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**Current Account Determinants in Central Eastern European
Countries**

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ABSTRACT

This paper empirically investigates the determinants of current accounts for a sample of 11 Central and East European Countries outside the Euro area. To this end we rely on the estimation of a panel VAR model with fixed effects over the period Q1 2005 to Q4 2014. Consistent with existing literature, we show that domestic GDP, the fiscal deficit, and the real effective exchange rate are key determinants of the current accounts of these countries. The dynamic relationships revealed in the paper complement the empirical literature on several fronts by providing new evidence from these emerging market economies.

Keywords: current account determinants, Central East Europe, P-VAR, GMM estimation

JEL classification: F31, F32, F41, F42



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I. Introduction

Current account imbalances are informative about the quantity of foreign resources that must be borrowed to fund domestic investment (Boileau and Normandin, 2004). Therefore, the size and sign of a country's current account is an important indicator of the economic activity of a country. Large and persistent current account deficits are considered to be the symptom of macroeconomic imbalances that have important implications on long-term economic progress. In this context, many scholars and policymakers have given central stage to understanding the relationships between policy transmissions and external imbalances.

During the last 10 years Central and Eastern Europe have been characterized by large current account deficits and strong capital inflows. As Lane (2008) underlined, one of the main determinants of the downhill capital inflows for the region was the EU accession that had implied lifting all capital controls by stimulating capital flows mainly in FDI flows. Moreover, the region's increasing financial integration with the EU (see Evans and Hnatkovska, 2005), and particularly the presence of a prevalent foreign ownership of the banking sector, had also contributed to capital inflows (Herrmann and Winkler, 2008). While "pull" factors and external "push" factors which drive capital flows could be multiple (for example high domestic rates of return to capital due to capital scarcity *vis a vis* the rest of the world, as well as productivity growth), there is evidence suggesting that unchecked capital inflows lead to the buildup of economic risks associated with a "sudden stop" of capital flows (Prasad et al., 2003 and Henry 2007)².

The objective of this paper is to provide an empirical investigation of the determinants of the current account for a sample of 11 Central and East European Countries (Albania, Bulgaria, Croatia, Czech Republic, Hungary, Lithuania, Macedonia, Poland, Romania, Serbia and Turkey).

To the best of our knowledge there exist a limited number of studies focused on studying the performance of current accounts in the Eastern European countries (e.g. Aristovnik, 2008, Zorzi

² In addition capital inflows may not increase investment or productivity if the country receives mainly short term capital flows and must hold large stocks of reserves to protect against the risk of sudden outflows of short term capital. In particular, in developing countries capital flows tend to behave pro cyclically in times of strain, exacerbating rather than mitigating shocks originating from the real economy. Weaknesses in the financial sector and public finances of such countries tend to amplify shocks originating in the capital account. Finally the lack of safety nets makes poor countries more vulnerable to such shocks (Gupta *et al.*, 2001).

et al., 2009). However, they are mostly focused on the period until year 2010 and they mainly include EU countries.

This study contributes to the growing literature on this field. In particular, this paper provides an empirical exploration of the interaction between GDP, fiscal policy, monetary policy, exchange rates, and external balances for this panel of countries.

To this end we rely on the estimation of a panel VAR model with fixed effects over the period from Q1 2005 to Q4 2014. The VAR model provides a flexible framework in which all variables in the system are treated as endogenous, and has now become a standard tool for analysing the effects of policy transmissions as well as other interactive behaviour among economic variables. The panel data approach is adopted to improve estimation efficiency due to the difficulties related to the short span of times series data available for the countries in question. The main results of the empirical analysis are presented as impulse response functions of key variables from the estimated P-VAR.

The results of our analysis are consistent with the existing literature on the determination of the current account. We show that domestic GDP is an important variable affecting the current account dynamics. The results of the impulse response analysis show that a positive shock to GDP has a persistent negative effect on the current account balance. The results also show that there is a positive correlation between the fiscal deficit and the current account deficit, consistent with the “twin deficit” hypothesis. In addition the impulse response analysis shows that the depreciation of the real effective exchange rate does not have an immediate effect on the current account, but can improve it after one year.

The rest of the paper is organized as follows. After a brief literature review in section 2, section 3 presents the econometric methodology, where we discuss issues including unobserved individual heterogeneity, Cholesky decomposition, and recursive restrictions on the order of endogenous variables. In section 4, we describe the data sources and variable definitions. Section 5 reports the empirical results, with discussions on both the impulse response functions of the panel VAR model and the forecast error variance decomposition. Section 6 concludes.

II. Literature review

There are several theoretical models existing in the literature that try to explain the behavior of the current account balance. Each of them gives different predictions about the elements determining the current account balance and the sign and magnitude of the relationships

between the current account fluctuations and its determinants. Therefore, undertaking an empirical analysis could help discriminate among competing theories. Due to the emergence of large global current account imbalances during the last two decades, economists and policymakers have paid more attention to the issue of the current account.

A current account deficit can occur due to various reasons. Though it is common to view current account deficits as symptomatic of economic problems, the underlying causes contributing to a current account deficit need not always be negative. Balnchard and Milesi-Feretti (2011) provide a classification of these causes into “good” and “bad”. They identify the two primary “bad” causes for current account deficits as fiscal profligacy of the authorities leading to a decline of national savings, and financial regulation failures causing large and possibly malignant expansions in credit volume (Balanchard and Milesi-Feretti, 2011). Some other reasons, which can be evaluated as “good” reasons, are temporarily low export prices, or bright future economic growth prospects leading to low savings and high investments spurred by higher expected marginal product of capital in the future.

