Zagreb International Review of Economics & Business, Vol. 17, Special Conference Issue, pp. 31-48, 2014

ISSN 1331-5609; UDC: 33+65

Modelling Croatian Export Dynamics Using Global Macroeconometric Model

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Abstract: Five years following the occurrence of the global economic and financial crisis, Croatia is one of the few countries in the region whose export has still not recovered to the pre-crisis level. In order to properly account for international linkages and possible crisis spillover effects, a Global Vector AutoRegressive (GVAR) model is defined. The GVAR model is a consistent global macroeconometric model which enables modelling interactions between Croatia and a set of Central and Southeast European (CSEE) countries. The empirical analysis reveals that the domestic variables are the main factor explaining Croatian export dynamics in the short run. However, in the long run, the main determinants of Croatian export are the US and German real exchange rates. These findings provide evidence in favour of low competitiveness of Croatian export.

Keywords: Global VAR, GFEVD, international trade, export, Croatia

JEL Classification: F10, F17, C30

Introduction

One of the stylized facts of the recent global economic and financial crisis was the abrupt decline in the international trade after almost a decade of continous growth (Figure 1). However, the pattern that followed in the aftermath of the crisis, varied across countries. The decrease lasted aproximately one year when the trend shifted its direction from downward to upward. While the World and the US export are now 6% and 18 % higher compared to pre-crisis peak in 2008, respectively, the export of the European Union (EU-27) has not yet returned to the pre-crisis level. Analysed CSEE countries share the same trends as the EU-27 with the exception of three countries (Slovak Republic, Bulgaria, Romania) that have higher exports than before the

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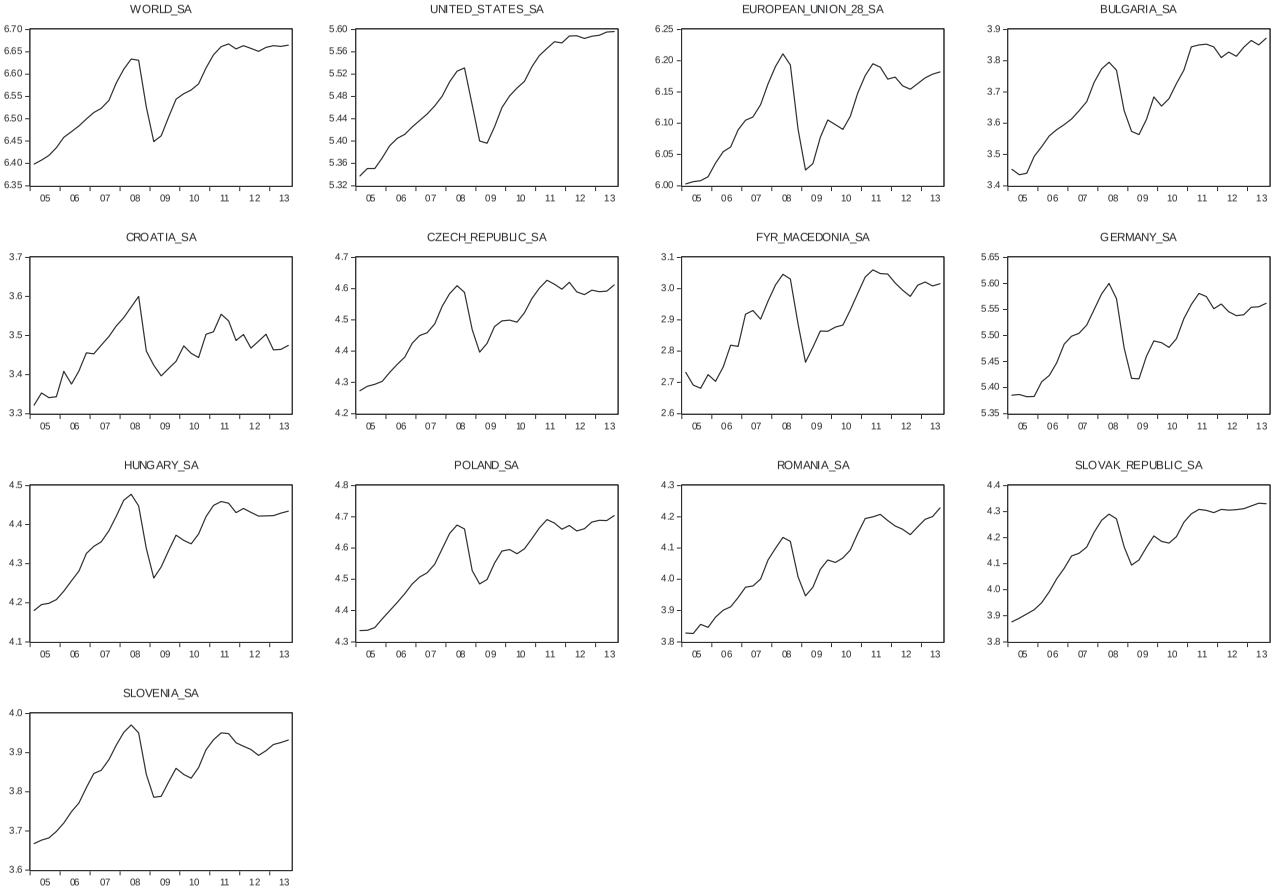
Figure 1: Log of exports, selected countries, observed period 2005Q1-2013Q3



Source: World Trade Organization, (2014)

crisis and Czech Republic and Poland that returned their exports to the pre-crisis level. The worst situation is in Croatia where recovery and return to the upward trend is still out of sight. The main question is: why some of the CSEE countries saw almost immediate recovery in the aftermath of the crisis while Croatia and other CSEE countries still haven't recovered their exports? This article tries to shed light on this issue and tries to address the key determinants that could explain the difference in the pattern of the response.

