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The Rise of China and its Implications for Emerging Markets - Evidence from a GVAR model*

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Abstract

This paper studies empirically the role of China in the world economy. We examine both how the Chinese economy reacts to selected exogenous macro-economic shocks, and the repercussions of a shock emanating from China on the world economy. With regard to the latter we focus on the responses of emerging markets, in particular those from Europe. Based on a global VAR (GVAR) model and using a new data set that excels in country coverage as well as covers the most recent time period including the period of the global financial crisis, our results are threefold: First, we show that a +1% shock to Chinese output translates into a permanent increase of 1.2% in Chinese real GDP and a 0.1% to 0.5% rise in output for most large economies. Also the countries of Central Eastern Europe (CEE) and the former Commonwealth of Independent States (CIS) see their output rise by 0.2%, while countries in South-Eastern Europe experience a permanent 0.1% dip in output. Secondly, we examine the effect of a +50% hike in oil prices on China and emerging economies. As one of the largest oil exporters, Russia's real output increases by about 6%. In contrast, the surge in oil prices puts a drag on Chinese output amounting to 4.5% in the long-run. Finally, we try to empirically assess the effect of a revaluation of the Chinese renminbi. Taking an European stance, a 10% depreciation of the euro boosts output in the euro area by 0.4%, while it decreases Chinese output by about the same margin.

Keywords: China, macroeconomic shocks, GVAR, great recession

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1. Introduction – The rise of China and its role in the global economy

China's economic growth since the 1980s has been enormous. The Chinese growth miracle has been fueled by high investment share coupled with strong growth in exports. Even in the period of the global financial crisis, with the global economy dipping into recession and global trade collapsing, the Chinese economy was able to post buoyant growth rates. Moreover, also many other emerging markets have been able to grow rapidly during the past years, which has shifted the balance of power in the global economy towards middle-income countries and away from high-income OECD countries.

This change in the composition of global output and trade makes analysis of the larger emerging markets, and especially China, even more important than before. Our contribution concerns the role of China in the global economy, but also the effects the global economy has on the Chinese economy. At the same time we aim to address a question that so far has received relatively little attention in the literature, namely China's effect on the Central and European countries. Many of these countries have also grown rapidly during the past years, but, unlike China, they also suffered from large output losses during the 2008-2009 economic crises. Many of these countries are also still potential competitors for China, which makes their analysis interesting.

The rise of the Chinese economy is accompanied by a steady increase in its trade integration with the world economy. Figure 1 depicts the share of trade (imports and exports of goods) to China in total trade over the period from 1995 to 2011. The graph illustrates a surge in China's trade integration with Asia, especially with Japan where the share in trade propelled from 10% in 1995 to 25% in 2011. Trade integration with other large economies such as the US, India, Brazil and Russia increased to around 10% in 2011, while that of the euro area increased to around 5%.

There are several studies looking at the impact of macroeconomic shocks on China, but there are only a few embedding the Chinese economy into a global context.

On the one hand, trade and as a consequence the re-location of productivity based on comparative advantages, fosters economic growth across the globe. On the other hand, the recent global financial crisis lent evidence to the danger of stress spilling over through the trade channel. It is thus natural to study the impact of macro-economic shocks by means of a global model that is able to model the interdependencies among the economies. There are two recent studies that examined the impact of an increase in Chinese real output on the world economy by means of a global vector autoregressive (GVAR) model. Cesa-Bianchi et al. (2011) have demonstrated the growing importance of China for the region of Latin America. In particular they show that the impact of a positive shock to Chinese output has increased almost by three times when compared to the same shock but using trade flows from the 1990s to account for the integration of China with the world economy. In the same vein, Cesa-Bianchi et al. (2011) demonstrate that the response of the Latin American region to a shock emanating from the US has halved as a consequence of the rise of China in the world economy.[1] Using the same empirical framework, Dreger and Zhang (2011) trace out the impact of a +1% of Chinese GDP on inflation and the real economy in industrialized countries. Their results show that the impact on output is in particular substantial for the Asian region, while the effects on the US economy and the euro area are less pronounced.

In this paper we study firstly, the impact of a shock emanating from the Chinese economy on the real economy of emerging markets, particularly those in Eastern Europe. For that purpose we have extended the country coverage of the data set used in Cesa-Bianchi et al. (2011) and Dreger and Zhang (2011) including 52 advanced and emerging economies. Secondly we look at potential threats to the Chinese growth miracle by examining revaluation of the renminbi as well as a hike in oil prices. The paper is structured as follows. The next section briefly introduces the empirical framework. Section 3 presents the data and the specification of the model together with a range of empirical tests to ensure the statistical properties of the model. In Section 4 we carry out 4 macro-economic shocks and examine the spatial and dynamic propagation thereof. Finally, Section 5 concludes.

[1] Interestingly, Fidrmuc et al. (2012) report that OECD countries trade more with China have seen their business cycle correlation with other OECD countries decrease.

2 Empirical Approach – The GVAR Model

The global vector autoregressive (GVAR) model is a compact representation of the world economy. It is designed to model economic and financial interdependencies within the global economy. The GVAR model has been successfully employed to study the propagation of macroeconomic shocks (see e.g. Dees et al., 2007, Pesaran et al., 2004, Pesaran et al. 2007) and financial stress (Chudik and Fratzscher, 2011 and Sgherri and Galesi, 2009).

The model comprises of *two layers*[2] that account for cross-sectional linkages among the economies. First, it consists of N country specific sub-models that link the economy to the world by allowing for foreign and global factors. Since macroeconomic time series predominantly share common stochastic trends, these country models are typically specified in vector error correction form. For a particular country j, and $z_t = (y_t, x_t)$ comprising the data, the following system of equations is estimated:

$$\begin{aligned} \Delta y_t &= c_0 + c_1 t + \Pi_y z_{t-1} + \sum_{i=1}^{p-1} \Gamma_{yy,i} \Delta y_{t-i} + \sum_{i=1}^{q-1} \Gamma_{yx,i} \Delta x_{t-i} + \sum_{i=1}^{lex-1} \Psi_i \Delta d_{t-i} + \Lambda_x \Delta \mathrm{x}_t + \Lambda_d \Delta \mathrm{d}_t + e_{yt} \\ \Delta x_t &= c_{x0} + c_{x1} t + \sum_{i=1}^{p-1} \Gamma_{xy,i} \Delta y_{t-i} + \sum_{i=1}^{q-1} \Gamma_{xx,i} \Delta x_{t-i} + e_{xt} \end{aligned} \quad (1)$$

with $u_t = (e_{yt}, e_{xt})$ and $u_t \sim N(0, \Sigma_u)$. We distinguish four different types of variables here: First, $\mathrm{y_t}$ denotes the set of domestic (endogenous) variables. The set of domestic variables is enlarged by controlling for external factors $\mathrm{x_t}$. This set of so-called foreign (weakly exogenous) variables is constructed as a cross-country weighted average of its domestic counterparts $x_t^i = \sum_{j \neq i} w_{ij} y_t^j$, with $w_{ij} \geq 0;\ w_{ii} = 0;\ \sum_{j=1}^{N} w_{ij} = 1$. The weights $w_{ij} \in W_b$ signify economic ties between the countries and are typically based on bilateral trade flows that are captured in an N x N matrix W_b. Thirdly, $\mathrm{d_t}$ denotes global (exogenous) variables that are not determined within the country systems. In the empirical application we will control for the global business cycle by including the price of oil as exogenous variable for all other countries except the US. Note that both weakly

[2] For an excellent text book exposition of the GVAR see Garrat et al. 2006.

exogenous and exogenous variables enter the conditional model for Δy_t both *contemporaneously* and in lagged form. Finally, each country model contains a trend and / or intercept term.

The system of equations comprises information about the long-run, $\Pi = \begin{pmatrix} \Pi_y \\ \Pi_x \end{pmatrix} = \begin{pmatrix} \Pi_{yy} & \Pi_{yx} \\ \Pi_{xy} & \Pi_{xx} \end{pmatrix}$, as well as the short-run, $\Gamma = \begin{pmatrix} \Gamma_{yy} & \Gamma_{yx} \\ \Gamma_{xy} & \Gamma_{xx} \end{pmatrix}$. Note that $\Pi_x = 0$, which indicates that information from the conditional model for Δy_t is redundant for Δx_t. Furthermore, this assumption implies that the vector of foreign variables is not cointegrated (Assenmacher-Wesche and Pesaran, 2008). The way common stochastic trends are accounted for in the GVAR resembles a cointegration system approach akin to Johansen (1995). In case the domestic variables are cointegrating, the 'long-run' matrix Π is rank deficient, which in turn prohibits a straightforward economic interpretations of the coefficients describing the long-run equilibrium.

In the *second layer* of the GVAR framework, the single country models are 'stacked' to yield a coherent global macro-model that is able to model the dynamics and spatial propagation of macro-economic shocks to the system:

$$\mathrm{G} y_t = c_0 + c_1 t + \sum_{k=1}^{P} \mathrm{H}_k \, y_{t-k} + \sum_{k=1}^{L} \Upsilon_k \Delta \, d_{t-k} + u_t \qquad (2)$$

with H and ϒ containing the stacked coefficient matrices from the single countries and $P = \max(p_i, q_i)$, $L = \max\,(lex_i)$. Note that we have linked the models by making use of the fact that $z_t^i = \begin{pmatrix} y_t^i \\ x_t^i \end{pmatrix} = W_{global}^i \begin{pmatrix} y_t^1 \\ \vdots \\ y_t^N \end{pmatrix} = W_{global}^i y_t$, with W_{global}^i denoting a $K_i \; x \; K$ matrix, where K_i is the sum of endogenous and weakly exogenous variables in country model i and $K = \sum_{i=1}^{N} K_i$ the total number of endogenous and weakly exogenous variables in the system. The matrix W_{global}^i is crucial in the sense that it 'links' the single country models and thus governs the propagation of a shock. Note that the weigths in W_{global}^i do not have to match the ones to construct the foreign variables. Since the square matrix G is non-singular, equation (2) can be multiplied by G^{-1} from the left to yield the GVAR model:

$$y_t = \tilde{c}_0 + \tilde{c}_0 t + \sum_{k=1}^{r} \widetilde{H}_k\, y_{t-k} + \sum_{k=0}^{p} \widetilde{\Upsilon}_k \Delta\, d_{t-k} + \tilde{u}_t \quad (3)$$

3 Data & Model Specification

3.1 Data

We have extended the data used in Cesa-Bianchi et al. (2011) and Dreger and Zhang (2011) to cover N=52 economies, among them 51 single countries and the euro area[3] as a regional aggregate:

Table 1: Country coverage

1.) Advanced Economies & BRIC (8):	US, ea14, UK, JP, BR, RU, IN, CN
2.) CEE and Baltics (8):	CZ, HU, PL, SK, SI, LT, LV, EE
3.) SEE (5):	BG, RO, HR, AL, RS
4.) CIS (9):	UA, BY, KG, TJ, MN, GE, AM, AZ, MD
5.) Emerging Asia (6):	KR, PH, SG, TH, ID, MY
6.) Latin America (4):	AR, CL, MX, PE
7.) Middle East and Africa (4):	EG, NG, SA, TR
8.) RoW (8):	CA, AU, NZ, CH, NO, SE, DK, IS

Source: Authors' calculations.

