

# Trends and Cycles in Small Open Economies: Making The Case for a General Equilibrium Approach

by

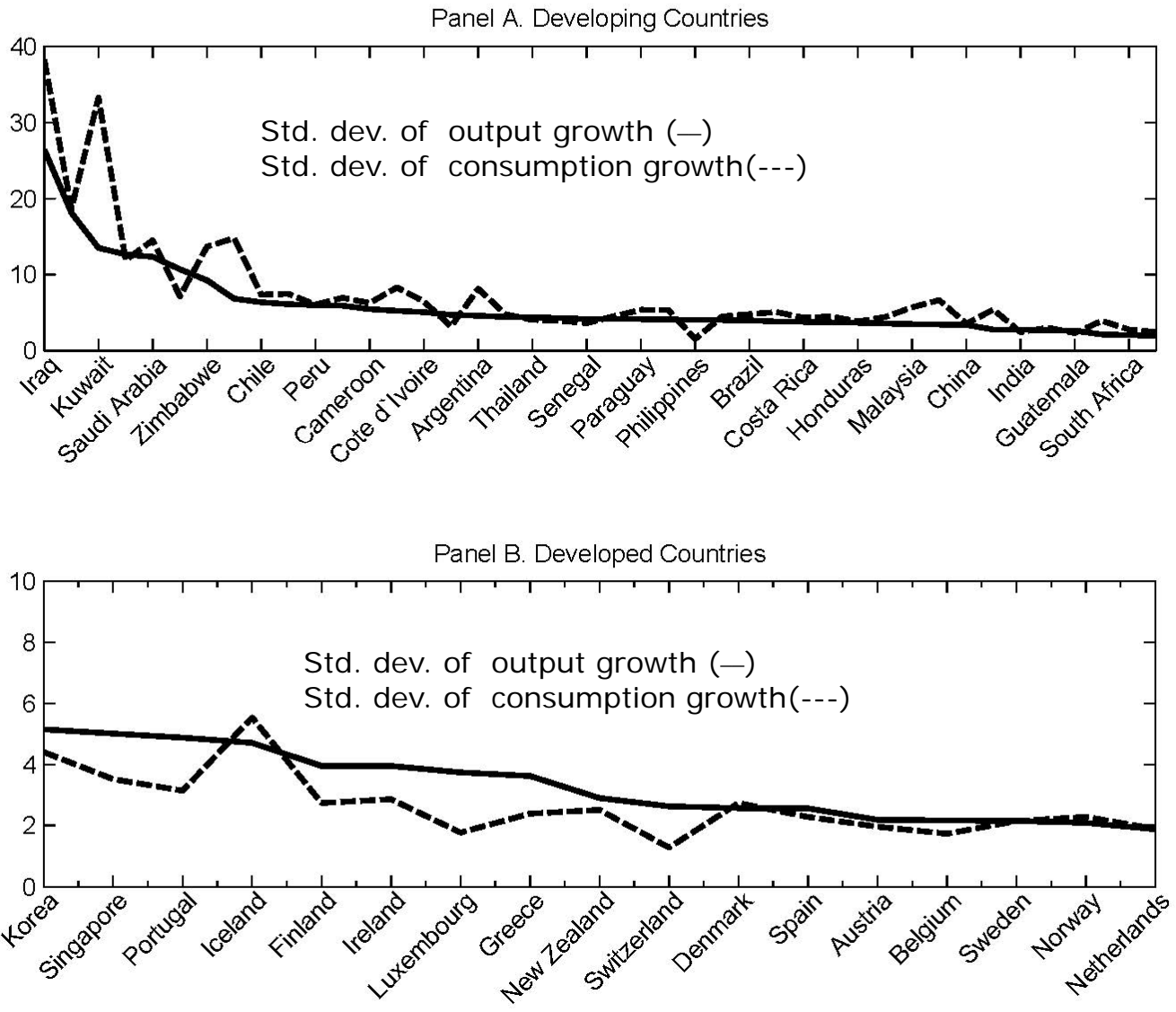
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## **WORKSHOP ON INTERNATIONAL ECONOMICS**

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Figure 1. International business cycles



# The Question

What are the relative contributions of permanent and transitory productivity shocks to a nation's output growth?

