Exchange rate pass-through to domestic prices in the Central European countries

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July 2009

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Abstract:

Exchange rate plays an important role in transmitting pressures from the external shocks to the domestic economy. Development of inflation in the domestic economy is significantly determined by the ability of exchange rate to transmit external price related pressures to the domestic market. Considering the new EU member countries obligation to adopt euro the loss of the monetary sovereignty should be analyzed not only in the view of the direct positive and negative effects of this decision but also in the view of many indirect effects. While the exchange rates of majority of the EMU candidate countries are strongly affected by the euro exchange rate on the international markets there is still room for them to float partially reflecting changes in the national economic development. Ability of the exchange rate to transfer external shocks to the national economy remains one of the most discussed areas relating to the current stage of the monetary integration process in the European single market.

In the paper we analyze the ability of the exchange rate to weaken or eventually to strengthen the transmission of the external inflation pressures to the national economy in the Czech republic, Hungary, Poland and the Slovak republic. In order to meet this objective we estimate a vector autoregression (VAR) model correctly identified by the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. Variance decomposition and impulse-response functions are computed in order to estimate the exchange rate pass-through from the foreign prices of import to the domestic consumer price indexes in the Visegrad countries. Ordering of the endogenous variables in the model is also considered allowing us to check the robustness of the empirical results.

Keywords: exchange rate, inflation, VAR, Cholesky decomposition, variance decomposition, impulse-response function

JEL Classification: C32, E52

1. Introduction

Ability of the exchange rate to transfer external shocks to the national economy remains one of the most discussed areas relating to the current stage of the monetary integration process in the European single market. New European Union (EU) member countries that accepted the obligation to adopt euro have to consider many positive and negative aspects of the euro adoption especially in the view of time they need for the implementation of all necessary actions to be ready to give up their monetary sovereignty. We do not want to speculate about the approximate date of the future European Monetary Union (EMU) enlargement especially due to increased uncertainty of the economy agents in the time of the global financial and economic crisis that also worsen the macroeconomic stability in the EMU candidate countries as well as their ability to meet the Maastricht convergence criteria. On the other hand it is still convenient to analyze the wide spectrum of effects related to giving up the relative flexibility of the national exchange rates after the euro adoption. While the exchange rates of majority of the EMU candidate countries are strongly affected by the euro exchange rate development on the international markets there is still room for them to float partially reflecting changes in the domestic economic development.

Among many of impulses that the exchange rate transmits from the external environment to the national economy we highlight the price effects of changes in the foreign import prices on the domestic price indexes. The degree of the exchange rate pass-through to the domestic prices emphasizes its role as the external price shocks absorber especially in the situation when the exchange rate development is less vulnerable to changes in the foreign nominal variables.

In the paper we analyze the ability of the exchange rate to weaken or eventually to strengthen the transmission of the external inflation pressures to the national economy in the Czech republic, Hungary, Poland and the Slovak republic. In order to meet this objective we estimate vector autoregression (VAR) model correctly identified by the Cholesky decomposition of innovations that allows us to identify structural shocks hitting the model. Variance decomposition and impulse-response functions are computed in order to estimate the exchange rate pass-through from the foreign prices of import (we use an index of the prices of import goods denominated in the foreign currency) to the domestic consumer price indexes in the Visegrad countries. Ordering of the endogenous variables in the model is also considered allowing us to check the robustness of the empirical results.

2. Overview of the literature

Vulnerability of the exchange rates to the exogenous shocks came to the centre of an academic discussion shortly after a break-down of a Bretton Woods system of fixed exchange rates at the beginning of the 1970s. Uncertainty on the foreign exchange markets together with higher volatility of exchange rates increased a sensitivity of domestic economies to the foreign partners' economic development as well as to the world leading economies' exchange rate movements. Exchange rate pass-through as the relationship between exchange rate movement and price adjustments of traded goods came to the centre in academic and policy circles (Lian, 2007). Toshitaka (Toshitaka, 2006) estimated exchange rate pass-through of six major industrial countries using a time-varying parameter with stochastic volatility model. Author divided an analysis into impacts of exchange rate fluctuations to import prices (first-stage pass-through) and those of import price movements to consumer prices (second-stage pass-through). Takatoshi (Takatoshi et al., 2005) examined the pass-through effects of exchange rate changes on the domestic prices among the East Asian countries using the conventional pass-through equation and a VAR analysis. In order to identify the VAR model authors used a Cholesky decomposition to identify structural shocks and to examine the pass-through of the exchange rate shock to the domestic price inflation. They conclude that while the degree of exchange rate pass-through to import prices is quite high in the crisis-hit countries, the pass-through to CPI is generally low. Takatoshi and Kiyotaka (Takatoshi and Kiyotaka, 2006) estimated five and seven variable VAR model (including all three price variables to check the robustness and to investigate directly the pass-through effect across the prices.) in order to examine the pass-through effects of exchange rate changes on the domestic prices. Cortinhas (Cortinhas, 2007) also tested the sensitivity of the results from the VAR models using several alternative ordering of the variables with mixed results. Ca' Zorzi et al. (Ca' Zorzi et al., 2007) on the sample 12 emerging markets in Asia, Latin America, and Central and Eastern Europe investigated that exchange rate pass-through declines across the pricing chain, i.e. it is lower on consumer prices than on import prices.

3. Econometric model

In order to analyze the transmission of the external inflation pressures to the domestic price inflation we estimate a vector autoregression model (VAR) that can be written by the following moving average representation

$$CY_t = A(L)Y_{t-1} + u_t \tag{1}$$

where $Y_t = [ip_t, m_t, e_t, y_t, p_t]$ is a N x 1 vector of the contemporaneous endogenous variables (ip - foreign prices of import, m - money supply, e - exchange rate, y - production gap, p - domestic price index), C is an N x N matrix with ones on the main diagonal and possibly non-zero off-diagonal elements representing the contemporaneous relationship among the endogenous variables of the model, $A(L)$ is a polynomial variance-covariance matrix in the lag operator L representing the relationship among variables on the lagged values and u_t is a N x 1 normalized vector of shocks to the model (foreign prices of import shock, nominal shock, exchange rate shock, production gap shock, inflation shock).

By multiplying equation (1) by an inverse matrix C^{-1} we obtain the reduced-form of the VAR model (this adjustment is necessary because the model represented by the equation (1) is not directly observable and structural shocks cannot by correctly identified):

$$Y_t = C^{-1}A(L)Y_{t-1} + C^{-1}u_t = B(L)Y_{t-1} + e_t \tag{2}$$

Equation (2) reveals the relationship between u_t and e_t, that is given by

$$C^{-1}u_t = e_t \text{ or } u_t = Ce_t \tag{3}$$

where *B(L)* is again a matrix representing the relationship among variables on the lagged values and e_t is a N x 1 vector of serially uncorrelated structural disturbance (errors) of the model.

In order to identify our model there must be exactly $n^2 - \left[\left(n^2 - n\right)/2\right]$ relationships among the endogenous variables of the model, where *n* represents a number of variables. We have to impose $\left(n^2 - n\right)/2$ restrictions on the matrix *C* based on the Cholesky decomposition of the residual variance-covariance matrix that define matrix *C* as a lower triangular matrix. The lower triangularity of *C* implies a recursive scheme among variables (the Wald chain scheme) that has clear economic implications and has to be empirically tested as any other relationship. Identification scheme of the matrix *C* implies that some structural shocks have no contemporaneous effects on some endogenous variables given the ordering of the endogenous variables. It is clear that the convenient causal ordering of variables is necessary to identify structural shocks and reflects the distribution chain of pricing[1].

