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ARTICLE

Sources of emerging market business cycles: an open-economy factor-augmented VAR approach

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ABSTRACT

This paper constructs an open-economy factor-augmented VAR model to assess the dynamic effects of global shocks on emerging market economies and to quantify their relative importance in explaining macroeconomic fluctuations in emerging countries. An unexpected favourable shock to global demand and supply has a strong and positive effect on emerging markets, whereas an unanticipated rise in global interest rates and commodity prices leads to a significant decline in aggregate activity. Variance decomposition analysis implies that more than 80% of the variation in emerging market output growth can be attributed to the global shocks. In particular, the global demand shock is the most critical, explaining roughly 30% of the fluctuation in output growth. The global supply shock is closely associated with the medium-to-long-term variation in output growth, explaining about 17%, whereas the monetary policy and commodity price shocks are relatively relevant for the short-term variation, explaining about 20% respectively.

KEYWORDS

Emerging market economies; global shocks; factor-augmented VAR

JEL CLASSIFICATION

C11; C32; F41; F44

I. Introduction

What are the main sources of emerging market business cycles? With the rapid integration of emerging countries into the global economy, world shocks have been increasingly important for emerging markets. Many studies have suggested a variety of global shocks, such as interest rate shocks (Neumeyer and Perri 2005; Uribe and Yue 2006), commodity price shocks (Fernández, Schmitt-Grohé, and Uribe 2017; Drechsel and Tenreyro 2018), and term-of-trade shocks (Mendoza 1995; Schmitt-Grohé and Uribe 2018). Most of the studies, however, focus on one or two particular shocks and do not present a systematic analysis of the relative importance of different shocks for macroeconomic fluctuations in emerging markets. Although several papers, such as Hoffmaister and Roldôs (2001), Canova (2005), and Maćkowiak (2007), consider world real and price shocks simultaneously, they focus only on shocks arising from the US economy and analyse a small subset of emerging countries.

This paper develops a unified empirical framework that nests various global shocks and diverse sample of countries to examine their importance for emerging market business cycles. Specifically, similar to Mumtaz and Surico (2009) and Mandalinci and Mumtaz (2019), we construct an open-economy factor-augmented vector autoregressive (FAVAR) model with a two-block structure of global shocks and emerging market output growth. Following the existing empirical and theoretical literature, we identify the well-documented global structural shocks: Aggregate demand shock, aggregate supply shock, monetary policy shock, and commodity price shock. Consistent with Mumtaz and Surico (2009) and Charnavoki and Dolado (2014), these structural shocks are identified via sign restrictions and the FAVAR model is estimated using a Bayesian method.

We find that an unexpected favourable shock to aggregate demand and supply has a strong and positive effect on emerging market economies. In contrast, an unanticipated rise in global interest rates and commodity prices leads to a significant decline in economic activity in emerging markets. Variance decomposition analysis shows that consistent with findings by Maćkowiak (2007) and Fernández, Schmitt-Grohé, and Uribe (2017), world shocks

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play a crucial role in driving emerging market business cycles, explaining more than 80% of the fluctuation in output growth. In particular, the aggregate demand shock is the most critical, explaining roughly 30% of the variation in output growth, which highlights the importance of the traditional trade channel argued by Baxter and Kouparitsas (2005) and Kose and Yi (2006). The aggregate supply shock is relatively associated with the medium-to-long-term variation in output growth, explaining about 17%, whereas the monetary policy and commodity price shocks are closely relevant for the short-term variation, explaining about 20% respectively.

II. Empirical methodology

Following Mumtaz and Surico (2009) and Mandalinci and Mumtaz (2019), we develop an open-economy FAVAR model to gauge the dynamic effects of global shocks on emerging markets. The model consists of a two-block structure: One is for global economic factors and the other is for an unobserved common factor of emerging market output growth. To account for the small-open economy nature of emerging countries, global factors are ordered first and treated as exogenous with respect to emerging markets. Each factor is assumed to have the following transition equation (1):

$$B_0 \begin{pmatrix} F_t^* \\ F_t^{emg} \end{pmatrix} = \sum_{j=1}^{p} B_j \begin{pmatrix} F_{t-j}^* \\ F_{t-j}^{emg} \end{pmatrix} + \varepsilon_t, \qquad (1)$$