In theoretical models, increased domestic demand and deterioration in fiscal position can be shown as the main factors that trigger the current account deficit other than interest rate. The extent to which fiscal adjustment can lead to predictable current account developments remains a controversial point. The Mundell-Fleming model proposes that increases in the fiscal deficit lead to current account deficits by raising domestic interest rates, the exchange rate, and the rate of capital inflows (Bitzis *et al.*, 2008). This static traditional view is challenged by the Ricardian equivalence principle in optimizing dynamic models, which suggests that when a government tries to stimulate demand by increasing debt-financed government spending, demand remains unchanged since households increase current savings in anticipation of the future tax burden. Thus the distinction in theoretical studies between intratemporal (Mundell, 1960; Salter, 1959) and intertemporal transmission mechanisms relating fiscal policy and the current account are key. In the traditional intratemporal approach, an increase in government spending raises the demand for domestic goods compared to foreign goods and thus it appreciates the real exchange rate and worsens the trade balance. The earlier versions of the modern intertemporal approach (Frenkel and Razin, 1996; Baxter, 1995) on the other hand, abstract from goods differentiation and real exchange rate misalignment and focuses purely on the intertemporal response of private agents. In these models, an increase in fiscal stimulus that worsens the trade balance would induce forward looking agents to act in accordance with Ricardian Equivalence and account for future tax increases while imputing their personal income. As a consequence, leisure and

consumption may both fall, leading to an increase in household savings. The intuition behind the intertemporal approach is that a decline in public savings resulting from a fiscal expansion would be offset by an equal increase in private savings, leaving national savings unaffected.

In contrast with the findings of the intertemporal literature, recent new open economy models incorporate both the intertemporal and intratemporal dimensions. Perotti and Monacelli (2007) argue that private consumption could rise in response to a government spending shock if agents need to consume more to compensate for working harder, and agents are unwilling to shift consumption towards the future. In Ravn *et al.*, (2007), currency depreciation can be a consequence of higher demand due to the increase in government spending, which induces firms to lower their markups to capture market share while forcing a depreciation of the domestic currency.

Recent notable studies in this field have been focused on the dynamics of exchange rates and current accounts (e.g., Obstfeld and Rogoff, 2005; Lee and Chinn 2006; Fratzscher *et al.*, 2010), the role of monetary transmission (e.g., Bini Smaghi, 2007; Ferraro *et al.*, 2010) and on the “twin deficit” hypothesis that relates fiscal deficits with current account deficits (e.g., Kim and Roubini, 2008; Monacelli and Perotti, 2010; Ali Abbas *et al.*, 2010). The logic behind this body of literature is that government tax cuts, which reduce revenue and increase the fiscal deficit, result in increased consumption as taxpayers spend their new-found money. The increased spending reduces the national savings rate, causing the nation to increase the amount it borrows from abroad.

Current account developments in the CEE and other European transition countries have been considered in a number of studies, but most of them have focused on the sustainability of current accounts (Lane and Milesi-Ferretti (2006), Bakke and Gulde (2010), Rahman (2008), Rahman J. Jesmin (2008)).

In their study Roubini and Wachtel (1998) while trying to analyse the current account dynamics of 10 transition countries, argue that the current account imbalances in the Eastern European Countries are very difficult to study because of data inadequacy.

Fidrmuc (2003) provides evidence for twin deficits hypothesis in several countries CEE Countries, although he found differences between the 1980s and the 1990s.

Aristovnik in his 2008 study on the short term determinants of the current account of some Eastern European and Former Soviet Union countries finds that economic growth has a

negative effect on the current account balance, implying that domestic growth is associated with a larger increase in domestic investment than savings. Current account balance deterioration is likely to be accompanied by shocks in public budgets confirming the validity of the twin deficit hypothesis in the region. The results also indicate a strong influence of the growth rate of EU-15 countries on external imbalances. Finally, appreciation of the real exchange rate and a worsening of terms of trade are found to generate deteriorations in the current account deficits of the transition region.

Harkmann and Staehr in 2012 while studying the effect of the recent global financial crisis on 10 former CEE countries that joined the EU found that the financial crisis led to a substantial reversal of capital flows.

In our study we will thus analyze to what extent our results are sensitive to the shock to our sample of economies from the global financial crisis.

There are two common ways of analyzing macroeconomic issues in interdependent economies. One is to build multi-country DSGE models and the other one is to build Panel VAR models. Even if DSGE models offer sharp answers to macro policy questions which would be appropriate for our analysis, they impose a lot of restrictions not always in line with the statistical properties of our data. Therefore in our study we will use a reduced form panel VAR model which has recently gained popularity (Love and Zicchino, 2006; Assenmacher-Wesche *et al.*, 2008; Goodhart and Hofmann, 2008). VAR models attempt to capture dynamic interdependencies among data by using a minimal set of restrictions. Shock identification techniques can transform these reduced form models into structural ones. Structural panel VAR models are liable to standard criticism of structural VAR models (see e.g. Cooley and Le Roy, 1983, Faust and Leeper, 1997, Cooley and Dweyer, 1998, Canova and Pina, 2005, Chari *et al.*, 2008) and thus need to be considered with care.

III. Methodology

We use panel VAR techniques to estimate the impulse response functions. There are mainly two advantages in using panel VAR model: a) allows addressing the endogeneity problem and b) overcome the data limitation problem. A Panel VAR approach also allows for individual heterogeneity and improves asymptotic results. The results provide advantageous insights which go beyond the estimated coefficients, reporting the adjustment and flexibility of unexpected production shocks as well as the relevance of other different shocks.

