A Test of Intertemporal Model of Current Account: Evidence from the Czech Republic, Hungary, Poland and Slovakia[1]

*Vít POŠTA**

Abstract

A current account may be viewed as an indicator of an imbalance between savings and investments in an economy. One of the key issues is the degree to which consumption is sensitive to actual temporary changes in current income. Modern intertemporal approach builds on permanent income hypothesis, which concludes that the sensitivity of consumption (and savings) to temporary changes in income is low. The paper formulates a simple intertemporal model of current account and employs the present value test of the model in the cases of the Czech Republic, Hungary, Poland and Slovakia. It further focuses on the role of habits in modeling current accounts. The results show that a simple intertemporal model has some descriptive power, especially in the case of the Czech Republic, but overall it gives rather poor results. It is the assumption that the economy consists strictly of ricardian agents that seems to be the main reason behind the empirical failure.

Keywords: *current account, intertemporal model, permanent income hypothesis, present value test*

JEL Classification: E21, F32, F41

Introduction

A current account of a balance of payments, as it will be derived further in the paper, may be viewed as a difference between economy's savings and investments, hence it points to possible imbalances which may exist within an economy. Typically, transitive economies run current account deficits because

* Vít POŠTA, University of Economics, Prague, Faculty of Business Administration, Department of Microeconomics, Nám. W. Churchilla 4, 130 67 Prague 3, Czech Republic; e-mail: vit.posta@vse.cz

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they offer huge investment opportunities on one hand, but lack sufficient amount of savings on the other hand. Therefore, they resort to foreign supply of capital, which fills the gap between investments and savings and results in a current account deficit. The current account deficit may be brought about in three ways: either by a balance of goods and services deficit, a balance of income (and transfers) deficit or both. It will be shown that the pattern of current account deficits differs across the economies under investigation.

When analyzing and forecasting behavior of a current account, one of the key questions to be asked (and answered) is to what extent the consumption of households is dependent on the actual and temporary changes in income, or to put it another way, to what extent it depends on wealth. In this sense a test of an intertemporal model, which typically assumes that consumption depends on wealth, is nothing but a test of permanent income hypothesis (PIH) in an open economy. The answer to this question is crucial for understanding the impact of various shocks, which usually, sooner or later, result in temporary or permanent changes in income, on current account behavior.

One of the first theoretical presentations of an intertemporal model of a current account within the representative agent framework is given by Sachs (1982). Many years later Obstfeld and Rogoff (1995) gave, from today's perspective, a standard textbook exposition of the issue under various conditions of an economy.

Three approaches to testing an intertemporal model of a current account have been established. The first one rests on applying the present value model as introduced by Campbell (1987), who tested the permanent income hypothesis within a closed economy. Also Campbell and Shiller (1988) applied this approach within the context of financial markets. The second strand of empirical research uses the productivity approach to testing the model as presented by Glick and Rogoff (1995). The Glick and Rogoff approach builds on the productivity series, which has to be estimated for the economy in question. The third approach taken recently by Gil, Lian and Yoonbai (2012) uses structural VARs. Regarding the difficulties with the estimation of potential product, which would be necessary to obtain a series of productivity shock in transitive economies, and the fact that structural VARs are rather data-intensive, I resort to the first method.

One of the first applications of the methodology of Campbell (1987) to an open economy context is given by Sheffrin and Woo (1990). Ghosh (1995) also applies this model, but mainly to find an answer to a little different question. He compares the volatility of the forecast of the current account given by the model with the volatility of the actual current account to assess the intensity of capital mobility. The question is crucial as high (perfect) capital mobility is an important

assumption in many economic models. As Feldstein and Horioka (1980) implied in their famous paper, the mobility may not be high enough. It follows from their finding of high correlation between savings and investments. However, as Obstfeld (1985) and Cardia (1991) show, high or even perfect capital mobility does not need to imply zero correlation between savings and investments as many exogenous shocks may lead to positive correlation between the two. Ghosh (1995) finds that in some cases the variability of the actual current account even exceeds the volatility implied by the model pointing to high capital mobility between economies. Brada, Mandel and Tomsik (2008) also examine this issue stressing the changes in the amount of foreign direct investments being transferred among the economies in the past decades.

In many cases the diagnostics of the estimated model under the present value approach does not comply with the econometrical implications. Gruber (2000) tries to solve this problem by employing habits introduced by Constantinides (1990), who used habit formation in utility function trying to solve the so-called equity premium puzzle (inability of intertemporal models to match relatively high premiums observed in actual data). Gruber (2000) shows that the use of habits, which are widely used in the new open macroeconomics modeling, improves both the fit of the estimated model and morover its diagnostics. Bergin and Sheffrin (2000) introduce another interesting feature in the present value testing of an intertemporal model of a current account. They add real interest rate and the effect of real exchange rate into the model. Unfortunately, the length of some of the series necessary to carry out such an analysis would significantly cut the whole sample within which the analyses presented further below were carried out. Thus the effect of the real exchange rate is not examined in the paper. Nason and Rogers (2003) point out the key problems of the present value testing. Lau, Baharumshah and Habibullah (2007) give one of the first analyses of this kind for a sample of less developed countries.

