Arbeiten aus dem

OSTEUROPA-INSTITUT REGENSBURG

Wirtschaftswissenschaftliche Abteilung

Working Papers

Nr. 289 August 2010

Drivers of exchange rate dynamics in selected CIS countries: Evidence from a FAVAR analysis*

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* We appreciate comments by Stephan Barisitz and the participants of the Astana Economic Forum, Kazakhstan, and the conference on Emerging Markets in Milas, Turkey. The opinions are those of the author and do not necessarily reflect the official viewpoint of the Oesterreichische Nationalbank or of the Eurosystem

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ISBN 978-3-938980-38-5

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Abstract

We investigate the likely sources of exchange rate dynamics in selected CIS countries (Russia, Kazakhstan, Ukraine, Kyrgyzstan, Azerbaijan, and Moldova) over the last decade (1999-2010). Evidence is based on country VARs augmented by a regional common factor structure (FAVAR model). The models include nominal exchange rates, the common factor of exchange rates in the CIS countries, and international drivers such as global trade, share prices, and oil price. Global, regional and idiosyncratic shocks are identified in a standard Cholesky fashion. Their relevance for exchange rates is explored by a decomposition of the variance of forecast errors. The impact of global shocks to in the developments of exchange rates has increased, in particular, if financial shocks are considered. Because of the financial crisis, regional shocks have become more important at the expense of global shocks.

