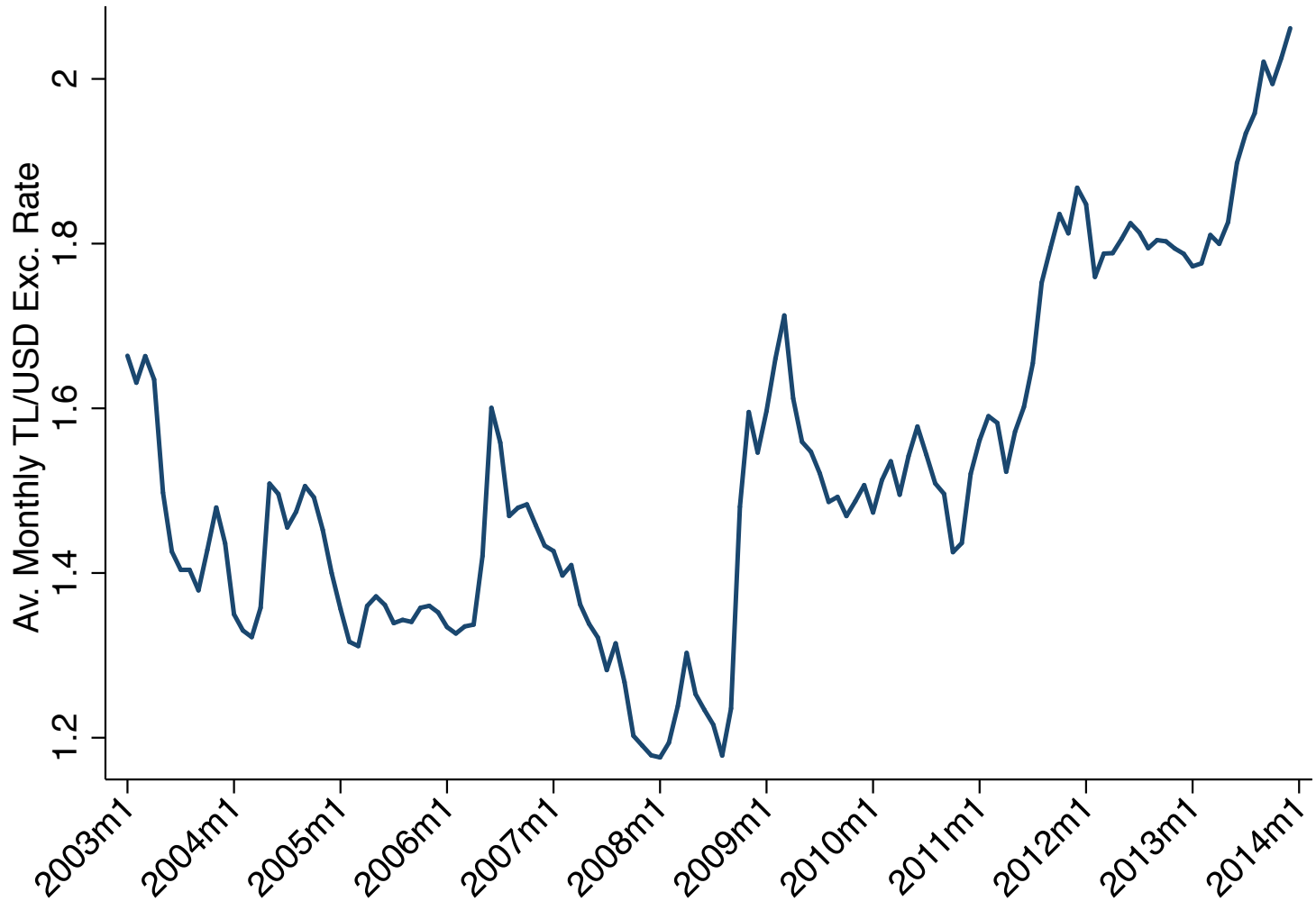
Growth of New Loans, 2003–13



Source: authors' calculations.

Turkish lira/US dollar Exchange rate, 2003-13

Interest rate channel appears key given large period of TL depreciation



Source: CBRT. ◂ Borrowing costs

IV Regressions: Total Loans

	$\log(\text{Loans}_t)$		$\log(1+r_t)$	
	(1)	(2)	(3)	(4)
K Inflows$_{t-1}$	1.691[a]	1.629[a]	-0.302[a]	-0.338[a]
	(0.064)	(0.067)	(0.004)	(0.004)
Observations	1,705,468	1,689,252	1,705,468	1,689,252
R-squared	0.758	0.759	0.602	0.615
Bank×firm F.E.	Yes	Yes	Yes	Yes
Bank controls	No	Yes	No	Yes
Macro controls & trend	Yes	Yes	Yes	Yes
First-stage F-stat	14.06	14.06	14.06	14.06

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level. ▸ Whole Credit Register

Interest Rate Channel: Monthly Interest Rate Regression

	(1)
log(Loan)	-1.505[a]
	(0.002)
Collateral / Principal	-.334[a]
	(0.0022)
FX Dummy	-8.710[a]
	(0.012)
Observations	20,530,564
R-squared	0.77
Bank×firm F.E.	Yes
Firm×quarter F.E.	Yes
Month F.E.	Yes
Opening date F.E.	Yes
Risk weight F.E	Yes
Activity F.E.	Yes

Notes: Standard errors clustered at firm level. 'a' indicates significance at the 1% level.