On the international transmission of productivity shocks

On the International Transmission of Productivity Shocks

Daniela Buscaglia

University of Pavia

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Introduction

The paper represents an empirical contribution to the study of international spillovers of Real Business Cycle shocks. I address to the international transmission of productivity shocks in the tradable sector on RER and NX.

Key issues:

*international relative price provide insurance against shocks?*
*a technology shock generates positive or negative international transmission?*
Usually, after a positive productivity shocks in the tradable sector:

- decrease in the export prices due to higher tradable supply, so that WORSENING in the TOT
- increase in price level due to Harrod-Balassa-Samuelson effect

Resultant RER dynamics:

- RER DEPRECIATION if TOT worsening prevails
- RER APPRECIATION if HBS effect prevails
Complete markets

Standard IRBC literature (Stockman and Tesar (1995)) assumes either complete markets or high degree of risk sharing.

\[ \frac{U_k^*}{U_k'} = \phi RER_k \]

A positive idiosyncratic productivity shock that increase the supply of tradable generates a decrease in the international price of the domestic goods, so that a worsening in TOT and a deterioration in the RER.

The international spillover is positive: foreigners can buy at cheaper prices, initial gap between wealth at home and abroad is reduced and consumption risk decreases.
Empirical evidence (Backus and Smith (1993)) suggests lack of international consumption risk sharing. We need to understand more deeply the relative price movements following a productivity shock. Corsetti, Dedola, Leduc (2008) show that assuming strong wealth and demand effects the traditional transmission mechanism is reversed. Key variables:

- elasticity of substitution between H and F goods ($\omega$), a measure of homogeneity between goods
- share of domestically produced goods in home consumption expenditure ($a_H$), a measure of home bias.
Incomplete markets II

General equilibrium implications:

- **Positive international transmission** if $\omega > \frac{1}{2a_H}$

shock - output increase - fall in export prices - worsening TOT & depreciation

RER

shock - output increase & strong demand increase (home bias) - rise in P -
appreciation in TOT & in RER

shock - output increase - strong fall in P - high TOT worsening - C* rises
compared to C
Incomplete markets II

General equilibrium implications:

- **positive international transmission** if $\omega > \frac{1}{2a_H}$

  - shock - output increase - fall in export prices - worsening TOT & depreciation RER

- **negative international transmission** if $0 < \omega < \left(1 - \frac{1}{2a_H}\right)$

  - shock - output increase & strong demand increase (home bias) - rise in P - appreciation in TOT & in RER

  - shock - output increase - strong fall in P - high TOT worsening - $C^*$ rises compared to C
General equilibrium implications:

- **positive international transmission** if $\omega > \frac{1}{2a_H}$
  
  shock - output increase - fall in export prices - worsening TOT & depreciation RER

- **negative international transmission** if $0 < \omega < \left(1 - \frac{1}{2a_H}\right)$
  
  shock - output increase & strong demand increase (home bias) - rise in P - appreciation in TOT & in RER

- **excessively positive international transmission** if $\left(1 - \frac{1}{2a_H}\right) < \omega < \frac{1}{2a_H}$
  
  shock - output increase - strong fall in P - high TOT worsening - C* rises compared to C
Model

I estimate a traditional reduced form VAR model

\[ Y_t = B(L) Y_{t-1} + u_t \]

where \( Y_t \) is an \((m \times 1)\) vector of variables of interest at date \( t = 1, \ldots, T \), \( B(L) \) is a lag polynomial of order \( p \) and \( u_t \) is the prediction error with variance-covariance matrix \( \Sigma \)

- all variables are in logs and seasonally adjusted
- data are quarterly, spanning from 1970q1 to 2006q2
- each specification is tested for two countries in terms of cross-country differentials: US vs ROW and UK vs ROW
- the VAR is estimated in levels, taking into account of any possible stochastic or deterministic trend and also possible cointegration relationships (Sims, Stock, Watson (1990), see also Dedola and Neri (2007) and Peersman and Straub (2009))
Uhlig (2005) proposed an informal identification criterion for shocks in order to reply to the "circularity problem" affecting macroeconomic literature:

