What are the Real Effects of Capital Flows with Macroprudential Response?

Evidence from Firm-Bank Matched Data in an Emerging Market*

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May 27, 2015

*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
  - Boom-bust episodes
  - Systemic risk and large potential costs during crises
- Capital flows have been highlighted as potential important drivers of these cycles in *emerging market economies* (EMEs)
- Policymakers face a difficult environment in preventing excessive credit buildup in the open economy

  $\Rightarrow$ "Leaning-against the wind" by raising interest rates may attract more capital flows, which feed into more domestic credit growth

  $\Rightarrow$ Need for other macroprudential and unorthodox tools

Research Questions

1. What is the effect of capital flows on EME's
   - Domestic credit growth and credit supply?
   - Real outcomes (output, employment, investment, etc.) through the *credit channel*?

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1. What is the effect of capital flows on EME's
   - Domestic credit growth and credit supply?
   - Real outcomes (output, employment, investment, etc.) through the *credit channel*?
2. What are the effects of a set of policies taken to manage capital flows?
   - Macroprudential
   - Non-conventional monetary policy (e.g., new uses of reserve requirements or interest rate ranges)
   - Capital controls
   - FX intervention

Issues Faced in Answering Questions

- The macroeconomics literature has tried to answer these questions, but face identification problems:
  - Are capital flows arising from "push" or "pull" factors?
  - Is domestic credit growth being driven by demand or supply?
  - What are the effects of these capital flows on
    - Domestic credit?
    - The real economy?
- Measuring impact of policies taken difficult given endogeneity (anticipation), potential confounding factors, and data constraints

This Paper

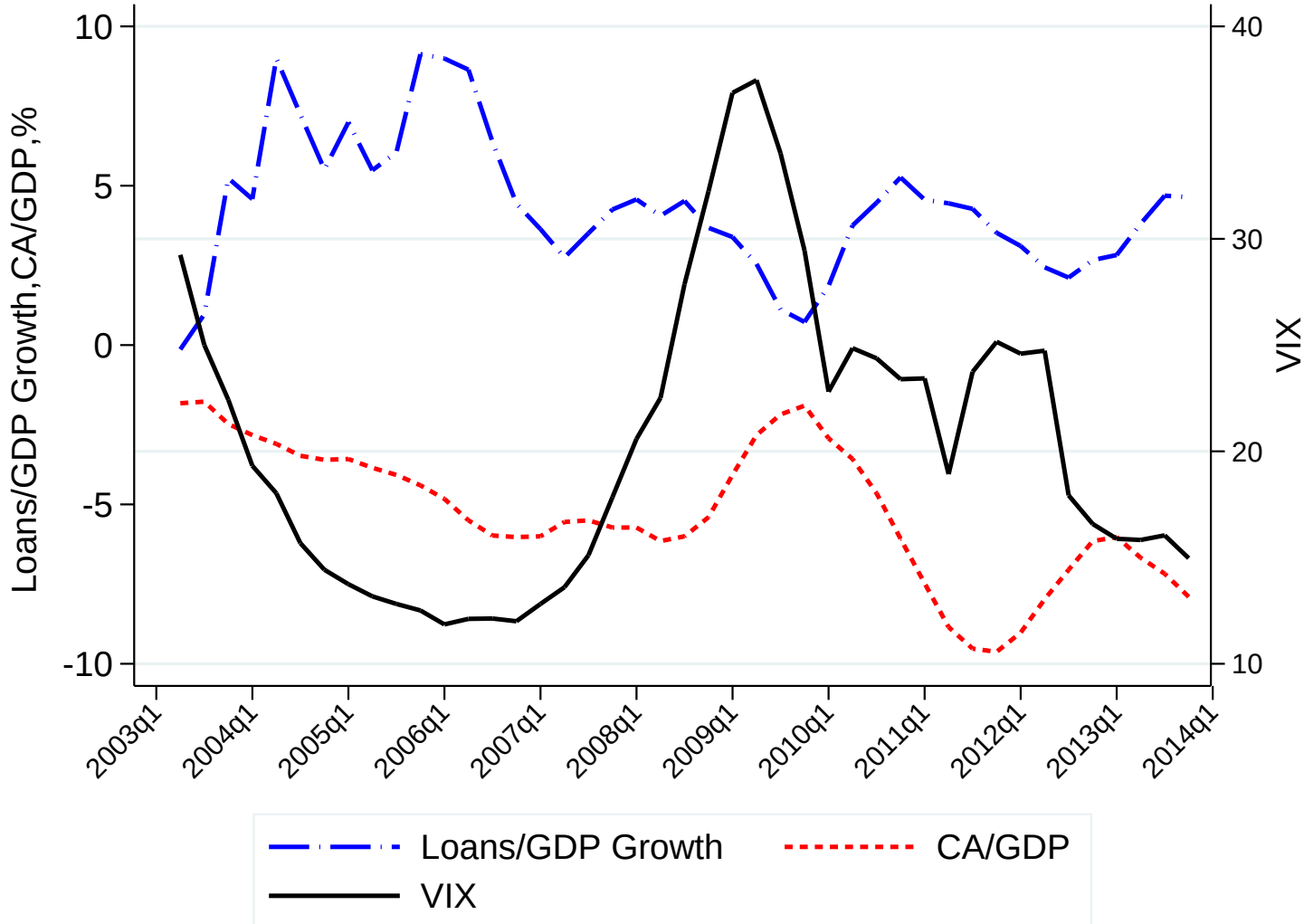
- Uses Turkey, a major EME, as an excellent laboratory to analyze the impact of capital flows and policy
- Exploits credit register data *matched* to detailed bank- and firm-level data over 2003Q1–2013Q4
  - Every business loan in the economy: principal outstanding, interest rates, maturity, collateral,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

