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Presentation to
"Modelling East Asian economies in a small open economy VECM: the influence of international and domestic shocks"

Modelling East Asian economies in a small open economy VECM: the influences of international and domestic shocks

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Motivation

- Apply recent macroeconometric modelling techniques to ASEAN economies
  - address the issue of the source of international shocks in the region

- We want to relate to contemporary modelling techniques
  - DSGE models particularly for New Keynesian theory
  - structural VAR for empirical dynamics

- There is an identification problem in open economy modelling in DSGE and VAR models
  - often resolved by a small open economy assumption as here
  - longer term agenda is to move to interdependent economies

Aspects of the Solution

- Use contemporary NK theory as basis of restrictions
- A SVAR framework to capture dynamics
- explicit modelling of the long run
- separation of long and short run shocks

- Apply this framework to 5 ASEAN economies
  - Singapore, the Philippines, Thailand, Malaysia, Indonesia
  - Foreign effects represented by US or China

Outline

1. Introduction and some literature
2. A basic theoretical framework
3. Econometric specification
   1. Permanent versus transitory shocks
   2. VECM specification
4. Data
5. Results
   1. impulse response functions
   2. historical decompositions
6. Concluding remarks

Existing empirical literature

- 100s of VAR studies on the US, closed economy
  - classic benchmarks are Sims (1980, 1992)

- Common findings are:
  - price puzzle: tighter monetary policy does not result in lower inflation
  - exchange rate puzzle: increaeses in domestic interest rates do not result in appreciation of US dollar
  - but these are worked around and seem to work in general quite well

- New Keynesian DSGE models
  - largely Bayesian estimations: eg
    - Christiano, Eichenbaum, Evans (2005), Lubik and Schorfheide (2005), del Negro and Shorfheide (2008)
  - Calvo pricing, staggered contracts
    - Gali and Monacelli (2005) and Monacelli (2005)

Existing empirical literature
ASEAN economies

- Chow and Yoonbai (2003) 3 variable VARs in output
- Zhang et al (2004) 3 variable VAR for demand, supply, monetary policy shocks
- Huang and Feng (2006) 4 variable VAR, find some commonality amongst countries
- Zhang et al (2010) closest to us
  - structural VAR with exogenous US shocks
  - find US shocks to be a dominant influence

A Basic Theoretical Framework

- A stylized small open economy model IS curve, NK Phillips curve, monetary policy reaction function, UIP condition

$$
\begin{aligned}
y_t &= \mu E_t(y_{t+1}) + (1 - \mu)y_{t-1} + \phi(r_t - E_{t-1}\pi_t) + \theta_1 \Delta q_t \\
&\quad + \theta_2 y_t^* + \epsilon_{AD,t} \\
\pi_t &= \delta E_t \pi_{t+1} + (1 - \delta)\pi_{t-1} + \lambda y_t + \theta_3 \Delta q_t + \epsilon_{AS,t} \\
r_t &= \rho r_{t-1} + (1 - \rho)(\beta E_t \pi_{t+1} + \gamma y_t) + \epsilon_{MP,t} \\
E_t(\Delta q_{t+1}) &= (r_t - E_t \pi_{t+1}) - (r_t^* - E_t \pi_{t+1}^*) - \epsilon_{RER,t}
\end{aligned}
$$

$$
\begin{aligned}
y_t(y_t^*) &: \text{ domestic (foreign) output gap} \\
r_t &: \text{ domestic nominal interest rate} \\
\pi_t &: \text{ domestic inflation rate} \\
q_t &: \text{ real exchange rate}
\end{aligned}
$$

Empirical framework

- We want to use a SVAR approach building on the theoretical relationships
- Want SVAR for empirical coherence, allows better dynamics
- Innovation:
    - using the properties of the data (empirical and theoretical) to provide identification
    - accounting for changes in exchange rate regime in some ASEAN economies in 1997/1998

Empirical Framework

- Properties of the data
  - We know that y_t, q_t, y_t^* will be I(1)
  - In fact from the IS equation we know they should cointegrate
  - Therefore we will have a mix of permanent and transitory shocks in the system

- This leads us naturally to a SVECM framework
  - but we will need to be able to encompass I(0) and I(1) variables within it
    - solution suggested by Pagan and Pesaran (2009)

Empirical Framework

- SVECM

$$B(L)\Delta Y_t = \Pi Y_{t-1} + \varepsilon_t = \alpha\beta' Y_{t-1} + \varepsilon_t$$

  with B_0 nonsingular and $E(\varepsilon_t \varepsilon_t')$ diagonal

- Partition the $n \times 1$ vector $Y_t = (Y_{1t}', Y_{2t}')'$ has r cointegrating vectors
  - Y_{1t} is $((n-r) \times 1)$ which experience permanent shocks
  - Y_{2t} is $(r \times 1)$ which experience temporary shocks

