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СТРУЧНИ РАДОВИ
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23

Анализа детерминанти текућег рачуна платног биланса коришћењем „jackknife“ метода моделског упросечавања

Милан Недељковић, Бранко Урошевић и Емир Зилцовић

Jackknife Model Averaging of the Current Account Determinants

Milan Nedeljković, Branko Urošević and Emir Zildžović

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Анализа детерминанти текућег рачуна платног биланса коришћењем „Jackknife“ метода моделског упросечавања

Милан Недељковић, Бранко Урошевић и Емир Зилдзовић*

Апстракт: Овај рад истражује краткорочне и средњорочне везе између текућег рачуна платног биланса и широког спектра макроекономских детерминанти у Србији и одабраним земљама централне и источне Европе. Користећи нову технику моделског упросечавања анализа је фокусирана на детерминанте дефицита текућег рачуна платног биланса појединачних земаља. Резултати указују да модел добро описује кретања дефицита текућег рачуна платног биланса током претходне деценије и да добро прати његову релативну волатилност. Знакови и вредности различитих коефицијената указују на значајну хетерогеност између земаља пружајући емпиријску потпору за анализу на нивоу појединачних земаља.

Кључне речи: Дефицит текућег рачуна платног биланса, Моделско упросечавање, Земље у транзицији

JEL Code: F32

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Jackknife Model Averaging of the Current Account Determinants

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Abstract: This paper investigates the short to medium-term empirical relationships between the current account balances and a broad set of macroeconomic determinants in Serbia and selected CEE countries. Using novel model averaging techniques we focus the analysis to individual country's data only. The results suggest that the model tracks the current account movements over the past decade quite well and captures its relative volatility. Signs and magnitudes of different coefficients indicate significant heterogeneity among countries providing empirical support for the country-level analysis.

Key words: Current account, Model averaging, Transition countries

JEL Code: F32

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Non-technical Summary

The importance of the current account (CA) as one of the leading indicators of the future behavior of the economy has been emphasized both in theoretical and economic policy literature. While large CA deficits do not necessarily lead to the balance of payments or broader financial crises per se, they may lead to or trigger the full-blown crises when they are caused by persistent internal imbalances or coincide with exogenous shocks. Understanding the determinants of CA imbalances therefore has important policy implications. A deficit caused by a reduction in savings is likely to be more dangerous than the one fueled by a surge in investment which contributes to future growth and a country's ability to repay the accumulated debt.

There is a large literature, both theoretical and empirical, that analyses the dynamics of the CA. The intertemporal approach to the CA provides a workhorse model for the analysis. The model treats CA as an outcome of consumption and investment decisions made over a long-term horizon under forward looking expectations. More concretely, with an infinitely lived representative agent who smooths consumption by lending or borrowing abroad, the standard intertemporal model implies that the movements in the CA should reflect factors that affect country's underlying saving and investment positions.

This paper investigates the short to medium-term empirical relationships between the current account balances and a broad set of macroeconomic determinants in Serbia and selected inflation-targeting CEE countries (the Czech Republic, Hungary, Poland and Romania). It builds on an extended class of intertemporal models and applies econometric techniques to identify the relationships between the CA and a set of macro variables.

Majority of empirical studies of the medium-term CA determinants employ panel regression techniques for estimation. This is reasonable since on one hand, the idea is to include many different variables, while at the same time the data is available typically on annual basis, which implies relatively short samples for most of emerging and developing countries. A potential limitation with using panel analysis in this context is that the significance of potential determinants may differ across large number of countries and this heterogeneity may bias the resulting parameter estimates for individual countries. In order to overcome the problem we use model averaging techniques which allow us to include all the relevant variables while simultaneously focusing on individual country's data only. Model averaging in the present context means that we use different combinations of the potential CA determinants (not all at once) as particular models, and the final estimate is obtained by averaging across all the estimated models using a suitable criterion to select individual models' weights.

The results suggest that the model tracks CA movements over the past decade quite well and captures its relative volatility. We find a large heterogeneity in signs and magnitudes of influence of potential determinants among countries providing empirical merit for our analysis. In particular, negative oil balance, the foreign direct investment (FDI) inflows and real exchange rate (RER) appreciation significantly contributed to the CA deterioration in Serbia. CA balance in Romania is similarly negatively affected by the FDI inflows and RER movements. In contrast, both Poland's and Czech's CA deficits are largely explained by the relative income convergence. The estimates for Hungary suggest that higher trade integration and negatively expanding net foreign asset position tend to improve the CA balance.

Contents

1	Introduction and Short Literature Review	1
2	Econometric Methodology	3
3	Current Account Determinants	5
4	Data and the Results	7
5	Concluding Remarks	10
6	Appendix: Variable Descriptions and Their Expected Signs	11
7	References	12

1 Introduction and Short Literature Review

The importance of the current account (CA) as one of the leading indicators of the future behavior of the economy has been emphasized both in theoretical and economic policy literature. While large CA deficits do not necessarily lead to the balance of payments or broader financial crises per se, they may lead to or trigger the full-blown crises when they are caused by persistent internal imbalances or coincide with exogenous shocks. Kamin, Schindler and Samuel (2007) for example find that large imbalances contribute mostly to the estimated probability during actual crises in emerging markets, rather to the average probability of the crises. More recently, Jorda, Schularick and Taylor (2011) also find that external imbalances historically played a role in predicting financial crises. Understanding the determinants of CA imbalances therefore has important policy implications. A deficit caused by a reduction in savings is likely to be more dangerous than the one fueled by a surge in investment which contributes to future growth and a country's ability to repay the accumulated debt.