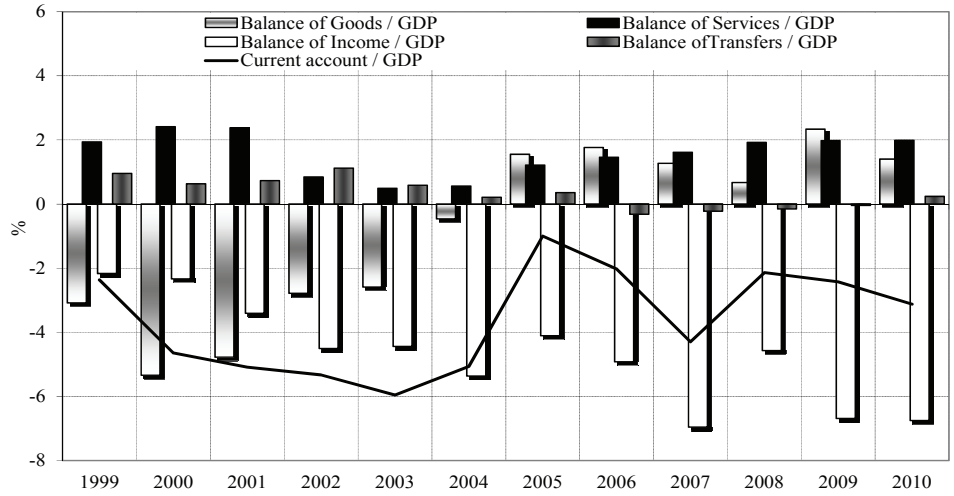
The paper is structured as follows. First some stylized facts on the development of the current accounts in the four economies are presented, then a standard derivation of the theoretical model is given. The model is based on the assumption of smoothing the level of consumption at first and then a model with habits is presented. The real interest rate is assumed to be constant in both models and the role of real exchange rate is not considered. Next the derivation of the theoretical model is followed by a presentation of the econometrical model and the hypotheses which are further tested. Then the data is introduced and the empirical estimates and results of the hypotheses tests are presented and discussed. Further analysis to tackle the rather poor results of the tests is pursued. Finally, the main findings of the paper are summarized.

1. Some Stylized Facts

To paint a general picture of what is modeled in the paper, some basic facts on the development of the current accounts of the four economies are given below. The output is based on data obtained from Eurostat. Figures 1 through 4 capture the behavior of the ratios of current account to GDP (*Gross Domestic Product*) and also the ratios of the four main components of the current account, i.e. balance of goods to GDP, balance of services to GDP, balance of income to GDP and balance of transfers to GDP.

F i g u r e 1

Czech Republic – Current Account to GDP and its Breakdown



Source: Own computation.

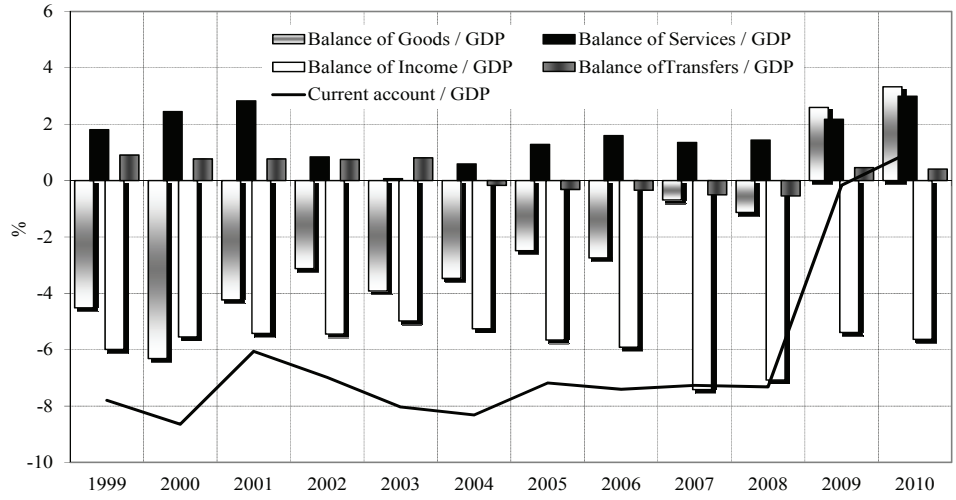
It is not surprising that all the four countries ran current account deficits throughout the sample with the exception of Hungary in 2010. The explanation of this phenomenon was given above. The development in Hungary in 2010 was influenced by a deep recession in 2009. Household consumption, as a result of the decline in GDP and huge foreign indebtedness, decreased not only in 2009 but also in 2010. Gross fixed capital formation also dropped in both 2009 and 2010. These two factors lead to much lower dynamics of imports of goods resulting in an increase of balance of goods, which was significantly positive in 2009 and 2010. This was the main factor behind the mildly positive current account balance in 2010. It is visible that in 2009 (where the Czech Republic, Hungary and Slovakia were in recession and Poland went through a slowdown) the ratios of current account deficit to GDP improved, except for the Czech Republic.

The ratios of deficits to GDP tended to keep their levels (the case of the Czech Republic and Poland) or improve (Hungary and Slovakia) in the last years of the sample.

The ratio of current account deficit to GDP in the Czech Republic was significantly improved in 2005. This is connected with the fact that the overall balance of goods and services moved into positive values in 2005 and stayed in that region. The current account deficit is thus caused mainly by the balance of income deficit due to high outflows of both repatriated and reinvested profits as a result of high FDI (*Foreing Direct Investment*) inflows.

F i g u r e 2

Hungary – Current Account to GDP and its Breakdown



Source: Own computation.

The ratio of current account deficit to GDP kept at around 8% in Hungary until 2009. The deficit of balance of goods tended to decrease over the years, however, as compared with the Czech Republic the high surpluses in 2009 and 2010 cannot be regarded as a persuasive signal. It still seems to be especially due to constrained domestic demand rather than a result of increased competitiveness. The deficit of balance of income is also significant as in the previous case.