# Answers

**Aguiar and Gopinath (JPE, 2007)**

**“Emerging Markets: The Cycle is the Trend”**

Permanent component accounts for **84%** of growth variability in **emerging markets**.

Permanent component accounts for **61%** of growth variability in **developed economies**

# Answers

## This paper

Permanent component accounts for ~~84%~~ **52%** of growth variability in **emerging markets**.

Permanent component accounts for ~~61%~~ **60%** of growth variability in **developed economies**.

# Why the Big Change for Emerging Markets?

GE calibration matches output and consumption growth **volatility** (as in AG) but also output and consumption **correlations** with the G-8

Developing nation's comove less with the G-8 → **smaller spillover of G-8 permanent shock**

Serves as counterbalance to quite valid inference in AG that emerging markets are hit with large **idiosyncratic permanent shocks**.

# The Model

Baxter and Crucini (1995)

$$U(C_{jt}, L_{jt}) = \frac{1}{1 - \sigma} [C_{jt}^\theta L_{jt}^{1-\theta}]^{1-\sigma}$$

$$Y_{jt} = A_{jt} K_{jt}^{1-\alpha} N_{jt}^\alpha$$

$$K_{jt+1} = (1 - \delta)K_{jt} + \phi(I_{jt}/K_{jt})K_{jt}$$

*j* – country  
*t* – time period

# The PE versus GE Versions

## *Partial Equilibrium*

$$P_t^B B_{jt+1} - B_{jt} = Y_{jt} - C_{jt} - I_{jt}$$

$$\lim_{t \rightarrow \infty} \beta^t p_{jt} B_{jt+1} = 0$$

## *General Equilibrium*

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

*0 – the G-8 composite*



# The Productivity Shocks

$$\begin{bmatrix} \ln A_{jt} \\ \ln A_{0t} \end{bmatrix} = \begin{bmatrix} 1 & 1 & \omega_j^P & \omega_j^T \\ 0 & 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} \ln A_{jt}^P \\ \ln A_{jt}^T \\ \ln A_{0t}^P \\ \ln A_{0t}^T \end{bmatrix}$$