Empirical Framework

- Common trends representation

$$\Delta Y_t = F(L)(B_0)^{-1}\varepsilon_t$$

  where $F(L) = I_{n+k} + F_1 L + F_2 L^2 + ...$
- and $F(1) = F$

$$F = \beta_\perp \left[\alpha'_\perp \Psi(L) \beta_\perp \right] \alpha_\perp^{-1},$$

  with $\alpha'_\perp \alpha = 0$, $\beta'_\perp \beta = 0$, $F\alpha = 0$ and $\beta' F = 0$.

- Practically what does this mean?
    - means we can partition the matrix and figure out what happens in the case of permanent and transitory shocks

Empirical Framework

- Take the first $(n-r)$ permanent shocks represented with ε_{1jt} and the ε_{2jt} to be transitory

$$\Delta Y_t = F(L)(B_0)^{-1} \begin{pmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{pmatrix}$$

Empirical Framework

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- So we know the effects of the transitory shocks on $\Delta Y_t = 0$ so

$$F(B_0^*)^{-1} \begin{pmatrix} 0_{(n-r) \times r} \\ I_{r+k} \end{pmatrix} = 0$$

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$$\begin{pmatrix} 0_{(n-r)\times r} \\ I_{r+k} \end{pmatrix} = B_0^* \alpha R = \alpha^* R = \begin{pmatrix} \alpha_1^* R \\ \alpha_2^* R \end{pmatrix}$$

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- MEANS: that transitory shocks may have a non-zero error correction term, *permanent shocks must have a zero error correction term*

Empirical Framework

- One further important aspect:

Empirical Framework

- One further important aspect:
  - exchange rate regime changes are handled with an interactive dummy variable specification for the break

$$B(L)\Delta Y_t + B^*(L)D_t\Delta Y_t = \Pi_1 Y_{t-1} + D_t\Pi_2 Y_{t-1} + \varepsilon_t$$

where
$$D_t = \left\{ \begin{array}{l} 0 : \text{before regime change} \\ 1 : \text{after regime change} \end{array} \right.$$

Application: the long run

- from the IS equation we should have cointegrating vector between

    - y_t ASEAN country GDP
    - y_t^* US GDP
    - q_t real exchange rate

- This is $3 \times$ I(1) variables, with 1 cointegrating vector $\Rightarrow$ 2 permanent shocks

- Assume these originate in y_t and y_t^*

The structural form:

- $\left\{ y_t^*, \cancel{\pi_t^*}, \cancel{r_t^*}, y_t, \pi_t, r_t, q_t \right\}$, augment the Phillips curve with exogeneous oil price inflation

$$
\begin{bmatrix}
1 & & & & \\
b_{21}^0 & 1 & & & \\
& b_{32}^0 & 1 & & \\
& b_{42}^0 & b_{43}^0 & 1 & \\
b_{51}^0 & b_{52}^0 & b_{53}^0 & b_{54}^0 & 1
\end{bmatrix}
\Delta Y_t = \alpha \beta' Y_{t-1}
$$

$$
+ \begin{bmatrix}
b_{11}^l & 0 & 0 & 0 & 0 \\
b_{21}^l & b_{22}^l & b_{23}^l & b_{24}^l & b_{25}^l \\
0 & b_{32}^l & b_{33}^l & 0 & b_{35}^l \\
0 & b_{42}^l & b_{43}^l & b_{44}^l & 0 \\
b_{51}^l & b_{52}^l & b_{53}^l & b_{54}^l & b_{55}^l
\end{bmatrix}
\Delta Y_{t-1} +
\begin{bmatrix}
0 \\
c \\
0 \\
0 \\
0
\end{bmatrix}
oil_t + \epsilon_t
$$

- where

$$\alpha\beta' = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & \alpha_{32} & 0 \\ 0 & \alpha_{42} & \alpha_{43} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} \end{bmatrix} \begin{bmatrix} \beta_{11} & 1 & 0 & 0 & \beta_{51} \\ 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 0 \end{bmatrix}$$

- ~~note that UIP is not imposed as there is little empirical support in the literature~~

Data

- Variables list: $\left\{ y_t^*, \pi_t^*, r_t^*, y_t, \pi_t, r_t, q_t \right\}$
- Sample period: 1986Q1 to 2009Q4
- Estimated with 3 lags in levels (2 lags in changes)
- dummy variable added for 1997Q3 to 1998Q4