Keywords: Exchange rates, CIS countries, financial crisis, FAVAR models

JEL Classification: F31, C22, G15

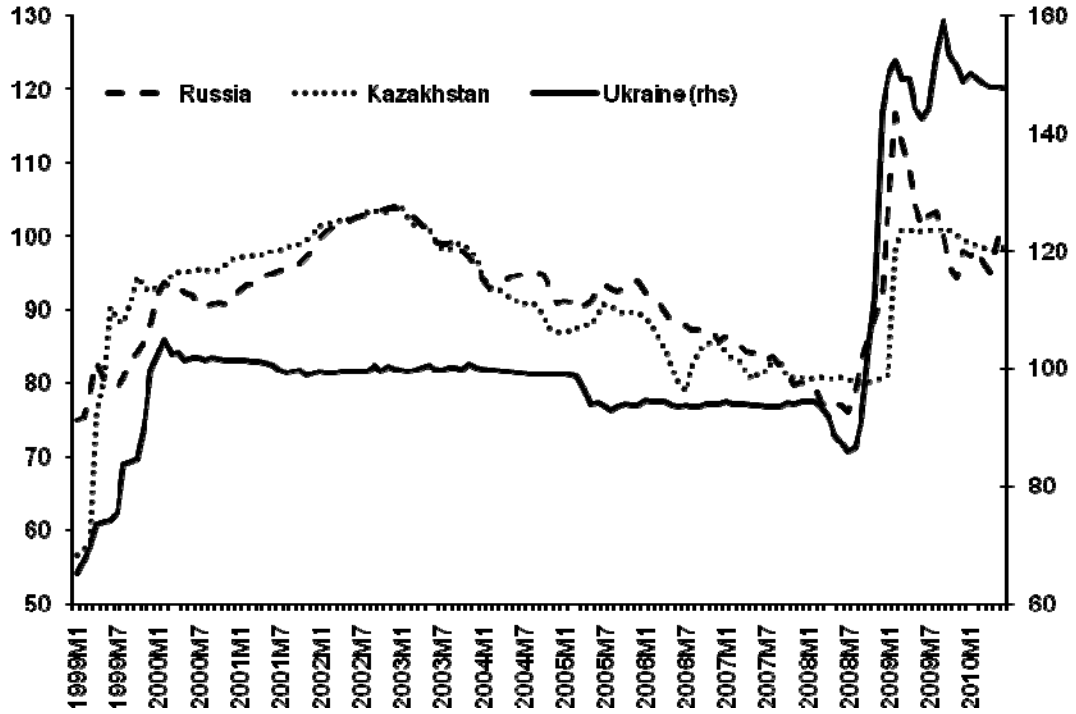
1 Introduction

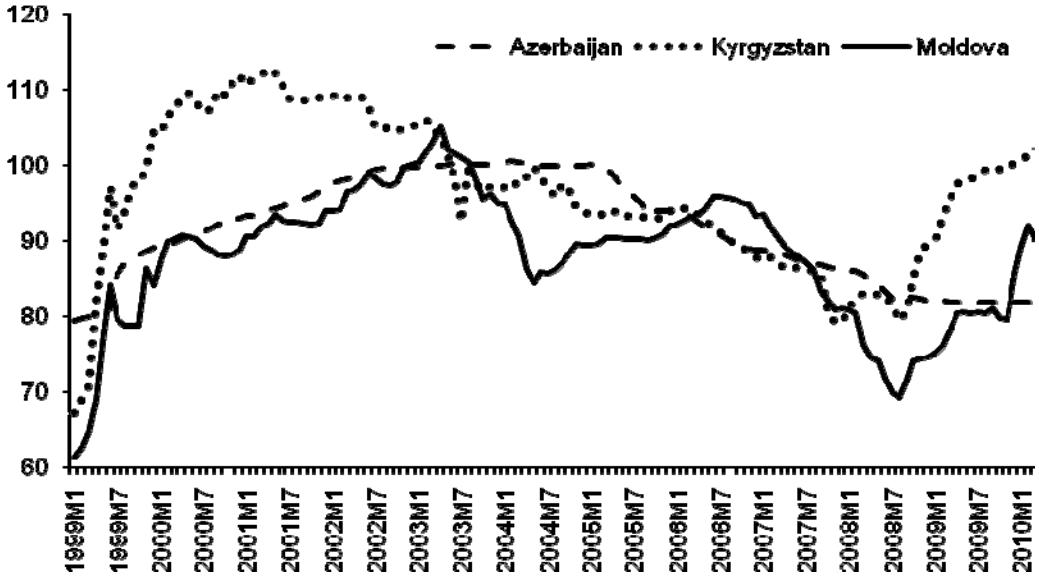
The countries of the Comonwelth of Intependent States (CIS) represent a very heterogeneous group of transition economies. The overall development is dominated by Russia (see Mayes and Korhonen, 2007). It accounts for almost 75 percent of nominal US dollar GDP and 50 percent of the population of the entire region. At the lower edge, some small states like Kyrgyzstan and Moldova have an output share of less than 1 percent. Despite frequent critique, Russia is also the leading reformer in the region (Shleifer and Treisman, 2005), influencing possibly the economic policies in other CIS counries also by its conduct of reforms. Although the region seems to be dominated by the Russian economy, the earlier analyses show a surprisingly low role of regional factors. Both Chaplygin, Hughes Hallett and Richter (2006) and Shiells, Pani and Jafarov (2005) find only a low degree of business cycle correlations in the region. Thus the level of trade integration remains low since the break-up of the Soviet Union (Fidrmuc and Fidrmuc, 2000). Moreover, Tiffin (2008) notes that also the level of financial integration in the region is below expectations. Moreover, nearly all countries show a slight negative trend of regional trade. Despite of this, Fungáčová and Solanko (2008) have noted that Russian policy intends to become a global financial center. However, Russian achievements in this field suffered clearly significant losses during the financial crisis since the second half of 2008. Russia and some other countries of the region are also well equipped with natural resources (oil, gas and minerals). Behind this, Russia is generally found not to be deeply integrated to the world economy (Koźluk, 2008, Korhonen and Mehrotra, 2009). Similar evidence for other CIS countries is largely not available.

In recent years, the boom in world demand exerted a strong upward pressure on GDP growth, implying a faster catching up towards the per capita income of industrialized countries. As a rule, this process was accompanied by an appreciation of exchange rates (see Figure 1) and an accumulation of foreign reserves.

Starting in 2003, more or less, both the Azerbaijani Manat and the Kazakh Tenge appreciated by 20 percent against the US Dollar. Higher exports of raw materials and soaring inflows of foreign investment raised demand for the CIS currencies, which caused concerns whether this appreciation is sustainable (Oomes and Kalcheva, 2007, and Égert and Leonard, 2008). In the mid of 2008, the appreciation of the CIS rates came to a halt and has even reversed. Most spectacular, the Ukrainian Hryvnia lost more than 70 percent of its value against the US Dollar since August 2008 in nominal terms. But also the Russian Rouble, which improved against the US dollar by 30 percent until the mid of 2008, has lost these gains due to the financial crisis. Lower prices for raw materials, slower global growth and tighter liquidity conditions due to the financial crisis have exerted a significant downward pressure on many CIS currencies. A further depreciation raises inflation and might create impediments for future growth.