Literature Review

By now, apart from studies that analyse the relationship between the exchange rate and the trade balance (Stučka, 2003), the determinants of Croatian export dynamics have not been studied in more detail. Using the panel data approach for 21 Croatian manufacturing industry sectors Vukšić (2005) found that the foreign direct investments (FDI) have positive and significant impact on exports, but the extent of this impact is relatively low. Bilas (2007) analysed the Croatian exports to EU member states. The employed model confirmed that the population growth affects trade positively, while geographical distance affects trade negatively. Buturac and Gržinić (2009) explored competitiveness of the Croatian export to EU market and showed that Croatia has positive trade balance with EU at low value added products. In a more recent research, Ćudina *et al*. (2012) showed that the stagnation of Croatia's export is predominantly reflected by the lack of competitiveness.

As the literature on the determinants of Croatian export dynamics is scarce, the authors also focus on the articles that investigate the vulnerability of the Croatian economy to external shocks. Krznar and Kunovac (2010) analysed effects of the external shocks on inflation and GDP in Croatia using a structural vector-autoregressive (SVAR) model. The impulse response functions and variance decomposition of the VAR model showed that the external factors are the main determinant of the domestic inflation and economic activity. However, after accounting for spillovers and interactions Jakšić (2012) showed that the domestic variables are the key factor of the Croatian economic activity. Feldkircher (2013), Backe et al. (2013) and Sun et al. (2013) applied a GVAR model to study how real and financial shocks are transmitted across CSEE countries and proved the importance of modelling spillovers in a global framework.

Trade model used in this paper consists of eleven countries. Data availability played a crucial role in the country selection stage and restricted the analysis to nine CSEE countries: Czech Republic, Hungary, Poland, Slovak Republic, Slovenia, Bulgaria, Romania, Croatia, and Macedonia. Additionally, two advanced economies are included in the model: USA, to emphasise the context of the study (global eco-

nomic and financial crisis), and Germany, as the main trading partner in most of the analysed countries, and the country through which the crisis was transmitted to the CSEE countries. Considering the international linkages of the economies under study and increasing globalisation as well as economic and financial integration, it is obvious that spillovers have to be modelled. Allowing for spillovers and international linkages offers possible better insight in the key determinants of export dynamics and competitiveness. Therefore, as an appropriate modeling framework, a GVAR approach (Pesaran *et al*., 2004) was applied because it enables modelling of the international linkages unlike the usual unrestricted VAR models that model each economy separatly (thus neglecting possible interactions between economies) or panel models, where countries are often treated as independent units which could lead to neglectance of important spillovers among countries. Furthermore, the flexible framework of a GVAR model is more convenient as it enables modelling economies of different sizes and relative importance.

The empirical analysis reveals that in the short run the Croatian export dynamics are highly correlated with the domestic demand. This means that any decrease in the demand for exports should be compensated on the domestic market in order to maintain the production in the short run. Therefore, exports of countries with weaker domestic demand are less resilient to external shocks. In the recent global crisis some countries (for instance, Indonesia) compensated for the reduced demand for exports with the domestic demand (IMF, 2010). On the other hand, the pattern of Croatian exports suggests the insufficient capacity of the domestic demand and that the products intended for exports are not competitive on the domestic market. Hence, in the short run it is the domestic economy and its structural weaknesses rather then the external spillovers as the primary reason why the export level has still not recovered even five years following the global crisis outbreak. Furthermore, in addition to the importance of the domestic factors the results of the study point out the importance of trade diversification. Namely, among the key factors why Croatia did not manage to recover exports above the pre-crisis peak is its exposure to few countries (Germany and Slovenia) and the importance of German economy in driving the export dynamics.

In the long run the main factors of the Croatian export dynamics are the US and German real exchange rates. The empirical results reveal important spillovers from US economy that is not directly linked to Croatia, but is an important German trading partner which indicates the importance of analysis in the framework of a global model. Furthermore, the results of the study reveal that Croatia is the only CSEE economy where the real exchange rate is the key factor of export dynamics.

This article is the first attempt to modelling Croatian exports in a global macroeconometric framework. Although Feldkircher (2013), Backe *et al*. (2013) and Sun *et al*. (2013) included Croatia in their GVAR model, their model did not include exports. Furthermore, Sun et al. (2013) did not include real exchange rate which turned out to be a key factor driving the Croatian exports in the long run in this paper.

The rest of the paper is organized as follows: the GVAR methodology applied in this paper is briefly described in Section 3. Section 4 provides a short overview of the employed data set and lists the sources from which the data were obtained. The main empirical results are analysed in section 5 while section 6 concludes with a brief summary of the main results and suggestions for further steps in research.

