EXTERNAL IMBALANCES IN CEE-10 COUNTRIES AND FELDSTEIN-HORIOKA PUZZLE IN 1994-2008[1]

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Abstract

The purpose of this paper is to analyze the role of foreign savings in financing domestic investment and thus to question the Feldstein-Horioka findings concerning international capital mobility in the case of CEE-10 countries for the period 1994-2008. In order to verify the relation between domestic savings, foreign savings and domestic investment a regression analysis based on cross-section and panel models (with fixed and random effects) was conducted. The results based on cross-sectional research are different from those observed by Feldstein and Horioka. Statistical models that include as its explanatory variables the savings rate and the ratio of the current account balance to GDP (foreign savings) show an increasing contribution of foreign capital in financing investment in the countries belonging to the CEE-10 group. The results of panel regressions present also empirical evidence to support a high degree of capital mobility when the relation between the changes in current account and the changes of investment were analyzed.

Keywords: *Feldstein-Horioka paradox, savings, investment, foreign capital, external imbalances*

JEL codes: *F32, F21*

1. Introduction

The role of foreign savings in financing domestic investment is broadly discussed in economic literature. Feldstein and Horioka (1980) observed domestic saving rates and investment rates in the sample of 16 OECD countries. They suggested that the correlation between domestic savings and investment rates could serve as a measure of the degree of capital mobility. A high correlation between the rates of domestic investment and domestic savings in OECD countries was interpreted as the evidence of limited capital mobility. The

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Feldstein-Horioka findings were contrary to the widely accepted belief that developed countries had almost no restriction on capital flows and therefore it was assumed that international capital in their case was highly mobile. The so-called Feldstein-Horioka paradox was broadly tested empirically. Although many studies confirm the high correlation between the rates of domestic investment and domestic savings in industrialized countries, the correlation coefficients are much smaller whenever developing countries are considered.

The purpose of this paper is to analyze the role of foreign savings in financing domestic investment and thus to question the Feldstein-Horioka findings concerning international capital mobility. Since the empirical evidence on the degree of capital mobility in emerging East European EU members (later: CEE-10 countries) is rather scarce, its main contribution is the empirical verification of the Feldstein-Horioka puzzle in this region.

The structure of the paper is the following. In section 2 I analyze the behaviour of the external imbalances and their role in financing domestic investment in CEE-10 countries. Section 3 reviews the past empirical literature concerning the role of domestic and foreign savings in financing domestic investment starting from the Feldstein-Horioka findings and deals with the explanation of the Feldstein-Horioka puzzle. Section 4 presents the empirical results of the correlations between the savings ratio, current account ratio and investment ratio in the CEE-10 countries. The final section contains a short discussion of the crucial role of foreign savings in financing domestic investment and thus in the economic growth for the CEE-10 countries, especially in the time of the global economic and financial crisis.

2. The External Imbalances in CEE-10 Region and Capital Mobility

Almost all barriers to the free movement of capital across countries were removed in the CEE-10 states due to their accession to the EU[2]. In fact it entailed a considerable inflow of foreign capital to these countries and consequently foreign savings were used to finance domestic investment and consumption.

In the period 1994-2008 the countries from Central and Eastern Europe belonging to the EU showed high current account deficits which were covered by the surplus balance in the finance and capital accounts. The debit balance in the current account over this period amounted altogether (the accumulated value for all the countries for the period 1994-2008) to 494.1 bln USD, which made for 5,5% of the accumulated GDP of all the countries analyzed

[2] The process of European Union accession (and OECD accession in case of the Czech Republic, Hungary, Poland, and the Slovak Republic) required full liberalization of capital account.

over this time. Table [1] shows that since 1996 the accumulated current account deficit in the CEE-10 region has risen dramatically by a factor almost 7, from 15.2 bln USD to 105.2 bln USD in 2008 while the current account deficit ratio to GDP increased in this period only from 4,1 % to 7,5 % due to the high economic growth in the region. Table [1] shows also that the growth of current account deficits has been accompanied by the increasing role of deficit on the income account. Since 1996 accumulated trade deficit has grown by a factor 3,4, whereas deficit on the income account by a factor of 13,4.

Current account deficits needed to be financed through the capital account. Over the period 1994 to 2008 net capital flows into the CEE-10 countries accounted for 685.5 bln USD[3] which accounted for 7,7 % of their accumulated GDP. FDI and the net position of other investments played a crucial role for the CEE countries: the accumulated net FDI inflows were above 4 % of the overall GDP (380.1 bln USD); accumulated international credits - 3% of the overall GDP (265.3 bln USD). Net capital flows to the CEE-10 countries increased significantly during the course of the 1990s and 2000s. They have risen from 9.4 bln USD in 1994 to 26.1 bln USD in 2000 and to a peak in 2008 at 143.4 bln USD. Table [2] confirms the leading role of FDI and other investment in the composition of net capital flows.

