The Transmission of US Shocks to Emerging Markets

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Co-movement of the US & EMEs Business Cycles

The Transmission of US Shocks to EMEs

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Previous Empirical and Theoretical Studies

- Empirical studies have used VARs to document the transmission of US shocks to emerging markets.
  - Canova (2005); Mackowiak (2007)

- Theoretical studies show that international business cycles with standard and “enriched” trade linkages have a difficult generating transmission.

- Another strand of the literature focuses on interest rate shocks and financial linkages to analyze the vulnerability of emerging markets to external shocks.
  - Neumeyer and Perri (2005); Uribe and Yue (2006); Garcia-Cicco, Pancrazi and Uribe (2010), Chang and Fernandez (2010)
Our approach: endogenous trade and financial linkages

The Trade Channel
MX exp: $C_H, I_H$
US exp: $C_F, I_F$
Baskets: $C = f(C_N, C_F, C_H, C_o)$
$I = f(I_N, I_F, I_H, I_o)$
$TOT = p_H * e / p_F$

non-tradable
$Y_N = f(L_N)$

US tradable
$Y_F = f(K, L_T)$

non-tradable
$Y_N = f(L_N)$

MX tradable
$Y_H = f(K, L_T)$
Our approach: endogenous trade and financial linkages

The Trade Channel
MX exp: $C_H, I_H$
US exp: $C_F, I_F$
Baskets: $C = f(C_N, C_F, C_H, C_o)$
$I = f(I_N, I_F, I_H, I_o)$
$TOT = \tilde{p}_H * e / \tilde{p}_F$

The Financial Channel
risk spreads:
$\tilde{S}_k = \tilde{Z} - \tilde{R}$
Rest of the world imp: $\tilde{C}_o, \tilde{I}_o$

Consumers safe deposits:
non-tradable $\tilde{Y}_N = f(\tilde{L}_N)$
US tradable $\tilde{Y}_F = f(\tilde{K}, \tilde{L}_T)$

Financial intermediary
risky entrepreneurs borrow:
$\tilde{B} = \tilde{Q}_k \tilde{K} - \tilde{N}$
get shock: $\tilde{\omega}$
rent: $\tilde{\omega}_K$
default prob: $F(\tilde{\omega})$
unrisky rate: $\tilde{Z}_S$

Consumers safe deposits:
non-tradable $R_N = f(L_N)$
US tradable $Y_F = f(K, L_T)$

Rest of the world bonds:
$\tilde{R}_o$

Rest of the world imp: $C_o, I_o$

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Our approach: endogenous trade and financial linkages

Rest of the world bonds: $R_o$

Consumer safe deposits: $\bar{R}$

$S^k = \bar{R} - \bar{R}$

Financial intermediary

risky entrepreneurs borrow: $\tilde{B} = \tilde{Q}^k \tilde{K} - \tilde{N}$

get shock: $\tilde{\omega}$

rent: $\tilde{\omega} \tilde{K}$

default prob: $F(\tilde{\omega})$

risky rate: $\tilde{Z}$

Consumer safe deposits: $R$

Rest of the world bonds: $R_o$

Rest of the world imp: $C_o, I_o$

Rest of the world imp: $\tilde{C}_o, \tilde{I}_o$

The Trade Channel

US exp: $C_F, I_F$

Rest of the world imp: $\tilde{C}_H, \tilde{I}_H$

Baskets: $C = f(C_N, C_F, C_H, C_o)$

$I = f(I_N, I_F, I_H, I_o)$

TOT = $\tilde{p}_H e / \tilde{p}_F$
Our approach: endogenous trade and financial linkages

- **Consumer safe deposits:**
  - Non-tradable: \( \tilde{R} = f(LN) \)
  - Tradable: \( \tilde{R} = f(K, \tilde{L}T) \)

- **Financial intermediary**
  - Risky entrepreneurs borrow: \( \tilde{B} = \tilde{Q}K - \tilde{N} \)
  - Get shock: \( \tilde{\omega} \)
  - Rent: \( \tilde{\omega}K \)
  - Default prob: \( F(\tilde{\omega}) \)
  - Risky rate: \( \tilde{Z} \)