where $B_j, j = 0, 1, \cdots, p$, is the coefficient matrices, and ε_t is a vector of structural innovations. F_t^* represents a matrix of global economic factors that contain the following four factors: A global growth factor F_t^{y*}, a global inflation factor F_t^{p*}, a global short-term interest rate factor F_t^{r*}, and a global commodity price factor F_t^{c*}. F_t^{emg} refers to the unobserved common factor of emerging market output growth. Each of the unobserved factors is extracted from an underlying panel data set and is related by the following observation equation (2):

$$\begin{pmatrix} X_t^{y*} \\ X_t^{p*} \\ X_t^{r*} \\ X_t^{c*} \\ X_t^{emg} \end{pmatrix} = \begin{pmatrix} \Lambda^{y*} & 0 & 0 & 0 & 0 \\ 0 & \Lambda^{p*} & 0 & 0 & 0 \\ 0 & 0 & \Lambda^{r*} & 0 & 0 \\ 0 & 0 & 0 & \Lambda^{c*} & 0 \\ 0 & 0 & 0 & 0 & \Lambda^{emg} \end{pmatrix} \begin{pmatrix} F_t^{y*} \\ F_t^{p*} \\ F_t^{r*} \\ F_t^{c*} \\ F_t^{emg} \end{pmatrix} + \nu_t, \qquad (2)$$

where X_t refers to data on which different factors load and ν_t is a vector of idiosyncratic component for each series. The global factors are identified based on the block diagonal assumption. For example, we extract the global growth factor from a panel data set of all global economic activity series. Similarly, the global inflation factor is identified from all global inflation series. The other global factors are extracted accordingly.

Our data are quarterly and cover the period 2000:Q1–2020:Q3. The sample period is selected to capture not only the post-Asian Financial Crisis period when a structural change occurred, but also the collective post-liberalization period for most emerging countries. Table 1 shows the list of countries used to extract global economic factors and common factor for output growth in emerging markets.[1] For each developed country, we collect data on real economic activity, inflation, and short-term interest rates. Regarding real economic activity, we include real GDP, industrial production, and composite leading indicators available at the

Table 1. List of developed and emerging countries.

Panel A. Developed countries					
Australia	Canada	France	Germany	Italy	Japan
Netherlands	New Zealand	Spain	Sweden	United Kingdom	United States
Panel B. Emerging countries					
Argentina	Brazil	Chile	Colombia	Hungary	India
Indonesia	Malaysia	Mexico	Peru	Philippines	Poland
Russia	South Africa	South Korea	Taiwan	Thailand	Turkey

[1]The classification of the developed and emerging countries is based on the IMF and Morgan Stanley, broadly consistent with Mandalinci and Mumtaz (2019) and Bhattarai, Chatterjee, and Park (2020). China is excluded in emerging markets due to its significant role for the world economy.

Organization for Economic Cooperation and Development (OECD) database.[2] For inflation, we use consumer price index, producer price index, and GDP deflator, all of which are expressed in yearly percentage changes. For short-term interest rates, policy rates and short-term rates available at the OECD database are utilized. For commodity prices, we employ a range of commodity price indices for energy, food, agricultural raw materials, base metals, and fertilizers collected by the World Bank. Finally, for each emerging country, we rely on real GDP expressed in yearly percentage changes.[3] All variables are standardized with zero mean and unit variance prior to factor extraction.

We attempt to identify the following global structural shocks: An aggregate demand (AD) shock, an aggregate supply (AS) shock unrelated to commodity markets, a monetary policy (MP) shock, and a commodity price (CP) shock. Similar to Mumtaz and Surico (2009) and Charnavoki and Dolado (2014), the identification scheme for these global shocks are based on a mixture of sign and impact matrix restrictions. Specifically, as demonstrated in Table 2, we impose sign restrictions on the impulse responses of global factors, which are broadly consistent with the theoretical literature. The sign of the response of global short-term rates after the AS shock is assumed to be uncertain, so that the data will determine it. In particular, the restrictions on real variables such as growth and inflation are binding at least for one quarter, while those on financial variables such as short-term rates and commodity prices are imposed only on impact. Additionally, to ensure a more permanent nature of the AS shock, the increase in economic activity is binding for four quarters. These sign restrictions are imposed using the algorithm developed by Rubio-Ramírez, Waggoner, and Zha (2010).

