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NET EXPORTS OF THE EUROPEAN POST-TRANSITION COUNTRIES: THE DYNAMIC FACTOR APPROACH

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Abstract: *The paper brings the common and unobserved factor of net exports of the six European post-transition countries, namely Czech Republic, Slovakia, Slovenia, Hungary, Latvia and Romania. The data sample consists of the quarterly net exports time series for the period 1996q1 – 2017q2. The results out of the dynamic factor analysis (DFA) revealed that one hidden random walk explains 53.17% of temporal variation in net exports of the observed sample countries. The relationship between unobserved hidden factor and net exports of Czech Republic, Slovakia, Slovenia and Hungary is found to be positive while the Romanian net export was negatively affected. However, the unobserved factor identified in this paper cannot explain the net export in case of Latvia.*

INTRODUCTION

In the last two and half decades European post-transition countries have experienced trade and financial liberalization followed by the deficit in net exports. Eventually, most of the European post-transition countries joined the European Union (EU). Taking into account the similar history and common path regarding EU membership, the international trade of the European post-transition countries has been under the same external factors. The relaxing of capital constraints followed by inflow of foreign loans boosted the consumption. Consequently, the increase in consumption supported imports demand and current account deficit (Aristovnik 2008; Zakharova 2008; Bakker and Gulde 2010; Obadić et al., 2014). Haltmaier (2014) pointed out the sizable reduction in global external

imbalance followed by the financial crisis that stared in 2007. Consequently, it is reasonable to assume the similar dynamic in international trade of the European post-transition countries. The paper observes the net exports of the six European post-transition countries, namely Czech Republic, Slovakia, Slovenia, Hungary, Latvia and Romania and explains to what extent the net exports of the sample countries can be explained by common trends.

The remainder of this paper is organized as follows: Section 2 briefly summarizes existing literature related to the topic under consideration. Section 3 presents research data and methodology, while Section 4 empirical analysis. The final section provides an overview of the main findings of the research.

BRIEF LITERATURE OVERVIEW

Athukorala and Bandara (1989) pointed out that the usual practice of using gross export data to analyse export performance leads to misleading conclusions due to reducing importance of primary exports in the export structure and overall export growth. Yi (1993) Pointed out the role of U.S. government purchases in explaining recent U.S. net export behaviour. Raffo (2008) showed that trade fluctuations were driven by consumption smoothing while generating pro-cyclical net trade in goods. Tagkalakis (2015) examined the case of Greece in the post 2000 period and found that a cut back in government spending boosts exports through the labour cost competitiveness channel further improving net exports. Prilepskiy (2017) analysed the case of Russia and demonstrated that in the medium term, low quality of the institutional environment in Russia hinders maintaining momentum for exports and import substitution associated with the depreciation. Germany has been one of the major trade partners and Heinze (2018) found that Germany has benefited from growth dynamics of trading partners and high income elasticities of demand for German exports indicate strong non-price competitiveness. Furthermore, a significant impact of the real exchange rate on intra-EMU exports was not detected while a stable relationship between the real exchange rate and extra-EMU exports was revealed. Bilas et al. (2016) based on a data sample for the period from 1995 to 2014 for Croatia, Romania and Latvia found that merchandise exports diversification correlated with exports development. Bilas et al(2017) established the relationship between financial development and international trade for the Case of Croatia where the international merchandise trade flows with other EU member countries was found unsustainable (Bošnjak et al., 2018). Johnston and Regan (2016) found the unsustainable divergences in external balances within European Monetary

Union (EMU) and pointed out that external imbalances did not emerge prior to EMU due to the presence of different inflation adjustment mechanisms. Stockhammer (2015) pointed out that deregulation of international financial flows has allowed countries to run larger current account deficits and for longer time periods. Using a panel regression analysis, Johnston et al (2014) demonstrated that rising differentials between public and manufacturing sector wage significantly correlated with decline of export. Furthermore, weak-governance institutions were significantly associated with more prominent decline in exports inside as opposed to outside EMU. Smith (2001) pointed out the need for substantial long-term structural changes to the economic system. Hamm et al. (2012) employed cross-national panel regressions for a sample of 25 post-communist countries between 1990 and 2000 and found that mass privatization programs negatively affected economic growth, state capacity, and property rights protection.

