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TRANSMISSION OF CHINA'S SHOCKS TO THE BRIS COUNTRIES

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Abstract
This paper investigates the effects of China on the BRIS countries, namely Brazil, Russia, India and South Africa. We identify Chinese supply and demand shocks and assess their transmission to BRIS in a structural dynamic factor model framework estimated over the period 1995Q2-2009Q4. The findings show that Chinese supply shocks are more important than its demand shocks. Supply shocks produce positive and significant output responses in all BRIS countries. And while these supply shocks have a permanent impact on the BRIS countries, the effects of demand shocks are short-lived. Both supply and demand shocks are transmitted through trade rather than financial linkages. However, the responses of the BRIS countries are heterogeneous and therefore require country-specific policy responses.
JEL Classification: C33, E32, F40, O57
Keywords: Dynamic factor model, supply and demand shocks, sign restrictions, BRIS

1. INTRODUCTION

Increasing economic integration among countries, especially through trade and financial flows, has been one of the most remarkable events in the world over the past two decades. Many emerging economies have gained in prominence as their economic activities now have significant ripple effects in other countries, including the developed ones (Akin and Kose, 2008). As far as geopolitics is concerned, five emerging economies – Brazil, Russia, India, China and South Africa (BRICS) – are rapidly becoming integrated and increasingly important to the world economy (Çakır and Kabundi, 2013a, 2013b). These countries intend to strengthen their multilateral cooperation by way of the alliance of the BRICS group. China is the dominant actor in this emerging group.

This paper is closely related to that by Eickmeier and Kühnlenz (2017). But unlike these authors, who focus on the role of Chinese supply and demand shocks on global inflation dynamics, the current study emphasises the overall effects of Chinese supply and demand shocks on BRIS countries. The reason for assessing the effects of China's shocks to BRIS is based on the fact that, in general, China has become the first trading partner of many countries, but in particular of the BRIS countries (Siklos and Zhang,

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2010).[1] China has become an economic powerhouse and has contributed to economic recoveries after meltdowns. Even after the subprime crisis in the United States (US), which triggered a global financial crisis in 2008, coupled with weak global economic growth, China's economy grew by 9.1% in 2009. Its growing importance as an assembly platform for the exports of manufacturers, a destination for foreign investment as well as a consumer of imported technology, raw materials and industrial goods is not a one-time shock. Rather, it is an ongoing process that continually shapes the balance of global supply and demand (Eichengreen and Tong, 2006).

The empirical framework used is somewhat related to Eickmeier (2007), Kabundi and Nadal De Simone (2011) and Eickmeier and Kühnlenz (2017). It involves the identification of these shocks using a structural dynamic factor model instead of the traditional vector autoregressive (VAR) model. The rationale for adopting this framework is motivated by the fact that the factor models can handle many variables and hence turn the *curse of dimensionality*, commonly observed in small VAR, into the *blessing of dimensionality*. The analysis includes 161 quarterly series of BRICS countries observed from 1995Q2 to 2009Q4. In addition, we adopt the sign restrictions identification strategy instead of short- or long-term restrictions techniques, which appear to be too restrictive. This identification is based on the IS-LM framework, which is commonly used in macroeconomics. Supply and demand shocks are identified in such a way that they explain a larger proportion of the Chinese gross domestic product (GDP). In so doing, we are confident that these shocks have their origin in China instead of the other BRICS countries. We then assess their effects on a set of BRIS variables.

There is a great deal of literature on China's economic influence on other countries. Studies in this area have been conducted at different levels. On a regional level, Jenkins and Edwards (2006) examine the effects of China and India on sub-Saharan Africa, looking at the channels through which the growth of the Asian drivers is affecting sub-Saharan Africa. Lederman *et al*. (2009) conducted another related study that focuses on the effects of the emergence of China and India on Latin America. Jenkins *et al*. (2008) investigate the effects of China on Latin American trade and foreign direct investment (FDI) flows, and the results demonstrate that there are winners and losers in the region, both at country and sector level.

On a country level, Jenkins (2012) analyses the economic effects of China's re-emergence on Brazil and finds that Brazil has benefited from trading with China in the short run, especially from the high prices of primary commodities, but it has lost export markets to China in manufacturing Rangasamy and Swanepoel (2011) investigate the effects of China on South African trade and inflation, and the results suggest that the effects of China on the South African trade balance are positive but, in terms of inflation, the paper does not provide any convincing empirical results that inflation in China leads to domestic price increases. More recently, Edwards and Jenkins (2013) undertook a similar study looking at the effects of China's imports on the manufacturing industry,

[1] China's annual real GDP growth rate has averaged around 10% over the past two decades. Its share of global output in 2012 stood at 8.7% measured by current prices, making it the second-largest economy after the US (International Monetary Fund, 2012). As Perkins (2005) notes, this annual growth rate could be sustained in the range of 8–10% a year for the next couple of decades. As a strategic power that is intent on rivaling the US, China is projected to surpass the US in 2030 to become the world's largest economy (Maddison, 2006).

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employment and inflation in South Africa. Their results show that South Africa's imports from China negatively affect labour-intensive industries in South Africa.

Other studies, such as those by Villoria (2012) and Eickmeier and Kühnlenz (2017), investigate the effects of China's growth on the international markets of agricultural products and its role in global inflation dynamics, respectively. Eickmeier and Kühnlenz (2017) find evidence of the effects of Chinese supply and demand shocks on global commodity prices.

Finally, Bloom *et al.* (2011) study the effects of China on developed economies, and Hsieh and Ossa (2011) assess the welfare effects of the observed pattern of sector-level growth in China on 14 major countries and 4 broad world regions.

However, few studies have been conducted on the effects of China on the BRIS countries, specifically looking at the effects of Chinese supply and demand shocks on these countries.

The main feature of China's high performance is higher labour productivity as well as policy reforms. According to Eickmeier and Kühnlenz (2017), the demand shock in China is driven by massive domestic investments, which boost the exports of goods and services and increase the imports of commodities, which in turn puts an upward pressure on export prices and commodity prices. Initially, state-owned enterprises were the engine of the economy, with large government support. However, private enterprises have overtaken state-owned enterprises recently as the environment has become more market-friendly. Besides promoting trade, demand shocks have also put pressure on import prices domestically and globally (Siklos and Zhang, 2010; Eickmeier and Kühnlenz, 2013).

On the other hand, the supply shock in China is mainly due to higher productivity (He *et al.*, 2009; Gong and Li, 2010; Autor *et al.*, 2013) and the inception of China in the World Trade Organization since 2001 (Gong and Li, 2010). Unlike demand shocks, supply shocks have a deflationary effect as a result of a low cost of production. Cargill and Parker (2004) argue that supply shocks were behind the deflation that China experienced in 2000. Consequently, the aggregate supply curve shifts downwards and generates a permanent increase in domestic output coupled with a decrease in inflation.

The effects of a supply shock are not confined to China; they are transmitted to the rest of the world via trade. As a result, inflation declines globally due to a supply of cheap products (Barsky and Kilian, 2004; Cargill and Parker, 2004; Rangasamy and Swanepoel, 2011; Diao *et al.*, 2012; Eickmeier and Kühnlenz, 2013). But more recently, with the increase in the middle-income population, the cost of production in China has shown a rising trend.

The main findings of this paper are as follows. First, China's supply shocks are transmitted more forcefully than its demand shocks to the BRIS countries. Second, the reaction of BRIS to China's shocks varies across the member countries. For example, the supply shocks have positive, permanent and significant effects on the output of all the BRIS countries except India. The demand shocks have positive and significant effects on BRIS output, but the effects are temporary. Finally, the main channels of transmission for all the shocks are exports and imports. Financial linkages are nonexistent, which implies that the transmission channels are trade-based rather than financial. The reactions of BRIS to China's shocks are heterogeneous and therefore require country-specific policy responses.

The BRIS countries should find a way to tap into the Chinese market for their manufactured goods. This can be achieved through the promotion of industrial policies which

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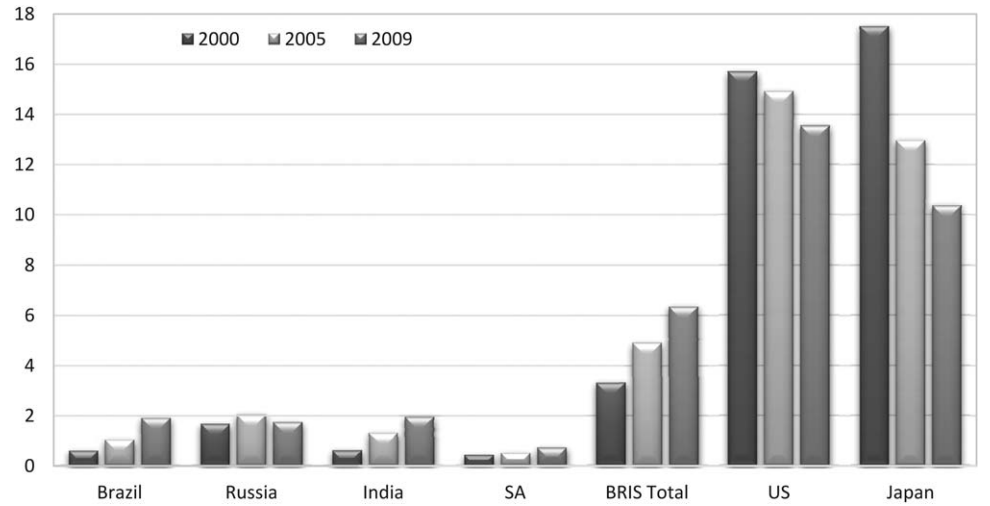

Figure 1. China's foreign trade with BRIS, the US and Japan (percentage)
Source: *Direction of trade statistics*, International Monetary Fund (2012).

make companies, products and labour markets more competitive. Also, China should open up its market to the other BRICS countries through bilateral trade agreements.