- Show the example of Singapore for the impulses
- Historical decompositions for Singapore, Thailand, Malaysia
- Influence of foreign shocks from US and China for all countries

Singapore
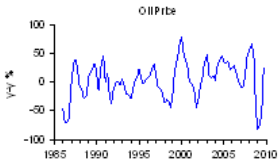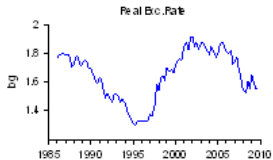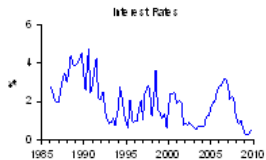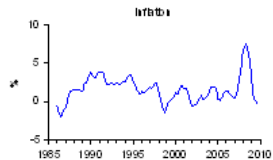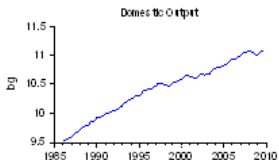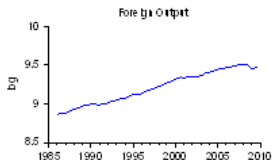
Impulse responses for foreign output shock in Singapore
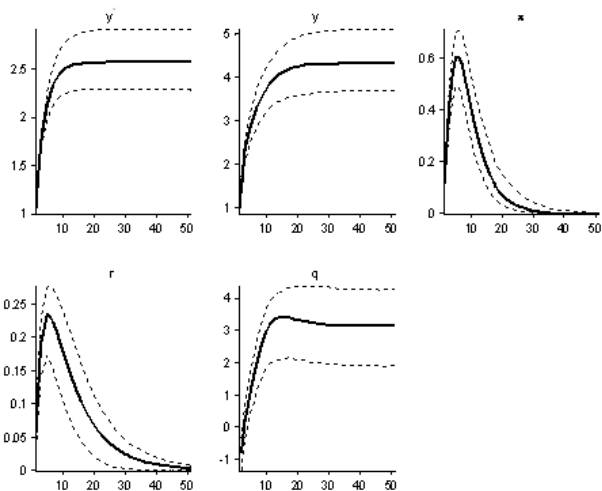
Historical Decomposition: Singapore output
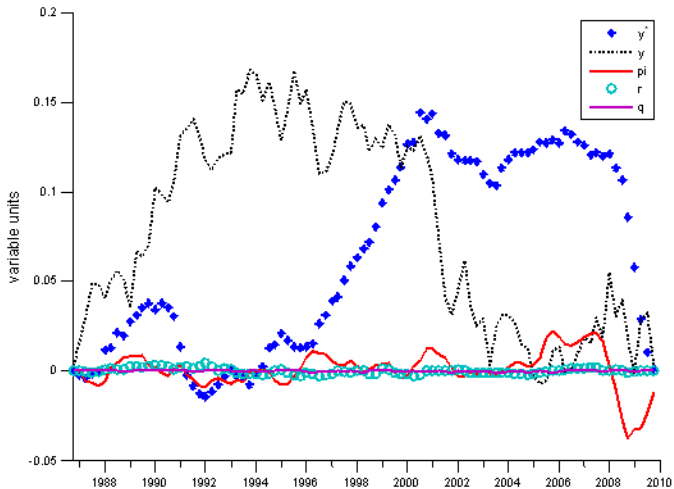
Historical Decomposition: Singapore inflation
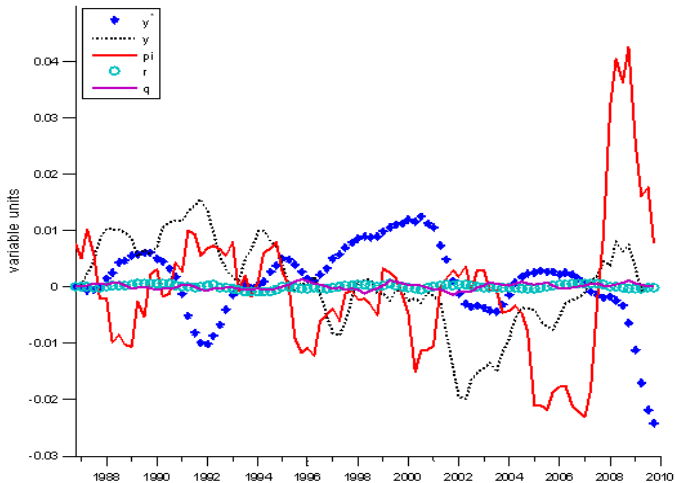
Historical Decomposition: Singapore