Figure [1] illustrates that the current account (and thus capital flows) fills in the gap between domestic savings and domestic investment, the latter being of great importance for the economic growth. Thus the current account balance is a reflection of the saving and investment balances:

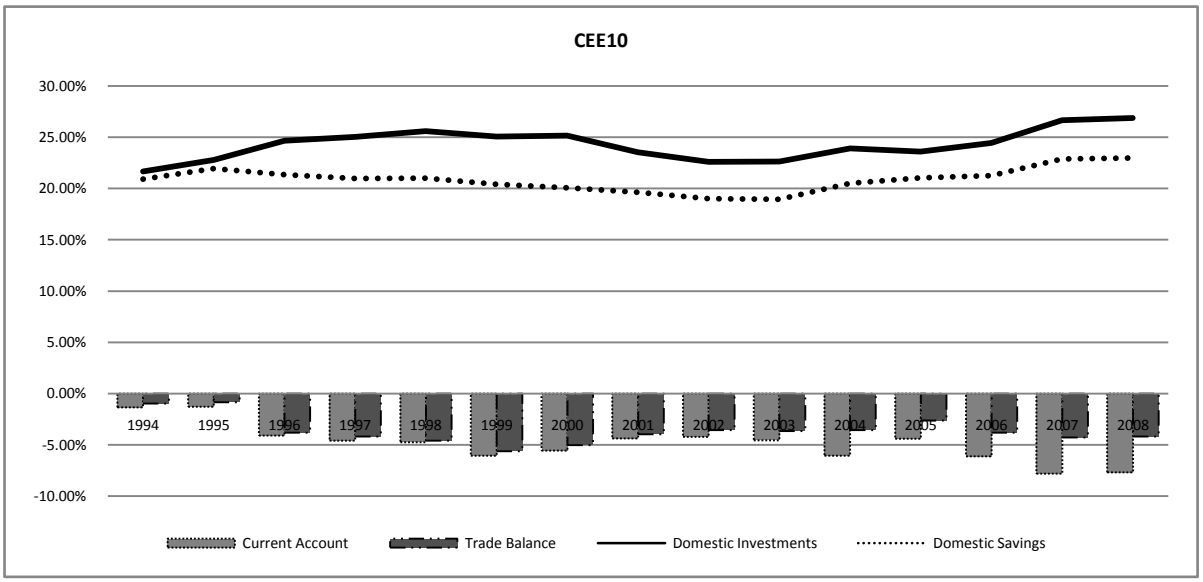
$$(\boldsymbol{CA/Y = S/Y - I/Y}) \qquad (1)$$

where $\boldsymbol{CA/Y}$ is the current account ratio, $\boldsymbol{S/I}$ – domestic savings ratio and $\boldsymbol{I/Y}$ – investment ratio.

The surplus balance of capital flows in CEE-10 countries was viable due to the macroeconomic stability manifesting in the GDP growth in each of the analyzed countries. The optimistic sentiment of investors concerning the direction of reforms, as well as high investment risk premiums contributed to an inflow of funds through direct investments, portfolio investments, loans and short- and medium-term credits. Foreign savings gave an impulse to higher investment and consequently they boosted economic growth in the CEE-10 region.

[3] Accumulated data from CEE-10 countries without Slovakia due to lack of statistical data for 2008.

Figure 1 Behaviour of domestic savings and investment in relation to overall GDP in the CEE-10 countries in the years 1994-2008



Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI) and National Bank of Slovakia.

The role of foreign savings in financing domestic investments in the CEE-10 countries can be recognized as the evidence of the high degree of financial openness and capital mobility. The empirical observation of capital flows supports the belief that the CEE-10 region is highly integrated financially with the international capital market. The size of capital flows is often considered as an imperfect indicator of capital mobility. Following Golub (1990) the high degree of capital mobility comprises not only large capital flows across countries but also assets and liabilities portfolio construction without any domestic preferences. The other concept of capital mobility measurement is based on assessing the extent to which domestic savings and investment rates are correlated[4]. A substantial number of empirical studies have measured a correlation between domestic savings and domestic investment. The best known study discussed in economic literature is the one by Feldstein and Horioka (Feldstein, Horioka, 1980).

[4] The other tests of capital mobility are based on e.g. parity conditions, effectiveness of sterilization and Euler equation. The interesting overview of several standard methods of estimating the degree of capital mobility was presented by Montiel (1993).

Table 1 Accumulated current account balances in the CEE-10 region over the time period 1994 to 2008

