On the Interest Channel and the Global Financial Cycle for Emerging Market Economies

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The interpretation and opinions in this presentation are those of the authors should not be attributed to CEMLA or the Banco de México.
Motivation and Objectives

1. There is an important debate on the Global Financial Cycle (GFCy).
   - Several researchers have explored its economic implications (e.g., Jordà et al. 2018).
   - For instance, it might be affecting the traction of local monetary policies within small open economies (Rey, 2015).
   - Some have expressed doubts on its bearing (e.g., Cerutti et al., 2017a).

2. Our general aim is to explore how the GFCy could be affecting the interest rate channel for a set of emerging market economies (EMEs).
Motivation and Objectives

More specifically, based on VAR models, we examine how shocks on the VIX, bond flows, and inflation affect the nominal exchange rate and term premium, and compare key responses.

- We use the VIX index as a proxy to the GFCy (Rey, 2015; Jordà et al., 2018). We use bond flows as an indicator of the GFCy.
- We consider EMEs term premiums as key variables.

In particular,

- We assess the magnitude of the term premiums’ responses.
- We explore the dynamics of different responses. This allows us to examine the extent to which, e.g., bond flows shocks are staved off by the nominal exchange rate response.
- We also consider the term premiums’ responses to joint shocks.
Global Financial Cycle (GFCy).

- Its measurement (Passari and Rey, 2015). Variables that can capture it: VIX (e.g. Rey, 2013), exchange market pressure index (Goldberg and Krogstrup, 2018).


- Some have argued that fluctuations in the risk premiums account for most of the equity price synchronization. Having said that, effects are muted in floating exchange rate regimes (Jordà et al., 2018).

- Little quantitative evidence of the GFCy (Cerutti et al., 2017a).
Term Structure Models of Interest Rate and the Estimation of the Term Premium

- Affine interest rate models, e.g., Piazzesi (2010).
- Estimation. Adrian et al. (2013).
- For EMEs: Blake et al. (2015), and Ceballos et al. (2016).
- For AEs: Wright (2011).
- EMEs and AEs: Albagli et al. (2018).

Monetary Policy Transmission Channels.

- The interest rate channel entails how changes in the short-term interest rates, or more generally the MP stance, affect investment and aggregate demand. Mishkin (1996, 2001).
- A central part of this channel is how changes in the short-term interest rates affect the rest of the term structure of interest rates. We have a keen interest in this aspect of such a channel.
An Overview of our Procedure

1. We estimate affine interest models using the principal components of the interest rates as unobservable risk factors for each EMEs.

2. Based on the affine interest rate models, we decompose the interest rates into their risk-neutral component and term premium components.
   \[ y_t^{(n)} = y_t^{(n,*)} + TP_t^{(n)} \]

3. We estimate VARs using the long-term interest rates or the term premium or the long-term risk-neutral interest rate, VIX index, inflation, bond flows, and changes in the nominal FX. We do so for each economy, and for Panel VARs.

4. With these models, we analyze the IRFs, keeping in mind key characteristics of each economy.
Emerging market economies: Brazil, Chile, Colombia, the Czech Republic, Hungary, India, Mexico, Poland, South Africa, and South Korea.

Samples: Generally, from January 2004 to May 2019.
- Nominal interest rates associated with one-day, three-, six-, 12-, 60-, 120- (or 108-), and 240-month maturities. To obtain all maturities, we use Nelson-Siegel functional.
- VIX index.
- Inflation rates (y/y).
- Monthly, from weekly EPFR Global - Bond Flows.
- Exchange Rate Variations, m/m monthly average nominal.