The rest of the paper is organised as follows. Section 2 describes the current patterns of China's economic integration with the world. Section 3 outlines the empirical model and discusses the identification of shocks. Section 4 analyses the data and their transformations as well as the estimation technique. Section 5 discusses the empirical results and the transmission channels. Section 6 concludes the paper.

2. CHINA'S ECONOMIC INTEGRATION WITH THE WORLD ECONOMY

There is already rich literature that focuses on China's trade and financial integration with the world (Cheung *et al.*, 2005; Francois and Wignaraja, 2008; Bussiere and Schnatz, 2009; Ghosh and Rao, 2010; Tokarick, 2011). The expansion of international trade has been a particularly remarkable aspect of China's rising prominence in the world economy.[2] International trade, especially exports, is a major driver of economic growth in China. Taken together, exports and imports amount to a significant proportion of its GDP. China's largest trading partners in terms of total exports and imports are the US and Japan (Fig. 1). However, its trade with the US and Japan has decreased somewhat over the last decade. For instance, its total trade with the US and Japan decreased from 15.7% to 13.5% and from 17.5% to 10.3%, respectively. On the other hand, the importance of China for BRIS countries' trade has increased significantly over the past decade, from 3.5% in 2000 to 6.4% in 2009. Over time, China's trade with Brazil and India has

[2] Between 1995 and 2009, China's exports and imports grew at an annual average rate of 20% and 18%, respectively, but in 2009 they both decreased to 16% and 11%, respectively. As a result, China's share of world trade in 2012 was almost 11%, making it the world's largest trading economy (International Monetary Fund, 2012).

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Table 1. China's foreign trade with BRIS, 2000–2009 (US$billions)

	Imports from				Exports to			
	Brazil	**Russia**	**India**	**SA**	**Brazil**	**Russia**	**India**	**SA**
2000	1.62	5.77	1.35	1.04	1.22	2.23	1.56	1.01
2001	2.35	7.96	1.70	1.17	1.36	2.71	1.90	1.05
2002	3.00	8.41	2.27	1.27	1.47	3.52	2.67	1.31
2003	5.84	9.73	4.25	1.84	2.14	6.03	3.34	2.03
2004	8.68	12.13	7.68	2.96	3.67	9.10	5.93	2.95
2005	9.98	15.89	9.78	3.44	4.83	13.21	8.94	3.83
2006	12.91	17.54	10.47	4.10	7.38	15.83	14.59	5.77
2007	18.34	19.63	14.66	6.61	11.38	28.48	24.04	7.43
2008	29.63	23.78	20.34	9.21	18.78	33.01	31.52	8.60
2009	28.31	21.10	13.72	8.68	14.13	17.52	29.68	7.37

Source: Direction of trade statistics, International Monetary Fund (2012).

increased the most among the BRIS countries. Russia and South Africa have also managed to accelerate their trade ties with China.

This high growth in trade has been supported by large investment flows to China (Eichengreen and Tong, 2006). As FDI plays an important role in the globalisation process and in promoting economic growth in host, especially developing, countries (Hermes and Lensink, 2003; Melitz, 2005; Andreas, 2006; Ndikumana and Verick, 2008), it can be argued that an important aspect of the rapid emergence of China in the global economy is FDI. No other country in the world, besides the US, receives more FDI than China. China's efforts to attract FDI have been a successful story. From 1995 to 2010, for instance, China received an average of 4% net FDI to GDP (World Bank, 2011). FDI in China is export-orientated and directed in part to investment in infrastructure. The increased integration of China into the world economy has contributed to its rapid growth. Also, China's growth has benefited significantly from the worldwide fragmentation of production, where parts of the production chain have been moved to low-cost countries (Den Butter and Hayat, 2008).Even though FDI and capital flows between the BRICS countries have increased recently, they are still very low compared to the FDI and capital flows between developed economies. For instance, in terms of regional sources of FDI, the Virgin Islands and the United Kingdom (UK) are collectively the largest source of FDI flows to China, followed by Japan, Singapore and the US (International Monetary Fund, 2011).

The existing empirical results on the effects of China's FDI on other countries' FDI are mixed and have focused on Asian, Latin American and Caribbean countries. For instance, the FDI flows into China have encouraged both horizontal and vertical FDI to other countries (Resmini and Siedschlag, 2013), and the emergence of China as a leading FDI destination has also encouraged FDI flows to other Asian countries (Eichengreen and Tong, 2006). On the other hand, Mercereau (2005) finds that, on average, FDI in China has had a negative effect on FDI in other Asian countries. The rising labour cost in the home country was a cause of the change in the FDI landscape (Tham, 2007) and the Chinese emergence of more attractive destinations for FDI (Hussain and Radelet, 2000).

As China's trade with the rest of the world has deepened, so have the composition and geographical pattern of its trade shifted. China's trade with the BRIS countries is also growing; China is now among the most important export destinations for these economies. Table 1 shows the Chinese foreign trade with the BRIS countries from 2000 to 2009.

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The table illustrates that imports from and exports to the BRIS countries increased between 2000 and 2008, but after the global financial crisis, from 2008 to 2009, there was an overall decline in trade for all countries. In 2009, the BRIS countries combined accounted for 7.2% of China's imports and 5.7% of China's exports. From the point of view of its source of imports among the BRIS countries, Russia was the main supplier for China until 2008. But Russia's annual export growth was not as fast as Brazil's between 2000 and 2008. Brazil became China's biggest import market when its exports increased from US$1.6 billion in 2000 to US$29.6 billion in 2008, which accounted for 2.6% of China's total imports. China's imports from India and South Africa have also increased from US$1.3 billion and US$1 billion in 2000 to US$13.7 billion and US$8.7 billion in 2009, respectively. In terms of total exports, Russia was the top export market for China's goods in 2000 (US$2.2 billion), followed by India (US$1.5 billion), Brazil (US$1.2 billion) and South Africa (US$1 billion). However, India overtook Russia in 2009 and became the leading export destination. China's exports to India increased to US$29.7 billion, accounting for 2.5% of China's total exports. China's exports to Brazil, Russia and South Africa have also increased, but its export growth to these countries was not as fast as India's.

Consequently, China has provided an opportunity and a market for primary commodity exporters from developing countries. This has helped to raise economic growth in a number of developing countries in recent years (Jenkins, 2008). Thus, the emergence of China as a large trading nation and destination of international investment is likely to have positive spillover effects on its trading partners. The question arises on the extent to which this affects the BRIS economies. This paper attempts to answer this question by identifying supply and demand shocks from China and investigating their transmission to the BRIS countries.

3. METHODOLOGY

This section outlines two steps. First, it introduces the dynamic factor model used to extract the common factors from a large panel of macroeconomic variables and financial variables. Second, it adopts a sign restriction procedure to identify the structural shocks from China.[3]

3.1 The Dynamic Factor Model

Factor analysis has increased in popularity in empirical macroeconomics because of its ability to accommodate a large number of variables without facing the degrees-of-freedom problem.[4] Classical factor models were initiated by Sargent and Sims (1977) and Geweke (1977). These models have been applied by Singleton (1980), Chamberlain and Rothschild (1983) and Stock and Watson (1998), among others. The main idea of factor models is that all the information included in a large dataset can be captured by few key common factors. These factors represent the hidden forces underlying the co-movement of observable series. This co-movement in macroeconomics is due to a handful of common factors, such as productivity, monetary policy, trade linkages, financial

[3] More details can be found in Forni and Lippi (2001) and Stock and Watson (2002a,b).

[4] Factor analysis has been used by Forni et al. (2005), Kabundi (2009), Kabundi and Nadal De Simone (2011), Doz et al. (2011), Crucini et al. (2011) and Çakır and Kabundi (2013b).

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linkages and oil price shocks. In this paper, the unobserved factors assist in the identification of supply and demand shocks. Various methods have been proposed to construct these common factors, the simplest being the principal component analysis introduced by Stock and Watson (2002a).