This Paper

- Exploits the rich data set to identify the causal effect of capital flows on domestic credit growth and the real economy
- Analyzes the impact of several macroprudential policies taken by the Turkish authorities:
  - On banks
  - Macroprudential and monetary policy
  - Capital account restrictions

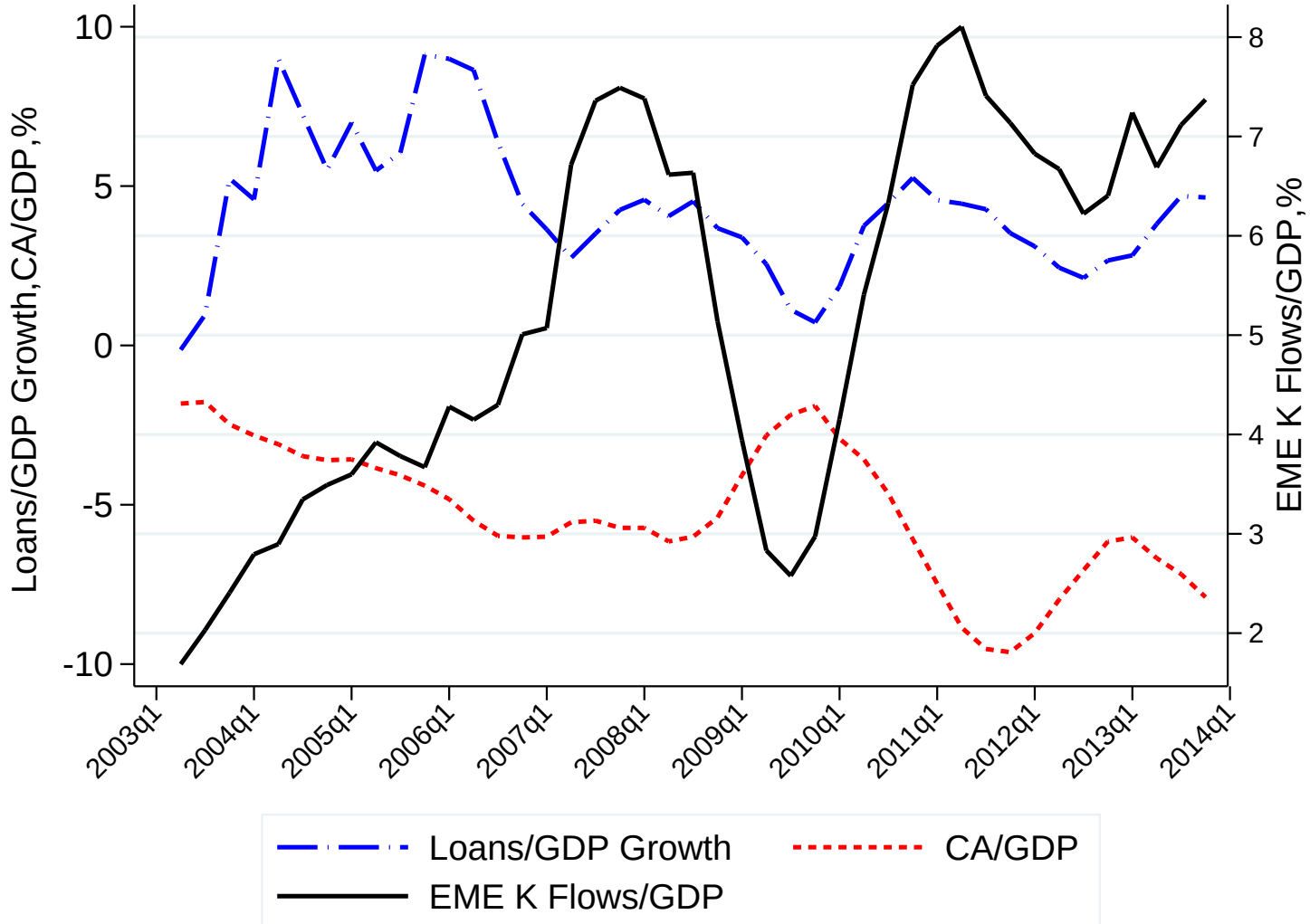
$\Rightarrow$ We focus on banks' foreign wholesale funding