- **Rest of the world bonds:**
  - Non-tradable: \( \tilde{R}_o = f(\tilde{L}N) \)
  - Tradable: \( \tilde{R}_o = f(\tilde{K}, \tilde{L}T) \)

- **Baskets:**
  - Total: \( \tilde{C} = f(CN, CF, CH, \tilde{C}_H) \)
  - Inventory: \( \tilde{I} = f(IN, IF, IH, \tilde{I}_H) \)

- **Trade Channel**
  - US export: \( CF, IF \)
  - Rest of the world import: \( CN, CH, \tilde{C}_H, \tilde{I}_H \)

- **Financial Channel**
  - Risk spreads: \( S^k = \tilde{Z} - \tilde{R} \)

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Our approach: endogenous trade and financial linkages

**Introduction**

- Rest of the world bonds: $\tilde{R}_o$
  - Rest of the world imp: $\tilde{C}_o, \tilde{I}_o$

**The Model**

- Consumer safe deposits: $\tilde{R}$
  - non-tradable
    - $Y_N = f(L_N)$
  - US tradable
    - $Y_F = f(K, L_T)$

- Financial intermediary
  - risky entrepreneurs borrow: $\tilde{B} = \tilde{Q}^k K - \tilde{N}$
    - get shock: $\tilde{\omega}$
    - rent: $\tilde{\omega} \tilde{K}$
    - default prob: $F(\tilde{\omega})$
  - risky rate: $\tilde{Z}$

- The Financial Channel risk spreads: $S_k$ $\tilde{S}^k$

- The Trade Channel
  - MX exp: $\tilde{C}_H, \tilde{I}_H$
  - US exp: $\tilde{C}_F, \tilde{I}_F$
  - Baskets: $C = f(C_N, C_F, C_H, C_o)$
  - $I = f(I_N, I_F, I_H, I_o)$
  - $TOT = \tilde{p}_H * e / \tilde{p}_F$

**Estimation**

**Results**

- Rest of the world bonds: $R_o$
  - Rest of the world imp: $C_o, I_o$
Our approach

- Using 16 quarterly series for Mexico and the US from 1994 to 2012, we estimate the model using Bayesian techniques.
- We use the estimated model to address three questions:
  - What are the driving forces of the Mexican business cycle?
  - What is the historical impact of US shocks on the Mexican economy?
  - What are the roles of trade linkages and financial market distortions in exposing the Mexican economy to the US shocks?
Econometric findings

- The model predicts cross-country correlations consistent with the data.
  
  \[
  \text{This paper} \quad \text{corr}(\Delta Y_t^{mx}, \Delta Y_t^{us})
  \]
  
  \[
  \text{Justiniano and Preston (JIE, 2010)} \quad \text{corr}(Y_t^{can}, Y_t^{us})
  \]
  
- The estimation endogenously delivers the “Small Open Economy” assumption needed in structural VARs estimations.

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Economic findings

- We find that US shocks explain around 70% of the variation in Mexico’s GDP growth rate. This is the largest source of fluctuations.
  - This finding is confirmed by an estimated structural VAR using our dataset.
  - For Mexico’s GDP variance, Mackowiak (JME, 2007) finds that external shocks explain 50% and Canova (JAE, 2005) finds that external shocks explain 92%.
- The transmission of shocks occurs throughout the business cycles in the sample. Interestingly, during the Tequila crisis (1994-1995) US shocks play a minor role.
- While Mexico’s growth substantially benefited from the US expansion in the second part of the 1990s, it was adversely hit by the US recessions in 2001 and 2008.
- Counter-factual experiments show that spill-overs from the US are more sensitive to the changes in financial frictions than to the changes in the volume of bilateral trade.
Our approach: endogenous trade and financial linkages

- International business cycle features (e.g., Stockman and Tesar (1995), Heathcote and Perri (2002))
- Financial aspects (BGG (1999), Christiano, Motto and Rostagno (AER, 2014))

- Consumer
- Final good producer
- Capital producer
- Entrepreneur
- Financial intermediary
- Exporter
- Government
Consumer’s Problem

- The household’s preferences are a modified version of GHH (AER, 1988) preferences to allow for habit in consumption

\[ U = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \xi_{C,t} \left[ C_t - \varphi C_{t-1} - \frac{\psi}{1+\eta} L_t^{1+\eta} \right]^{1-\sigma} - 1, \]  

where:

- \( C \): consumption basket
- \( L \): labor composite
- \( \varphi \): habit parameter
- \( \xi_C \): preference shock
- \( \beta \): discount factor
- \( \sigma \): inter-temporal elasticity
- \( \eta \): aggregate labor-wage elasticity
- \( \psi \): scale parameter
Labor composite

\[ L_t = \left[ (L_{N,t})^{1+\chi} + (L_{T,t})^{1+\chi} \right]^{1/(1+\chi)} \] (2)

- \( L_N \): labor in non-traded sector
- \( L_T \): labor in traded sector
- \( \frac{1}{\chi} \): elasticity of substitution

Consumption composite

\[ C_t = \left[ a^{\frac{1}{\theta}} C_{T,t}^{\frac{\theta-1}{\theta}} + (1 - a)^{\frac{1}{\theta}} C_{N,t}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}} \] (3)

- \( C_T \): traded consumption basket
- \( C_N \): non-traded good
- \( \theta \): elasticity of substitution
- \( a \): share parameter
Our approach: endogenous trade and financial linkages

The traded consumption basket:

\[
C_{T,t} = \left[ m_H^{\frac{1}{\omega}} C_{H,t}^{\frac{\omega-1}{\omega}} + m_F^{\frac{1}{\omega}} C_{F,t}^{\frac{\omega-1}{\omega}} + m_O^{\frac{1}{\omega}} C_{O,t}^{\frac{\omega-1}{\omega}} \right]^{\frac{1}{\omega-1}} \tag{4}
\]

- \( C_H \): traded good produced in Mexico (Home country)
- \( C_F \): traded good produced in US (Foreign country)
- \( C_O \): traded produced elsewhere (Other country)
- \( \omega_c \): elasticity of substitution within traded goods
- \( m's \): shares
The household’s budget constraint (in units of the domestic consumption basket) is given by

$$e_{t}B_{o,t} = - \left[ w_{H,t}^{*}L_{H,t} + w_{N,t}^{*}L_{N,t} + \Pi_{t} \right]$$

$$+ \left[ C_{t} + T_{t} \right] + e_{t}R_{t-1}B_{o,t-1} + e_{t} \frac{\pi}{2} (B_{o,t} - \bar{B}_{o})^{2}$$

The lump-sum transfers $\Pi_{t}$ include: transfers from the firms, from the capital producers and from the entrepreneurs.
U.S. households

- U.S. households save in a portfolio of three risk-free bonds: $\tilde{B}_t$, $B_t$ and $\tilde{B}_t^o$.
- The funds of $\tilde{B}_t$ and $B_t$ finance the domestic and foreign branches—correspondingly—of a mutual fund described below.
- By law, the mutual fund cannot divert funds from the domestic branch to the foreign branch and vice-versa. The third bond $\tilde{B}_t^o$ is traded with the rest of the world.
- The budget constraint is

$$\tilde{C}_t + \tilde{B}_t + nB_t + \tilde{B}_t^o + \tilde{T}_t = \tilde{w}_T T_t \tilde{L}_T t + \tilde{w}_N N_t \tilde{L}_N t$$

$$+ \tilde{R}_{t-1} \tilde{B}_{t-1} + nR_{t-1} B_{t-1} + \tilde{R}_t^o \tilde{B}_t^o + \frac{\tilde{\pi}}{2} (\tilde{T}B_t - \tilde{B})^2 + \tilde{\Pi}_t$$

where $\tilde{T}B_t = \tilde{B}_t + nB_t + \tilde{B}_t^o$ and $n$ is the inverse of the relative size of MX.
Final good producer

- Production functions with input adjustment costs (e.g. Basu and Shapiro (2001), Ireland and Schuh (RED, 2008))

\[
Y_N = \left[ A_{N,t} L_{N,t} \right] \left[ \frac{\phi_L}{2} \left( \frac{L_{N,t}}{L_{N,t-1}} - 1 \right)^2 \right] 
\] (6)

\[
Y_{H,t} = \left[ A_{T,t} K_{T,t-1} \right] \left[ \frac{\phi_L}{2} \left( \frac{L_{T,t}}{L_{T,t-1}} - 1 \right)^2 \right] \left[ \frac{\phi_K}{2} \left( \frac{K_{T,t-1}}{K_{T,t-2}} - 1 \right)^2 \right] 
\] (7)

- Working capital constraint in total production revenues, thus

\[
\left[ 1 - \kappa_j (R^o_t - 1) \right] \frac{p_{j,t} Y_{j,t}}{1 - \tau_j} 
\] (8)

is the net revenue, with \( j = N, H \)
We follow Christiano, Motto and Rostagno (AER, 2014) closely, and adapt it to a two-country setting.