$$\ln A_{jt}^P = \ln A_{jt-1}^P + \ln \varepsilon_{jt}^P$$

$$\ln A_{jt}^T = \rho \ln A_{jt-1}^T + \ln \varepsilon_{jt}^T$$

*Partial equilibrium adds exogenous world interest rate*

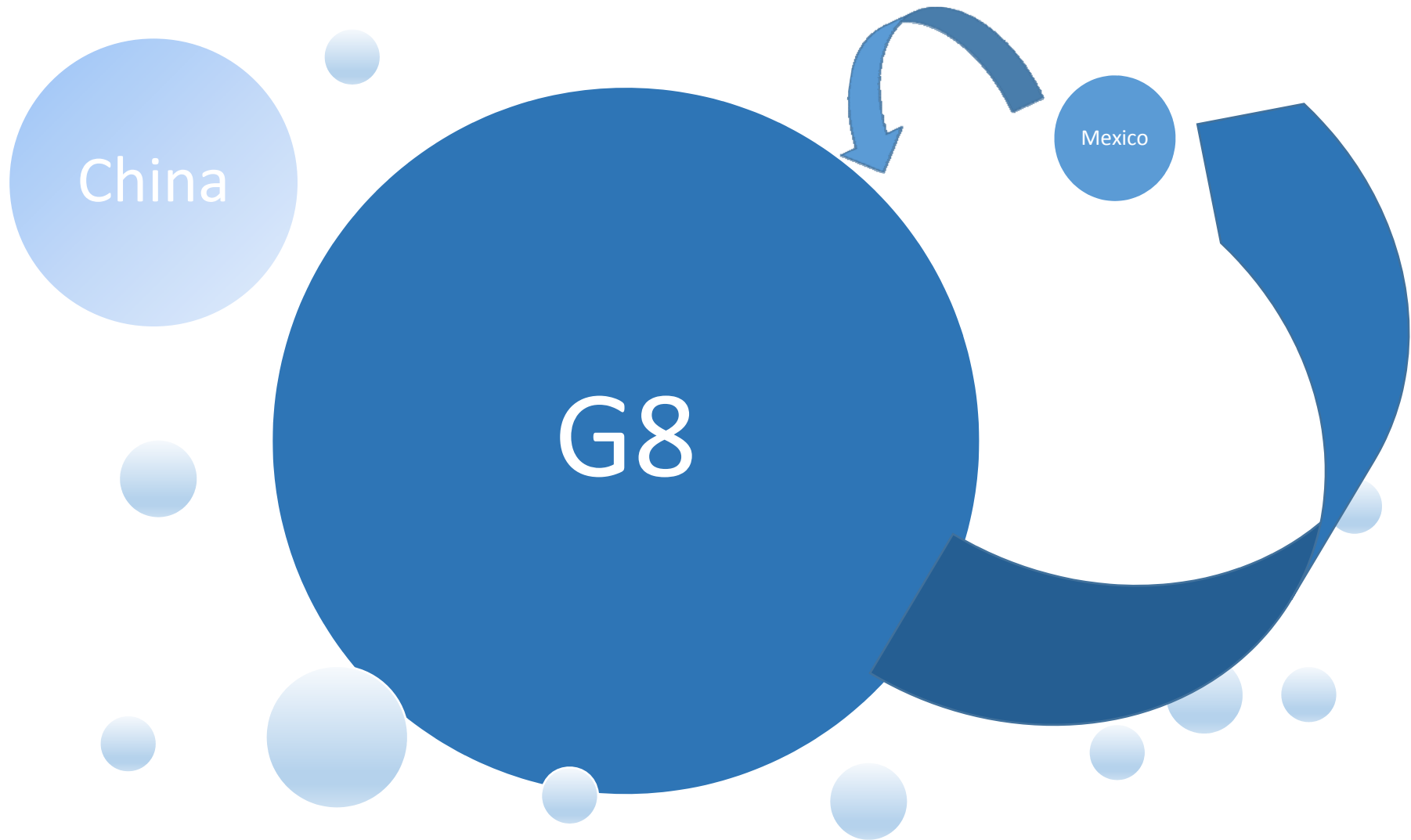
$$\ln P_t^B = \gamma_j \ln P_{jt-1}^B + \ln \varepsilon_{jt}^B$$

# The SOE Model

## Differences from Aguiar and Gopinath (2007)

- AG use debt-elastic interest rate no role for exogenous changes in world interest rates, we follow Mendoza and have an AR(1) process for the world interest rate.
- AG indicate the debt-elastic interest rate matters little, we show the world interest rate matters somewhat
- Adjustment costs in capital are convex rather than quadratic
- We show our SOE model tells the same basic story as AG, our GE model does not!

# Small Open Economies in General Equilibrium (Trick – take them one at a time!)



# Table 1 – G-8 Moment Matching, Closed Economy

|                                    | Data | Model       |
|------------------------------------|------|-------------|
| <b>Standard deviation of:</b>      |      |             |
| GDP growth                         | 1.80 | 1.94        |
| Consumption growth                 | 1.28 | 1.15        |
| Consumption-GDP ratio              | 1.44 | 1.32        |
|                                    |      |             |
| <b>G-8 productivity parameters</b> |      |             |
| Std. dev. of permanent shock       |      | <b>1.1</b>  |
| Persistence of transitory shock    |      | <b>0.85</b> |
| Std. dev. of transitory shock      |      | <b>1.2</b>  |

## Table 2 – SOE Moment Matching, GE Model

|                            | Developing |       | Developed |       |
|----------------------------|------------|-------|-----------|-------|
|                            | Data       | Model | Data      | Model |
| Std. Dev. of Con growth    | 7.77       | 7.74  | 2.45      | 4.43  |
| Std. Dev. of GDP growth    | 5.98       | 7.16  | 3.01      | 4.32  |
| Corr. with G-8 GDP growth  | 0.16       | 0.17  | 0.49      | 0.48  |
| Corr. with G-8 Cons growth | 0.04       | 0.04  | 0.37      | 0.38  |