The focus of our analysis rests on the first 4 groups of countries comprising advanced economies to cross-check our results with the established literature, the largest emerging countries (BRICs), as well as emerging countries from Central Eastern Europe (CEE), South-Eastern Europe (SEE) and the former Commonwealth of

[3] Note that the country composition on which data for the euro area is based on changes with time. That is, while historical time series are based on data of the 10 original memberstates, the most recent data is based on 17 countries. Nevertheless we report separate results for Estonia, Slovenia and Slovakia since our focus rests on emerging Europe. Our results are qualitatively unchanged if we use instead of the rolling country composition for the data on the euro area a consistent set of 14 euro area member states throughout the sample period, as the relative economic size of these three countries is quite small.

Independent States (CIS) region. Thus our data set spans a very heterogeneous set of countries covering advanced economies, catching-up economies as well as the most important oil producers and consumers. The inclusion of European emerging economies limits the time span of the analysis to the period starting after the transition to market based economies has taken place. We thus have collected quarterly data from 1995Q1 to 2011Q4, which makes up for 68 quarterly observations per variable. To the best of our knowledge this data set thus excels on the one hand in its country coverage and on the other hand by the inclusion of the most recent data that is available on a global scale.

We include the following five *domestic variables*[4]: Real GDP (y), inflation (Dp), the nominal exchange rate vis-à-vis the USD deflated by national price levels (rer), short-term interest rates (stir) and long-term interest rates (ltir). Among the variables, only real GDP, inflation and the real exchange rate are available for all of the 52 countries. In particular long-term interest rates are often not available for emerging economies. The set of domestic variables is complemented by oil prices.

Economic ties among countries are captured by bilateral flows of exports and imports of goods that are available on an annual basis. These trade flows are captured in row-standardized link matrices denoted by $W_{b,t} \in \{W_{b,1995}, \cdots, W_{b,2011}\}$.

All variables are tested for a unit root by means of an augmented Dickey-Fuller test. We follow Pesaran et al. (2004) in allowing for a trend and intercept term in the ADF regression in levels for all variables but interest rates and inflation. These are modeled with an intercept term only. The results are presented in Table B.4 in the appendix. For most variables the ADF test could not reject the null-hypothesis of a unit root. One notable exception is the long-term interest rate in the euro area. This skews also the results on foreign long-term interests for emerging economies in Europe due to the regions' strong trade integration with the euro area. Table B.5 contains the results of the ADF test on first differences of the data. Note that we have specified the ADF test here without a trend term for all variables. The test results show that most of the variables are stationary after first differencing. Together with the results on the levels

[4] See the appendix, Table A.1 for more details.

this implies that roughly all variables are integrated of order 1, which renders the cointegration framework we pursue in this study appropriate.

3.1 Model Specification & Specification Tests

Based on the trade weights, *foreign variables* are constructed to account for global and regional factors. Economic activity seems to be pre-dominantly assumed to be the channel via which spillovers take place. However, spillovers could in principle take place via each one of the domestic variables. Due to degrees of freedom considerations we aim at keeping the number of variables per country small. We thus allow for spillovers via real GDP (y*) and interest rates (stir*, ltir*) only. Note that co-movements of these variables are strong, with cross-sectional correlations ranging from 0.5 (short-term interest rates) to 0.9 (real GDP), while cross-country correlation of inflation is rather low (0.2). Following Cesa-Bianchi et al. (2011) foreign variables x_t are constructed using *time varying* trade weights. This allows to empirically keeping track with the rise of the Chinese economy in the global economy. The weights for stacking the single models are based on trade flows in 2011.

As outlined in Pesaran et al. (2000) we test for the specification of the deterministic terms (trend and intercept) in equation (1). For the majority of the countries (34 out of the 52) the likelihood ratio test lent empirical support to including an unrestricted intercept and a trend term that is restricted to lie in the cointegration space (Case "IV")[5]. Note that this is the specification one would expect during 'normal' times since most macroeconomic variables are trending (see e.g. Cesa-Bianchi et al., 2001, Dees et al. 2007). For the remaining countries the test revealed a zero intercept, zero trend model (Case "I", 8 times), a restricted intercept, zero trend model (Case "II", 6 times) and an unrestricted intercept, zero trend model (Case "III", 4 times).

The number of the long-run relationships is tested by means of the trace statistic test (Juselius, 2006). The trace statistic is preferred to the maximum eigenvalue statistic since it has better small sample properties (Cesa-Bianchi et al., 2011). In order to

[5] See Juselius, 2006 for a textbook discussion on trends and intercepts in VECMs.

achieve a parsimonious model and to ensure the stability of the global model, we examine the long-run properties for each country model in more detail. More specifically, we assess the dynamics of a global shock[6] to the country specific long-run equilibria by means of persistence-profiles (see Pesaran et al., 2003). Following Cesa-Bianchi et al. (2011) the cointegration rank has then been reduced as long as the economy is restored to an equilibrium within 10-15 quarters. Note that we have set the lag length for domestic, foreign and global variables to 1 in equation (1). Finally, the modeling of the global variable (oil prices) is discussed in detail in the next section. Table B.1 in the appendix summarizes the specification for each country model.

Our final model has passed several specification tests. First, it is globally stable in that all its roots lie either on or inside the unit circle. Secondly, we have tested whether the foreign variables can be considered as weakly exogenous. The results provided in Table B.2 show that weak exogeneity is by and large met in all country models. Finally we have carried out an F test to test for residual serial correlation (Pesaran et al., 2004). Although our hands are tied in the sense that increasing the number of lags in the GVAR would require longer time series we still think that testing for autocorrelation in a time series model is necessary. From the 220 equations in the model, 161 pass the F test for first order serial autocorrelation, which gives us further confidence in the statistical properties of the model.

4 Macroeconomic Shocks

We are interested in the propagation of four different macroeconomic shocks in the global economy and their impact on the real economy:

1. A +1% shock to Chinese GDP
2. A +50% increase of oil prices
3. A 3% appreciation of the renminbi vis-à-vis the USD
4. A 10% depreciation of the euro vis-à-vis the USD

[6] Full results are available from the authors upon request.

On top of assessing the dynamics of a shock locally, the GVAR framework allows us to trace out the spatial shock propagation. For that purpose we follow the bulk of the literature in employing the Generalized Impulse Response Functions (GIRF) put forward in Pesaran and Shin (1998):

$$\mathrm{GIRF}(y_t, u_t, n) = \frac{F_n G^{-1} \sum_u s_j}{\sqrt{s'_j \sum_u s_j}}$$

with s_j denoting a binary shock indicator vector, n the shock horizon, Σ_u the corresponding variance covariance matrix of the GVAR and $F = G^{-1}H$. As noted in Pesaran and Shin (1998) the generalized impulse responses are not sensitive to the ordering of the variables in the country models – as opposed to standard VAR analysis. However, this comes at the certain cost of having non-orthogonalized impulse responses. That, is shocks cannot be isolated since the variables in the system are typically correlated. Lastly, note that the dynamic analysis in a GVAR is carried out on the *levels* of the variables, which implies that the effects of a certain shock are typically permanent.

4.1 Shock to China's output

We first assess the impact of a positive +1% shock to real Chinese output that is depicted in Figure 2. The initial shock translates into a 1.2% permanent increase of GDP in the Chinese economy. Among the remaining BRIC countries, Brazil shows a very pronounced response of 0.5% increase in GDP, while India's and Russia's reaction to the Chinese GDP increase are rather contained. Our estimate for the effects on the US and euro area (GDP increase between 0.1% and 0.15%) are relatively close to those in Cesa-Bianchi et al (2011). The bottom panel of Figure 2 displays PPP aggregated impulse responses for the six different regional aggregates provided in Table 1. The 1% increase in Chinese GDP translates into a 0.2% permanent increase for output in Latin America, followed by a somewhat smaller effect on the CEE region. Surprisingly the results for the Asian region are smaller, which could be interpreted as an indication of competition in the region.

[FIGURE 2 TO BE INSERTED HERE]

4.2 Shock to oil price

Second, we look at the response of the real economy to a +50% hike in oil prices. On the one hand, positive oil price shocks are expected to deter economic activity in oil importing countries slowing down the global economy. On the other hand, oil price hikes are expected to boost real GDP of oil exporting countries with the potential for spillovers to countries they share strong economic ties with. Following the literature we have opted to model the oil price as an endogenous variable in the US country model. This might be justified since the US is the "dominant" economy in the GVAR system as well as among the largest oil producers and by the far the largest oil importer.

In contrast to Dees et al. (2007) and Cesa-Bianchi et al. (2011), we have opted for excluding oil prices as a conditioning variable from the long-run equilibrium. Thus oil prices are assumed to have a short-run influence on the domestic variables only. We relax this assumption for the largest oil exporters (Saudi Arabia, Russia, US, Norway, Canada, Mexico, Nigeria and Azerbaijan) and importers (euro area, China and India) where oil price is included as an additional foreign variable.

The effect of the +50% increase in oil prices is shown in Figure 3.

