INTERNATIONAL SPILLOVERS AND LOCAL CREDIT CYCLES*

Yusuf Soner Başkaya¹ Julian di Giovanni²
Şebnem Kalemli-Özcan³ Mehmet Fatih Ulu⁴

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

March 2018
BIS Research Network, Pushing the Frontier on CBs’ Macro Modeling

*This project does not represent official views of the CBRT.
Big Picture

Large debate on how advanced country shocks and policies affect emerging market business cycles.

1. How do policy decisions in AE drive financial conditions in ROW? (spillovers)
2. What channels transmit these spillovers?
3. How do we use this information to build a better financial system and mitigate risks?

We exploit a new and very large dataset to address these questions:

Focus: On the role of capital flows/global financial conditions in international transmission.
Big Picture

Large debate on how advanced country shocks and policies affect emerging market business cycles.

Christine Lagarde, November 2, 2017:

1. How do policy decisions in AE drive financial conditions in ROW? (spillovers)

2. What channels transmit these spillovers?

3. How do we use this information to built a better financial system and mitigate risks?
Big Picture

Large debate on how advanced country shocks and policies affect emerging market business cycles.

Christine Lagarde, November 2, 2017:

1. How do policy decisions in AE drive financial conditions in ROW? (spillovers)

2. What channels transmit these spillovers?

3. How do we use this information to built a better financial system and mitigate risks?

We exploit a new and a very large dataset to address these questions:

Focus: On the role of capital flows/global financial conditions in international transmission
Motivating Macro Stylized Facts

In Emerging Markets:

- Business cycles correlate strongly with credit cycles.
- Capital flows go hand-in-hand with credit cycles.

⇒ Often resulting in financial crisis.

- EM policy makers: “capital inflows/outflows problem.”
Motivating Macro Stylized Facts

In Emerging Markets:

- Business cycles correlate strongly with credit cycles.
- Capital flows go hand-in-hand with credit cycles.

⇒ Often resulting in financial crisis.

- EM policy makers: “capital inflows/outflows problem.”

We ask:

- Do capital flows *causally* drive domestic credit cycles in EMs?
- If so, what are the mechanisms at work?
- ..and how BIG are the magnitudes? Enough to justify EM central bankers’ actions?
Challenges

A basic *identification problem*:

- Relative importance of "pull" or "push" factors for capital flows?
  - Is domestic credit growth being driven by *exogenous* capital flows, i.e., an *exogenous international supply of credit*?
  - *Standard open economy models*: capital flows are an endogenous response to a domestic or external shock to C and/or I.
  - No role for global shocks/foreign investor sentiment for driving capital flows under UIP.
Challenges

A basic *identification problem*:

- Relative importance of “pull” or “push” factors for capital flows?
  - Is domestic credit growth being driven by *exogenous* capital flows, i.e., an *exogenous international supply of credit*?
  - *Standard open economy models*: capital flows are an endogenous response to a domestic or external shock to C and/or I.
  - No role for global shocks/foreign investor sentiment for driving capital flows under UIP.

- Is there a role of heterogeneous agents?
  - Important to shed light on micro-foundations of macro models.
  - Evidence necessary to understand the *quantitative* role of heterogeneity for aggregate outcomes; important implications for policy.
A Big Data Approach


- A decade long panel on every single loan contract between a bank and a firm in a representative EM.
A Big Data Approach


- A decade long panel on every single loan contract between a bank and a firm in a representative EM.

- Instrument capital flows with VIX to investigate effect of capital flows driven by “risk-on” episodes.
A large causal effect of supply-side capital flows: on domestic borrowing costs and credit growth at bank-firm and aggregate levels.

Challenge for: standard theory with no arbitrage and to advanced country policy makers’ argument—EM flows due to fundamentals/demand.
Contribution of Big Data Approach to Theory

- **A large causal effect of supply-side capital flows:** on domestic borrowing costs and credit growth at bank-firm and aggregate levels.

  Challenge for: standard theory with no arbitrage and to advanced country policy makers’ argument—EM flows due to fundamentals/demand

- **A new international transmission mechanism—the interest rate channel:** via internationally-funded domestic banks’ funding costs

  Challenge for: models that assume banks have access to deposits at the risk-free rate (e.g., Brunnermeier and Sannikov, 2014; Gertler and Karadi, 2011; Gertler and Kiyotaki, 2010).
**Contribution of Big Data Approach to Theory**

- A large causal effect of supply-side capital flows: on domestic borrowing costs and credit growth at bank-firm and aggregate levels.