**Production takes place with capital $K_{t-2}$ and $K_{t-1}$ is produced.**

**Entrepreneur buys $K_{t-1}$ at a price $Q_{t-1}^k$.** Borrows $B_{t-1}^N = Q_{t-1}^N K_{t-1} - N_{t-1}$. In the contract the loan amount and the payment $B_{t-1}^N Z_{t-1}^N$ are specified (in US dollars so that the MX entrepreneur bears the exchange rate risk).

**Entrepreneur receives a productivity shock.** Effective capital is $\omega K_{t-1}$. Rent is set at $r_t^k$.

**Entrepreneur collects rents and sells undepreciated capital at $Q_t^k$.** The return is $\omega R_t^k$. For a threshold $\omega_t$ and above the loan is repaid. Below $\omega_t$ the entrepreneur gets liquidated.

**Production takes place.**

**Entrepreneurs that didn't default get a shock and $1 - \gamma$ die.** The capital producer buys $(1 - \gamma)K_{t-1}$ at $Q_t^k$, invest and produces $K_t$ to be sold at $Q_t^k$. 

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To produce new capital, the capital producer purchases the un-depreciated capital \((1 - \delta)K_{t-1}\) used in period \(t\) at a price \(Q^k_t\) and \(I_t\) units of investment to produce \(K_t\). Then, the newly produced raw capital is sold to the entrepreneur at a price \(Q^k_t\).

The capital producer combines the un-depreciated capital and investment goods to produce the new capital with the following technology:

\[
K_t = (1 - \delta)K_{t-1} + \xi_{l,t}I_t \left[1 - \frac{\phi_l}{2} \left(\frac{I_t}{I_{t-1}} - 1\right)^2\right],
\]

(9)

where \(\xi_{l,t}\) is a shock to the marginal efficiency of investment in producing capital, and \(\phi_l\) determines the cost of adjustment.
Investment baskets

\[ I_t = \left[ a^{\theta-1} I_{T,t}^{\theta-1} + (1 - a) \frac{1}{\theta} I_{N,t}^{\theta-1} \right]^{\theta-1}, \]  

with

\[ I_{T,t} = \left[ m_H^{\nu} I_{H,t}^{\nu-1} + m_F^{\nu} I_{F,t}^{\nu-1} + m_O^{\nu} I_{O,t}^{\nu-1} \right]^{\nu-1}, \]

Note that investment plays a direct role in the trade channel (is traded) and also in the financial channel (capital is the collateral).
Entrepreneur

The timing of events is as follows

(t-1):
- $K_{t-1}$ is produced
- Entrepreneur $N$ buys $K_{t-1}^N$ at a price $Q_{t-1}^k$. Borrows $e_{t-1}B_{t-1}^N = Q_{t-1}^N K_{t-1}^N - N_{t-1}$. In the contract the loan amount and the payment $B_{t-1}^N Z_t^N$ are specified (in US dollars so that the MX entrepreneur bears the exchange rate risk).

(t):
- Productivity shock is realized. Effective capital is $\omega K_{t-1}^N$. Rent is set at $r_t^k$.
- Production takes place
- Entrepreneur collects rents and sells undepreciated capital at $Q_t^k$.
  The return is $\omega R_t^k$, where:

$$R_t^k = \frac{r_t^k + (1 - \delta) Q_t^k}{Q_{t-1}^k}$$
Entrepreneur

- For a threshold $\omega_t$ and above the loan is repaid, below $\omega_t$ the entrepreneur gets liquidated. We can write the solvency condition as
  \[ e_{t-1} B^N_{t-1} Z^N_t \leq \omega_t R^k_t Q^k_{t-1} K_{t-1} \]  
  (12)

- A bankrupt entrepreneur is monitored by the bank, which seizes the entrepreneur’s assets after paying a monitoring cost $\mu$.