We estimate affine models using end-of-the month data for interest rates (as in Adrian et al., 2013).
Data and Basic Stats

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Notes: Daily frequency. Means and standard deviations are in percentages. In a few cases, such as Chile, we substituted data points that were clearly outliers with the last available data points.
Source: Bloomberg, and Valmer for Mexico.
### Preliminaries I

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Source: Garriga (2016)

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Measures of Macroprudential Policy Stance.
Source: Cerutti et al. (2017b).
Model to obtain Term Premium II

1 Obtaining the Risk Factors
   - $F_{t+1} = \theta + \Phi F_t + \nu_{t+1}$ (VAR, factors are from PCA)

2 Bond Pricing
   - $y_t^{(n)} = \beta_{0,n} + \beta_{1,n} F_t + \epsilon_{t,n}$ (affine model)
   - $P_t^{(n)} = \mathbb{E}_t \left[ M_{t+1} P_{t+1}^{(n-1)} \right]$ (pricing equation)
   - $M_{t+1} = \exp \left( -y_t^{(1)} - \frac{\lambda_t' \lambda_t}{2} - \lambda_t' \Sigma^{1/2} \nu_{t+1} \right)$ (SDF)

3 Market Price of Risk
   - $\Sigma^{1/2} \lambda_t = (\lambda_0 + \lambda_1 F_t)$
Model to obtain Term Premium II

4 Ordinary Bond Pricing

\[ \ln P_t^{(n)} = A_n + B'_n F_t = -n \cdot y_t^{(n)} \]

5 Risk-Neutral Bond Pricing

\[ \ln P_t^{(n),*} = A_n^* + (B_n^*)' F_t = -n \cdot y_t^{(n,*)}, \]

\[ \text{Market Price of Risk is zero, } \lambda_t = 0. \]

6 Decomposing the long-term interest rate:

\[ y_t^{(n,*)} = \mathbb{E}_t \left[ y_t^{(1)} + y_{t+1}^{(1)} + \cdots y_{t+n-1}^{(1)} \right] n^{-1} \]

\[ y_t^{(n)} = \mathbb{E}_t \left[ y_t^{(1)} + y_{t+1}^{(1)} + \cdots y_{t+n-1}^{(1)} \right] n^{-1} + TP_t^{(n)} \]

\[ y_t^{(n)} = y_t^{(n,*)} + TP_t^{(n)} \]
Term Premium Estimation Results

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Notes: Each datum corresponds to the mean absolute error $T^{-1} \sum_{t=1}^{T} |y_{t,\text{data}}^{(n)} - y_{t,\text{model}}^{(n)}|$ for each economy (row) and maturity (column), its units are basis points.
We consider if the following characteristics of each economy:

- Central bank independence (average of 5 de jure indicators)
- Exchange rate regime (IMFs classification)
- Financial openness (Chinn-Ito, de jure indicator)
- Macroproudential policies (general indicator)
- Monetary Policy Regime (all IT)

have a role in the dynamics of the IRFs. To be clear, we do not use them in the VARs.

In the VAR models, we include the following variables:

- VIX
- Bond flows
- Percentage change of the FX exchange rate
- Inflation
- $10y \cdot X$, $X = \{TP, RN, Y\}$
We use the short-run identification (aka recursive identification or Cholesky decomposition).

1. Order for individual VAR models and for the first PVAR.
   - VIX, bond flows, FX, inflation, and 10y-\(X\).
   - A shock on the VIX affects any other variables contemporaneously, but a shock on any other variable does not affect the VIX. Intuitively, VIX is mostly determined by factors beyond a given EME.
   - This is the preferred order.

2. Alternative order for a second PVAR model:
   - Inflation, bond flows, 10y-\(X\), FX, and VIX.
   - Inflation moves the slowest, given the presence of nominal rigidities in prices.
   - VIX moves the fastest, given that it is an expectation based on a financial price.
Remark 1: Inflation shocks tend to have a statistically significant effect on term premiums for several economies.

Remark 2: The effects of a VIX shock on the term premiums are in general positive and statistically significant. Chile and India’s TPs present an unexpected initially negative response. We hypothesize that:
   ❖ Chile: foreign bond holders are a minority.
   ❖ India: its economy is financially much more closed.

Remark 3: A bond inflow shock leads to a negative 10-year term premium response.

Remark 4: Term Premiums’ responses tend to last longer than those of the exchange rates.

Remark 5: Under shocks on the exchange rate, short-lived positive term premium responses for the majority of the EMEs.
Remarks on the IRFs, FX

② Given a shock on bond flows and a statistically significant response, the exchange rate appreciates.

③ Given a shock on the VIX, the exchange rate response is, in general, positive (i.e., depreciates), statistically significant, but short-lived.

