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Dynamics between External Equilibrium and Investment Ratio. The Case of the Central and East European Countries, Members of the European Union

Summary

The balance of payments performance informs us about "savings transformation" occurring between a given economy and its economic partners (foreign environment). In the paper, we assessed the long-term relationships between the dynamics of the balance of payments components and investments outlays in the Central and East European countries, the members of the European Union in the years 1995-2017. It is important to know the strength of these associations as the changes of the investment policy can in certain situations worsen international financial stability. In order to research this issue we regressed investment and consumption of each country on its current and capital account (CCA) and net export (EX). We used two different OLS linear models and additionally examined the interaction between the chosen variables, treated as endogenous, using VAR models.

The independent variables, as expected, had a negative association with CCA and EX. For most countries, the negative coefficients of relationships between CCA, EX and investment were bigger than the coefficients for consumption. The increase of one percentage point of the ratio of investment share in GDP (*ceteris paribus*) caused the share of net export in GDP to fall more than proportionally, more than by one percentage point in six countries that is in Poland, the Czech Republic, Bulgaria, Latvia, Lithuania, and Slovakia. There was a similar connection between investments and external balance (CCA) in the Visegrad countries and in the Baltic States, except for Hungary, where these relationships were the weakest. Using the Autoregressive Distributed Lag (ARDL) approach we found the long- and short-term speed of adjustment. The error correction rate (CoinEq) indicated that the corrections of the departure from equilibrium between net exports and investments were very different between economies. In the majority of cases, the adjustment rate of about 100 percent took place. But while looking at the short-term relationship we see that an increase of the investments share in GDP by one percentage point caused net export to fall more than proportionally only in Bulgaria, the Czech Republic, Poland, Slovakia, and in Cyprus, where the change amounted to 0.98 percentage points.

Finally we used vector autoregressive models which describe the dynamic relationship of lagged values all treated as endogenous. We can see that in the short run the forecast error variance in net export was explained mainly by investments shocks (in over 50%) in Cyprus, Estonia, Lithuania, Poland, Slovenia, and Slovakia. It means that shock to investments outlays in these economies had a strong negative influence on net exports. In the long run, the influence of investment innovations on net exports was steady or dying away over the years. We found the weakest influence of investments outlays changes on net export position in the Czech Republic, Hungary, and Malta.

Key words: investment ratio, balance of payments, financial stability.

JEL codes: F32, F43

Introduction

This paper addresses the dynamics of relationships between the balance of payments and investments ratio in GDP in the Central and Eastern European countries - members of the European Union (EU13) – within the period 1995-2016. The world crisis in 2008 followed by the debt situation in the European Economic and Monetary Union increased governments concerns about foreign financial stability. From the past financial crisis we have learned that financial sustainability could be impaired when the country has an excessive level of foreign public debt, experiences private sector credit booms or/and sudden capital stops or flights. Particularly when economy is shaken by an external or internal shock, we could observe rising difficulties in servicing and/or refinancing foreign obligations at acceptable (past) costs. Foreign financial stability when impaired could exert negative impact on domestic investments and destabilizes growth. Therefore markets focus on flow of capital registered on the balance of payments since its trend informs about ”savings transformation” occurring between a given economy and its economic partners (foreign environment). This saving transformation affects country's investment ratio. As long as growth depends on the investments level it is important to assess what is the relationship between dynamics of the balance of payments and the investments outlays. In order to research this issue we regressed investment and consumption on the current and capital account and net export. We used two different OLS linear models and additionally examine the interaction between chosen variables, treated as endogenous, using vector autoregressive models (VAR).

Some remarks on the rationale behind the current account deficits

The financial globalization and high liquidity at the capital markets[1] foster an increase of capital flows between economies, including net inflow of capital from the developed economies to the emerging markets. On the one hand this net capital flows facilitate en economic growth of emerging markets but at the same time entails rapid increase in the foreign debt of the borrower countries and builds-up of their negative international investment position. That in turns could generate, within the debtor economies, serious problems in servicing foreign liabilities or/and debt repayments in case of a sudden rewind of the capital flows (e.g. the change of world's major central bank's policy stance) or of other types of "black swan" external shocks. When foreign markets assess country's foreign debt as excessive the government could be compel to reverse net capital flows and to decrease foreign net liabilities. The revised government's policy stance will influence the savings-investments interrelations and therefore GDP dynamics in the short as well as in the long run. A proper

[1] The accumulation of the foreign liabilities was aggravated also by an accommodating monetary policy of the main central banks – FED, ECB, Bank of England or Bank of Japan.

selection of the policy instruments requires an answer the following questions – why a country was running current account deficit accumulating substantial foreign debt and what kind of relationships between balance of payments, consumption and investments this capital inflow brought about.

The theory provides many explanations. One stylized simplification indicates that current external deficit arises while output is below its long-term (”permanent”) level and a country is in a catch-up phase of economic development or when investment exceeds its own long-term level. In this case, households need to draw on foreign capital markets to avoid falling short of their desired long-run consumption path. This rationale fits the situation of developing countries where a relatively smaller capital stock implies higher marginal product of the capital, which stipulates that incomes are expected to rise over time. In response, investors in the capital abounded countries look at poorer economies as profitable places in which to invest. This requires however that the economy is functioning in an environment which is in harmony with the standard economic theory based on factor endowments of stocks of labor, capital, and other resources and which operates in the regime of free capital movements. Feldstein and Horioka argued that if these assumptions are true and a perfect capital mobility prevails, we should observe low correlation between domestic investment and domestic savings (Feldstein, Horioka 1980; Lucas 1990; Gourinchas, Jeanne 2007; Alfaro, Kalemli-Ozcan, Volosovych 2005; Ahmed, Zlate 2013; Borio, Disyatat 2015; Ohta 2015). That of course should result in a balance of payments deficit as investments are financed by foreign savings. Reducing indebtedness subsequently causes either a decrease in investment or consumption. However, already in 1980, Feldstein and Horioka (Feldstein, Horioka 1980; Lucas 1990; Giannone, Lenza 2009) observed that in some countries, which attracted foreign capital, domestic savings and domestic investment were highly correlated. In this particular situation if investment rate grows the foreign debt could fall only if consumption rate drops.