More explicitly written equation (3) following our identification scheme is given by

$$\begin{bmatrix} u_{ip,t} \\ u_{m,t} \\ u_{e,t} \\ u_{y,t} \\ u_{p,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ c_{21} & 1 & 0 & 0 & 0 \\ c_{31} & c_{32} & 1 & 0 & 0 \\ c_{41} & c_{42} & c_{43} & 1 & 0 \\ c_{51} & c_{52} & c_{53} & c_{54} & 1 \end{bmatrix} \begin{bmatrix} e_{ip,t} \\ e_{m,t} \\ e_{e,t} \\ e_{y,t} \\ e_{p,t} \end{bmatrix} \tag{4}$$

To check the robustness of our empirical results we estimate three VAR models identified through the restrictions resulting from the recursive Cholesky decomposition of the residuals for each country from the Visegrad group - model A ($Y_t = [ip_t, m_t, e_t, y_t, p_t]$); model B ($Y_t = [ip_t, y_t, m_t, e_t, p_t]$); model C ($Y_t = [ip_t, y_t, e_t, m_t, p_t]$).

In each model we assume different ordering of the variables that reflects the different distribution chain of pricing. This approach has a potential to thoroughly estimate the ability of the exchange rate to transmit external inflation pressures to the domestic economy assuming that different ordering of the variables respects the economic logic of the chain of pricing and it also reflects the structure of the economy. It also allows us to compare the results with those of other studies.

It is also possible to analyze the variability as well as the responses of the variety of the price indexes (CPI, PPI, ULC, and IPD). Another suitable alternative is to alternate different variables in the beginning of the distribution chain in the role of external inflation source (i.e. different energy prices, key import commodities, intermediate or final goods).

Additionally, if the estimated results from variance decomposition as well as the impulse-response analysis confirm the model is not very sensitive to the endogenous variables ordering, the Cholesky decomposition method can be interpreted as providing robust results.

In order to meet the objective of the article to analyze the ability of exchange rate to transmit external price related pressures to the domestic prices we examine variance decompositions from the estimated VAR models focusing only on the interpretation of the sources of exchange rate and inflation variability in the selected group of countries. Similarly we estimate accumulated impulse-responses of exchange rate and inflation.

[1] In the paper we only want to analyze the degree of exchange rate pass-through along the distribution chain of pricing not its determinants.

4. Data and results

We use the quarterly data ranging from 1999Q1 to 2008Q3 (39 observations) for the foreign prices of import, money supply represented by the monetary aggregate M3, nominal effective exchange rate (NEER), production gap, and inflation represented by the adjusted domestic consumer price index (indicator of core inflation). Time series for the monetary aggregate M3 are seasonally adjusted. The production gap was estimated by the Hodrick-Prescott filter applied to the quarterly real GDP.

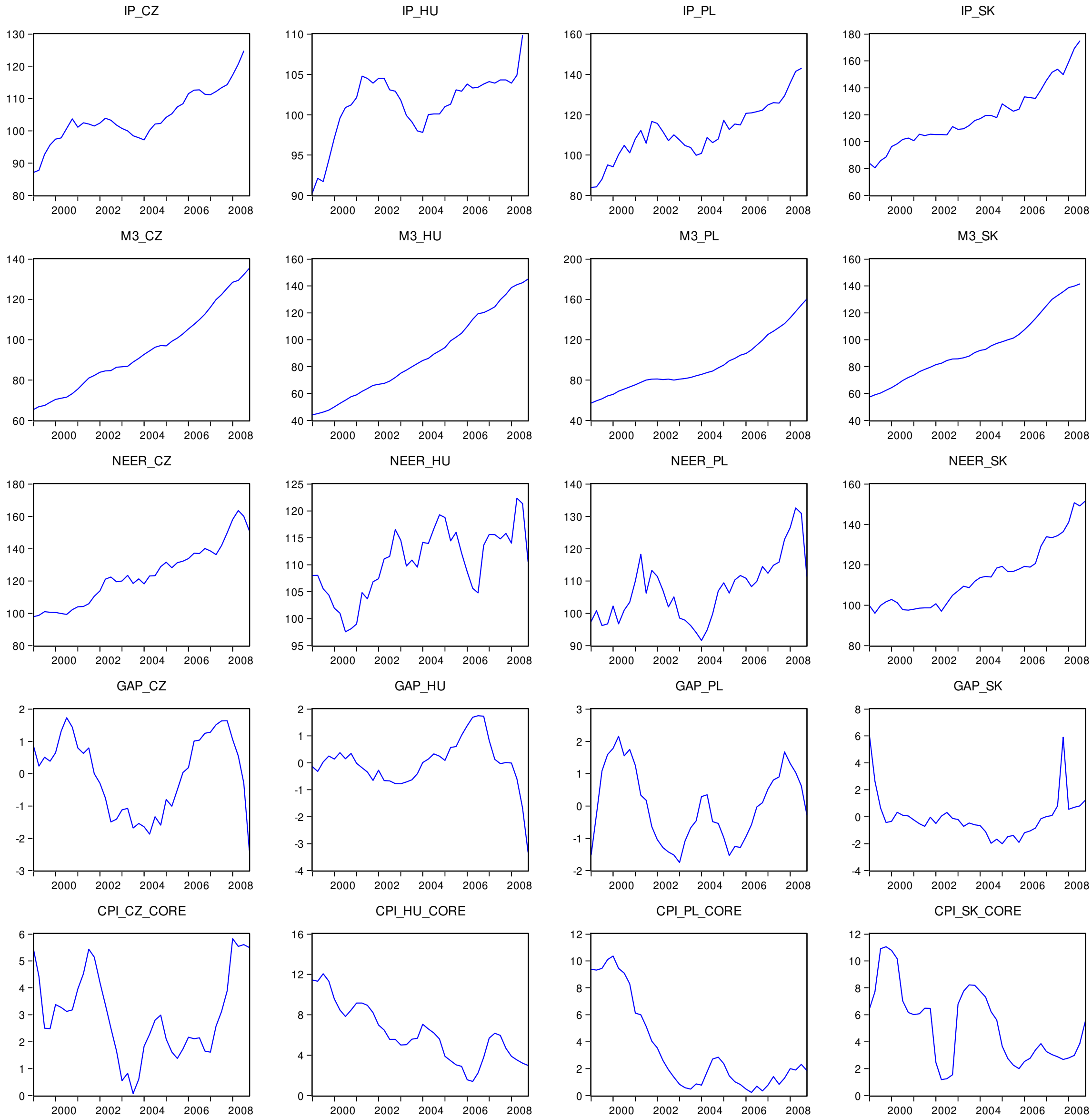


Figure 1. Variables

Source: Bank for international settlements, OECD

Before estimating the model we test the time series for stationarity and cointegration. The augmented Dickey-Fuller (ADF) and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the existence of the unit roots. Both ADF and PP tests indicate the variables are non-stationary on the values (except for the production gap in Hungary and the Slovak republic where both ADF and PP tests indicated the time series are stationary on the values) so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that the variables are I(1) and the time series for the production gap in Hungary and the Slovak republic are I(0).