- Output decomposition:
  - prior to 2001 domestic output shocks largest contributor to variation in output
  - after Asian crisis influence of foreign shocks started to rise
  - from June 2001 foreign shocks exceeded domestic shocks
  - after Sept 2007 positive impact of foreign shocks falls, corresponds to financial crisis

- Inflation decomposition:
  - Inflationary pressures from domestic inflation shocks from March 2008
  - substantial offset from foreign output shocks - global financial crisis
  - 2004-2008 foreign inflation shocks reduced Singaporean output volatility

- Summary: Singaporean economy had dramatic change of focus for sources of output variation in the period

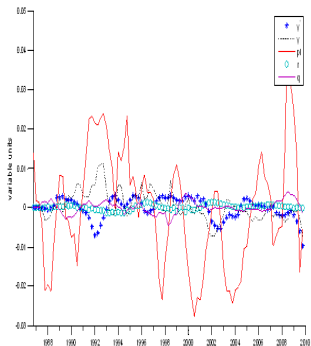# Historical Decomposition: Thailand

Output | Inflation
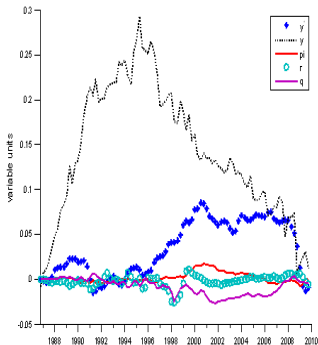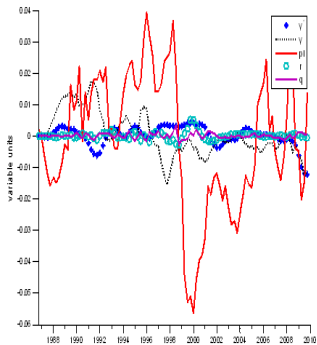
- output: contribution of foreign shocks begins to increase after Asian crisis
- inflation: domestic ~~monetary policy~~ shocks are evident source (other than own shocks)
- suggests model not great for this country

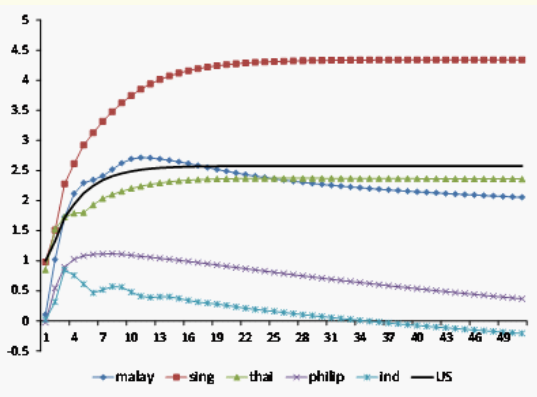# Historical Decomposition: Malaysia
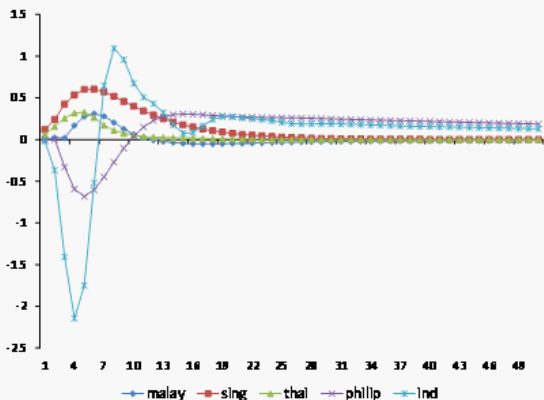
Output   Inflation
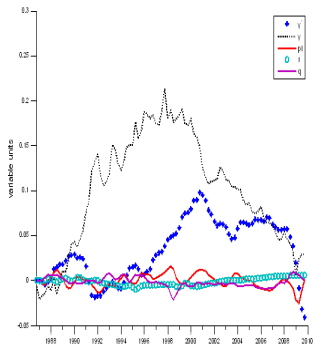
- output: contribution of foreign shocks begins to increase after Asian crisis
- inflation: persistent and affected by own past behaviour

# Comparing responses to US output shicks: Output responses

- Singapore most sensitive to shock, followed by Thailand, Malaysia
- lines up with degree of openness of the different economies

Comparing responses to US output shocks: Inflation responses

- inflation response in Singapore, Thailand, Malaysia synchronised
- Philippines, Indonesia negative - effects of 1997 need work