GVAR Trade Model

The GVAR approach is apllied to assess the importance of various factors in explaining the dynamics of Croatian exports in a multi-cuntry setting. The approach can be summarized as a two step procedure. First, individual country models are estimated, each containing domestic variables and foreign-specific variables. Although estimated separately, individual country models are connected by entering foreign-specific variables. Foreign-specific variables ($\mathbf{x}^*_{it}$) defined as weighted averages of the corresponding domestic variables for the remaining countries, act as a proxy for common unobserved factors. Namely, $\mathbf{x}^*_{it}$ are defined as

$$\mathbf{x}^*_{it} = \sum_{j=0}^{N} w_{ij}\mathbf{x}_{jt}, \tag{1}$$

where $w_{ij} \geq 0$, $j = 0,1,2,...,N$ are weights such that: $\sum_{j=0}^{N} w_{ij} = 1$ and $w_{ii} = 0$ for every i. Weights w_{ij} reflect importance of country j for the economy of country i. In case of trade weights, w_{ij} is share of country j in the international trade of country i. Foreign-specific variables are modelled as weakly exogenous $I(1)$ variables which is a reasonable assumption considering that analysed CSEE countries are small open economies (SOE). Furthermore, the exogeneity assumption is a standard SOE literature assumption (Fleming (1962) and Mundell (1963)). In the second step, the estimated coefficients are stacked and solved in a global VAR model. The approach enables modelling interlinkages on various levels, both national and international and is based on a modified and generalised version of Johansen (1988, 1991, 1995) maximum likelihood approach. Under the weak exogeneity assumption, coefficients of the country specific models are estimated on the basis of reduced-rank approach developed by Johansen. Although Johansen's approach is based on the assumption that all variables are endogenous and $I(1)$, Harbo *et al.* (1998) and Pesaran *et al.* (2000) modified the methodology to allow for weakly exogenous $I(1)$ variables.

GVAR model applied in this paper analyses $N + 1$ economies, indexed by $i = 0,1,2,...,N$, where index 0 denotes the reference country. In this paper index 0 denotes USA, because of its dominant role in the world economy and as a country from which

the recent global crisis originated. Domestic macroeconomic variables are related to its lagged values, deterministic variables (trend), foreign-specific variables and global variables. For country i a VARX*(2,2) model that relates $k_i \times 1$ vector of domestic variables, $\mathbf{x}_{it}$, with $\mathbf{x}^*_{it}$, $k^*_i \times 1$ vector of foreign-specific variables is defined as:

$$\mathbf{x}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \mathbf{\Phi}_{i1}\mathbf{x}_{it-1} + \mathbf{\Phi}_{i2}\mathbf{x}_{it-2} + \mathbf{\Lambda}_{i0}\mathbf{x}^*_{it} + \mathbf{\Lambda}_{i1}\mathbf{x}^*_{it-1} + \mathbf{\Lambda}_{i2}\mathbf{x}^*_{it-2} + \mathbf{u}_{it} \tag{2}$$

for $t = 1,2,...,T$, $i = 0,1,2,...,N$, where $\mathbf{\Phi}_{i1}$ and $\mathbf{\Phi}_{i2}$ are $k_i \times k_i$ matrices of coefficients related to lagged domestic variables. $\mathbf{a}_{i0}$ and $\mathbf{a}_{i1}$ are $k_i \times 1$ vectors of coefficients related to deterministic variables (intercept and trend). $\mathbf{\Lambda}_{i0}$ and $\mathbf{\Lambda}_{i1}$ $k_i \times k^*_i$ matrices of fixed coefficients related to contemporaneous and lagged foreign-specific variables, and $\mathbf{u}_{it}$ (error terms for country specific models) is a $k_i \times 1$ vector of country specific shocks. The approach assumes that $\mathbf{u}_{it}$ is serially uncorrelated, with zero mean and non-singular covariance matrix, $\Sigma_{ii} = (\sigma_{ii,ls})$, where $\sigma_{ii,ls} = \text{cov}(u_{ilt}, u_{ist})$. Specifically

$$\mathbf{u}_{it} \sim i.i.d.(0,\Sigma_{ii}). \tag{3}$$

The approach allows for cross-country correlation among the idiosyncratic shocks. Namely,

$$\begin{aligned} E(\mathbf{u}_{it}\mathbf{u}'_{jt}) &= \Sigma_{ij} \text{ for } t = t' \\ &= 0 \text{ for } t \neq t' \end{aligned} \tag{4}$$

After estimating $N + 1$ VARX* individual country models (2), individual models are stacked together and the GVAR model is then solved for the world as a whole. Domestic and foreign specific variables are grouped as a $(k_i \times k^*_i) \times 1$ vector

$$\mathbf{z}_{it} = \begin{pmatrix} \mathbf{x}_{it} \\ \mathbf{x}^*_{it} \end{pmatrix}, \tag{5}$$

in order to write each VARX* model (2) as

$$\mathbf{A}_{i0}\mathbf{z}_{it} = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \mathbf{A}_{i1}\mathbf{z}_{it-1} + \mathbf{A}_{i2}\mathbf{z}_{it-2} + \mathbf{u}_{it} \tag{6}$$

where

$$\mathbf{A}_{i0} = (\mathbf{I}_{ki}, -\mathbf{\Lambda}_{i0}),\ \mathbf{A}_{i1} = (\mathbf{\Phi}_{i1}, \mathbf{\Lambda}_{i1}),\ \mathbf{A}_{i2} = (\mathbf{\Phi}_{i2}, \mathbf{\Lambda}_{i2})$$

are $k_i \times (k_i \times k_i^*)$ matrices and are of full rank. Namely, rank $(\mathbf{A}_{i0}) = k_i$. After that all domestic variables are collected to form a $k \times 1$ global vector,

$$\mathbf{x}_t = (\mathbf{x}_{0t}, \mathbf{x}_{1t},...,\mathbf{x}_{Nt})' \tag{7}$$

$k = \sum_{i=0}^{N} k_i$, containing all endogenous variables. Individual countries are connected to a global model through $(k_i \times k_i^*) \times K$ country-specific link matrix $\mathbf{W}_i$, defined by using trade weights w_{ij},

$$\mathbf{z}_{it} = \mathbf{W}_i \mathbf{x}_t,\ i = 0,1,2,...,\ N. \tag{8}$$

By substituting (8) into (6) follows

$$\mathbf{A}_{i0}\mathbf{W}_i\mathbf{x}_t = \mathbf{a}_{i0} + \mathbf{a}_{i1}t + \mathbf{A}_{i1}\mathbf{W}_i\mathbf{x}_{it-1} + \mathbf{A}_{i2}\mathbf{W}_i\mathbf{x}_{it-2} + \mathbf{u}_{it},\ \text{for } i = 0,1,2,...,\ N.$$