The econometric model takes the following reduced form:

$$X_{it} = \Gamma(l)X_{it} + u_i + \gamma_t + \varepsilon_{it}$$

where X_{it} is a vector of stationary variables and, $\Gamma(l)$ is a matrix polynomial in the lag operator defined as:

$$\Gamma(l) = \Gamma_1 L^1 + \Gamma_2 L^2 + \dots + \Gamma_p L^p$$

The error process is represented by three components, u_i is a vector of country specific effects, γ_t the yearly effect and ε_{it} is a vector of idiosyncratic errors (zero means, constant variances, individually serially uncorrelated and cross-sectionally uncorrelated). There are two restrictions imposed by the specification: i) it assumes common slope coefficients, and ii) it does not allow for interdependencies across units. Therefore the estimates Γ are interpreted as the average dynamics in our group of countries in response to shocks. As with standard VAR models, all variables depend on past values of all variables in the system. The main difference is the presence of the individual country-specific terms which allows us to control for time-invariant country idiosyncracies while making use of the larger sample size of the paenel. However it should be noted that our assumption of common slope coefficients is a strong one and the results of our analysis should be interpreted while keeping this in mind.

The endogenous variables included in the panel VAR model are the log difference of real GDP, Δgdp , the first difference of fiscal deficit, Δfd , the first difference of the short-term nominal interest Δir the first difference of current account Δca and the log difference of real effective exchange rate, $\Delta reer$. As such the vector X_{it} is given by:

$$X_{it} = [\Delta GDP_{it} \ \Delta FD_{it} \ \Delta IR_{it} \ \Delta CA_{it} \ \Delta REER_{it}]$$

As mentioned before, we impose that the underlying structure is the same for each country in the sample, i.e. there are no cross-country differences in the estimated dynamic relationship (the coefficients in the Γ matrices are the same for all the countries in the sample). Actually, this constraint is often violated in practice (Goodhart and Hofmann 2008, Gavin and Theodorou 2005). To overcome this restriction of the aforementioned constraint to some extent and allow for a limited amount of country heterogeneity, country fixed effects are introduced. These control for any time-invariant (that is, for the time horizon of our analysis) features of the

countries in questions, for example, differences in institutional arrangements, or deeper structural differences. However, as it is now well known, the fixed effects are correlated with regressors due to inclusion of lags of the dependent variables (Arellano, 2003). Following Love and Zicchino (2006), we thus use forward mean differencing or orthogonal deviations (the Helmert procedure), which was originally suggested by Arellano and Bover (1995). In this procedure, to remove the fixed effects, all variables in the model are transformed in deviations from forward means. Each observation is subtracted by the mean of the remaining future observations available in the sample. The resulting transformed variables and error term are as shown below:

$$x_{it}^* = w_{it} \left[x_{it} - \frac{1}{T_i - t} \sum_{j=1}^{T_i-t} x_{i(t+j)} \right]$$

and

$$\varepsilon_{it}^* = w_{it} \left[\varepsilon_{it} - \frac{1}{T_i - t} \sum_{j=1}^{T_i-t} \varepsilon_{i(t+j)} \right]$$

where x_{it} is any give variable in X_{it} , T_i is the size is the size of the time series for a given country, and w_{it} given by:

$$w_{it} = \sqrt{\frac{T_i - t}{T_i - t + 1}}$$

is a weighting value to equalize the error term variance. This transformation cannot be calculated for the last period of data, since there are no future values for the construction of the forward means.

The first-difference procedure has the weakness of magnifying gaps in unbalanced panels (as in our case). The forward means differencing is an alternative to the first-difference procedure and has the virtue of preserving sample size in panels with gaps (Roodman, 2009), and is thus especially suitable for our data. This transformation is an orthogonal deviation, in which each observation is expressed as a deviation from average future observations. Each observation is weighted so as to standardize the variance. If the original errors are not autocorrelated and are

characterized by a constant variance, the transformed errors should exhibit similar properties. Thus, this transformation preserves homoscedasticity and does not induce serial correlation (Arellano and Bover, 1995). Additionally, this technique allows use of the lagged values of regressors as instruments, and estimates the coefficients by the generalized method of moment (GMM).

In the sample, each variable in the VAR is time demeaned, i.e., for each time period. As in Love and Zicchino (2006), the mean of the series across panels is computed and then subtracted from the series. This *iter* removes the time specific effects and, thus, moderates the influence of cross-sectional dependence on panel data (Levin *et al.*, 2002). Using time demeaned series permits to satisfy the above assumption of cross-sectionally uncorrelated error.

We estimate the model using generalized method of moments (GMM). The standard OLS estimation methods are liable to lead to seriously biased coefficients in dynamic models (e.g., Nickell, 1981). In contrast, GMM is well suited for obtaining efficient estimators in a panel data context where a model like ours contains lagged dependent variables along with unobserved effects (e.g., Arellano and Bond, 1991).

The impulse response functions and error variance decompositions are often centred in VAR analyses, which allow us to gain a clear picture of the dynamic relationships among variables of interest. Particularly, the impulse response functions describe how one variable responds over time to the innovations in other endogenous variables which are assumed to be uncorrelated with other shocks in the system (while holding all other shocks equal to zero). The variance decomposition shows how much of the error variance of each of the variables can be explained by shocks to the other variables. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the system. To better understand the implications of the impulse response functions, confidence bands are warranted. We use Monte Carlo simulations to generate 1000 impulse responses based on the estimated coefficients and their standard errors. The confidence bands are thus given by 2.5th and 97.5th percentiles of the 1000 simulated impulse responses³.

³ In practice, we randomly generate a draw of coefficients Γ by employing the estimated coefficients and their variance–covariance matrix and re-calculate the impulse-responses.