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CURRENT ACOOUNT (as GDP ratio)	-1,35%	-1,30%	-4,10%	-4,60%	-4,77%	-6,06%	-5,56%	-4,38%	-4,21%	-4,56%	-6,07%	-4,41%	-6,14%	-7,48%	-7,54%
Trade account (as GDP ratio)	-2,89%	-3,32%	-6,16%	-6,43%	-6,76%	-6,91%	-6,70%	-5,50%	-4,64%	-4,40%	-4,37%	-3,68%	-4,93%	-5,51%	-5,54%
Services account (as GDP ratio)	1,92%	2,47%	2,34%	2,24%	2,16%	1,27%	1,67%	1,53%	1,08%	0,74%	0,80%	1,04%	1,12%	1,34%	1,43%
Income account (as GDP ratio)	-1,63%	-1,25%	-1,20%	-1,53%	-1,57%	-1,66%	-1,54%	-1,55%	-1,97%	-2,21%	-3,88%	-3,17%	-3,80%	-4,61%	-4.25%
Transfers account (as GDP ratio)	1,25%	0,79%	0,92%	1,12%	1,40%	1,24%	1,01%	1,14%	1,31%	1,31%	1,37%	1,40%	1,47%	1,29%	1,25%
	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
CURRENT ACOOUNT (USD bln)	-3,5	-4,4	-15,2	-16,9	-19,3	-23,7	-21,7	-18,7	-20,2	-26,1	-41,7	-35,4	-56,0	-86,2	-105,2
Trade account (USD bln)	-7,6	-11,4	-22,8	-23,7	-27,3	-27,0	-26,1	-23,5	-22,2	-25,2	-30,0	-29,5	-45,0	-63,4	-77,2
Services account (USD bln)	5,0	8,5	8,6	8,2	8,7	5,0	6,5	6,5	5,2	4,2	5,5	8,3	10,2	15,5	19,9
Income account (USD bln)	-4,3	-4,3	-4,4	-5,6	-6,3	-6,5	-6,0	-6,6	-9,4	-12,7	-26,6	-25,4	-34,7	-53,1	-59,2
Transfers account (USD bln)	3,3	2,7	3,4	4,1	5,6	4,8	3,9	4,9	6,3	7,5	9,4	11,2	13,4	14,9	17,5

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI), National Bank of Slovakia and National Bank of Poland.

Table 2 Accumulated capital and financial account balances in the CEE-10 region over the time period 1994 to 2008

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CAPITAL AND FINANCIAL ACCOUNT (as GDP ratio)	**3,58%**	**8,12%**	**4,40%**	**5,13%**	**6,94%**	**6,74%**	**6,68%**	**4,58%**	**7,93%**	**6,04%**	**7,84%**	**9,22%**	**8,34%**	**12,06 %**	**9,39%**
FDI (as GDP ratio)	1,93%	3,59%	2,85%	3,51%	4,39%	5,16%	5,56%	4,60%	4,93%	2,10%	4,88%	5,01%	4,57%	5,13%	3,59%
Portfolio investment (as GDP ratio)	1,05%	1,42%	0,37%	0,77%	1,32%	0,42%	0,54%	0,99%	0,97%	0,70%	2,75%	1,21%	0,05%	-1,29%	-0,37%
Other investment (as GDP ratio)	-3,24%	2,92%	1,03%	0,79%	1,10%	0,95%	0,38%	-1,08%	2,14%	3,29%	-0,17%	2,59%	3,40%	7,49%	6,17%
Capital account (as GDP ratio)	3,84%	0,11%	0,14%	0,07%	0,09%	0,07%	0,13%	0,14%	0,07%	0,04%	0,33%	0,45%	0,44%	0,83%	0,90%
	1994	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
CAPITAL AND FINANCIAL ACCOUNT (USD bln)	**9,4**	**27,8**	**16,2**	**18,9**	**28,0**	**26,3**	**26,1**	**19,5**	**38,0**	**34,6**	**53,8**	**74,0**	**76,0**	**138,8**	**130,9**
FDI (USD bln)	5,1	12,3	10,5	12,9	17,7	20,2	21,7	19,6	23,6	12,0	33,5	40,2	41,7	59,0	50,1
Portfolio investment (USD bln)	2,7	4,9	1,4	2,8	5,3	1,6	2,1	4,2	4,7	4,0	18,9	9,7	0,5	-14,8	-5,1
Other investment (USD bln)	-8,5	10,0	3,8	2,9	4,4	3,7	1,5	-4,6	10,2	18,8	-1,2	20,8	31,0	86,3	86,1
Capital account (USD bln)	10,1	0,4	0,5	0,3	0,4	0,3	0,5	0,6	0,3	0,2	2,3	3,6	4,0	9,5	12,5

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI), National Bank of Slovakia and National Bank of Poland.

3. Feldstein-Horioka puzzle and its explanation

Feldstein and Horioka (1980) based their research method on the fact that domestic investment is financed by domestic savings and foreign savings (defined as the current account balance which equals approximately the difference between domestic investment and domestic savings). Their proposition of assessing the degree of capital mobility is based on the assumption that any changes in domestic savings should have no effect on domestic investment since they are determined in the world capital market by their rates of return.

If we assume that the level of investment is determined by the expected return rates (and the risk accompanying them) then in the case of a perfect capital mobility they should be equaled. Thus, if we consider the investment possibilities, the source of savings is of no importance. Investors while taking their investment decisions should seek maximization of return rates in relation to risk. According to such a way of reasoning, domestic savings are a part of the global pool of savings. Domestic investment has to compete with investment made in other countries for funds from the same pool and, on the other hand, domestic savings can be used to finance investment made in places where the highest return rate is expected. Feldstein and Horioka concluded that in the case of a perfect capital mobility, domestic savings should not be strongly correlated with domestic investment. High correlation between indicated macroeconomic aggregates would mean that there are certain constraints in the capital flow between countries.

To verify the correlation between domestic savings and investment, Feldstein and Horioka analyzed the following regression:

$$\overline{I}_j = \alpha + \beta \overline{S}_j + \varepsilon_j \qquad (2)$$

where $\overline{I}_j$ and $\overline{S}_j$ referred to cross-section data from the period 1960-1974 for *j* state (21 OECD countries were analyzed) and represented respectively: the ratio of domestic investment to GNP and the ratio of domestic savings to GNP ($\overline{I}_j = \frac{1}{T}\sum_{t=1}^{T} I_{jt}$ and $\overline{S}_j = \frac{1}{T}\sum_{t=1}^{T} S_{jt}$, where *t* refers to a consecutive year).

