What are the sources of macroeconomic fluctuations in emerging markets?

Two leading theories:
- trend shocks
- country risk shocks combined with financial frictions

This project:
- compares the two theories empirically
- using the business cycle accounting methodology of Chari, Kehoe and McGrattan (CKM)
Business cycles in emerging markets are different.

- Consumption more volatile than output
- Net exports strongly counter-cyclical
- Sudden stops
  - Current account reversals, e.g. in Mexico during the “Tequila Crisis”
Two leading explanations

   - trend growth is stochastic
   - permanent income fluctuates more than output

2. Interest rate shocks - Neumayer and Perri (2005)
   - world interest rate and country risk fluctuate
   - working capital constraint amplifies their effects

Empirical comparisons of the two approaches

- Bayesian estimation of an encompassing model
  - Garcia-Cicco et al. (2010), Chang & Fernandez (2010)
- *Business Cycle Accounting - this paper*
Theoretical motivation

1. Detailed economy with frictions is equivalent to a frictionless model with time varying “wedges”,
   
   e.g. labor wedge

   \[ MRS = \frac{U_{l,t}}{U_{c,t}} = (1 - \tau_{l,t})F_{l,t} = MPL \]

Accounting procedure

1. Use theory plus data to measure wedges
2. Feed wedges back one at a time and in combinations
3. How much of macro aggregates accounted for by each?
Outline

1. Prototype economy with wedges
2. Recovering the process for wedges from the data
3. Accounting for the “Tequila crisis”
Preferences

\[ E_0 \sum \beta^t \frac{C_t^\eta (1 - \ell_t)^{1-\eta}^{1-\sigma}}{1 - \sigma} \]

Budget constraint

\[ C_t + (1 + \tau_{x,t})X_t \leq (1 - \tau_{\ell,t})w_t\ell_t + r_tK_t + TR_t - D_t + \]
\[ + \frac{1}{R^*}(1 - \tau_{q,t})D_{t+1} - \frac{\psi}{2} \left( \frac{D_{t+1}}{\Gamma_{t-1} \bar{d}} - \bar{\gamma} \right)^2 \Gamma_{t-1} \bar{d} \]

\( \tau_{q,t} \) is the debt price wedge
Prototype Small Open Economy

- Output: \( Y_t = A_t K_t^\alpha (\Gamma_t \ell_t)^{1-\alpha} \)

where \( \Gamma_t = \gamma_t \Gamma_{t-1} \).

\( \log A_t \) is the (stationary) technology shock wedge.

\( \log \gamma_t \) is the trend shock wedge.

- Resource constraint: \( C_t + X_t + G_t + NX_t = Y_t \)

- Wedges: \( s_t := (\log A_t, \tau_{\ell,t}, \tau_{x,t}, \log G_t, \log \gamma_t, \tau_{q,t}) \)

- CKM wedges

- New wedges

- De-trending: \( \tilde{x}_t = \frac{X_t}{\Gamma_{t-1}} \)
 ACCOUNTING PROCEDURE

1 Estimation of the stochastic process governing wedges

\[ \Pr(s_{t+1}|s_t, s_{t-1}, \ldots) =? \]

- necessary to compute expectations in inter-temporal equilibrium conditions.

2 Recover the realizations of wedges using model equilibrium conditions and the data.

3 Feed in one wedge at a time or in combinations to assess their contribution to fluctuations.
Recovering wedges - example

Consumption-leisure trade-off in a neoclassical model:

\[
\frac{u_l(C_t, l_t)}{w u_c(C_t, l_t)} = 1
\]

In general:

\[
\frac{u_l(C_{\text{data}}^t, l_{\text{data}}^t)}{w^{\text{data}} u_c(C_{\text{data}}^t, l_{\text{data}}^t)} \neq 1
\]

but we can find a wedge \( \tau_{\ell,t} \) such that:

\[
\frac{u_l(C_{\text{data}}^t, l_{\text{data}}^t)}{w^{\text{data}} u_c(C_{\text{data}}^t, l_{\text{data}}^t)} = 1 - \tau_{l,t}
\]
Debt price wedge identified by data on CA and NX

Net Export:

\[ NX_t = D_t - \frac{1}{R^*}(1 - \tau_{q,t})D_{t+1} + \frac{\psi}{2}\left(\frac{D_{t+1}}{\Gamma_{t-1}\bar{d}} - \bar{\gamma}\right)^2\Gamma_{t-1}\bar{d} \]

Current Account:

\[ CA_t = D_t - D_{t+1} \]

\( \tau_{q,t} \) debt price wedge
IDENTIFICATION: TREND SHOCK WEDGE

- Trend wedge identified by asymmetric response of C, Y to TFP shocks
  
  - Debt Euler equation:
    \[ u_c(\tilde{c}_t, l_t) = \beta \gamma_t^{\eta(1-\sigma)-1} E_t \left\{ \frac{\tilde{\lambda}_{t+1}}{\tilde{\lambda}_t} u_c(\tilde{c}_{t+1}, l_{t+1}) \right\} \]