③ The response of FX responses to shocks tend to be short-lived.

④ Results are robust to using term premiums, risk-neutral components or nominal interest rates in the VARs.
Discussion I, Comparison

1. Two ‘polar’ cases: the **Czech Republic** vs **India**.

2. **Czech Republic**:
   - Financially opened.
   - Independent central bank.
   - Stabilized arrangement exchange rate regime.

3. **India**
   - Financially more closed.
   - Its central bank is one of the least independent.
   - Floating exchange rate regime.

4. The **Czech** interest rates response is positive and statistically significant.

5. **India’s** interest rate response is small and not statistically significant.
Chile, Mexico, and Poland have similar exchange rate regimes, central bank independence, and financial openness.

A key difference: macroprudential policies.
- Chile has a higher activity
- Poland and Mexico have somewhat similar levels

Statistically significant response to VIX, bond flows, and exchange rate positive (depreciation) shocks in the Mexican and Polish term premiums, whereas those of Chile are not statistically significant.

Chilean macroprudential policies could have implications for its sensitivity to outside shocks. Still, such policies are general.
Remarks on the IRFs, PVAR

1 Responses of the EMEs to shocks related to the GFCy. A typical or ‘average’ EME.

2 Two short-run identification schemes for the IRFs for our PVAR models:
   i. The same that we use for individual VAR models, i.e. VIX, bond flows, FX, inflation, and 10y-X.
   ii. Based on the ‘adjustment speed’: Inflation, bond flows, 10y-X, FX and VIX. Inflation moves the slowest given the presence of nominal rigidities in prices. VIX moves the fastest given that it is an expectation based on a financial price.
Remarks on the IRFs, PVAR – 1st order

1. The exchange rate depreciates as a response to a shock on the VIX. Relatively short-lived response, lasting for approximately 2 months.

2. The exchange rate response to shocks on bond flows is negative and short-lived (about two months). The sign is as expected.

3. The term premium somewhat increases as a response to a shock on the VIX. In effect, bond holders would need to be compensated given an increase in uncertainty. Prominently, the response is persistent, lasting for about 16 months.

4. While responses have the expected signs, IRFs dynamics cast doubts on the capacity of exchange rate to offset shocks on the VIX.
Remarks on the IRFs, PVAR – 1\textsuperscript{st} order

5 A bond flows’ shock is associated with a negative response by the term premium, lasting for about 12 months.

6 This casts doubts on the ability of the exchange rate to completely stave off bond flows or VIX shocks. This, we think, is due to their magnitudes or to their persistence.

7 Term premium’s response to an inflation shock is positive and statistically significant, it is somewhat small.

8 Considering the magnitudes of the response of the TP to shocks on VIX or the bond flows vis-à-vis to those to shocks on inflation. In the later months, either the VIX or the bond flows could affect how the response to a shock on inflation would play out.
The response of the exchange rate to a shock on the VIX is a short-lived depreciation.

The response of the term premium to shock on the VIX is not statistically significant. In this case, the exchange rate could be playing the role as a buffer.

The response of the exchange rate to a shock on the bond flows is negative. However, it is short-lived.

However, a shock on the bond flows affects the term premium negatively. Its response is persistent, lasting for about 20 months.

Considering the exchange rate, and the term premium responding to shocks on the bond flows, given their dynamics, the former only partly offsets the latter, if at all.
Final Remarks I

1. The response of the term premium to a joint shock in the VIX and inflation is statistically significant and positive. Assuming a monetary policy response to the inflation shock, the VIX might be affecting the interest rate channel.

2. The exchange rate seems to be playing a role as a buffer only in the initial periods, if at all. Thereafter, the VIX or bond flows have repercussions on the term premium.

3. We have considered ‘common’ size shocks (i.e., one standard deviation shocks). Under financial stress episodes the responses would become more of a concern and those that were not relevant in our estimation might become so.
For instance, m/m change in the VIX index for October 2008 was about 4.5x the usual (m/m) change (using data, 2004 – 2019).

An EME would be in a better position to face the GFCy by reducing the term premium of the long-term interest rate.