VIX, CA/GDP, and Domestic Credit



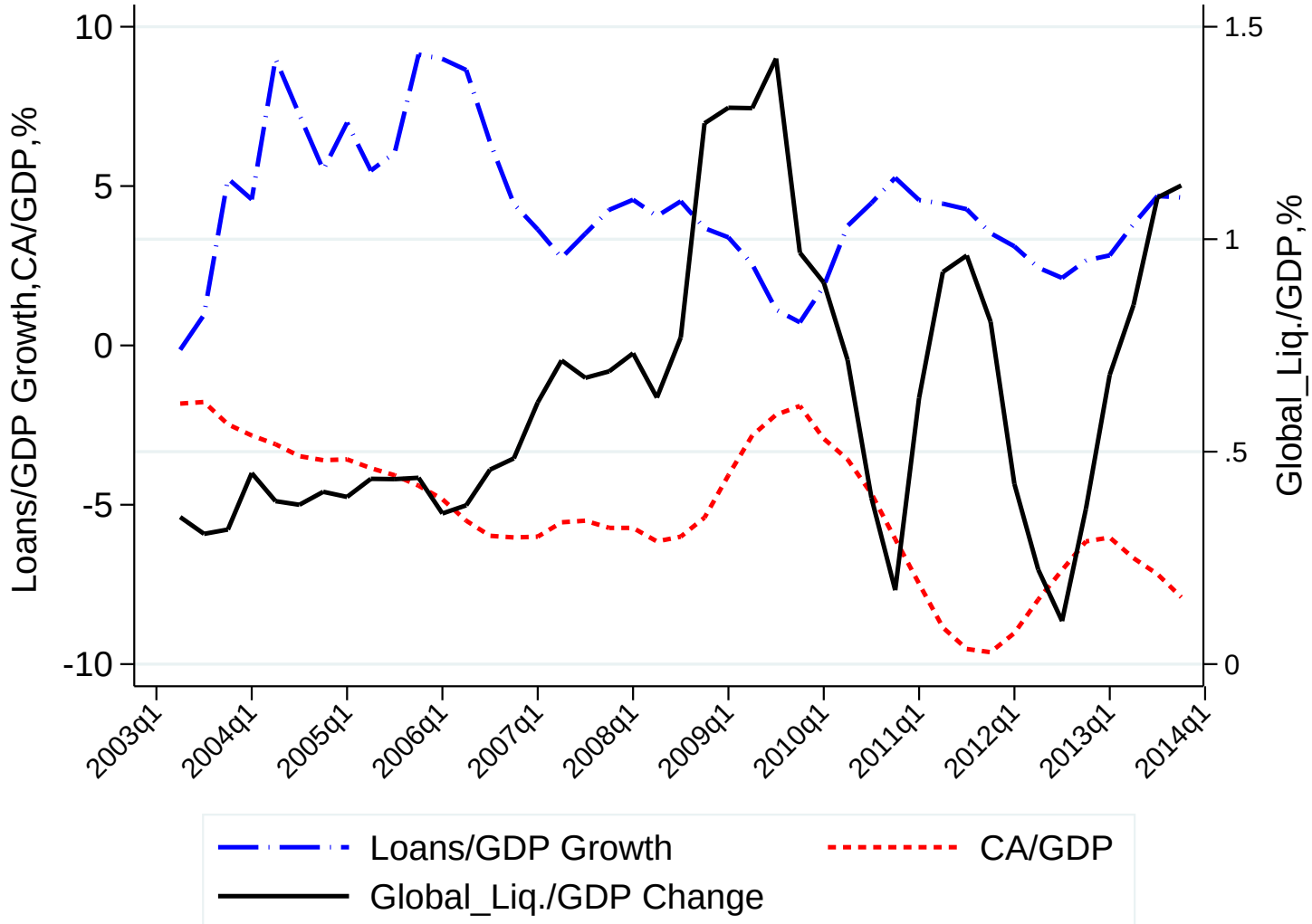
Sources: CBRT and CBOE

EME Capital Flows, CA/GDP, and Domestic Credit



Sources: CBRT and IMF. Capital flows based on gross assets + gross liabilities

Global Liquidity,CA/GDP, and Domestic Credit



Sources: CBRT and IMF. Global liquidity measure is world reserves + U.S. M0

Related Literatures

1. Capital Flows
   - **"Push-Pull" and Dynamics**: Calvo, et al. (1993,1996) on *net*; Broner, et al. (2013) on *gross*
   - **Global Factor**: Forbes and Warnock (2012), Bruno and Shin (2015), Rey (2015) point towards importance of VIX

   $\Rightarrow$ Hahm, Shin, and Shin (2013) highlight importance of banks' noncore liabilities

2. Monetary Policy Spillovers
   - **Trilemma**: Shambaugh (2004), Obstfeld and Taylor (2008), di Giovanni and Shambaugh (2008) (real effects)
   - **Global Financing**: Bruno and Shin (2015), Miranda-Agrippino (2014), Rey (2015) (Dilemma)

   $\Rightarrow$ Importance of U.S. monetary policy for global financial conditions

Related Literatures

3. Macroprudential policy in EMEs
   - **Macro Cross-Country Effectiveness**: Forbes and Klein (2015), Claessens, et al. (2014), Ostry et al. (2012, 2013)
   - **Loan-Level Effectiveness**: Dassati and Peydro (2013)
4. Real Effects
   - **Macro cross-country data**: Aizenman, et al. (2013), Abiad, et al. (2013), Fratzscher, et al. (2013, 2014)