Suppose there are N number of different observable economic variables, each one consisting of T observations. It is assumed that, for each observation in time t, all the N individuals partially depend on a small number, r, of nonobservable, or latent, common factors. Assume that Y_t is represented as the sum of the two latent components: a common component, $X_t=(x_{1t}, x_{2t}, \ldots, x_{Nt})'$ and the idiosyncratic component, $\Xi_t=(\varepsilon_{1t}, \varepsilon_{2t}, \ldots, \varepsilon_{Nt})'$. Thus, the dynamic factor model of Stock and Watson (1998, 2002a) can be represented as

$$Y_t=X_t+\Xi_t=\Lambda F_t+\Xi_t \tag{1}$$

where X_t is the N vector of common components and $\Lambda=\left(\lambda_1', \lambda_2', \ldots, \lambda_N'\right)'$ is the $N\times r$ matrix of factor loadings with $r \ll N$. $F_t=(f_{1t}, f_{2t}, \ldots, f_{rt})'$ being a vector of r common factors. The common component of each series is driven by a small number of shocks common to all variables. However, the effects of the common shocks are different for each variable because of the different factor loadings. The idiosyncratic component is the part of the series driven by idiosyncratic shocks that are specific to each variable or measurement errors, and they are orthogonal to common factors. Unlike the VAR process, the factor model can accommodate a large number of variables. All the N series depend on r factors, meaning that there is an r-dimensional matrix representing the N series. Mathematically, we have

$$X_t=VV'Y_t \tag{2}$$

where V' is the $N\times r$ matrix of eigenvectors corresponding to the largest r eigenvalues. The common factors, F_t, are estimated in a consistent manner using the standard principal component analysis to Y_t,

$$F_t=V'Y_t \tag{3}$$

where V is an estimate of the matrix of factor loadings, Λ in equation (1). Hence, the idiosyncratic components are

$$E_t=Y_t-X_t \tag{4}$$

Lastly, as in Forni *et al.* (2005), we estimate the dynamics of the common factors by a VAR(1) as follows

$$F_t=\Psi F_{t-1}+\mu_t \tag{5}$$

where Ψ is an $r\times r$ matrix and μ_t a $r\times T$ is a vector of residuals. We allow the mild serial correlation of the idiosyncratic errors as in Chamberlain (1983) and Chamberlain and Rothschild (1983), but the weak correlation vanishes with the law of large numbers, allowing a better approximation of common factors.

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Table 2. Sign restrictions

Shocks	Output	Prices	Interest rates
Positive supply shock	+	–	–
Positive demand shock	+	+	+

3.2 Identification of Structural Shocks

The identification of structural shocks is based on the reduced-form VAR model in equation (5). The study follows the identification of supply and demand shocks based on sign restrictions imposed on the short-run impulse response functions of the variables of interest proposed by Faust (1998).[5]

In the first step, the reduced-form VAR residuals, μ_t, are orthogonalised using the Cholesky decomposition. The vector of orthogonalised residuals is $v_t = A^{-1}\mu_t$ and $E\left(v_t\, v_t'\right) = \mathrm{I}$. Thus,

$$\mathrm{cov} = (\mu_t) = AE\left(v_t v_t'\right)A' = AA' \tag{6}$$

with A being the $r \times r$ lower triangular Cholesky matrix.

In the second step, we identify the main driving forces behind China's GDP. This is achieved by extracting the shocks which maximise the changes in China's GDP of the k-step ahead of the forecast error variance out of the orthogonalised residuals.[6] The vector of the estimated main driving forces $\omega_t = (\omega_{1t}, \omega_{2t}, \ldots, \omega_{rt})'$ is linearly correlated to the identified shocks through the $r \times r$ matrix Q. In doing so, we assure that the shocks observed are indeed from China.[7] Hence, we have

$$v_t = Q\omega_t \tag{7}$$

The objective of the procedure is to choose Q so that the first shock explains as much as possible the forecast error variance of China's GDP over a certain horizon k and the second shock explains as much as possible the remaining forecast error variances.

In the third step, orthogonal shocks are identified by rotation. We rotate v_t and impose sign restrictions, as specified in Table 2, to identify Chinese supply and demand shocks given by $\eta_t = R\omega_t$. The vector of orthogonal two shocks $\omega_t = (\omega_{1t}, \omega_{2t})'$ is multiplied by any 2×2-dimensional orthogonal rotation matrix, R, of the form

$$R = \begin{pmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{pmatrix}$$

with θ being the rotation angle, $\theta \in (0, \pi)$, which varies on a grid to produce all possible rotations. In this study, the angle of rotation is applied on the first two principal

[5] These restrictions have gained popularity in empirical macroeconomics. See, for instance, Uhlig (2005), Peersman (2005), Ruffer et al. (2007) and Kabundi and Nadal De Simone (2011).

[6] In this case k is 20 quarters or 5 years.

[7] In general, the results based on a sample containing only Chinese variables depict the same pattern. These results are available upon request.

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component shocks. To account for uncertainty in the factor estimation, we use the bootstrapping technique proposed by Kilian (1998) in constructing confidence bands.

The identification strategy is based on the aggregate supply and aggregate demand paradigm, which is the core of many macroeconomic textbooks. We have adopted this procedure to avoid the unrealistic identification strategies that are commonly used in the VAR framework setting to zero short-term restrictions and long-run restrictions of Blanchard and Quah (1989).

The sign restrictions used here are in line with a typical aggregate supply and aggregate demand diagram. In addition, they are consistent with the many theoretical models, such as the IS-LM model and the new Keynesian model, used in the dynamic stochastic general equilibrium model of Smets and Wouters (2003). The positive demand shock shifts the aggregate demand curve upwards while the positive supply shock shifts the aggregate supply curve downwards. Hence, the positive demand shock affects both domestic output and prices positively, whereas the positive supply shock has a positive effect on domestic output, but domestic prices react negatively. The central bank is thus likely to react to the supply shock by decreasing the nominal interest rates to account for price reduction and increasing them in the case of a positive demand to curb upward pressure on inflation.[8] Other variables are left unrestricted. If these shocks are correctly identified, the restricted variables – *i.e.* the output, prices and short-term interest rates – should portray a pattern consistent with the restrictions imposed. Only then can we trust their transmissions to unrestricted variables domestically and their spillover to BRIS countries.

4. DATA AND ESTIMATION

The dataset comprises 161 ($N = 161$) quarterly variables, ranging from 1995Q2 to 2009Q4, which implies that $T = 59$. The reason for the choice of this time span is to consider the pre-crisis period as the BRIS countries, especially South Africa, were mainly affected from 2009Q2 onwards. Specifically, the dataset contains 32 variables for Brazil, 28 for China, 30 for India, 34 for Russia and 37 for South Africa. The dataset covers real variables (such as GDP, industrial production, consumption expenditure, investment, exports and imports), nominal variables (*e.g.* the consumer price index (CPI)) and financial variables (like interest rates, exchange rates, monetary aggregates, portfolio flows and direct investment flows). The series were obtained from the databases of International Financial Statistics of the International Monetary Fund (IMF), the Organisation for Economic Co-operation and Development and the GVAR Toolbox1.0.[9] In order to be consistent, all the variables are measured in US dollars. They are included in the same dataset as in Eickmeier (2007) and Kabundi and Nadal De Simone (2011). We then use the ICp1 information criteria developed by Bai and Ng (2002) to determine the number of factors, which gives three common factors, $r = 3$. As pointed out by Stock and Watson (2002b), increasing the number of factors does not alter the results but it does lead to a degrees-of-freedom issue, given the small sample size.

[8] For more details on sign restrictions, see Peersman (2005), Straub and Peersman (2006), Fratzscher et al. (2010) and Canova and Paustian (2011).

[9] The GVAR series can be obtained from http://www-cfap.jbs.cam.ac.uk/research/gvartoolbox/download.html

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Where appropriate, all the series are seasonally adjusted using the X12 filter. They are transformed into logarithms, except those in percentages and those containing negative values. As required in the factor model, the series are transformed to induce stationarity using two-unit root tests, namely the Augmented Dickey-Fuller (ADF) tests and the Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test (1992). The KPSS test differs from the ADF tests in that the data series in the former are assumed to be trend-stationary and use the different null hypothesis of stationarity as opposed to nonstationarity. The variables and their transformation are provided in the Appendix.

5. EMPIRICAL RESULTS

This section presents the empirical results in the form of impulse response functions and the variance share of the common components. The impulse response analysis shows the direction, magnitude and time path of domestic variables from the supply and demand shocks emanating from China. Figures 2–6 show the profiles of these variables for each of the BRICS countries, where the dotted lines indicate the 90% confidence intervals. They are calculated over 20 quarters. The variance share of the common component is useful, as it measures the importance of channels through which shocks are transmitted.

5.1 China's Shocks

The impulse response functions of China's supply and demand shocks and their effects on its variables are depicted in Fig. 2. The results show that the responses of output, interest rates and inflation to supply and demand shocks are consistent with the restrictions imposed in Section 3.2. The supply shocks increase output and lower interest rates. However, the response of inflation is positive although insignificant.

In contrast to supply shocks, positive demand shocks induce an immediate increase in output, interest rates and inflation. It is more likely that a supply shock in China is driven by an increase in productivity, which in turn leads to an improvement of the quality of goods produced and a decline in the cost of production. This is evident in the fact that the country has experienced higher productivity in the past three decades (He *et al.*, 2009; Gong and Li, 2010) with lower cost of production. High productivity combined with low cost of production pushes exports up and increases the imports of raw materials. This is in line with the empirical work of Liu *et al.* (2001), who find that the growth of exports causes the growth of imports. While the supply shock is productivity-driven, the demand shock is driven by massive domestic investment (Eickmeier and Kühnlenz, 2013), which boosts output and drives export prices as well as commodity prices up (Cargill and Parker, 2004; Diao *et al.*, 2012).