Figure 1: **Exchange rate of selected CIS countries**
(local currency per USD)





Source: IMF, own calculations.

To provide further evidence to this process, we explore the likely sources of exchange rate dynamics in selected CIS countries (Russia, Kazakhstan, Ukraine, Kyrgyzstan, Azerbaijan, and Moldova) over the past decade (1999-2008), that is, after the Russian financial crisis in 1998. The countries have been selected on the base of their exchange rate regime. All countries in the sample have flexible exchange rates, although many countries have used intervention policies to stabilize their currencies against the US Dollar. Schnabl (2005) has compared exchange rate stabilization before and after the Russian crisis. Korhonen and Wachtel (2006) have presented an analysis of the exchange rate pass-through of CIS countiries after between 1998 and 2004. Kutan and Wyzan (2005) have provided evidence for Dutch disease in Kazakhstan between 1996 and 2003.

The analysis is built upon a FAVAR (factor augmented VAR) model. Country specific models include nominal exchange rates, the common factor of exchange rates in the CIS countries, and global drivers. Global, regional and idiosyncratic shocks are identified in a standard Cholesky fashion. In this framework, the relative importance of idiosyncratic (national), regional, and global shocks on exchange rates is explored. According to the variance decomposition of forecast errors, global and regional shocks have become increasingly important in the second half of the sample, reflecting the vast economic integration of the CIS countries. The relevance of idiosyncratic shocks has decreased over time. These results imply that many CIS countries have become more vulnerable to external shocks. The findings are robust to changes in the model specification. In particular, they hold irrespectively of the concrete measure of global shocks, where global trade, stock market prices, and oil price are considered. Due to the financial crisis, regional shocks have become more important at the expense of global shocks.

The paper is organized in several sections. The econometric framework is reviewed in the next section (section 2). Section 3 presents the data and the empirical results. The final section (section 4) offers some conclusions.

2 The FAVAR model

The drivers of exchange rates are explored in a FAVAR framework. The VAR model is a convenient tool to study the dynamic interactions that drive the evolution of nominal exchange rates in CIS countries. The basic VAR specification, however, is extended by a common factor structure to proxy the regional element in the CIS exchange rates. This is recommended for two reasons. First, a large variable set can be compressed by the factor approach. Second, the regional element can affect exchange rates not only with a delay, but also in a contemporaneous way. In this sense, the common factor relieves the identification of regional shocks.

The empirical strategy resembles the Stock and Watson (2005) approach to examine the driving forces of business cycles. The regional variable is defined as the principal component of the residuals from a first step VAR regression. Country exchange rates are regressed on their own lags, and lagged exchange rates from all the other CIS countries. Similarly to Marcellino, Stock and Watson (2003), the model is given by where y

$$y_t = a(L)y_{t-1} + u_t \tag{1}$$

$$u_t = \Gamma f_t + \varepsilon_t \tag{2}$$

is the ix1 vector of nominal exchange rates, and $a(L)$ is a (ixi) matrix polynomial in the lag operator, and i is the number of countries. The VAR errors u follow a common factor structure, where f is the (kxi) matrix of k common regional factors, Γ is a (ixk) matrix of factor loadings, and ε is a vector of idiosyncratic shocks.

After constructing regional factors, country individual VAR models are estimated. They are built upon three variables, i.e. a global variable (g), the regional common factor (f) and the country exchange rate (s). The global variable is measured, *inter alia*, by the level of world trade, a stock market index and the oil price. The shocks are exactly identified in a triangular fashion by using the Cholesky decomposition. Due to the ordering (g, f, s), a global shock is allowed to affect all variables in a contemporaneous way. While the regional shock has an immediate impact on the national evolution, the latter can affect the region only with a delay. Then, inference is conducted on the basis of a decomposition of the h-step ahead forecast error for the exchange rate. In particular, its variance can be traced to global, regional and idiosyncratic shocks. Since these fractions are orthogonal by construction, they sum of to 1. Hence, the relative contribution of the various shocks to the forecast error variance can be interpreted as a percentage.

Overall, a two-step procedure is applied for the FAVAR analysis. At the first step, a regional factor is constructed. Afterwards, this factor is embedded as an ingredient of the FAVAR model in the second stage. Bernanke, Boivin and Eliasz (2005) have compared this approach with the results based on a one step procedure. They conclude that the two-step approach is more practical and better performing than the joint estimation of all parameters.