   - **Bank-firm matched data**: Cingano, et al. (2013, investment), Jimenez, et al. (2014, employment)

Empirical Strategy: Credit Register

- Analyze impact of external world wide macro time-varying variables, such as VIX, global liquidity, and capital flows to EMEs
- Analyze impact on credit variables, both volume and price (interest rate, collateral, and maturity)
- As controls we can include individual time-varying firm and bank variables, and bank$\times$firm fixed effects
- Some banks are more affected than others: add firm$\times$time fixed effects and bank macro interactions

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

Basic Empirical Strategy: Real Effects and Policy Analysis

- Use predicted credit changes to explain change in firm-level (real) variables
  - Investment
  - Sales
  - Employment
- Examine impact of policy interventions on credit and real variables
  - Dif-in-dif approach ("triple interaction")
  - Sub-samples splits

Baseline Regression

$$\Delta Loan_{bft} = \alpha_{bf} + \beta \Delta KFlow_{t-1} + \boldsymbol{\theta_1} \mathbf{Bank}_{bt-1} + \boldsymbol{\theta_2} \mathbf{Firm}_{ft-1} + \boldsymbol{\lambda} \mathbf{Macro}_{t-1} + \varepsilon_{bft} \quad (1)$$

Loan	*KFlow*
1. ln(Principal outstanding)	1. VIX
2. Interest rate	2. (K flows to EMEs)/GDP
3. Collateral/Principal	3. Global liquidity
4. Maturity	4. U.S. FFR