  Challenge for: standard theory with no arbitrage and to advanced country policy makers’ argument—EM flows due to fundamentals/demand

- A new international transmission mechanism—the interest rate channel: via internationally-funded domestic banks’ funding costs

  Challenge for: models that assume banks have access to deposits at the risk-free rate (e.g., Brunnermeier and Sannikov, 2014; Gertler and Karadi, 2011; Gertler and Kiyotaki, 2010).

- A different mechanism for the relaxation of firm-level borrowing constraints: not via collateral values, via borrowing costs.

  Challenge for: models where total debt cannot exceed a fraction of the market value of capital/collateral, flows relaxes this limit (e.g., Calvo, 1998; Caballero and Krishnamurthy, 2001; Mendoza, 2010; Korinek and Sandri, 2016)
Empirical Contribution

Macro Literature so far:

- Many papers on the transmission of VIX/US Policy on global/country specific asset prices. (e.g., Bruno-Shin, 2014; Rey, 2013)
- Little consensus on whether VIX/US policy drive/explain capital flows to EMs (e.g., Cerutti-Claessens-Rose, 2017; Miranda-Agrippino-Rey, 2016; Forbes-Warnock, 2012; Borio-Disyatat, 2011).
- Missing: causal evidence on the effect of exogenous “risk-on-flows” on EMs’ real and financial outcomes.
Empirical Contribution

Macro Literature so far:

- Many papers on the transmission of VIX/US Policy on global/country specific asset prices. (e.g., Bruno-Shin, 2014; Rey, 2013)

- Little consensus on whether VIX/US policy drive/explain capital flows to EMs (e.g., Cerutti-Claessens-Rose, 2017; Miranda-Agrippino-Rey, 2016; Forbes-Warnock, 2012; Borio-Disyatat, 2011).

- Missing: causal evidence on the effect of exogenous “risk-on-flows” on EMs’ real and financial outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Macro Data</th>
<th>Micro Data</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pros</strong></td>
<td>Comparability country/time</td>
<td>Identification</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pin down the mechanism</td>
</tr>
<tr>
<td><strong>Cons</strong></td>
<td>Identification is hard (unobserved factors, UF)</td>
<td>Specific country/episode</td>
</tr>
<tr>
<td></td>
<td>Different fundamentals/policies (F, P)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hard to pin down the mechanism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Different frequency of AP&amp;Q data</td>
<td></td>
</tr>
</tbody>
</table>
1. Supply ("push") driven capital inflows have a quantitatively important impact on domestic credit cycle
   - Large effect of VIX on capital flows (elasticity $-1.7$ & high partial $R^2$).
   - An increase in capital flows equivalent to its IQR leads to 1 pp reduction in real borrowing costs.
   - Supply driven capital inflows explain 43% of aggregate corporate sector cyclical credit growth on average.
1. Supply ("push") driven capital inflows have a quantitatively important impact on domestic credit cycle
   - Large effect of VIX on capital flows (elasticity $-1.7$ & high partial $R^2$).
   - An increase in capital flows equivalent to its IQR leads to 1 pp reduction in real borrowing costs.
   - Supply driven capital inflows explain 43% of aggregate corporate sector cyclical credit growth on average.

⇒ Driven by the interest rate channel.
1. Supply ("push") driven capital inflows have a quantitatively important impact on domestic credit cycle
   - Large effect of VIX on capital flows (elasticity $-1.7$ & high partial $R^2$).
   - An increase in capital flows equivalent to its IQR leads to 1 pp reduction in real borrowing costs.
   - Supply driven capital inflows explain 43% of aggregate corporate sector cyclical credit growth on average.

   $\Rightarrow$ Driven by the interest rate channel.

2. Internationally-funded large domestic banks are more procyclical:
   - Banks with higher non-core liabilities expand more credit and offer lower rates during "risk-on" periods.
1. Supply ("push") driven capital inflows have a quantitatively important impact on domestic credit cycle
   - Large effect of VIX on capital flows (elasticity \(-1.7\) & high partial $R^2$).
   - An increase in capital flows equivalent to its IQR leads to 1 pp reduction in real borrowing costs.
   - Supply driven capital inflows explain 43% of aggregate corporate sector cyclical credit growth on average.

   ⇒ Driven by the interest rate channel.

2. Internationally-funded large domestic banks are more procyclical:
   - Banks with higher non-core liabilities expand more credit and offer lower rates during “risk-on” periods.