There is a large literature, both theoretical and empirical, that analyses the dynamics of the CA. The intertemporal approach to the CA that appeared from the beginning of 1980s (Sachs, 1981) and was further elaborated in the new open economy macroeconomics literature (Obstfeld and Rogoff, 1996) provides a workhorse model for the analysis. The model treats CA as an outcome of consumption and investment decisions made over a long-term horizon under forward looking expectations. More concretely, with an infinitively lived representative agent who smooths consumption by lending or borrowing abroad, the standard intertemporal model implies that the movements in the CA should reflect factors that affect country's underlying saving and investment positions.

Empirical studies of the intertemporal approach developed in two main directions. The first strand of the literature applies the present value tests developed by Campbell and Shiller (1987) in the asset pricing context. A general idea in this literature is that under some regular assumptions one can derive the CA series that would have been optimal from a consumption smoothing perspective, see Sheffrin and Woo (1990), Otto (1992) for early applications among others. Typically, these models exhibited a poor empirical fit – while the model-predicted and the actual series were usually positively correlated, the latter series were substantially more volatile. Recent research moved to relaxing some of the models' assumptions through incorporating endogenous investments (Glick and Rogoff, 1995), allowing for real exchange rate and interest rate variability (Bergin and Sheffrin, 2000, Campa and Gavilan, 2011), incorporating consumption habits (Gruber, 2004), introducing capital market imperfections that limit the consumption smoothing (Bussière et al., 2006) or adding an exogenous world real interest rate shock (Nason and Rogers, 2006). Overall, although relaxation of some of the assumptions improves the models' fit, the obtained results are sensitive to the maintained assumptions and the choice of variables. In addition, the present-value tests do not distinguish between the temporary and permanent shocks driving the CA dynamics and hence are of limited applicability for assessing the CA sustainability, at least from the short to medium run perspective.¹

¹For an interesting application of the present- value test to CA sustainability see Campa and Galvan (2011).

The second strand of the literature, building on an extended class of intertemporal models with overlapping generations, uses standard econometric techniques to identify the relationships between the CA and a set of macro and socio-economic variables. The aim behind this literature is not to discriminate between the competing intertemporal models by choosing a limited number of variables that correspond to a particular model in empirical exercise. Rather, the idea is to capture as many potential influences on the CA as possible using a large number of variables in empirical analysis. Since the interest of the present study is to analyze current and past developments in the Serbia's CA, the latter approach appears to be better-suited for our analysis. Empirical literature in this vein is enormous, see, for example, Beidas-Strom and Cashin (2011) for a selective summary. Below we summarize the key papers that motivate this strand of the literature.

Early literature on CA determinants focuses on the medium- to long-run determinants using dynamic panel data estimation techniques. Debelle and Faruquee (1996) and later the IMF's CGER (2006) empirically study the saving-investment perspective of the structural determinants of CA balances in industrial countries. Calderón et al (2002, 2007), Chinn and Prasad (2003), and Chinn and Ito (2007) extended this analysis to include developing countries. The findings of this literature are in line with theory, with most regressors' displaying the expected signs, although with differing magnitudes or intensities across particular geographic regions.

In particular, Calderón et al (2007) focus on emerging market economies (EMEs) and low-income countries (LICs) and find that there is a significant and negative relationship between the real exchange rate (REER) and the CA. De Santis and Lührmann (2008) studying global CA balances find negative impact of real GDP growth, losses in competitiveness and increases in the quality of the institutions on CA balance. Medina, Prat and Thomas (2010) by studying determinants of the equilibrium CA balances for emerging markets indicated that the fiscal balance has stronger impact on CA developments than in industrialized countries and that stock of net foreign assets (NFA) and oil balance have significant positive effect on CA. Hermann and Jochem (2005) and Bussière et al. (2006) investigate the large CA deficits observed in most new EU member states. According to panel estimates the deficits in these countries can be attributed primarily to the relative income level and high capital building. The positive impact of a closing income gap, however, is largely compensated by real appreciation, while the effect of government budget deficits is rather small. On the other hand, Zanghieri (2004) concludes that CA in new EU member states is significantly negatively affected by government deficits and financial deepening. Aristovnik (2006) finds that fiscal balance, investments, REER, real interest rate, economic growth and financial development underlie CA positions for twelve transition economies. Analysing emerging Europe countries Rahman (2008) finds that FDI and the transition index (a proxy for the investment climate) significantly and negatively affect CA balances, while private remittances (larger than 5 percent of GDP) have the opposite effect.

Majority of empirical studies of the medium-term CA determinants employ panel regression techniques for estimation. This is reasonable since on one hand, the idea is to include many different variables, while at the same time the data is available typically on annual basis,

which implies relatively short samples for most of emerging and developing countries. A potential limitation with using panel analysis in this context is that the significance of potential determinants may differ across large number of countries and this heterogeneity may bias the resulting parameter estimates for individual countries. In order to overcome the problem in this paper we use model averaging techniques which allow us to include all the relevant variables while simultaneously focusing on individual country's data only. We study a wide range of potential determinants of the CA behavior in Serbia and the selected CEE countries (the Czech Republic, Hungary, Poland and Romania). We find a large heterogeneity in signs and magnitudes of influence of potential determinants among countries providing empirical merit for our analysis.