Positive supply shocks have permanent effects on output, exports, imports, inward FDI flows and share prices. They record 1, 0.5, 0.8, 1 and 0.7% increases, in that order, and stay high and significant. However, the effects on outward FDI flows and short-term interest rates are insignificant. In general, by increasing productivity in China, supply shocks lead to an increase in exports to BRIS countries. All goods that are produced locally are not consumed locally, and a substantial portion is thus exported. Exports to the BRIS group increase as a result, distorting domestic production through outsourcing or simply closing down, which means a decrease in wages in the BRIS countries. Autor *et al.* (2013) show how the emergence of China has affected the labour markets in the

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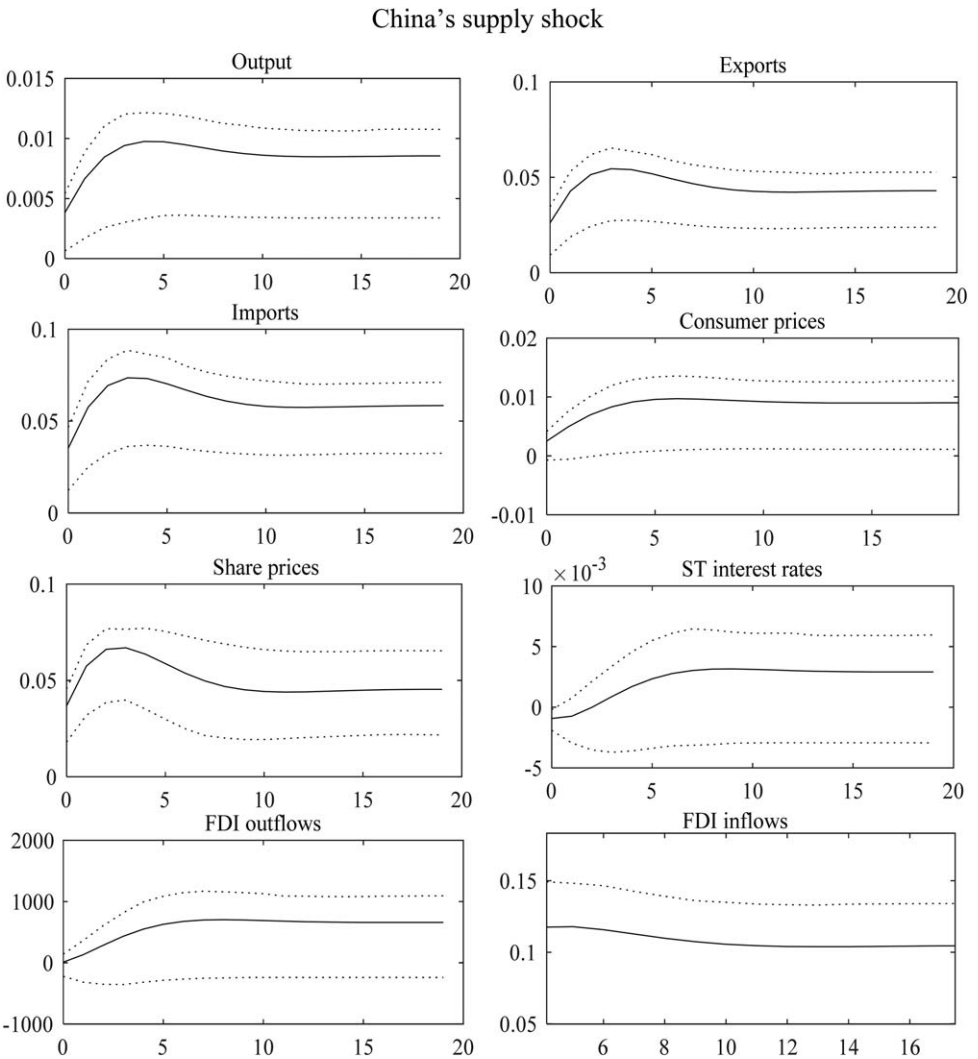

Figure 2. Impulse response functions of Chinese variables. China's supply shock, China's demand shock

US and in Brazil negatively, especially for the industries that produce similar products. Recipient countries are experiencing an exodus of labour from tradable industries to non-tradable industries. Due to outsourcing, the BRIS FDI outflows support new industries in China. In addition, China's economic expansion due to higher productivity and low production costs attracts FDI from both advanced and emerging market economies.

Positive demand shocks, on the other hand, have positive but short-lived effects on output, exports, imports and inward FDI flows. The immediate response of these variables to demand shocks is less than 0.5% and the effect dies out after a few quarters. The effect of demand shocks on outward FDI flows, short-term interest rates and consumer prices is positive and significant, and stays high over the long term. Demand shocks encourage more import of raw materials. As the import of raw materials increases, the

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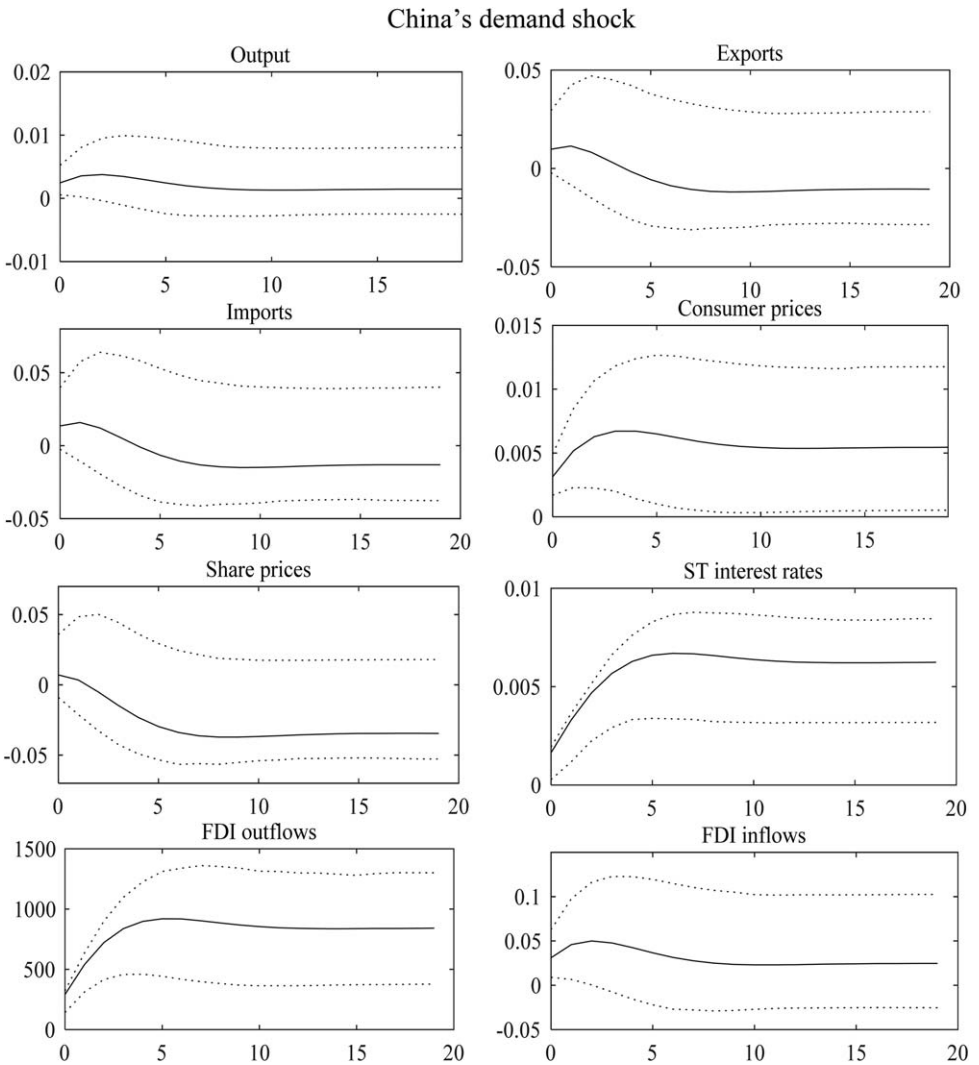

Figure 2. (Continued)

outward FDI rises to support imports. An increased demand for raw materials and agricultural products leads thus to an increase in imports from China. As imports from China rise, BRIS exports to China in turn trigger exports, but the effects caused by a demand shock on exports are less than the effects induced by a supply shock.

In general, supply shocks seem more important and persistent than demand shocks. These findings are consistent with the work of Kojima *et al.* (2005), who point out that the increase in China's annual GDP growth rate since 1998 indicates the existence of positive supply shocks. Supply shocks attract more inflows of foreign investments into the country, while demand shocks encourage outflows of foreign investments. Supply shocks have permanent positive effects on inward FDI flows, while demand shocks; on the other hand, have positive and long-lasting effects on outward FDI flows. In addition, the effects of supply shocks on exports and imports are positive and stay high and