   ⇒ Bank heterogeneity is key in transmission of global funding conditions.
PREVIEW OF RESULTS AND THEIR CONTRIBUTION

1. Supply ("push") driven capital inflows have a quantitatively important impact on domestic credit cycle
   - Large effect of VIX on capital flows (elasticity $-1.7$ & high partial $R^2$).
   - An increase in capital flows equivalent to its IQR leads to 1 pp reduction in real borrowing costs.
   - Supply driven capital inflows explain 43% of aggregate corporate sector cyclical credit growth on average.

⇒ Driven by the interest rate channel.

2. Internationally-funded large domestic banks are more procyclical:
   - Banks with higher non-core liabilities expand more credit and offer lower rates during “risk-on” periods.

⇒ Bank heterogeneity is key in transmission of global funding conditions.

3. “Risky” firms finance borrowing at lower interest rates during “risk-on” periods
   - Some of the risky (low net-worth) firms are collateral constrained.
1. Supply (“push”) driven capital inflows have a quantitatively important impact on domestic credit cycle

   - Large effect of VIX on capital flows (elasticity $-1.7$ & high partial $R^2$).

   - An increase in capital flows equivalent to its IQR leads to $1$ pp reduction in real borrowing costs.

   - Supply driven capital inflows explain $43\%$ of aggregate corporate sector cyclical credit growth on average.

$\Rightarrow$ Driven by the interest rate channel.

2. Internationally-funded large domestic banks are more procyclical:

   - Banks with higher non-core liabilities expand more credit and offer lower rates during “risk-on” periods.

$\Rightarrow$ Bank heterogeneity is key in transmission of global funding conditions.

3. “Risky” firms finance borrowing at lower interest rates during “risk-on” periods

   - Some of the risky (low net-worth) firms are collateral constrained.

$\Rightarrow$ Two margins of adjustment: interest rate and collateral.
VIX, CA/GDP, and Domestic Credit in Turkey

Source: CBRT.
Emerging Market External Financing

60 percent of external liabilities is debt
Within external debt: Other Investment Debt (Loans) 70%, Portfolio Debt (Bonds) 30%

Source: Avdjiev, Hardy, Kalemli-Ozcan, Serven (2017).
Bank and Firm External Financing in Turkey

Sources: CBRT; Hale, Kapan, Minoiu (2017).
Conceptual Framework

Borrowing/funding costs decline with exogenous capital flows. UIP with time varying risk premium:

\[ i_{c,t} = i^* + \mathbb{E}_t \Delta e_{t+1} + \gamma_{c,t}, \quad \text{where} \]
\[ \gamma_{c,t} \equiv \omega \text{VIX}_t + \alpha_{c,t} \]

At firm-bank level:

\[ \gamma_{f,b,t} \equiv \alpha_{f,t}, \quad \text{then} \]
\[ i_{f,b,t} = i_t + \gamma_{f,b,t} \]
\[ = i^* + \mathbb{E}_t (\Delta e_{t+1}) + \omega \text{VIX}_t + \alpha_{c,t} + \alpha_{f,t} \]

Assuming PPP:

\[ r_t = r^*_t + \gamma_t \]
\[ r_{f,b,t} = r^*_t + \omega \text{VIX}_t + \alpha_{c,t} + \alpha_{f,t} \]

Data: UIP fails and VIX strongly correlates with regression residuals.
QE, VIX, Interest Rates
Effect of VIX on Dynamics of Real Borrowing Costs

Source: authors' calculations.
Empirical Strategy: Two-Layer Identification

Layer I: Macro Credit Supply Shock
- Analyze impact of VIX on firm-bank-loan level borrowing/lending, both in IV and reduced-form regressions.

- Focus on domestic credit variables, both volume (loans) and price (interest rate) for identification.

- Include time-varying firm and bank variables, bank×firm fixed effects, firm-year effects and macro fundamentals/expectations/policy rate.

Layer II: Within-Firm and Within-Firm-Bank Estimators
1. We use a within firm estimator via firm×quarter fixed effects: Analyze firms that borrow from multiple banks (Khwaja-Mian, Jimenez et al., Chodorow-Reich).

   Exploit heterogeneity in non-core ratio at bank level.

2. Drill down to loan level to investigate firm credit constraints (lower cost versus hard collateral): Identification from within firm-bank pair (firm×bank×month fixed effects)

   Exploit heterogeneity in collateral ratio of newly issued loans.
Empirical Strategy: Two-Layer Identification

Layer I: Macro Credit Supply Shock

- Analyze impact of VIX on firm-bank-loan level borrowing/lending, both in IV and reduced-form regressions.

