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

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1 Literature Review

What drives business cycles in small open economies (SOE)? This is still an open question in the International Macroeconomics literature. The candidates include TFP, foreign interest rates, external demand/supply and commodity price shocks (or more generally terms of trade). The recent large swings in country's terms of trade, mostly due to fluctuations in commodity prices, have been accompanied by strong economic fluctuations, especially in small commodity-exporting economies. Based on that, there has been a renewed interest in study the role of commodity prices on business cycle fluctuations. This paper explores the dynamic effect of commodity price shocks on real and financial variables for a set of small commodity exporters through the estimation of a Panel VAR model with lagged inter-dependencies and time varying parameters.

According to the Real Business Cycle (RBC) school, productivity shocks account for most of business-cycle fluctuations[1]. For one instance, Aguiar and Gopinath (2007) find that non stationary total factor productivity (TFP) shocks play an important role in explaining movements at business cycle frequencies. García-Cicco et al. (2010), using a standard stochastic small open economy business cycle model, also stress the role play by TFP shocks. However, they argue that, unlike Aguiar and Gopinath (2007), the main driver for emerging economies are stationary TFP shocks.

The previous studies highlight TFP shocks, which are mainly of domestic source. However, the nature of small open economies make them subject to external (foreign) shocks too, which can also be an important source of fluctuations[2]. Among these kind of shocks, the literature have focused mainly on global interest rates and global demand/supply shocks. Neumeyer and Perri (2005) explain that the reason why emerging economies are more volatile than advanced economies is related with more pronounced fluctuations in the real interest rate faced by emerging economies. In particular, their results show that almost 30% of output volatility can be accounted by global interest rate shocks. In the same line, Uribe and Yue (2006) also studies

[1] See Mendoza (1991), Backus et al. (1992), Correia et al. (1995) and Schmitt-Grohé and Uribe (2003) for a review of the standard RBC model for small open economies.

[2] There are some works which do not find a significant contribution of foreign shocks for emerging economies. See for example Sánchez (2007), Hoffmaister and Roldós (1997) and Kose et al. (2003).

the relationship between world interest rate and business-cycle fluctuations. By considering US interest rate as the world interest rate faced by emerging economies, their findings indicate that about 20% of movements in aggregate activity are explained by US interest rate shocks. Moreover, world interest shocks affect domestic variables through their effect on country spreads, which account for almost 12% of output fluctuations. Other works which have also highlighted the major role that world interest rates play for business cycles in emerging economies are Fernández-Villaverde et al. (2011), Akinci (2013)[3].

Regarding global GDP shocks, most studies for emerging economies have focused on the role played by US or China. For example, Canova (2005) analyzes the transmission of US shocks to eight Latin American countries. Although he does not find significant impacts of US real demand or supply shocks, the study finds that US monetary shocks do induce large and significant responses for Latin American macroeconomic variables. He also finds quantitative differences between countries with floating and non-floating exchange rates, but no differences in terms of pattern of transmission. Using also Latin America data, Cesa-Bianchi et al. (2011) employ a Global VAR model to ask how the emergence of China has changed business cycles in Latin America. Their results show that the long-term impact of a China GDP shock on the average Latin America country has increased by a factor of three since the mid-1990s.

Another important external shock, specially relevant for commodity-exporting economies, are commodity prices or, more generally, terms of trade. They have received major attention since the beginning of the last decade due to the large increase it was observed in several commodity prices (fuel and metal, for example). Because of this improvement in prices, many commodity exporting economies experienced significant positive impacts on their GDP, current accounts and other macroeconomic variables.

However, the quantitative importance of these shocks for business cycle fluctuations is still a matter of doubt. The first study on the subject was conducted by Mendoza (1995). Using a calibrated model, he shows that almost 50% of actual GDP variability was explained by terms-of-trade shocks. Kose (2002) extends the model proposed by Mendoza (1995) to consider a richer production structure and finds that these shocks explain roughly 88% of aggregate output

[3]See Fernández and Chang (2013) for a set up combining TFP and foreign interest rate shocks.

fluctuations in small open economies. These two studies are the main reference regarding the big impact of terms-of-trade shocks. However, more recently, Schmitt-Grohé and Uribe (2018) have cast doubt about that result. They estimate structural individual VAR models for 38 poor and emerging economies and find that in fact terms of trade only represent at most 10% of GDP variability[4].