[FIGURE 3 TO BE INSERTED HERE]

As expected the Russian economy sees a permanent and large increase in real GDP. After 10 quarters, real output in Russia rises by 6%. This result is in line with Korhonen and Ledyaeva (2010) who use a trade linkages approach to capture economic ties between countries. As expected, oil importers, such as the US, India and the euro area are negatively affected by increases in oil prices on impact. However, this negative effect disappears after approximately 4 quarters. In contrast, China experiences a permanent and pronounced drag on real output amounting to approximately 5.5%. The negative response of Chinese output to the oil price hike is in line with Tan et al. (2010).

Among the emerging economies, the CIS aggregate - representing both oil importing and exporting countries – shows a positive output response to the 50% surge in oil prices of close to 2%. Booming Russian economy is likely to exert positive growth spillovers to the CIS region, which are transmitted through the trade linkages.

The Latin American region shows a rather contained response, while the Asian economies show a slightly positive reaction. Strikingly, the Middle East-African countries react negatively to the oil price hike, although Saudi Arabia and Nigeria, which together make up close to 40% of the regional aggregate, are both important oil exporters. Investigating the respective country models reveals oil prices negatively influencing the short run GDP dynamics, which seems counterintuitive at first sight. However, as a consequence of the global recession oil prices were declining in 2009, while Saudi Arabia and Nigeria both were relatively sheltered from the crisis. This might partially account for the negative association of oil prices and GDP growth in these countries.

The countries belonging to the SEE and CEE region are all oil importers. Consequently the oil price hike translates into a permanent drag on real output that amounts to 1%. This negative effect is reinforced by the drop in the output in the euro area, these countries' largest trading partner. On the other hand, trade ties with Russia mitigate these negative effects somewhat.

4.3 Shock to exchange rate

Finally, we try to model effects from a revaluation of the Chinese renminbi. The nominal exchange rate of the renminbi has appreciated over the sample period vis-à-vis the USD by about 20% and vis-à-vis the euro by about 40%. In the same period, the average annual growth rate of real output was close to 10%. There is an intense debate on whether the Chinese growth miracle was partially fueled by the undervalued renminbi and what the potential undervaluation of the renminbi might be. While most of the empirical contributions show that the renminbi was undervalued over the last years (Feng and Wu, 2008) others seem to find the opposite (Cheung et al., 2007). Korhonen and Ritola (2011) provide meta-analysis of studies regarding the renminbi's misalignment from its equilibrium value. They find that the renminbi may have been undervalued, especially against the dollar, but the degree of this undervaluation has decreased over recent years. In a recent contribution, Zhang and Sato (2012) show that the effect of a revaluation of the renminbi on China's trade balance is very limited. The trade balance in China seems to be largely determined by world demand.

On top of that, the literature on the direct impact of a revaluation of the renminbi on real output is scarce. Cheung et al. (2012) show that Chinese exports are well-behaved in the sense that they rise with foreign GDP and decrease when the renminbi appreciates. However, imports often give counterintuitive results responding positively to a depreciation of the renminbi and negatively to an increase in Chinese GDP. Also García Herrero and Koivu (2008) arrive at the same conclusion regarding the link between imports and exchange rate, and they attribute this to the special role of processing trade in China.

In the context of the GVAR model interpretation of currency shocks are notoriously difficult. Since there is no foreign counterpart of the real exchange rate variable that soaks up cross-country correlation in the system, cross-country residual correlation of the marginal models for real exchange rates is typically non-negligible[7]. Given these caveats and against the backdrop of not having data on exports and imports available, we try to assess the impact of a Chinese revaluation with two different shocks.

Given that the nominal exchange rate vis-à-vis the USD has been broadly stable over the last years (Zhang and Sato, 2012), we induce a small shock to the renminbi USD currency pair. The response of the Chinese economy to a 3% appreciation of the renminbi (deflated by national price levels) is as follows: In the first quarter, real activity ticks up by 1%, while in the long-run real output increases by marked 3%. Abstaining from a structural interpretation, we note that the appreciation of the renminbi goes in parallel with an increase in the domestic short-term interest, while inflation decreases strongly. The real exchange rate itself appreciates by 7.5% in the first year and by 10% in the long-run (after 5 years).

[FIGURE 4 TO BE INSERTED HERE]

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[7] The mean of the average pair-wise cross-country correlations of the residuals from the marginal model for the real exchange rate is 0.2 with a standard deviation of 0.13.

The rise in Chinese output does not leave the other countries unaffected. The US and the euro area show an increase in real output of close to 0.3 to 0.4%, while the increase for Japan is slightly more contained. Among emerging economies, Russia shows the largest response with output edging up by close to 1% in the long-run. Real output in the CEE and the SEE region increases in the long-run by some 0.3%, while output in the CIS region is rather resilient to the shock. Consistent with our previous findings examining the positive shock to Chinese real output, the response of Asian countries is somewhat negative. Taken at face value, these results would suggest that sizeable exchange rate appreciation in China is welfare-enhancing for almost everyone in the global economy. However, the problems mentioned above (e.g. Cheung et al. (2012) and García Herrero and Koivu (2008)) regarding exchange rate, imports and GDP in China are almost certainly affecting our empirical results.

Lastly, we also implemented a renminbi revaluation shock from a European perspective to gain more robust understanding of the issue at hand. For that purpose we carried out a 10% depreciation shock to the euro (deflated by national price levels) vis-à-vis the USD. The size of the shock has been calibrated such that it matches the long-run appreciation of the renminbi carried out in scenario 3 above. In fact, the 10% depreciation of the euro (on impact) translates into a permanent 10% depreciation of the euro vis-à-vis the USD in real terms. If we assume that the renminbi remains tightly linked to the USD, this translates into a 10% appreciation of the real exchange rate of China versus the euro in the long-run.

[FIGURE 5 TO BE INSERTED HERE]

A 10% depreciation of the real euro rate against the USD results into an increase in euro area output by 0.4% in the long-run. For Russia, Japan and the US the effect lies in the range of 0.1% to 0.4%. Chinese GDP is more strongly affected by a bilateral currency appreciation of the renminbi vis-à-vis the euro, with the impact being around -0.2% in the first four quarters converging to -0.4% in the long-run. This shows that exchange rate does have a large role in the open Chinese economy.

The SEE and CIS countries show the expected negative response to a depreciation of the euro, while the CEE countries show a positive response. That is, the euro area's increase in output spreads to the CEE region, thus outweighing the loss of competitiveness for the region that is caused by the real depreciation of the euro. The Latin American region seems to benefit from a depreciation of the euro, which again, might be attributed to the particular time period our sample is based on. In particular, the Mexican economy that is by far the largest country in terms of economic activity in the region reacts strongly to foreign GDP. This strong reaction might have been further enforced by the fact that the economic crisis hit the US, Mexico and the euro area quite synchronized, while the other Latin American countries have been more resilient. That is, this general strong reaction of Mexico to foreign GDP, which is further re-enforced by an increase in US GDP as a consequence of the euro depreciation, might explain the positive response of the Latin American regional aggregate to a depreciation of the euro.

Comparing these two exchange rate shocks, it is obvious that China's exchange rate policy has a decisive influence on the transmission of the shock. Also the problems regarding the link between imports and exchange rate mentioned earlier will have an effect on our estimations as well.

As the renminbi has been linked to the US dollar one way or another for practically all of the data sample, the effects from euro shock may be more indicative of a shock e.g. to China's real effective exchange rate, especially since the euro area has been China's most important trading partner for most of the data sample.[8] By contrast, the shock to the euro has a more structural interpretation which is reflected in the clear and predicted effect on Chinese output.

5 Conclusions

We have assessed the role of China in the global economy with the help of a GVAR model. We are especially interested in the effects the development of the Chinese economy has on other emerging market countries in different parts of the world, as this question has not received attention in the literature so far. Furthermore, our GVAR model has larger country coverage and is estimated on a more recent data sample than

[8] Moreover, overall residual correlation in the euro area country model is much smaller than in the China model, where especially the real exchange rate is strongly correlated with inflation. This might blur the interpretation of the exchange rate shock that emanates from the China model.

other models attempting to look at similar questions.

We find that developments in the Chinese economy have very clear and often large effects on other countries. For example, Brazil, which has increased its exports to China tremendously during the past decade, is perhaps the largest outside beneficiary of higher Chinese GDP. Usually those countries or country groups trading more with China will benefit from higher Chinese GDP, but China's smaller neighbors in Asia are partial exception to this.

As China and other large emerging markets have grown, so has their demand for raw materials. To proxy for this trend, we have examined a large positive shock to the price of oil. As can be expected, this has a retarding effect on the growth of most oil-exporting countries, while oil-exporters (especially Russia) benefit. Interestingly, China is the largest sufferer from this shock to oil price.

China's exchange rate policy has been discussed intensively in the past years. While the literature on the effects of exchange rate movements and e.g. import developments is far from conclusive, we have tested the effects of two different exchange rate shocks on both the Chinese economy and other economies. Conduct of Chinese exchange rate policy most probably hampers the interpretation of the direct shock to the Chinese renminbi (against the US dollar), and therefore the euro shock may give truer picture of the effects of a exchange rate revaluation in China. Our results indicate that China would suffer from stronger renminbi, while China's trading partners would benefit.

Our results emphasize the pre-eminent role large and open Chinese economy has attained during the last years. China's economic fortunes have large effects on other countries, developed and developing alike. As China's growth continues, these effects will only become more pronounced.

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Appendix A – Data Description

Table A.1: Data Description

Variable	*Description*	*Source*	*Min.*	*Mean*	*Max*	*Coverage*
y	Real GDP, average of 2005=100. Seasonally adjusted, in logarithms.	IMF, IFS database. Data for China is from BOFIT, Finland	3.253	4.499	5.375	100%
Dp	First differences of Consumer price inflation, seasonally adjusted, in logarithms.	IMF, IFS database and OECD.	-0.2578	0.02195	1.194	100%
rer	Nominal Exchange Rate vis-a-vis the USD, deflated by national price levels.	IMF, IFS database, Thomson data stream, Eurostat.	-5.699	-2.172	5.459	98.1%
stir	3 months money market rate. For some countries, overnight deposit rates / treasury bill rate.	IMF, IFS database	1	1.105	5.332	90.4%
ltir	Government bond yield.	IMF, IFS database, OECD.	1	1.059	1.777	32.7%
poil	Price of oil, seasonally adjusted, in logarithms.	IMF, IFS database.	-	-	-	-
Trade flows	Exports and Imports of Goods and services, annual data.	IMF, DOTS database.	-	-	-	-

Note: Data span is from 1995Q1-2011Q4, 68 quarterly observations. Data on bilateral trade flows is annual. Coverage refers to the availability of a particular variable in all the country models of the GVAR, in %.