The contribution of the paper is therefore twofold. First, to the best of our knowledge this is the first paper that analyses the current account determinants for Serbia, at least over the past decade. Second, and different to other empirical studies, we use jackknife model averaging to control for model uncertainty. Ca'Zorzi, Chudik and Dieppe (2012) is the first paper that uses model averaging techniques for analysis of the CA determinants. They use Bayesian model averaging in a panel of 181 countries. Unlike them we focus on individual country data thus controlling for potential parameter heterogeneity. Moreover, we use frequentist model averaging discussing also its benefits compared to the Bayesian approach.

The rest of the paper is organized as follows. The next section contains a discussion of econometric methodology. Section III discusses the choice of the CA determinants. Data and results from model averaging estimation for Serbia and some selected CEE countries are presented in section IV. Section V concludes together with some policy implications. In the Appendix we review the key CA determinants, their definitions and expected signs.

2 Econometric Methodology

Estimation of the single-country determinants typically puts relatively strong limits on the number of variables to be included, even in the first step of general-to-specific exercise. An alternative is to use factor augmented approach (Bai and Ng, 2006), where one would select one or several "core" variables and use factors extracted from a rich set of potential determinants to eliminate the omitted variable bias from the estimates of parameters for "core" variables. The drawback of this approach is the necessity to a priori select the core variables (coming back again to the issue of a preferred model) and at the end only the influences of the core variables are obtained since factors do not have a direct economic meaning.

A preferable solution for confronting parametric model uncertainty and limited number of observations is model averaging. Model averaging, unlike model selection, deals with model uncertainty by averaging over the set of candidate models in a particular manner, rather than selecting one model according to some criterion. By the nature of the average, model averaging is also more robust than model selection as the averaging estimator considers the uncertainty

across different models together with the model bias form each candidate model.² Model averaging in the present context means that we will use different combinations of the potential CA determinants (not all at once) as particular models, and the final estimate is obtained by averaging across all the estimated models using a suitable criterion to select individual models' weights. In this way, we are able to include a large number of variables typically found in the panel literature, whilst, at the same time, focusing our analysis on individual country's data only.

The key element in empirical model averaging is the choice of the criterion for selecting the weights for individual models. Both Bayesian and frequentist approaches have been proposed. Bayesian model averaging attaches probabilities to each individual model and then averages the models based on these probabilities. As common in Bayesian methods, application of the Bayesian averaging approach requires determination of prior probabilities for each model. Although this requirement can be transferred to specification of only one hyper-parameter - the expected model size (number of variables in regression in our context), the choice of this parameter may have a significant influence on posterior (final) probabilities for individual models (Ley and Steel, 2008).

Frequentist model averaging in turn selects models' weights using a suitable well-defined criterion. Different criteria have been proposed in the literature, see Buckland, Burnham and Austin (1997), Yang (2001), Hjort and Claeskens (2003), Yuan and Yang (2005), Hansen (2007), Liang, Zou, Wan, Zhang (2010). Most of the methods exclude heteroscedasticity and/or consider nested setup³, which limits their applicability to the CA analysis. Recently, Hansen and Racine (2012) proposed the Jackknife Model Averaging (JMA) estimator for non-nested and heteroscedastic models where the weights are chosen by minimizing a leave-one-out cross-validation criterion. Liu (2012) extend their results to cover the time series case and we apply this method in our empirical analysis.

In particular, let y_t denotes the CA to GDP ratio (the dependent variable), while X_t is the d -dimensional vector of the previously described explanatory variables. We are interested in estimating a following simple regression model:

$$y_t = X_t\beta + u_t \tag{1}$$

$$E(u_t | X_t) = 0 \tag{2}$$

$$E(u_t^2 | X_t) = \sigma^2(X_t) \tag{3}$$

where u_t is random term that is allowed to be heteroscedastic and no assumption on the distribution of the error term is imposed. Let M be the number of models where each model

²Hansen (2007) showed that the frequentist averaging estimator can achieve lower mean-squared error than any individual estimator.

³Nested in the present context means that one starts with a simple 2-variable regression (include variables X and Z for example), and then all subsequent candidate regressions (models) include expanding number of explanatory variables - (X,Z,W), then (X,Z,W,P) and so forth. Non-nested setup implies that one can also include combinations of variables that do not coincide, for example (X,Z,W), (P,Q,V) and so on.

$m=1 \dots M$, represents a particular subset of the explanatory variables $X_{t,m}$ whose dimension is smaller than d . The OLS parameter estimate for the m^{th} model is simply:

$$\tilde{\beta}_m = (X'_m X_m)^{-1} X'_m y \quad (4)$$

The averaging estimator for the full regression model is:

$$\tilde{\beta}_m = \sum_{m=1}^M w_m \tilde{\beta}_m \quad (5)$$

where the the continuous weights w_m are assumed to be non-negative and sum to one.