The use of cross-section data resulted from the attempt to verify long-run associations between domestic savings and investment. On the grounds of the calculations made (the β parameter was nearly equal to 0,9) Feldstein and Harioka concluded that the capital mobility between those countries was low, which was contrary to the widely accepted belief that it was high, especially between industrialized countries.

High correlation rates between domestic savings and investment were also estimated in other studies based on the Feldstein-Horioka method. Fieleke (1982) tested data from 87 countries and found an estimate for the β parameter equal to 0.7, both for the whole group and for a sub-group consisting of non-industrialized countries. Similar results were obtained by Dooley, Frankel and Mathieson (Dooley, Frankel, Mathieson, 1987). The estimated regressions for the research period between 1960 and 1984 found a strong correlation between domestic investment and savings (0.5 – 0.6), both in the case of the analysis of the correlation between their levels and the analysis of their annual changes. Obstfeld and Rogoff (1996) carried out econometric research based on the Feldstein-Horioka method in a panel of OECD countries for the period 1982–1991 and found an estimate for the β parameter equal to 0.6. Vamvakidis, Wacziarag (1998) confirmed a drop in the correlation between the rates of domestic savings and investment in the decade of the 1980s (β parameter = 0.8) and in the first years of the 1990s (β parameter = 0.6). The research conducted by Blanchard and Giavazzi (Blanchard, Giavazzi, 2002) for the period 1975-2001 found that the correlation between domestic savings and investment in the OECD countries remained at an unchanged level (β parameter = 0.6) also in that period. Blanchard and Giavazzi extended their study by including a group of countries belonging to the European Union and the Economic and Monetary Union (the eurozone). In this group the β ratio was declining in time, reaching much lower values in the 1990s (β parameter for the eurozone countries was equal to 0.14 for the sample period 1991-2001).

Rocha (2000) in a panel study encompassing annual observation of savings and investment rates for the period 1960-1996 in 36 developing countries found that in the group of developing countries the β parameter measuring the correlation between domestic savings rate (S/Y) and investment rate (I/Y) was equal to 0.36 and was much lower in comparison to the representative coefficient for developed countries accepted in economic literature, which according to Murphy is equal to about 0.6 (Murphy, 1984). Rocha also found that the β parameter was getting lower in time. In the period 1960-1974 it was equal to 0.99, whereas in the period 1975-1996 it was only 0.31. The findings are similar to the ones of other economists who observe the diminishing role of domestic savings in financing foreign investment in developing countries together with a progressing liberalization of capital flows globally (Vamvakidis, Wacziard, 1998).

The high correlation between domestic savings and investment is still a kind of puzzle in the light of the standard growth theory (e.g. Aghion, Comin, Howitt, Tecu, 2009). In

countries characterized by openness to international capital flows domestic savings should not be such an important factor of growth (because domestic investment can be financed from foreign saving).

Various economists have been trying to account for the high correlation between domestic savings and investment in open economies. The most frequently quoted arguments in economic literature are listed below.

(i) Domestic savings and investment are determined by many the same factors and particularly they have a pro-cyclic character (among others: Murphy, 1984, Sinn, 1992, Baxter, Crucini, 1993, Najlepszy, Śliwiński, 2008). Obstfeld (1986) showed that temporary shocks referring to productivity, to the behaviour of real interest rates in the world or to the prices of imported goods can consequently lead to a situation in which domestic savings and investment change in the same direction.

(ii) As early as in the 1980s another explanation pointed at the government policies as a source of the high correlation. In the case of macroeconomic imbalances (i.e. the case of current account deficits or deficits in the private sector budget) governments implement economic policies aiming at reducing these imbalances, which influence both domestic savings and investment (among others: Fieleke, 1982, Bayoumi, 1990). In the case of too large imbalances in the current account government intervention can take the form of reducing public savings and public investment, which leads to an increase of the correlation between domestic savings and investment (Jansen, 1998).

(iii) According to Summers (1986) the high correlation between domestic savings and investment can be accounted for by some limitations related to the balance of payments. Countries characterized by high deficits in current accounts experience difficulties in finding foreign financing. So in a long term the high correlation between domestic savings and investment is caused by a limited access to foreign capital, which is explained by the intertemporal model of economic growth (Visser, 2004).

(iv) The limitations indicated above refer both to the whole economy and particularly to individual economic entities which yet take into account other factors while selecting the sources of financing. Schmidt-Hebel, Serven and Solimano (1996) point at the high contribution of companies' savings made of retained profits (particularly in industrialized countries) in private savings. They are the main source of investment for companies. According to the pecking order theory of business finance economic entities prefer their own

sources of financing (retained profits) to other sources (debt, issue of shares). They take the view that financing by debt increases the risk of bankruptcy if there is no other possibility to service the debt and the issue of shares is disadvantageous from the point of view of their current holders due to the high cost of its organization and the dispersion of the current shareholding (McLaney, 2007). Empirical studies carried out for the American economy do not yield conclusive results confirming the theory in question. For instance, the research by Graham and Harvey (2001) confirms it but the studies conducted by Frank and Goyal (2003) show that businesses while taking decisions concerning sources of financing take into consideration other criteria.