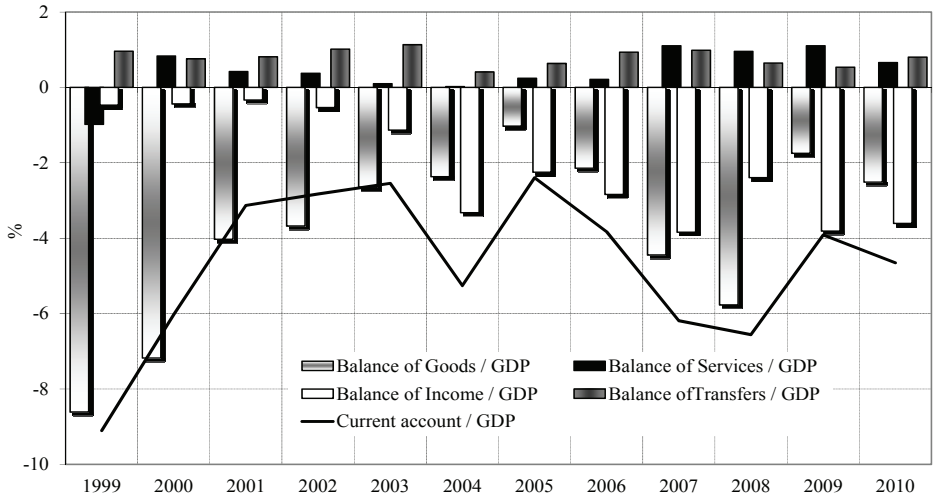
In the case of Poland the deficit of balance of goods was present throughout the sample, and in comparison with the Czech Republic and Hungary the deficit of balance of income kept at much lower figures in the beginning of the sample.

As in the case of Poland, the development of the deficit of balance of goods in Slovakia did not show any plausible trends although it increased into positive region in 2009 which, however, might as well be a transitory effect due to

constrained domestic demand. This is supported by the decrease of positive balance of goods in 2010. There is one more feature Slovakia and Poland have in common and that is a relatively low deficit of balance of income in the beginning of the sample.

F i g u r e 3

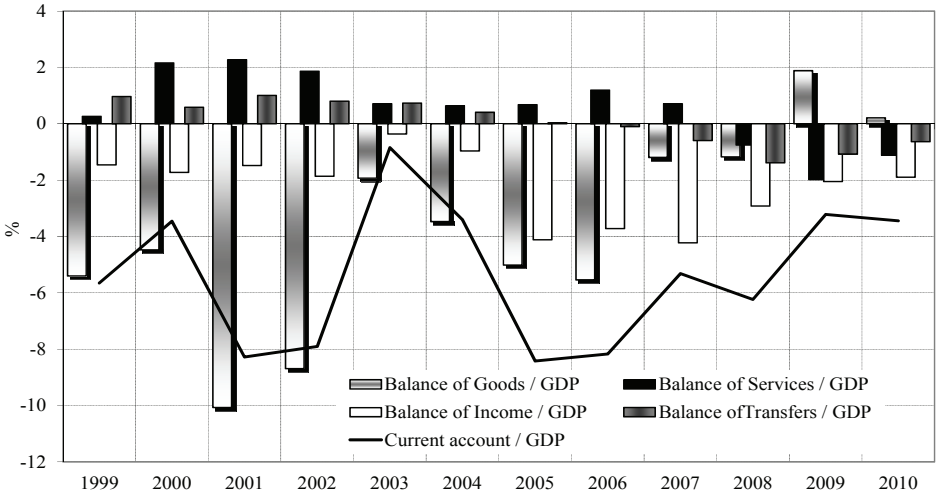
Poland – Current Account to GDP and its Breakdown



Source: Own computation.

F i g u r e 4

Slovakia – Current Account to GDP and its Breakdown



Source: Own computation.

2. Theoretical and Econometrical Model

2.1. Intertemporal Model of Current Account

Let's assume an infinitely lived representative agent whose aim is to maximize the expected utility, which depends on the level of consumption , in discrete time. The agent is constrained by their exogenously given income and interest income, which is dependent on the stock of riskless foreign bonds they hold and real (world) interest rate. The income is used for consumption, investment and government expenditures and the excess is saved in the form of the asset or the stock of the asset is decumulated in the case the income fails to cover the expenditures. Transversality condition is imposed upon the optimization problem so that the agent cannot run deficit or surplus forever. The period utility function is assumed to be strictly increasing in consumption and strictly concave. Solving a dynamic problem of this type yields a typical Euler equation, e.g. Obstfeld and Rogoff (1995):

$$u'(C_s) = \beta(1+r)E_t u'(C_{s+1}) \tag{1}$$

Assuming that the subjective discount factor equals the market discount factor gives the equality of current and future expected marginal utility of consumption, i.e. the equality of current and future expected level of consumption. One can easily derive the consumption function:

$$C_t = \frac{\beta(1+r)^2 - 1}{\beta(1+r)^2}\left[(1+r)B_t + \sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} E_t\left(Y_s - I_s - G_s\right)\right] \tag{2}$$

The consumption consists of two parts: the consumption smoothing motive and consumption tilting motive, which arises when the subjective discount factor is not equal to the market discount factor. Following Gosh (1995) it can be expressed as:

$$C_t = \frac{r}{\Theta}\left[B_t + \frac{1}{1+r}\sum_{s=t}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} E_t\left(Y_s - I_s - G_s\right)\right] \tag{3}$$

where Θ is the consumption tilting factor: $\Theta = \dfrac{\beta(1+r)r}{\beta(1+r)^2 - 1}$

Current account takes on the following form:

$$CA_t \equiv B_{t+1} - B_t = -\sum_{s=t+1}^{\infty}\left(\frac{1}{1+r}\right)^{s-t} E_t \Delta NO_s \tag{4}$$

where *NO* denotes net output, i.e. difference between income on one hand and investments and government consumption on the other. Equation (4) states that the value of current account should be equal to the negative value of discounted expected changes in net output. For example, if the agent expects a temporary increase in real income, they save today (increase the stock of foreign bonds) to smooth consumption. From the point of view of the consumption function (3), consumption hardly reacts to temporary increases in income. This stands in stark contrast to the income approach to the current account, which assumes that consumption is dependent primarily on the actual level of income. Such an assumption results in opposite effects on current account behavior. Equation (4) represents the first version of the intertemporal model to be tested in the paper.