The JMA estimator selects the weights by minimizing a leave-one-out cross-validation criterion. Hansen and Racine (2012) showed that the average squared error of the JMA estimator asymptotically attains the lowest average squared error among all feasible weight vectors. The leave-one-out estimate of the expected true error is:

$$CV_t(w) = \frac{1}{T} w' \tilde{u}'_{-i} \tilde{u}_{-i} w \quad (6)$$

where $\tilde{u}_{-i} = (\tilde{u}_{-i,1}, \dots, \tilde{u}_{-i,M})$ is a $T \times M$ matrix of leave-one-out residuals where $\tilde{u}_{-i,m}$ are the residuals from the m^{th} model estimated by least squares excluding the i^{th} observation. The jackknife choice of vector w_m is the value of w_m which minimizes $CV_t(m)$.

3 Current Account Determinants

Following the empirical evidence from a large number of studies for emerging and developing countries below we outline the main prospective determinants of the CA behavior.

CA persistence. Empirical studies document the strong persistence in the CA movements. Theoretically, this can be related to habit formation in the consumption and savings of countries or agglomeration effects in investment which suggests a certain degree of inertia in the CA. We capture the persistence by including the lagged values of the dependent variable.

Initial level of NFA. The level of NFA can have two opposite effects on the CA dynamics. On one hand, countries with higher NFA tend to benefit from higher net foreign income inflows (on accumulated net assets), implying a positive relationship between the NFA and the CA balance. On the other hand, countries with higher NFA can run larger trade deficits while remaining externally solvent, giving rise to a potentially negative relationship. The NFA position as a ratio to GDP is computed at the beginning of each period to avoid the balance sheet link from the CA balance on the NFA at the end of the period.

Oil balance. If a country is highly dependent on oil imports, higher oil prices contribute negatively to the CA developments. The variable used is the oil trade balance in percentage of GDP, implying a positive relationship with the CA.

Real effective exchange rate. The REER is used as a measure of overall export competitiveness. Note that the REER is defined such that an increase in the REER implies appreciation of the exchange rate, hence the corresponding parameter should have a negative sign since depreciation of the REER should lead to the CA improvements by making exports more attractive and imports less attractive (to domestic residents). Since agents do not react to REER changes immediately, but they rather have cumulative effect, we measure REER as four quarters moving window.

Trade integration – openness. Trade openness can have two opposite effects on the CA dynamics. On one hand, as a proxy for trade barriers (or the trade costs), less open countries may improve the CA through lower imports, suggesting a negative relationship. Moreover, more open countries tend to generate larger foreign exchange earnings and have better ability to service the external debt making them more attractive for foreign capital. This in turn increases the available sources of external financing and relaxes the constraints on CA deficit financing. The latter effect however may also work in the opposite direction - less open economies may have more difficulties in servicing external liabilities, leading to CA deterioration due to higher debt services. Moreover, the more open economy is, the larger are the effects on the CA from a relatively small improvements in exports. We use a standard measure of openness in the literature – the share of exports and imports in GDP as a deviation from the weighted average of the trading partners.

The underlying assumption of the intertemporal approach to the CA is that movements in the CA reflect factors that affect country's underlying saving and investment positions. Investments potentially have several effects on the CA balance. As discussed above, higher investment rates may be associated with higher expected productivity gains and income increases contributing to the present CA deficit through consumption smoothing channel. In addition, being a component of domestic demand, higher investment rates directly affect the worsening of the trade balance in emerging and developing countries. Contrary to investments, higher domestic savings have positive effect on the CA through lower current domestic consumption and lower borrowing from abroad. We therefore include several determinants of the investment-savings relation.

Economic growth. The link between the GDP growth and the CA is one of the key elements of the intertemporal approach to CA. Since the households are more likely to expect future income increases in a growing economy, they will be also more willing to increase consumption now and consequently the CA balance may deteriorate. Higher growth rates in the economy relative to its trading partners thus potentially may have a negative effect on the CA. We use real GDP growth as a deviation from the weighted average of the trading partners as a measure of economic growth.

Relative income. Economies with low income are expected to have higher CA deficits due to a strong need for financing its economic and financial development. Conversely, as the country reaches mature stages of the development, its CA should improve since the country that expects to see its relative income diminishing in the future, should have a higher current

savings rate (Engel and Rogers, 2006). Deviation of the real GDP per capita from the weighted average of the trading partners is used as a proxy for the relative income. A positive sign is expected.

Demographic variables. Demographic trends may have an effect on the CA through its impact on national savings decisions – countries with higher share of economically inactive population are expected to have a lower level of national savings and consequently lower CA balance. Deviation of the growth rate of population from the weighted average of the trading partners is used as a proxy for the dependent population share.

Foreign direct investment (lagged). The foreign direct inflows have been of significant importance for financing CA deficits of emerging economies. However, gross foreign direct inflows may also have a direct negative effect on the CA depending on its import content and whether FDI increases investment or acquires existing capital stocks. We use gross foreign direct inflows in percentage of GDP. FDI are measured by using four quarter moving averages in order to include their long run effect on CA balance.

Terms of trade. Terms of trade (ToT) also have potentially two distinct effects on the CA balance through saving and investment channels. Positive ToT shocks ceteris paribus lead to an improvement in the CA via increase in savings due to larger current income relative to the permanent income (the Harberger-Laursen-Metzler effect). However, changes in the terms of trade may also affect the optimal capital stock and hence the investment plans leading to worsening of the CA. The prevalence of the channels depends on the persistence of ToT shocks – the greater the persistence, the more dominant is the investment effect.