  - Production:
    \[ \tilde{y}_t = A_t (\tilde{k}_t)^\alpha (\gamma_t l_t)^{1-\alpha} \]

  - \( \log \gamma_t \) trend shock wedge
ACCOUNTING

We feed in:

1. stationary technology shock only
   - i.e. use values of $A_t$ recovered in the previous step and set all other wedges constant at their steady state

2. trend shock wedge only

3. debt price wedge only

4. labor and debt price wedges together

5. all CKM wedges ($\log A$, $\tau_x$, $\tau_l$, $\log G$)
Gross Domestic Product, Mexico, 1994q2−1998q3

Data

Technology

Trend

Debt price

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Business Cycle Accounting in a Small Open Economy
Net Export, Mexico, 1994q2−1998q3

Data
Trend
Labor & Debt price
CKM

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Current Account, Mexico, 1994q2–1998q3

Data
Trend
Labor & Debt price
CKM

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Business Cycle Accounting in a Small Open Economy
## Results - Mexico

### Correlation of simulated series with the data
(whole sample: 1986-2010)

<table>
<thead>
<tr>
<th>Active wedge(s)</th>
<th>Y</th>
<th>NX / Y</th>
<th>CA / Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>0.91</td>
<td>-0.08</td>
<td>-0.37</td>
</tr>
<tr>
<td>Trend</td>
<td>0.03</td>
<td>0.74</td>
<td>0.95</td>
</tr>
<tr>
<td>Debt price</td>
<td>-0.58</td>
<td>0.55</td>
<td>-0.35</td>
</tr>
<tr>
<td>Labor &amp; Debt price</td>
<td>-0.30</td>
<td>0.67</td>
<td>0.18</td>
</tr>
<tr>
<td>Trend &amp; Debt price</td>
<td>-0.20</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>CKM</td>
<td>0.78</td>
<td>-0.33</td>
<td>-0.37</td>
</tr>
</tbody>
</table>

Rahmati & Rothert, UT Austin

Business Cycle Accounting in a Small Open Economy
Summary and Conclusions

Methodological contributions

1. Adding trend shock and debt price wedge to CKM.

2. Accounting for net exports and current account.
   - important macro variables in an open economy.
   - in CKM part of the gov’t wedge.

3. Equivalence results (in the paper)
   - Debt price and labor wedge
     - equivalent to a model with interest rate shocks and working capital constraint.
   - Trend shock
     - Equivalent (up to a first-order approximation) to a model with terms of trade shocks, if the latter are random walks
Summary and Conclusions

Fluctuations in emerging markets

1. Evaluating two leading theories with new methodology.

2. Trend shock (non-stationary) wedge alone can account for most of the movements in net exports and current account.

3. Debt price wedge accounts well for net exports.

4. Technology (stationary) wedge drives output movements.
   - in line with the CKM results for the United States

Our results call for a theory of the stochastic trend.
Future Work

- Robustness Check for $\psi$
  - $\tau_{q,t}$ is identified from $NX$ vs. $CA$

- Repeat the accounting with GHH preferences.
  - $c_t$ drops out of $U_l/U_c = (1 - \tau_l)MPL$

- Constrained Maximum Likelihood
  - Add moments like $\frac{\sigma(c)}{\sigma(y)}$, $\cdots$ to the estimation
Summary and Conclusions

1. Extension of the CKM methodology to allow for external interest rate shocks and internal non-stationary shocks.

2. Equivalence results for the two new wedges.

3. Application to Tequila Crisis
   - empirical evaluation of two leading theories of emerging markets business cycles using a new methodology

4. Rahmati & Rothert, UT Austin  Business Cycle Accounting in a Small Open Economy
Methodological contributions

1. Introduce two more wedges into the CKM method:
   - trend shock wedge
   - debt price wedge.

2. Accounting for net export and current account in CKM trade balance is part of the gov’t wedge

3. Equivalence results
   - Debt price and labor wedge
     - equivalent to a model with interest rate shocks and working capital constraint.
   - Trend shock wedge
     - Equivalent (up to a first-order approximation) to a model with terms of trade shocks, if the latter are random walks.
Estimating the stochastic process

1. Assume 1-st order VAR:

\[ s_{t+1} = P_0 + P s_t + \epsilon_{t+1}, \quad \epsilon_{t+1} \sim N(0, \Sigma) \]

2. Linearize the model’s equilibrium conditions and find laws of motion of endogenous variables.

3. Use Kalman filter to estimate \( P_0, P \) and \( \Sigma \) with maximum likelihood.

   series used in estimation

\[ \left[ \log Y_t, \log X_t, \log \ell_t, \log G_t, \Delta \frac{NX_t}{Y_t}, \Delta \frac{CA_t}{Y_t} \right]’ \]