Because the most of the endogenous variables have a unit root on the values it is necessary to the test the time series for cointegration using the Johansen cointegration test. The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). The results of the Johansen cointegration tests seem to be clear in comparison with the results of the unit root tests. Both trace statistics and maximum eigenvalue statistics (both at 0.05 level) indicate there is no cointegration among the endogenous variables of the model. The results of the Johansen cointegration tests do not correspond with the results of the unit root tests (for Hungary and the Slovak republic) because it implies that there is no long-run equilibrium relationship among the variables of the model (they follow the different stochastic trend in the long run).

The results of unit root and cointegration tests are not reported here to save space. Like any other results, they are available upon request from the author.

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the models for each country lie inside the unit circle, although several roots are near unity in absolute value (figure 2).

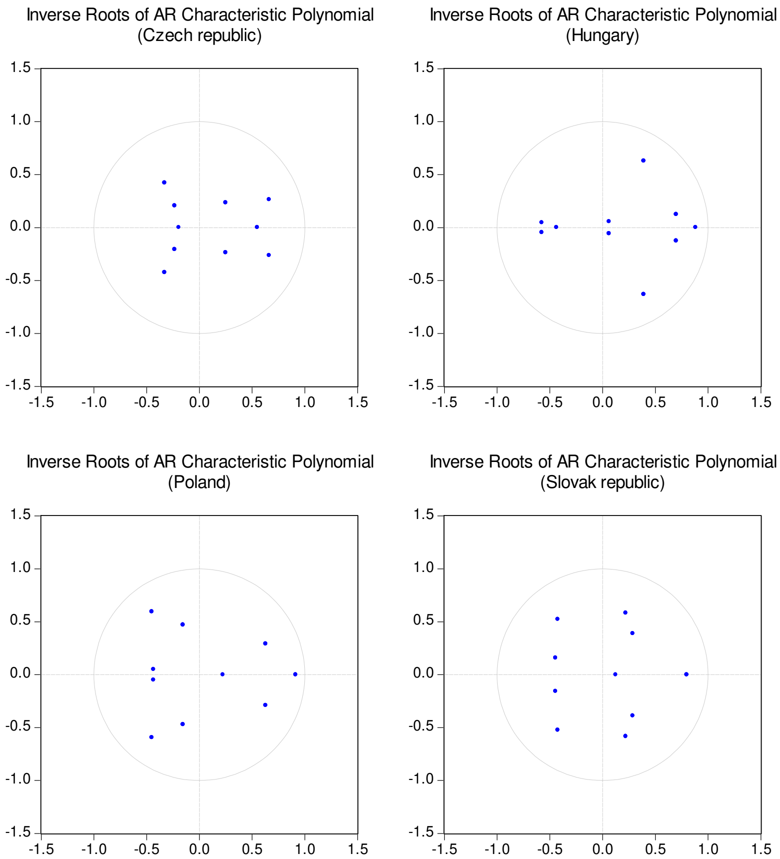


Figure 2. *VAR stability condition check (Visegrad countries)*[2]

Source: Author's calculations.

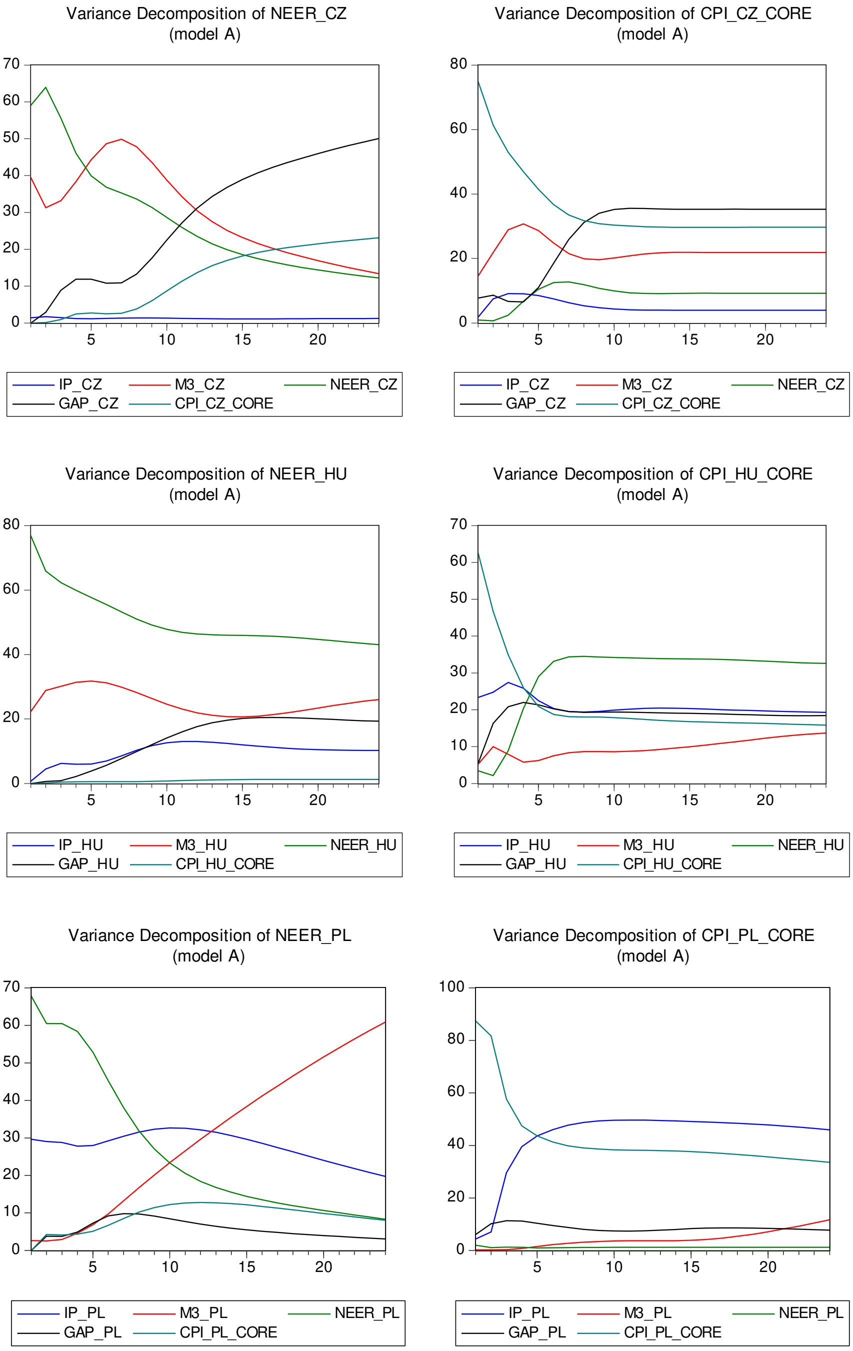
Following the results of the unit root and cointegration tests we estimate the model using the variables in the first differences so that we can calculate variance decompositions (we focus on the

[2] The results of the VAR stability condition check are reported only for the model A. Like any other results, VAR stability condition check for models B and C are available upon request from the author.

foreign prices of import contributions to the NEER conditional variance as well as NEER contributions to the CPI conditional variance) and impulse-response functions (we focus on the responses of NEER to foreign prices of import one standard deviation as well as the responses of CPI to NEER one standard deviation) in each country from the Visegrad group. In the figure 3 and 4 we summarize variance decomposition and impulse-response function for the model A ($Y_t = [ip_t, m_t, e_t, y_t, p_t]$). In the figure 5 and 6 we summarize variance decomposition and impulse-response function for the model B ($Y_t = [ip_t, y_t, m_t, e_t, p_t]$). In the figure 7 and 8 we summarize variance decomposition and impulse-response function for the model C ($Y_t = [ip_t, y_t, e_t, m_t, p_t]$).