- The effects of a shock are identified by directly imposing sign restrictions on the impulse responses of some variables
- Restrictions imposed come from stylized facts of the literature
- The sign of the variables of interest is left unconstrained, agnostically open, letting data to decide

**Crucially, the sign restriction allows to impose assumptions that seem to be the least controversial implication of a particular shock and that seem to be the distinguishing features of that particular shock compared to other shocks proposed in the literature**
I identify an asymmetric positive technology shock on labour productivity in manufacturing sector; the shock is one s.d. in size and it is persistent \((k=20)\).

My interest is on the effects of the shock on the RER and on the trade balance

**Sign restrictions on VAR variables**

\[ \begin{align*}
\text{Specification 1} & \quad (a_j - a_{rw}) > 0 \\
& \quad (y_j^M - y_{rw}^M) > 0 \\
& \quad (y_j^M - y_j) > 0 \\
& \quad (PPI / CPIs) < 0 \\
\text{CPI based RER free} & \quad \text{TOT free} \\
\text{Specification 2} & \quad (a_j - a_{rw}) > 0 \\
& \quad (y_j^M - y_{rw}^M) > 0 \\
& \quad (y_j^M - y_j) > 0 \\
& \quad (PPI / CPIs) < 0 \\
\text{PPI based RER free} & \quad (NX / GDP) free \\
\text{Specification 3} & \quad (a_j - a_{rw}) > 0 \\
& \quad (y_j^M - y_{rw}^M) > 0 \\
& \quad (y_j^M - y_j) > 0 \\
& \quad (PPI / CPIs) < 0 \\
\text{TOT free} & \quad (NX / GDP) free
\end{align*} \]
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United States

Specification 1 US

Table: US Impulse Responses

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US Results

- sizable and persistent increase in labour productivity, in relative manufacturing output, in domestic manufacturing output over GDP;
- fall in the ratio between PPI and services CPI;
- clear results for the variables left unconstrained:
  
  deterioration in the NX/GDP ratio
  strong CPI-based RER appreciation

- results from second and third specification very similar to the former ones
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United Kingdom

Table: UK Impulse Responses

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UK Results

- sizable and persistent increase in labour productivity, in relative manufacturing output, in domestic manufacturing output over GDP;
- fall in the ratio between PPI and services CPI;
- clear results for the variables left unconstrained:
  - deterioration in the NX/GDP ratio
  - PPI-based RER depreciation
- results from second and third specification very similar to the former ones
US vs UK

- responses of RERs is of the opposite sign (US appreciation, UK depreciation) and always bigger in the UK case
- worsening of the TOT is stronger in the UK

Relating these results to the relevant economic theory:
- **US negative international transmission**
US vs UK

- responses of RERs is of the opposite sign (US appreciation, UK depreciation) and always bigger in the UK case
- worsening of the TOT is stronger in the UK

Relating these results to the relevant economic theory:

- **US negative international transmission**
- **UK excessively positive transmission**
Robustness check

- relative consumption persistent increase in the US and decrease in the UK
- consumption in level found positive for both US and UK, against the idea of immiserizing growth
- results broadly unchanged varying the restriction horizon, adding or subtracting 8 quarters relatively to the baseline specification
Relative Consumption

Table: Relative Consumption
Conclusions

- This paper provide empirical evidence of the main features of the international transmission of a productivity shock in the manufacturing sector.
- Two countries are considered: US, closed and big country, and UK, small and open one. In both cases, macroeconomic dynamics in response to productivity shocks are dominated by movements in domestic absorption and wealth effects.
- International risk sharing finds no empirical support.
- To test international transmission mechanisms differentiated for different degrees of openness and size of countries is a promising avenue of future research.