The reviewed literature pointed out the diversity of net exports determinants and its dynamics. Consequently, this paper contributes to the existing literature by identifying the common factor of net export of the sample of European post-transition countries.

RESEARCH DATA AND METHODOLOGY

The paper examines the dynamics of net exports for the six European post-transition countries. The goal of the research is to identify the similarities in dynamics of net exports of the countries under consideration. The research hypothesis of this paper assumes the existence of common trend in net exports of the European post-transition countries. The sample countries to test the research hypothesis were selected based on data availability. The data sample in this paper consists of the quarterly time series of imports and exports of Czech Republic, Slovenia, Slovakia, Latvia and Romania for the period 1996q1 – 2017q2 retrieved from national bureaus of statistics. The observed variable for each country is net exports (NX) in (natural) log levels given in the equation (1):

$$NX_t = \log(EXP_t) - \log(IMP_t) \qquad (1)$$

The net export series from equation (1) are z-scored for each of the sample countries. Following Harvey (1989), this paper employs the dynamic factor analysis (DFA) to detect underlying trends among the set of net exports time series for the sample countries. Using DFA the paper explains temporal variation in a set of six observed net exports time series using linear combinations of a set of hid-

den random walks, where $m < 6$. The structure of the DFA model is given in the equation (2) and (3):

$$\boldsymbol{x_t = x_{t-1} + e1_t},\ \boldsymbol{e1_t} \sim MVN(0, \boldsymbol{Q}) \qquad (2)$$
$$\boldsymbol{y_t = Zx_{t-1} + a + e2_t}\ \boldsymbol{e2_t} \sim MVN(0, \boldsymbol{R}) \quad (3)$$

Where $\boldsymbol{y_t}$ in the equation (3) presents the vector of the observed series, $\boldsymbol{x_t}$ in the equation (2) vector of hidden trends, $\boldsymbol{Z}$ in the equation (3) factor loadings and $\boldsymbol{a}$ in the equation (3) presents the offsets. Therefore, the observations $\boldsymbol{y_t}$ are modelled as the linear combination of hidden trends and factor loadings. The expected value of the hidden trends $\boldsymbol{x_t}$ is obtained using Kalman filter (Kalman, 1960) and to determine the number of trends Ahn and Horenstein (2013) test is employed.

The **R** matrix in equation (3) is specified as same variances and no covariance (diagonal and equal), different variances and no covariance (diagonal and unequal), same variances and same covariance (equal var- cov) and different variances and covariances (unconstrained). To determine the proper specification, the small sample size corrected AIC (AICc) is used.

There are many different but equivalent solutions to the dynamic factor loadings and they can be related to each other by a rotation matrix **H.** The paper employs varimax rotation to determine the loadings and trends.

RESEARCH RESULTS AND DISCUSSIONS

Following Ahn and Horenstein (2013) test, the one factor was found and proportion of variation explained by the one principal components amounts 53.17%. Following methodology presented in the section Research data and methodology the different specification of **R** matrix in equation (3) are estimated and tested. The results are summarized in Table 1.

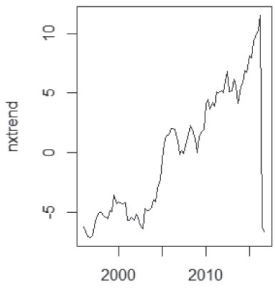
Table 1. Small sample size corrected AIC (AICc) for different specifications of **R** matrix

R	m	log likelihood	AICc
diagonal and equal	1	-535.3812	1084.9937
diagonal and unequal	1	-457.3267	939.3048
equal var- cov	1	-426.3826	869.0632
unconstrained	1	-359.8043	776.8672

Source: Authors

As suggested by the results in Table 1, the lowest value of small sample size corrected AIC (AICc) was found when **R** matrix in equation (3) was unconstrained and unobserved common trend after varimax rotation is illustrated in Figure 1.