4.1 Model A ($\mathbf{Y_t = [ip_t, m_t, e_t, y_t, p_t]}$)

In the model A we consider the exchange rate shocks are determined by the monetary policy shocks. At the same time the nominal exchange rate shocks affects output gap contemporaneously, but not vice versa (assumption is given by the Cholesky structure that allows us to identify the model).



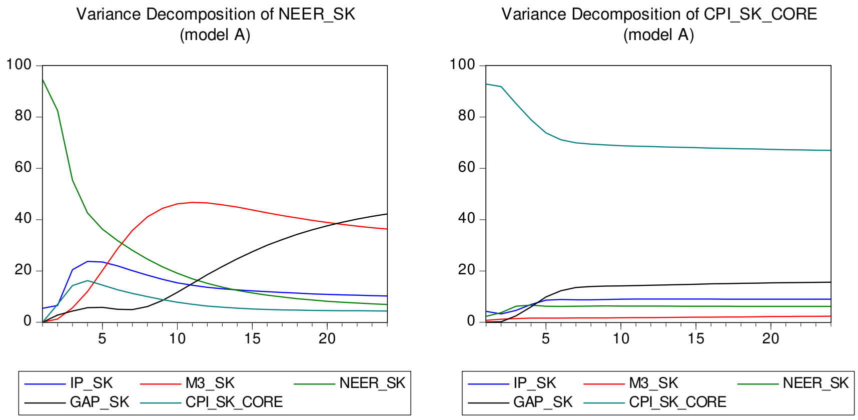
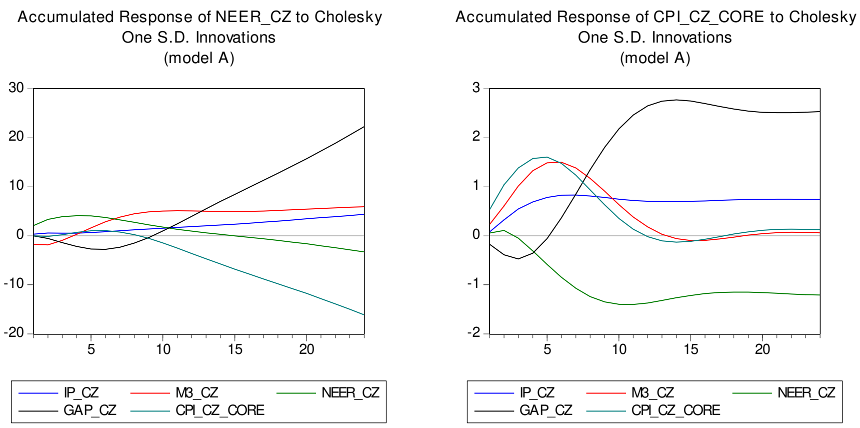


Figure 3. Variance decomposition of NEER and CPI (Model A)

Source: Author's calculations.

The figure 3 reflects variance decomposition of NEER in the Czech republic, Hungary, Poland and the Slovak republic in order investigate the relative importance of the foreign import prices shock in the NEER fluctuations. It also depicts variance decomposition of CPI to investigate the relative importance of the exchange rate shock in the CPI variability. The percentage contribution of the foreign import prices to the variance of NEER doesn't offer clear results among selected group of countries. In the Czech republic the foreign import prices shock doesn't seem to have much influence in the NEER variability during the whole period of 24 quarters. On the other hand this shock is responsible for around 30 percent of the NEER variability in the first 3 years in Poland. While in Hungary the weight of the foreign import prices shock continuously increases during 11 quarters in the Slovak republic it was only during first 4 quarters and then its impact steadily decreases.

The figure 3 also shows variance decomposition of the domestic consumer prices in the Visegrad countries. The contribution of the NEER shock in the CPI variability is quite large in Hungary (a sharp increase of the weight is visible during first 7 quarters) reflecting high vulnerability of the domestic price development to the external determinants affecting exchange rate path. In the three remaining countries the role of the NEER shock in determining the domestic inflation seems to be rather low (even though it reaches around 10 percent in the Czech republic).



