How important are commodity prices shocks? A small open economy analysis

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Proposal

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Motivation

- Commodity exporting economies are exposed to several external shocks:
  1. foreign interest rate (Neumeyer and Perri, 2005; Uribe and Yue, 2006)
  2. global GDP (Canova, 2005; Cesa-Bianchi *et. al.*, 2012)
  3. commodity prices.
- However, the quantitative importance of commodity prices for these economies is still an open question.
- Mendoza (1995) and Kose (2002) find that commodity prices are important (explaining 30 perfect of GDP), while Schmitt-Grohe and Uribe (2018) find that they do not account for much (10 percent of GDP).

Literature Review

- Cespedes and Velasco (2012): Impact on output and investment. Output response depend on the degree of exchange flexibility.
- Fornero *et. al.* (2016): Impact on investment (mining sector) highly depends on the temporal nature of the price shock.
- Fernandez *et. al.* (2015): Country's risk premium amplifies commodity prices shocks for emerging economies.
- Shousha (2016): Introduce working capital constraints as an amplification mechanism.
- Garcia-Cicco *et. al.* (2017): Financial intermediation as another amplification mechanism.

Research Question

- How important are commodity prices for business fluctuations in commodity-exporting economies?
- Has the impact changed along time?
- Objective: Study the dynamic impact of commodity prices on a set of macroeconomic variables (specially GDP).

Contribution

- The studies previously cited rely on the estimation of individual VAR's models. However, the shock that I want to study is common to all the countries. In that sense, a simultaneous estimation seems more appropriate.
- The standard VAR model does not take into account the interaction among countries and the time-varying effect of the shock.
- Shousha (2016) uses a Panel VAR but it imposes homogeneity of the parameters.
- The model that I proposed (Multi-Country VAR estimated with Bayesian Methods) takes into account dynamic inter-dependencies and time-varying parameters.
- Also, it allows to explore the transmission at different dates of external shocks.

Empirical Model: The Multi-Country Panel VAR model

The statistical model employed in this paper has the form:

$$y_{it} = D_{it}(L)\, Y_{t-1} + F_{it}(L)\, Z_t + c_{it} + e_{it} \tag{1}$$

where

- $i = 1, \ldots, N$ refers to countries and $t = 1, \ldots, T$ refers to time periods.
- y_{it} is a $M \times 1$ vector of endogenous variables for each country i and $Y_t = (y'_{1t}, y'_{2t}, \ldots, y'_{Nt})'$.

$$D_{it}(L) = D_{it,1} + D_{it,2}L + \cdots + D_{it,p}L^{p-1}$$

$$F_{it}(L) = F_{it,0} + F_{it,1}L + \cdots + F_{it,q}L^{q}$$

The Multi-Country Panel VAR model

Equation (1) can be rewritten in a compact form as

$$Y_t = W_t \delta_t + E_t, \qquad E_t \sim N(0, \Omega) \tag{2}$$

where

- $W_t = I_{NM} \otimes X_t'$
- $X_t' = \left(Y_{t-1}', Y_{t-2}', \ldots, Y_{t-p}', Z_t', Z_{t-1}', \ldots, Z_{t-q}', 1\right)$
- $\delta_t = \left(\delta_{1,t}', \delta_{2,t}', \ldots, \delta_{N,t}'\right)'$
- δ_{it} are $Mk \times 1$ vectors containing, stacked, the M rows of matrix D_{it} and F_{it}
- Y_t and E_t are $NM \times 1$ vectors.

The Multi-Country Panel VAR model

Canova and Ciccarelli (2009) suggest to reduce the dimensionality of this model as follows:

$$\delta_t = \Xi_1 \theta_{1t} + \Xi_2 \theta_{2t} + \Xi_3 \theta_{3t} + \Xi_4 \theta_{4t} + u_t \tag{3}$$

where

- Ξ_1, Ξ_2, Ξ_3, Ξ_4 are matrices of dimensions $NMk \times 1$, $NMk \times N$, $NMk \times M$, $NMk \times 1$ respectively.
- θ_{1t}: movements in coefficients that are common across countries and variables.
- θ_{2t}: movements in coefficients which are common across countries.
- θ_{3t}: movements in coefficients which are common across variables
- θ_{4t}: movements in coefficients which are common across exogenous variables.
- u_t: all the un-modeled features of the coefficient vector.

The Multi-Country Panel VAR model

- The factorization (3) significantly reduces the number of parameters to be estimated.
- In other words, it transforms an over-parametrized panel VAR into a parsimonious SUR model.
- In fact, substituting (3) in (2) we have

$$Y_t = \sum_{i=1}^{4} \mathcal{W}_{it}\theta_{it} + \upsilon_t$$

where $\mathcal{W}_{it} = W_t \Xi_i$ capture respectively, common, country specific, variable specific and exogenous specific information present in the data, and $\upsilon_t = E_t + W_t u_t$.

Data Description

- Countries: Australia, Brazil, Canada, Chile, Colombia, Mexico, New Zealand, Norway, Peru and South Africa.
- For each country we use year-to-year growth rates of GDP, investment, CPI, trade balance, bank credit, interest rate, exchange rates and EMBI spreads.
- As exogenous variables, we include the annual growth rate of US and a commodity price index.
- The sample of analysis covers the period 1997Q1-2017Q4.
- Data comes from the International Financial Statistics from the IMF and the databases of FRED, IDB, OECD and domestic Central Banks.