- The shock $\omega$ is such that
  \[ \ln(\omega) \sim N(0, \sigma_t) \]  
  (13)

  where $\sigma_t$ is a “risk shock”
Optimal debt contract

- The profit for the emerging market section of the bank is given by
  \[ \pi_{t}^{\text{bank}, \text{em}} = \int_{\omega_t}^{\infty} B_{t-1}^N Z_t^N dF(\omega) + (1 - \mu) \int_{0}^{\omega_t} \frac{1}{e_t} R_t^k \omega_t Q_{t-1}^k K_{t-1}^N dF(\omega) - R_{t-1} B_{t-1}^N \]  
  (14)

- The expected net worth of the entrepreneur is (in units of the US consumption basket)
  \[ E_t V_{t+1}^N = E_t \left\{ \int_{\omega_t}^{\infty} \frac{1}{e_{t+1}} R_{t+1}^k \omega_t Q_t^k K_t^N - Z_{t+1}^N B_t^N dF(\omega) \right\} \]  
  (15)

- The optimal debt contract (specified at the end of period \( t \)) for type \( N \) entrepreneur sets \( Z \) and \( B \) to maximize \( E_t V_{t+1}^N \) subject to a zero profit condition of the bank.
Introduction
The Model
Estimation
Results

International Pricing: Exporters

There are intermediary firms that buy the traded good, H, and export it to the US. The exporting firms face a similar working-capital constraint as the producers.

The representative exporter maximizes

\[
\left[ 1 - \kappa_E (R_t - 1) \right] \frac{1}{1 - \tau_E} \tilde{p}_{H,t} \tilde{\xi}_{tot,t} \tilde{Q}_{H,t} - \frac{p_{H,t}}{e_t} \tilde{Q}_{H,t}
\]

\[\tilde{Q}_{H,t} = n \left( \tilde{C}_{H,t} + \tilde{X}_{FH,t} \right) : \text{total exports to the US.}\]

The pricing equation for the H good:

\[
\tilde{p}_{H,t} = \frac{p_{H,t}}{e_t} \frac{1 - \tau_E}{1 - \kappa (R_t - 1)} \frac{1}{\tilde{\xi}_{tot,t}}
\]

\[\tilde{\xi}_{tot} : \text{terms of trade shock}\]
Closing the model

- **Government**
  - Government finances expenditures with lump-sum taxes:
    \[ T_t = p_{G,t} G_t \]
  - and adjusts spending according to:
    \[ G_t = (G) \left( \frac{Y_t}{Y_{t-1}} \right)^{\psi_{G,Y}} \xi_{G,t} \]

- **Other net imports**
  - Imports from the rest of the world, \( p_{o,t} [C_{o,t} + X_{No,t} + X_{Ho,t}] \), follows an autoregressive process:
    \[ ONMY_t = (ONMY)^{1-\rho_{onm}} \left( ONMY_{t-1} \right)^{\rho_{onm}} \left( \frac{Y_t}{Y_{t-1}} \right)^{\psi_{onm,y}} \epsilon_{onm,t} \]
The fourteen structural shocks in the model follow AR(1) processes:

\[ \hat{\xi}_t = \rho \hat{\xi}_{t-1} + \hat{\epsilon}_{\xi,t} \]

where \( \hat{\xi} = \{ \xi_C, \tilde{\xi}_C, \xi_I, \tilde{\xi}_I, \xi_{AT}, \tilde{\xi}_{AT}, \xi_{AN}, \tilde{\xi}_{AN}, \xi_\sigma, \tilde{\xi}_\sigma, \xi_{tot}, \xi_{onm}, \tilde{\xi}_{onm}, \xi_G, \tilde{\xi}_G, \tilde{\xi}_{Lt} \} \). We allow for \( \hat{\epsilon}_{AT,t} \) and \( \hat{\epsilon}_{AN,t} \) to be positively correlated within countries but not across countries and all other shocks \( \hat{\epsilon}_{\xi,t} \) are i.i.d.
The solution of the model and its relation to the data take the state-space form:

\[ X_t = \Gamma X_{t-1} + \Xi \epsilon_t \]
\[ D_t = \Theta X_{t-1} + \epsilon_{t}^{me} \]

We estimate

- parameters of the shock processes;
- parameters that determine the real rigidities (e.g., degree of the financial market imperfection, investment adjustment costs).

