

# Trends and Cycles in SOE: Making the Case for a General Equilibrium Approach.

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<sup>1</sup>The views in this presentation are solely the responsibility of the author and should not be interpreted as reflecting the views of the Federal Reserve Bank of Atlanta or the Federal Reserve System.

# Common and Idiosyncratic Shocks in SOE

- **Old Question:** Is there a "Common" international business cycle in the data?
- **Answer: Yes, there evidence of sizable "world" factor in cross-country analysis.**
  - Gregory et al (1997); Kose et al (2003 & 2008); Stock and Watson (2005); Canova and Cicarelli (2009) and others.
- This "world" factor is particularly important to explain fluctuations in developed (stable) economies.

# Document this evidence with structural business-cycle models?

- **Multi-country business cycle analysis is painful:** Capturing interactions across countries is infeasible (Guerron-Quintana, 2012)
- **Practical Solution: "Partial" equilibrium** in which we take the rest of the world as a *given*.

## Two key contributions for SOE models:

- 1 They incorporate this "world" factor in a **tractable way** in a structural RBC.
- 2 In doing so, they force us to **drastically rethink** how we interpret some business cycle facts.

# A "General-Equilibrium" RBC for a SOE

- Take the standard one-good, two-country, RBC model (Baxter and Crucini, 1995)
- The two countries are **asymmetric** in size
  - 1 Small-Open Economy (SOE)
  - 2 The Rest of the World

# TFP Shock Processes

## Rest of the world (0)

$$\ln A_{0t} = \ln A_{0t}^P + \ln A_{0t}^T,$$

*Random walk* component  $\mapsto \ln A_{0t}^P = \ln A_{0t-1}^P + \ln \varepsilon_{0t}^P$

*Stationary* component  $\mapsto \ln A_{0t}^T = \rho_0 \ln A_{0t-1}^T + \ln \varepsilon_{0t}^T$ , where  $\rho_0 < 1$

## Small open economy (j)

$$\ln A_{jt} = \ln A_{jt}^P + \ln A_{jt}^T + \underbrace{\omega_j^P \ln A_{0t}^P + \omega_j^T \ln A_{0t}^T}_{\text{"Spillovers" from the rest of the world}}$$

# "General" vs "Partial" Equilibrium in SOE

## In **General-Equilibrium**,

The market clearing condition is:

$$\pi_0 (Y_{0t} - C_{0t} - I_{0t}) + \pi_j (Y_{jt} - C_{jt} - I_{jt}) = 0,$$

where  $\pi_j$  is the share of world GDP produced by the small country  $j$ .

## In **Partial-Equilibrium**:

Replace the equation above with an exogenous AR(1) process for the interest (discount) rate for international borrowing.

# Model Calibration

**Large country**  $\mapsto$  Weighted average of the G-8 (G7+Australia).

**Small country**  $\mapsto$  Each of the 68 small economies in the panel rotates in this role (Average moments are considered).



# Model Calibration

- 1 **First-Stage:** Simulate a **Closed Economy** version of the model.
  - Pick parameters in the TFP process for (0) to match observed moments of key G-8 macro variables.
- 2 **Second-Stage:** Simulate **Complete model**. Choose TFP parameters for each ( $j$ ) (including ROW spillovers,  $\omega_j$ ) to match:
  - Std. Dev. of Output ( $\sigma_Y$ )
  - Std. Dev. of Consumption ( $\sigma_C$ )
  - Cross-country Output correlation ( $j$  with the G-8 aggregate)
  - Cross-country Consumption correlation ( $j$  with the G-8 aggregate)

# Model Results: Rethinking some "facts" in RBC models.

## Two-Group of Countries:

**Developing:**  $\frac{\sigma_C}{\sigma_Y} > 0$       **Developed:**  $\frac{\sigma_C}{\sigma_Y} < 0$ .

- With Financial Integration, agents can easily smooth  $C$  when facing transitory income shocks  $\rightarrow \sigma_C < \sigma_Y$ .
- However, if income shocks are permanent consumption jumps on anticipation of higher income  $\rightarrow \sigma_C > \sigma_Y$ .
- **Aguiar-Gopinath: Permanent (transitory) TFP shocks drive the cycle in Developing (Developed) countries.**