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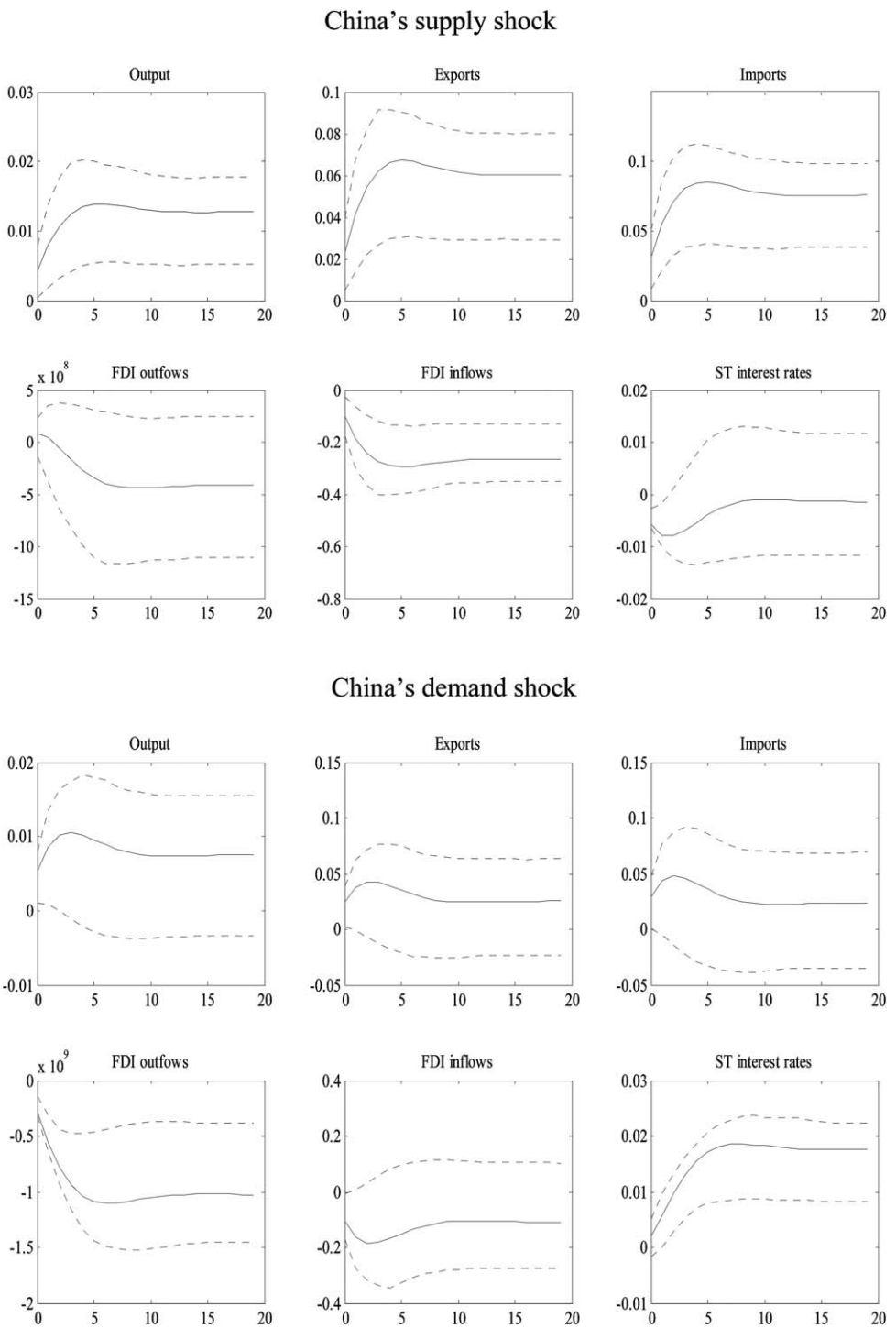

Figure 3. Impulse response functions of Brazilian variables. China's supply shock, China's demand shock

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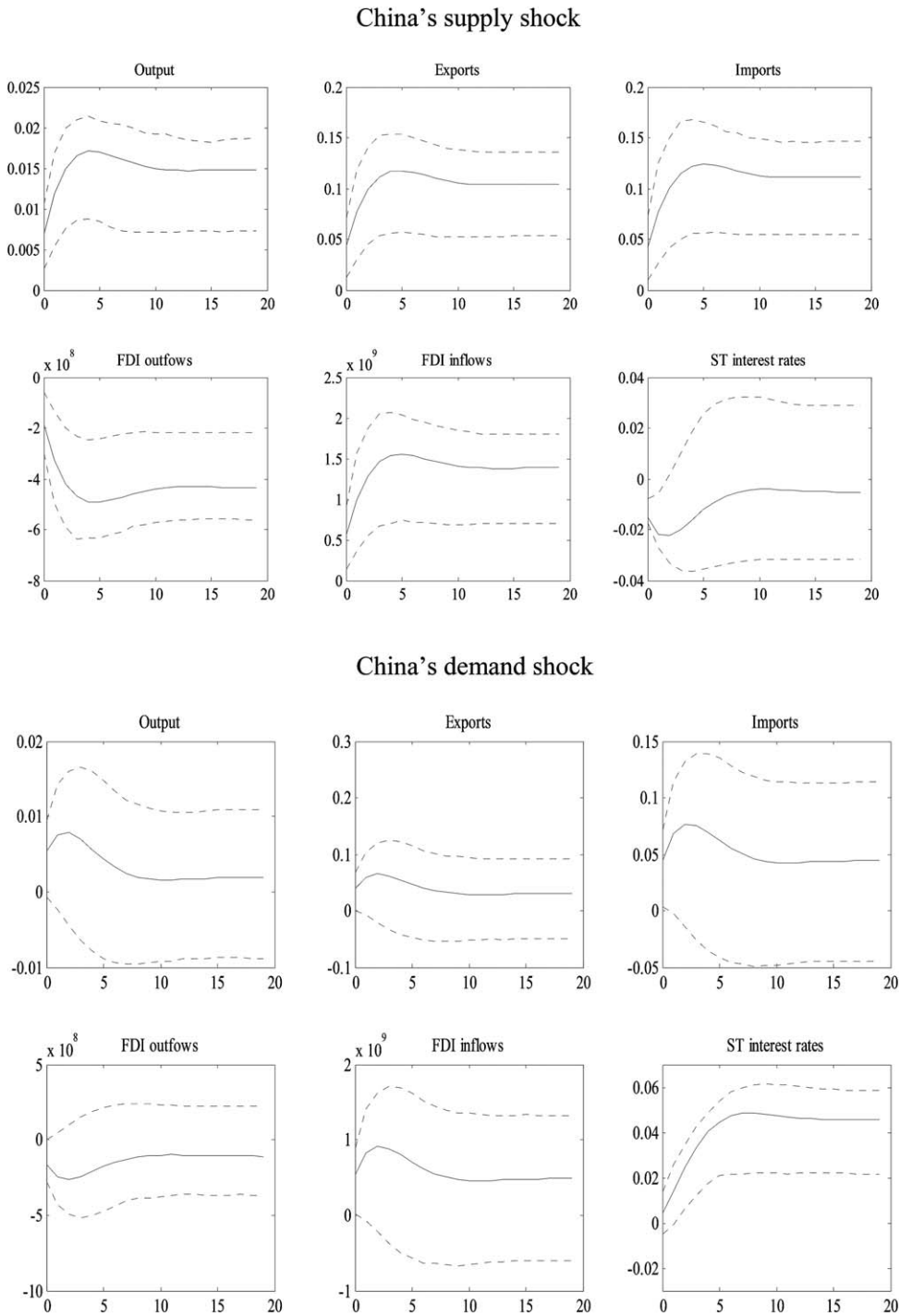

Figure 4. Impulse response functions of Russian variables. China's supply shock, China's demand shock

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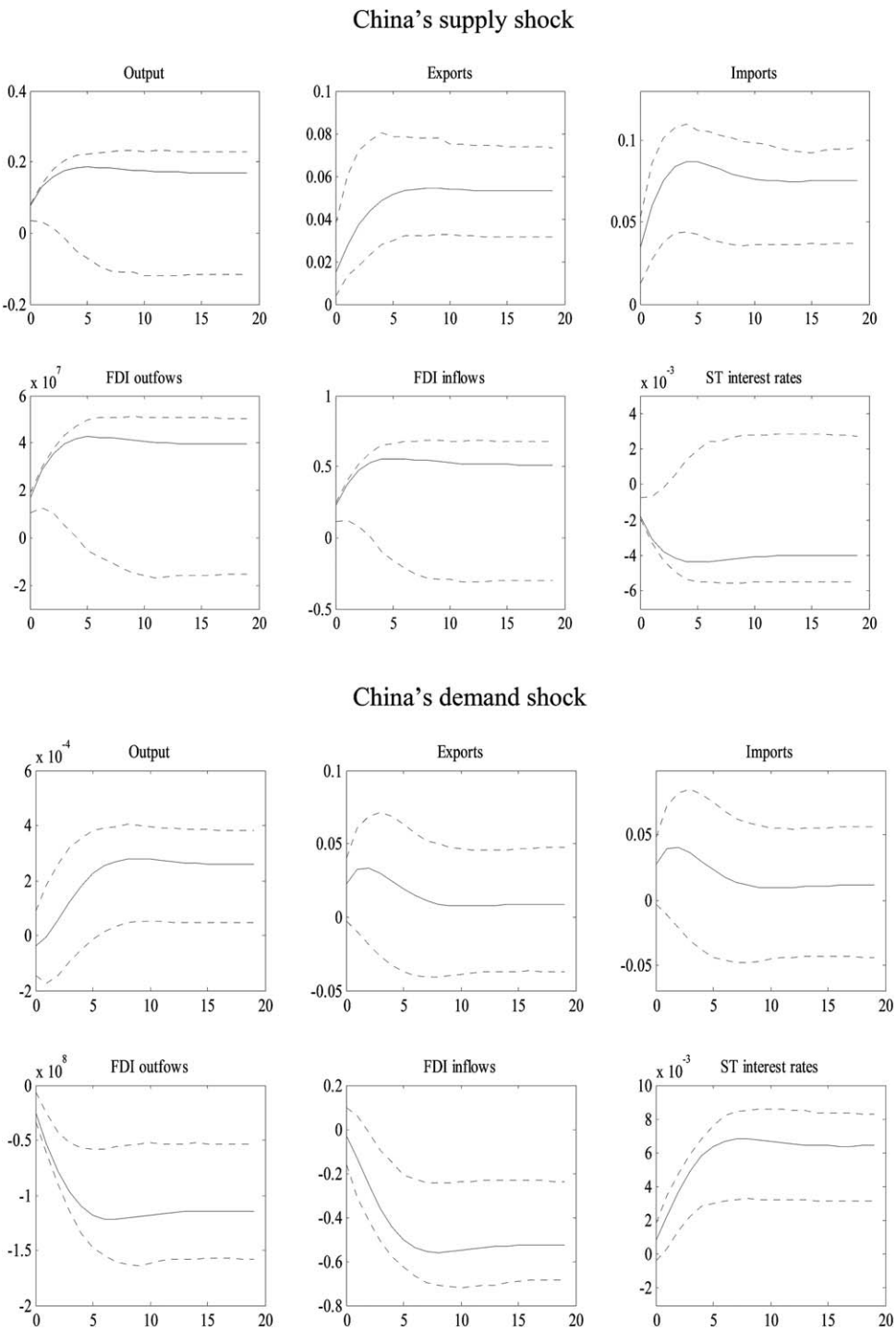