Since terms of trade and commodity prices tend to move together, some works have focused in the specific topic of commodity price shocks, a more primitive concept. Céspedes and Velasco (2012) study the empirical relation among commodity prices, output and investment for a group of commodity-exporting countries during periods of booms and busts (large commodity prices shocks). According to their empirical evidence, commodity price shocks have a significant impact on output and investment. Moreover, they find that the response on output depends on the degree of exchange rate flexibility and the response on investment on the degree of financial market development[5]. Gruss (2014), using a Global VAR model, also finds significant impacts of commodity prices on output growth for the Latin American and Caribbean region. Using individual VAR models, Fornero et al. (2016) study the impact of commodity prices (focusing on the case of metal prices) on sectoral investment for a group of metal-exporting economies. According to their results, an increase in commodity price produces positive and significant effects on investment, which ultimately increases real GDP (this expansion is more pronounced for countries with a greater share of commodities in their exports). The expansionary effects on investment occurs mainly because of the response of investment in the commodity sector, which later spills over to the non-commodity sector investment. Other studies, like Collier and Goderis (2012), have focused not only on the short-run effects of commodity prices, but also on the long-term ones. Using a panel error correction model, they show that increases in commodity prices have unconditional positive short-run effects on output, but conditional adverse long-term effects (present in the case of non-agricultural booms in countries with poor governance).

[4]Using also structural VAR models but for only 15 emerging countries, Aguirre (2011) finds that terms-of-trade shocks explain about 5% of output fluctuations.

[5]Using terms of trade instead of commodity prices, Broda (2004) also finds heterogeneous effects on output based on exchange rate flexibility.

Some studies that have emphasized the importance to work with theoretical and empirical models that combine commodity prices and financial variables[6]. Within the theoretical works, García-Cicco et al. (2017) develop a New Keynesian small open economy model with frictions in the domestic financial intermediation sector and a commodity sector in order to asses the contribution of financial, real and external shocks on output and investment fluctuations for Chile, Colombia, Mexico and Peru. Their results suggest that financial shocks are important drivers of output and investment fluctuations in the short run for most countries, but in the long run their contribution is small. On the other hand, a fall in commodity prices generates a negative income effect that translates into drops in consumption, investment and output, which are amplified in the presence of financial frictions and generates heterogeneity in the response of real sector variables across countries[7]. Recently, considering the negative relation between the interest rate premium and commodity prices found in the data, the DSGE models proposed by Shousha (2016), Drechsel and Tenreyro (2018) and Fernández et al. (2018) have pointed out the relevance of the country's risk premium as a amplifying channel of commodity price shocks. On the empirical side, Shousha (2016) estimates a Panel VAR and shows that commodity price shocks are an important source of business cycle fluctuations for commodity exporters and have stronger effects on real activity, credit and country interest rates in emerging countries in comparison with advanced economies. The main difference in the response between emerging and advanced economies is the response of the country interest rate to these shocks and differences in working capital constraints faced by firms. According with his findings, the contribution of interest rate shocks become negligible when the model includes also commodity prices. Fernández et al. (2018) and Drechsel and Tenreyro (2018) deliver also empirical evidence

[6] A related work is Izquierdo et al. (2008), which not only combines foreign interest rates (measured by the return of the 10 year US T-bond) and terms of trade, but also includes a measure of global GDP (measured by the industrial production index of G7 countries) and risk (measured by the spread on high yield bonds over US T-bonds). Based on a restricted Vector Error Correction Model (VECM) for an index that captures output behavior of the typical Latin American country, they find that financial variables have a higher elasticity (in absolute value) when compared with terms of trade: the risk and foreign interest rate elasticities are -0.36 and -0.33, respectively (for an increase of 100 basic points in each variable); while the terms-of-trade elasticity is 0.11 (for an increase of 1% in the variable).

[7] Another theoretical work along the same line but using terms of trade instead of commodity prices is Lubik and Teo (2005). They estimate a DSGE model for five developed and developing economies and find that world interest rate shocks are the main driving forces in small open economies while terms of trade shocks are not relevant.

of the importance of commodity prices for aggregate fluctuations based on the estimation of individual VAR models for each of the countries on their samples. Unlike Shousha (2016), the VAR specification of Fernández et al. (2018) and Drechsel and Tenreyro (2018) do not consider directly interest rates in their set up. However, they present regression results that show the negative correlation between country's risk premium and commodity prices[8].