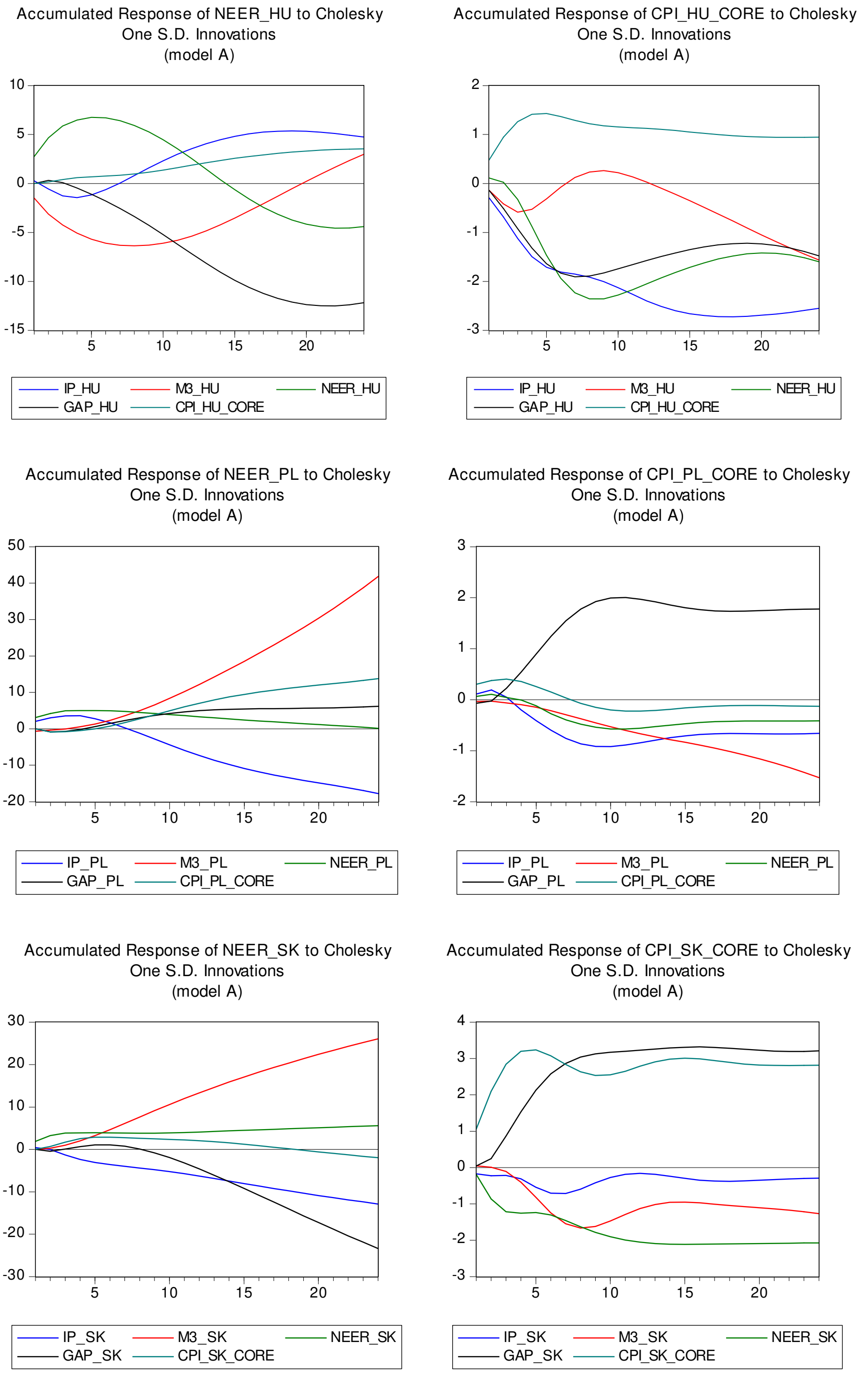


Figure 4. Response of NEER and CPI (Model A)

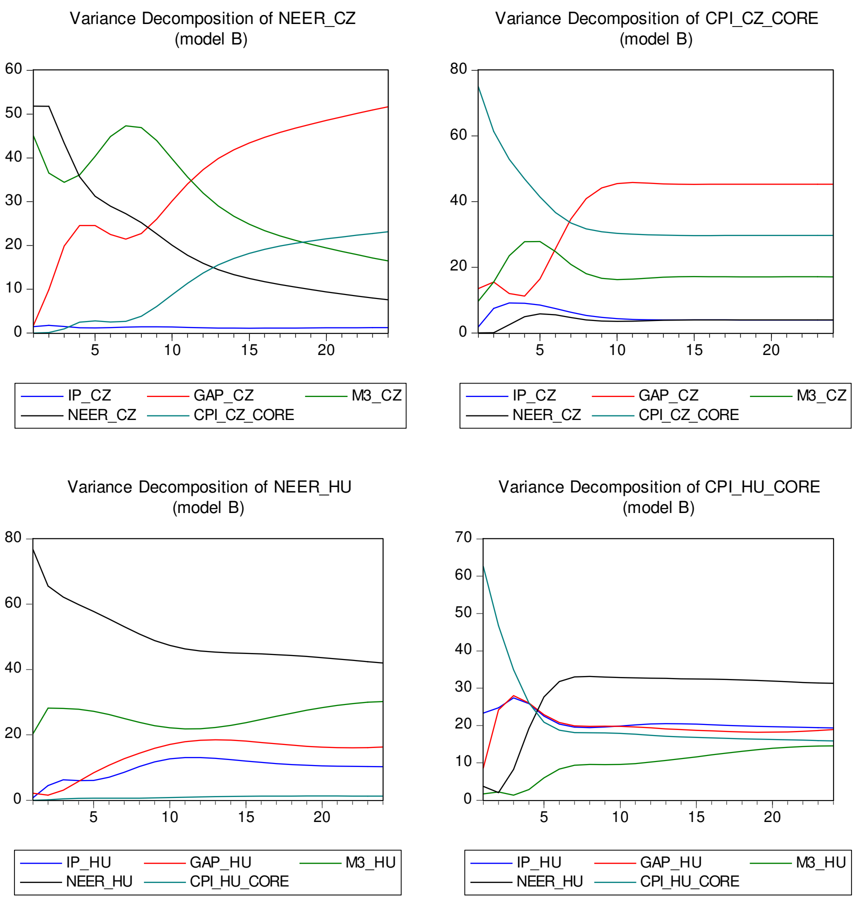
Source: Author's calculations.

The figure 4 depicts the estimated accumulated impulse-response functions that show responses of NEER to the Cholesky one standard deviation shocks in the Czech republic, Hungary, Poland and the Slovak republic. We would expect the foreign import prices shock increases NEER (NEER appreciates) upon impact, most likely because of the direct contribution of lower import expenditures to the drop in the foreign exchange demand. It is also suitable to consider the exchange rate will not respond immediately to the foreign import prices shock due to lagged reactions of agents (due to i.e. timed import contracts) or even not in the right direction especially because of mixed unclear expectations of the agents. The weaker is the response of NEER to the foreign import prices shock the better is the absorption capability of the exchange rate to neutralize the potential effects of the external inflation pressures resulting from the foreign import prices shock on the domestic price development. After the foreign import prices shock NEER belatedly appreciates in the Czech republic and Hungary while in Poland and the Slovak republic NEER depreciates over the time.

The figure 4 also shows the estimated accumulated responses of CPI to the Cholesky one standard deviation shocks in the selected group of countries. We would expect the positive exchange rate shock (appreciation of NEER) decreases the domestic inflation. This scenario is clearly visible in all countries from the group except Poland. In Poland CPI seems to be less responsive to the exchange rate shock over the time (inflation decreases only at 0.4 percent). In the Czech republic, Hungary and the Slovak republic inflation decreases during first 8-12 quarters after the positive exchange rate shock. The CPI response seems to be fast and quite large in Hungary (almost 2.4 percent after 8 quarters) while in the Slovak republic it takes 13 quarters until the positive impact on inflation reaches full effect (almost 2.2 percent) and in the Czech republic it takes 11 months (almost 1.4 percent). At the same time we observe the exchange rate shock has a permanent effect on inflation in all three countries (inflation remains permanently lower after the exchange rate appreciates).

4.2 Model B ($Y_t = [ip_t, y_t, m_t, e_t, p_t]$)

In the model B we have adjusted the ordering of the variables so that the output gap is now at the second place. We consider the exchange rate shocks are determined by the monetary policy shocks as well as output gap shocks.