- Focus on domestic credit variables, both volume (loans) and price (interest rate) for identification.

- Include time-varying firm and bank variables, bank×firm fixed effects, firm-year effects and macro fundamentals/expectations/policy rate.

Layer II: Within-Firm and Within-Firm-Bank Estimators

1. We use a within firm estimator via firm×quarter fixed effects:
   - Analyze firms that borrow from multiple banks (Khwaja-Mian, Jimenez et al., Chodorow-Reich).
   - Exploit heterogeneity in non-core ratio at bank level.

2. Drill down to loan level to investigate firm credit constraints (lower cost versus hard collateral):
   - Identification from within firm-bank pair (firm×bank×month fixed effects)
   - Exploit heterogeneity in collateral ratio of newly issued loans.
Basics of “Macro” Identification

Supply Shock

\[ r \] vs. \[ L \]

- \( S_0 \)
- \( S_1 \)
- \( D_0 \)

Points:
- \( A \)
- \( B \)
Basics of “Macro” Identification

Demand and Supply Shocks

$r_D < r_C = r_A < r_B$
\[ \log Y_{f,b,d,q} = \alpha_{f,b} + \lambda \text{Trend}_q + \beta \log \text{Capital inflows}_{q-1} + \delta \text{FX}_{f,b,d,q} \\
+ \Theta_1 \text{Bank}_{b,q-1} + \Theta_2 \text{Macro}_{q-1} + \varepsilon_{f,b,d,q} \]

- **Y**: Loan or interest rate (nominal and real) at firm \((f)\times\text{bank (b)}\times\text{currency denomination (d)}\times\text{quarter (q)}\) level
- **Capital inflows**: Turkish real inflows
  \[ \Rightarrow \text{Instrument with VIX.} \]
- **FX**: FX dummy \((0 = \text{TL}, 1 = \text{FX})\).
- **Bank**: log(Assets), capital ratio, liquidity ratio, noncore ratio, ROA.
- **Macro controls**: GDP growth, inflation, exchange rate change, expectations, policy rate.
- Include **firm\times year** effects to control slow-moving demand.
**Macro Regressions: OLS and IV**

★ Low VIX/high capital inflow episodes lead to more credit and lower rates
★ IV estimates systematically larger (in absolute value) than OLS

---

**Panel A. OLS and Second-stage of IV**

<table>
<thead>
<tr>
<th></th>
<th>log(Loans&lt;sub&gt;q&lt;/sub&gt;)</th>
<th>log(1+i&lt;sub&gt;q&lt;/sub&gt;)</th>
<th>log(1+r&lt;sub&gt;q&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS (1)</td>
<td>IV (2)</td>
<td>OLS (3)</td>
</tr>
<tr>
<td>log(K Inflows&lt;sub&gt;q-1&lt;/sub&gt;)</td>
<td>0.040&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.041&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-0.005&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.017)</td>
<td>(0.001)</td>
</tr>
<tr>
<td>FX</td>
<td>0.645&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.645&lt;sup&gt;a&lt;/sup&gt;</td>
<td>-0.070&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Policy rate&lt;sub&gt;q-1&lt;/sub&gt;</td>
<td>-0.078</td>
<td>0.171</td>
<td>0.231&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.262)</td>
<td>(0.325)</td>
<td>(0.022)</td>
</tr>
</tbody>
</table>

Observations 19,982,267 19,982,267 19,982,267 19,982,267 19,982,267 19,982,267
R-squared 0.850 0.850 0.791 0.793 0.778 0.779
Bank×firm F.E. Yes Yes Yes Yes Yes Yes
Macro controls & trend Yes Yes Yes Yes Yes Yes
Bank controls Yes Yes Yes Yes Yes Yes

**Panel B. First-stage of IV: log(K inflows<sub>q</sub>) Regression**

<table>
<thead>
<tr>
<th>log(VIX&lt;sub&gt;q-1&lt;/sub&gt;)</th>
<th>Observations</th>
<th>R-squared</th>
<th>F-stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1.667&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1,685</td>
<td>0.5625</td>
<td>15.28</td>
</tr>
<tr>
<td>(0.427)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First stage with US MP; Other Works—Brauning and Ivashina (2017); Morais et al. (2015)
VIX Reduced-Form Regressions

\[ \log Y_{f,b,d,q} = \tilde{\alpha}_{f,b} + \tilde{\lambda}_{\text{Trend}_q} + \tilde{\beta} \log \text{VIX}_{q-1} + \tilde{\delta} \text{FX}_{f,b,d,q} + \tilde{\Theta}_1 \text{Bank}_{b,q-1} + \tilde{\Theta}_2 \text{Macro}_{q-1} + \xi_{f,b,d,q} \]