We assume in the paper that in the capital poorer countries there are periods when conditions of the financial as well as goods market integration allow net capital inflow. This could lead to the situation which causes deterioration of the balance of payments: increases in investment and consumption accompanied by decrease in savings. Obviously, a final effect of the capital flows on investments ratio depends on the relative position of capital endowment and total factor productivity, which both could explain the differences across countries in income per capita. The level of financial integration, financial liberalization and the exchange rate regimes also play an important role. The deficit on the current account when caused mainly by the trade deficit (negative net export), accompanied by investments inflow (registered on the financial account), would /should be reversed in two cases. First, when the changes in borrowers fundamentals caused by net capital inflow transformed economy to be export oriented. Second, when the economy, due to the market situation, has to stop increasing its foreign indebtedness and should stabilize

its net international investment position. When en economy begins register growing net export surplus and reverse flow of capital flow then changes of investment and consumption ratios could be observed. If an economy attain trade surpluses and does not reduce investment ratio it indicates that the gross savings ratio increases and investments have become more dependent on countries own resources and less dependent on the external financial resources, as F-H hypothesis has predicted. If the opposite is truth and the current account surplus development is accompanied by falling investment ratio, it means that we observe process where domestic investments are crowded out by domestic consumption. This picture is even more distinct when we focus on the current account which contains in addition to the net export also net capital income and net capital transfers. First depends on the net international investment position, which in all EU13 countries is negative, as well as on the cost of capital. The latter is contingent on the unilateral capital subsidies (mainly from the EU). The negative correlation between net export and dynamics of investment if exists could create kind of a conflict if at the same time a country wishes to increase its investments outlays and better its foreign position. This could be especially visible when the capital costs (internationally) would rise and the external subsidies fall. In the paper we examine if this situation could be a case in the EU13 economies.

The savings gap in the EU13

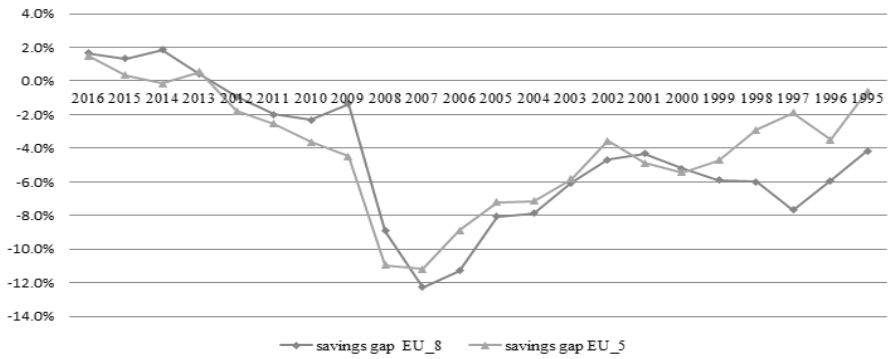
We analyzed relations between investments and savings in the EU13 economies. The dynamics of savings gap measured as a difference between share of savings and investment in GDP (*World Economic*… 2005) is presented in the figure 1. The figure 1 shows an average of nominal savings gaps in the EU13 measured as a difference between share of investments (gross capital formation at current prices: total economy (UITT[2])) and savings (gross national saving (USGN)) in GDP. Figure 1 presents dynamics of the changes for two groups of economies – members of the euro-zone (EU_8) and other countries (EU_5). The savings gap which was obviously financed by "import" of foreign savings indicates to what extend during the last 22 years the EU13 countries utilized capital mobility for their internal purposes.

Both paths presented at figure 1 have a similar profile although indicate different scale of the capital inflow during last 22 years. The only significant differences between both groups were observed before 2000 and in 2009. It's worth stressing that savings gaps in the EU13 begun rising even before these economies accessed the EU. From the beginning of the world crisis this trend reversed and savings gaps are falling.

[2] Codes according to AMECO

Figure 1

Average savings gap in the EU13



Source: Author's calculations, AMECO data.

The savings gap is of course related to the balance on current transactions with the rest of the world (National accounts) (UBCA) in the given period *t*[3]. In table 1 we present for the EU13 countries an average share of balance on current transactions with the rest of the world (National accounts) (UBCA) (which we further on denote as CA) and net capital transfers with the rest of the world (National accounts) (UBKA) (which were mostly results of the EU's net capital transfers to the new members).

In all EU13 countries the balance of current account was on average in deficit within last 22 years – the lowest deficit was noticed in Slovenia (-0.8) and the biggest in Cyprus (-7%). When we divide the whole 22 years into two periods i.e. before 2004 and after, in the period 2005-2016 we see falling deficit on the current account in all countries except for Bulgaria, Cyprus and Poland and a rising surpluses of the capital transfers in all the EU13 economies.

One of the reasons for the capital flows to certain economies, as we already indicated, is scarcity of capital. In the Figure 2 we present differences (capital gap) between the capital supply in the EU13 countries and e.g. in Germany and Italy, which we take as a proxy for the developed economies. We have chosen these two countries from among developed economies of the EU's as they could represent the North and the South of the developed EU (endowments of capital, in the selected EU countries was calculated using fixed assets (net) per capita).

[3] We did not use data from the balance of payments statistics (BMP6) in national currency, as they are for the EU13 countries available only from 2008.