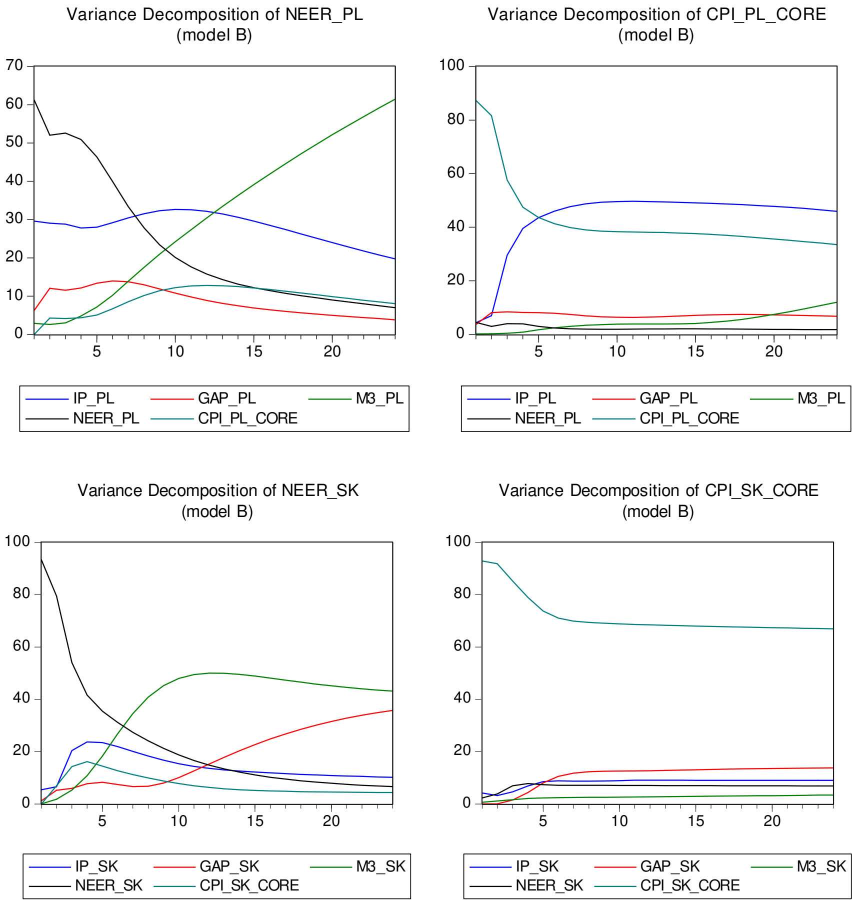


Figure 5. Variance decomposition of NEER and CPI (Model B)

Source: Author's calculations.

The figure 5 reflects variance decomposition of NEER in the countries from the Visegrad group in order investigate the relative importance of the foreign import prices shock in the NEER fluctuations in the model B with adjusted ordering of the endogenous variables. When we compare figures 3 and 5 we investigate a high degree of similarity in the results of the models A and B. Changed ordering of the variables doesn't seem to have any impact on variance decomposition of NEER.

The figure 5 also shows variance decomposition of the domestic consumer prices in the Visegrad countries in the model B with adjusted ordering of the endogenous variables. The results for the model B seems to be also similar to those in the model A for all countries. Even thought certain differences reports results for the Czech republic where the contribution of the exchange rate to the inflation variability is little smaller (the difference is on average around 3.5 percent during whole period) in the model B.

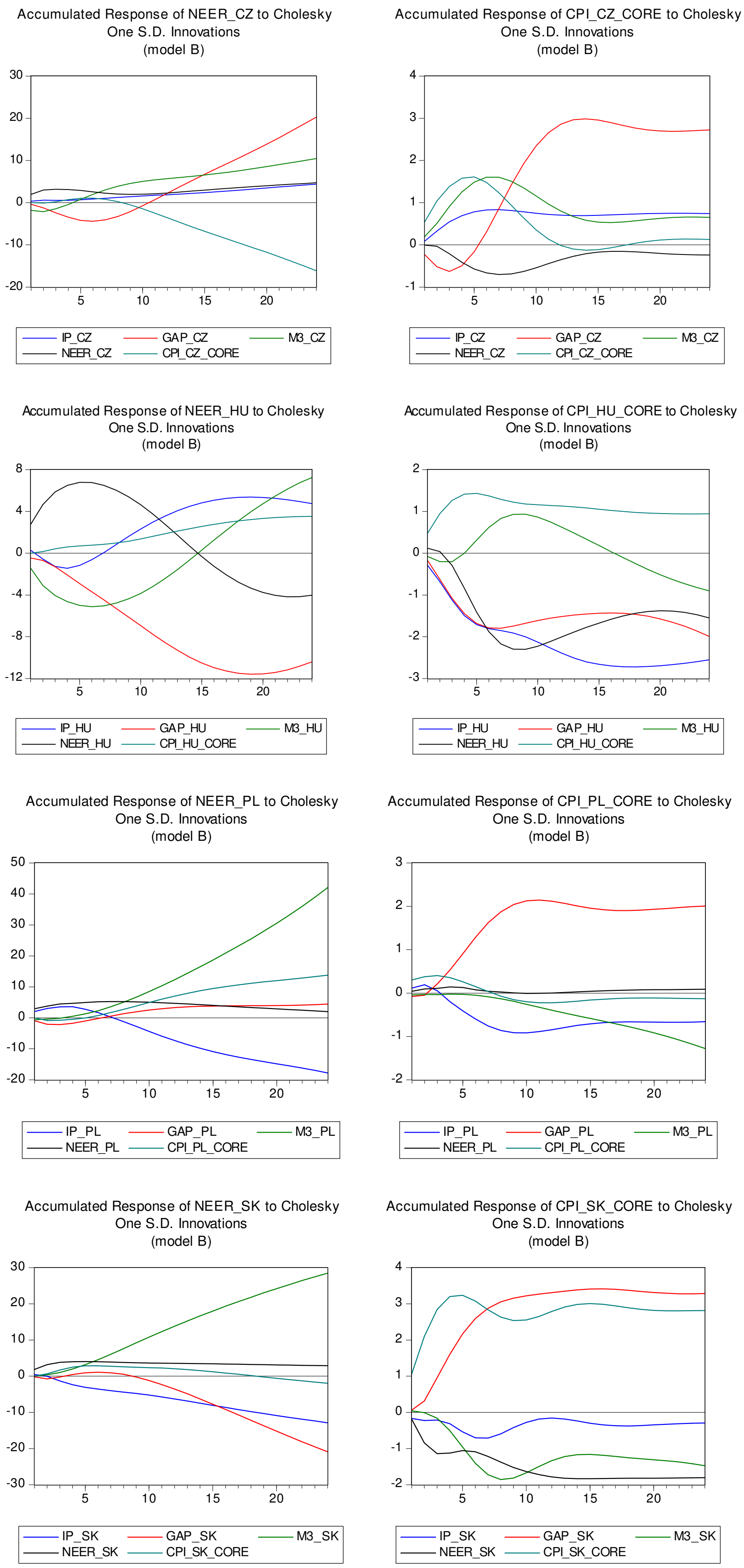


Figure 6. Response of NEER and CPI (Model B)

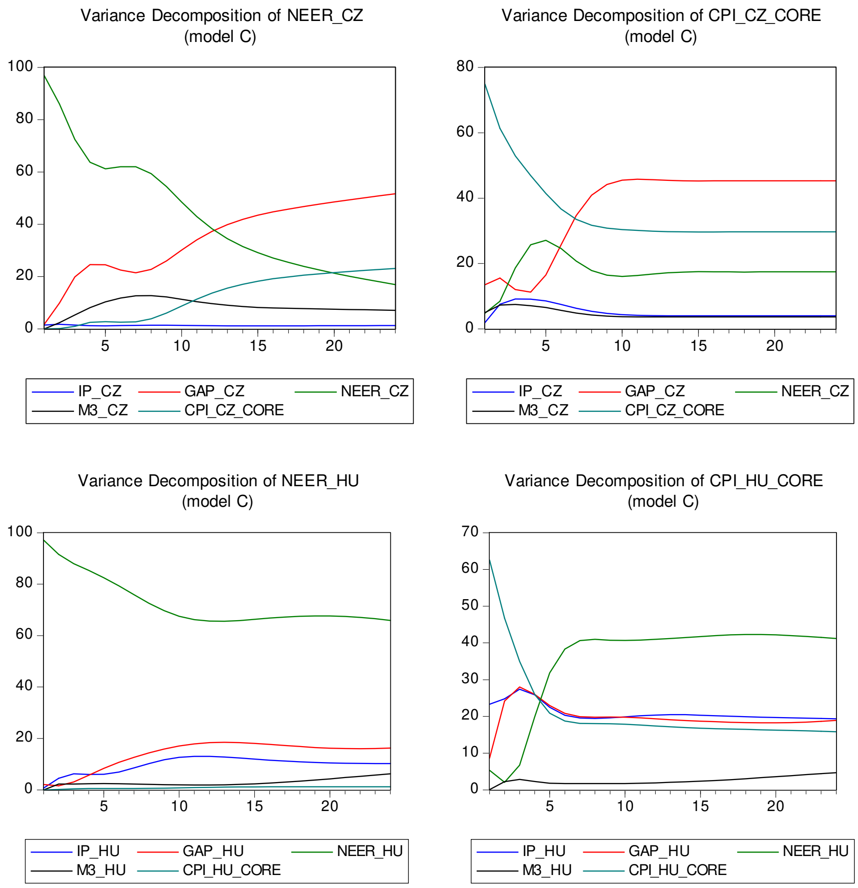
Source: Author's calculations.