Once all the coefficients of the panel VAR are estimated, we compute the impulse response functions (IRFs) and the variance decompositions (VDCs)⁴. In order to compute the IRFs we use the Cholesky decomposition. Considering that the actual variance–covariance matrix of the errors is unlikely to be diagonal, to isolate shocks to one of the variables in the system it is necessary to decompose the residuals in such a way that they become orthogonal (i.e. Cholesky decomposition). The assumption behind the Cholesky decomposition is that series listed earlier in the VAR order impact the other variables contemporaneously, while series listed later in the VAR order impact those listed earlier only with lag. Consequently, variables listed earlier in the VAR order are considered to be more exogenous. The identifying restrictions on the order of variables for our equations are based on the rationale suggested by the literature on the mechanism of monetary/fiscal transmission and the determination of exchange rate and the current account. The ordered list of the variables is $\{\Delta\text{GDP}, \Delta\text{FD}, \Delta\text{IR}, \Delta\text{CA}, \Delta\text{REER}\}$ where the contemporaneously exogenous variables are ordered first. Following Kim and Roubini (2008), we order the fiscal balance before the interest rate. This setup shares the same spirit with van Aarle *et al.* (2003) in modelling monetary and fiscal policy transmission together. In the model, the (exogenous) government deficit shocks are extracted by conditioning on the current and lagged GDP and all other lagged variables. We condition on current GDP since the government budget (deficit) is likely to be endogenously affected by the current level of economic activity within a quarter. In particular, elements of government revenue, such as sales taxes and income taxes, are very likely to depend on the current level of economic activity within a quarter. In addition, the government budget deficit may also depend on the lagged level of various variables. For example, some elements of government revenue, such as the income tax, may depend on the lagged level of economic activity. However, we do not condition on current variables other than the real GDP considering the nontrivial decision lags in fiscal policy. That is, conditioning on the current real GDP is essential to control the current endogenous reactions of the government primary deficit to current economic activity; while not conditioning on other current variables is reasonable to identify exogenous or discretionary changes in the government deficit since such changes are less likely to depend on other current variables because of the decision lags of fiscal policy. The exchange rate is often assumed to be more endogenous, allowing for an immediate reaction to policy shocks and other economic variables (e.g., Peersman and Smets, 2001; Kim and Roubini, 2008), which hinges on the insights provided by

⁴ The panel VAR is estimated using the package provided by M. Abrigo and I. Love (2015). This package is an updated Stata program for Love (2001) and is also used in Love and Zicchino (2006).

canonical models of exchange rate determination such as Dornbusch's overshooting model and the monetary models of Frenkel and Mussa. Granger causality tests are also used to support the ordering of the variables. Some of the variables exhibit feedback relationship, at which point economic theory is also considered. The results of the Granger causality tests are provided in Table 1.

In this study, imposing a long-run steady state relationship for the Central East European countries may not be realistic as these emerging market economies have different growth paths and their economic patterns may change substantially along the path. Therefore, we use the unrestricted panel VAR model and rely exclusively on the data themselves to identify the underlying structure.

IV. Data and Econometric Analysis

Data

Our analysis utilizes the dataset available from the Eurostat and IMF's International Financial Statistics (IFS)⁵ for the countries: Albania, Bulgaria, Croatia, Czech Republic, Hungary, Lithuania, Macedonia, Poland, Romania, Serbia and Turkey. We collect quarterly data on GDP (index 2010=100), fiscal balance as percentage of GDP, short-term interest rate⁶, current account balance as percentage of GDP, and real effective exchange index (see Table 2).

Fiscal balance is calculated as the difference between total revenue and total expenditure which are compiled on a national accounts (ESA 2010) basis. The REER indexes for all the countries under the study are constructed based on the computation of the nominal effective exchange rate and consumer price, which states the price or relative cost between the country under review and its trading partners:

$$REER = \prod \left[\frac{P_{fn} E_n}{P} \right]^{\beta_n}$$

⁵ We update, if appropriate, the data using resources from official websites of relevant countries, including central bank websites.

⁶ For EU countries we have considered the 3-months money market interest rate, except Bulgaria. For the rest of the countries the o/n interest rate has been considered.

where P_{fn} and P are foreign and domestic price indices, E_n is the nominal exchange rate for the national and foreign currency expressed as the price of a foreign currency unit to the national currency, and β_n is the share of the relevant trading partner n in domestic trade.

The dataset is sampled from the first quarter of 2005 up to the last quarter of 2014, while the Macedonias fiscal balance is only available starting 2008:Q1. Variables exhibit strong seasonality, for which we seasonally adjusted⁷, and then transformed them into logarithms.

A striking advantage of using the structural fiscal balance as the fiscal policy indicator, instead of the more conventional headline balance, is that it is cyclically-adjusted, allowing policymakers, analysts and observers to more accurately assess the fiscal position net of cyclical effects. Public revenues and expenditures are often affected substantially by the boom and bust cycle of the economy in ways that are not related to the underlying fiscal position. Decreases in tax revenues and increases in unemployment benefits spending during economic recessions, for instance, will generally lead to a huge surge in government deficits, which indeed is not the result of a deliberately expansive policy.

Of the 11 countries that are part of the panel, seven are EU members (Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, and Lithuania). Four countries, Bulgaria, Croatia, Lithuania and Macedonia have a fixed exchange rate regime. Lithuania has become member of the Eurozone only in January 2015 and this does not affect our panel data.