Table 1

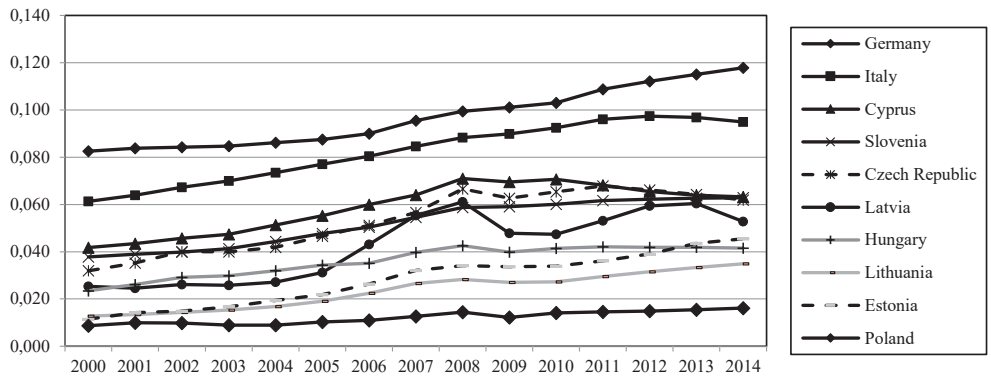
Share in GDP (%) of balance of current transactions and net capital transfers (average for the indicated period)

	BU	CZ	EE	CR	CY	LV	LT	HU	MT	PL	RO	SI	SK
1995-2016													
CA	-3.4%	-3.4%	-5.9%	-3.5%	-7.0%	-6.7%	-5.7%	-3.5%	-2.8%	-3.1%	-5.4%	-0.8%	-4.5%
capital net	0.7%	0.8%	1.4%	nd	0.3%	1.3%	1.4%	1.1%	1.2%	0.8%	0.7%	0.1%	0.4%
1995-2004													
CA	0.0%	-3.9%	-9.1%	-4.4%	-3.2%	-7.9%	-8.0%	-6.3%	-5.6%	-3.0%	-5.4%	-2.1%	-6.0%
capital net	0.0%	0.1%	0.5%	nd	0.2%	0.3%	0.1%	0.1%	0.6%	0.1%	0.4%	-0.1%	-0.4%
2005-2016													
CA	-6.2%	-3.0%	-3.3%	-2.8%	-10.1%	-5.7%	-3.8%	-1.1%	-0.4%	-3.1%	-5.3%	0.4%	-3.4%
capital net	1.3%	1.3%	2.2%	nd	0.4%	2.0%	2.6%	2.0%	1.6%	1.4%	1.0%	0.3%	0.9%

Source: Ameco, national currencies.

Figure 2

Total fixed assets (net) per capita (million euro)



Source: Author's calculations based on Ameco data - Balance sheets for non-financial assets [nama_10_nfa_bs] and Population change – Demographic balance and crude rates at national level [demo_gind].

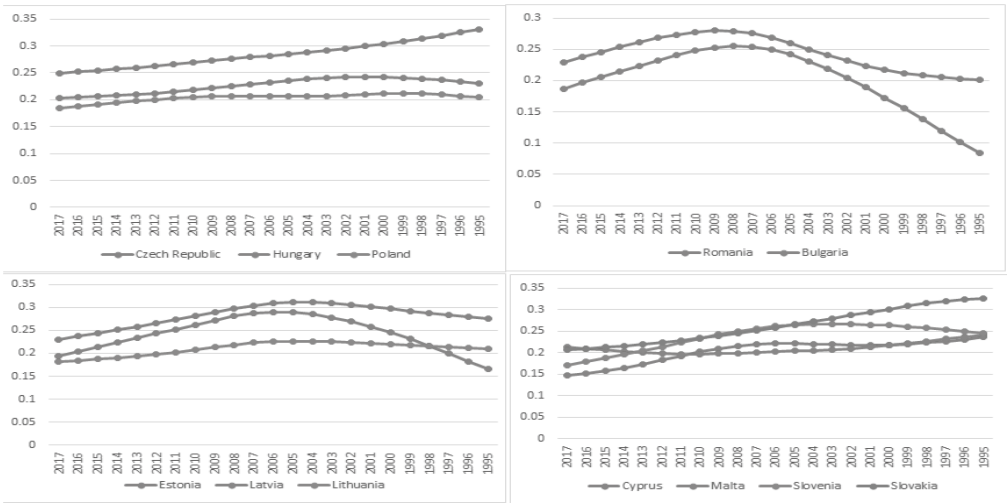
The difference of capital endowment (capital gap) between the EU13[4] countries and Germany and Italy is obvious. Systemic convergence (product, financial, market integration, etc.) after new countries accessed the EU resulted in capital flows to these economies. But the capital gap between old and new members of the EU stays almost as it was at the beginning of the century or even widen (as in case of Poland). It is visible that the process of the capital injection has a different dimension across the EU13 economies[5] but in some countries

[4] Eurostat presents data only for the economies listed in figure 1.
[5] An average standard deviation of financial gaps in the period 2003-2010 amounted to 4,7% and in the period 2011-2016 to 2,9%.

with the onset of the financial crisis this convergence apparently seems to slow down. At the same time current account balances begun to rise. In the last 8-10 years we observed across the EU13 countries improving current balance and falling investments ratio – see trends on Figure 3.

Figure 3

HP trends of the share of the investments outlays in GDP



Source: Author's calculations based on Ameco data (Gross fixed capital formation at current prices: total economy (UIGT), Gross domestic product at current prices (UVGD).

The dynamics of the investments rates could be result of the dynamics of export sectors caused by the foreign capital (FDI effect) inflow accompanied by kind of a crowding out effect – when consumption was "crowding out" investments. But the falling investment ratio "could also reflect lack of the profitable investment opportunities in emerging market economies vis-a-vis industrial countries" (*World Economic…* 2005). This situation could suggest rising conflict between export led policy (which could be a necessity e.g. because of high net capital income) and an pro-investment strategy essential for further GDP growth, in particular when savings rate does not rise and autonomous or public foreign capital inflows fall. If in the economy exists strong and negative relationships between exports net and investments outlays then the policy stance aimed at increasing investments outlays (as an economy's growth engine) could significantly worsen balance of trade. If that policy coincides with the capital cost upswing and a downfall of the external transfers then economy which is import sensitive could face difficulties supporting its external equilibrium position.

It is essential to identify how changes of the current account balances affect investments in the long and short run. In other words one should estimate what is the impact of the shock to investment outlays on the net export or seeing broadly on the current and capital account. These relationships could illustrate dependence of the domestic investments ratio on the level and dynamics of the foreign savings transfers. From a long run perspective it could inform about resilience of the foreign financial stability of an economy.