Following Gruber (2000) and Gruber (2002) habits will be employed in the utility function. Let's assume that the utility function takes the form:

$$U_t = E_t \sum_{s=t}^{\infty} \beta^{s-t} u\left(C_s - \gamma C_{s-1}\right) \tag{5}$$

where γ denotes rate of depreciation of past consumption (also habit persistence). It means that the agent draws utility not from the current level of consumption but rather from the change in consumption between the current level and depreciated past level. Following Gruber (2000) and assuming quadratic utility function, the consumption function then is:

$$C_t = \frac{\gamma}{1+r} C_{t-1} + \left(1 - \frac{\gamma}{1+r}\right) \left[rB_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} E_t\left(Y_s - I_s - G_s\right) \right] \tag{6}$$

Comparing (6) to (3) it is assumed that the consumption tilting motive is equal to 1. The behavior of consumption in the two regimes may be rather different. The higher the factor of depreciation γ (the closer to 1), the more the agent cares about the change in consumption. Thus, assuming an unexpected temporary increase in income, the agent does not allocate all the increase to consumption level, but they increase the consumption so that the growth of consumption remains unchanged. The higher the depreciation factor, the more the agent behaves as if they smooth the growth of consumption. The current account formula is:

$$CA_t \equiv B_{t+1} - B_t = \gamma CA_{t-1} + \frac{\gamma}{1+r} NO_{t-1} - \left(1 - \frac{\gamma}{1+r}\right) \sum_{s=t+1}^{\infty} \left(\frac{1}{1+r}\right)^{s-t} E_t \Delta NO_s \tag{7}$$

Now the current account also depends past changes in net output and on past value of net output. An unexpected temporary increase in income does not have an abrupt positive impact on the current account as in the previous version of the model, but rather gradual positive impact.

2.2. Econometrical Model

The econometrical model employs the present value model introduced by Campbell (1987). To test the model in this way, the objective is to obtain the series of current account based on the theoretical model eq. (4) and (7). This in turn means it is necessary to estimate the expected changes in net output. The present value model builds on the idea, that assuming the underlying model is correct, all the relevant information on which the agent bases their expectations of future changes in net output is included in the values of actual current account series. Thus the theoretical series of current account may be recovered from a bivariate VAR model:

$$\begin{bmatrix} NO_t \\ CA_t \end{bmatrix} = \begin{bmatrix} \varphi_{11} & \varphi_{12} \\ \varphi_{21} & \varphi_{22} \end{bmatrix} \begin{bmatrix} NO_{t-1} \\ CA_{t-1} \end{bmatrix} + \begin{bmatrix} \eta_{1t} \\ \eta_{2t} \end{bmatrix} \tag{8}$$

where φs denote the coefficients of the transitory matrix and ηs the residuals. The series of changes in net output should be stationary, i.e. $I(1)$. The current account series given by the sum of discounted changes in net output should be therefore also stationary, i.e. $I(1)$. Thus the VAR should be stationary too and the infinite sum given by eq. (4) is:

$$CA_t = -[1,\ 0]\frac{\Phi}{1+r}\left[I - \frac{\Phi}{1+r}\right]^{-1}\begin{bmatrix} NO_t \\ CA_t \end{bmatrix} \tag{9}$$

where Φ is the transition matrix and I is the identity matrix. The basic model works with a consumption series adjusted for the consumption tilting motive as implied by the model. To obtain the adjusted series of consumption, i.e. to estimate consumption tilting factor, one can run a cointegration between consumption and net output. The resulting cointegration coefficient can be regarded as the consumption tilting factor, see Ghosh (1995).

In the case of habits, eq. (7), the infinite sum of the bivariate VAR is:

$$CA_t = \gamma CA_{t-1} + \frac{\gamma}{1+r}NO_{t-1} - [1,\ 0]\left(1 - \frac{\gamma}{1+r}\right)\frac{\Phi}{1+r}\left[I - \frac{\Phi}{1+r}\right]^{-1}\begin{bmatrix} NO_t \\ CA_t \end{bmatrix} \tag{10}$$

If the underlying model is correct and the empirical model well specified, the current account should Granger cause the following changes in net output. It holds because of the fact that the current account series contains more information relevant for future changes-in-net-output series than the past values of the changes-in-net-output series. Next, if the model is correct, the estimated and actual current account series should equal. Then the difference:

$$D_t = CA_t - NO_t - (1+r)CA_{t-1} \tag{11}$$

should not be significantly correlated with the lagged values of the series of current account and changes in net output.

3. Data

Data on quarterly national accounts were retrieved from Eurostat database running from the first quarter of 1996 to the second quarter of 2011 (in the case of Slovakia the sample starts with the first quarter of 1997). The net output series is computed as a difference between GDP, investment and government spending. This is deflated by GDP deflator and expressed in logs. As the computation is based on GDP rather than GNP the balance of income is excluded from the analysis. The current account series is computed by substracting log of adjusted consumption (adjusted for the tilting motive) from the net output series. Next, an estimate of real interest rate is needed. The economy of Euro area is taken as the approximation for the world economy. Quarterly series of one year nominal interest rate and quarterly series of inflation rate based on harmonized index of consumption prices (HICP) were retrieved from Eurostat database. Inflation expectation is modeled using a simple AR process (three lags). Based on the estimation I calibrate the real interest rate at 3 %, which is in line with many other analyses. It should be noted that the change in the real interest rate by 1 pp has little impact on the final estimates as it can be seen from eq. (9) and (10).

In table 1 results of ADF (augmented Dickey-Fuller) unit root tests for the series of adjusted consumption, net output and current account are given.