This paper makes an empirical contribution by estimating the impact of commodity prices on real and financial variables through a Panel VAR which features cross-country lagged interdependencies. The model follows the approach developed by Canova and Ciccarelli (2009) and allows for common, country-specific and variable-specific indicators summarizing spillover effects across countries and variables[9].

As in Shousha (2016), the model is estimated for a group of emerging (Brazil, Chile, Colombia, Mexico, Peru and South Africa) and advanced (Australia, Canada, New Zealand and Norway) small commodity exporters. I consider commodity prices instead of terms of trade because the exogenous assumption of terms of trade, usually employed by the previous works, might not be appropriate for all the countries in my sample. As stress by Bodenstein et al. (2018), to assume that terms of trade are exogenous seems only plausible for developing economies, which tend to have a small and homogeneous set of exportable goods. However, advanced commodity exporters present a more pronounced difference between the commodity and non-commodity traded goods sector. Along the same line, Shousha (2016) explains the reasons why a commodity export price index is preferred over the typical terms of trade index (ratio of export and import unit value indices): (i) unit value indices are subject to biases that produce important discrepancies between them and price indices[10], (ii) unit value indices are more possible to be endogenous with respect to country-specific shocks than global commodity prices, and (iii) nominal rigidity and incomplete pass-through prevent terms of trade indices from correctly incorporate contemporaneous shocks that induce immediate effects on the exchange rate[11].

[8] Fernández et al. (2018) and Drechsel and Tenreyro (2018) do not make a distinction between emerging and advanced economies as Shousha (2016) because their sample of countries is more homogeneous. For instance, Fernández et al. (2018) works with four Latin American countries (Brazil, Chile, Colombia and Peru) and Drechsel and Tenreyro (2018) with Argentina as a representative small commodity exporting economy.

[9] See also Canova and Ciccarelli (2013).

[10] See Silver (2009) for a detailed explanation of the sources of bias for unit value indices.

[11] This feature has been noted by Chen and Rogoff (2003).

I depart from Shousha (2016) along two lines. The fist difference is that I do not use a country specific export price index. Instead, I work with the IMF Commodity Price Index as an exogenous variable common to all countries. As mention by García-Cicco et al. (2017), using a country specific price index makes the commodity price shock not completely comparable among countries. Moreover, Fernández et al. (2018) find that country specific commodity price indices share an important common global factor. According with their results, commodity price shocks account for a median of 42% of output variance, with common global factors representing 73% of that response. In that sense, modelling commodity prices as a exogenous common external shock seems more appropriate. Furthermore, since all countries are subject to the same external shock (i.e. the commodity price index I employ is common to all countries), it is necessary to estimate country's behavior simultaneously. For that reason, unlike the previous works cited which rely on the estimation of individual VAR models, I work using a Panel VAR[12]. The second difference with Shousha (2016) is associated with the methodology use to estimate the Panel VAR. He estimates his Panel VAR model by pooling the data and using the Least Square Dummy Variable (LSDV) estimator, which imposes common parameters to every country. I set up a more flexible Panel VAR approach by allowing inter-linkages among countries and variables as well as time varying parameters[13].

[12]Besides the works already cited which estimate a VAR for each country, there are several other studies which have studied the impact of commodity prices (or terms of trade) by just focusing on a particular country of my sample. See Jääskelä and Smith (2011), Rees (2013), Atkin et al. (2014), Knop and Vespignani (2014), Kulish and Rees (2017) (Australia); Benguria et al. (2018) (Brazil); Dib (2008), DePratto et al. (2009), Vasishtha and Maier (2013), Charnavoki and Dolado (2014) (Canada); Medina and Soto (2007), Medina and Naudon (2012), Pedersen (2015), Medina and Soto (2016), Roch (2017), Fornero and Kirchner (2018) (Chile); Hernández (2013), Toro-Córdoba et al. (2015), Cárdenas-Hurtado et al. (2018) Roch (2017) (Colombia); Medina et al. (2007), Karagedikli (2012) (New Zealand); Bergholt (2015), Bjørnland and Thorsrud (2016), Bergholt et al. (2017) (Norway); Han (2014), Roch (2017) (Peru); and Hove et al. (2015) (South Africa).

[13]An alternative approach would be to use the modified (bias-corrected) LSDV estimator proposed by Hahn and Kuersteiner (2002). However, that estimator still has the disadvantage of not allowing inter-linkages across countries and variables.

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