Appendix B – Model Specification

Table B.1: Specification of country models

Country	*Domestic Variables*	*Foreign Variables*	*Coint. Rank*	*Trend / Intercept*	*p=q=lex*
AL	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
AM	y, Dp, rer, stir	y*, stir*, ltir*	1	I	1
AR	y, Dp, rer, stir	y*, stir*, ltir*	2	II	1
AU	y, Dp, rer, stir, ltir	y*, stir*, ltir*	2	IV	1
AZ	y, Dp, rer	y*, stir*, ltir*	1	IV	1
BG	y, Dp, rer, stir, ltir	y*, stir*, ltir*	2	IV	1
BR	y, Dp, rer, stir	y*, stir*, ltir*, poil*	1	IV	1
BY	y, Dp, rer, stir	y*, stir*, ltir*	3	IV	1
CA	y, Dp, rer, stir, ltir	y*, stir*, ltir*, poil*	1	IV	1
CH	y, Dp, rer, stir, ltir	y*, stir*, ltir*	2	IV	1
CL	y, Dp, rer	y*, stir*, ltir*	2	IV	1
CN	y, Dp, rer, stir	y*, stir*, ltir*, poil*	1	IV	1
CZ	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
DK	y, Dp, rer, stir, ltir	y*, stir*, ltir*	3	IV	1
ea14	y, Dp, rer, stir, ltir	y*, stir*, ltir*, poil*	1	IV	1
EE	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
EG	y, Dp, rer	y*, stir*, ltir*	1	III	1
GE	y, Dp, rer, stir	y*, stir*, ltir*	3	I	1
HR	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
HU	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
ID	y, Dp, rer, stir	y*, stir*, ltir*	1	II	1
IN	y, Dp, rer, stir	y*, stir*, ltir*, poil*	1	III	1
IS	y, Dp, rer, stir, ltir	y*, stir*, ltir*	3	IV	1
JP	y, Dp, rer, stir, ltir	y*, stir*, ltir*, poil*	1	III	1
KG	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
KR	y, Dp, rer, stir, ltir	y*, stir*, ltir*	1	III	1
LT	y, Dp, rer, stir	y*, stir*, ltir*	2	I	1
LV	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
MD	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
MN	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
MX	y, Dp, rer, stir, ltir	y*, stir*, ltir*, poil*	2	II	1
MY	y, Dp, rer, stir, ltir	y*, stir*, ltir*	1	I	1
NG	y, Dp, rer, stir	y*, stir*, ltir*, poil*	1	IV	1
NO	y, Dp, rer, stir, ltir	y*, stir*, ltir*, poil*	2	IV	1
NZ	y, Dp, rer, stir, ltir	y*, stir*, ltir*	2	II	1
PE	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
PH	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
PL	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
RO	y, Dp, rer, stir	y*, stir*, ltir*	2	I	1
RS	y, Dp, rer	y*, stir*, ltir*	1	I	1
RU	y, Dp, rer, stir	y*, stir*, ltir*, poil*	2	I	1

SA	y, Dp, rer	y*, stir*, ltir*, poil*	1	IV	1
SE	y, Dp, rer, stir, ltir	y*, stir*, ltir*	1	IV	1
SG	y, Dp, rer, stir	y*, stir*, ltir*	1	I	1
SI	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
SK	y, Dp, rer, stir	y*, stir*, ltir*	1	II	1
TH	y, Dp, rer, stir, ltir	y*, stir*, ltir*	1	II	1
TJ	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
TR	y, Dp, rer, stir	y*, stir*, ltir*	1	IV	1
UA	y, Dp, rer, stir	y*, stir*, ltir*	2	IV	1
UK	y, Dp, rer, stir, ltir	y*, stir*, ltir*	1	IV	1
US	y, Dp, stir, ltir, poil	y*, ltir*	1	IV	1

Source: Authors' calculations.

Table B.2: Test of weak exogeneity assumption.

Country	DoF	F-crit. (0.95)	y*	stir*	ltir*	poil*
ea14	F(1,55)	4.0162	1.96696	0.32856	1.09617	1.77878
-	-	-	(0.166)	(0.569)	(0.300)	(0.188)
US	F(1,56)	4.01297	3.64463	-	3.40914	-
-	-	-	(0.061)	-	(0.070)	-
UK	F(1,55)	4.0162	2.35300	0.04144	0.68865	4.95456
-	-	-	(0.131)	(0.839)	(0.410)	(0.030)
JP	F(1,55)	4.0162	0.78281	0.37040	0.00002	0.72773
-	-	-	(0.380)	(0.545)	(0.996)	(0.397)
CN	F(1,56)	4.01297	0.92011	0.59097	0.75680	0.09353
-	-	-	(0.342)	(0.445)	(0.388)	(0.761)
CZ	F(2,55)	3.16499	1.95806	4.59723	0.59779	0.47253
-	-	-	(0.151)	(0.014)	(0.554)	(0.626)
HU	F(1,56)	4.01297	3.99728	0.07630	0.04179	2.82760
-	-	-	(0.050)	(0.783)	(0.839)	(0.098)
PL	F(2,55)	3.16499	0.55663	6.37082	0.08101	2.65687
-	-	-	(0.576)	(0.003)	(0.922)	(0.079)
SI	F(2,55)	3.16499	2.35668	6.05846	2.17366	1.85291
-	-	-	(0.104)	(0.004)	(0.123)	(0.166)
SK	F(1,56)	4.01297	6.21822	0.14444	1.44328	1.06542
-	-	-	(0.016)	(0.705)	(0.235)	(0.306)
BG	F(2,54)	3.16825	1.34741	0.61846	0.92060	0.74797
-	-	-	(0.269)	(0.543)	(0.404)	(0.478)
RO	F(2,55)	3.16499	0.09716	3.91042	0.56428	1.97560
-	-	-	(0.908)	(0.026)	(0.572)	(0.148)
HR	F(1,56)	4.01297	1.26964	5.97495	4.23664	9.37572
-	-	-	(0.265)	(0.018)	(0.044)	(0.003)
AL	F(2,55)	3.16499	0.42867	0.46565	0.41674	0.67887
-	-	-	(0.654)	(0.630)	(0.661)	(0.511)
RS	F(1,57)	4.00987	0.12692	0.13589	0.64095	0.74933
-	-	-	(0.723)	(0.714)	(0.427)	(0.390)
MD	F(1,56)	4.01297	0.44810	2.19501	1.20486	0.00564
-	-	-	(0.506)	(0.144)	(0.277)	(0.940)
LT	F(2,55)	3.16499	3.19002	1.25578	0.17428	1.83305
-	-	-	(0.049)	(0.293)	(0.841)	(0.170)
LV	F(2,55)	3.16499	0.12948	9.04428	1.00630	2.51195
-	-	-	(0.879)	(0.000)	(0.372)	(0.090)
EE	F(1,56)	4.01297	0.68916	0.03576	0.00108	0.91571
-	-	-	(0.410)	(0.851)	(0.974)	(0.343)
RU	F(2,55)	3.16499	4.24151	0.14361	2.60750	0.36841
-	-	-	(0.019)	(0.867)	(0.083)	(0.694)
UA	F(2,55)	3.16499	2.63835	0.35587	2.86326	0.04677
-	-	-	(0.081)	(0.702)	(0.066)	(0.954)
BY	F(3,54)	2.77576	0.97716	0.37060	1.98583	1.23803
-	-	-	(0.410)	(0.775)	(0.127)	(0.305)
GE	F(3,54)	2.77576	3.56617	1.86399	1.57789	2.52249
-	-	-	(0.020)	(0.147)	(0.205)	(0.067)

AM	F(1,56)	4.01297	4.40742	5.24995	0.37818	1.84421
-	-	-	(0.040)	(0.026)	(0.541)	(0.180)
AZ	F(1,57)	4.00987	0.01148	0.03189	0.27800	0.23942
-	-	-	(0.915)	(0.859)	(0.600)	(0.627)
MN	F(2,55)	3.16499	0.78759	0.20422	0.26778	1.37948
-	-	-	(0.460)	(0.816)	(0.766)	(0.260)
KG	F(1,56)	4.01297	0.80706	0.10154	0.72925	0.64975
-	-	-	(0.373)	(0.751)	(0.397)	(0.424)
TJ	F(2,55)	3.16499	1.00962	1.02990	0.49088	1.03101
-	-	-	(0.371)	(0.364)	(0.615)	(0.363)
AR	F(2,55)	3.16499	1.25351	1.08513	1.97427	0.76521
-	-	-	(0.294)	(0.345)	(0.149)	(0.470)
BR	F(1,56)	4.01297	0.75995	0.00676	0.03405	0.40630
-	-	-	(0.387)	(0.935)	(0.854)	(0.526)
CL	F(2,56)	3.16186	2.46626	1.15155	1.41692	0.62297
-	-	-	(0.094)	(0.324)	(0.251)	(0.540)
MX	F(2,54)	3.16825	0.77501	0.15740	1.00074	0.21843
-	-	-	(0.466)	(0.855)	(0.374)	(0.804)
PE	F(1,56)	4.01297	0.02324	0.01595	2.20966	0.47510
-	-	-	(0.879)	(0.900)	(0.143)	(0.493)
KR	F(1,55)	4.0162	3.42283	0.00000	0.01650	4.76902
-	-	-	(0.070)	(0.999)	(0.898)	(0.033)
PH	F(1,56)	4.01297	0.93767	1.12850	0.06377	0.13541
-	-	-	(0.337)	(0.293)	(0.802)	(0.714)
SG	F(1,56)	4.01297	1.07623	1.96508	0.64429	0.93103
-	-	-	(0.304)	(0.166)	(0.426)	(0.339)
TH	F(1,55)	4.0162	5.55020	2.86487	0.04479	0.52321
-	-	-	(0.022)	(0.096)	(0.833)	(0.473)
IN	F(1,56)	4.01297	3.29447	2.37544	1.37775	1.26074
-	-	-	(0.075)	(0.129)	(0.245)	(0.266)
ID	F(1,56)	4.01297	0.00083	1.31275	1.83449	0.67599
-	-	-	(0.977)	(0.257)	(0.181)	(0.414)
MY	F(1,55)	4.0162	0.42877	0.86653	0.78701	0.05229
-	-	-	(0.515)	(0.356)	(0.379)	(0.820)
AU	F(2,54)	3.16825	0.36304	0.06401	1.37374	0.48910
-	-	-	(0.697)	(0.938)	(0.262)	(0.616)
NZ	F(2,54)	3.16825	0.95963	0.53812	0.61638	0.92512
-	-	-	(0.389)	(0.587)	(0.544)	(0.403)
TR	F(1,56)	4.01297	0.91710	1.31130	0.40093	0.04006
-	-	-	(0.342)	(0.257)	(0.529)	(0.842)
EG	F(1,57)	4.00987	6.69551	1.32871	1.06253	11.53355
-	-	-	(0.012)	(0.254)	(0.307)	(0.001)
NG	F(1,56)	4.01297	0.03394	0.05435	1.70727	2.90764
-	-	-	(0.854)	(0.817)	(0.197)	(0.094)
SA	F(1,57)	4.00987	0.07958	0.22875	0.17318	0.00260
-	-	-	(0.779)	(0.634)	(0.679)	(0.960)
CA	F(1,55)	4.0162	2.85534	7.29358	2.26026	1.28618
-	-	-	(0.097)	(0.009)	(0.138)	(0.262)
CH	F(2,54)	3.16825	6.33325	1.19812	0.38082	7.54456