Table 2 – Estimates of Productivity Processes  
(Reported: Cross-country averages)

|                             | Developing | Developed |
|-----------------------------|------------|-----------|
| Std. dev. relative to G-8   |            |           |
| $v_j^P \in [0.1,15]$        | 4.21       | 1.18      |
| $v_j^T \in [0.1,15]$        | 2.14       | 1.19      |
| Spillover factor loadings   |            |           |
| $\omega_j^P \in [-15,15]$   | 0.7        | 2.5       |
| $\omega_j^T \in [-15.1,15]$ | 0.6        | 0.3       |

# Table 4. Output Variance Decompositions Small Open Economy Model w/o spillovers

| Countries  | Variance Decomposition (source of shock) |                 |                     | Total | No. of countries | Std. dev. of Output |
|------------|--|-----------------|---------------------|-------|------------------|---------------------|
|            | Home Permanent                           | Home Transitory | World Interest Rate |       |                  |                     |
| All        | 48.6                                     | 44.0            | 7.5                 | 100   | 60               | 5.2                 |
| Developing | 59.9                                     | 35.4            | 4.7                 | 100   | 42               | 6.0                 |
| Developed  | 22.2                                     | 63.9            | 13.8                | 100   | 18               | 3.2                 |

Productivity spillovers are abstracted from here because they would not be identified in the SOE framework.

Figure 3. Proportion of output growth variance accounted for by permanent shocks:  
Comparison of SOE model with productivity spillovers to SOE model without spillovers