T a b l e 1

Unit Root Tests

Variable	t-statistic	Variable	t-statistic	Variable	t-statistic	Variable	t-statistic
Czech Republic				***Hungary***			
NO – level	–0.43305	NO – 1st diff	–9.62628***	NO – level	–0.85956	NO – 1st diff	–10.26471***
CA – level	–1.74735	CA – 1st diff	–9.47259***	CA – level	–0.78589	CA – 1st diff	–9.26186***
C – level	0.39514	C – 1st diff	–6.66961***	C – level	–2.07807	C – 1st diff	–6.83417***
Poland				***Slovakia***			
NO – level	–1.08272	NO – 1st diff	–12.27911***	NO – level	–0.73414	NO – 1st diff	–11.02968***
CA – level	–1.87190	CA – 1st diff	–8.74318***	CA – level	–2.56994	CA – 1st diff	–10.48035***
C – level	–1.74769	C – 1st diff	–10.60492***	C – level	–0.70453	C – 1st diff	–8.89078***

Notes: Variable codes: net output (NO), current account (CA), consumption (C). *,**,*** denotes the rejection of the null of a unit root at 10, 5, and 1%, respectively. In all cases of net output and consumption series trend was included in the regression upon the visual inspection of the series.

Source: Own computation.

The importnant finding is that the series of changes in net output can be considered stationary and also the series of differences of current account can be taken as stationary. Consumption is nonstationary in levels so that Johansen cointegration procedure can be run on the cosumption and net output in level to determine the consumption tilting parameter. The estimates of the consumption tilting parameter are very close to one, which is in accordance with the findings of Ghosh (1995). I don't present the results; they will be supplied upon request.

4. Results

4.1. VARs

The estimate of the underlying VAR model, eq. (8), is identical for both the cases: a model without and with habit formation. The VARs are constructed using the information criteria and residual diagnostics so that autocorrelation and heteroskedasticity are not statistically significant at usual levels and they approximately follow normal distribution. Table 2 presents the results of the estimated VAR models. In the cases of the Czech Republic, Hungary and Slovakia one lag was sufficient to achieve satisfactory behavior of residuals. In the case of Poland 3 lags had to be chosen to get rid of statistically significant heteroskedasticity (and to achieve joint normality) in residuals.

Generally, the equation for current account has significantly larger coefficient of determination, which is line with the theoretical model. Also the behavior of current account is much more driven by the past current account values than the past changes in net output, which is also in accordance with theory.

The estimations for the Czech Republic and Hungary show slightly higher coefficients of determination for the current account equation. As measured by the F-test, the model for Poland is the least significant one. Based on the results of the model, the current account series was estimated for each country according to eq. (9) in the case without habits and eq. (10) in the case with habit formation.

To see whether the estimated VARs capture the very basic logic of the intertemporal model of the current account, simple impulse – response output is given in Figure 5. The impulse – response functions show that a temporary increase in net output results in an increase in current account, which is in line with the intertemporal model. The reaction of the current account in the case of Poland is lower and adjustment longer, which corresponds to the fact that a higher order VAR was used.

T a b l e 2

VARs: **Estimates of Underlying VAR Models**

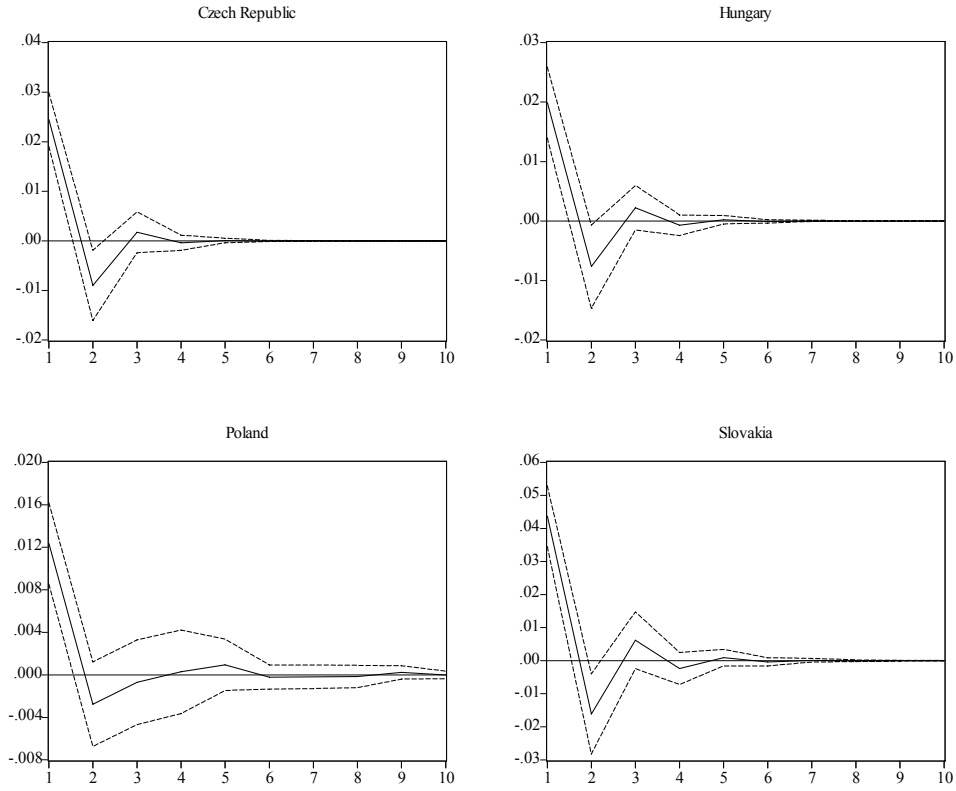
Czech Republic			**Hungary**		
	ΔNO_t	ΔCA_t		ΔNO_t	ΔCA_t
variable	coefficient (standard error)	coefficient (standard error)	variable	coefficient (standard error)	coefficient (standard error)
ΔNO_{t-1}	–0.25026 (0.12823)	–0.29601 (0.12644)	ΔNO_{t-1}	–0.256464 (0.12628)	–0.25855 (0.12548)
ΔCA_{t-1}	–0.02380 (0.04807)	0.947589 (0.37401)	ΔCA_{t-1}	–0.07813 (0.05644)	0.96457 (0.35608)
c	0.01177 (0.00376)	0.00677 (0.00370)	c	0.01064 (0.00366)	0.00419 (0.00364)
Adj R^2	0.07448	0.77579	Adj R^2	0.10938	0.73853
F-statistic	2.29361	180.9565	F-statistic	3.5000	137.9978
Log likelihood	131.9842	132.8277	Log likelihood	132.7665	133.1463
AIC	–4.29947	–4.32759	AIC	–4.32555	–4.33821
No. of observations		60	No. of observations		60
Log likelihood		315.1903	Log likelihood		291.0837
AIC		–10.30634	AIC		–9.50279
Poland			**Slovakia**		
	ΔNO_t	ΔCA_t		ΔNO_t	ΔCA_t
variable	coefficient (standard error)	coefficient (standard error)	variable	coefficient (standard error)	coefficient (standard error)
ΔNO_{t-1}	–0.65457 (0.15518)	–0.22591 (0.18917)	ΔNO_{t-1}	–0.31114 (0.12564)	–0.26216 (0.11880)
ΔNO_{t-2}	–0.41131 (0.16326)	–0.24399 (0.19903)	ΔNO_{t-2}	…	…
ΔNO_{t-3}	–0.29799 (0.10657)	–0.07773 (0.05992)	ΔNO_{t-3}	…	…
ΔCA_{t-1}	0.16678 (0.15368)	0.95468 (0.28735)	ΔCA_{t-1}	–0.19992 (0.08909)	0.82829 (0.28424)
ΔCA_{t-2}	–0.13719 (0.19925)	0.07659 (0.14290)	ΔCA_{t-2}	…	…
ΔCA_{t-3}	–0.16960 (0.16221)	–0.16481 (0.19775)	ΔCA_{t-3}	…	…
C	0.01735 (0.00437)	–0.00106 (0.00532)	c	–0.00517 (0.00998)	–0.00486 (0.00944)
Adj R^2	0.37229	0.67706	Adj R^2	0.22245	0.64631
F-statistic	5.04134	25.62723	F-statistic	7.58126	48.42396
Log likelihood	170.998	152.5076	Log likelihood	93.1928	96.32681
AIC	–5.65511	–5.25888	AIC	–3.22117	–3.33310
No. of observations		58	No. of observations		56
Log likelihood		261.5656	Log likelihood		249.5823
AIC		–11.60571	AIC		–8.69937