The figure 6 depicts the estimated accumulated responses of NEER and CPI to the structural shocks in the Czech republic, Hungary, Poland and the Slovak republic in the model B with adjusted ordering of the endogenous variables.

While the responses of NEER to the foreign import prices don't seem to be affected by the changes in the order of the variables in all countries the behaviour of the domestic inflation after the exchange rate shock differs among countries in the models A and B. In the Czech republic the exchange rate shock seems to have smaller impact on the inflation in the model B. Since the tenth quarter the difference was around 0.8 percent on average. In Hungary we didn't investigate any differences among models A and B relating to the CPI responses to the exchange rate shock. While in the model A the results for Poland reflects CPI seems to be less responsive to the exchange rate shock, in the model B inflation doesn't respond to the exchange rate shock over the time with sufficient statistical significance (the CPI neutrality is clearly visible). In the Slovak republic we observe almost similar behaviour of CPI after the exchange rate shock in both models even though there are certain minor differences in the path of the response curve in the middle of the selected horizon.

4.3 Model C ($Y_t = [ip_t, y_t, e_t, m_t, p_t]$)

In the model C we have switched the ordering of the monetary aggregate M3 and the exchange rate (according to the model B) so that we consider the exchange rate shocks are not determined by the monetary policy shocks. At the same time the nominal exchange rate shocks affect monetary aggregate contemporaneously, but not vice versa.



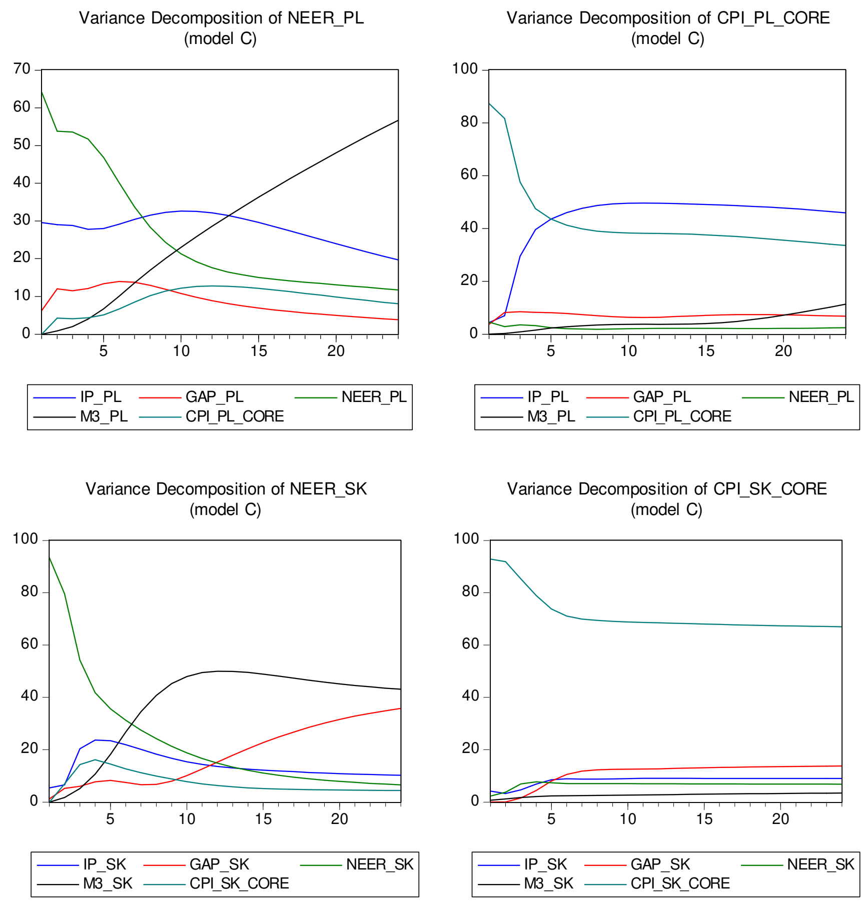


Figure 7. Variance decomposition of NEER and CPI (Model C)

Source: Author's calculations.

The figure 7 shows variance decomposition of NEER in the countries from the Visegrad group in order investigate the relative importance of the foreign import prices shock in the NEER fluctuations in the model C with adjusted ordering of the endogenous variables. When we compare variance decomposition of NEER from figures 3 and 7 we investigate again a high degree of similarity in the results of the models A and C. Changed ordering of the variables repeatedly doesn't seem to have any impact on variance decomposition of NEER.

The figure 7 also shows variance decomposition of the domestic consumer prices in the Visegrad countries in the model C with adjusted ordering of the endogenous variables. The results for the model C seems to be also similar to those in the model A and B for Poland and the Slovak republic. On the other hand the results from the model C reveals (similarly like the model B) certain differences in variance decomposition of CPI in the Czech republic where the contribution of the exchange rate to the inflation variability is little higher (the difference is on average around 9 percent during whole period) in the model C. Differences were also observed in variance decomposition of CPI in Hungary where the contribution of NEER to the CPI variability is higher on average at around 9 percent during whole period in the model C.