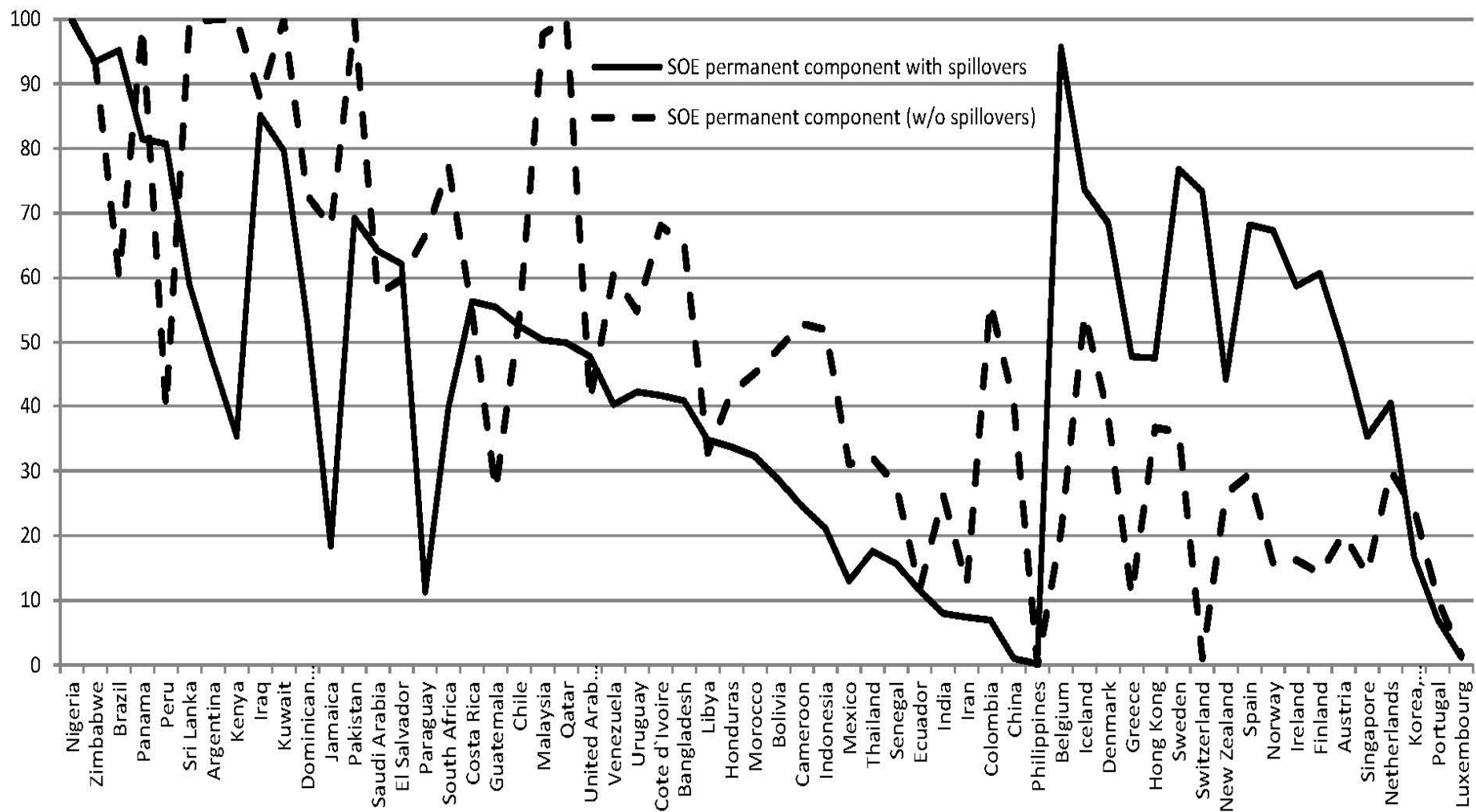
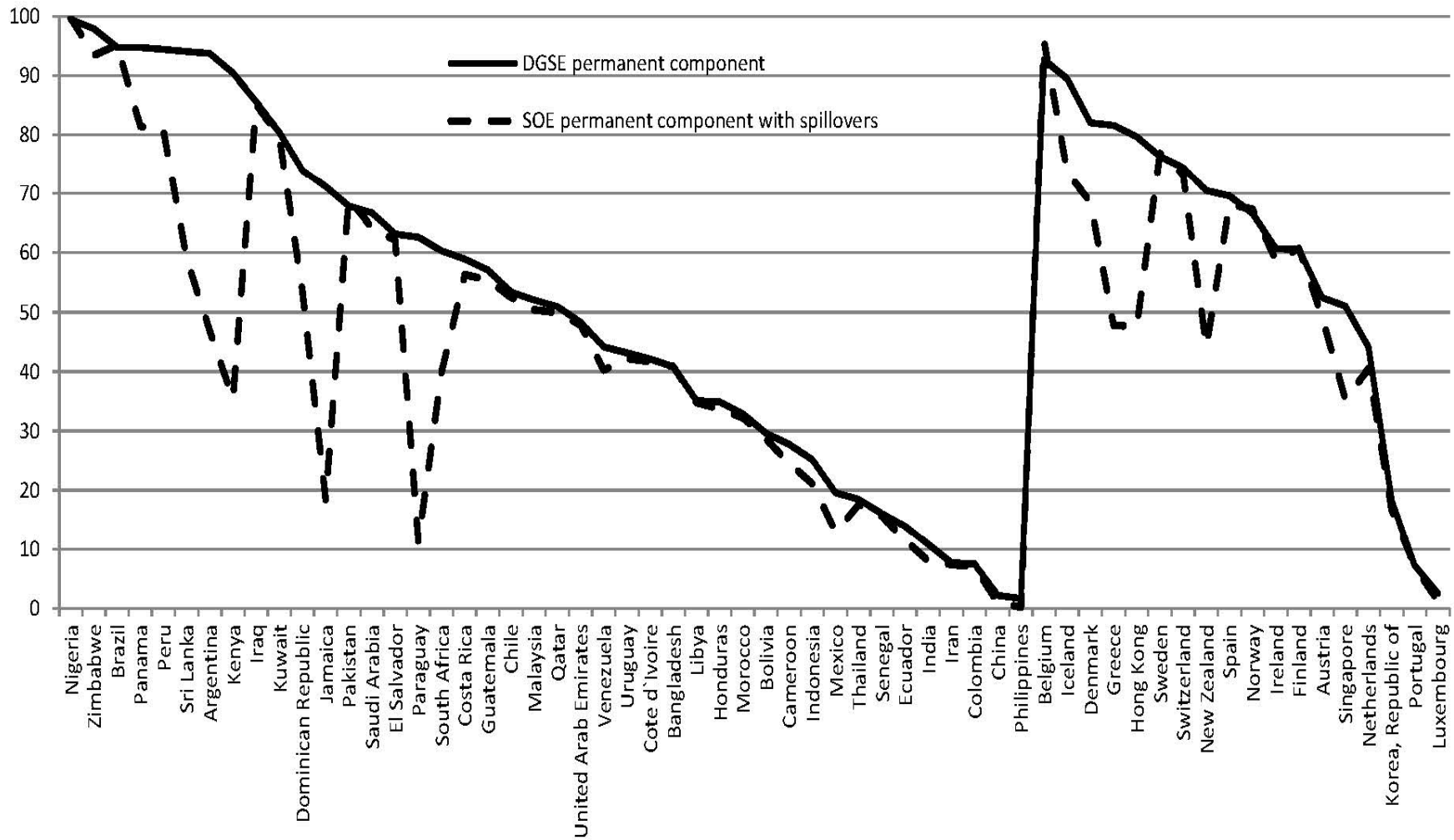