We calibrate

- parameters that are commonly used in the literature (e.g., coefficient of risk-aversion);
- parameters that are difficult to identify with our data-set (e.g., elasticity of substitution between home and foreign goods).
### Steady-state values and ratios

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>MX &amp; US</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta$</td>
<td>Subjective discount factor</td>
<td>0.994</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Intertemporal elasticity of substitution</td>
<td>4</td>
</tr>
<tr>
<td>$\eta$</td>
<td>Curvature on disutility of labor</td>
<td>1</td>
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<tr>
<td>$\gamma$</td>
<td>Labor elasticity of substitution</td>
<td>2</td>
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<tr>
<td>$\xi_L$</td>
<td>Steady state wage markup</td>
<td>1.15</td>
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<tr>
<td>$\theta$</td>
<td>Elasticity of substitution between tradable and non-tradable</td>
<td>0.7</td>
</tr>
<tr>
<td>$\nu$</td>
<td>Elasticity of substitution among tradables</td>
<td>1.5</td>
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<tr>
<td>$\delta$</td>
<td>Capital depreciation rate</td>
<td>0.025</td>
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<tr>
<td>$\alpha$</td>
<td>Power on capital in production function</td>
<td>0.4</td>
</tr>
<tr>
<td>$a$</td>
<td>Share of tradables in consumption and investment baskets</td>
<td>0.7</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>data</th>
<th>model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R$</td>
<td>US interest rate</td>
<td>1.0245</td>
<td>1.0242</td>
</tr>
<tr>
<td>$S^k$</td>
<td>US risk spread</td>
<td>1.0241</td>
<td>1.0242</td>
</tr>
<tr>
<td>$S_k$</td>
<td>MX risk spread</td>
<td>1.0351</td>
<td>1.0353</td>
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### Financial variables

<table>
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<tr>
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<th>model</th>
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<tbody>
<tr>
<td>$\text{exp}/\bar{Y}$</td>
<td>MX exports / MX GDP</td>
<td>0.1927</td>
</tr>
<tr>
<td>$\text{imp}/\bar{Y}$</td>
<td>MX imports / MX GDP</td>
<td>0.1446</td>
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</tbody>
</table>

### Bilateral Trade

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>data</th>
<th>model</th>
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</thead>
<tbody>
<tr>
<td>$C/\bar{Y}$</td>
<td>Consumption / GDP</td>
<td>0.6619</td>
<td>0.6619</td>
</tr>
<tr>
<td>$I/\bar{Y}$</td>
<td>Investment / GDP</td>
<td>0.1676</td>
<td>0.1676</td>
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<tr>
<td>$G/\bar{Y}$</td>
<td>Government spending / GDP</td>
<td>0.2061</td>
<td>0.2061</td>
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### MX

<table>
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<th>Variable</th>
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<th>data</th>
<th>model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C/\bar{Y}$</td>
<td>Consumption / GDP</td>
<td>0.6429</td>
<td>0.6429</td>
</tr>
<tr>
<td>$I/\bar{Y}$</td>
<td>Investment / GDP</td>
<td>0.2026</td>
<td>0.2026</td>
</tr>
<tr>
<td>$G/\bar{Y}$</td>
<td>Government spending / GDP</td>
<td>0.1152</td>
<td>0.1152</td>
</tr>
<tr>
<td>$Y/\bar{Y}$</td>
<td>MX GDP / US GDP</td>
<td>0.0645</td>
<td>0.0645</td>
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</tbody>
</table>
Our data ($D$) covers 1994Q1–2012Q4.