Following Mumtaz and Surico (2009) and Charnavoki and Dolado (2014), the FAVAR model is estimated using a two-step approach. In the first step, the global factors and the unobserved common factor for output growth in emerging markets are extracted via the principal component estimator. In the second step, using these factors, we estimate the FAVAR model by adopting the Bayesian approach proposed by Bańbura, Giannone, and Reichlin (2010). In particular, consistent with Kadiyala and Karlsson (1997), we impose a normal inverted Wishart prior that retains the principle of the Minnesota prior but modifies the assumption on the covariance matrix of residuals to allow for their possible correlations. The lag length in the model is set to $p = 2$ based on the Schwarz and Hannan-Quinn information criterion.[4] A standard Gibbs sampling method is used to approximate the posterior distributions of the parameters in the model. The total number of Gibbs replications is set to 25,000 with a burn-in of 20,000. The 68% equal-tailed credible intervals are estimated by drawing 5,000 samples from the resulting posterior distribution.

III. Results

Figure 1 illustrates the impulse responses of emerging market output growth to a one-standard-deviation structural innovation in each of the global shocks.[5] In line with an empirical

Table 2. Sign restrictions on impulse response functions.

	AD shock	AS shock	MP shock	CP shock
Global economic activity F_t^{y*}	+	+	-	-
Global inflation F_t^{p*}	+	-	-	+
Global short-term rate F_t^{r*}	+	·	+	+
Global commodity price F_t^{c*}	+	+	-	+

[2]The real GDP and industrial production are seasonally adjusted and expressed by yearly percentage changes.
[3]The main source of real GDP data for emerging countries is the OECD database, complemented with the data from the national statistics agency and the central bank for each country.
[4]Akaike information criterion suggests the lag length to be $p = 5$, but the results are largely robust to different lag-length choices.
[5]To examine the question of potential heterogeneity in the effects of global shocks on emerging markets, we conduct subgroup analysis as follows. Motivated by Kose, Otrok, and Whiteman (2003) and Bhattarai, Chatterjee, and Park (2020), we first divide emerging countries into two groups based on the structural characteristics of economies, such as per capita GDP, commodity dependence in export, manufacturing's share of output, and current account balance, respectively. We then extract common component for each group, estimate the FAVAR model using the same identification as in the baseline, and compare impulse response functions between the subgroups. We find that although the results quantitatively differ slightly, they are qualitatively similar and there is no statistically significant difference.