Table 5 – Output Variance Decompositions,  
DGSE Model

|            | Permanent   |             |             | Transitory  |      |      |
|------------|-------------|-------------|-------------|-------------|------|------|
|            | Total       | Home        | G8          | Total       | Home | G8   |
| Developing | <b>51.5</b> | <b>39.0</b> | 12.5        | <b>48.4</b> | 36.1 | 12.3 |
| Developed  | <b>60.0</b> | 14.4        | <b>45.5</b> | <b>40.0</b> | 29.3 | 10.7 |

Figure 2. Proportion of output growth variance accounted for by permanent shocks:  
Comparison of DGSE model and SOE with productivity spillovers



# Concluding Remarks

**We all know GE analysis is appropriate when studying large open countries.**

**Less well known is the importance of GE analysis when studying small open economies.**

**As first pointed out in Crucini (1991), in stochastic environments we need to know not only that a country is small enough to not affect world interest rates, we need to know how home and foreign shocks correlate. How idiosyncratic is the country?**

**The method outlined in this paper is not more demanding than the SOE model, but has starkly different business cycle implications.**

**Moreover, it allows all prices to be endogenous.**

# Thank you!

# Table 4. Output Variance Decompositions Small Open Economy Model

| Countries  | Variance Decomposition (source of shock) |                 |                     | Total | No. of countries | Std. dev. of Output |
|------------|--|-----------------|---------------------|-------|------------------|---------------------|
|            | Home Permanent                           | Home Transitory | World Interest Rate |       |                  |                     |
| All        | 48.6                                     | 44.0            | 7.5                 | 100   | 60               | 5.2                 |
| Developing | 59.9                                     | 35.4            | 4.7                 | 100   | 42               | 6.0                 |
| Developed  | 22.2                                     | 63.9            | 13.8                | 100   | 18               | 3.2                 |
| AG Sample  | 34.6                                     | 54.0            | 11.4                | 100   | 20               | 3.3                 |
| Developing | 49.9                                     | 47.2            | 2.8                 | 100   | 9                | 4.2                 |
| Developed  | 22.2                                     | 59.5            | 18.4                | 100   | 11               | 2.5                 |

Productivity spillovers are abstracted from here because they would not be identified in the SOE framework.

# Table 5 – Output Variance Decompositions, Model Comparison

|            | DGSE Model  |             |             |      | SOE Model |      |            |      |               |  |
|------------|-------------|-------------|-------------|------|-----------|------|------------|------|---------------|--|
|            | Permanent   |             | Transitory  |      | Permanent |      | Transitory |      | Interest Rate |  |
|            | Home        | G8          | Home        | G8   | Home      | G8   | Home       | G8   |               |  |
| Developing | <b>39.0</b> | 12.5        | <b>36.1</b> | 12.3 | 9.2       | 33.9 | 10.6       | 35.0 | 11.4          |  |
| Developed  | 14.4        | <b>45.5</b> | <b>29.3</b> | 10.7 | 38.6      | 13.2 | 9.2        | 28.8 | 10.2          |  |