Financial development. The overall effects of financial development on the CA are ambiguous. Financial development could provide incentive for savings and potentially improvement in the CA, but may also make borrowing easier and consequently lead to a large increase in domestic demand. The latter effect may be dominant in emerging and developing countries. We use credit to private sector to GDP ratio as a measure of financial development.

Fiscal balance. To the extent that the full Ricardian equivalence holds, there should be no relation between the budget and CA deficit. The “twin deficit” hypothesis and different overlapping generations models however suggest the existence of a positive link between the two deficits.

Structural changes. To take into account potential outliers in the data we include a dummy variable for VAT introduction, 2008-2009 crises and high remittance inflows for Serbia and EU accession and crisis dummy for other countries.

4 Data and the Results

The majority of the data, for compatibility reasons, come from the EUROSTAT database. For REER we use the World Banks’ WDI database. The quarterly data on NFA come from

the national central banks' databases and EUROSTAT. The weights for trading partners are based on the average importance of each country as export destination for all countries in our sample; they are calculated using the COMTRADE data for 2002-2004 and 2008-2010. The final weights include 25 largest trading partners, which constitute around 80% of the value of overall non-oil exports. Data for Serbia come from the National Bank of Serbia and National Statistical Office. The longest time period for which all of the data are available is 2000:Q1 to 2011:Q4 for the Czech Republic. Sample for Hungary and Poland covers period from 2000:Q2 to 2011:Q4, for Romania from 2002:Q1 to 2011:Q4 and for Serbia the period from 2002:Q2 to 2011:Q4.

Before applying the model averaging to study the determinants of the CA movements we check the order of integration of the individual series as the methodology is valid only in case of stationary variables. Table 1 presents the results from the Kwiatkowski et al. (KPSS, 1992) test of a null hypothesis that an observable time series is stationary. A careful examination of the series for which KPSS rejects the null of stationarity suggests the presence of structural breaks. To control for structural brakes we implement Zivot and Andrews (1992) test and the results suggest the stationarity of all series. Although the length of the sample is relatively short, the results suggest the stationarity of the CA series, giving also some support for (in sample) CA sustainability.

[Insert Table 1 about here]

Table 2 presents the main results of this section. We estimate all possible models with four, five and six variables included (2211 models in total) for each country in our sample. The reported estimates are the weighted averages of the (non-zero weight) models. Different signs and magnitudes of coefficients indicate heterogeneity among countries providing empirical support for the country-level analysis.

All variables are found to be significant (at least for some countries) and have expected signs and magnitudes mostly in line with the existing empirical literature.

Second row of Table 2 shows relatively higher *persistence* of the CA balances in Hungary, Poland and Romania compared to Serbia and Czech Republic, indicating slower CA adjustment to transitory shocks for these countries⁴. Coefficient on the *NFA stock* is negative for the Czech Republic, Hungary and Romania. Since the NFA was worsening over the past decade, this implies that reaching higher negative levels of the foreign exposure imposes a (more binding) constraint on worsening of the trade balance (depending on a structure of the NFA) and a stimulus for the CA improvements. The *oil balance* is contributing negatively in all countries apart from the Czech Republic, although its influence becomes stronger in the less developed countries (Romania and Serbia). The fact that the estimated coefficient is smaller than one

⁴As Beidas-Strom and Cashin (2011) note, lower CA persistence may also represent greater likelihood of CA reversals.

implies that imports of other goods may compress as the oil prices increase. *REER*⁵ is also contributing negatively to the CA in all countries. This effect is higher in Serbia, Romania and Poland indicating stronger effects of real appreciation to CA deterioration in these countries and implying some role for the exchange rate policy in the external adjustment. Conversely, the *trade openness* has different effect among the countries – it tends to improve the CA in Hungary, while the effect is negative in all other countries. Since Hungary is the country with the largest openness ratio in our sample, this seems to suggest the existence of a threshold after which the higher trade integration brings a positive effect on the CA. *Real GDP growth* contributes negatively to CA balance for all countries except for Czech Republic where the opposite sign is observed. This may be due to the fact that GDP growth in Czech Republic was driven by net exports which also contributed to CA improvement. Higher “catching up” effect led to larger contributions of *real GDP growth* and *FDI* to CA deficits in Serbia and Romania. Analogously to Hermann and Jochem (2005) we find significant impact of *relative income* to CA balance in Poland and Czech Republic. This finding indicates the ability of convergence process to explain a large part of the past deficits in these countries. As in Rahman (2008) *financial development* measured by private sector credit to GDP is negatively affecting CA balance. The effect was more pronounced in Serbia and Romania, indicating larger credit activity expansion in these countries. Positive coefficient on *fiscal balance* in all countries supports the “twin deficits” hypothesis. However, except for Serbia where fiscal balance contributed positively to CA balance due to privatization revenues, in other countries the contribution was negative, since the fiscal deficit of these countries was higher relative to their main trading partners. *Terms of trade* have a more diverse influence. They contribute to CA improvement in Romania and Hungary, suggesting the dominance of the savings channel, whilst investment effect is prevalent in the Czech Republic.