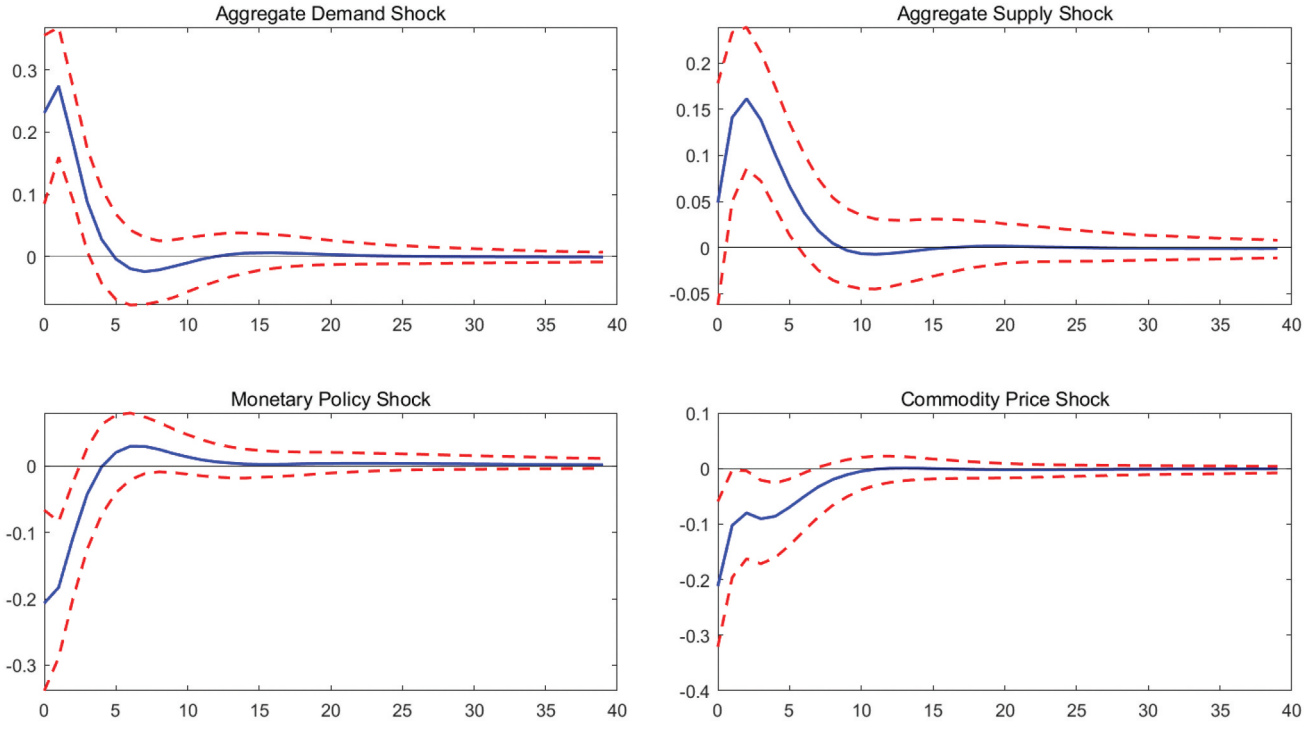

Figure 1. Impulse responses of emerging market output growth to global shocks.

practice in the Bayesian literature, the solid blue lines represent the posterior median estimates and the upper and lower dash lines are the 16%-84% posterior coverage intervals.[6] We find that contrast to the results of Hoffmaister and Roldôs (2001) and Canova (2005), global real demand and supply shocks are an important source of economic fluctuations in emerging markets.[7] Specifically, the AD shock has a strong and positive impact on emerging markets, with an increase of output growth by more than 0.2% for the first quarter horizon. As pointed out by Baxter and Kouparitsas (2005) and Kose and Yi (2006), this result can be intimately related to the traditional trade channel through which the boost in aggregate demand stimulates production and investment in emerging markets. The AS shock also leads to an expansion in emerging economies, but the positive effect is relatively small but persistent compared to the demand shock. In contrast, the contractionary MP shock causes a significant fall in output growth by around 0.2% on impact, but it rebounds quite quickly. This result is generally in line with Neumeyer and Perri (2005) and Uribe and Yue (2006) showing that a rise in world interest rates raises borrowing costs in emerging markets due to the increased default risk, consequently dampening consumption and investment.[8] Finally, the CP shock reduces output growth in emerging markets by around 0.2% on impact, followed by a slow recovery. Since the CP shock captures unexpected changes in real commodity prices orthogonal to aggregate demand and supply shocks mostly stemming from an unforeseen disruption in commodity supply or from commodity-specific demand shocks, it generally raises production costs and declines the over-

[6]Following the suggestion by Sims and Zha (1999), we use the 68% credible intervals corresponding to one-standard-error bands, which is common practice in reporting VAR estimates of structural impulse responses. For robustness checks, we additionally calculate the 90% credible intervals and find that the overall results still remain valid.

[7]This finding is consistent with the recent study of Feldkircher and Huber (2016) showing the substantial spillover effects of US aggregate demand and supply shocks on international output.

[8]Canova (2005) and Maćkowiak (2007) also find that US monetary policy shocks have strong and negative effects on emerging market economies through the interest rate and exchange rate channels. In a recent year, Dedola, Rivolta, and Stracca (2017) show that an increase in US interest rates depreciates a local currency in most countries and declines industrial production and real GDP, driving them into recession.

all demand, resulting in a contraction in aggregate activity in emerging markets.[9]

Next, we conduct variance decomposition analysis to quantify the role of the global shocks in accounting for emerging market business cycles. As displayed in Table 3, we find that more than 80% of the variation in emerging market output growth can be attributed to the global shocks. This is largely in line with previous papers including Maćkowiak (2007) and Fernández, Schmitt-Grohé, and Uribe (2017) documenting that world shocks are an important source of economic fluctuations in emerging markets. As expected from the results of impulse response functions, the AD shock is the most critical, explaining between 29% and 35% of the variation of output growth in emerging countries. The AS shock is relatively less important for the short-run fluctuation in output growth, but it becomes more relevant in the medium-to-long-term variation, accounting for more than 16%. Both MP and CP shocks play a relatively significant role in driving the short-term movement in emerging markets, explaining more than 24% on impact respectively.

Figure 2 depicts the historical contributions of each global shock to output growth in emerging markets. Consistent with the results presented for variance decomposition, the AD shock has been the main driver of movements in emerging market output growth for the sample periods. Specifically, it significantly contributed to the substantial decline in output growth during the 2008–09

Table 3. Variance decomposition of output growth in emerging markets.