Panel unit root test and cointegration analysis

The first step of the analysis is to look at the properties of the data. Failing to account for these properties of the data may lead to spurious or misleading characterization of the dynamic relationships among variables. To date, several methods have been developed to test for unit roots in panels, Levin, Lin, and Chu (2002, LLC) and Im, Pesaran and Shin (2003, IPS). The LLC and IPS tests both maintain the null hypotheses that each series in the panel contains a unit root, but the alternative of the LLC test requires each series to be stationary with an identical autoregressive coefficient for all panel units while the alternative of the IPS test allows for some (but not all) of the individual series to have unit roots; that is, the autoregressive coefficients are heterogeneous. Hadri (2000) derives a residual-based test where the null hypothesis is that the

⁷ Variables are adjusted by using the Census XII multiplicative seasonal adjustment method used by the US Bureau of Census.

series are stationary against the alternative of a unit root in the panel. Table 3 reports the results of the panel unit root tests based on different testing procedures. Levels of time series are found to be nonstationary for the short-term interest rate and real exchange rate. According to the Hadri approach all the variables are non-stationary. Nevertheless, it has been shown by Hlouskova and Wagner (2006) that the Hadri test may suffer significant size distortion in the presence of autocorrelation when the series does not contain a unit root. Indeed, Hlouskova and Wagner find that the Hadri test tends to over-reject the null hypothesis of stationarity for all processes that are not close to a white noise. However, the results show that all variables are stationary in first-difference. Therefore, in our panel of 11 countries, we conclude that the variables are non-stationary in level but stationary in first-difference.

Table 4 reports the results of the cointegration tests. These are error correction based panel cointegration tests developed by Pedroni (1999) in order to check if long-run relationships exist among integrated variables for selected countries. Pedroni (1999) develops two classes of statistics to test for the null hypothesis of no cointegration in heterogeneous panels, namely panel cointegration statistics (within-dimension) and group-mean cointegration statistics (between-dimension), which allow for heterogeneity in cointegrating relationships across members of the panel. As shown by the robust p-value, for most of the statistics considered, the null hypothesis of no cointegration cannot be rejected. Therefore, the empirical properties of the variables examined require estimation of the VAR in first differences, since no cointegration relationships exist between the (non-stationary) variables (in level).

V. Empirical Results

This section presents the impulse response functions and the variance decomposition from the panel VAR.

While the optimal VAR lag length in a standard VAR can be determined by statistical criteria, this is not straightforward for the PVAR due to cross-sectional heterogeneity. Following Abrigo and Love (2015), we apply the consistent moment and model selection criteria (MMSC) for GMM models proposed by Andrews and Lu (2001), based on Hansen’s (1982) J statistic of over-identifying restrictions. Their proposed MMSC are analogous to various commonly used maximum likelihood-based model selection criteria, namely the Akaike information criteria (AIC) (Akaike, 1969), the Bayesian information criteria (BIC) (Schwarz, 1978; Rissanen, 1978; Akaike, 1977), and the Hannan-Quinn information criteria (HQIC) (Hannan and Quinn, 1979). As an

alternative criterion, the overall coefficient of determination (CD) may be calculated even with just-identified GMM models (see Table 5).

As in Abrigo and Love (2015), in our case the first-order panel VAR is the preferred model, since this has the smallest MBIC, MAIC and MQIC. However, the over-all coefficient of determination suggests applying a model with more than 1 lag. In addition, in most macroeconomic analyses, a lag length of 1 or 2 is often regarded as too short to capture enough economic interactions among variables for a model with quarterly data (see for example Kim and Roubini, 2008). Balancing the need of allowing for a sufficient number of lags given the nature of the data and trying to avoid overparametrization, we set the number of lags to 3, opting for a third-order panel VAR model.

Impulse Response Function

Figures 1 and 3 display the impulse response functions respectively for the current account and for all the endogenous variable of the panel VAR model. The accumulated impulse responses (solid line) are presented over time⁸. The confidence bands, given by 2.5th and 97.5th percentiles of the 1000 simulated impulse responses are presented by the dash lines.

The response of the current account to interest rate shocks seems not to be statistically significant. This seems to be consistent with the conclusions pointed out by Ferraro *et al.* (2010). According to this study the behavior of international variables (such as current account and exchange rate) is less sensitive to monetary policy compare to domestic variables⁹.

In relation to the exchange rate, a positive shock means a depreciation of the local currency. As one can see, the response of the external balance to a real depreciation of domestic currency is not immediate. The importance of the real shock in the first quarter is zero (see Table 7 on variance decomposition), because the initial response is close to zero. It increases later, and is

⁸ For example, the first row in Figure 3 displays the effect of one standard deviation shock on real effective exchange rate (REER) on itself and on the other endogenous variables.

⁹ The authors by employing two-country monetary DSGE model have pointed out that in case of a sharp current account reversal (due to a sudden revision of the relative growth prospects of the home versus foreign country) home central bank will raise interest rates sharply to avoid currency depreciation. However, by the other side, this sharp increase in interest rates, in turn, causes a major contraction in aggregate economic activity within the home country. The shrinkage is particularly relevant in the nontradable goods sector, pointing out the inefficient sectoral reallocation.

statistically significant only after 4 quarters and the effect remains significant. As shown, depreciation in the real exchange rate has a positive effect on these countries' external balances after a year. It is clear that some J-curve effect associated with this interaction is not missing for the countries under review¹⁰.

In response to a positive output shock, the current account worsens. The effect is significant just 1 quarter after the shock and it is larger after 3 quarters. These results are not surprising and in line with theoretical expectations that positive domestic economic output boosts demand for foreign goods and services and consequently deteriorates the current account balance (see Calderon *et al.*, 2002; Aristovnik, 2008). Although an increase in domestic output can be associated with a greater savings rate, it seems that the rise in consumption and investment together are somewhat greater, thus leading to an expansion of the current account deficit (Backus *et al.*, 1994). This is also consistent with the findings of Aguiar and Gopinath 2007, who report that emerging markets are characterized by strongly counter-cyclical current accounts.