<table>
<thead>
<tr>
<th>Log(Loans)</th>
<th>Log(1+i)</th>
<th>Log(1+r)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(VIX)</td>
<td>-0.067</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.029)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>FX</td>
<td>0.645</td>
<td>-0.070</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Policy rate</td>
<td>0.127</td>
<td>0.204</td>
</tr>
<tr>
<td></td>
<td>(0.323)</td>
<td>(0.024)</td>
</tr>
</tbody>
</table>

Observations: 19,982,267
R-squared: 0.850 0.793 0.779
Bank×firm F.E.: Yes Yes Yes
Macro controls & trend: Yes Yes Yes
Bank controls: Yes Yes Yes
Heterogeneity: Differences-in-Differences

Bank and Firm Risk-Taking:

\[
\log Y_{f,b,d,q} = \alpha_{f,q} + \kappa(\text{Noncore}_b \times \log \text{VIX}_{q-1}) \\
+ \delta_2 \text{FX}_{f,b,d,q} + \vartheta_{f,b,d,q}
\]

\[
\log Y_{f,b,d,q} = \alpha_{b,q} + \alpha_{f,q} + \kappa(\text{Noncore}_b \times \text{NetWorth}_f \times \log \text{VIX}_{q-1}) \\
+ \delta_2 \text{FX}_{f,b,d,q} + \vartheta_{f,b,d,q}
\]

- Lower rates and more credit from banks with higher non-core liabilities.
- Low net worth firms obtain lower rates from high non-core banks, but they do not borrow more than high net worth firms given collateral constraints (loan-level evidence).
### VIX and the Exchange Rate Risk-Taking Channels

<table>
<thead>
<tr>
<th></th>
<th>( \log(\text{Loans}_q) )</th>
<th>( \log(1+r_q) )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Leverage(b)×FXshare(f)×log(VIX(_q)-1)</td>
<td>0.041</td>
<td>-0.003</td>
</tr>
<tr>
<td></td>
<td>(0.032)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Leverage(b)×FXshare(f)×log(XR(_q)-1)</td>
<td>-0.392(^a)</td>
<td>-0.006</td>
</tr>
<tr>
<td></td>
<td>(0.107)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>FX</td>
<td>0.688(^a)</td>
<td>-0.079(^a)</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.003)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Observations</th>
<th>9,280,825</th>
<th>9,280,825</th>
<th>9,280,825</th>
<th>9,280,825</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-squared</td>
<td>0.877</td>
<td>0.877</td>
<td>0.877</td>
<td>0.877</td>
</tr>
<tr>
<td>Bank×firm F.E.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm×quarter F.E.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Bank×quarter F.E.</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

\(^a\) Heterogeneity results
Aggregate Impact: “Macro” Regression

\[ \log Y_{f,b,d,q} = \tilde{\alpha}_{f,b} + \tilde{\lambda}_{\text{Trend}_q} + \tilde{\beta} \log VIX_{q-1} + \xi_{f,b,d,q} \]

\[ \Rightarrow \log(\text{Loan}_{f,b,d,q}) = \tilde{\beta} \log(VIX_{q-1}) \]

Differentiate and multiply by \( w_{f,b,d,q-1} \), such that \( \sum w_{f,b,d,q-1} = 1 \):

\[ w_{f,b,d,q-1} d\log(\text{Loan}_{f,b,d,q}) = w_{f,b,d,q-1} \tilde{\beta} d \log(VIX_{q-1}) \]

so,

\[ w_{f,b,d,q-1} \left( \frac{\Delta \text{Loan}_{f,b,d,q}}{\text{Loan}_{f,b,d,q}} \right) = w_{f,b,d,q-1} \tilde{\beta} \left( \frac{\Delta \text{VIX}_{q}}{\text{VIX}_{q}} \right)_{q-1} \]