# Rethinking some "facts" in RBC models

- **Main Result:** With this new GE approach, **Permanent TFP shocks also the main driver of the cycle in developed countries.**
- In particular, the world permanent shock ( $A_{0t}^P$ ) is Key (consistent with the empirical cross-country evidence)

## (My) intuition behind the results.

- Calibrated TFP shocks are set to match  $\sigma_{C_j}$  and  $\sigma_{Y_j}$ , but **also** the  $\text{corr}(\mathbf{Y}_j, \mathbf{Y}_0)$  and  $\text{corr}(\mathbf{C}_j, \mathbf{C}_0)$ .
- Data for **Developed Countries**:  
 $\text{corr}(\mathbf{Y}_j, \mathbf{Y}_0) = 0.49 > \text{corr}(\mathbf{C}_j, \mathbf{C}_0) = 0.37$ .
- **Not possible to match these moments without Permanent Shocks.**

# Why Permanent Shocks are important also in Developed Countries.?

Permanent shocks are key

- **If only transitory shocks (either domestic or worldwide) matter:**
  - International borrowing should allow for risk-sharing across countries  $\rightarrow \text{corr}(\mathbf{C}_j, \mathbf{C}_0) \simeq 1$
  - Contrarian to evidence:  $\text{corr}(\mathbf{C}_j, \mathbf{C}_0)$  is **quite low**.
- **Permanent Shocks will fundamentally improve the model fit,**

# Permanent Shocks in Developed Countries.

- **If we add permanent domestic shocks are sizable:**  
 $\text{corr}(\mathbf{C}_j, \mathbf{C}_0) \neq 1$  (As in the data)
  - Risk-sharing is more difficult with permanent idiosyncratic income shocks.
  - But...if this is the case:  $\text{corr}(\mathbf{Y}_j, \mathbf{Y}_0) \simeq 0$  in the model... while quite high in the data.
- **If we also add permanent world shocks with strong spillovers:**  
 $\text{corr}(\mathbf{Y}_j, \mathbf{Y}_0) > 0$ .

## Some Possible Extensions

To Further Validate the Model.

- Use the Solow residuals to estimate these TFP shocks.
- Use Bayesian methods estimate other model parameters and use likelihood principle to rank models.
- Extend the model to a two-good framework (i.e. BKK)→ Insights on Exch. Rate (Adress Backus-Smith Puzzle?)
- This framework **is flexible enough** to add another block of nations (E.g. BRICS). **This can enrich the analysis greatly....**

# Some Possible Extensions

## Garcia-Cicco, Pancrazi and Uribe (2010)

- RBC for SOE predicts a near random walk for consumption  $\rightarrow \frac{\text{Trade Balance}}{\text{Output}}$  also a ransom walk.
- However  $\frac{\text{Trade Balance}}{\text{Output}}$  closer to AR(1) process **quickly** converging to zero  $\rightarrow$  **Rejecting RBC.**
- **Their Solution:** Add one financial friction:  $r_t^* = f'(B_t^*), f'(\cdot) > 0$ .
- Country runs sustained deficits  $\rightarrow$  borrowing  $\uparrow$   
(i.e.  $\uparrow B_t^*$ )  $\rightarrow \uparrow r_t^* \rightarrow \frac{\text{Trade Balance}}{\text{Output}}$  must decline, thus converging to zero.



# Some Possible Extensions

## Garcia-Cicco, Pancrazi and Uribe (2010)

- This new General Equilibrium approach might **revalidate** the RBC.
- **Spillovers:** Robust growth in Major Emerging Markets  $\rightarrow \uparrow r_t^*$  (endogenously)  $\rightarrow$  **Forcing our SOE to rebalance.**

## Some Issues

- Emerging and Advanced economies may display diverging growth paths that can lead to explosive dynamics..
- To warrant a balanced-growth path, imposing a VECM to the TFP process may help when taking this model to the data.

# Conclusions

- Very interesting paper.
- Tractable model that can be easily extended to address many issues.
- It will force us to reconsider many "established" facts from the literature.