- **Bank**: size (log assets), capital ratio, liquidity ratio, NPL ratio, ROA, noncore liabilities/total liabilities
- **Firm**: size (log assets), growth rate of sales, tangibles asset ratio
- **Macro**: Turkish GDP growth and inflation, world GDP growth
- α_{bf}: Firm×Bank fixed effects

Identifying Supply Effects via Bank Heterogeneity

We can extend regression (1) to identify supply channel:

$$\Delta Loan_{bft} = \alpha_{bf} + \alpha_{ft} + \gamma(BChar \times \Delta KFlow)_{t-1} + \boldsymbol{\theta}\mathbf{Bank}_{bt-1} + \nu_{bft} \quad (2)$$

- *BChar*: set of bank characteristics
  - Size (log assets)
  - Capital ratio
  - Noncore liability ratio
- α_{ft}: Firm×time fixed effects
- Run separate regressions interacting each *KFlow* with each *BChar* (3 interaction terms)

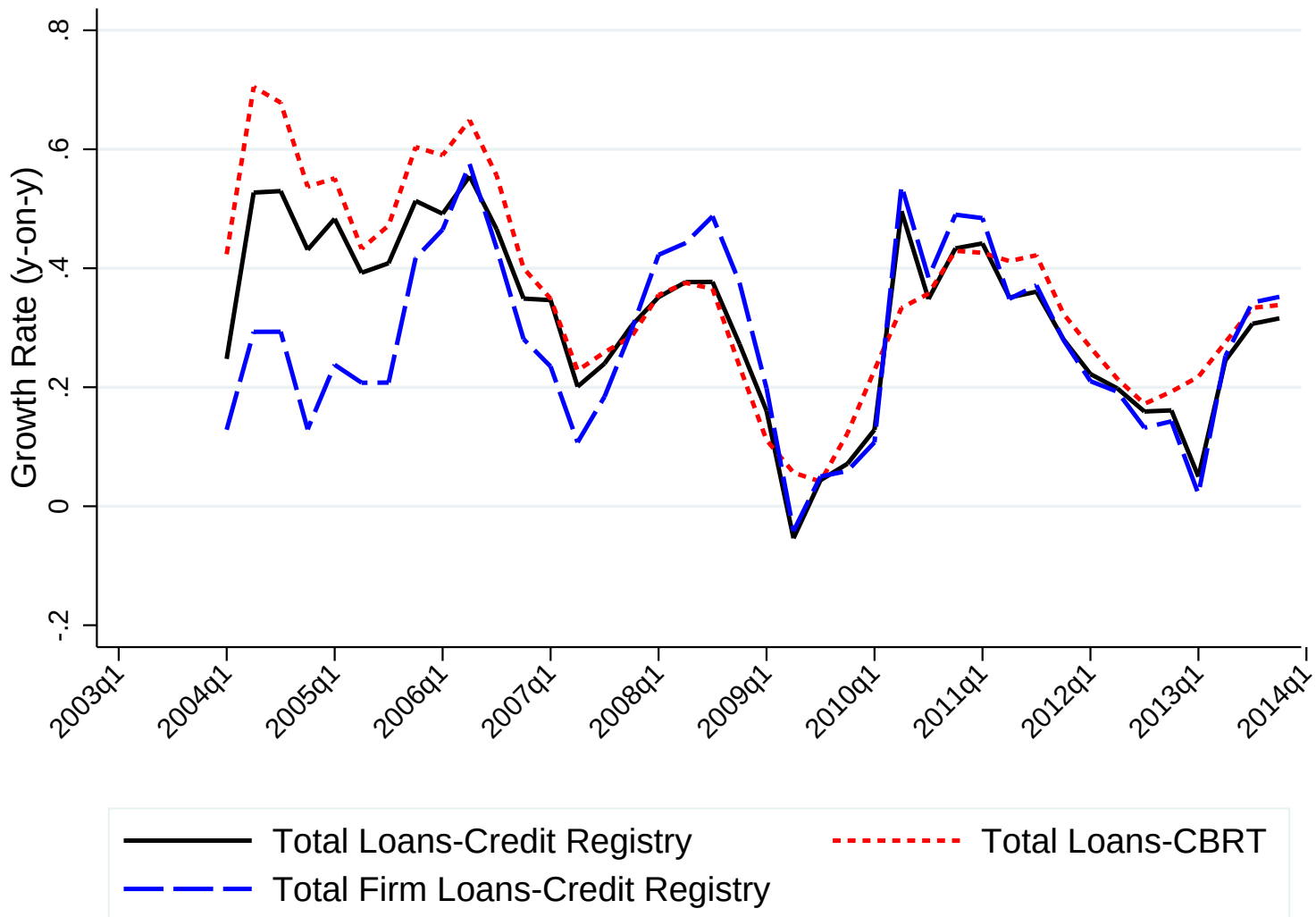
Data: Merging Three Large Datasets over 2003–13