-	-	-	(0.003)	(0.310)	(0.685)	(0.001)
NO	F(2,54)	3.16825	1.07473	0.08114	0.25042	1.07754
-	-	-	(0.349)	(0.922)	(0.779)	(0.348)
SE	F(1,55)	4.0162	0.37969	0.69049	0.05593	0.02393
-	-	-	(0.540)	(0.410)	(0.814)	(0.878)
DK	F(3,53)	2.77911	0.94920	1.15182	1.29221	1.82517
-	-	-	(0.424)	(0.337)	(0.287)	(0.154)
IS	F(3,53)	2.77911	1.51577	2.24424	1.77417	4.26881
-	-	-	(0.221)	(0.094)	(0.163)	(0.009)

Note: Weak exogeneity test. P-values at the 5% significance level in parentheses.

Source: Authors' calculations.

Table B.3: Serial autocorrelation test.

Country	*DoF*	*F-crit. (0.95)*	*y*	*Dp*	*rer*	*stir*	*ltir*	*poil*
ea14	F(1,60)	4.00119	9.54841	8.14755	6.65700	0.15699	0.01742	-
-	-	-	(0.003)	(0.006)	(0.012)	(0.693)	(0.895)	-
US	F(1,62)	3.99589	29.66541	0.08317	-	21.18373	5.81331	2.43547
-	-	-	(0.000)	(0.774)	-	(0.000)	(0.019)	(0.124)
UK	F(1,60)	4.00119	20.38726	0.88512	5.32330	0.05681	8.81658	-
-	-	-	(0.000)	(0.351)	(0.025)	(0.812)	(0.004)	-
JP	F(1,60)	4.00119	0.11818	18.80690	1.51567	4.42996	0.16579	-
-	-	-	(0.732)	(0.000)	(0.223)	(0.040)	(0.685)	-
CN	F(1,60)	4.00119	9.10103	4.89257	2.80551	2.39136	-	-
-	-	-	(0.004)	(0.031)	(0.099)	(0.127)	-	-
CZ	F(1,59)	4.00398	0.02637	0.35914	3.35404	6.72358	-	-
-	-	-	(0.872)	(0.551)	(0.072)	(0.012)	-	-
HU	F(1,60)	4.00119	15.40696	1.13277	4.19465	4.38900	-	-
-	-	-	(0.000)	(0.291)	(0.045)	(0.040)	-	-
PL	F(1,59)	4.00398	0.36210	0.06816	1.01515	1.44023	-	-
-	-	-	(0.550)	(0.795)	(0.318)	(0.235)	-	-
SI	F(1,59)	4.00398	0.11372	0.78171	2.95243	0.88414	-	-
-	-	-	(0.737)	(0.380)	(0.091)	(0.351)	-	-
SK	F(1,61)	3.99849	0.05964	2.47305	2.97667	1.07308	-	-
-	-	-	(0.808)	(0.121)	(0.090)	(0.304)	-	-
BG	F(1,59)	4.00398	2.13353	1.21932	21.50645	0.61380	0.03424	-
-	-	-	(0.149)	(0.274)	(0.000)	(0.436)	(0.854)	-
RO	F(1,60)	4.00119	0.36946	0.45970	0.25542	0.20821	-	-
-	-	-	(0.546)	(0.500)	(0.615)	(0.650)	-	-
HR	F(1,60)	4.00119	0.05907	0.35171	3.31934	0.01557	-	-
-	-	-	(0.809)	(0.555)	(0.073)	(0.901)	-	-
AL	F(1,59)	4.00398	0.32533	0.43143	12.73369	0.00001	-	-
-	-	-	(0.571)	(0.514)	(0.001)	(0.998)	-	-
RS	F(1,61)	3.99849	1.03628	0.04042	0.10255	-	-	-
-	-	-	(0.313)	(0.841)	(0.750)	-	-	-
MD	F(1,60)	4.00119	24.28499	0.19531	1.67837	0.01560	-	-
-	-	-	(0.000)	(0.660)	(0.200)	(0.901)	-	-
LT	F(1,60)	4.00119	0.07250	0.15796	2.64269	0.00215	-	-
-	-	-	(0.789)	(0.692)	(0.109)	(0.963)	-	-
LV	F(1,59)	4.00398	3.45391	0.11939	6.14980	3.60590	-	-

-	-	-	(0.068)	(0.731)	(0.016)	(0.062)	-	-
EE	F(1,60)	4.00119	0.46254	0.31566	4.70003	0.09808	-	-
-	-	-	(0.499)	(0.576)	(0.034)	(0.755)	-	-
RU	F(1,60)	4.00119	0.85588	0.01125	5.50937	0.17262	-	-
-	-	-	(0.359)	(0.916)	(0.022)	(0.679)	-	-
UA	F(1,59)	4.00398	0.82343	0.06992	0.26450	0.05901	-	-
-	-	-	(0.368)	(0.792)	(0.609)	(0.809)	-	-
BY	F(1,58)	4.00687	7.25435	0.09144	0.44298	0.00301	-	-
-	-	-	(0.009)	(0.763)	(0.508)	(0.956)	-	-
GE	F(1,59)	4.00398	0.46932	0.03516	0.38889	0.00520	-	-
-	-	-	(0.496)	(0.852)	(0.535)	(0.943)	-	-
AM	F(1,61)	3.99849	82.47449	5.10349	5.38831	3.65830	-	-
-	-	-	(0.000)	(0.027)	(0.024)	(0.060)	-	-
AZ	F(1,60)	4.00119	217.70178	0.18319	2.62015	-	-	-
-	-	-	(0.000)	(0.670)	(0.111)	-	-	-
MN	F(1,59)	4.00398	3.84831	3.69444	5.69927	0.65224	-	-
-	-	-	(0.055)	(0.059)	(0.020)	(0.423)	-	-
KG	F(1,60)	4.00119	0.17996	3.38957	0.51417	0.67622	-	-
-	-	-	(0.673)	(0.071)	(0.476)	(0.414)	-	-
TJ	F(1,59)	4.00398	71.00536	0.00799	0.13116	1.60401	-	-
-	-	-	(0.000)	(0.929)	(0.719)	(0.210)	-	-
AR	F(1,60)	4.00119	2.30209	0.68333	5.68188	0.93154	-	-
-	-	-	(0.134)	(0.412)	(0.020)	(0.338)	-	-
BR	F(1,60)	4.00119	1.62774	0.11728	0.90347	4.38931	-	-
-	-	-	(0.207)	(0.733)	(0.346)	(0.040)	-	-
CL	F(1,59)	4.00398	0.45450	0.92837	4.47086	-	-	-
-	-	-	(0.503)	(0.339)	(0.039)	-	-	-
MX	F(1,60)	4.00119	3.28262	0.39554	0.97505	0.09152	0.26860	-
-	-	-	(0.075)	(0.532)	(0.327)	(0.763)	(0.606)	-
PE	F(1,60)	4.00119	4.70721	3.68226	3.67603	0.91657	-	-
-	-	-	(0.034)	(0.060)	(0.060)	(0.342)	-	-
KR	F(1,60)	4.00119	0.21125	0.32879	2.01956	4.91745	8.22326	-
-	-	-	(0.647)	(0.569)	(0.160)	(0.030)	(0.006)	-
PH	F(1,60)	4.00119	5.58439	6.10217	0.00173	1.18412	-	-
-	-	-	(0.021)	(0.016)	(0.967)	(0.281)	-	-
SG	F(1,61)	3.99849	2.04114	5.46891	1.20341	7.98401	-	-
-	-	-	(0.158)	(0.023)	(0.277)	(0.006)	-	-
TH		3.99849	0.43707	0.04650	4.63933	9.39118	1.39122	-