In the paper we evaluate the relationships between net export (EX) (and alternatively current and capital account (CCA)) and investments and consumption. We took for calculations ratios of these variables in GDP (measured in national currencies) in the period 1995-2017.

OLS regression

We assumed that the relationships between the share of current and capital account in GDP (CCA) and alternatively, the share of net export (EX) in GDP and the investment ratio (I) and consumption ratio (C) can be expressed by the following linear functions:

$$\Delta CCA^1_{jt} = \beta^1_{0j} + + \beta^1_{2jt} * \Delta C^1_{jt} + ... \beta^5_{2jt} * \Delta I^5_{jt} + \xi^1_{jt} \quad (1)$$

and

$$\Delta EX^1_{jt} = \beta^1_{0j} + + \beta^1_{2jt} * \Delta C^1_{jt} + ... \beta^5_{2jt} * \Delta I^5_{jt} + \xi^1_{jt} \quad (2)$$

where:

CAA – represents share of current and capital account ratio in GDP, EX – represents net export (balance between export of goods and services and imports of goods and services) ratio in GDP, I-means investment ration in GDP and C– means consumption ratio in GDP;
Δ – represents first difference of variables

j = 1, …13 – the 13EU countries

t = 1995, …, 2017

Solving these equations we use ordinary least squares method (OLS) and obtained results presented in Table 2.

The results presented in Table 2 indicate strength of the relationships between CCA/EX, investment and consumption in the EU13 economies. The shaded coefficients are statistically significant. The values of the coefficients of determination, but also of the adjusted coefficient of determination are high, especially for the net export regression models. Only in Hungry the variation of both CCA and EX were not statistically significantly explained by exogenous variables. At the same time, the statistics Durbin – Watson (DW), in all equations was above 2. Thus, we can assume that in all cases no autocorrelation of the random component is present. We divided country's data presented in Table 2 into groups depending on economies link with the euro-zone and their geographical location.

Table 2

Regression results

	Regression on the share of CCA in GDP							Regression on the share of EX in GDP					
	BU	CZ	HU	PL	RO	average		BU	CZ	HU	PL	RO	average
	coeff.	*coeff.*	*coeff.*	*coeff.*	*coeff.*			*coeff.*	*coeff.*	*coeff.*	*coeff.*	*coeff.*	
C	-1.19	-0.39	-0.28	-0.34	-0.73	*-0.58*	**C**	-0.78	-0.69	-0.44	-0.73	-0.62	*-0.65*
I	-0.96	-1.11	-0.21	-0.86	-0.53	*-0.73*	**I**	-1.33	-1.38	-0.71	-1.02	-0.50	*-0.99*
	EE	LV	LT					EE	LV	LT			
C	-0.09	-1.42	0.35			*-0.42*	**C**	-0.51	-0.87	-0.01			*-0.65*
I	-0.96	-1.52	-1.47			*-1.06*	**I**	-0.93	-1.05	-1.07			*-0.99*
	CY	MT						CY	MT				
C	0.88	-0.68				*0.10*	**C**	-1.48	0.63				*-0.43*
I	-1.10	-0.85				*-0.97*	**I**	-1.01	-0.71				*-0.86*
	SI	SK						SI	SK				
C	-0.26	-0.40				*-0.33*	**C**	-0.48	-0.72				*-0.60*
I	-0.83	-0.98				*-0.91*	**I**	-0.01	-1.09				*-0.55*

C share if consumption in GDP (NC)
I share of investment in GDP (NC)

Adjusted R-squared

	BU	CZ	HU	PL	RO	EE	LT	LV	CY	MT	SI	SK
CCA/GDP	*0.56*	*0.31*	*-0.06*	*0.30*	*0.53*	*0.48*	*0.71*	*0.60*	*0.15*	*0.30*	*0.34*	*0.66*
EX NET / GDP	*0.89*	*0.77*	*0.29*	*0.70*	*0.72*	*0.67*	*0.83*	*0.76*	*0.74*	*0.55*	*0.47*	*0.81*

Source: Author's calculations.

As all structural parameters are statistically relevant we can interpret their economic meaning. The independent variables, as expected, have a negative association with CCA and EX. For most of countries the negative coefficients of the relationships between dependent variables (CCA and EX) and investment are bigger than coefficient for consumption. In many cases coefficient of consumption is also statistically not significant. We can read from table 2 that an increase of one percentage point of the ratio of investment share in GDP (ceteris paribus) caused share of EX in GDP to fall more than proportionally – more than one percentage point – in six countries: it is in Poland, Czech republic, Bulgaria, Latvia, Lithuania, Slovakia. There is a similar relationship between investments and external balance in the Visegrad countries and the Baltics states except for Hungary where this link was the weakest. The low dependency between investments and external balances was registered in Romania, Slovenia, Malta and surprisingly, as we indicated in Hungary. At this stage the only explanation of the Hungarian case is that the equations (1) and (2) do not express correctly in this economy the relationships between dependent and explanatory variables, even though signs of the relevant coefficients are in line with expectations. In all cases the adjusted coefficient of determination was higher for the regression between investments, consumption and EX than with CCA. We observe also that in the Visegrad countries and in Bulgaria recorded relationships between CCA and investments were weaker than associations between EX and explanatory variables. These results could indicate a different importance for the analysed countries of the exogenous autonomous variables, which are parts

of CCA, i.e. the capital transfers and net foreign investments services. We could assume that in the Visegrad countries (and Bulgaria) balance of net foreign investment service and the capital transfers amortise to certain extend the impact of investment fluctuations on the countries' external equilibrium position. The opposite was observed in other cases.

We would like to stress that presented above rationale is based on study of the long term data. During last 22 years all analysed economies have experienced couple of external shocks – to name only the accession to the EU, the world economic crisis, the EMU debt situation. Therefore these results should be treated only as an indication of the problems that lie ahead, especially when in the past no deep structural changes in the analysed economies has occurred.