Notes: Variables codes: same as in Table 1.

Source: Own computation.

F i g u r e 5

Impulse – Response Functions: Reactions of Current Accounts to One Standard Deviation Shock to Net Output (dotted lines = +/– 2 standard dev.)



Source: Own computation.

4.2. Estimated Current Account within a Model without Habits

Two tests will be run to check the relevancy of the estimated current account based on the VARs. First theoretical implication relates to the fact that the estimated current account series should Granger cause the net output series while the reverse should not hold. The second issue is concerned simply with the fact that the estimated current account should equal to the actual current account, which can be tested by the correlation of their difference against the net output series and the actual current account series. The correlation should be insignificant.

Table 3 presents the results of the Granger causality tests. In all four cases the hypothesis that changes in net output do not Granger cause changes in current account is supported by the test. The test also shows that the hypothesis that the changes in current account do not Granger cause changes in output is accepted; in the cases of Poland and Slovakia very significantly.

Table 3

Granger Causality Tests

	ΔCA does not Granger cause ΔNO	ΔNO does not Granger cause ΔCA
Czech Republic	3.44095*	0.05413
Hungary	5.07889**	0.11569
Poland	9.54530***	0.8857
Slovakia	8.98981***	0.59794

Notes: The table presents F-statistic for the tests. *, **, *** denotes the rejection of the null, which is stated in the head of each column, at 10, 5, and 1%, respectively, variable codes: same as in previous tables. The null hypotheses are stated in the head of the table.

Source: Own computation.

Due to space limitations I don't present the correlation analysis; they will be supplied upon request. However, some correlation exists in all four cases, but generally it is quite low in the cases of Hungary, Poland and Slovakia.

Based on the results of the Granger causality tests and the correlation tests the intertemporal model without habits in the utility function is not rejected by the data. In other words, habit formation may not help the model to fit the data better.

4.3. Estimated Current Account within a Model with Habits

The same tests are given below for the case of models with habit formation. Current accounts in the models with habit formation were estimated for varying parameter of habit persistence from 0.1 to 0.9 (step 0.1). I do not present results for each estimation, only the results for the „most suitable" values (most significant estimates) of the parameter are given. The Granger causality tests in Table 4 show that the model without habit formation is acceptable. The result in the case of the Czech Republic is better – the null is rejected at 5% level of significance (instead of 10%). This is achieved for the value of habit persistence of 0.5. The null is rejected at 5% in the case of Hungary if the parameter of habit persistence is set at 0.1. The null is always rejected in the cases of Poland and Slovakia, the resported results are for the values of habit persistence set at 0.1.

Table 4

Granger Causality Tests

	ΔCA does not Granger cause ΔNO	ΔNO does not Granger cause ΔCA
Czech Republic	4.45861**	0.21552
Hungary	6.21209**	0.04234
Poland	0.7168	0.00384
Slovakia	0.03263	0.18854

Notes: The table presents F-statistic for the tests. *, **, *** denotes the rejection of the null, which is stated in the head of each column, at 10, 5, and 1%, respectively, variable codes: same as in previous tables. The null hypotheses are stated in the head of the table.

Source: Own computation.

The correlation analysis, supplied upon request, shows little higher values with more persistence in the case of Hungary, Poland and Slovakia. The opposite holds for the Czech Republic. The results show that only in the Czech Republic it is reasonable to include habit formation into the utility function to obtain a more statistically relevant intertemporal model of current account.

4.4. Estimated Current Account Series

Figure 6 presents the estimated current account series based on the model with habit formation. Two estimations of current account based on extreme values of habit persistence (0.1 and 0.9) are given for each economy.