- Credit register data has information on households and firms
  - Number of (cash) loans: 110+ million
  - Number of loans to firms: 55.8 million
  - Share of firm loans: 87% in value
  - Number of bank-firm pairs: 6 million
- We collapse credit register at firm-bank-quarter level going from 55.8 to 25.9 million observations
  - 40% represent firms borrowing from multiple banks
  - Currency composition, multiple loans to a firm by a bank in a given period
  - Interest rate, maturity, collateral
  - Risk measures

Data: Merging Three Large Datasets over 2003–13

- Bank data captures all the balance sheet items and portfolio items for 48 banks
  - 26 commercial
  - 13 investment and development
  - 4 Islamic
  - 4 branches of foreign banks
  - 1 bank taken over by Deposit Insurance Fund
- Firm data captures 70 percent of the real economy
  - Annual data
  - Balance sheet and income statement data

Domestic Credit Growth



Source: CBRT, Turkish Credit Register. Year-on-year growth rates

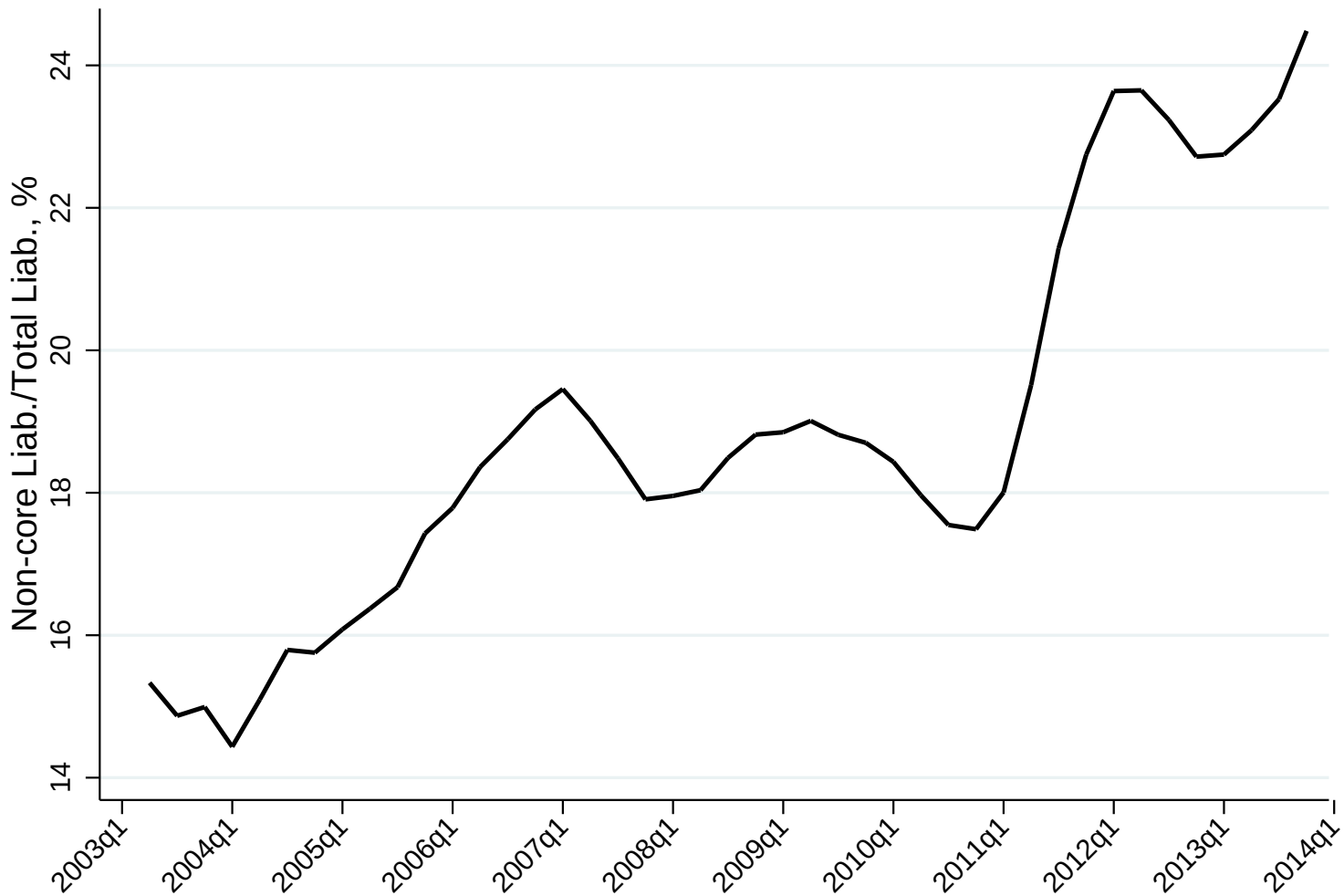
Credit Register Summary Statistics

Levels	Obs.	Mean	St. Dev.	Min.	Max.
log(Outstanding)	1.82E+07	10.68	1.59	6.42	15.8
Interest rate (%)	1.82E+07	14.46	14.01	0	84.71
Collateral/Outstanding	1.82E+07	1.42	2.47	0	19.39
Maturity	1.59E+07	2.5	1	0	4.43

Differences	Obs.	Mean	St. Dev.	Min.	Max.
log(Outstanding)	1.45E+07	-0.04	0.67	-2.93	2.98
Interest rate (%)	1.45E+07	-0.06	5.36	-35.16	30.19
Collateral/Outstanding	1.45E+07	0.02	1.12	-7.44	7.58
Maturity	1.24E+07	-0.12	0.61	-2.07	2.47

Notes: principal outstanding is expressed in logs, and maturity is in months

Noncore Liabilities Ratio



Source: CBRT. Year-on-year growth rates

Bank-Level Summary Statistics

	Obs.	Mean	St. Dev.	Min.	Max.
log(Total Assets)	1873	14.69	2.36	8.52	19.15