Figure 5. Impulse response functions of Indian variables. China's supply shock, China's demand shock

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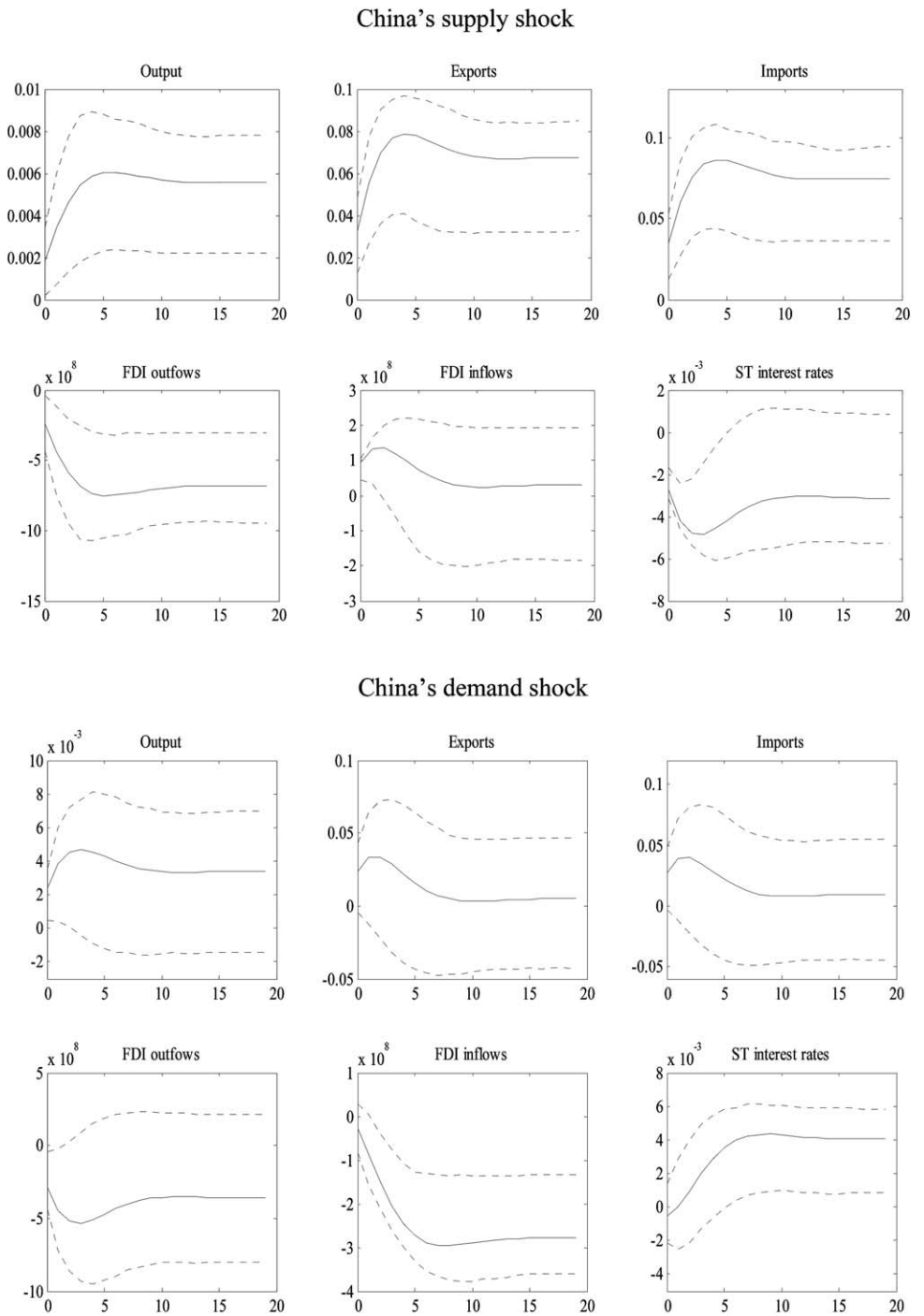

Figure 6. Impulse response functions of South African variables. China's supply shock, China's demand shock

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significant over the entire period. As expected by theory, both exports and imports react to a positive demand shock. The effects are positive and short-lived on both variables. These findings are in line with the nature of China's economy, which boosts a significant current account surplus. The findings are further shown to be consistent with the data and the literature, as the average share of international trade (exports and imports) amounts to a significant proportion of China's GDP (World Bank, 2011).

5.2 Transmission of China's Shocks to the BRIS Countries

Figures 3–6 present the effects of China's supply and demand shocks on the BRIS variables. Better performance of the Chinese economy leads to a higher demand for raw materials from emerging markets, namely (in the case of the present study) Brazil, Russia and South Africa. Thus, China's supply shocks have a permanent effect on both the exports and the imports of all the BRIS countries.

Second, since supply shocks induce downward pressure on global inflation through a low cost of production, Chinese products are cheap and of high quality compared to its competitors (Pula and Santabarbara, 2011). These products are very attractive in both advanced and emerging market economies. Hence, by increasing Chinese exports, supply shocks boost imports in the BRIS countries. China's supply shocks have a permanent effect on both the exports and the imports of all the BRIS countries. This finding is in line with Freund and Ozden (2006), who find that China is displacing Central American exports, mostly in sectors associated with relatively high-wage countries.

Ultimately, the permanent increase in exports feeds into a rise in output from recipient countries. The real outputs in all the BRIS countries rise and stay high for the entire period, except in India. The effects vary across the countries, with the highest response recorded in Brazil and Russia. They both record a 1% rise immediately after the shock and an increase to 1.5% and 1.7% by the fourth and fifth quarters, respectively. The supply shocks are transmitted to South Africa's output much less forcefully than to Brazil and Russia. On impact, South African output increases to 0.2% and reaches a maximum of 0.4% in quarter four. In the case of India, positive supply shocks are positively transmitted to its output, but the effect is significant only for short horizons.

Positive supply shocks have positive and short-lived effects on South Africa's FDI inflows and India's FDI inflows and FDI outflows. The shocks, however, are negatively transmitted to South Africa's and Russia's FDI outflows and Brazil's FDI inflows. On the other hand, China's supply shocks have a positive, significant and long-lasting effect on Russia's FDI inflows. The recent movements in FDI flows between China and BRIS support existing trade linkages. These results are consistent with the study by Liu *et al.* (2001), who find evidence of a relationship between inward FDI flows and better economic performance in China and the study by Kueh *et al.* (2008), who find a positive relationship between trade openness and Malaysia's outward FDI in the short and long run besides other macroeconomic determinants like income and the real effective exchange rate. As reported by China's Ministry of Commerce in 2014, 90% of China's outward FDI was invested in six sectors: leasing and business services (33%), finance (18%), mining (14%), wholesale and retail trade (13%), transportation and storage (6%) and manufacturing (6%) MOFCOM (2014). Chinese investments are spread across a wide range of sectors in manufacturing, natural resources and services in Brazil, while the sectors that have attracted Chinese investments in South Africa include energy,

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Table 3. Variance shares of the common components of BRIS

Variables	Brazil	Russia	India	SA
GDP	0.07	0.36	0.02	0.40
Consumer prices	0.12	0.02	0.05	0.04
FDI inflows	0.21	0.07	0.08	0.04
FDI outflows	0.12	0.01	0.02	0.08
Exports	0.37	0.59	0.47	0.40
Imports	0.55	0.36	0.51	0.40
Industrial production	0.29	0.06	0.14	0.30
Real effective exchange rate	0.08	0.16	0.03	0.17
Short-term interest rates	0.08	0.20	0.21	0.17

technology, mining and metallurgy, electronics, telecommunication, textiles, commercial banking, transportation, manufacturing, construction and automobiles(Yaw Baah and Jauch, 2009).

As discussed in Section 5.1 and consistent with Eickmeier and Kühnlenz (2017), supply shocks in China put downward pressure on global inflation. BRIS monetary authorities react to a decrease in inflation by decreasing short-term interest rates. South Africa is the most affected, with a recorded drop of 3% immediately after the shock, reaching 4% in the third quarter, while the maximum decline for other BRIS countries varies between 0.1 and 1%.