Autoregressive distributed-lag model (ARLD)

We complement the above presented results with the outcomes provided by autoregressive distributed-lag model (ARDL model) (EViews 10 2017, chapter 27; Pesaran, Shin 1997; Khan, Sajjid 2005) used to assess in a different way the relationship between net export (EX), investments and consumption's share in GDP. The ARDL model is a method of examining cointegrating relationships between chosen variables and short-term association between variables using standard least squares regressions. Autoregressive distributed-lag model specification contains combination of lagged values of the depended variable and current and lagged values of the explanatory variables (regressors) - both of I(0) and I(1).

The ARLD model we used is specified as follows:

$$Y_t = a_{0j} + \sum_{i=1}^{p} \beta j * Y_{t-i} + \sum_{i=1}^{q} \alpha j * X_{t-i} + \varepsilon_{it} \quad (3)$$

where:

Y – means EX ratio in GDP, X_j is vector of variables (in our cases investment and consumption ratio), j = 1,2 represents respectively consumption ratio in GDP and investment ratio in GDP; a – constant term; β, α, coefficients associated with a linear trend; p, q optimal lag orders: p – for the depended variables, q – for regressors; ε – vector of error terms, innovations.

We solved model using standard procedure. First we constructed unrestricted VAR (vector autoregressive models) using first differences of the variables: export share in GDP as dependent and as independent variables first differences of investments and consumption's share in GDP. Subsequently using VAR models we obtain by the Akaike Information Criterion appropriate lag structure. For the Baltic countries, Hungary, Czech Republic, Romania and Malta we got one lags for the dependent variable and the no lags for regressors. In the remaining cases one lag vas suggested for all variables. After we solved for intertemporal dynamics and deter-

mine that models are stable and that the errors of this model are serially independent we tested if the variables, some of which may be stationary while others not are cointegrated. We made a bound test for cointegration using ARLD model. After we found that cointegrations is possible we evaluated short run dynamics effect (intertemporal dynamics) and the long-run equilibrating relationship between the variables (represented by error correction term (*CoinEq*)). The latter indicates speed of adjustment, which specifies level of correction (in percentage points) of the departure from equilibrium between net exports, investments and consumption in every period (in our cases within one period - one year). In other words when the share of net exports in GDP deviates from long-run relationship with both the share in GDP of consumption and investment it adjusts downwards next year at a given rate (*CionEq*) (expressed in percentage points). As in all our cases variables were cointegrated, error correction term, as expected, was negative and highly significant (all models were stable). The statistics Durbin – Watson (DW), were in intervals dV < DW <4 - dV or a short distance from that range in seven cases. Thus, we can assume that when the autocorrelation of the random component is present, it is poor (shaded area). In remaining events the results are not statistically satisfactory – see Table 3.

Table 3

Short-run and cointegration results

EX NET AS DEPENDENT VARIABLE													
	BU	CR	CY	CZ	EE	HU	LT	LV	MT	PL	RO	SI	SK
CointEq(-1)	-0.4	-1.1	-1.3	-1.0	-1.1	-0.7	-0.7	-1.0	-0.8	-1.1	-0.9	-1.2	-0.9
D(C)	-0.92												
D(C (-1))	0.14												
D(I)	-1.19	-1.86	-0.98							-1.32			-1.11
R2	0.95	0.91	0.92	0.87	0.78	0.48	0.72	0.82	-0.85	0.87	0.78	0.77	0.92
DW	1.81	1.93	2.08	1.46	1.72	1.91	1.46	1.29	1.75	1.81	1.48	1.87	1.50

Source: as in Table 2.

The empirical results reveal that there is a stationary long run relationship between variables in all analysed countries. An error correction terms (*CoinEq*) indicates that the corrections of the departure of equilibrium between net exports and investments and consumptions share on GDP are very different between economies. The results indicate that when net export exceed its long-run relationship with investments and consumption ratio, it adjust downwards at a rate of about 100 percent in majority of cases. Only in Bulgaria, Hungary, Latvia the error correction term was substantially below one. We see also from table 3 that only in Bulgaria, Poland, Slovakia, Cyprus and Croatia statistically significant coefficients of short term relationships were noticed. An increase of investments share in GDP by one percentage point caused net export to fall more than proportionally in

Bulgaria, the Czech Republic, Poland, Slovakia and in Cyprus where a change amounted 0,98 percentage points.

From this empirical analysis we can deduct couple points worth mentioning. First, there is cointegration between analysed variables and because investments contain a import component, hence the speed of adjustment could be high. We can also assume that high speed of adjustment is based on the resident's precautionary motive influenced by the long-run considerations of the future rate of exchange and resulted price changes. Second, we observed short run relationships between net export and investments only in five economies Bulgaria, Cyprus, Croatia, Poland and the Slovak Republic. In the remaining cases no short run relationships between net export and investments were discovered. Finally, the response of net export to the consumption shock was statistically not significant.

We exercised also ARLD model with two lags for each of variables. In the case of Poland ARLD model with two lags shows, when using the LM test, a positive autocorrelation in errors. In all other cases outcomes were not far distant from the results presented in Table 3.

VAR model

Finally we analysed the relationships between variables all being considered as endogenous. To detect dynamic characteristics of the relationships between analysed ratios we use a reduced form of vector autoregressive models (VAR).

Our reduced form of the VAR model in the matrix notation looks as follows:

$$\mathbf{y}_t = \mathbf{G}_1 \mathbf{y}_{t-1} + \mathrm{e}_t \tag{4}$$

For our analyse we write:

$$\mathbf{y_t} = \begin{bmatrix} I \\ C \\ EX \end{bmatrix} \quad \mathbf{y^*_t} = \begin{bmatrix} I \\ C \\ CCA \end{bmatrix} \tag{5}$$

were CCA – is CCA rate in GDP, EX is export net rate in GDP, C – consumption rate in GDP, I – investment rate in GDP.

The VAR models were constructed for each of the EU13 economies. We study relationship between investments, consumption and net export (EX) then separately relationship of these ratios with current and capital account (CCA).

