International transmission of shocks:
A time-varying FAVAR approach to the Open Economy

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Abstract
A growing literature has documented changes to the dynamics of key macroeconomic variables in industrialized
countries and highlighted the possibility that these variables may react differently to structural shocks over time.
This paper introduces an empirical model which allows the estimation of time-varying response of a large set of
domestic variables to foreign money supply, demand and supply shocks.

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Motivation

What we do in the paper:

- Extends the open economy FAVAR models to allow for time variations
- Examine possible changes to the transmission of international shocks: foreign monetary policy, demand and supply
- The model captures the changing co-movements among the macroeconomic time series by allowing their dependence on common factors to evolve over time
- Also allows for stochastic volatility in the innovation process of the factors
Why is this interesting or useful?

- Understanding of the international transmission mechanism is an essential ingredient for policy discussions.

- Small-scale SVAR studies often encounter many open economy “anomalies”.

- Different identification schemes have had mixed successes.\(^1\)

- Bernanke et al. (2005) propose using FAVAR for structural analysis to overcome limited information problem \(\Rightarrow\) helps with closed economy “anomalies”

- Boivin and Giannoni (2008), and Mumtaz and Surico (2008) extend the FAVAR to open economy framework \(\Rightarrow\) many of the open economy anomalies disappear.

- The great moderation literature had documented significant fall in inflation and output volatility.

\(^1\)More references included in the paper.
Moreover, detect changes in the domestic transmission mechanism

Fix coefficient model estimates only tell us the “average of the past”

Unsatisfactory to simply assume the size and the transmission of international shocks has not changed over this period

Main contribution of the paper:

- assess possible changes to the transmission of world monetary policy, demand and supply shocks on the U.K. economy
- derive dynamic responses for a wider range of economic indicators
- robust identification: large dataset and agnostic structural identification scheme
The small open economy FAVAR model

Transition equation:

\[
\begin{pmatrix}
F^*_t \\
F^*_{Uk}
\end{pmatrix} =
\begin{bmatrix}
B_{11}(L) & 0 & 0 \\
B_{21}(L) & B_{22}(L) & B_{23}(L) \\
B_{31}(L) & B_{32}(L) & B_{33}(L)
\end{bmatrix}
\begin{pmatrix}
F^*_{t-1} \\
F^*_{t-1} \\
R_{t-1}
\end{pmatrix}
+ u_t
\]

(1)

The structure of \( B(L) \) reflects the small open economy assumption such that domestic factors do not impact on world factors, but not the vice versa; and \( u_t = \Omega_t^{1/2} e_t \), where \( \Omega_t = A_{0,t} (A_{0,t})' \). The time-varying covariance matrix of the VAR innovations, \( u_t \), can be factored as

\[
\text{Var}(u_t) \equiv \Omega_t = A_t^{-1} H_t (A_t^{-1})'
\]

(2)
**Observation equation:**

\[
\begin{pmatrix}
    X_t^Y^* \\
    X_t^\pi^* \\
    X_t^R^* \\
    X_t^{UK} \\
    R_t
\end{pmatrix}
= \begin{pmatrix}
    \Lambda_t^Y^* & 0 & 0 & 0 & 0 \\
    0 & \Lambda_t^\pi^* & 0 & 0 & 0 \\
    0 & 0 & \Lambda_t^R^* & 0 & 0 \\
    0 & 0 & 0 & \Lambda_t^{UK} & \Lambda_t^R \\
    0 & 0 & 0 & 0 & 1
\end{pmatrix}
\begin{pmatrix}
    F_t^Y^* \\
    F_t^\pi^* \\
    F_t^R^* \\
    F_t^{UK} \\
    R_t
\end{pmatrix}
+ v_t
\]  

(3)

\[v_t = \rho(L)v_t + \epsilon_t\]  

(4)

The structure of \( \Lambda \) matrix reflects the factor identification restrictions.\(^2\)

**Note:**

1. the factor loading \( \Lambda \) is time-varying (the nature of co-movement changes over \( t \)), all TV coefficients are assumed to follow RW

2. (1) and (3) are closely related to Canova and Ciccarelli’s (2006) “large” VAR

\(^2\)We assume that all real activity series in the foreign block of the model share a common dynamics and that such common dynamics is not shared by any other series in the panel. The domestic factors are not explicitly identified.
Estimation - Multi-step Gibbs sampling

In state-space form:

\[ F_t = B(L)F_t + e_t, \text{ where } e_t \sim N(0, \Omega_t) \text{ and } \Omega_t = A_t^{-1}H_t \left( A_t^{-1} \right)' \] (5)

\[ X_t = \Lambda_t F_t + v_t, \text{ where } v_t = \rho(L)v_t + \epsilon_t \text{ and } \epsilon_t \sim N(0, R) \] (6)

- Break the complex problem (sampling from the joint posterior distribution) into a sequence of tractable ones (sampling from the conditional distributions), see Kim and Nelson (1998) and Carter and Kohn (1994)

- Quarterly data from 1974Q1 to 2005Q1 which span 17 countries and 560 series
International co-movements

Figure 1: Standardized foreign factors (light blue band is the 95% confidence intervals)
A stylized view of the transmission of MP* shock

Foreign monetary expansion ($R^*$ falls)

Appreciation of sterling ($Q$ increases)

UK activities (depend on ES/IE)

Producer currency pricing
- PPP holds
- ToT improves as UK exports more expensive and imports are cheaper
- Expenditure switching (ES) effect from UK to foreign goods
- $Y^*$ rises while $Y$ falls
- Beggar-thy-neighbour scenario

Local currency pricing
- Imperfect ERPT
- PPP does not hold
- ToT improves by less because imports are not cheaper (priced in £)
- Less incentive for UK consumer to buy foreign goods
- $Y^*$ rises while $Y$ may rise

Positive income effect (IE) from lower $R^*$
An unanticipated increase in world interest rates
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Time-varying IRF

Accumulated response: 1975 and 2004

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Concluding remarks

- Our results are robust to different identification scheme, eg: Choleski

- Key results:
  - Evidence of switch from PCP to LCP changes the transmission of foreign monetary policy shocks substantially
  - In the period before 1990, the U.K. response resembles the classic beggar-thy-neighbour scenario
  - The muted response of asset prices to the MP* shock in the recent period suggest the recent increase asset prices are attributed to other shocks