In general, positive demand shocks from China are transmitted in a similar fashion across all the BRIS countries. They affect both the exports and the imports of the BRIS countries in the short run, and the effects die out gradually. These effects are then translated into a positive and short-lived rise in output. Brazil's, Russia's and South Africa's outputs increase by 0.05%, 0.03% and 0.002%, respectively. The effect on India's GDP is permanent, although weak. It reaches a maximum of 0.002% in quarter four. Both FDI inflows and outflows drop, except FDI inflows in Russia, which show a short-term increase. In contrast to supply shocks, Eickmeier and Kühnlenz (2017) find evidence that China's demand shocks contribute largely to global inflation. Figures 3–6 depict the reaction of BRIS to the upward trend in inflation by increasing short-term interest rates.

It is evident from the above analysis that Chinese supply and demand shocks both affect all the BRIS countries. But the analysis is silent on the channels through which the shocks are transmitted. Table 3 presents the variance shares of the common components, which measure the degree of variation of each BRIS country's variable attributable to Chinese factors. We extract 3 common factors from a dataset, including 28 Chinese variables. We then compute the variance shares of the common components for each BRIS variable attributed to Chinese factors.

The findings are consistent with Cesa-Bianchi *et al.* (2012) and Eickmeier and Kühnlenz (2017). The variance shares of the common components are 55%, 36%, 51% and 40% for the imports of Brazil, Russia, India and South Africa, respectively, while we have 37, 59, 47 and 40% for the exports of the same countries in the same order. But financial variables exhibit low variance shares of the common components. Therefore, these results point to the relevance of trade as the main channel of the transmission of shocks rather than financial linkages. These findings are consistent with Çakır and Kabundi (2013a), who find strong trade linkages among the BRICS countries.

Overall, the shocks affect the BRIS countries differently depending on their trade relationship with China. Hence, it can be argued that since China's supply and demand shocks do not have similar effects on the BRIS countries, they require country-specific

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policy responses. The differences in each response will depend on the products that are traded. China mainly exports manufactured goods to these countries and imports natural resources (Rangasamy and Swanepoel, 2011; Jenkins, 2012). For instance, commodities, especially metal products, dominate South Africa's exports to China (Rangasamy and Swanepoel, 2011) while South Africa's imports from China consist mainly of machinery and electrical equipment, textiles, clothing and footwear (Çakır and Kabundi, 2013a). Brazil's exports to China are commonly concentrated in a small number of primary products while its imports from China consist mainly of manufactured goods (Jenkins, 2012). Given that oil is an indispensable commodity for the expansion of the Chinese economy and the fact that it makes up a large proportion of Russian exports to China, one would expect that trade between China and Russia would affect the latter more than South Africa. This is why different countries have a different reaction to shocks. But they import similar products from China. In addition, the reaction of BRIS depends largely on the structure of the countries' industry (Jenkins, 2012; Vadra, 2012; He, 2013; Besada *et al.*, 2013).Specifically, the most-affected industry is textile and manufacturing. Even though the rise of China has been generally positive for BRIS as an alternative to trade with advanced economies, China has benefited a great deal from this trade agreement.

This trade imbalance is the result of the structure of the Chinese economy, which is mostly closed to external competition. BRIS countries should find ways of penetrating the Chinese market and China should open up its economy to BRIS countries to allow direct access to its market. If they succeed, they will benefit enormously due to the size of the Chinese market, which is related to the size of its population. In addition, the emergence of the middle class in China creates immense opportunities for many countries. However, the challenge is that any country aspiring to penetrate the Chinese market should be at least as competitive as China. Or they need to identify niche markets where they have a competitive advantage. One way of achieving this is through the support of government or the adoption of industrial policies that enhance the competitiveness of some industries with a flexible labour market. For example, South-East Asian countries such as Bangladesh and Vietnam have embarked on reforms which have made them more competitive than China, especially in the textile industry. India has followed a similar approach in the pharmaceutical industry and thus has emerged as one of the fastest-growing pharmaceutical industries in the world, with growing trade surpluses (Pradhan, 2006). Another way to access the Chinese market is through the initiative of the Chinese government, such as bilateral trade agreements.

6. CONCLUSIONS

Since China's emergence as a major player in the global economy there has been increasing interest among policymakers and academics in examining its effects on other countries, especially the developing ones. This paper investigates the effects of China's shocks on the BRIS countries. In particular, two types of shocks, namely positive supply and demand shocks, are used to assess the time profile of the effects of these shocks. This study uses a large dimensional dynamic factor model with quarterly data from 1995Q2 to 2009Q2.

The findings show that China's shocks have different effects on each of the BRIS countries. For instance, its supply shocks are more forcefully transmitted to BRIS than

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the demand shocks. They have a permanent, positive and significant effect on real output in all the countries, except India. In the case of India, the effect is positive and significant only for short horizons. In addition, the main channels of transmission of all the shocks are exports and imports between China and Brazil, but mainly imports; exports and imports between China and Russia, but more exports; more exports but less imports between China and India; and roughly equal exports and imports between China and South Africa. This shows that across China and the BRIS countries, transmission channels are mainly trade-based rather than financial. Financial linkages are almost non-existent. This seems to suggest that China is a dominant powerhouse when it comes to trade, but its financial integration with BRIS is still in its infancy. China's significant demand for raw materials seems to track positive supply shocks, which explains why it seems to affect Brazil, Russia and South Africa positively. It is then possible to refer to the increased volume of trade and investment between China and the BRIS countries as evidence of increased international economic integration. As the BRIS countries do not trade the same products with China, they have different reactions to China's shocks.

Even though the BRIS countries have benefited from trading with China, the gain is minute in comparison to China. In order to correct this imbalance, the BRIS countries should embark on policy reforms which would increase their competitiveness and thus enable them to penetrate the opaque Chinese market of manufactured goods and services. This can be done via government support and/or a reform of the labour and product markets. Another way of gaining access to the Chinese market is through the initiative of the Chinese government, such as bilateral trade agreements.

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APPENDIX: MACROECONOMIC SERIES

No.	Country and variable name	Short name	Log	Stationarity	Treatment
1	Brazil – Current transfers: credit (flow)	bra01	l	1	5
2	Brazil – Current transfers: debit (flow) sa	bra02	nl	1	2
3	Brazil – Direct invest. in rep. econ.(inward FDI, flow)	bra03	l	0	4
4	Brazil – Direct investment abroad (outward FDI, flow)	bra04	nl	0	1
5	Brazil – Exports, f.o.b. (flow) sa	bra05	l	1	5
6	Brazil – GDP vol. (2005=100) (index, 2005=100) sa	bra06	l	1	5
7	Brazil – Gold in million ounces	bra07	l	1	5
8	Brazil – Government consumption expend. (flow) sa	bra08	l	1	5
9	Brazil – Gross fixed capital formation (flow) sa	bra09	l	1	5
10	Brazil – Household cons. expenditure (flow)	bra10	l	1	5
11	Brazil – Imports, c.i.f. (flow) sa	bra11	l	1	5
12	Brazil – Industrial production (index, 2005=100) sa	bra12	l	1	5
13	Brazil – Monetary aggregate (M1) sa	bra13	l	1	5
14	Brazil – Monetary aggregate (M2) sa	bra14	l	1	5
15	Brazil – Monetary aggregate (M3)	bra15	l	1	5
16	Brazil – National CPI (index, 2005=100) sa	bra16	l	1	5
17	Brazil – National currency per US dollar sa	bra17	l	1	5
18	Brazil – NEER from ins (index)	bra18	l	1	5
19	Brazil – Portfolio investment assets (flow)	bra19	nl	1	2
20	Brazil – Portfolio investment liabilities (flow)	bra20	nl	0	1
21	Brazil – PPI/WPI (index, 2005=100) sa	bra21	l	1	5
22	Brazil – Production in total manufacturing (index, 2005=100) sa	bra22	l	1	5
23	Brazil – Production in total mining (index, 2005=100)	bra23	l	1	5
24	Brazil – Production of crude petroleum (index, 2005=100)	bra24	l	1	5
25	Brazil – Production of total construction (index, 2005=100) sa	bra25	l	1	5
26	Brazil – REER based on rel. cpi (index) sa	bra26	l	1	5
27	Brazil – Reserve assets (flow)	bra27	nl	0	1
28	Brazil – Savings deposits (percent per annum)	bra28	nl	1	2
29	Brazil – Share prices (index)	bra29	l	1	5
30	Brazil – Short-term interest rates (percent per annum)	bra30	nl	1	2
31	Brazil – Time deposits (percent per annum)	bra31	nl	1	2
32	Brazil – Total reserves minus gold	bra32	l	1	5
33	China – Bonds (stock)	chn01	l	1	5
34	China – Capital accounts (stock)	chn02	l	1	5
35	China – Consumer prices: all items (index, 2005=100) sa	chn03	l	1	5
36	China – Consumer prices: food (index, 2005=100) sa	chn04	l	1	5
37	China – Demand deposits (stock) sa	chn05	l	1	5
38	China – Direct invest. in rep. econ. (inward FDI, flow)	chn06	l	1	5
39	China – Direct investment abroad (outward FDI, flow)	chn07	nl	1	2
40	China – Exports, f.o.b. (flow) sa	chn08	l	1	5
41	China – Foreign assets (stock)	chn09	l	1	5
42	China – Foreign liabilities (stock)	chn10	l	1	5
43	China – GDP vol. (index, 2005=100)	chn11	l	1	5
44	China – Gold ac.to national valuation (stock)	chn12	l	1	5
45	China – Imports, c.i.f. (flow) sa	chn13	l	1	5
46	China – Industrial production (index)	chn14	l	1	5
47	China – Monetary aggregate (M1) sa	chn15	l	1	5
48	China – Monetary aggregate (M2)	chn16	l	1	5
49	China – Money (stock) sa	chn17	l	0	4
50	China – National currency per US dollar	chn18	l	1	5
51	China – NEER from ins (index) sa	chn19	l	1	5
52	China – Production of cement sa	chn20	l	1	5
53	China – REER based on rel. cpi (index) sa	chn21	l	1	5
54	China – Reserve money (stock) sa	chn22	l	1	5
55	China – Restricted deposits	chn23	l	0	4
56	China – Savings deposits (stock)	chn24	l	1	5
57	China – Share prices (index)	chn25	l	1	5
58	China – Short-term interest rates (percent per annum)	chn26	nl	1	5
59	China – Time deposits (stock) sa	chn27	l	1	5
60	China – Total reserves minus gold (stock) sa	chn28	l	1	5
61	India – Consumer prices: all items (index, 2005=100) sa	ind01	l	1	5
62	India – Demand deposits (stock) sa	ind02	l	1	5
63	India – Dir. invest. in rep. econ. (inward FDI, flow)	ind03	l	0	4
64	India – Direct investment abroad (outward FDI, flow)	ind04	nl	1	2