$N + 1$ individual country models are stacked into GVAR(2) model

$$\mathbf{G}_0\mathbf{x}_t = \mathbf{a}_0 + \mathbf{a}_1 t + \mathbf{G}_1\mathbf{x}_{t-1} + \mathbf{G}_2\mathbf{x}_{t-2} + \mathbf{u}_t, \tag{9}$$

where

$$\mathbf{G}_0 = \begin{pmatrix} \mathbf{A}_{00}\mathbf{W}_0 \\ \mathbf{A}_{10}\mathbf{W}_1 \\ \vdots \\ \mathbf{A}_{N0}\mathbf{W}_N \end{pmatrix},\ \mathbf{G}_1 = \begin{pmatrix} \mathbf{A}_{01}\mathbf{W}_0 \\ \mathbf{A}_{11}\mathbf{W}_1 \\ \vdots \\ \mathbf{A}_{N1}\mathbf{W}_N \end{pmatrix},\ \mathbf{G}_2 = \begin{pmatrix} \mathbf{A}_{02}\mathbf{W}_0 \\ \mathbf{A}_{12}\mathbf{W}_1 \\ \vdots \\ \mathbf{A}_{N2}\mathbf{W}_N \end{pmatrix}$$

$$\mathbf{a}_0 = \begin{pmatrix} \mathbf{a}_{00} \\ \mathbf{a}_{10} \\ \vdots \\ \mathbf{a}_{N0} \end{pmatrix},\ \mathbf{a}_1 = \begin{pmatrix} \mathbf{a}_{01} \\ \mathbf{a}_{11} \\ \vdots \\ \mathbf{a}_{N1} \end{pmatrix},\ \mathbf{u}_t = \begin{pmatrix} \mathbf{u}_{0t} \\ \mathbf{u}_{1t} \\ \vdots \\ \mathbf{u}_{Nt} \end{pmatrix}.$$

If matrix $\mathbf{G}_0$ is non-singular then (9) can be inverted to obtain reduced form GVAR(2) model

$$\mathbf{x}_t = \mathbf{b}_0 + \mathbf{b}_1\mathbf{t} + \mathbf{F}_1\mathbf{x}_{t-1} + \mathbf{F}_2\mathbf{x}_{t-2} + \boldsymbol{\varepsilon}_t, \tag{10}$$

where

$$\mathbf{F}_1 = \mathbf{G}_0^{-1}\mathbf{G}_1,\ \mathbf{F}_2 = \mathbf{G}_0^{-1}\mathbf{G}_2$$

$$\mathbf{b}_0 = \mathbf{G}_0^{-1}\mathbf{a}_0,\ \mathbf{b}_1 = \mathbf{G}_0^{-1}\mathbf{a}_1,\ \boldsymbol{\varepsilon}_t = \mathbf{G}_0^{-1}\mathbf{u}_t.$$

Data

Trade model used in the empirical analysis consists of eleven countries, including nine CSEE countries and two advanced economies. The central variables of the trade model are the real exports and imports. The real effective exchange rate and real output are added to proxy for relative prices and domestic demand. Additionally, oil prices and foreign specific variables are included in the model in order to capture possible unobserved common factors influencing the CSEE countries export dynamics. Although GDP is a common measure of output, it is available only on quarterly basis. So the industrial production index was used as a proxy for output because it is available on monthly basis and thus reacts earlier to external shocks. Monthly data for the period from January 1995 to December 2012 are employed in the study, which makes a total of 216 observations. Data on exports, imports, real effective exchange rates and industrial production indices are obtained from the IFS and OECD databases. Oil prices are obtained from the U.S. Department of Energy. All series are seasonally adjusted using the TRAMO/SEATS method within DEMETRA statistical program.

Vector of domestic variables ($\mathbf{x}_{it}$) contains real output (y_{it}), real effective exchange rate (e_{it}), export (ex_{it}) and import (im_{it}), for country $i = 1,2,...,10$ (all variables are in logs)

$$\mathbf{x}_{it} = (y_{it}, e_{it}, ex_{it}, im_{it})' \text{ for } i = 1,...,N,$$

As a reference country, US economy ($i = 0$) is modelled differently to account for its importance in the world economy. US model also includes the price of oil (p_t^0), as an additional endogenous variable.

$$\mathbf{x}_{0t} = (y_{0t}, e_{0t}, ex_{0t}, im_{0t}, p_t^0)'$$

Weights play an important role in a GVAR model as they are used in defining foreign-specific variables and in linking country-specific models. Similar to Pesaran *et al*. (2004), Dees and Saint-Guilhem (2009) and Dees *et al*. (2007), this paper employed fixed trade weights calculated as average trade flows for the period from 2008 to 2010 (Table 1). Although weights can also be time varying and they can be

defined on the basis of data other than international trade (capital flows), they should not introduce additional randomness in the analysis. In defining trade weights IMF Direction of Trade Statistics (DOTS) data on international trade were used. Weights add up to one by column, but not by row. Inconsistency is due to different ways the countries report their trade. For instance, in some countries certain costs and taxes are included in the trade value. That is why the exports from country *i* to country *j* are not always equal to imports from country *j* to country *i*.