[Insert Table 2 about here]

Figure 1 reports actual CA, model CA and contributions (two-year averages) for select CEE countries. In line with CGER (2006) high contribution of CA persistence is seen for all countries, except for the Czech Republic. This finding may suggest that CA persistence is driven not just by habit persistence, but also income outflows generated by debt accumulation from previous periods, since these outflows are the largest negative component of CA balance for the majority of the countries in our sample (Hungary, Poland and Czech Republic). In Serbia, the negative oil balance, the FDI inflows and the REER appreciation significantly contributed to the CA balance deterioration. Similarly, the CA balance in Romania is significantly affected by the FDI inflows and REER movements, although the latter has slightly larger contribution. Both Poland’s and the Czech’s CA deficits are largely explained by the relative income convergence. However, while REER has higher impact in Poland, the trade openness plays a more important role in explaining CA developments in the Czech Republic. Oil balance and FDI inflows had the largest negative effect in Hungary where trade openness and negatively expanding NFA

⁵We separately estimated specifications where the REER is defined using various moving averages windows and selected the specification which maximizes the R2 (since two separate REERs cannot be included in the model averaging procedure).

position yield improvements in the CA balance.

[Insert Figure 1 about here]

Looking at dynamics, the largest change in contributions to CA balance in Serbia and Romania is seen for the FDI inflows which contributed increasingly to the deficit over 2002-2009, while its contribution in both countries fell more than one percentage point over 2010-2011. Lower consumption (as evident from CA persistence dynamics) and FDI inflows accompanied by increasingly positive contribution of trade openness were behind CA reversal in Hungary in the last two-year period. The importance of the main determinants of Poland's CA balance contrary remained relatively stable over the sample. In the Czech Republic the NFA significantly increased its contribution to the CA balance, while the FDI inflows become less influential.

Figure 2 show that the model tracks the past CA movements rather well for countries in our sample. It captures relative volatility of the CA as well as CA trends in both depreciation and appreciation periods.

[Insert Figure 2 about here]

5 Concluding Remarks

We study determinants of CA balances in CEE inflation targeting countries (the Czech Republic, Hungary, Poland, Romania and Serbia) over the past decade. Using model averaging techniques we focus the analysis to individual country's data only and find a large heterogeneity in signs and magnitudes of influence of potential determinants among countries. The results for all five countries suggest that the model tracks CA movements over the past decade quite well. In particular, negative oil balance, the FDI inflows and REER appreciation significantly contributed to the CA deterioration in Serbia. CA balance in Romania is similarly negatively affected by the FDI inflows and REER movements. In contrast, both Poland's and Czech's CA deficits are largely explained by the relative income convergence. The estimates for Hungary suggest that higher trade integration and negatively expanding NFA position tend to improve the CA balance.

We believe that this paper presents a good starting point for assessing individual country's external position sustainability. Namely, one could use identified influences of macro-variables on CA balance to analyze the future paths of the NFA under different scenarios on the evolution of the determinants. In this way, it would be possible to generate a rich set of possible outcomes for the external position of the country while not imposing any steady-state assumption on the evolution of the economy. Focusing on the NFA relates to the other side of the sustainability coin – the CA deficits are sustainable as long as foreigners are willing to finance it, which is, in turn, ultimately connected to the accumulated level of the NFA.

6 Appendix: Variable Descriptions and Their Expected Signs

Variable/regressor	Expected sign	Variable description
Constant	ambiguous	-
Lagged dependent	+	Lagged CA to GDP ratio
Initial NFA	ambiguous	Net Foreign Assets to GDP ratio, at beginning of period to avoid the balance sheet link from the CA balance on the NFA at the end of the period
Oil balance	+	Oil trade balance to GDP ratio
REER*	-	Logarithm of trade-weighted real exchange rate, four quarter moving average, from 2 to 6 previous quarters
Trade openness	ambiguous	Ratio of total exports and imports to GDP
Real GDP growth	-	Difference between real GDP growth and the weighted average of the trading partners GDP growth
FDI*	-	FDI inflows to GDP ratio, four quarter moving average, from 4 to 8 previous quarters
Relative income	+	Difference between the real GDP per capita and the weighted average of the trading partners GDP per capita
Terms of trade shocks	ambiguous	Residuals from the terms of trade autoregression
Financial development	-	Private sector credit to GDP ratio
Fiscal balance	+	Difference between fiscal balance and the weighted average of the trading partners fiscal balances
Dummy for VAT, crisis and remittances	ambiguous	VAT introduction, 2008-2009 crises and high remittance inflows for Serbia, EU accession and 2008-2009 crisis dummy for other countries

* Since agents do not react to REER changes immediately, average changes in REER rather have cumulative effect, we measure REER as four quarters moving average. We also measure FDI as four quarters moving average to include their long run effects on CA balance.