Summing above equation over \( \{ f, b, d \} \) in a given quarter \( q \):

\[ \left( \frac{\Delta \text{Agg. Loan}}{\text{Agg. Loan}} \right)_q = \tilde{\beta} \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1} \]

\[ \frac{\text{Avg} \left\{ \left( \frac{\Delta \text{Agg. Loan}}{\text{Agg. Loan}} \right)_q \right\}}{\text{Avg} \left\{ \left( \frac{\Delta \text{Agg. Loan}}{\text{Agg. Loan}} \right)_q \right\}} = 0.43 \]
Aggregate Impact: “Heterogeneity” Regression

\[
\log Y_{f,b,d,q} = \alpha_{f,b} + \lambda \text{Trend}_q + \beta_1 \text{VIX}_{q-1} + \beta_2 (\text{Noncore}_b \times \log \text{VIX}_{q-1}) + \vartheta_{f,b,d,q}
\]

\[
w_{f,b,d,q-1} \left( \frac{\Delta \text{Loan}}{\text{Loan}} \right)_{f,b,d,q} = w_{f,b,d,q-1}^H \text{NC} \left( \hat{\beta}_1 + \hat{\beta}_2 \right) \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1} + w_{f,b,d,q-1}^L \text{NC} \hat{\beta}_1 \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1}
\]

Summing above equation over \(\{f, b, d\}\) in a given quarter \(q\):

\[
\left( \frac{\Delta \text{Agg. Loan}}{\text{Agg. Loan}} \right)_q = \sum w_{q-1}^H \text{NC} \left( \hat{\beta}_1 + \hat{\beta}_2 \right) \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1} + \sum w_{q-1}^L \text{NC} \hat{\beta}_1 \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1}
\]

\[
\text{Avg} \left\{ \sum w_{q-1}^H \text{NC} \left( \hat{\beta}_1 + \hat{\beta}_2 \right) \left( \frac{\Delta \text{VIX}}{\text{VIX}} \right)_{q-1} \right\} = 0.94
\]

\[
\text{Avg} \left\{ \left( \frac{\Delta \text{Agg. Loan}}{\text{Agg. Loan}} \right)_q \right\}
\]

22 / 24
Summary and Theoretical Implications

- We provide causal evidence on impact of a global capital flow push factor on domestic loan growth in an EM.

- Interest rate channel: a fall in all firms’ borrowing rates due to a decline in risk premium is the main transmission channel.
Summary and Theoretical Implications

- We provide causal evidence on impact of a global capital flow push factor on domestic loan growth in an EM.

- **Interest rate channel**: a fall in all firms’ borrowing rates due to a decline in risk premium is the main transmission channel.

- Heterogeneity in financial intermediation/international market access:
  - Internationally funded large domestic banks and their funding costs are the key; i.e., they extend more credit at lower rates.

    Different from but complementary:
    - Closed-economy macro literature: infinite access to domestic deposit at risk free rate, MP work via small banks.
    - Foreign banks/cross-border syndicated loans
We provide causal evidence on impact of a global capital flow push factor on domestic loan growth in an EM.

Interest rate channel: a fall in all firms’ borrowing rates due to a decline in risk premium is the main transmission channel.

Heterogeneity in financial intermediation/international market access:

- Internationally funded large domestic banks and their funding costs are the key; i.e., they extend more credit at lower rates.

Different from but complementary:

- Closed-economy macro literature: infinite access to domestic deposit at risk free rate, MP work via small banks.

- Foreign banks/cross-border syndicated loans

Margins of adjustment: interest rate and collateral

- Risky firms can finance their borrowing at a lower cost but not necessarily increase borrowing due to collateral constraints.

Different from but complementary: relaxation of borrowing constraints with shock to collateral values due to capital flows.
**Policy Implications**

Global conditions impact domestic borrowing costs *conditional on changes in domestic monetary policy and the exchange rate*

⇒ Leads to an expansion of *local credit*.

- Driven by large domestic banks—importance of heterogeneity in designing *macroprudential and capital flow management policies*
**Policy Implications**

Global conditions impact domestic borrowing costs *conditional on changes in domestic monetary policy and the exchange rate*

⇒ Leads to an expansion of local credit.

- Driven by large domestic banks—importance of heterogeneity in designing **macroprudential and capital flow management policies**

Support for the existence of a **financial trilemma**:

Regardless of the exchange rate regime, achieving financial stability is difficult under:

1. National financial regulation,
2. Free capital flows, and
3. A global financial cycle.

⇒ Obstfeld (2015)
Appendix Slides
Merging Three Large Datasets

1. **Credit register data** have information on **all** loans in economy to households and firms (monthly).

   Focus on loans to corporate sector.

   - Bank, firm, currency, quarter level: 53+ million cash loans.
   - Loan value, interest rate, maturity, collateral, risk measures, ...
   - Roughly 75% of observations in value are firms with loans from multiple banks (50% in number, 2.5 bank per firm on average).

2. **Bank-level data** on all the balance sheet items and portfolio items for 45 banks.