Table 1. Trade weights

Country	bug	cze	hrv	hun	mac	ger	pol	rum	us	svk	svn
bug	0	0.0055	0.0161	0.0126	0.2137	0.0130	0.0066	0.0845	0.0040	0.0068	0.0153
cze	0.0588	0	0.0557	0.0808	0.0225	0.1908	0.1225	0.0578	0.0239	0.3100	0.0662
hrv	0.0140	0.0047	0	0.0201	0.0973	0.0109	0.0047	0.0054	0.0040	0.0050	0.1530
hun	0.0783	0.0500	0.0930	0	0.0473	0.1147	0.0567	0.1871	0.0260	0.1346	0.0964
mac	0.0526	0.0005	0.0301	0.0022	0	0.0031	0.0009	0.0042	0.0006	0.0010	0.0124
ger	0.3898	0.6052	0.4126	0.5457	0.3839	0	0.6782	0.4823	0.8779	0.3681	0.4614
pol	0.0689	0.1262	0.0547	0.0885	0.0424	0.2244	0	0.0842	0.0379	0.1173	0.0677
rum	0.2416	0.0166	0.0236	0.0857	0.0527	0.0458	0.0231	0	0.0119	0.0239	0.0387
us	0.0386	0.0284	0.0685	0.0420	0.0281	0.3130	0.0366	0.0382	0	0.0165	0.0362
svk	0.0308	0.1517	0.0327	0.0987	0.0251	0.0588	0.0594	0.0382	0.0090	0	0.0526
svn	0.0265	0.0112	0.2129	0.0237	0.0870	0.0255	0.0111	0.0181	0.0049	0.0167	0

Source: authors' calculation

For all of the CSEE countries, Germany is the most important trading partner, its share ranging from 36,8% in Slovak Republic to 67,8% in Poland. Table 1 shows the importance of the inclusion of US economy in the model. Although US trade share with CSEE countries is relatively small (ranging from 1,65% to 6,85%), it takes up 31,3% of trade with Germany. Therefore, a shock in the US economy will indirectly, through its impact on the German economy, influence the CSEE countries. Additionally, Table 1 illustrates the insufficient involment of the CSEE countries in the intra-regional trade flows, especially considering their geographical proximity. This indicates that the trade potential of the CSEE countries could be higher and expanding trade to regional markets, instead of relying solely on the large EU economies like Germany, could reduce the vulnerability of the CSEE economies to external shocks.

Using (4), $k_i^* \times 1$ vector of foreign-specific variables (all variables are in logs.) is

$$\mathbf{x}_{it}^* = \left(y_{it}^*, e_{it}^*, p_t^0\right)' \text{ for } i = 1,\ldots,N,$$

and for US economy,

$$\mathbf{x}_{0t}^* = \left(y_{0t}^*, e_{0t}^*\right)'.$$

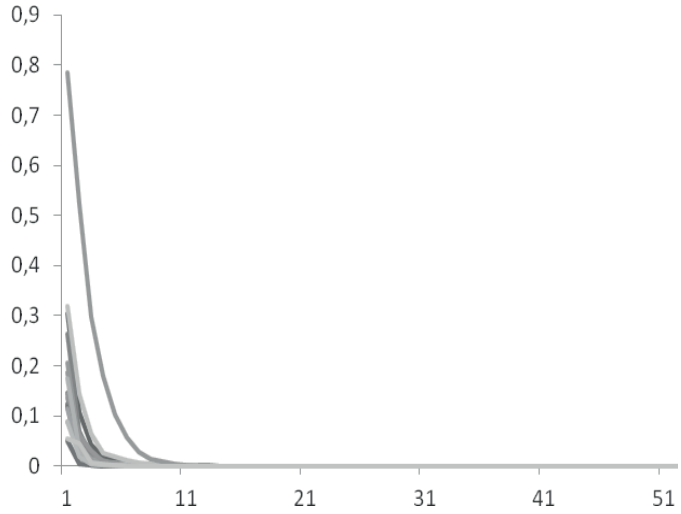
Foreign export and import are not included in the model. In addition to defining a more parsimonious model, the main reason for their omission is of theoretical nature. Namely, including imports and exports as domestic variables and then foreign imports and exports as foreign-specific variables would lead to theoretical inconsistentcy (Greenwood-Nimmo *et al.*, 2012).

Both unit root tests, ADF (Augmented Dickey Fuller) and WS (weighted symmetric), indicate that all variables (domestic, foreign-specific and global variable) are *I*(1). Out of 87 variables, the results are ambiguous for only one variable (Macedonia's output). Therefore, the empirical analysis is performed under the assumption that all of the variables are *I*(1). Furthermore, weak exogeneity tests indicate that all foreign specific variables are weakly exogenous. Results of the unit root and weak exogeneity tests as well as descriptive statistics for domestic, foreign-specific and global variable are available upon request.

Empirical Results

Empirical results are obtained using GVAR Toolbox 1.1 (Smith and Galesi, 2010). Pesaran and Shin (1998) recommend persistence profiles for investigating the speed at which long-run relations converge to their equilibrium values following the shock. The estimated persistence profiles (Figure 2) indicate that the model is well defined.