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Table 1 Unit root tests results

Country	Test/variable	Current account	Current account (-1)	NFA	Oil balance	REER	Trade openness	GDP growth	FDI	Relative income	ToT shocks	Financial development	Fiscal balance
Serbia	KPSS test	0.140	0.198	0.149*	0.141	0.105	0.117	0.135	0.189*	0.086	0.056	0.093	0.090
	Zivot-Andrews test			0.00***					0.012**				
Romania	KPSS test	0.170	0.162	0.169*	0.076	0.126*	0.138*	0.083	0.280	0.064	0.541**	0.110	0.141
	Zivot-Andrews test			0.03**		0.02**	0.01***				0.00***		
Hungary	KPSS test	0.186**	0.179**	0.112	0.086	0.184**	0.148**	0.115	0.078	0.120*	0.114	0.060	0.524**
	Zivot-Andrews test	0.00***	0.00***			0.03**	0.00***			0.03**			0.01**
Poland	KPSS test	0.152	0.171	0.074	0.077	0.063	0.152**	0.099	0.125	0.189	0.081	0.146	0.173
	Zivot-Andrews test						0.00***						
Czech Republic	KPSS test	0.092	0.103	0.052	0.086	0.069	0.113	0.194**	0.054	0.113	0.158	0.175**	0.500***
	Zivot-Andrews test								0.044**			0.01***	0.00***

* significant at 10% percent level; **significant at 5% percent level; ***significant at 1% percent level;

In KPSS test the stationarity null hypothesis is tested against the alternative of unit root.

Zivot and Andrews (1992) $t(\alpha)$ -test. H_0 : I(1) without break; H_A : I(0) with one endogenous break in the trend function

Table 2 Parameter estimates and average CA contributions

	Coefficient estimates					Average contributions				
	Serbia	Romania	Hungary	Poland	Czech Republic	Serbia	Romania	Hungary	Poland	Czech Republic
Constant	-2.535	0.862	-2.618	3.846	1.977	-2.535	0.862	-2.618	3.846	1.980
Lagged dependent	0.327	0.599	0.736	0.659	0.133	-3.317	-4.543	-4.117	-2.847	-0.480
Initial NFA	0.007	-0.017	-0.018	0.005	-0.027	-0.350	0.693	1.604	-0.214	0.770
Oil balance	0.473	0.569	0.189	0.195	-	-1.945	-0.736	-0.651	-0.468	-
REER	-0.247	-0.409	-0.041	-0.317	-0.056	-1.152	-1.873	-0.188	-1.452	-0.262
Trade openness	-0.001	0.000	0.021	-0.013	-0.031	0.002	-0.003	1.414	0.123	-1.137
Real GDP growth	-0.378	-0.539	-0.075	-0.013	0.051	-0.161	-0.364	-0.008	-0.008	0.017
FDI	-0.295	-0.278	-0.111	-0.008	-0.088	-1.449	-1.435	-0.510	-0.031	-0.531
Relative income	0.005	-	0.008	0.064	0.114	-0.140	-	-0.327	-3.178	-3.921
Financial development	-0.063	-0.002	-	-0.020	0.000	-0.257	-0.208	-	-0.052	-0.071
Fiscal balance	0.124	0.019	0.019	0.003	0.026	0.180	-0.018	-0.035	-0.005	-0.026
Terms of trade	-	0.025	0.089	-	-0.068	-	0.002	-0.001	-	0.000
Dummy for VAT, crisis and remittances	6.487	1.527	1.435	0.506	-2.248	0.487	0.153	0.060	0.053	0.094
Model CA						-10.636	-7.470	-5.377	-4.233	-3.576
Actual CA						-10.708	-7.492	-5.401	-4.244	-3.592
R ²	0.379	0.698	0.761	0.614	0.521					

Figure 1 Actual CA, model CA and contributions to CA balance – two- year averages, as % of GDP