3 Data and results

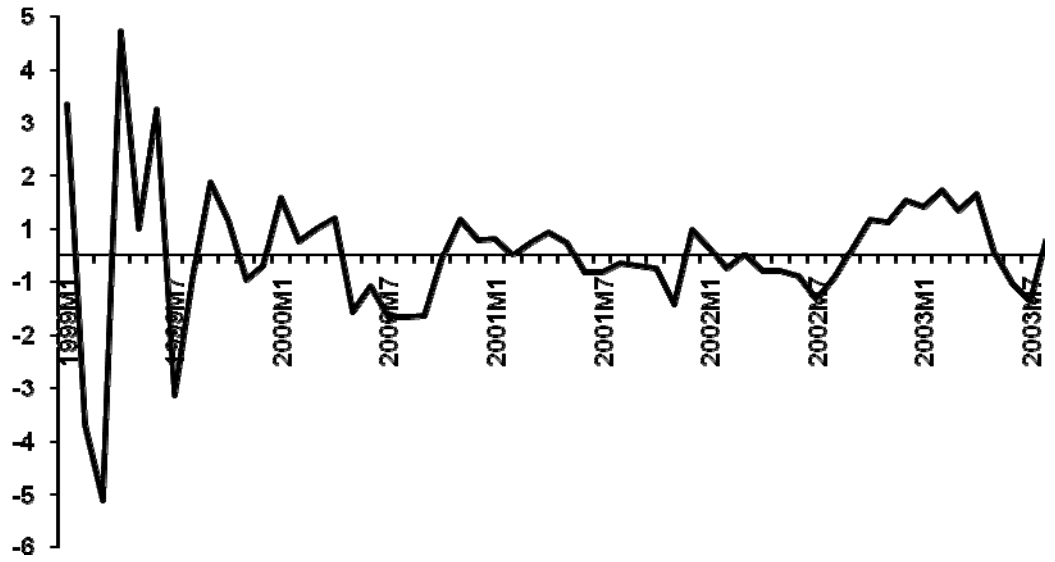
The evidence is based on end of month data for nominal exchange rates against the US Dollar over the 1999.01 to 2010.4 period, that is after the Russian financial crisis (Odling-Smee, 2006). Six currencies are included in the analysis. The Rouble (Russia), the Tenge (Kazakhstan), the Hryvnia (Ukraine), the Som (Kyrgyzstan), the Manat (Azerbaijan) and the Leu (Moldova). To control for developments in the world economy, global trade (in US Dollar) is considered. Moreover, the Dow Jones industrial index is used as a proxy for the evolution in the international financial markets. In addition, the results are compared with oil price. Hence, three alternative measures for the global economic development are included to assess the robustness of the results. Most data are taken from the International Financial Statistics of the IMF. As an exception, world trade is from the Netherlands Bureau for Economic Policy Analysis (CPB). To obtain insights into possible changing patterns in the process of economic integration, the sample is splitted into two halves, i.e. 1999.01-2003.12 and 2004.01-2010.4. The dating is motivated by two arguments. First, the oil price has been rather modest until the end of 2003, while it increased sharply in the second period. Second, exchange rates (with the exception of Ukraine) depreciated before 2003, while they appreciated between 2004 and financial crisis (summer 2008).

The first step is to construct the common regional factor. At this stage, a VAR model is estimated for the CIS exchange rates. According to Sims, Stock and Watson (2002) and Juselius (2007), a level specification is favouralbe to capture possible cointegration relationships. According to the Schwarz Bayesian information criterion, a lag length equal to 1 is the optimal choice. Then, a principal component is conducted on the grounds of the VAR residuals. Due to the information criteria provided by Bai and Ng (2002), the first two principal components seem to be appropriate. They represent almost 60 percent of the overall variance of exchange rates in the first subsample, and 50 percent in the second period. In terms of this statistic, the relevance of regional components seems to have decreased over the recent years, i.e. the currencies have become more differentiated. In order to obtain a unique measure, the regional factor is defined as a linear combination of the first two principal components (see Figure 2). The principal components are weighted according to their eigenvalues. Hence, the first principal component receives a weight of two third in the combination. The results are almost identical, when the analysis is done only with the first principal component. Between 2004 and 2008, the CIS factor declined until August 2008. Afterwards, high fluctuations are striking, but the magnitude remained below the variations observed after the Russian financial crisis in 1999.