Figure 2. Persistence profiles of the effect of system wide shocks to the cointegrating relations



Source: authors' calculation

The assessment of the relative importance of various factors of export dynamics is carried through generalised forecast error variance decomposition (GFEVD)[1]. GFEVD estimates the proportion of the variance of the *h*-step ahead forecast errors of each variable that is explained by conditioning on contemporaneous and future values of the generalised shocks of the system. GFEVD is not sensitive to ordering of the variables in the country specific models which is very useful in the multi-country models like the one applied in this paper. Due to non-zero correlation between errors, the individual shock contributions to the GFEVD need not sum to unity. GFEVD results for Croatia's exports are shown in Table 2 in terms of the ten most important determinants at the five-year horizon (60 months) while GFEVD results for other CSEE countries are in the Appendix. The importance of the variables is ranked according to their contributions in explaining the forecast variance after two years following the shock. Tables also include the sum of the contributions of the ten most important determinants (row Sum 10) as well as the sum of all contributions (row Total).

Table 2. GFEVD of Croatian exports

	0	6	12	24	36	48	60
ger_ep	0.0149	0.1578	0.2144	0.2560	0.2734	0.2831	0.2893
us_ep	0.0070	0.0604	0.1413	0.2273	0.2652	0.2863	0.2997
hrv_ex	0.9057	0.4642	0.3149	0.1896	0.1357	0.1056	0.0865
ger_im	0.0517	0.0740	0.0877	0.0974	0.1013	0.1035	0.1049
hun_ep	0.0030	0.0290	0.0495	0.0693	0.0779	0.0828	0.0859
ger_ex	0.0299	0.0383	0.0477	0.0579	0.0625	0.0651	0.0668
pol_ep	0.0042	0.0274	0.0430	0.0575	0.0639	0.0675	0.0698
poil	0.0225	0.0834	0.0704	0.0460	0.0348	0.0286	0.0246
ger_y	0.0036	0.0231	0.0253	0.0258	0.0258	0.0259	0.0259
us_im	0.0158	0.0106	0.0142	0.0211	0.0246	0.0265	0.0277
Sum 10	1.06	0.97	1.01	1.05	1.07	1.08	1.08
Total	1.47	1.27	1.26	1.26	1.27	1.27	1.27

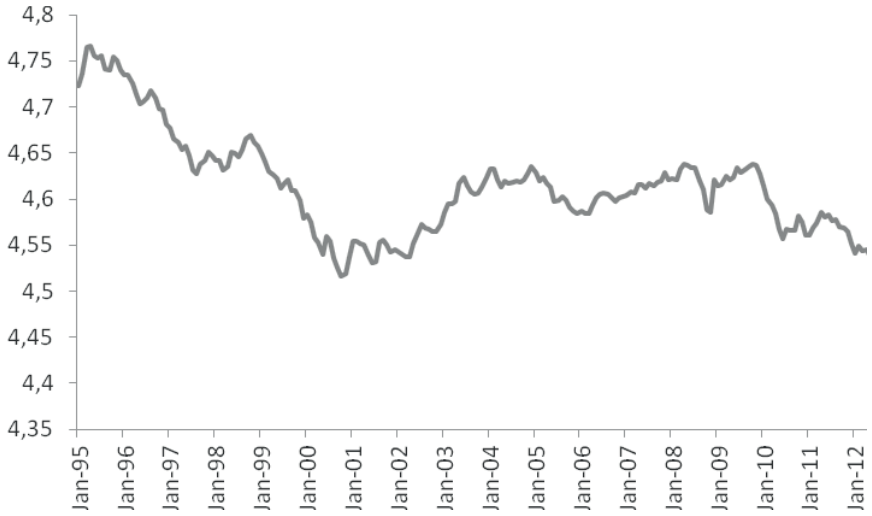
Source: authors' calculation

In Croatia and Czech Republic domestic variables explain the most of the forecast error variance, in the short but not in the long run. Croatia is the only CSEE country (besides Romania) with just one domestic variable in the top ten determinants. It turns out that countries in which domestic variables are the main determinant of export dynamics (both in the short and in the long run) and that are not highly exposed to only one or two countries, managed to increase their exports above the pre-crisis peak (Slovak Republic, Romania and Bulgaria). Countries in which German economy is one of the key factors of export dynamics did not manage to rise their exports above the pre-crisis value (Hungary, Czech Republic, Poland, Slovenia, Croatia).

In the long run, the main determinants of Croatian export are the US and German real exchange rates. Furthermore, the results of the study reveal that Croatia is the

only country where the real exchange rate is the key factor of export dynamics. Figures 3 and 4 illustrate the real effective exchange rate movements for Germany and USA (both series are in logs).

Figure 3. Real effective exchange rate (Germany)



Source: authors' calculation

Figure 4. Real effective exchange rate (USA)

Source: authors' calculation

Both USA and German real exchange rates depreciated in the last three years which corresponds to the period of the downward trend of the Croatian exports. The role of the German real exchange rate is not surprising as Germany is Croatia's main trading partner. However, the dominant role of USA real exchange rate is less clear considering the relatively low share of USA in the Croatian international trade (6%). The explanation could be that certain export contracts, for instance shipbuilding[2] and oil, are denominated in US$.

Another interesting finding is that oil prices are among the top ten determinants only in Croatia which suggests that Croatian exports are energy intensive. Other explanation could be that the rise in the oil prices influences Croatia's export through impact on its trade partners, especially through countries that are nett importers of oil.