   Banks capture 90 percent of corporate liabilities and 86 percent of country’s financial assets.

3. **Firm-level data** on balance sheet and income statement (annual level).
Literature

- Older literature on push-pull of net capital flows

- Many papers on the transmission of VIX/US Policy on global/country specific asset prices
  - Miranda-Agrippino and Rey (2015); Bruno and Shin (2015a,b); Rey (2013, 2015).
  - These papers also show a tight link between VIX and the US monetary policy

- Unclear whether VIX/US policy drive capital flows into EMs or have any effect on domestic real and financial variables
  - Work based on annual capital flows data finds mixed results; studies using quarterly bank flow data or monthly emerging market fund data find procyclical effects but not studies based on yearly IMF-BOP data
    - Fratzscher (2011); Forbes and Warnock (2012); Fratzscher et al. (2013); Ahmed and Zlate (2014); Claessens et al. (2016); Cerutti et al. (2016); Kalemli-Ozcan et al. (2016).
**UIP Regressions**

\[ i_t - i_t^* = \alpha + \lambda_t + \beta \Delta e_{TL/USD,t+1} + \epsilon_t \]

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \Delta e_{TL/USD,t} )</td>
<td>-0.005</td>
<td>0.122&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.083)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>Time trend</td>
<td>-0.002&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.000)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.084&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.336&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.026)</td>
</tr>
</tbody>
</table>

- Observations: 30
- R-squared: 0.010, 0.780
- Correlation of residuals and VIX: 0.685, 0.487

---

Conceptual framework
1. Credit register data have information on all loans in economy to households and firms
   - Number of (cash) loans: 114 million
   - Number of loans to firms: 57 million
   - Share of firm loans: 87% in value
   - Number of bank-firm pairs: 3.3 million

2. We collapse credit register at firm-bank-quarter level going from 57 to 20.9 million observations (45 banks)
   - 50% represent firms borrowing from multiple banks
   - Multiple loans to a firm by a bank in a given quarter; do a weighted average
   - Currency composition: majority of loans in TL (count), but 2/3rd value in FX
Loan Growth Comparison of Corporate Sector and the Whole Economy

Notes: Firm sample and whole credit registry loan growth.
FX AND TL LOAN GROWTH IN TURKEY

Sources: CBRT.
# Impact of VIX’s Spillovers on Real Borrowing Costs by Bank Type

<table>
<thead>
<tr>
<th>Bank Type</th>
<th>Commercial (1)</th>
<th>Comm. + State (2)</th>
<th>Domestic (3)</th>
<th>Foreign (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>log(VIX&lt;sub&gt;q-1&lt;/sub&gt;)</td>
<td>0.023&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.017&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.019&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.009&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Observations</td>
<td>13,376,195</td>
<td>19,922,760</td>
<td>14,514,150</td>
<td>5,440,975</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.784</td>
<td>0.779</td>
<td>0.706</td>
<td>0.857</td>
</tr>
</tbody>
</table>

*Reduced-form regressions*
Macro Regression Robustness

- Add firm×year effects.
- Decompose VIX into volatility and risk aversion.
- Use only firms who borrow from multiple banks in a quarter.
- Separate short and long term maturity loans.
- Control for LT rates.
- Pre-post GFC/VIX spike.
- Control for exchange rate level and expectations.
**Heterogeneity: Differences-in-Differences**

\[
\log Y_{f,b,d,q} = \alpha_{b,q} + \alpha_{f,q} + \kappa(\text{Noncore}_b \times \text{NetWorth}_f \times \log VIX_{q-1}) \\
+ \delta_2 \text{FX}_{f,b,d,q} + \psi_{f,b,d,q},
\]

\[
\log Y_{f,b,d,q} = \alpha_{b,q} + \alpha_{f,q} + \rho(\text{Noncore}_b \times \text{FX}_{f,b,d,q} \times \log VIX_{q-1}) \\
+ \delta_3 \text{FX}_{f,b,d,q} + u_{f,b,d,q}
\]

- **Noncore\(_b\):** non-core liabilities ratio (0 = “low,” 1 = “high”).
- **NetWorth\(_f\):** firm net worth: (0 = “low,” 1 = “high”).
- **FX:** foreign currency indicator (0 = TL, 1 = FX).
- **\(\alpha_{f,q}\):** firm×quarter effect; fully controls time varying firm unobservables.
- **\(\alpha_{b,q}\):** bank×quarter effect; fully controls time varying bank unobservables.
- **Macro** controls are in the quarter fixed effect.
# Heterogeneity Regressions