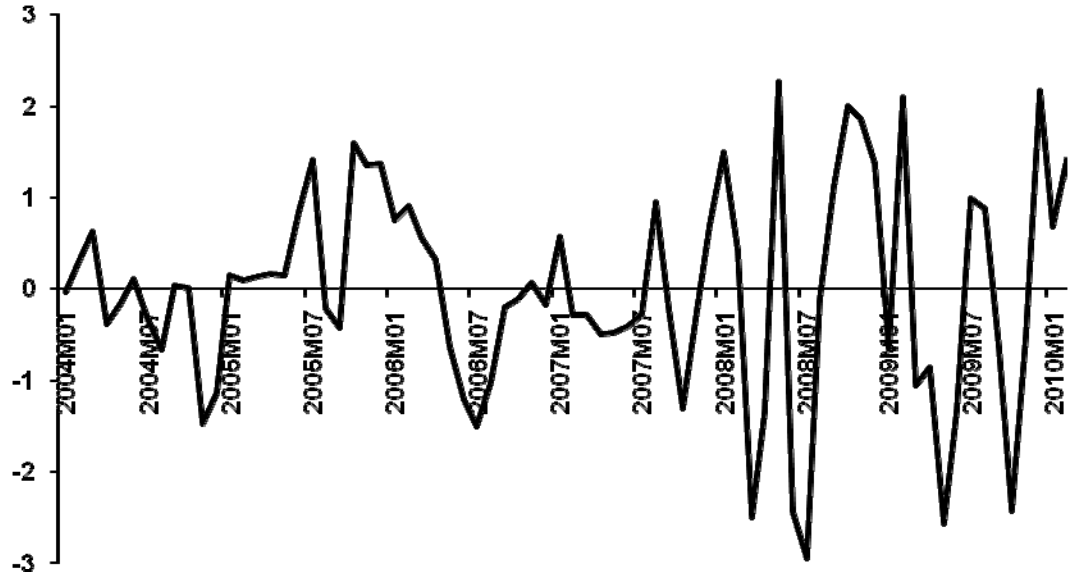
In the second step, VAR models are estimated at the individual country level. They include a global variable, the regional factor and the respective exchange rate. To shed light on the robustness of the results, the global variable is measured, *inter alia*, by the global trade (as a proxy for real shocks) and the evolution in international stock markets (financial shocks), and the oil price,. As a rule, the Schwarz-Bayesian information criterion recommends a lag order of 1 throughout the specifications. Global, regional and idiosyncratic shocks are identified using the triangular structure outlined above, and the

Figure 2: **CIS factor**

Sample 1999M1 to 2003M12



Sample 2004M1 to 2010M4



Source: Own estimations.

Table 1: **Decomposition of variance of forecasting errors after 12 quarters**

A. Global factor is proxied by world trade

	World		Regional		Idiosyncratic	
	1999-2003	2004-2010	1999-2003	2004-2010	1999-2003	2004-2010
Azerbaijan	4.7	26.1	1.6	13.4	93.7	60.5
Kazakhstan	2.7	6.4	58.4	6.1	38.9	87.4
Kyrgyzstan	27.5	2.5	19.4	42.5	53.1	55.0
Moldova	0.2	2.8	40.4	36.1	59.4	61.1
Russia	23.4	16.5	19.8	35.8	56.7	47.6
Ukraine	2.9	6.0	10.2	34.7	86.9	59.3

B. Global factor is proxied by the Dow Jones industrial index

	World		Regional		Idiosyncratic	
	1999-2003	2004-2010	1999-2003	2004-2010	1999-2003	2004-2010
Azerbaijan	2.9	10.7	1.4	10.8	95.7	78.6
Kazakhstan	0.5	61.2	60.6	6.9	38.9	31.9
Kyrgyzstan	35.6	63.2	23.9	23.8	40.5	13.0
Moldova	4.5	24.8	39.3	31.9	56.2	43.3
Russia	6.0	68.3	13.1	11.0	80.9	20.7
Ukraine	9.6	34.4	10.2	29.0	80.2	36.6