(v) Dornbusch (1991) points at the institutional barriers limiting the flow of savings across countries. These are primarily legal limitations concerning the free movement of international capital. Even if the barriers concerning capital flow are removed, there might be other constraints, for instance mainly big businesses and the public sector will have access to the world finance markets.

(vi) Feldstein (1994) emphasizes that domestic savings are usually not transferred internationally due to the low tolerance of risk among their owners, especially low tolerance of the political and exchange rate related risks. The studies concerning creating investment portfolios show overrepresentations of domestic assets in investment portfolios (e.g. Golub, 1990).

(vii) The portfolio theory was also used by Vamvakidis and Wacziarg (1998) to explain why the correlation ratios obtained in statistical studies in industrialized countries are much higher than the ones in developing countries. According to the theory of investment portfolio investors diversifying their portfolios buy assets which are least correlated with each other. The analysis of correlations between exchange rates within developed countries and between developed countries and so called emerging markets led them to the conclusion that the opportunities of diversification are considerably greater due to investing in developing countries.

(viii) Another explanation for the high correlation between domestic savings and investment is related to the sample group analyzed by Feldstein and Horioka embracing the most industrialized countries in the world[5]. Murphy (1984) noticed that if a country's

[5] The studies embracing countries outside OECD found usually far lower ratios of domestic savings to investment in comparison to OECD countries (i.e. Summers, 1986 – 0.3, Vamvakidis, Wacziarg, 1998 – below 0.3 against the ratios of about 0.6 for developed countries, Murphy, 1984).

economy is big enough in terms of its influence on global finance markets, then the global interest rate will not be exogenous in relation to the domestic savings rate. Changes of the savings rate will then have an impact on both domestic and global interest rates. Their correlated changes will entail the correlation between the investment rate and the savings rate as well. Frenkel (1992) emphasizes that in the case of a large state, a decrease in its savings will cause an increase in domestic and global interest rates and consequently a decline in investments in the state and abroad. He highlights that changes of domestic savings are frequently associated with changes of real interest rates which consequently cause changes in investment proceeding in the same direction[6]. It must be noted though that the so called country-size effect cannot explain for the high correlation between savings and foreign investment in cross-section studies embracing many different states.

Although the debate among economists concerning the cause of the high correlation between domestic savings and investment is still on, the positive role of domestic savings in increasing domestic investment is out of the question.

4. Testing of the correlation between savings and domestic investment

4.1 Cross-section study in the spirit of Feldstein-Horioka and Sachs

A cross-section regression analysis according to the method applied by Feldstein and Horioka (1980) was conducted in order to capture the long-term relations between domestic savings and domestic investment. Hence, I run equation [3] where full-sample averages of each country over the period 1994 to 2008 were used:

$$\overline{I_j} = \alpha + \beta \overline{S_j} + \varepsilon_j \qquad (3)$$

where $\overline{I_j}$ and $\overline{S_j}$ referred to cross-section data for the years 1994-2008 for the *j* country from the CEE-10 group and represented respectively: the ratio of domestic investment to GDP and the ratio of domestic investment to GDP ($\overline{I_j} = \frac{1}{T}\sum_{t=1}^{T} I_{jt}$ and $\overline{S_j} = \frac{1}{T}\sum_{t=1}^{T} S_{jt}$, where *t* refers to a consecutive year). In order to study how the relation between investment and domestic savings was affected by the process of accession to the EU the additional analysis of the two subperiods 1994-200 and 2001-2008 was conducted.

[6] The issue is further discussed in Schmidt-Hebel, Severn and Solimano (1996).

Sachs (1982) proposed an alternative way of analyzing how foreign savings influence domestic investment. He carried out a panel study in a group of OECD countries estimating the following regression equation:

$$d(\frac{CA}{Y})_i = \theta + \gamma d(\frac{I}{Y})_i + \varepsilon \quad (4)$$

where $d(\frac{CA}{Y})_i$ represents a change in the current account balance in the country *i* and $d(\frac{I}{Y})_i$ - a change in the domestic investment rate in the country *i*.

In order to find a positive correlation between financial sources flowing in from abroad and domestic investment, the parameter γ shown in the equation [4] should show negative values. Sachs (1982) assumed that perfect capital mobility occurs when the parameter γ equals -1. Accepting such an assumption could mean that the inflow of net foreign capital is the only source of domestic investment financing. This proposed condition must be recognized as too rigorous because it depreciates the role of domestic savings in financing investment. Nevertheless, it is agreeable to accept the assumption that the more negative correlations between current account balance and domestic investment can indicate more freedom in capital flows between countries.

The tests of the relation between domestic savings and investment were supplemented by studies of the relation between the current account balance and domestic investment in a group of the CEE-10 countries (Equation [5]):

$$\overline{I_j} = \alpha + \gamma \overline{CA_j} + \varepsilon_j \quad (5)$$

where $\overline{I_j}$ and $\overline{CA_j}$ represent respectively: the relation of domestic investment to GDP and the relation of domestic savings to GDP ($\overline{CA_j} = \frac{1}{T}\sum_{t=1}^{T} CA_{jt}$, where *t* represents a consecutive year) and they refer to cross-section data from the period 1994-2008 (and to the following sub-periods: 1994-2000 and 2001-2008) for the *j* country from the CEE-10 group.