F i g u r e 6
Estimated Current Account Series

Source: Own computation.

One can see that although the correlation between the actual values and estimates may be relatively high, only in the case of the Czech Republic is the model capable of capturing the level of the actual current account. In the previous analysis, it was shown that value of habit persistence at 0.5 is most statistically acceptable. It is also acceptable from this point of view as the graphical result would not be significantly different from that given in Figure 6 with the value of the parameter at 0.9.

The tests showed that only the lowest value of habit persistence may be acceptable in the case of Hungary (0.1). This is supported by the graphical output. The estimate does not tend to systematically over/underestimate the actual values, but clearly the result is much worse than in the case of the Czech Republic.

The other two models are clearly disappointing because the acceptable estimates (those with habit persistence at 0.1) systematically overestimate the levels of the actual current accounts.

Naturally, the results raise the question: why does the model fail in the cases of Poland and Slovakia and why does it give much poorer results in the case of Hungary? Before addressing this issue, let's turn the attention to another interesting feature of the estimates, i.e. level of habit persistence.

4.5. Are the Values of Habit Persistence Acceptable?

The analysis indicated that habit persistence may in fact be rather low or unimportant, at least from the perspective of the intertemporal model of current account.

The truth is that habit persistence is traditionally calibrated at higher values than those used here. Roeger, Varga and Veld (2008) and Varga and Veld (2009), who use a structural model to evaluate the impact of structural funds on new EU member states, set habit persistence at 0.7 for all economies. Benes et al. (2005) and Stork, Zavacka and Vavra (2009) formulate a DSGE model of the Czech economy for simulation and forecasting purposes. Habit persistence is set at 0.8 in both of the papers. Jakab and Vilagi (2008) estimate a DSGE model of Hungarian economy with habit persistence in the utility function of households. They estimate the parameter at 0.65. Grabek, Klos and Koloch (2011) estimate a DSGE model of Poland. They set habit persistence at 0.65. Finally, Zeman and Senaj (2009) formulate a structural model of Slovakia and calibrate habit persistence at 0.6.

Based on this analysis the habit persistence values used in the models seem to be too high, except for the Czech economy. What is more, there is hardly any evidence of a need of habit persistence in the utility function at all in the other cases.

Hoewever, typically DSGE models include two kinds of households: ricardian (those who have access to financial markets to smooth consumption) and non-ricardian (those who cannot smooth consumption). Except for the model of the

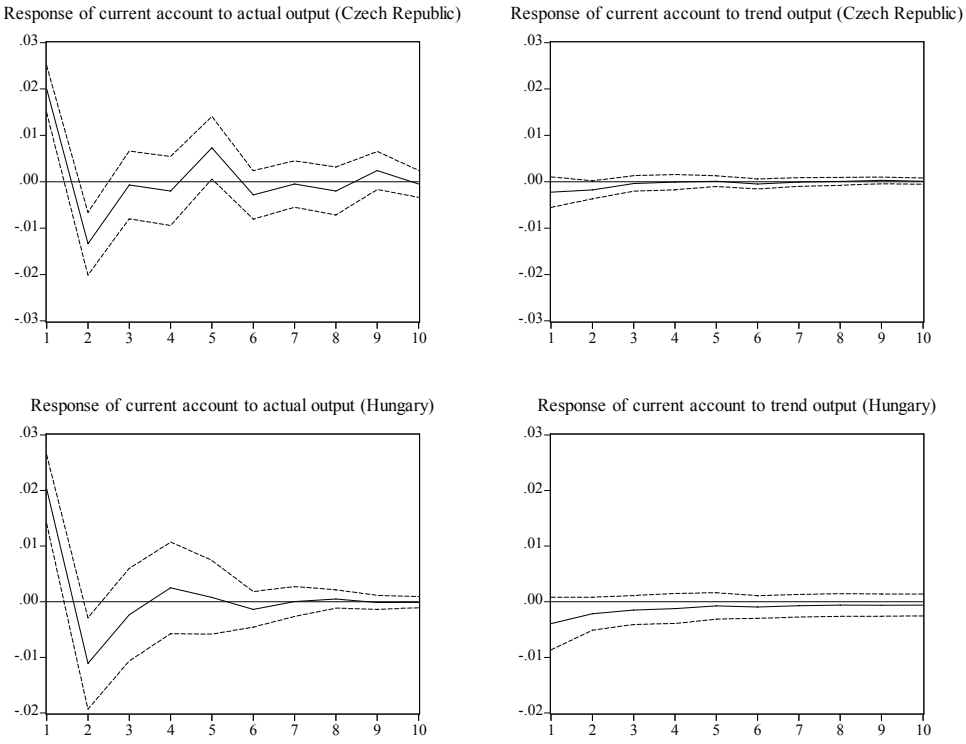
Polish economy referred to above, the other models consider these two kinds of households. Clearly the basic intertemporal model of current account does not take nonricardian households into account. This has two implications for the analysis. First, the acceptable values of habit persistence with respect to the basic intertemporal model of current account may be too low. Second, the assumption of ricardian households may be the key one, which alters the results presented above.

4.6. Is the Assumption of Consumption Smoothing too Strong?

To tackle this question, I construct a series of trend net output by using Hodrick-Prescott filter for each economy to obtain a proxy for long-term net output. I follow up on the analysis given in Figure 5 and construct VARs using differences of net output (actual net output), long-term net output and current account. VARs of three lags were satisfactory to meet the standard conditions for residuals.

F i g u r e 7

Reaction of Current Account to Shocks to Actual and Long-term Net Output – Czech Republic and Hungary (dotted lines = +/– 2 standard dev.)