	F(1,61)							
-	-	-	(0.511)	(0.830)	(0.035)	(0.003)	(0.243)	-
IN	F(1,60)	4.00119	0.05522	0.83771	1.76432	1.97372	-	-
-	-	-	(0.815)	(0.364)	(0.189)	(0.165)	-	-
ID	F(1,61)	3.99849	5.83540	0.37519	3.31697	0.07976	-	-
-	-	-	(0.019)	(0.542)	(0.073)	(0.779)	-	-
MY	F(1,61)	3.99849	0.09108	3.13833	6.67933	0.09144	0.21369	-
-	-	-	(0.764)	(0.081)	(0.012)	(0.763)	(0.646)	-
AU	F(1,59)	4.00398	1.24787	0.75027	1.41422	1.54098	0.94825	-
-	-	-	(0.268)	(0.390)	(0.239)	(0.219)	(0.334)	-
NZ	F(1,60)	4.00119	2.48239	0.00723	5.70756	3.28745	0.19933	-
-	-	-	(0.120)	(0.933)	(0.020)	(0.075)	(0.657)	-
TR	F(1,60)	4.00119	0.54989	2.44480	0.06431	1.37171	-	-
-	-	-	(0.461)	(0.123)	(0.801)	(0.246)	-	-
EG	F(1,60)	4.00119	2.42758	0.00001	6.83578	-	-	-
-	-	-	(0.124)	(0.998)	(0.011)	-	-	-
NG	F(1,60)	4.00119	35.01954	6.67239	0.37814	4.03374	-	-
-	-	-	(0.000)	(0.012)	(0.541)	(0.049)	-	-
SA	F(1,60)	4.00119	61.77756	0.25091	0.26816	-	-	-
-	-	-	(0.000)	(0.618)	(0.606)	-	-	-
CA	F(1,60)	4.00119	1.24118	0.82877	1.77255	10.98086	3.17686	-
-	-	-	(0.270)	(0.366)	(0.188)	(0.002)	(0.080)	-
CH	F(1,59)	4.00398	5.24743	0.50777	0.03054	2.14604	0.02032	-
-	-	-	(0.026)	(0.479)	(0.862)	(0.148)	(0.887)	-
NO	F(1,59)	4.00398	19.67493	7.77609	0.04074	5.20441	2.28482	-
-	-	-	(0.000)	(0.007)	(0.841)	(0.026)	(0.136)	-
SE	F(1,60)	4.00119	2.87089	0.01845	5.09645	1.41885	15.18612	-
-	-	-	(0.095)	(0.892)	(0.028)	(0.238)	(0.000)	-
DK	F(1,58)	4.00687	3.83915	7.08498	0.98146	11.95102	0.44263	-
-	-	-	(0.055)	(0.010)	(0.326)	(0.001)	(0.508)	-
IS	F(1,58)	4.00687	1.39595	0.01835	0.12165	0.04167	0.02806	-
-	-	-	(0.242)	(0.893)	(0.729)	(0.839)	(0.868)	-

Notes: Test for first order serial autocorrelation, p-values at the 5% significance level in parentheses.
Source: Authors' calculations.

Table B.4 ADF test in levels

	ea14	US	UK	JP	CN	CZ	HU	PL	SI	SK	BG	RO	HR	AL	RS	MD	LT	Nr. > CV
y	-0.874	-1.292	0.369	-1.732	-3.11	-2.185	-0.179	-2.168	0.637	-1.256	-0.747	-2.771	0.44	-2.165	-1.385	-2.288	-0.829	0
Dp	-3.078	-2.874	-0.841	-3.119	-3.213	-2.725	-3.121	-2.835	-1.836	-2.029	-2.415	-1.565	-3.015	-3.314	-2.656	-2.544	-4.621	7
rer	-2.152	-	-2.093	-1.75	-0.69	-1.993	-1.827	-1.999	-2.049	-2.101	-2.716	-1.897	-1.941	-1.725	-2.425	-2.229	-1.875	0
stir	-1.344	-1.462	-1.035	-2.36	-5.082	-1.469	-2.93	-1.339	-2.83	-1.145	-2.011	-0.994	-5.047	-2.002	-	-2.063	-5.172	4
stir	-3.119	-1.557	-1.561	-2.998	-	-	-	-	-	-	-3.283	-	-	-	-	-	-	3
*y**	-2.083	-2.576	-1.808	-2.164	-1.841	-1.921	-1.719	-1.205	-1.064	-1.297	-1.049	-1.178	-1.879	-2.364	-1.118	-1.233	-1.84	0
*stir**	-1.621	-1.89	-1.626	-1.732	-2.18	-1.829	-2.602	-2.314	-1.968	-3.089	-2.445	-2.424	-2.338	-1.83	-1.526	-2.615	-2.992	2
*stir**	-1.972	-1.626	-2.968	-2.634	-2.45	-3.113	-3.141	-3.074	-3.084	-3.16	-3.156	-3.16	-3.086	-3.229	-3.652	-3.959	-3.01	13
	LV	EE	RU	UA	BY	GE	AM	AZ	MN	KG	TJ	AR	BR	CL	MX	PE	KR	Nr. > CV
y	-0.871	-1.369	-1.898	-1.35	-1.781	-1.994	-1.482	-1.76	-1.948	-2.625	-0.597	-1.126	-1.004	-1.92	-1.917	-0.625	-2.184	0
Dp	-3.613	-5.223	-2.468	-3.608	-1.196	-4.3	-4.178	-2.134	-3.085	-2.676	-9.313	-2.116	-2.926	-2.794	-3.754	-2.764	-3.131	10
rer	-2.009	-2.041	-2.429	-2.62	-2.324	-1.986	-1.816	-2.019	-1.461	-2.046	-2.682	-1.516	-1.152	-1.339	-2.379	-0.959	-2.586	0
stir	-6.448	-2.693	-3.519	-2.087	-1.95	-4.603	-4.508	-	-4.227	-2.189	-2.341	-3.084	-2.65	-	-2.205	-1.352	-1.386	6
stir	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-1.599	-	-1.354	0
*y**	-2.104	-1.136	-1.822	-1.735	-1.629	-2.13	-1.866	-2.021	-1.915	-0.535	-0.857	-1.275	-1.773	-1.059	-1.354	-2.467	-1.736	0
*stir**	-3.207	-2.866	-2.072	-3.115	-3.288	-2.767	-3.544	-2.787	-3.607	-3.307	-2.389	-2.27	-2.162	-1.753	-1.258	-1.455	-1.92	6
*stir**	-2.929	-2.899	-3.097	-3.291	-2.973	-4.468	-3.328	-4.097	-1.527	-2.391	-2.89	-3.115	-2.796	-2.269	-1.774	-2.797	-2.521	8
	PH	SG	TH	IN	ID	MY	AU	NZ	TR	EG	NG	SA	CA	CH	NO	SE		Nr. > CV
y	-1.452	-1.606	-1.903	-1.213	-1.836	-2.305	0.138	0.05	-1.645	-1.231	-2.432	-1.661	-1.024	-1.791	-1.373	-1.573	-	0
Dp	-3.249	-2.109	-2.779	-2.141	-2.402	-3.099	-2.705	-3.204	-1.068	-1.369	-3.989	-1.139	-3.346	-3.065	-4.371	-2.769	-	7
rer	-1.472	-1.012	-2.104	-1.461	-2.769	-2.059	-1.771	-2.105	-2.074	-1.346	-1.774	0.422	-1.982	-2.462	-2.095	-2.092	-	0
stir	-1.124	-1.474	-1.788	-4.429	-2.687	-2.164	-2.919	-1.355	-1.027	-	-2.079	-	-1.785	-2.489	-2.118	-2.743	-	2
stir	-	-	-1.571	-	-	-1.209	-3.123	-1.234	-	-	-	-	-1.401	-0.883	-0.755	-2.266	-	1
*y**	-2.738	-2.25	-2.075	-2.042	-1.953	-1.896	-1.645	-2.742	-2.09	-2.543	-3.067	-2.209	-1.771	-1.271	-1.006	-1.196	-	0
*stir**	-1.33	-2.027	-1.54	-2.125	-1.857	-1.543	-1.63	-2.017	-2.686	-1.741	-1.711	-2.019	-1.425	-1.46	-1.582	-1.438	-	0
*stir**	-2.289	-2.637	-2.199	-2.68	-2.772	-2.467	-2.437	-2.657	-3.135	-2.989	-2.498	-2.807	-1.974	-3.131	-2.752	-2.733	-	3
*poil***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-2.389	0

Notes: ADF tests on variables in levels. T-statistics reported. The regressions for all variables except interest rates and inflation together with its foreign counterparts contain a constant and a trend term. ADF tests for interest rates and inflation are based on a constant in the ADF regression only. The 5% critical value of the ADF statistic including trend and intercept is -3.47, the one without trend is -2.91.
Source: Authors' calculations.