Horizon	AD shock	AS shock	MP shock	CP shock
0Q	29.24%	4.11%	24.10%	24.43%
1Q	35.86%	7.67%	22.25%	15.92%
4Q	31.78%	15.98%	17.71%	15.91%
8Q	30.10%	16.56%	17.64%	16.80%
12Q	29.94%	16.88%	17.66%	16.59%
20Q	29.78%	17.25%	17.55%	16.43%
30Q	29.64%	17.40%	17.59%	16.34%
40Q	29.64%	17.54%	17.55%	16.23%

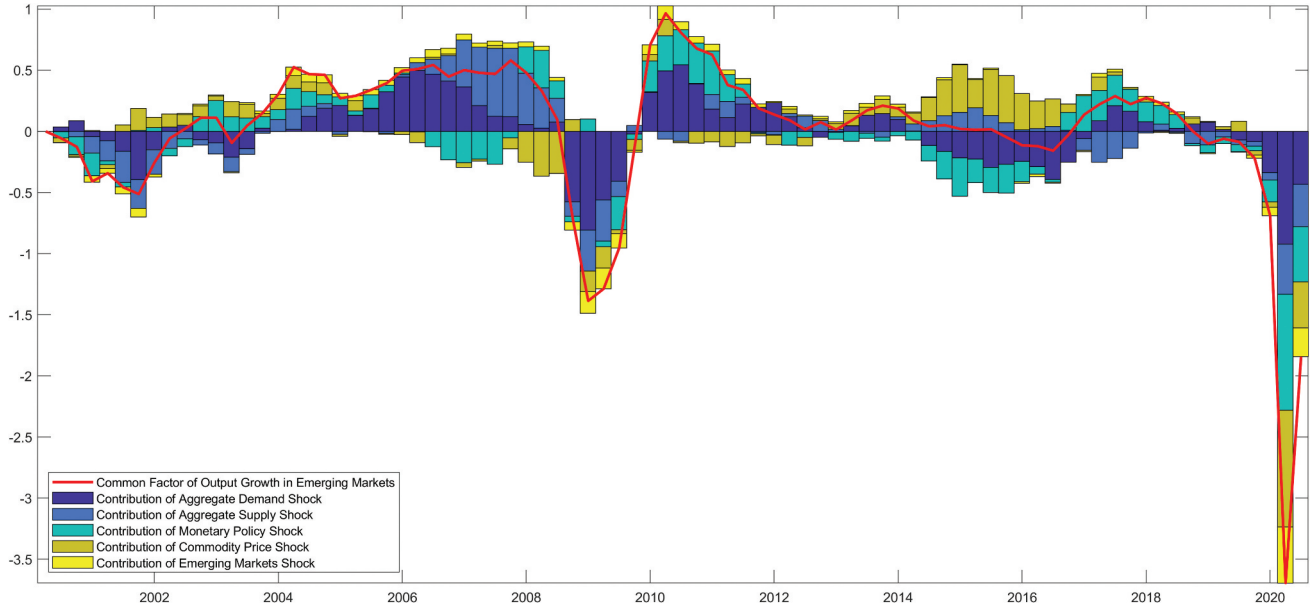

Figure 2. Historical decomposition of output growth in emerging markets.

[9]Fernández, Schmitt-Grohé, and Uribe (2017), Drechsel and Tenreyro (2018), and Fernández, González, and Rodríguez (2018) similarly emphasize the importance of commodity price shocks for emerging market business cycles, but their commodity price shocks differ from ours in that they do not separate specific shocks driving world commodity prices such as supply or demand shocks.

Global Financial Crisis (GFC) and the COVID-19 pandemic. The AS shock, however, has broadly contributed the least towards movements in output growth, except for a couple of years before the GFC. The MP shock greatly contributed to the rebound in emerging market output growth in 2010–11 and 2017–18, as well as the dramatic drop during the COVID-19 pandemic. The CP shock contributed positively to output growth in emerging countries during the 2014–16 oil price plunge, whereas it contributed negatively during the COVID-19 pandemic.

IV. Conclusion

This paper evaluates the extent to which economic fluctuations in emerging markets are caused by global shocks originating from industrialized countries. We find that the global shocks explain more than 80% of the variation in output growth in emerging markets. In particular, more than one-third of that contribution is driven by aggregate demand shocks. Monetary policy and commodity price shocks are closely related to the short-term variation in emerging market output growth, explaining about 20% respectively, whereas aggregate supply shocks are relatively associated with the medium-to-long-term variation, explaining about 17%. These results provide crucial implications not only for policymakers in emerging countries who cope with external shocks, but also for researchers who attempt to build a business cycle model of emerging market economies.

Disclosure statement

The views expressed in this paper do not necessarily reflect those of the National Pension Service or the National Pension Research Institute.

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