- GDP growth for Mexico and the US
- Consumption growth for Mexico and the US
- Investment for growth Mexico and the US
- Bilateral imports growth for Mexico
- Bilateral exports growth for Mexico
- Real exchange rate depreciation
- Government spending growth for Mexico and the US
- Non-bilateral trade/ GDP for Mexico and the US
- J.P. Morgan EMBI+ Spread Mexico
- Spread between BAA and 10-year Treasury for the US
- Growth in per capita work hours US
## Priors and Posteriors of Estimated Parameters

<table>
<thead>
<tr>
<th>Param.</th>
<th>Dist.</th>
<th>Prior mean</th>
<th>s.d.</th>
<th>Mexico Posterior mean</th>
<th>5%</th>
<th>95%</th>
<th>US Posterior mean</th>
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Our prior elicitation presumes that both countries face symmetrically volatile shocks and let the data speak.
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Model Fit: Key Second Moments

\[
\text{Corr}(\Delta Y, \Delta Y_{t-j}) \quad \text{Corr}(\Delta Y, \Delta C_{t-j}) \quad \text{Corr}(\Delta Y, \Delta I_{t-j}) \quad \text{Corr}(\Delta Y, \Delta \tilde{Y}_{t-j}) \quad \text{Corr}(\Delta Y, \Delta \tilde{I}_{t-j})
\]

\[
\text{Corr}(\Delta Y, \Delta \exp_{t-j}) \quad \text{Corr}(\Delta Y, \Delta \imp_{t-j}) \quad \text{Corr}(\Delta Y, \Delta e_{t-j}) \quad \text{Corr}(\Delta \tilde{Y}, \Delta e_{t-j}) \quad \text{Corr}(\Delta \tilde{I}, \Delta e_{t-j})
\]

\[
\text{Corr}(\Delta S^k, \Delta S^k_{t-j}) \quad \text{Corr}(\Delta Y, S^k_{t-j}) \quad \text{Corr}(\Delta I, S^k_{t-j}) \quad \text{Corr}(\Delta \tilde{Y}, \Delta \tilde{S}^k_{t-j}) \quad \text{Corr}(\Delta \tilde{I}, \Delta \tilde{S}^k_{t-j})
\]
Comparing to Justiniano & Preston 2010 JIE
## Variance Decomposition

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Kolver Hernandez

The Transmission of US Shocks to EMEs
## Variance Decomposition

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Kolver Hernandez  
The Transmission of US Shocks to EMEs
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<td>28.9</td>
<td>0.4</td>
</tr>
<tr>
<td>$\xi_I$</td>
<td>2.6</td>
<td>1.4</td>
<td>45.3</td>
</tr>
<tr>
<td>$\xi_{AT}, \xi_{AN}$</td>
<td>12.3</td>
<td>0.8</td>
<td>0.3</td>
</tr>
<tr>
<td>$\xi_{TOT}$</td>
<td>2.7</td>
<td>5.7</td>
<td>2.1</td>
</tr>
<tr>
<td>$\tilde{\xi}_T$</td>
<td>0.3</td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>$\tilde{\xi}_C$</td>
<td>1.8</td>
<td>2.1</td>
<td>1.2</td>
</tr>
<tr>
<td>$\tilde{\xi}_I$</td>
<td>1.6</td>
<td>1.6</td>
<td>3.2</td>
</tr>
<tr>
<td>$\tilde{\xi}_L$</td>
<td>1.3</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>$\tilde{\xi}<em>{AT}, \tilde{\xi}</em>{AN}$</td>
<td>69.0</td>
<td>49.3</td>
<td>29.4</td>
</tr>
<tr>
<td>m.e.</td>
<td>4.6</td>
<td>6.0</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Structural BVAR estimation

Partitioning the observables $y_t$ into U.S., Mexican variables and, exchange rate and spreads: $Y^U_t, Y^M_t, y^e_t, y^s_t,$ and $y^\tilde{s}_t$ respectively, the five blocks are given by