Capital Ratio	1873	0.25	0.22	0.04	0.99
Liquidity Ratio	1873	0.42	0.23	0.02	0.96
NPL Ratio	1873	0.07	0.43	0	5.31
ROA	1873	0.01	0.04	-0.24	0.15
Noncore liab./Total liab.	1873	0.29	0.23	0	0.91

- Noncore liabilities = Payables to money market + Payables to securities + Payables to banks + Funds from Repo + Securities issued (net)

Firm-Level Summary Statistics

	Obs.	Mean	St. Dev.	Min.	Max.
No. of Employees	135,099	167.32	620.46	1	62409
Growth of Gross Sales	98,901	1	5.6	-0.99	50.24
Fixed Tangible Investment	94,083	1.18	4.39	0	35.75
PPE Investment	96,597	1.04	3.77	0	30.23
Cash Flow/Assets	101,051	0.04	0.23	0	0.86
Net Worth/Assets	135,294	0.36	0.29	0	0.99

- Fixed Tangible Investment: Change in Fixed Tangible Assets normalized by lagged Tangible Assets
- PPE Investment: Change in Plant, Property and Equipment normalized by lagged Plant, Property and Equipment

Macroeconomic Summary Statistics

	Obs.	Mean	St. Dev.	Min.	Max.
VIX	44	-0.339	7.530	-19.560	26.440
EME Capital Flows	44	0.001	0.022	-0.057	0.043
Global Liquidity	44	0.006	0.007	-0.008	0.030
U.S. Rate	44	-0.0003	0.004	-0.017	0.006
World GDP	44	0.036	0.018	-0.018	0.059
Turkish GDP	44	0.014	0.124	-0.320	0.325
Turkish Inflation	44	0.021	0.014	-0.003	0.062

- EME Capital Flows = Gross Capital Flows/GDP
- Global Liquidity = (World Reserves + U.S. M0)/GDP
- U.S. Rate: U.S. Federal Funds rates

Baseline Regressions: Principal Outstanding

	(1)	(2)	(3)	(4)
VIX	-0.0059			-0.0045
	(0.000)			(0.000)
EME Capital Flows		2.8415		1.4865
		(0.009)		(0.010)
Global Liquidity			10.5995	9.6337
			(0.027)	(0.029)
Observations	14,264,342	14,264,342	14,264,342	14,264,342
Bank×Firm F.E.	2,404,457	2,404,457	2,404,457	2,404,457
R^2	0.107	0.111	0.117	0.123

Notes: Regressions include firm and bank controls, with standard errors in parentheses.