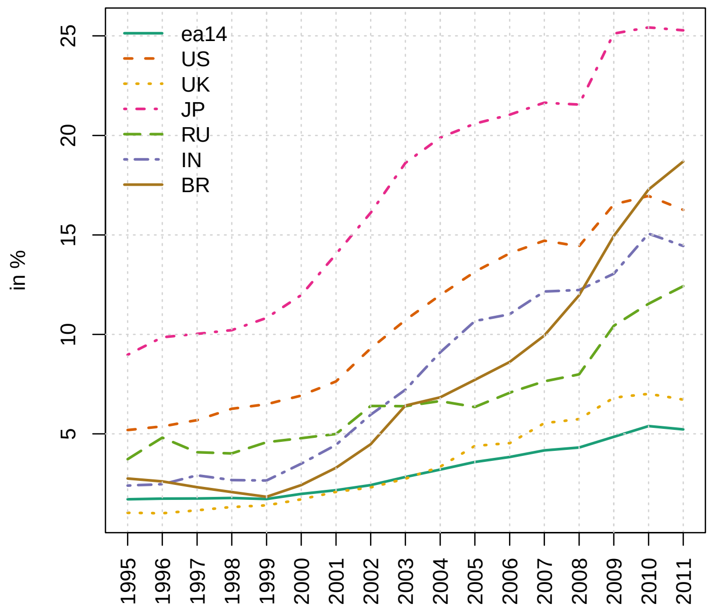
Table B.5 ADF test in first differences

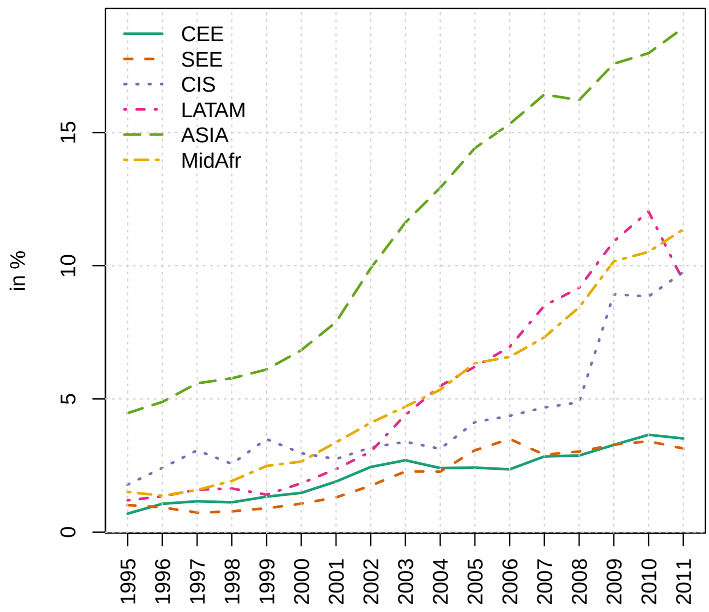
	ea14	US	UK	JP	CN	CZ	HU	PL	SI	SK	BG	RO	HR	AL	RS	MD	LT	Nr. > CV
y	-2.391	-2.313	-1.838	-3.912	-3.174	-2.253	-2.086	-4.113	-2.049	-2.88	-2.903	-2.55	-3.138	-3.973	-4.08	-1.764	-3.112	7
Dp	-5.774	-6.152	-7.209	-6.435	-4.304	-6.663	-4.751	-5.115	-6.047	-6.829	-5.32	-4.911	-5.659	-4.167	-4.542	-4.615	-4.845	17
rer	-2.876	-	-3.138	-2.704	-2.186	-3.504	-3.096	-3.919	-2.919	-2.403	-4.272	-3.636	-2.763	-3.599	-4.415	-3.218	-3.517	11
stir	-3.476	-3.419	-3.856	-3.719	-2.822	-2.846	-4.045	-4.458	-4.13	-2.816	-4.871	-4.258	-4.309	-4.367	-	-4.277	-2.158	12
stir	-3.017	-3.38	-3.248	-4.1	-	-	-	-	-	-	-3.676	-	-	-	-	-	-	5
*y**	-3.69	-3.687	-2.977	-4.328	-3.357	-3.318	-3.293	-2.772	-2.868	-3.116	-3.405	-3.049	-3.396	-3.312	-3.356	-3.259	-3.282	15
*stir**	-4.447	-4.595	-4.05	-4.626	-3.746	-4.366	-3.992	-4.249	-4.08	-4.481	-4.755	-4.72	-4.071	-4.288	-5.143	-4.633	-5.014	17
*stir**	-3.336	-5.484	-3.268	-3.983	-4.488	-2.994	-3.037	-3.125	-3.008	-2.911	-3.154	-2.738	-2.986	-1.851	-7.439	-1.309	-2.895	13
	LV	EE	RU	UA	BY	GE	AM	AZ	MN	KG	TJ	AR	BR	CL	MX	PE	KR	Nr. > CV
y	-2.49	-2.642	-2.935	-2.531	-4.589	-3.958	-1.592	-1.296	-3.358	-4.234	-2.665	-2.252	-3.471	-3.324	-3.273	-3.003	-3.996	10
Dp	-4.69	-5.8	-5.049	-5.283	-4.485	-5.415	-8.149	-6.359	-4.498	-5.523	-7.129	-4.718	-4.648	-5.191	-5.651	-5.361	-5.89	17
rer	-2.97	-3.381	-3.475	-3.404	-3.525	-3.888	-3.619	-1.962	-4.925	-3.652	-7.554	-3.484	-3.083	-3.683	-3.492	-2.848	-3.6	15
stir	-3.382	-3.82	-4.846	-3.821	-4.3	-5.61	-4.444	-	-4.223	-4.282	-2.911	-4.631	-4.942	-	-4.154	-5.693	-3.488	15
stir	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-6.562	-	-4.913	2
*y**	-3.5	-3.076	-3.377	-3.367	-2.898	-3.832	-4.324	-2.825	-3.473	-3.822	-2.177	-3.62	-4.078	-3.618	-3.266	-3.634	-4.019	14
*stir**	-4.706	-4.814	-3.645	-4.821	-4.841	-5.41	-5.143	-4.668	-4.836	-5.304	-5.046	-5.119	-3.806	-3.861	-3.66	-4.022	-3.776	17
*stir**	-2.897	-3.071	-2.713	-2.051	-2.636	-1.617	-3.887	-2.66	-5.041	-5.642	-2.902	-3.269	-3.419	-4.141	-3.431	-3.544	-3.732	10
	PH	SG	TH	IN	ID	MY	AU	NZ	TR	EG	NG	SA	CA	CH	NO	SE		Nr. > CV
y	-3.062	-4.061	-2.186	-2.608	-2.279	-3.849	-2.567	-2.806	-3.581	-3.328	-1.285	-1.913	-2.11	-2.534	-3.454	-4.049	-	7
Dp	-5.531	-5.99	-6.518	-7.225	-4.677	-5.873	-5.773	-6.533	-6.224	-5.737	-5.265	-5.876	-6.796	-6.558	-7.138	-5.935	-	16
rer	-3.717	-2.804	-3.684	-3.435	-3.788	-3.44	-3.336	-3.107	-3.528	-2.011	-3.434	-1.159	-4.182	-3.225	-3.721	-3.126	-	13
stir	-4.869	-3.686	-4.423	-5.552	-4.73	-4.035	-3.877	-4.148	-5.361	-	-4.32	-	-3.844	-2.771	-3.538	-3.669	-	13
stir	-	-	-4.837	-	-	-4.021	-3.43	-5.26	-	-	-	-	-2.87	-3.805	-2.926	-3.326	-	7
*y**	-4.167	-4.05	-3.97	-4.223	-4.012	-3.663	-4.936	-4.512	-3.168	-3.444	-4.171	-4.521	-2.821	-2.916	-2.881	-2.921	-	14
*stir**	-4.609	-4.594	-4.121	-3.763	-4.273	-4.371	-4.81	-4.413	-5.129	-4.609	-3.978	-4.359	-3.751	-4.014	-4.093	-3.979	-	16
*stir**	-4.497	-4.73	-4.286	-3.681	-4.955	-4.636	-4.51	-3.842	-2.786	-3.313	-3.359	-4.198	-3.355	-3.196	-3.107	-3.027	-	15
*poil***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-3.321	11

Notes: ADF tests on variables in first differences. T-statistics reported. The regressions for all variables contain a constant term in the ADF regression only. The 5% critical value of the ADF statistic including trend and intercept is -3.48, the one without trend is -2.91.
Source: Authors' calculations.

Appendix C – Figures

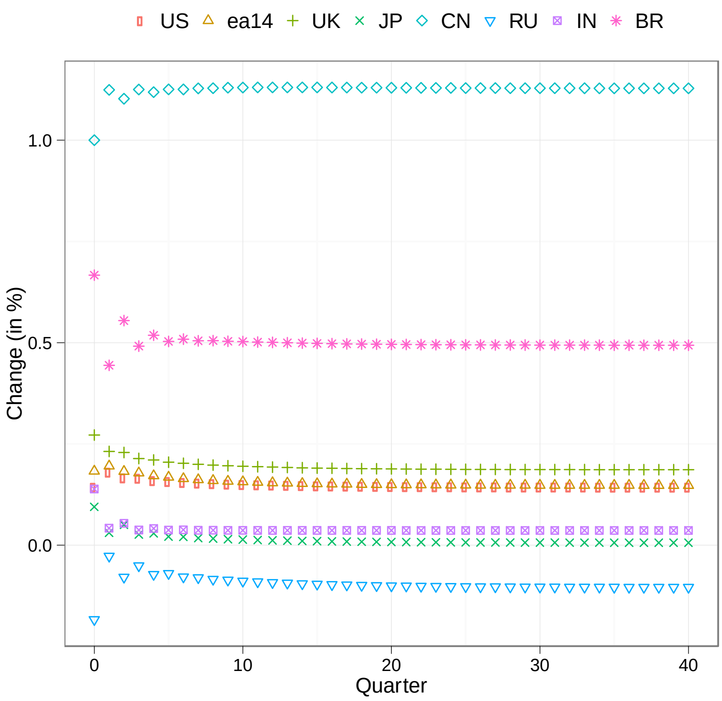
Figure 1: Share of Trade to China in Total Trade, in %.

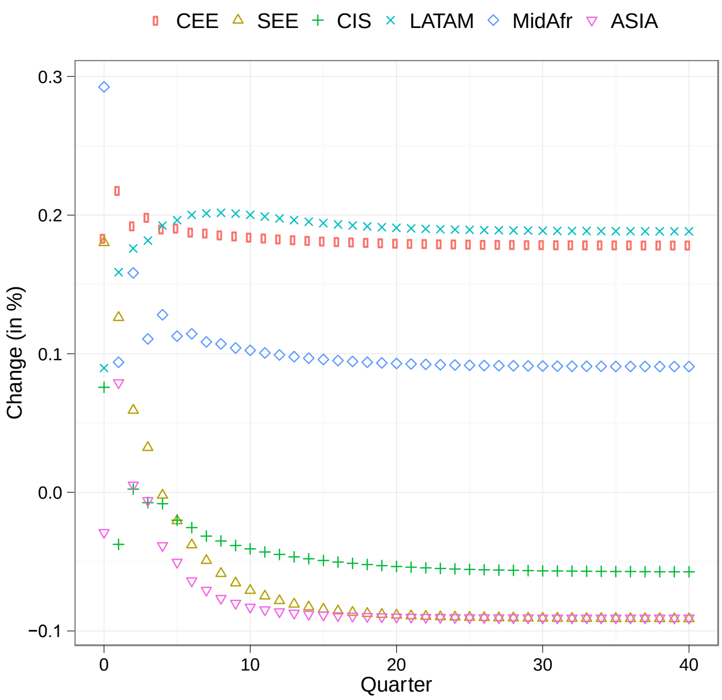




Source: Authors' calculations.