VAR(p) models describes the relationship of all lagged values found as significant for the analysed topic and treated as endogenous. Having specified the model which encompasses chosen variables we decided about ordering, which means placing the variables (all) in the

decreasing order of exogeneity, hence called as the Choleski decomposition. In our model we assume that shocks to the investments outlays affects first consumption and next net export. So, the ordering we selected is equivalent to assuming that shocks to investments affects all other variables (consumption, export next) contemporaneously. The ordering is such that the first variable is the only one with a potential immediate impact on all other variables. Next we positioned in a sequence consumption and net export. The variable that is affected by all the others, within the period, is ordered last (in our case it is net export). One problem with this type of analysis is that the ordering of the variables cannot be determined with statistical methods is result of the adopted assumption.

All series in our VAR model are in first difference and are stationary. In order to solve the VAR model we established the lag number and we choose two lags. The VAR models after appropriate testing proved to be stationary, stable and with no serial correlations (according to LM test).

In order to determine how important the exogenous shocks were in explaining the dependent variables we calculated fractions of the forecast error variance of variables attributable to the respective shocks. Solving VAR model we decompose the prediction error of each variables ***n*** periods forward and determine how much of the forecast error variance of each of the variables can be explained by exogenous shocks to other variables. Therefore variance decomposition assists in the interpretation of the VAR model results. It allows to determine the proportion of variations of the dependent variable explained by each of the independent variables. In addition, VAR solution shows which of the independent variables is "stronger" in explaining the variability in the dependent variables over time. In other words the Forecast Error Variance Decomposition (FEVD) shows how much of the future uncertainty of one time series is due to future shocks into the other time series in the system, within a given horizon. Thus, the forecast error decomposition could be compared to partial R2 for the forecast error, by forecast horizon (Stock, Watson 2001). The shock to the exports net results evolves over time, so they may be observed over the chosen period. In this paper we found the proportion of the changes in net export attributable to shocks in investments variable over 10 years.

In table 4 we present the variance decomposition of exports net variable and show the proportion of the movements in net export due to shocks of investment variable. Each response includes the effect of a specific shock to investments in time ***t***, then on ***t+1***, up to the 10^{th} period. This enables to analyse variance decomposition in the short as well as in a long run.

We can see that in the short run forecast error variance in net export is explained mainly by the investments (in over 50%) in Cyprus, Estonia, Lithuania, Poland, Slovenia and Slovakia. In the long run influence is steady or is dying away over the years. The weakest influence of investments shocks on the net export we found in the Czech Republic, Hungary and Malta.

Table 4

Dynamic response of exports net to investment shock

	BU	CR	CY	CZ	EE	HU	LT	LV	MT	PL	RO	SI	SK
1	30.9	49.8	59.1	28.5	65.7	23.7	80.5	65.0	28.3	58.0	36.7	62.9	54.7
2	17.3	34.4	44.4	26.5	70.2	22.6	64.3	59.6	32.7	50.0	31.7	58.7	53.8
3	15.0	33.0	42.9	24.5	70.1	21.1	62.5	57.1	32.7	41.9	34.9	52.3	57.3
4	14.8	30.4	42.7	23.6	66.2	20.5	59.4	56.5	34.4	42.6	34.8	53.0	55.5
5	14.9	30.1	44.5	23.5	65.8	20.6	59.9	56.4	34.1	41.4	35.1	53.4	55.8
6	15.0	29.8	45.1	23.7	64.9	20.4	59.8	56.6	34.4	41.4	35.0	54.4	55.8
7	14.9	29.2	45.3	23.6	65.0	20.4	59.9	56.6	34.4	41.0	34.8	54.7	56.2
8	14.9	29.0	45.4	23.6	64.7	20.4	59.8	56.5	34.4	41.1	34.9	54.8	56.2
9	14.9	28.9	45.3	23.6	64.6	20.4	59.9	56.5	34.5	40.8	34.9	54.7	56.1
10	14.9	28.7	45.3	23.6	64.6	20.4	59.8	56.5	34.4	40.7	34.9	54.7	56.1

Source: as in Table 2.

The responses of current and capital account to investment shock shown in the form of a Forecast Error Variance Decomposition are presented in table 5.

Table 5

Dynamic response of current and capital account to investment shock

t	BU	CR	CY	CZ	EE	HU	LT	LV	MT	PL	RO	SI	SK
1	41.6	64.3	15.7	8.7	48.0	0.4	62.5	51.7	14.1	33.19	30.87	54.2	34.32
2	64.6	55.0	13.5	14.5	54.0	30.1	43.2	63.9	20.1	28.01	32.06	53.7	32.80
3	64.8	50.4	13.2	37.2	59.2	29.8	45.1	57.2	24.2	28.65	25.58	52.3	23.98
4	62.4	49.2	13.4	36.6	60.2	30.1	39.9	59.4	29.5	29.52	28.09	51.3	23.81
5	61.2	47.6	13.4	38.0	58.6	30.1	39.9	58.0	29.5	28.64	27.41	51.4	23.10
6	61.1	48.4	13.7	38.0	59.4	30.2	39.4	57.3	30.3	28.64	28.03	50.0	23.10
7	61.1	47.7	13.7	39.0	58.9	30.2	39.4	57.1	30.5	28.70	28.01	50.0	23.05
8	61.1	48.2	13.7	38.9	58.8	30.2	39.5	57.1	30.4	28.65	28.09	49.7	23.05
9	61.1	47.6	13.7	39.0	58.8	30.2	39.5	57.0	30.4	28.66	28.10	49.6	23.05
10	61.1	47.9	13.7	39.0	58.7	30.2	39.5	57.0	30.4	28.66	28.09	49.6	23.05

Source: as in Table 2.

The response of the current and capital account to the investment shocks measured by the forecast error decomposition is almost in all cases weaker than response of the net export to the investment fluctuations presented in Table 4. There is also another profile of variable changes in the Czech Republic, Hungary, Estonia, Lithuania and Malta where responses are weakest in the short run (in the first year) and changes are increasing in the following years. We can try to find rationale behind these results in the structure of the current and capital account. One can assume that balance of foreign capital investments income and net foreign capital inflow could in these economies cushion the immediate impact of the fluctuations in investment outlays on the CCA.