The results of the econometric research are presented in Tables [3] and [4]. Statistically significant repressors are marked in bold.

Table 3 Estimates of equation parameters on the basis of a cross-section sample; the explained variable: domestic investment in relation to GDP, the explanatory variable: domestic savings in relation to GDP

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,16	0,03	4,99	0,00	0,76
S/Y_1994-2008	**0,45**	**0,16**	**2,89**	**0,02**	**0,51**
	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,08	0,04	2,07	0,07	0,35
S/Y_1994-2000	**0,80**	**0,20**	**4,01**	**0,00**	**0,67**
	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,23	0,05	4,42	0,00	0,71
S/Y_2001-2008	0,21	0,24	0,88	0,40	0,09

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics – IFS).

Tab 4 Estimates of equation parameters on the basis of a cross-section sample; the explained variable: domestic investment in relation to GDP, the explanatory variable: current account in relation to GDP

	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,24	0,03	8,45	0,00	0,90
CA/Y_1994-2007	-0,24	0,43	-0,57	0,59	0,04
	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,20	0,03	6,50	0,00	0,84
CA/Y_1994-2000	-0,79	0,63	-1,26	0,24	0,17
	Coefficient	Std.Error	t-value	t-prob	Part.R^2
Constant	0,22	0,02	9,71	0,00	0,92
CA/Y_2001-2008	**-0,62**	**0,27**	**-2,27**	**0,05**	**0,39**

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS) and National Bank of Slovakia.

The analysis of results of the obtained regressions shows the following relations in the group of the CEE-10 countries in the sample period, i.e. from 1994 to 2008:

(i) Over the period embracing the years 1994-2008, the β parameter measuring the ratio between the savings rate (S/Y) and the investment rate (I/Y) was equal to 0.45 and was far lower than the representative ratio for developed countries widely accepted in literature; the analysis of the coefficient measuring the correlation between the ratio of current account balance to GDP (CA/Y) and the domestic investment ratio (I/Y) shows that the γ parameter was equal to –0.24, but it was statistically significant.

(ii) The values of the β and γ parameters were not stable throughout the entire analysis period. The cross-section study over the period 1994-2000 found that the domestic investment rate was strongly correlated with the domestic savings rate in that time. The high value (and statistical significance) of the β parameter (0.8) indicated that domestic investment was to great extent dependent on domestic savings. In the subsequent sample sub-period (2001-2008) domestic investment was in a statistically

significant extent explained by foreign savings, what was confirmed by a very high negative γ parameter which reached the value of –0.62 for the period in question.

(iii) The behaviour analysis of the parameters β and γ in time shows an increasing contribution of foreign capital in financing investment in the countries belonging to the CEE-10 group, which became the most important engine of their growth.

4.2 Panel studies

The statistical methods of modeling correlations between domestic investment and savings in the group of the CEE-10 countries were also based on the analysis of time series carried out for panel data[5]. In order to avoid spurious correlations between the dependent variable and the independent ones the study was focused on testing how real increase in domestic and foreign savings influences real increase in domestic investment. As in the case of cross-sectional research the whole sample 1994-2008 and the two subsamples 1994-2000 and 2002-2008 were analyzed.

First, the study embraced an estimation of parameters of the following panel regressions (the ordinary least squares method):

$$\frac{I_{it}-I_{it-1}}{Y_{it-1}} = \alpha + \beta \frac{S_{it}-S_{it-1}}{Y_{it-1}} + \varepsilon_{it} \tag{6}$$

$$\frac{I_{it}-I_{it-1}}{Y_{it-1}} = \alpha + \gamma \frac{CA_{it}-CA_{it-1}}{Y_{it-1}} + \varepsilon_{it} \tag{7}$$

where S_{it}, I_{it}, CA_{it} denotes respectively the value of domestic savings, investment, current account and GDP expressed in the prices from the year 2000 in country *i* at time *t* (or over the period *t* – *l* for S_{it-1}, I_{it-1}, CA_{it-1}).

Since specific results are expected for each country an individual specific constant α_i was introduced (where *i = 1, ..., n* countries) capturing "country effect". The model is also extended by a time specific constant λ_t capturing "time effect." The effects α_i and λ_t are assumed to be fixed (deterministic) or random. Thus additional panel studies based on fixed effects model and random effects model were also carried out. In the econometric tests the following regressions were estimated:

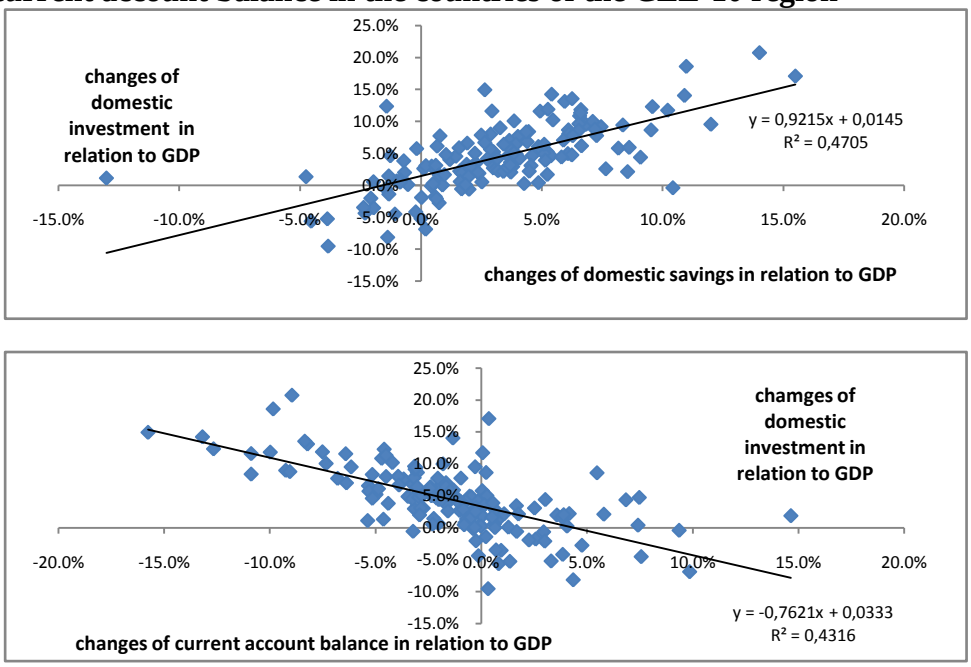
$$\frac{I_{it}-I_{it-1}}{Y_{it-1}} = \alpha_i + \lambda_t + \beta \frac{S_{it}-S_{it-1}}{Y_{it-1}} + \varepsilon_{it} \tag{8}$$

$$\boldsymbol{\frac{I_{it}-I_{it-1}}{Y_{it-1}} = \alpha_i + \lambda_t + \gamma \frac{CA_{it}-CA_{it-1}}{Y_{it-1}} + \varepsilon_{it}} \tag{9}$$

[5] The review of the panel regression models is presented in Wooldridge (2003).

The figure [2] presents the relations between the changes of domestic savings and of current account and the changes of domestic investment (all values in relation to GDP) in the CEE-10 countries over the period 1994-2008.

Figure 2 The relations between the changes of domestic investment, domestic savings and the current account balance in the countries of the CEE-10 region



Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI) and National Bank of Slovakia.

The strong positive correlations between changes in domestic savings and in investment and strong negative relation between changes in current account and in investment shown in Figure [2] confirm that the main sources for financing domestic investments in CEE-10 region are domestic savings and foreign savings.

The estimates of panel regressions [6] – [9] are summarized below in Tables [5] and [6]. For the CEE-10 countries the β coefficient (measuring the correlation between changes of domestic savings and changes of investment) of 0.9 was obtained. The β coefficient increased slightly over time from 0.9 to 1 (fixed and random effects models) or was stable in the case of OLS method (0.9).

The γ coefficient measuring the correlation between changes of current account and changes of investment had the value of –0.75 and decreased slightly over time (from –0.75 in the years 1995-2000 to –0.7 in the years 2001-2008).

Table 5 Estimates of panel regressions; the explained variable: the change of domestic investment in relation to GDP for the countries of the CEE-10 region over the period 1995-2008

Explaining variables:	Estimates of panel regressions		
	least squares method	fixed effects model	random effects model
changes of domestic savings in relation to GDP	OLS	LSDV	GLS
beta	0,92	0,95	0,94
t-value	8,11	7,89	12,00
t-prob	0,00	0,00	0,00
R-squared	0,47	0,54	0,49
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.033]	[0.055]	[0.016]
AR(2)	[0.796]	[0.511]	[0.561]
changes of current account in relation to GDP	OLS	LSDV	GLS
beta	-0,76	-0,74	-0,76
t-value	-9,66	-9,76	-10,60
t-prob	0,00	0,00	0,00
R-squared	0,43	0,45	0,43
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.179]	[0.235]	[0.017]
AR(2)	[0.350]	[0.537]	[0.455]

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI) and National Bank of Slovakia.

Table 6 Estimates of panel regressions; the explained variable: change of domestic investment in relation to GDP for the countries of the CEE-10 region over the periods 1995-2000 and 2001-2008

Explaining variables:	Estimates of panel regressions (1995-2000)		
	least squares method	fixed effects model	random effects model
changes of domestic savings in relation to GDP	OLS	LSDV	GLS
beta	0,87	0,86	0,87
t-value	6,70	6,73	7,94
t-prob	0,00	0,00	0,00
R-squared	0,48	0,53	0,48
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.196]	[0.253]	[0.175]
AR(2)	[0.747]	[0.374]	[0.730]
changes of current account in relation to GDP	OLS	LSDV	GLS
beta	-0,77	-0,75	-0,77
t-value	-8,35	-8,35	-5,72
t-prob	0,00	0,00	0,00
R-squared	0,32	0,37	0,32
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.880]	[0.817]	[0.851]
AR(2)	[0.209]	[0.034]	[0.496]
	Estimates of panel regressions (2001-2008)		
changes of domestic savings in relation to GDP	OLS	LSDV	GLS
beta	0,91	1,03	1,00
t-value	4,72	5,34	8,01
t-prob	0,00	0,00	0,00
R-squared	0,35	0,59	0,45
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.027]	[0.480]	[0.324]
AR(2)	[0.283]	[0.106]	[0.118]
changes of current account in relation to GDP	OLS	LSDV	GLS
beta	-0,70	-0,66	-0,68
t-value	-5,79	-5,67	-10,6
t-prob	0,00	0,00	0,00
R-squared	0,59	0,67	0,59
Wald joint test	[0.000]	[0.000]	[0.000]
AR(1)	[0.012]	[0.026]	[0.004]
AR(2)	[0.851]	[0.066]	[0.514]