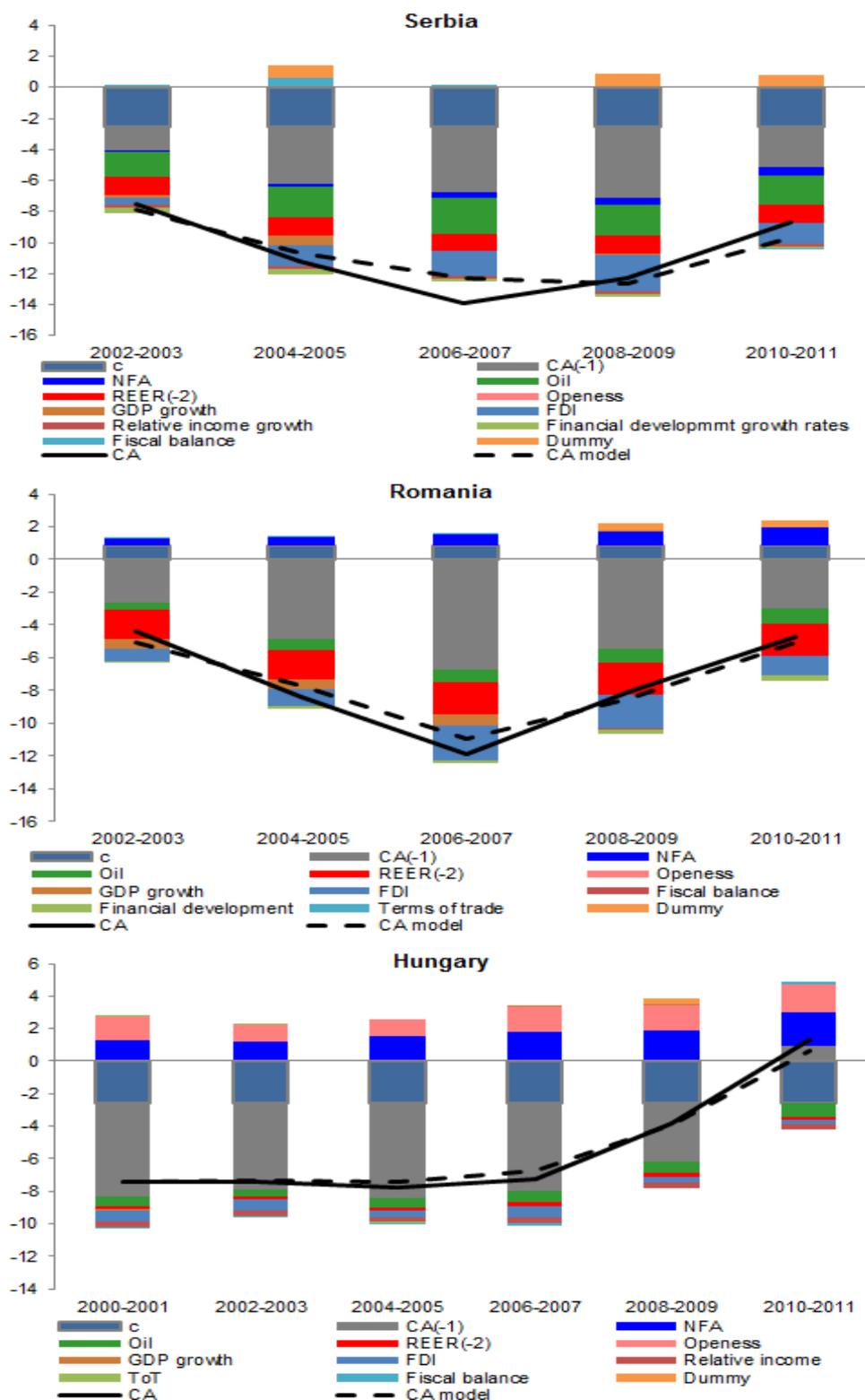


Figure 1 Continued

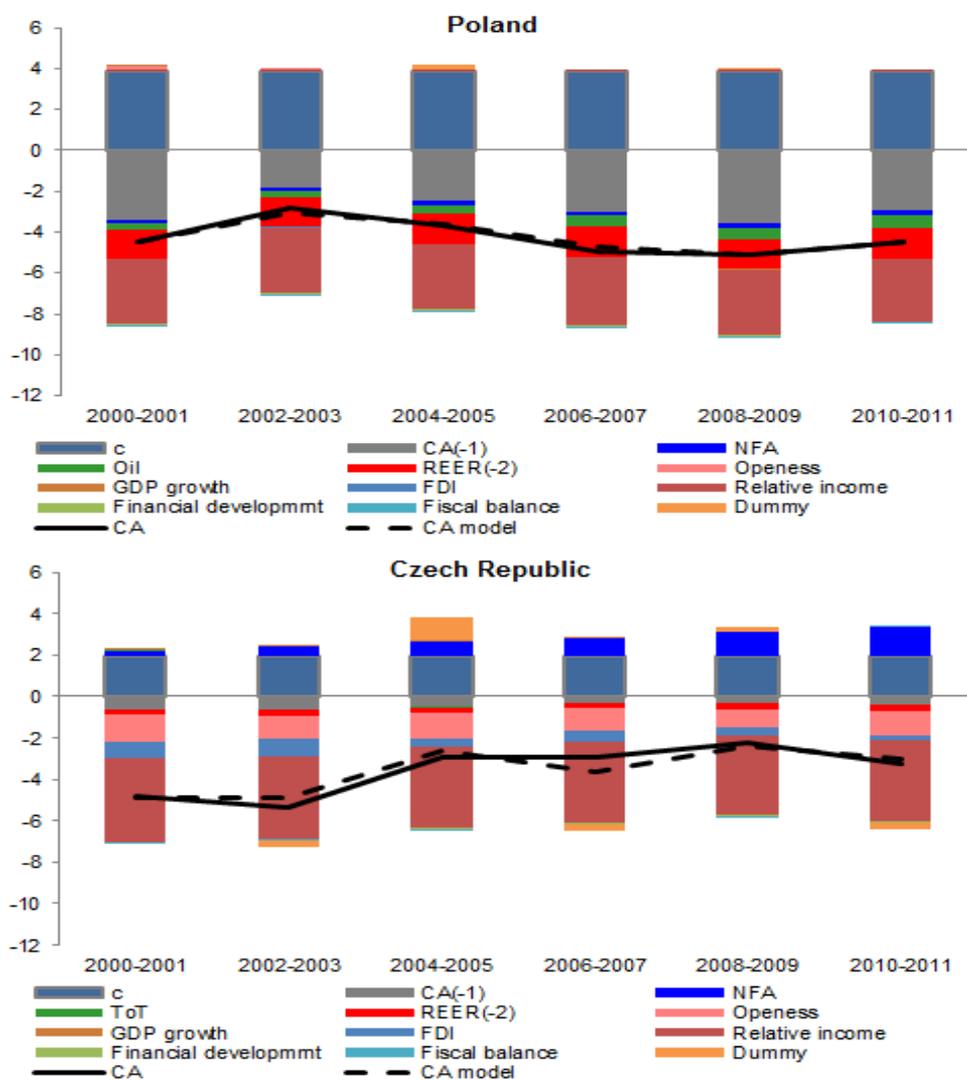


Figure 2 Actual vs. model CA, as percentage of GDP