In table 6 we compare results of the VAR for investments, consumption and current and capital account (after $\boldsymbol{y^*}$ solved is solved) with the variance decomposition of net export (after $\boldsymbol{y}$ is solved).

Table 6

Difference between variance decompositions of net export and CCA

t	BU	CR	CY	CZ	EE	HU	LT	LV	MT	PL	RO	SI	SK
1	-10.7	-14.5	43.4	19.8	17.8	23.3	17.9	13.4	14.2	24.8	5.8	8.6	20.4
2	-29.6	-11.5	38.3	11.0	16.0	8.6	12.2	14.1	9.6	21.5	4.4	3.7	19.0
3	-28.3	-11.7	29.1	3.3	12.3	9.6	13.6	17.0	10.0	15.3	3.9	3.4	18.3
4	-26.0	-8.3	27.8	2.2	12.3	9.5	13.9	16.2	6.5	14.5	3.7	3.2	18.2
5	-25.4	-7.6	27.1	3.0	12.8	9.5	14.1	17.5	6.6	13.7	3.4	3.2	17.1
6	-25.4	-7.5	26.9	3.1	12.2	9.6	14.4	17.7	6.6	13.7	3.0	3.4	16.9
7	-25.3	-6.4	27.0	2.3	12.4	9.6	14.5	17.9	6.4	13.7	3.0	3.1	16.4
8	-25.4	-7.0	27.0	2.2	12.4	9.6	14.4	17.9	6.6	13.6	3.0	3.4	16.4
9	-25.4	-6.1	27.0	2.1	12.3	9.6	14.3	17.9	6.6	13.3	3.0	3.4	16.3
10	-25.4	-6.6	27.0	2.1	12.4	9.6	14.3	17.9	6.6	13.3	3.0	3.5	16.3

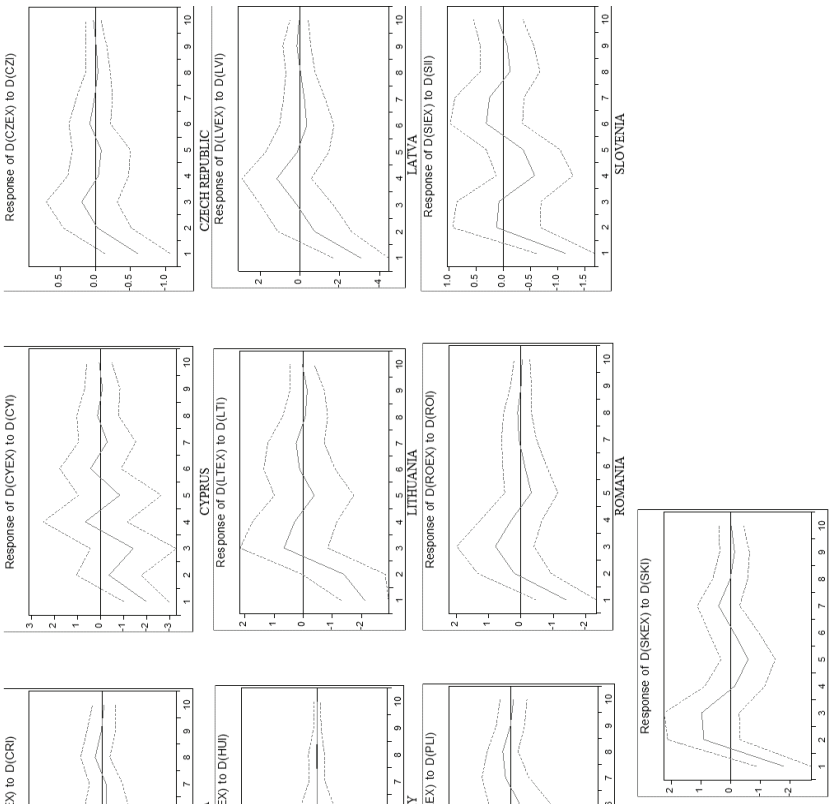
Source: as in Table 2.

From Table 6 we can perceive that in all but two cases (Bulgaria and Croatia) shock to investments influenced more net export than current and capital account, as the difference between variance decomposition of net export and current and capital account are positive. This difference could indicate the importance of the balance between net capital investments income and net capital transfers (mainly from EU) for the country's external equilibrium. The higher the specified difference the more important role of capital costs, which influence level of net foreign debt service and amount of foreign transfers as it could absorb the impact of the investment shock on the trade deficit. The most sensitive in this respect are Cyprus, Poland, Slovakia, Baltic countries.

The response of variable ***i*** to shock (forecast error) in variable ***j*** is sometimes depicted graphically to get a visual impression of the dynamic interrelationships within the system. We present in the graphic form (graph 1) the response in net export to Cholesky one standard deviation innovations (+- 2 S.E.) of investments. Impulse-responses trace the effects of structural shocks on the endogenous variables. We have to stress that the choice of the ordering we already made has an influence on the impulse responses and is therefore important for the interpretation of the system.

Graph 1 presents impulse response of the net export to the investment shocks in all EU13 countries. The common feature of the variables behaviour is a drop in the first year of the net export to the innovation caused to investments outlays. Therefore in all analysed cases the investments shocks (increase) contribute to the deepening of net export deficit. The dynamics is different within the EU13 countries. In almost all countries investments chock causes exports net to fluctuate. The trade balance after rise in the second or third year fall again, but this time less than initially. The smallest response of the net export to the investment fluctuations were detected in Hungary, Czech Republic, Bulgaria. The sinusoidal type reaction was observed in Slovenia, Slovakia. In Poland and Cyprus an impulse response took similar pattern and suggests the longest negative impact of the investment shocks on the net export position.

Graph 1
Impulse response to Cholesky one s.d. (d.f. adjusted) innovations ± 2 s.



Source: Author's calculations.

Conclusions

In all examined countries we found in the period 1995-2017 an intensive absorption of foreign savings registered as deficit on the current account. Subsequently since the world economic crisis we noticed rising foreign trade surpluses which were accompanied by falling investments ratios.