Baseline Regressions: Interest Rate

	(1)	(2)	(3)	(4)
VIX	0.0003			0.0003
	(0.000)			(0.000)
EME Capital Flows		-0.0573		-0.0169
		(0.001)		(0.001)
Global Liquidity			-0.2466	-0.2274
			(0.002)	(0.02)
Observations	14,264,342	14,264,342	14,264,342	14,264,342
Bank×Firm F.E.	2,404,457	2,404,457	2,404,457	2,404,457
R^2	0.121	0.120	0.121	0.122

Notes: Regressions include firm and bank controls, with standard errors in parentheses.

Baseline Regressions: Collateral Ratio

	(1)	(2)	(3)	(4)
VIX	0.0012			0.0008
	(0.000)			(0.000)
EME Capital Flows		-0.9085		-0.563
		(0.000)		(0.017)
Global Liquidity			-2.9351	-2.5994
			(0.042)	(0.047)
Observations	14,264,342	14,264,342	14,264,342	14,264,342
Bank×Firm F.E.	2,404,457	2,404,457	2,404,457	2,404,457
R^2	0.086	0.086	0.086	0.086

Notes: Regressions include firm and bank controls, with standard errors in parentheses.

Quantitative Implications

We consider the impact of a one standard deviation increase in the external variables on the bank-firm level variables given regression estimates in Columns (4):

	Principal Outstanding	Interest Rate	Collateral Ratio
		(in percent)	
VIX	-3.4	0.191	0.6
EME Capital Flows	3.2	-0.036	-1.2
Global Liquidty	7.2	-0.169	-1.9

Role of Noncore Liabilities: Principal Outstanding

	(1)	(2)	(3)
VIX	-0.0086		
	(0.001)		
EME Capital Flows		1.7531	
		(0.286)	
Global Liquidity			0.9145
			(0.737)
Observations	6,133,393	6,133,393	6,133,393
Bank×Firm F.E.	1,073,288	1,073,288	1,073,288
Firm×Time F.E.	2,574,506	2,574,506	2,574,506
R^2	0.557	0.557	0.557

Notes: This table presents the interaction coefficient for noncore liabilities. Regressions include bank controls, with standard errors in parentheses.

Role of Noncore Liabilities: Interest Rate

	(1)	(2)	(3)
VIX	-0.0004		
	(0.000)		
EME Capital Flows		-0.2069	
		(0.020)	
Global Liquidity			-0.0710
			(0.046)
Observations	6,134,681	6,134,681	6,134,681
Bank×Firm F.E.	1,073,306	1,073,306	1,073,306
Firm×Time F.E.	2,574,626	2,574,626	2,574,626
R^2	0.523	0.524	0.523

Notes: This table presents the interaction coefficient for noncore liabilities. Regressions include bank controls, with standard errors in parentheses.

Role of Noncore Liabilities: Collateral Ratio

	(1)	(2)	(3)
VIX	0.0018		
	(0.001)		
EME Capital Flows		9.3238	
		(0.462)	
Global Liquidity			-4.0332
			(1.050)
Observations	6,133,393	6,133,393	6,133,393
Bank×Firm F.E.	1,073,288	1,073,288	1,073,288
Firm×Time F.E.	2,574,506	2,574,506	2,574,506
R^2	0.523	0.523	0.523

Notes: This table presents the interaction coefficient for noncore liabilities. Regressions include bank controls, with standard errors in parentheses.

Conclusion

- EMEs financial cycles highly sensitive to global financing conditions
- Zoom in at bank-firm level using a rich credit register data for Turkey
- Supply of credit by banks with larger noncore liability ratios more sensitive to world financial conditions
- Going forward
  - Consider real effects of capital-flow induced changes in credit conditions (investment, sales, employment)
  - Analyze macroprudential and other policies taken by the authorities related to bank liquidity/risk geared at (i) the external sector borrowing in the short-term wholesale market, and (ii) the internal system as a whole