It is interesting to note the positive relation between the current account balance and fiscal balance. An improvement of the fiscal balance tends to have a positive effect on the current account deficit. A variety of models predict a positive relationship between government budget balances and current accounts over the medium term. Overlapping generations models suggest that government budget deficits tend to induce current account deficits by redistributing income from future to present generations (see Obstfeld and Rogoff, 1994 and Chinn, 2005). Only in the particular case of full Ricardian equivalence, where private saving fully offsets changes in public saving, would there be no link between government budget balances and current account balances. Our result seems to confirm the Bussière *et al.*, (2004) findings on the connection between the government fiscal deficits and the current account (the idea of the “twin deficits”).

It seems also important to report how an improvement of fiscal balance has a negative and significant impact on the GDP activity of this group of countries, consistent with standard theory (for more details see Figure 3). By the other side, one can see that a positive growth of

¹⁰ Under the J-Curve phenomenon the trade balance of a given country follows an immediate deterioration after real currency depreciation (short run deterioration combined with long-run improvement), due to some time lag between order and delivery of imports. This is partly consistent with the immediate negative response of the terms of trade to devaluation: the pass-through from a devaluation to export prices in the national currency is slower than that to import prices in the national currency due to the missing price adjustment of domestic producers to get a competitive advantage (Backus *et al.*, 1994).

domestic output worsens the fiscal deficit by showing a permanent effect. This is consistent especially for developing countries due to investment increasing.

Variance Decomposition

These results seem to be confirmed by the forecast-error variance decomposition (FEVD) based on a Cholesky decomposition of the residual covariance matrix of the underlying panel VAR model (see Table 7). The results contained in Table 7 show that the contribution of gross domestic output (first column) and fiscal deficit (second column) explain 1.3% and 42.3% of the variation of current account deficit just after one quarter. It finds that fiscal deficit seems to play an especially important role in explaining the current account balance. After 10 quarters the contribution of GDP increases somewhat (3.4%) and that of domestic interest rate and real effective exchange rate both is 2.5%.

To check the robustness of our results, we perform again the IRF analysis using alternative measures of external imbalances like the trade deficit (net exports). These results show that our previous findings are robust to this alternative measure. Indeed, as before, trade deficit improves in response to an appreciation of real effective exchange rate and a positive fiscal deficit shock for the whole panel (see Figure 2).

VI. Concluding Remarks

This paper use a panel VAR model to empirically investigate the dynamic interactions between monetary policy, fiscal policy, exchange rates, as well as their impacts on current account balance in eleven emerging market economies in central and east Europe. The results are largely consistent with the theoretical literature and previous empirical analysis. We found that fiscal deficit worsening is likely to be accompanied with current account balance deterioration, confirming the validity of the twin deficit hypothesis in the region. It shows that the fiscal deficit is an important variable affecting the current account dynamics by explain between 40-42% of it variance in a variance decomposition exercise. The results also show that an increase in domestic GDP has a persistent negative effect on the current account balance, implying that the domestic growth rate is associated with a larger increase in domestic investment than saving. Further, the impulse response analysis shows that the depreciation of the real effective exchange rate does not have an immediate effect on the current account, but can improve it after one year.

We improve on the existing literature in several directions. First, although cross-country empirical studies are not missing, they are mainly focused on the advanced economies and EU/EA countries. Our work is among the very few studies that focus on this sample of developing market countries in East Europe by employing quarterly data. Trying to understand the dynamic interactions between policy impacts, real economic activities, and external imbalances for these countries may provide important insights into the main current account drivers and policy coordination in the region. Moreover, taking into account the correlation between fiscal and monetary policy, we have considered both fiscal and monetary policy transmissions in unified framework. This is an additional contribution of our paper to the literature on monetary and fiscal analysis.

Future work may build on our analysis in a number of ways. *In primis* further research remains obviously needed in order to better understand the factors that lie behind the dynamic interactions for this set of countries. In addition, while in this study no theoretical constraints have been imposed, an analysis based on a Bayesian Panel VAR framework would present a further step for future works.

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Appendix

Table 1 - Panel VAR-Granger causality Wald test

Equation/Excluded	Prob.	Equation/Excluded	Prob.	Equation/Excluded	Prob.
dGDP		dFD		dREER	
<i>dFD</i>	0.846	<i>dGDP</i>	0.002	<i>dGDP</i>	0.558
<i>dIR</i>	0.107	<i>dIR</i>	0.712	<i>dFD</i>	0.874
<i>dCA</i>	0.069	<i>dCA</i>	0.275	<i>dIR</i>	0.057
<i>dREER</i>	0.915	<i>dREER</i>	0.531	<i>dCA</i>	0.334
<i>ALL</i>	0.091	<i>ALL</i>	0.003	<i>ALL</i>	0.268
dIR		dCA			
<i>dGDP</i>	0.039	<i>dGDP</i>	0.050		
<i>dFD</i>	0.880	<i>dFD</i>	0.017		
<i>dCA</i>	0.159	<i>dIR</i>	0.088		
<i>dREER</i>	0.012	<i>dREER</i>	0.114		
<i>ALL</i>	0.000	<i>ALL</i>	0.002		

Notes: Ho: Excluded variable does not Granger-cause Equation variable and Ha: Excluded variable Granger-causes Equation variable.