<table>
<thead>
<tr>
<th></th>
<th>log(Loans₉)</th>
<th>log(1+r₉)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Noncoreₜ × log(VIXₗ₋₁)</td>
<td>-0.035ₜ</td>
<td>0.015ᵃ</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Noncoreₜ × NetWorthₙ × log(VIXₗ₋₁)</td>
<td>-0.004 (0.018)</td>
<td>-0.005ᵃ (0.001)</td>
</tr>
<tr>
<td>Noncoreₜ × FX × log(VIXₗ₋₁)</td>
<td>-0.007 (0.018)</td>
<td>-0.012ᵃ (0.004)</td>
</tr>
<tr>
<td>FX</td>
<td>0.690ᵃ (0.013)</td>
<td>0.802ᵃ (0.019)</td>
</tr>
<tr>
<td></td>
<td>(0.013)</td>
<td>(0.019)</td>
</tr>
</tbody>
</table>

| Observations            | 9,280,825 | 9,280,825 | 9,280,825 | 9,280,825 | 1,281,369 | 9,280,825 |
| R-squared               | 0.876     | 0.764     | 0.877     | 0.852     | 0.814     | 0.877     |
| Bank × firm F.E.        | Yes       | Yes       | Yes       | Yes       | Yes       | Yes       |
| Bank controls           | Yes       | No        | No        | Yes       | No        | No        |
| Firm × quarter F.E.    | Yes       | Yes       | Yes       | Yes       | Yes       | Yes       |
| Bank × quarter F.E.    | No        | Yes       | Yes       | No        | Yes       | Yes       |

*Heterogeneity results*
Turkish Capital Inflows: A representative EM

Source: CBRT.
**Capital Flows and Non-Core Liabilities**

![Graph showing median bank noncore ratio and capital inflows/GDP over time.](graph)

- **Heterogeneity results**
Issuance Regressions: Within Firm-Bank Estimator

Identify from within variation in loans given a firm-bank pair.

Firm $f$’s new loan $l$ and month $m$ from bank $b$ (in FX or TL):

$$
\log Y_{f,b,l,m} = \omega_{f,b,m} + \beta_1 \text{Collateral}_{f,b,l,m} + \beta_2 (\text{Collateral}_{f,b,l,m} \times \log VIX_{m-1}) \\
+ \beta_3 (\text{Noncore}_b \times \text{Collateral}_{f,b,l,m}) \\
+ \beta_4 (\text{Noncore}_b \times \text{Collateral}_{f,b,l,m} \times \log VIX_{m-1}) \\
+ \beta_5 \text{FX}_{f,b,l,m} + e_{f,b,l,m},
$$

where ‘Collateral’ is the loan’s collateral-to-principal ratio, and $\omega_{f,b,m}$ is a configuration of firm-bank-month effects.

Further control for other loan-level characteristics (maturity, subjective risk, sectoral use...).
**Loan-Level Results**

★ **Loan level collateral constraints are not related to firm and bank factors.**

★ **Interest rate-collateral relation does not respond to VIX once firm factors are controlled for.**

<table>
<thead>
<tr>
<th></th>
<th>log(Loans&lt;sub&gt;m&lt;/sub&gt;)</th>
<th>log(1+r&lt;sub&gt;m&lt;/sub&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Collateral/Loan</td>
<td>0.106&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.089&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>Collateral/Loan×log(VIX&lt;sub&gt;m−1&lt;/sub&gt;)</td>
<td>0.019&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.025&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.010)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Noncore&lt;sub&gt;b&lt;/sub&gt;×Collateral/Loan</td>
<td>-0.013</td>
<td>-0.204&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.038)</td>
<td>(0.030)</td>
</tr>
<tr>
<td>Noncore&lt;sub&gt;b&lt;/sub&gt;×Collateral/Loan×log(VIX&lt;sub&gt;m−1&lt;/sub&gt;)</td>
<td>0.441&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.488&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>FX</td>
<td>0.441&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.488&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>(0.019)</td>
<td>(0.038)</td>
</tr>
<tr>
<td>Observations</td>
<td>16,578,790</td>
<td>11,618,529</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.738</td>
<td>0.840</td>
</tr>
<tr>
<td>Bank×firm F.E.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Sector FE</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Risk F.E.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Maturity F.E.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Month F.E.</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Firm×month F.E.</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Bank×month F.E.</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Heterogeneity results</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Exchange Rates
vis-à-vis the USD

Quarterly av. USD/TL Exc. Rate
Quarterly av. USD/TL Real Exc. Rate

Heterogeneity results