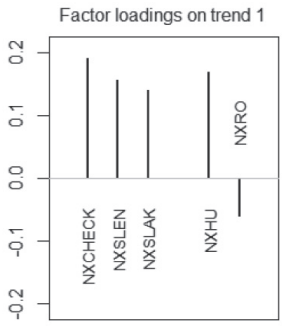
Figure 1. Unobserved trend (following varimax rotation) from the model fit to the net exports series of the sample countries



Source: Authors

As illustrated in Figure 1, common unobserved trend turned to be positive after the financial crisis that stared in 2007. Therefore, the net export of the sample countries generally turned to be positive after the crises. However, the detected unobserved trend does not explain the same portion of the each single sample country. Rotated factor loadings for the model are shown in Figure 2 and we chose to plot only those loadings that are greater than 0.05. All of the rotated factor loadings for the model are presented in Table 2 in the Appendix.

Figure 2. Factor loadings (following varimax rotation) from the model fit to the net exports series of the sample countries



Source: Authors

Following the factor loadings on trend in Figure 2, some of the net exports series had much better overall fits than others. The factor loadings for Latvia amounts

-0.0226 and therefore was not given in the Figure 2. The highest positive factor loading was found for the case of Czech Republic, Hungary, Slovenia and Slovakia while the factor loadings in case of Latvia and Romania was negative. Czech Republic, Hungary, Slovenia, Slovakia and Latvia joined the European Union in 2004. However, the case of Latvia differs in terms of net exports dynamics and dynamics of net exports in case of Latvia seems to be more similar to the dynamics of net exports in case of Romania. Even tough Romania joined the European Union three years later (in 2007). As introductory stated, after the financial crisis that stared in 2007 the reduction in external imbalance has stared (Haltmaier, 2014). Consistently, unobserved trend identified in this paper represents the dynamics of change for the countries under consideration. Furthermore, the deficit reduction is not prominent in case of Latvia and Romania. Consistently with the results from this paper, contemporary literature points out the existence of macroeconomic imbalance in Latvia and Romania. Awokuse (2007) examined the causal relationship between imports exports and economic growth for Bulgaria, Czech Republic, and Poland. The results for the Czech Republic revealed the effects from both exports and imports to economic growth pointing out not only the role of exports but imports as well. Sağlam and Egeli (2018) Employed dynamic panel data approach on the annual data for the period between 1990 and 2015 for 16 European transition countries to examine the role of exports and domestic demand for economic growth of the considered countries. The results for Poland and Czech Republic indicated the more prominent effects from domestic demand to economic growth comparing to effects from exports to economic growth.

On the sample of panel data for Romania, Bulgaria, Hungary, Czech Republic, Croatia and Poland, Motofei (2017) analysed the trends in GDP dynamics while focusing on recent periods. The results for Czech Republic showed the most convincing upward trends among considered countries while Hungary and Romania experienced sudden drops in the GDP level. GDP growth is under pressure of household's consumption for all of the sample countries. The contribution of external balance for GDP growth of Czech Republic ranges between 5.28 and 7.50%. The upward trend of contribution from external balance was reported for Hungary amounting about 10%, while for Romania the contribution of external balance to GDP growth was negative. Cetin and Ackrill (2018) pointed out that Slovakia's economy is one of the most open economies in the world and based on quarterly data from 1997Q1 to 2014Q4 supported the positive effects from exports as well as from imports on the economic growth in Slovakia. Pancenko and Ivanova (2016) pointed out that imports dominated over Latvia's international trade while after 2013 the deficit in international trade decreased gradu-

ally due to accelerated growth of exports. Franc and Peulić (2017) examined the trade flows of Slovenia based on the framework of its sustainability and reported importing to export as the trade pattern that dominates.