Table 2 – Descriptive Statistics

Variable	<i>Mean</i>	<i>Std dev.</i>	<i>Min</i>	<i>Max</i>	<i>N.obs.</i>
Real GDP	4.604	0.081	4.322	4.839	440
Fiscal Deficit	-0.029	0.035	-0.200	0.072	428
Interest Rate	0.053	0.038	0.000	0.179	440
Current Account	-0.057	0.060	-0.270	0.106	440
Real Effective Exchange Rate	4.589	0.082	4.347	4.85	440

Table 3 - Panel Unit Root Tests, period 2005 Q1- 2014 Q4

		<i>FD</i>	<i>GDP</i>	<i>IR</i>	<i>CA</i>	<i>REER</i>
Panel A: variables in level (in logarithms)						
LLC test	<i>stat</i>		-4.35***	-0.36	-2.19**	-0.78
	<i>p-value</i>		0.000	0.361	0.0144	0.219
IPS Test	<i>stat</i>	-6.73***	-2.62***	-2.16**	-3.55***	-1.45*
	<i>p-value</i>	0.000	0.004	0.015	0.000	0.073
ADF Test	<i>stat</i>	95.29***	44.03***	36.33**	55.71***	32.15*
	<i>p-value</i>	0.000	0.003	0.028	0.000	0.075
Hadri Test	<i>stat</i>	5.04***	11.04***	4.64***	6.37***	6.66***
	<i>p-value</i>	0.000	0.000	0.000	0.0000	0.000
Panel B: variables in first difference						
LLC Test	<i>stat</i>		-10.70***	-7.93***	-20.71***	-10.58***
	<i>p-value</i>		0.000	0.000	0.000	0.000
IPS Test	<i>stat</i>	-24.47***	-13.30***	-9.29***	-19.67***	-10.27***
	<i>p-value</i>	0.000	0.000	0.000	0.000	0.000
ADF Test	<i>stat</i>	350.32***	191.22***	131.49***	288.67***	144.39***
	<i>p-value</i>	0.000	0.000	0.000	0.000	0.000
Hadri Test	<i>stat</i>	0.40	0.49	-0.67	1.56*	0.99
	<i>p-value</i>	0.34	0.31	0.75	0.059	0.16

Notes: IPS test is based on Im, Pesaran and Shan (2003), and Hadri test is based on Hadri (2000). H0 LLC: panel series contain a common unit root; H0 IPS: panel series contain heterogenous unit roots; H0 Hadri: panel series contain no unit root. Whenever needed, the lag length is chosen by SIC, kernel is based on Bartlett, and bandwidth is based on New-West. * denotes significance at 10%, ** at 5%, and *** at 1%, respectively.

Table 4 - Panel Cointegration Tests

Pedroni's residual-based test								
with intercept, no linear trend			with intercept, linear trend			no intercept, no linear trend		
	<i>Statistics</i>	<i>Prob.</i>		<i>Statistics</i>	<i>Prob.</i>		<i>Statistics</i>	<i>Prob.</i>
Panel v-	0.981	0.163	Panel v-	-0.538	0.705	Panel v-	-2.511	0.994

Statistic			Statistic			Statistic		
Panel rho-Statistics	-1.112	0.133	Panel rho-Statistics	0.579	0.719	Panel rho-Statistics	0.349	0.637
Panel PP-Statistics	-1.269	0.102	Panel PP-Statistics	-0.053	0.478	Panel PP-Statistics	0.363	0.642
Panel ADF-Statistics	-2.756	0.003	Panel ADF-Statistics	-3.185	0.000	Panel ADF-Statistics	-0.101	0.496
Group rho-Statistics	0.136	0.554	Group rho-Statistics	2.111	0.9826	Group rho-Statistics	2.309	0.989
Group PP-Statistics	-0.609	0.271	Group PP-Statistics	1.612	0.946	Group PP-Statistics	1.335	0.909
Group ADF-Statistics	-2.991	0.002	Group ADF-Statistics	-1.436	0.076	Group ADF-Statistics	0.828	0.796

Notes: Pedroni test is based on Pedroni (1999). The null hypothesis of all Pedroni's statistics is no cointegration. The panel cointegration statistics (within dimension) require a common value in cointegration while group-mean cointegration statistics (between-dimension) do not.

Table 5 – Panel VAR Selection Order Criteria

Lag	<i>CD</i>	<i>J</i>	<i>J pvalue</i>	<i>MBIC</i>	<i>MAIC</i>	<i>MQIC</i>
1	0.899	122.19	0.0005	-319.69	-27.81	-143.84
2	0.938	98.10	0.00006	-196.48	-1.89	-79.25
3	0.957	53.00	0.0009	-94.28	3.01	-35.67
4	0.968	0.00	0.00	0.00	0	0

Table 6 - Stability condition test

Eigenvalue		Modulus
<i>Real</i>	<i>Imaginary</i>	
0.847	0	0.847
0.375	0.502	0.627
0.375	-0.502	0.627

-0.319	0.477	0.574
-0.319	-0.477	0.574
0.363	-0.416	0.552
0.363	0.146	0.552
-0.529	0	0.529
-0.409	0.186	0.449
-0.49	-0.186	0.449
0.281	0.348	0.448
0.281	-0.348	0.448
-0.309	0.300	0.431
-0.309	-0.300	0.431
0.24	0	0.241

Table 7 – Current Account Balance Variance Decomposition

Period	<i>GDP</i>	<i>FD</i>	<i>IR</i>	<i>CA</i>	<i>REER</i>
1	0.013	0.423	0	0.564	0
2	0.011	0.400	0.014	0.570	0.004
3	0.027	0.398	0.015	0.556	0.004
4	0.027	0.0393	0.018	0.554	0.007
5	0.033	0.392	0.019	0.549	0.007
6	0.032	0.393	0.019	0.548	0.008
7	0.033	0.393	0.019	0.546	0.008
8	0.034	0.394	0.019	0.545	0.008
9	0.034	0.394	0.019	0.545	0.008
10	0.034	0.395	0.019	0.544	0.008