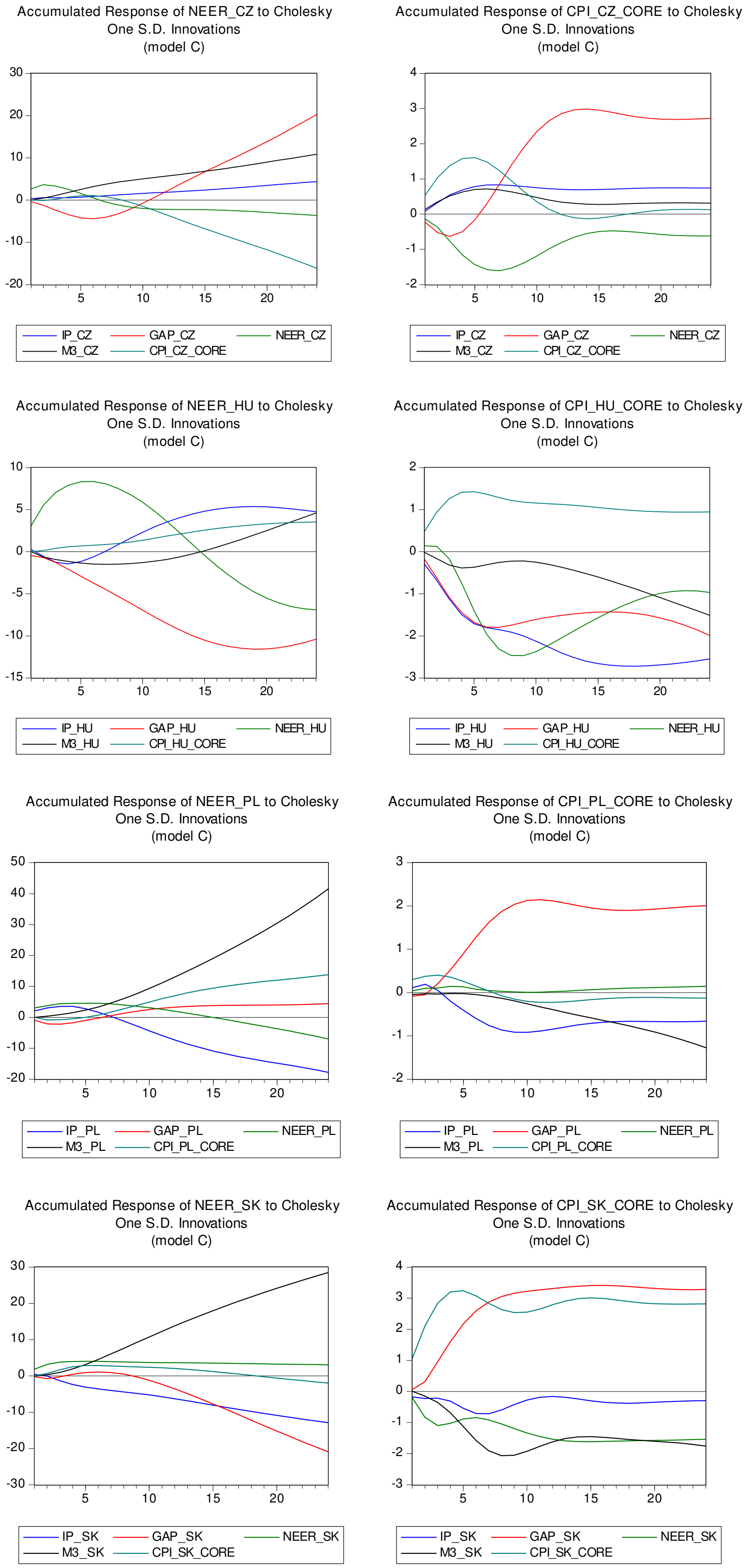


Figure 8. Response of NEER and CPI (Model C)

Source: Author's calculations.

The figure 8 depicts the estimated accumulated responses of NEER and CPI to the structural shocks in the Czech republic, Hungary, Poland and the Slovak republic in the model C with adjusted ordering of the endogenous variables.

The responses of NEER to the foreign import prices don't seem to be affected by the changes in the order of the variables in all countries (just like in the model B). In the Czech republic the exchange rate shock seems to have smaller impact on the inflation in the model C (similarly like in the model B) but there are still some differences that have to be explained. In the model C the inflation in the Czech republic dropped faster (during first 7 quarters) after the exchange rate shock according the model A (here it takes around 11 quarters). Long run impact on the inflation is also varying. While in the model A inflation remained lower at approximately 1.20 percent in the model C it was only 0.6 percent. In Hungary the response of inflation to the exchange rate shock was almost similar among all three models so that the ordering of the variables didn't affect the results with sufficient statistical significance. The only difference we identified was the weaker long run effect of the exchange rate shock on the inflation in model C in comparison with models A and B. In Poland the results in the model C seems to be similar to the results in the model B as the inflation didn't respond to the exchange rate shock in the selected period. In the Slovak republic we observe almost similar behaviour of inflation after NEER shock in comparison with models A and B. Even thought there are minor differences in short term path of the inflation response to the exchange rate shock among the models.

5. Conclusion

In the paper we have analyzed the exchange rate pass-through do the domestic prices in the group of Visegrad countries (the Czech republic, Hungary, Poland, the Slovak republic) in terms of exchange rate (we used NEER) ability to transmit pressures from the external price shocks (we used the foreign prices of import shock) to the domestic inflation (we used adjusted consumer price index - core inflation) using vector autoregression model identified by the Cholesky decomposition of innovations. In order to test the robustness of the results we have estimated three models with different causal ordering of the endogenous variables. The analysis was split in two parts. In the first step we have analyzed the contribution of the foreign prices of import shock to the NEER variability as well as the accumulated response of NEER to this shock. In the second step we have analyzed the contribution of NEER shock to the CPI variability as well as the accumulated response of CPI to this shock.

Comparing the result for each country from the Visegrad group has revealed following important facts. The contribution of the foreign prices of import shock to the exchange rate variability differs among the Visegrad countries. While in Poland the foreign import prices shock is responsible for around 30 percent of the NEER variability in the Czech republic this shock doesn't seem to have much influence in the NEER variability. In Hungary and the Slovak republic the weight of this shock differs in the short run (even though it still remains rather low) but in the long-term perspective its contribution to the NEER variability is quite similar. Changed ordering of the variables doesn't seem to have any impact on variance decomposition of NEER. On the other hand impulse-response functions of NEER offer quite differing results for all countries. While in the Czech republic and Hungary NEER appreciates with a lag after the foreign import prices shock in Poland and the Slovak republic NEER depreciates over the time. Changed ordering of the variables didn't affect the estimated results. We may conclude the foreign import prices shock mostly determine the NEER variability in Poland (followed by the Slovak republic and Hungary) while in the Czech republic it played a negligible role. The foreign import prices shock affected NEER in Poland and the Slovak republic (in the Slovak republic with the less contribution) negatively so that it can be considered as the potential source of the inflation pressures. In the Czech republic and Hungary the foreign import prices shock affected NEER positively but only in Hungary it can be considered as the potential source of disinflation (due to the negligible impact of the foreign import prices shock to the NEER variability).

Differing results among countries also offers variance decomposition of CPI. The contribution of the NEER shock in the CPI variability is quite large only in Hungary. In the three remaining countries the role of the NEER shock in determining the domestic inflation seems to be rather low. Changed ordering of the variables doesn't seem to have significant impact on variance decomposition of CPI except for the Czech republic where the model C revealed little higher NEER shock contribution to the

CPI variability. The impulse-response analysis has confirmed our expectations. In all countries except Poland (inflation in Poland seems to be less responsive (model A) or even neutral (models B and C) to the exchange rate development) CPI decreases after the NEER shock. The most intensive CPI decrease we have examined in Hungary followed by the Slovak republic and the Czech republic. Changed ordering of the variables has slightly changed the results in the Czech republic.

The degree of the exchange rate pass-through to the domestic prices seems to be quite high in the Czech republic, Hungary and the Slovak republic. On the other hand NEER significantly determines CPI only in Hungary, while in the remaining countries the exchange rate pass-through is eliminated due to low NEER contribution in the CPI variability.

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