$$
\begin{bmatrix}
I_{1\times1} & A^s_e & A^M_x & 0 & A^US_e \\
0 & I_{1\times1} & A^M_x & A^\tilde{s}_s & A^US_e \\
0 & 0 & I_{nxn} & 0 & 0 \\
0 & 0 & 0 & I_{1\times1} & A^US_s \\
0 & 0 & 0 & 0 & I_{nxn}
\end{bmatrix}
\begin{pmatrix}
y^e_t \\
y^s_t \\
y^M_t \\
y^\tilde{s}_t \\
y^US_t
\end{pmatrix}
= 
\begin{bmatrix}
B^e_e & B^s_e & B^M_x & B^\tilde{s}_s & B^US_e \\
B^e_s & B^s_s & B^M_x & B^\tilde{s}_s & B^US_s \\
B^M_x & B^M_x & B^M_x & B^US_x & B^US_x \\
0 & 0 & 0 & B^\tilde{s}_s & B^US_s \\
0 & 0 & 0 & 0 & B^US_s 
\end{bmatrix}
\begin{pmatrix}
y^e_{t-\ell} \\
y^s_{t-\ell} \\
y^M_{t-\ell} \\
y^\tilde{s}_{t-\ell} \\
y^US_{t-\ell}
\end{pmatrix}
+ 
\begin{pmatrix}
\epsilon^e_t \\
\epsilon^s_t \\
\epsilon^M_t \\
\epsilon^\tilde{s}_t \\
\epsilon^US_t
\end{pmatrix}
$$

The structural errors $[\epsilon^U_t, \epsilon^M_t, \epsilon^e_t, \epsilon^s_t, \epsilon^\tilde{s}_t]^\prime$ are orthogonal with unit variance.
Structural BVAR estimation

Partitioning the observables $y_t$ into U.S., Mexican variables and, exchange rate and spreads: $Y_t^US, Y_t^MX, y_t^e, y_t^s$, and $y_t^\tilde{s}$ respectively, the five blocks are given by

$$
\begin{bmatrix}
I_{1\times 1} & A_e^s & A_e^MX & A_e^\tilde{s} & A_e^US \\
0 & I_{1\times 1} & A_s^MX & A_s^\tilde{s} & A_s^US \\
0 & 0 & I_{nxn} & 0 & 0 \\
0 & 0 & 0 & I_{1\times 1} & A_s^US \\
0 & 0 & 0 & 0 & I_{nxn}
\end{bmatrix}
\begin{bmatrix}
y_t^e \\
y_t^s \\
y_t^{MX} \\
y_t^\tilde{s} \\
y_t^{US}
\end{bmatrix}
= \begin{bmatrix}
B_e^e & B_e^s & B_e^MX & B_e^\tilde{s} & B_e^US \\
B_s^e & B_s^s & B_s^MX & B_s^\tilde{s} & B_s^US \\
B_{MX}^e & B_{MX}^s & B_{MX}^MX & B_{MX}^\tilde{s} & B_{MX}^US \\
B_{US}^e & B_{US}^s & B_{US}^MX & B_{US}^\tilde{s} & B_{US}^US
\end{bmatrix}
\begin{bmatrix}
y_{t-\ell}^e \\
y_{t-\ell}^s \\
y_{t-\ell}^{MX} \\
y_{t-\ell}^\tilde{s} \\
y_{t-\ell}^{US}
\end{bmatrix}
+ \begin{bmatrix}
\epsilon_t^e \\
\epsilon_t^s \\
\epsilon_t^{MX} \\
\epsilon_t^\tilde{s} \\
\epsilon_t^{US}
\end{bmatrix}
$$

The structural errors $[\epsilon_t^{'US}, \epsilon_t^{'MX}, \epsilon_t^{'e}, \epsilon_t^{'s}, \epsilon_t^{'\tilde{s}}]'$ are orthogonal with unit variance.
Estimated Spill-overs from the US to Mexico
Historical Contribution of US Shocks in Mexico: When the US sneezes . . .

GDP

Consumption

Investment

Kolver Hernandez
The Transmission of US Shocks to EMEs
Historical Contribution of US Shocks in Mexico

Exports

Imports

Risk spread

Kolver Hernandez
The Transmission of US Shocks to EMEs
Conclusions

- The econometric estimation of the model
  - Predicts cross-country correlations consistent with the data
  - Delivers without extraneous assumptions the Small Open Economy characteristic of Mexico
- We find that US shocks explain 70% of the variation in Mexico’s GDP growth rate, constituting the most important source of fluctuations for Mexico’s economy.
- Historical decompositions show that the US expansions during the 1990s contributed to Mexico’s growth by 1 percentage points on average. On the other hand, the 2001 US recession led to a reduction of 3 percentage points in Mexico’s GDP growth in that year, whereas the 2008 crisis lead to a reduction of 10 percentage points.
- We also find that the financial frictions are the most important features that allow the model to capture the cross-country correlations and spill-overs in the data.

... future work ...