C. Global factor is proxied by the oil price

	World		Regional		Idiosyncratic	
	1999-2003	2004-2010	1999-2003	2004-2010	1999-2003	2004-2010
Azerbaijan	2.6	50.3	1.0	5.4	96.4	44.3
Kazakhstan	4.8	10.6	62.2	4.1	33.0	85.3
Kyrgyzstan	2.2	11.9	33.1	33.2	64.8	54.9
Moldova	0.2	16.5	38.3	21.4	61.6	62.0
Russia	18.0	30.7	7.8	22.5	74.2	46.7
Ukraine	20.0	29.7	13.7	19.7	66.3	50.6

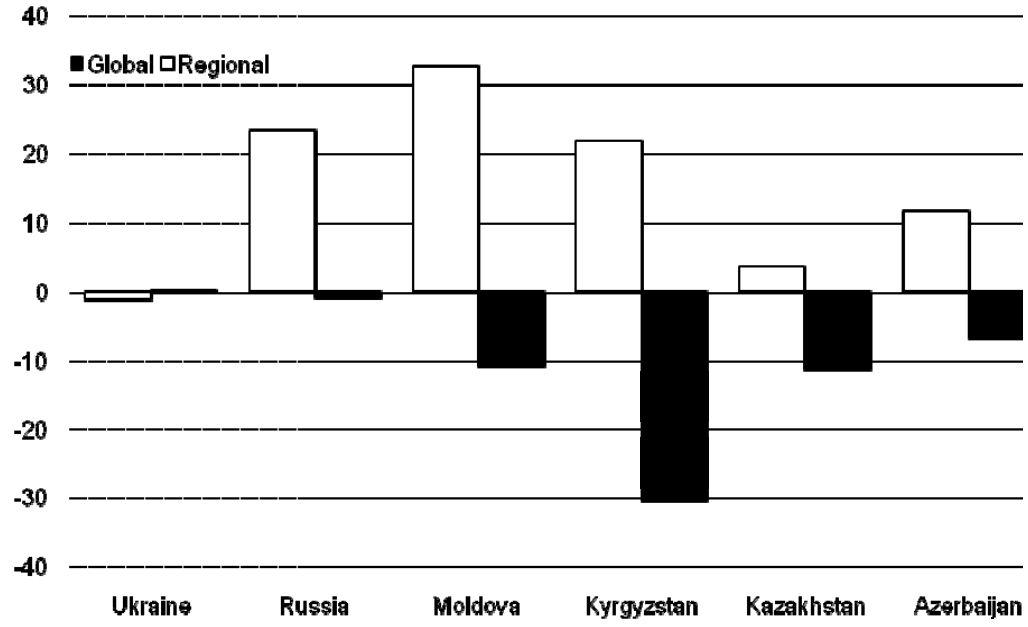
Source: Own Estimations.

relative importance of these shocks to explain forecast errors of exchange rates is assessed by a variance decomposition exercise, see Table 1 for the results.