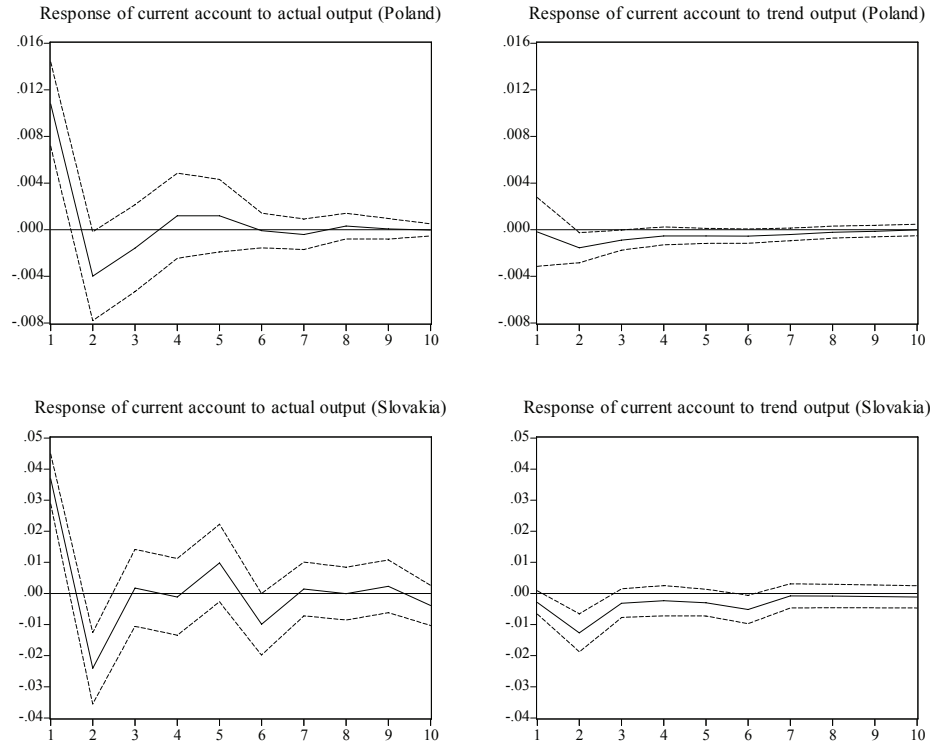


Source: Own computation.

Figures 7 and 8 present impulse-response analysis which tracks reactions of current account to shocks to actual and long-term net output. The hypothesis based on intertemporal model of current account is obvious: reaction to changes in actual net output should be positive while reaction to changes in long-term net output should be negative.

F i g u r e 8

Reaction of Current Account to Shocks to Actual and Long-term Net Output – Poland and Slovakia (dotted lines = +/– 2 standard dev.)



Source: Own computation.

The impulse-response analysis shows that changes in actual net output have positive effect on current account, which has already been shown before. This is in accordance with the theory. The reaction of current account to long-term net output is much less convincing. The reaction is prompt in the cases of the Czech Republic and Hungary although it cannot be ruled out it is actualy zero or slighly positive when taking account of the standard deviation of the estimates. In the case of Poland the reaction is much slower and the probability of the reaction being positive is much higher. The case of Slovakia is similar to the case of Poland, but the probability of positive reaction is much smaller.

To tackle the question more seriously, it would be instructing to run VARs with both output series, consumption and current account. However, such an analysis is not possible due to data limitations; the sample is too short to build robust VARs with four variables in this case. To get a hint, I use a simple correlation analysis among the four variables for each case. The results are available upon request.

The correlation analysis reveals some notable facts. According to the model, changes in consumption should be influenced especially by changes in long-term output. Changes in consumption are positively correlated with changes in actual output in all of the cases but clearly the correlation between changes in long--term net output and consumption is very small in the case of Poland and there is a high difference in correlations between changes in actual and long-term output and changes in consumption in the case of Slovakia. Only in the case of the Czech Republic is the correlation between changes in consumption and changes in long-term output higher than the correlation between changes in consumption and changes in actual net output.

As it was explained earlier, the correlation between changes in actual net output and changes in current account should be positive while it is expected to be negative in the case of changes in consumption and changes in long-term net output. The positive correlation is found in all the four cases. But this just supports the impulse-response analysis presented earlier. There is negative correlation between changes in current account and changes in long-term net output in the cases of the Czech Republic and Hungary, but it is positive in the other two.

The correlation analysis supports the hypothesis that the assumption of consumption smoothing (existence of ricardian households only) may be too strong, especially in the cases of Poland and Slovakia. The assumption is less harmful in the case of Hungary and especially the Czech Republic. It seems to be this assumption, which drives the acceptable values of habit persistence in the utility function of households so low, and which makes it impossible to construct reasonable forecasting models of current account based strictly on intertemporal approach, especially in the cases of Poland and Slovakia.

Conclusions

The intertemporal model of current account in two versions was presented in the paper: without and with habit formation included in the utility function of the representative agent. Present value model was used to test the intertemporal model in the cases of the Czech Republic, Hungary, Poland and Slovakia.

Surprisingly, the results of the model without habit formation were definitely better for Poland and Slovakia and rather better for Hungary. Only the model for the Czech Republic was clearly improved after habit formation was included in the utility function of the representative agent. Closer examination of the results showed that the estimated models for Poland and Slovakia are in fact useless as the forecasts of the model clearly missed the levels of the actual current accounts. The most acceptable model was constructed for the Czech economy.

Additional VAR analysis and correlation analysis showed that it is probably the key assumption of intertemporal models – consumption smoothing, which may be the most problematic with respect to the results. It was shown that changes in actual output tend to be correlated with changes in consumption while the correlation between changes in long-term output and changes in consumption was significantly less important in Poland and Slovakia. Further it was shown that the correlation between changes in long-term output and changes in current account was positive in Poland and Slovakia, which contradicts the theory.

Based on the results of the analysis, it seems to be necessary to include agents that do not have the possibility to smooth consumption over time in the model. This should increase the forecasting power of the model and also lead to more usual values required for habit persistence for the optimizing agents.

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