Conclusion

Croatia is one of the CSEE countries with lower exports compared to the pre-crisis level. GVAR methodology employed in this paper tries to shed some light on the factors driving the dynamics of Croatian export that could provide explanation why its exports have not recovered to the pre-crisis level. The empirical analysis reveals that in the short run the Croatian export dynamics are highly correlated with the domestic demand. The pattern of Croatian exports suggests that insufficient capacity of the domestic demand and uncompetitiveness of the products intended for exports on the domestic market, rather than the external spillovers, are the primary reason why the export level has still not recovered even five years following the global crisis outbreak. Furthermore, in addition to the importance of the domestic factors, the results of the study point out the importance of trade diversification. Namely, among the key factors why Croatia did not manage to recover exports above the pre-crisis peak is its exposure to few countries (Germany and Slovenia) and the importance of German economy in driving the export dynamics. In the long run the main factors of the Croatian export dynamics are the US and German real exchange rates. The empirical results reveal important spillovers from US economy that is not directly linked to Croatia, but is an important German trading partner which indicates the importance of analysis in the framework of a global model. Furthermore, the results of the study reveal that Croatia is the only CSEE economy where the real exchange rate is the key factor of export dynamics. As a whole, the empirical analysis provides a lot of evidence of the low competitiveness of Croatian export. However, further research should include different industries to figure out if there is an industry or a product that could be competitive in the export markets.

Appendix

Table A1. GFEVD of Bulgarian exports

	0	6	12	24	36	48	60
bug_ex	0,9714	0,9351	0,9211	0,9119	0,9086	0,9070	0,9060
bug_im	0,4452	0,3578	0,3068	0,2760	0,2652	0,2597	0,2564
bug_y	0,0078	0,0478	0,0640	0,0740	0,0775	0,0793	0,0804
svn_ex	0,0462	0,0480	0,0478	0,0478	0,0478	0,0478	0,0478
hun_im	0,0313	0,0340	0,0343	0,0345	0,0347	0,0347	0,0347
hrv_y	0,0461	0,0385	0,0347	0,0324	0,0316	0,0312	0,0309
ger_ep	0,0242	0,0273	0,0280	0,0281	0,0282	0,0282	0,0282
ger_im	0,0155	0,0236	0,0262	0,0277	0,0282	0,0284	0,0286
rom_ep	0,0295	0,0264	0,0253	0,0246	0,0244	0,0242	0,0242
mac_im	0,0272	0,0253	0,0247	0,0244	0,0243	0,0243	0,0242
Sum 10	1,65	1,56	1,51	1,48	1,47	1,47	1,46
Total	1,92	1,84	1,79	1,76	1,75	1,75	1,74

Source: authors' calculation

Table A2. GFEVD of Czech Republic exports

	0	6	12	24	36	48	60
ger_ep	0,1087	0,2654	0,2967	0,3144	0,3209	0,3243	0,3264
ger_im	0,1243	0,1380	0,1403	0,1414	0,1418	0,1421	0,1422
cze_y	0,0452	0,0963	0,1065	0,1128	0,1152	0,1165	0,1173
cze_ex	0,7673	0,2749	0,1659	0,0975	0,0721	0,0588	0,0506
ger_ex	0,1970	0,1247	0,1034	0,0903	0,0854	0,0829	0,0814
pol_ep	0,0217	0,0675	0,0790	0,0869	0,0898	0,0914	0,0923
us_ep	0,0264	0,0376	0,0536	0,0657	0,0701	0,0724	0,0738
ger_y	0,0050	0,0356	0,0431	0,0477	0,0494	0,0503	0,0509
cze_im	0,3380	0,1124	0,0696	0,0432	0,0334	0,0283	0,0251
hun_ep	0,0020	0,0245	0,0336	0,0400	0,0425	0,0437	0,0445
Sum 10	1,64	1,18	1,09	1,04	1,02	1,01	1,00
Total	3,14	1,82	1,55	1,38	1,32	1,28	1,26

Source: authors' calculation

Table A3. GFEVD of Hungarian exports

	0	6	12	24	36	48	60
hun_y	0,0337	0,1745	0,2293	0,2702	0,2869	0,2959	0,3016
hun_ex	0,8546	0,4952	0,3436	0,2311	0,1852	0,1603	0,1447
hun_im	0,3551	0,2774	0,2230	0,1827	0,1663	0,1574	0,1518
ger_ep	0,0134	0,0923	0,1246	0,1478	0,1572	0,1623	0,1655
ger_im	0,0898	0,1333	0,1382	0,1414	0,1427	0,1434	0,1438
ger_ex	0,1030	0,0963	0,0841	0,0750	0,0713	0,0693	0,0681
ger_y	0,0123	0,0351	0,0442	0,0509	0,0536	0,0551	0,0560
cze_ex	0,1275	0,0840	0,0630	0,0476	0,0414	0,0380	0,0359
cze_im	0,1270	0,0819	0,0607	0,0452	0,0389	0,0355	0,0334
pol_ep	0,0138	0,0315	0,0380	0,0430	0,0451	0,0462	0,0469
Sum 10	1,73	1,50	1,35	1,24	1,19	1,16	1,15
Total	2,88	2,28	1,97	1,73	1,64	1,58	1,55

Source: authors' calculation

Table A4. GFEVD of Macedonian exports

	0	6	12	24	36	48	60
mac_ex	0,9369	0,9069	0,9013	0,8981	0,8970	0,8964	0,8961
mac_im	0,1294	0,2506	0,2631	0,2700	0,2725	0,2737	0,2745
mac_y	0,0688	0,0995	0,1023	0,1036	0,1041	0,1043	0,1044
hun_ex	0,0477	0,0674	0,0706	0,0727	0,0734	0,0738	0,0740
ger_im	0,0420	0,0625	0,0663	0,0683	0,0690	0,0694	0,0696
hun_im	0,0287	0,0469	0,0496	0,0513	0,0519	0,0522	0,0524
rom_ex	0,0408	0,0488	0,0495	0,0499	0,0501	0,0502	0,0502
svk_ex	0,0375	0,0457	0,0467	0,0473	0,0475	0,0476	0,0476
rom_im	0,0304	0,0390	0,0398	0,0402	0,0404	0,0404	0,0405
ger_ex	0,0241	0,0309	0,0317	0,0322	0,0324	0,0325	0,0325
Sum 10	1,39	1,60	1,62	1,63	1,64	1,64	1,64
Total	1,66	1,92	1,96	1,97	1,98	1,99	1,99