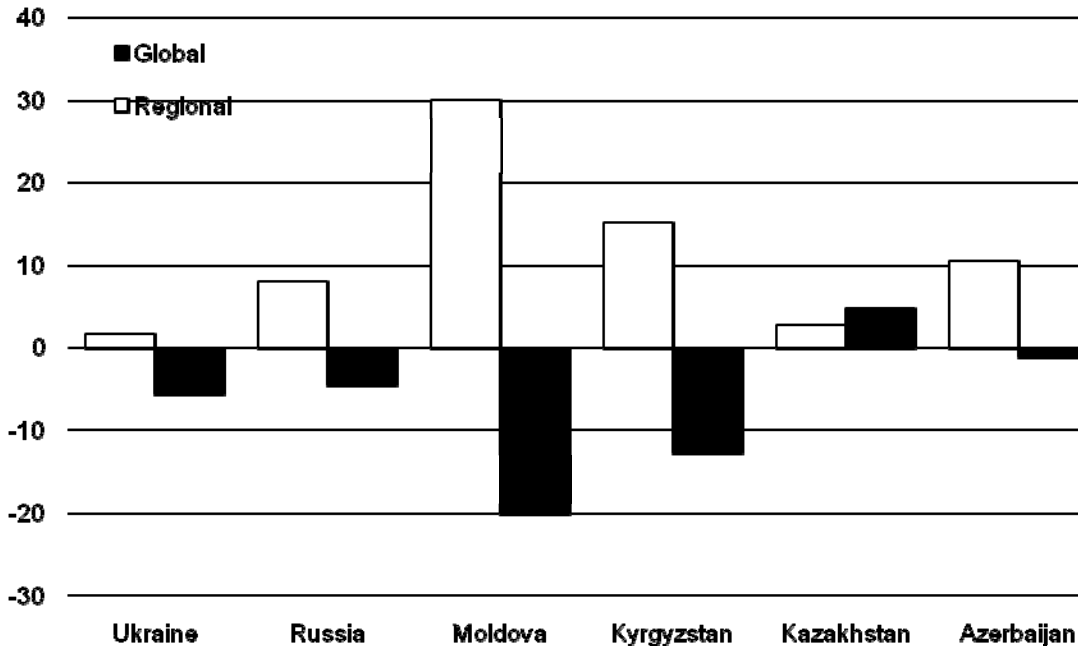
Although the results show a relative heterogeneous pattern, some similarities emerge. First, the results are quite different over the two subperiods. Hence, an analysis for the entire period would be inappropriate. More general, this finding points to the fact that empirical work for the CIS countries should take instabilities into account, as the countries are in a period of transition. Second, while the idiosyncratic shocks are still most important for the determination of exchange rates, their relevance has decreased. In contrast, the relevance of regional shocks seems to have increased over the recent period. The regional factors are especially important if global trade is used as a proxy

Figure 3: **Impact of financial crisis**

A. Shock measured in terms of world trade (real shock)



B. Shock measured in terms of stock market (financial shock)



Source: Own estimations.

The bars show the difference of variances attributed to global and regional shocks in the following periods: 2004.1-2010.4 and 2004.1-2008.8.

for international developments. Regional shocks account for about one third of exchange rate variance for Moldova, Russia and Ukraine, and nearly one half in Kyrgyzstan. Third, global real and financial shocks show slightly mixed evidence. On the one hand, the global trade shocks have become less relevant to explain exchange rate movements in Russia and Kyrgyzstan, while their importance remained low in Kazakhstan, Moldova and Ukraine. This corresponds to the increased role of regional shocks.

On the other hand, global financial shocks have become more relevant. For example, they explain more than two thirds of exchange rate movements in Russia. Their impact is only slightly lower for Kyrgyzstan and Kazakhstan. In the other CIS countries, neither trade nor financial shocks are important for the path of exchange rates. The results for the oil price stand between the results for global trade and stock prices. It shows that this variable has a composite effect of real and financial shocks on the CIS exchange rates. Idiosynchratic shocks play a more important role if oil prices are used as a proxy for global developments.

Finally, the impact of the financial crisis is explored in Figure 3. The variance decomposition exercise is done for two different periods, 2004.1-2010.4, compared to the pre-crisis period, 2004.1-2008.8. The bars show the difference in the decomposition attributed to regional and global shocks between these periods. The figure shows that regional and global shock developed in opposite directions as a result of the financial crisis. While the relevance of regional shocks has increased up to 30 percentage points, the relevance of global shocks lost importance.

4 Conclusion

From an external perspective, the economic development of the CIS countries is expected to be dominated by the Russian economy, which represents the largest market in the region. Surprisingly, this has not been found in earlier studies, which looked either at synchronization of business cycles or the degree of financial integration between the CIS countries.

In this paper this issue is addressed by means of FAVAR models. This presents the first analyis of this kind for the CIS countries. In particular, nominal exchange rate movements are decomposed to global, regional and idiosynchratic shocks for two periods: 1999 to 2003 and 2004 to 2010. Moreover, the impact of global real (trade) and financial (stock markets) shocks on the CIS countries is compared. The results confirm the previous findings that the regional shocks did not account for a significant share of exchange rate variance in the CIS economies before 2003. However, the importance of the regional factor has increased in the second period and especially after the outbreak of the financial crisis.

Moreover, the results show that global real and finacial shocks have had a significantly different impact across the CIS countries. On the one hand, the financial shocks tend to gain importance. In fact, they are the major source of exchange rate variation in Russia, Kazakhstan and Kyrgyzstan. On the other hand, the relevance of global real shocks remained relatively low. A similar finding of increased regionalization has been reported by Fidrmuc and Fidrmuc (2003) after the Russian financial crisis.

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