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Appendix (Continued)

No.	Country and variable name	Short name	Log	Stationarity	Treatment
65	India – Equity price (index)	ind05	l	1	5
66	India – Foreign assets (stock) sa	ind06	l	1	5
67	India – Foreign liabilities (stock) sa	ind07	l	1	5
68	India – GDP vol. (index, 2005=100)	ind08	l	1	5
69	India – Goods exports: f.o.b. (flow) sa	ind09	l	1	5
70	India – Goods imports: f.o.b (flow)	ind10	l	1	5
71	India – Government deposits (stock)	ind11	l	1	5
72	India – Industrial production (index, 2005=100) sa	ind12	l	1	5
73	India – Lending rate (percent per annum)	ind13	nl	1	2
74	India – Monetary aggregate (M1) sa	ind14	l	1	5
75	India – Monetary aggregate (M3) sa	ind15	l	1	5
76	India – Money (stock) sa	ind16	l	1	5
77	India – National currency per US dollar, sa	ind17	l	1	5
78	India – Portfolio investment liabilities (flow)	ind18	nl	0	1
79	India – PPI/WPI (index, 2005=100) sa	ind19	l	0	4
80	India – Production in total manufacturing (index, 2005=100) sa	ind20	l	1	5
81	India – Production in total mining (index, 2005=100) sa	ind21	l	1	5
82	India – Production of electricity (index, 2005=100) sa	ind22	l	1	5
83	India – REER based on rel. CPI (index) sa	ind23	l	1	5
84	India – Reserve assets (flow)	ind24	nl	0	1
85	India – Reserve money (stock) sa	ind25	l	1	5
86	India – Reserve position in the fund (US dollars)	ind26	l	1	5
87	India – Share prices (index)	ind27	l	1	5
88	India – Short-term interest rates (percent per annum)	ind28	nl	1	5
89	India – Time deposits (stock) sa	ind29	l	1	5
90	India – Total reserves minus gold (US dollars) sa	ind30	l	1	5
91	Russia – Capital account: credit (flow)	rus01	l	0	4
92	Russia – Capital account: debit (flow)	rus02	nl	0	1
93	Russia – Consumer price index (index, 2005=100) sa	rus03	l	1	5
94	Russia – Consumer prices: food (index, 2005=100) sa	rus04	l	1	5
95	Russia – Consumer prices: services (index, 2005=100)	rus05	l	1	5
96	Russia – Current transfers: credit (flow) sa	rus06	l	1	5
97	Russia – Current transfers: debit (flow) sa	rus07	nl	1	2
98	Russia – Deposit rate (percent per annum) sa	rus08	l	1	5
99	Russia – Direct invest. in rep. econ. (inward FDI, flow)	rus09	nl	1	2
100	Russia – Direct investment abroad (outward FDI, flow)	rus10	nl	1	2
101	Russia – Employment (index, 2005=100)	rus11	l	1	5
102	Russia – Exports, f.o.b. (flow) sa	rus12	l	1	5
103	Russia – GDP vol. (index, 2005=100) sa	rus13	l	1	5
104	Russia – Gold in million ounces (stock)	rus14	l	1	5
105	Russia – Government consumption expenditure (flow)	rus15	l	1	5
106	Russia – Gross fixed capital formation (flow)	rus16	l	1	5
107	Russia – Household cons. expenditure (flow) sa	rus17	l	1	5
108	Russia – Imports, c.i.f. (flow)	rus18	l	1	5
109	Russia – Industrial production (index, 2005=100) sa	rus19	l	1	5
110	Russia – Lending rate (percent per annum)	rus20	l	1	5
111	Russia – National currency per US dollar	rus21	l	1	5
112	Russia – NEER from ins (index)	rus22	l	1	5
113	Russia – Portfolio investment assets (flow)	rus23	nl	0	1
114	Russia – Portfolio investment liabilities (flow)	rus24	nl	0	1
115	Russia – Private final consumption expenditure sa	rus25	l	1	5
116	Russia – Production of coal (units, tonnesmln) sa	rus26	l	0	5
117	Russia – Production of crude petroleum (index, 2005=100) sa	rus27	l	1	4
118	Russia – Production of gas (units, m^3 bln) sa	rus28	l	0	5
119	Russia – REER based on rel. CPI (index) sa	rus29	l	1	5
120	Russia – Refinancing rate (percent per annum)	rus30	l	1	5
121	Russia – Reserve assets (flow)	rus31	nl	0	1
122	Russia – Reserve position in the fund (US dollars)	rus32	l	1	5
123	Russia – Short-term interest rates (percent per annum)	rus33	l	1	5
124	Russia – Total reserves minus gold (stock) sa	rus34	l	1	5
125	South Africa – Capital account: debit (flow)	sa01	nl	0	1
126	South Africa – Consumer price index (index, 2005=100) sa	sa02	l	1	5
127	South Africa – Consumption of fixed capital (average) sa	sa03	l	1	5
128	South Africa – Current transfers: credit (flow)	sa04	l	1	5

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Appendix (Continued)

No.	Country and variable name	Short name	Log	Stationarity	Treatment
129	South Africa – Current transfers: debit (flow)	sa05	nl	1	2
130	South Africa – Deposit rate (percent per annum)	sa06	nl	1	2
131	South Africa – Direct invest. in rep. econ. (FDI inward, flow)	sa07	nl	0	1
132	South Africa – Direct investment abroad (FDI outward, flow)	sa08	nl	0	1
133	South Africa – Discount rate (percent per annum)	sa09	nl	0	1
134	South Africa – GDP deflator (index, 2005=100) sa	sa10	l	1	5
135	South Africa – GDP vol. (index, 2005=100) sa	sa11	l	1	5
136	South Africa – Gold production (index, 2005=100) sa	sa12	l	1	5
137	South Africa – Goods exports: f.o.b. (flow) sa	sa13	l	1	5
138	South Africa – Goods imports: f.o.b (flow)	sa14	l	1	5
139	South Africa – Government bond yield (percent per annum) sa	sa15	nl	1	2
140	South Africa – Government consumption expend. (average) sa	sa16	l	1	5
141	South Africa – Gross fixed capital formation (average) sa	sa17	l	1	5
142	South Africa – Household cons. expenditure (average) sa	sa18	l	1	5
143	South Africa – Lending rate (percent per annum)	sa19	nl	1	2
144	South Africa – Manufacturing production (index, 2005=100) sa	sa20	l	1	5
145	South Africa – Mining production (index, 2005=100) sa	sa21	l	1	5
146	South Africa – Monetary aggregate (M1) sa	sa22	l	1	5
147	South Africa – Monetary aggregate (M2) sa	sa23	l	1	5
148	South Africa – Monetary aggregate (M3) sa	sa24	l	1	5
149	South Africa – Money market rate (percent per annum)	sa25	nl	1	2
150	South Africa – National currency per US dollar	sa26	l	1	5
151	South Africa – NEER from ins (index)	sa27	l	1	5
152	South Africa – Portfolio investment assets (flow)	sa28	nl	0	1
153	South Africa – Portfolio investment liabilities (flow)	sa29	nl	0	1
154	South Africa – PPI/WPI (index, 2005=100) sa	sa30	l	0	4
155	South Africa – Private final con. expend. (index, 2005=100) sa	sa31	l	1	5
156	South Africa – REER based on rel. cpi (index)	sa32	l	1	5
157	South Africa – Reserve assets (flow)	sa33	nl	0	1
158	South Africa – Reserve position in the fund (US dollars) sa	sa34	l	1	5
159	South Africa – Share prices: all shares (index) sa	sa35	l	1	5
160	South Africa – Short-term interest rates (percent per annum)	sa36	nl	1	2
161	South Africa – Total reserves minus gold (stock)	sa37	l	1	5

Note: The transformation codes (treatment) are as follows: 1 – no transformation (level); 2 – first difference; 4 – logarithm (log-level); 5 – first difference of logarithm (log-first difference). "sa" denotes seasonally adjusted series; "l" denotes a logarithm; "nl" indicates the level of the data; "0" stands for integrated of order zero; "1" denotes the first difference of the series. The data are available over the 1995Q2–2009Q4 period.

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