Analysing the relationships between investments, consumption and net exports and current and capital accounts, using different methods, does not give the same results. Using OLS regression between net export and investment and consumption we found in some countries statistical significant relationships between net export and investments outlays. It means that an increase of one percentage point of the ratio of investment share in GDP (ceteris paribus) caused share of net export in GDP to fall more than proportionally – more than one percentage point. These relationships were observed in six countries, in Poland, the Czech Republic, Bulgaria, Latvia, Lithuania, the Slovak Republic. The similar association between investments and external balance was noticed in the Visegrad countries states (except for Hungary) and in the Baltic's economies, where these relationships were the weakest. These results could suggest an possible conflict between export led policy (which could be a necessity because of e.g. high net capital income service) and the level of investment outlays (important for further GDP growth). That policy situation may limit growth when a savings rate do not rise (consumption rate growth continue to increase) and foreign capital flows (autonomous or public) decline.

An Autoregressive Distributed Lag (ARDL) approach reveals that there is a stationary long-run relationship between variables in all analysed countries. We observed that in the short run an increase of investments share in GDP by one percentage point caused net export to fall more than proportionally in Bulgaria, the Czech Republic, Poland, Slovakia and in Cyprus – that change amounted to 0,98 percentage points. The results indicate also that in the long run when net export exceed its long-run relationship with investments and consumption ratio, it adjust, in majority of cases, at the rate of about 100 percent. Only in Bulgaria, Hungary, Latvia the error correction term was substantially below one.

Finally we examined VAR models which described the dynamic relationship of all lagged values all treated as endogenous. We focused on Forecast Error Variance Decomposition of net export due to future shocks into investment outlays within 10 years. We can see that in the short run forecast error variance in net export is explained mainly by investments (in over 50%) in Cyprus, Estonia, Lithuania, Poland, Slovenia and Slovakia. It means that shock to investments outlays in these economies has strong negative influence on exports net changes. In the long run influence of investments innovations is steady or is dying away over the years. The weakest influence of investments outlays changes on net export position we found in the Czech Republic, Hungary and Malta.

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Dynamika między równowagą zewnętrzną a wskaźnikiem inwestycji. Przypadek krajów Europy Środkowej i Wschodniej, członków Unii Europejskiej

Streszczenie

Wyniki bilansu płatniczego informują nas o „transformacji oszczędności" występującej między daną gospodarką a jej partnerami ekonomicznymi (środowiskiem zagranicznym). W artykule oceniono długookresowe relacje między dynamiką komponentami bilansu płatniczego a nakładami inwestycyjnymi w krajach Europy Środkowej i Wschodniej, państwach członkowskich Unii Europejskiej w latach 1995-2017. Rzeczą ważną jest poznanie siły tych związków, jako że zmiany polityki in-

westycyjnej mogą w pewnych sytuacjach pogarszać międzynarodową stabilność finansową. W celu zbadania tej kwestii dokonano regresji inwestycji i konsumpcji w każdym kraju na jego rachunku bieżącym i kapitałowym oraz eksportu netto. Użyto dwóch różnych modeli liniowych zwykłych najmniejszych kwadratów (OLS) i dodatkowo zbadano interakcję między wybranymi zmiennymi, traktowanymi jako zmienne endogeniczne, z zastosowaniem modeli wektorowej autoregresji.

Zmienne niezależne, jak się spodziewano, miały ujemną korelację z rachunkiem bieżącym i kapitałowym oraz z eksportem netto. Dla większości krajów ujemne współczynniki korelacji między rachunkiem bieżącym i kapitałowym i eksportem netto a inwestycjami były większe niż współczynniki dla konsumpcji. Wzrost o jeden punkt procentowy wskaźnika udziału inwestycji w PKB (przy pozostałych warunkach równych, *ceteris paribus*) spowodował, że udział eksportu netto w PKB obniżył się bardziej niż proporcjonalnie, o więcej niż jeden punkt procentowy w sześciu krajach, tzn. w Polsce, Czechach, Bułgarii, na Łotwie, Litwie i Słowacji. Wystąpił podobny związek między inwestycjami a bilansem zewnętrznym (rachunki bieżące i kapitałowe) w krajach Grupy Wyszehradzkiej i w krajach bałtyckich z wyjątkiem Węgier, gdzie te korelacje były najsłabsze. Stosując podejście oparte na modelu autoregresyjnym z rozkładem opóźnień (ARDL) stwierdzono długo- i krótkookresową szybkość wyrównania. Współczynnik korekcji błędów (CoinEq) wykazał, że korekty odstępstwa od równowagi między eksportem netto a inwestycjami bardzo się różniły między gospodarkami. W większości przypadków miał miejsce wskaźnik wyrównania w wysokości około 100 procent. Jednakże patrząc na korelację krótkookresową widzimy, że wzrost udziału inwestycji w PKB o jeden punkt procentowy spowodował spadek eksportu netto więcej niż proporcjonalnie jedynie w Bułgarii, Czechach, Polsce, na Słowacji i na Cyprze, w których zmiana wyniosła 0,98 punktu procentowego.

Na koniec posłużono się autoregresyjnymi modelami wektorowymi, które opisują dynamiczną zależność wartości opóźnień, przy czym wszystkie są traktowane jako zmienne objaśniane (endogeniczne). Można zauważyć, że w okresie krótkim wariancję błędu prognozy w eksporcie netto wyjaśniono głównie szokami inwestycyjnymi (w ponad 50%) na Cyprze, w Estonii, na Litwie, w Polsce, Słowenii i na Słowacji. Oznacza to, że szok inwestycyjny w tych gospodarkach miał silny ujemny wpływ na eksport netto. W okresie długim wpływ innowacji inwestycyjnych na eksport netto był stabilny lub zanikał z upływem lat. Stwierdzono najsłabsze oddziaływanie zmian w nakładach inwestycyjnych na pozycję w eksporcie netto w Czechach, na Węgrzech i Malcie.

Słowa kluczowe: wskaźnik inwestycji, bilans płatniczy, stabilność finansowa.

Kody JEL: F32, F43

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