The unobserved common factor identified in this paper remains to be explained. However, funded on economic theory there might be some possible explanations. Theory of international economics suggests several approaches to explain current account dynamics and consequently the net exports. Followed by financial crises the sample countries has experienced the contraction of aggregate output. Therefore, the absorption approach (Harberger, 1950) that explains the change in current account by the changes in domestic demand and domestic output might be followed to explain unobserved trend detected in this paper. Another view of current account balance observe the imbalances between the demand for and supply of money stock as the one that explains current account balance (Polak, 1957). In the extensive literature overview Kauko (2014) found that banks borrow internationally and finance domestic lending while boosting the current account deficit and a real estate bubble. Therefore, excessive money supply followed by financial and trade liberalization in the sample countries according to monetary approach (Polak, 1957) needs to be taken into account to explain unobserved trend detected in this paper. Eventually, following Marshall (1923), Robinson (1937) and Lerner (1944) the elasticity of supply and demand for foreign exchange and foreign goods can be considered to explain detected unobserved trend. Furthermore, the research results points out the need for measures in Latvia and Romania to improve manufacturing conditions and support the tradable sector.

CONCLUDING REMARKS

There are several conclusions that can be drawn out of the research presented in this paper. Firstly, the dynamic factor analysis (DFA) revealed that one hidden random walk explains 53.17% of temporal variation in net exports of the observed sample countries. However, the relationship between unobserved hidden factor and net exports of Czech Republic, Slovakia, Slovenia and Hungary is found to be positive while the net export in case of Romania and Latvia was negatively affected. In line with previous findings, the research results indicate the existence of prominent macroeconomic imbalances in Latvia and Romania and point out the need for measures to improve manufacturing conditions and support the tradable sector. Secondly, the unobserved hidden trend detected in this paper turned to be positive after the 2007 that corresponds to the financial

crises. Therefore, impact of the global financial crisis varied across sample countries. While Czech Republic, Slovakia, Slovenia and Hungary experienced the reduction of its external imbalances the international trade deficit remained in Latvia and Romania Eventually, the theoretical explanations of the detected unobserved trend might be found following the monetary and absorption approach as well as following elasticity of supply and demand for foreign exchange and foreign goods. However, the empirical explanation of the unobserved hidden trend detected in this paper remains to be further examined.

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APPENDIX

Table 2. Rotated factor loadings for the model

	ML.Estimates	Std. Error	low.CI	up.CI
Z.11	0.1905	0.03067	0.13040	0.25063
Z.21	0.1565	0.02815	0.10129	0.21163
Z.31	0.1395	0.02706	0.08650	0.19256
Z.41	-0.0226	0.02206	-0.06578	0.02067
Z.51	0.1694	0.02928	0.11204	0.22681
Z.61	-0.0598	0.02295	-0.10480	-0.01483
R.(1,1)	0.0367	0.00968	0.01771	0.05566
R.(2,1)	-0.0520	0.01654	-0.08437	-0.01953
R.(3,1)	-0.0141	0.01878	-0.05093	0.02268
R.(4,1)	-0.0332	0.02588	-0.08394	0.01749
R.(5,1)	-0.0361	0.01423	-0.06403	-0.00824
R.(6,1)	-0.0251	0.02490	-0.07394	0.02366
R.(2,2)	0.3463	0.05625	0.23605	0.45655
R.(3,2)	0.1466	0.04959	0.04941	0.24381
R.(4,2)	0.4185	0.07988	0.26190	0.57502
R.(5,2)	0.1590	0.03853	0.08343	0.23448
R.(6,2)	0.4255	0.07798	0.27266	0.57836
R.(3,3)	0.4776	0.07636	0.32796	0.62730
R.(4,3)	0.1494	0.07785	-0.00323	0.30194
R.(5,3)	0.1358	0.04225	0.05302	0.21864
R.(6,3)	0.2682	0.07861	0.11415	0.42229
R.(4,4)	0.9745	0.15223	0.67611	1.27283
R.(5,4)	0.2524	0.06114	0.13253	0.37220
R.(6,4)	0.7431	0.13189	0.48459	1.00160
R.(5,5)	0.2356	0.03963	0.15794	0.31327
R.(6,5)	0.2660	0.05974	0.14887	0.38306
R.(6,6)	0.8940	0.13992	0.61982	1.16828

Source: Authors