Comparing responses to US output shocks: Interest rate responses
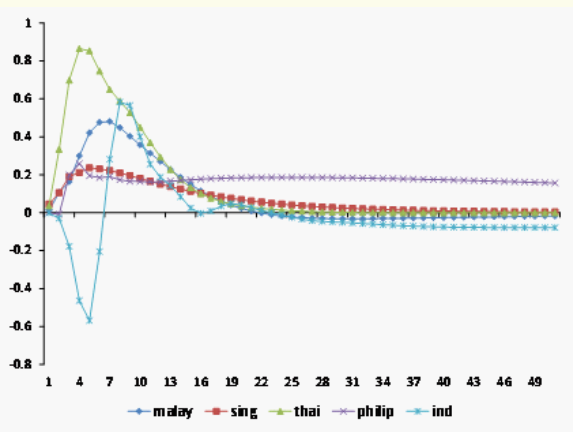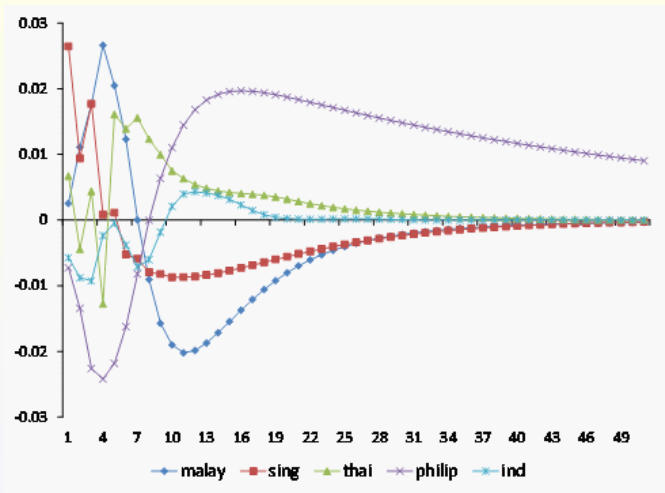

- central banks react to increased AD by increasing interest rates
- except Indonesia where price puzzle exists

Chinese output shocks: output responses

- replace the role of US in the model with the Chinese economy
- consider the role of Chinese output shocks to compare the models
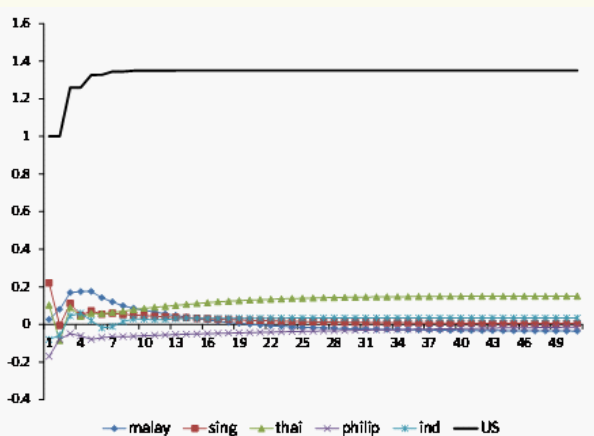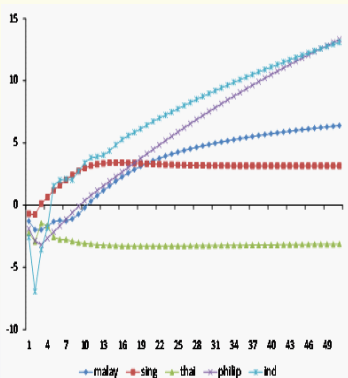
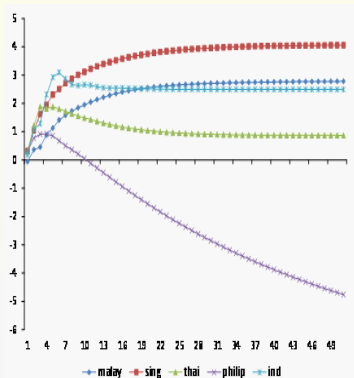# Chinese output shocks: inflation responses

- these are very small,

Output shocks: exchange rate responses

US   Chinese

- scale for Chinese responses is 1/3 of the size of US.
- output shocks are the same size

Summary

- output shocks from China result in smaller responses in the ASEAN countries
- Chinese shocks are comparatively less important than US shocks of same size
  - consistent with Zhang et al (2010)
- Evidence is that more explanatory power is gained using US than China despite China's growing importance
  - Could be because
    - importance of US as source of final demand for Asian production
    - trade contracts priced in US dollar
- Paper has implemented a modern SVECM framework for ASEAN economies relatively successfully
  - challenges are to extend to proper 3 country model to allow ASEAN/US/China interactions