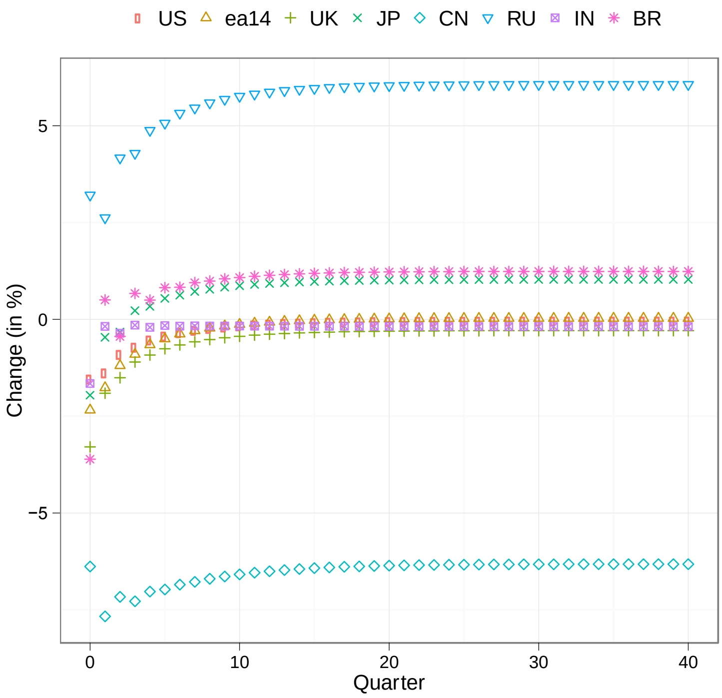
Figure 2: Responses of Output to 1% (on impact) positive Shock on Chinese Output.

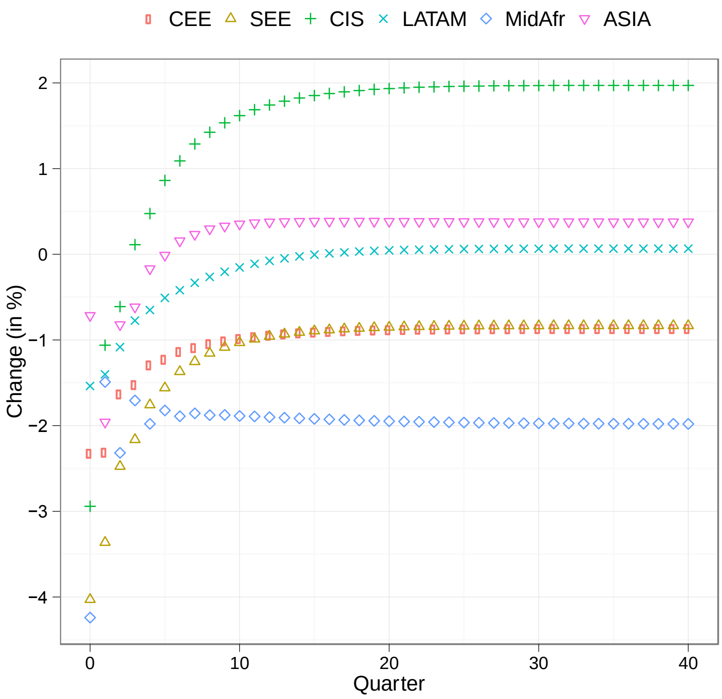




Source: Authors' calculations.

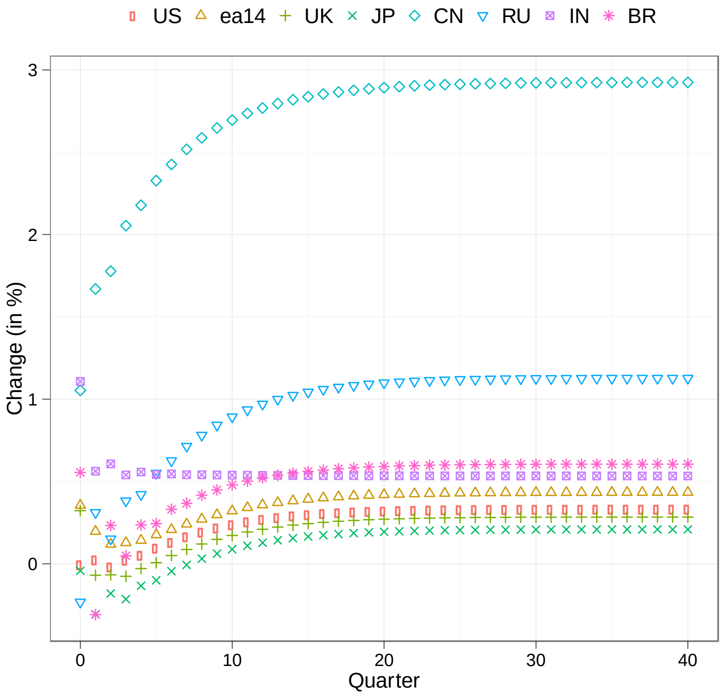
Figure 3: Responses of Output to +50% hike (on impact) in oil prices (on impact).

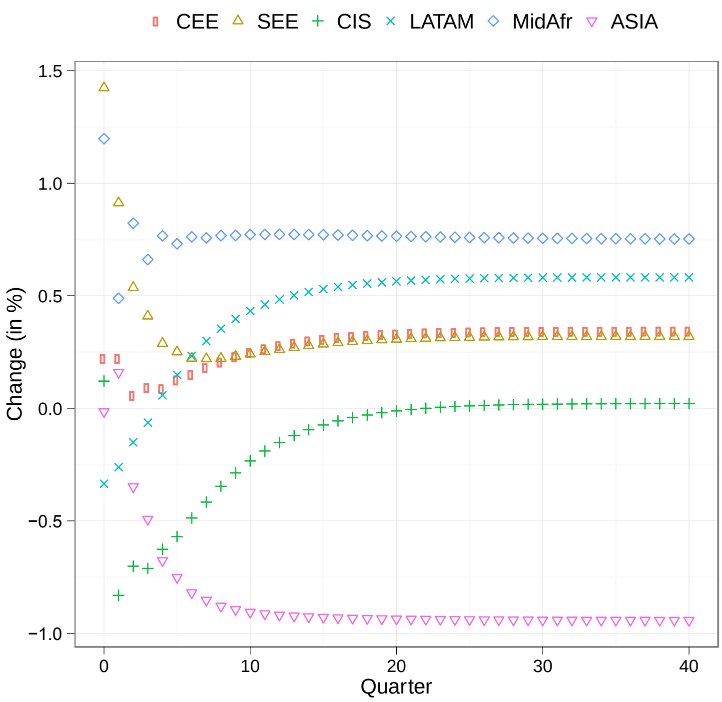




Source: Authors' calculations.

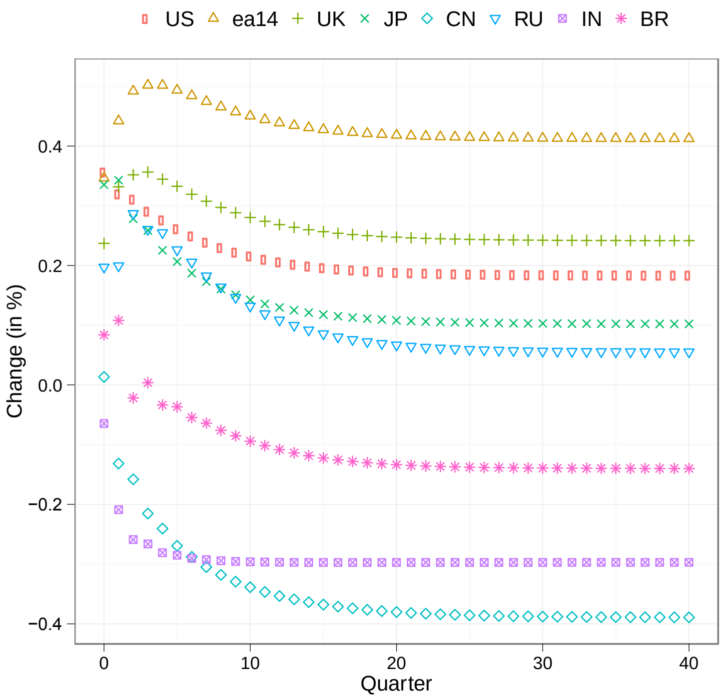
Figure 4: Responses of Output to 3% (on impact) appreciation of the renminbi vis-à-vis the USD.

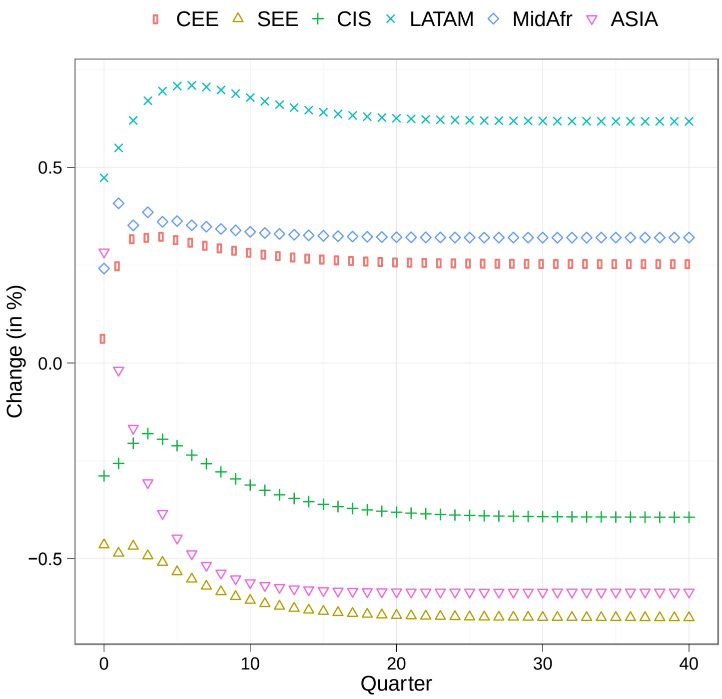




Source: Authors' calculations.

Figure 5: Responses of output to 10% (on impact) depreciation of the euro vis-à-vis the USD.





Source: Authors' calculations.