Figure 1 – Impulse Response Function: current account

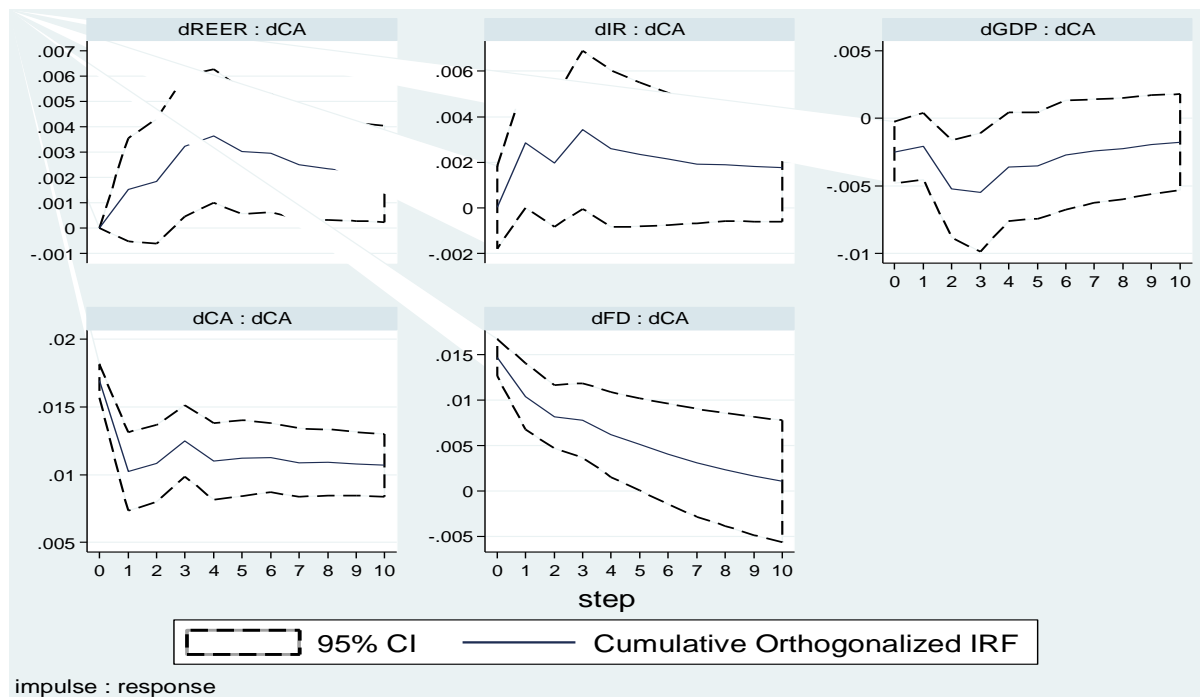


Figure 2 - Impulse Response Function: trade balance

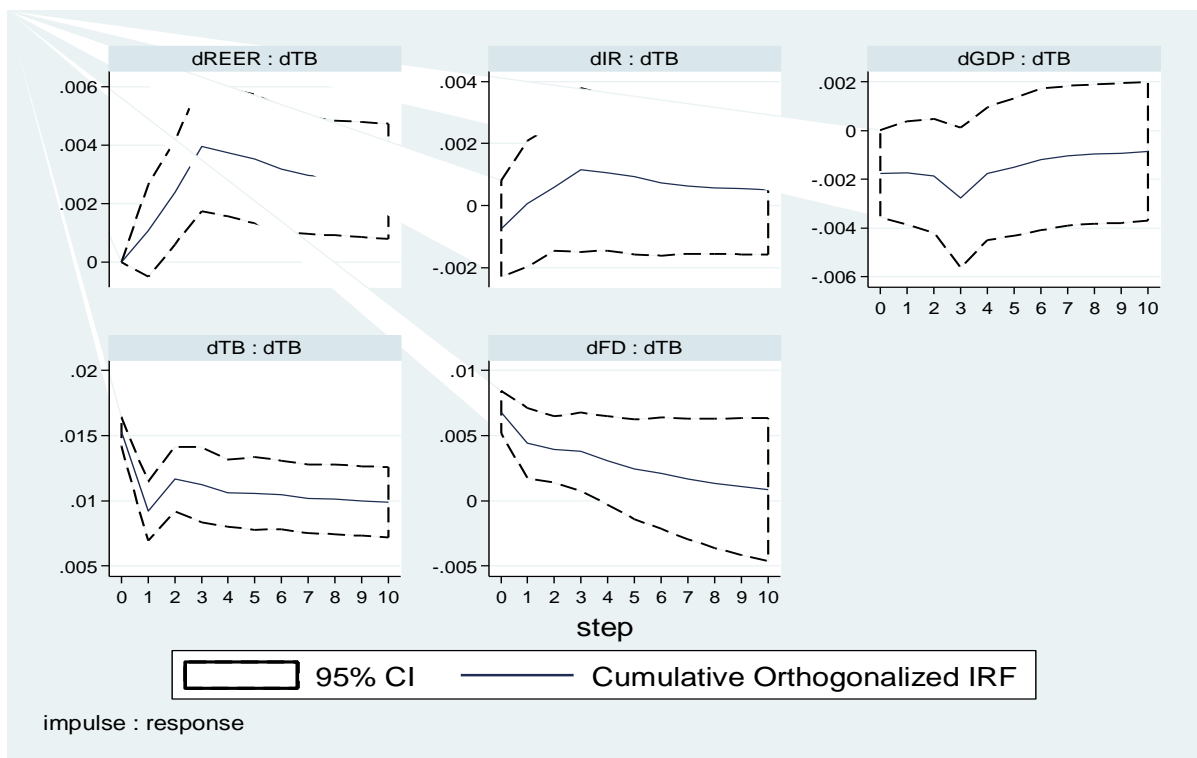


Figure 3 – Impulse Response Function