E.g., reducing risks that the authorities are in a position to modify.

Some of these risks might be of a more longstanding nature, such as the development of financial markets. Their modifications might entail extended implementation efforts.
References

The unconditional correlations of inflation and the VIX could be important.

This might be relevant for the analysis of the impulse-response functions.

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<th>Country</th>
<th>Unconditional Correlation VIX, Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
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<tr>
<td>Chile</td>
<td>0.36</td>
</tr>
<tr>
<td>Colombia</td>
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<tr>
<td>Czech Republic</td>
<td>0.24</td>
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<tr>
<td>Hungary</td>
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<tr>
<td>India</td>
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<tr>
<td>Mexico</td>
<td>0.23</td>
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<tr>
<td>Poland</td>
<td>0.39</td>
</tr>
<tr>
<td>South Africa</td>
<td>0.47</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Source: Own estimation with data from Haver Analytics, and the respective Central Banks or Statistical Offices, and Yahoo Finance.
Appendix – IRFs, Individual EMEs
Brazil – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Brazil – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Brazil – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Chile – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Chile – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Chile – Risk-Neutral Component

**Notes:** 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, $r_{FX}$, inflation, and Risk-neutral component.
Chile – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Colombia – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Colombia – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Colombia – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Czech Rep. – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Czech Rep. – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Czech Rep. – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Czech Rep. – 10-year Interest Rate

**Notes:** 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Hungary – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Hungary – Term Premium

Bond Flows → TP

r_FX → TP

Inflation → TP

VIX → TP

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Hungary – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Hungary – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
India – FX appreciation / depreciation

Bond Flows → r_FX

VIX → r_FX

Inflation → r_FX

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
India – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
India – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
India – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Mexico – FX appreciation / depreciation

**Bond Flows → r_FX**

**Inflation → r_FX**

**VIX → r_FX**

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Mexico – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Mexico – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Mexico – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Poland – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Poland – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Poland – Risk-Neutral Component

Bond Flows → RN

r_FX → RN

Inflation → RN

VIX → RN

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
Poland – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
S. Africa – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
S. Africa – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
S. Africa – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
S. Korea – FX appreciation / depreciation

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
S. Korea – Term Premium

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
S. Korea – Risk-Neutral Component

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
S. Korea – 10-year Interest Rate

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
Appendix – IRFs, PVAR
FX appreciation / depreciation, 1\textsuperscript{st} order

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, $r_{FX}$, inflation, and Term Premium.
Term Premium, 1st order

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Term Premium.
Risk-Neutral Component, 1\textsuperscript{st} order

**Bond Flows → RN**

![Graph showing Bond Flows → RN](image)

**r_FX → RN**

![Graph showing r_FX → RN](image)

**Inflation → RN**

![Graph showing Inflation → RN](image)

**VIX → RN**

![Graph showing VIX → RN](image)

Notes: 95\% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and Risk-neutral component.
10-year interest rate, 1st order

Notes: 95% confidence intervals in dotted lines. Variable order: VIX, bond flows, r_FX, inflation, and 10-year interest rate.
FX appreciation / depreciation, 2\textsuperscript{nd} order

Bond Flows $\rightarrow$ $r_{FX}$

Inflation $\rightarrow$ $r_{FX}$

VIX $\rightarrow$ $r_{FX}$

Notes: 95% confidence intervals in dotted lines. Variable order: inflation, bond flows, Term Premium, $r_{FX}$, and VIX.
Term Premium, 2\textsuperscript{nd} order

**Bond Flows → TP**

**Inflation → TP**

**r_FX → TP**

**VIX → TP**

Notes: 95\% confidence intervals in dotted lines. Variable order: inflation, bond flows, Term Premium, r_FX, and VIX.
Risk-Neutral Component, 2\textsuperscript{nd} order

Notes: 95\% confidence intervals in dotted lines. Variable order: inflation, bond flows, Risk-neutral component, \textit{r}_\textit{FX}, and VIX.
10-year interest rate, 2\textsuperscript{nd} order

Notes: 95% confidence intervals in dotted lines. Variable order: inflation, bond flows, 10-year interest rate, r_\text{FX}, and VIX.