Source: authors' calculation

Table A5. GFEVD of Polish exports

	0	6	12	24	36	48	60
pol_ex	0,9358	0,4316	0,3259	0,2684	0,2492	0,2395	0,2336
pol_y	0,1368	0,1965	0,2047	0,2101	0,2121	0,2131	0,2138
ger_ep	0,0114	0,1602	0,1882	0,2007	0,2047	0,2067	0,2079
ger_im	0,0843	0,1093	0,1185	0,1232	0,1248	0,1256	0,1261
us_ep	0,0009	0,0317	0,0667	0,0925	0,1012	0,1056	0,1083
ger_ex	0,1358	0,0928	0,0826	0,0778	0,0762	0,0755	0,0750
cze_ex	0,1188	0,0486	0,0383	0,0342	0,0329	0,0322	0,0318
svk_ex	0,0691	0,0412	0,0358	0,0332	0,0323	0,0319	0,0316
rom_ex	0,1081	0,0482	0,0368	0,0311	0,0292	0,0283	0,0277
rom_im	0,0863	0,0440	0,0355	0,0310	0,0295	0,0287	0,0283
Sum 10	1,69	1,20	1,13	1,10	1,09	1,09	1,08
Total	2,66	1,67	1,50	1,42	1,39	1,38	1,37

Source: authors' calculation

Table A6. GFEVD of Romanian exports

	0	6	12	24	36	48	60
rom_ex	0,8240	0,6871	0,6486	0,6260	0,6187	0,6150	0,6128
us_ep	0,0179	0,0520	0,0709	0,0834	0,0875	0,0895	0,0907
hun_ex	0,0760	0,0713	0,0703	0,0703	0,0704	0,0704	0,0704
ger_im	0,0389	0,0596	0,0627	0,0641	0,0645	0,0647	0,0648
svk_ex	0,0841	0,0686	0,0646	0,0624	0,0617	0,0613	0,0611
svn_im	0,1029	0,0682	0,0598	0,0556	0,0543	0,0536	0,0532
ger_ex	0,0620	0,0589	0,0551	0,0531	0,0525	0,0521	0,0519
hun_ep	0,0152	0,0375	0,0459	0,0512	0,0530	0,0538	0,0544
hun_im	0,0663	0,0551	0,0516	0,0503	0,0499	0,0497	0,0496
ger_ep	0,0153	0,0416	0,0473	0,0496	0,0503	0,0507	0,0509
Sum 10	1,30	1,20	1,18	1,17	1,16	1,16	1,16
Total	2,29	1,89	1,77	1,72	1,70	1,69	1,69

Source: authors' calculation

Table A7. GFEVD of Slovak Republic exports

	0	6	12	24	36	48	60
svk_ex	0,7775	0,7600	0,7527	0,7483	0,7468	0,7460	0,7455
svk_im	0,1579	0,1567	0,1544	0,1529	0,1524	0,1521	0,1519
cze_ex	0,1118	0,1128	0,1152	0,1171	0,1178	0,1181	0,1184
hun_im	0,0830	0,0955	0,0981	0,1000	0,1006	0,1010	0,1012
hun_ex	0,0724	0,0859	0,0894	0,0916	0,0924	0,0928	0,0931
rom_ex	0,0893	0,0901	0,0901	0,0901	0,0902	0,0902	0,0902
ger_im	0,0427	0,0724	0,0781	0,0812	0,0822	0,0828	0,0831
cze_im	0,0969	0,0814	0,0807	0,0808	0,0809	0,0809	0,0810
svn_im	0,0788	0,0793	0,0800	0,0807	0,0810	0,0811	0,0812
ger_ex	0,0661	0,0711	0,0712	0,0714	0,0715	0,0716	0,0716
Sum 10	1,58	1,61	1,61	1,61	1,62	1,62	1,62
Total	2,32	2,35	2,36	2,37	2,37	2,37	2,37

Source: authors' calculation

Table A8. GFEVD of Slovenian exports

	0	6	12	24	36	48	60
svn_ex	0,7232	0,4932	0,4424	0,4115	0,4005	0,3948	0,3913
ger_im	0,0995	0,1848	0,2073	0,2207	0,2255	0,2280	0,2295
ger_ex	0,1902	0,1952	0,1921	0,1899	0,1891	0,1887	0,1885
ger_ep	0,0765	0,1315	0,1416	0,1466	0,1483	0,1492	0,1497
svn_im	0,1753	0,1393	0,1373	0,1368	0,1367	0,1367	0,1367
hun_im	0,1043	0,1174	0,1199	0,1215	0,1220	0,1223	0,1225
cze_ex	0,1349	0,1202	0,1196	0,1197	0,1198	0,1198	0,1199
hun_ex	0,0970	0,1099	0,1139	0,1164	0,1172	0,1177	0,1180
rom_im	0,1598	0,1263	0,1184	0,1132	0,1113	0,1103	0,1097
us_im	0,1097	0,1040	0,1025	0,1028	0,1029	0,1030	0,1031
Sum 10	1,87	1,72	1,70	1,68	1,67	1,67	1,67
Total	3,11	2,80	2,73	2,69	2,68	2,67	2,67

Source: authors' calculation

NOTES

[1] Estimated VARX* model, model diagnostics and other empirical results not reported in the paper are available upon request.

[2] Shipbuilding takes up 12% of Croatia's total export.

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