Source: Author's calculations on the basis of the database of International Monetary Fund (International Financial Statistics - IFS), World Bank (World Development Indicators - WDI) and National Bank of Slovakia.

The analysis of results of the obtained regressions could lead to different conclusions depending on which regression was conducted.

(i) The estimated coefficients for the CEE-10 countries are much larger than those obtained with cross-sectional data. The β coefficients are between 0.9 and 1.0. A close association between domestic savings and investment could indicate, contrary to the expected notion, a low degree of capital mobility. The estimated close correlations between savings and investment within analyzed countries were due to business cycle effects which were washed away by averaging data in the cross-section analysis. The endogeneity of domestic savings and investment could also result from other than procyclicality factors, which is well described in the economic literature. Thus the use of annual data implies an upward bias in the estimation of the β coefficient.

(ii) The evidence for capital mobility in the CEE-10 countries seems quite strong when using time series data for current account deficits. The γ coefficient of –0.7/-0.8 indicates that there is a large extent of capital mobility in the CEE-10 region according to Sachs reasoning. Although a greater capital mobility was expected for the period 2001-2008 comparing to the period 1994-2000, surprisingly the correlations for the first period were larger than for the second one. One explanation for that fact could be the necessity of foreign debt repayment. As the result of growing foreign indebtness financing the current account deficits in the CEE-10 countries more foreign capital was used to roll over foreign debt instead of financing domestic investment.

5. Conclusion

The cross-sectional results from sub-periods allowed to analyze the evolution of the correlation between savings, current account and investment over time. The results report that during the period 1994-2008 capital mobility in the CEE-10 countries was growing, especially after they accessed the European Union. The positive and significant impact of foreign capital on the investment rates in these countries was confirmed by panel studies. The empirical findings generally reported in the paper do not support those obtained by Feldstein and Horioka (especially the savings-investment coefficient instability through time in the cross-section research) and therefore they reveal that the Feldstein-Horioka puzzle is not valid in the CEE-10 countries.

In recent years we could observe large capital flows to the CEE-10 countries. The capital flows are generally welcomed by convergating economies not only because they can

be an important source of additional savings financing domestic investment but also because they can serve as a vehicle for technology transfer and managerial skills improvement.

The discussion on the role of foreign capital in financing investment and thus economic growth seems to be especially important in the period of financial crisis. In the year 2008 the declining economic growth in 15 countries of the so called old EU and the mounting financial crisis caused a significant decrease in the economic activity in the CEE-10 countries. The pace of economic growth in that year in the whole region dropped to 4.1% against 6.3% in the year 2007. In the 4th quarter of 2008 GDP estimated for all these countries altogether did not show any increase and the forecasts concerning economic growth in the CEE-10 countries held that the downward tendency can continue in the years 2009 and 2010 (NBP, 2009).

The large capital outflows from CEE-10 countries at the end of 2008 and the beginning of 2009 had important implications for their economies. A big pressure on depreciation of exchange rates forced some countries to intervene on the foreign exchange market to defend the fixed exchange rate, in other cases we observed sudden depreciations of the floating currencies. For the first time in the period 1994-2008 the accumulated official reserves of the CEE-10 region decreased. The global financial crisis caused not only deterioration of the capital inflows but also deterioration of domestic and foreign demand. As a result most of the CEE-10 countries plunged into a deep economic depression which meant a severe decline in their economic growth rates.

The important question concerns the policy to return to high investment and thus on the high economic growth path. From a basic macroeconomic identity, domestic investment is the sum of domestic and foreign savings, the CEE-10 countries have in general the alternative of increasing domestic savings or/and introducing the policy of attracting capital inflows to increase the domestic investment.

Domestic savings generally depend positively on income and negatively on consumption. In short time, as the CEE-10 countries experience generally a heavy depression, one cannot expect higher real GDP. The only way to increase domestic savings seems to be deterioration of the consumption ratio which was the case in some countries that experienced negative or almost zero growth in 2008 year (Estonia, Latvia, Hungary). However, there is no positive correlation between increased domestic savings and domestic investment in those

countries. The main reason is that domestic investments are crowded out by foreign debt repayment.

The role of foreign savings in promoting economic growth in the CEE-10 countries is undoubted. High economic growth connected with economic reforms and the EU accession (expected high rates of return on capital and lower investment risk) have attracted foreign investment into the CEE-10 countries. However, since the beginning of the economic and financial crisis the overall level of foreign inflows to CEE-10 countries has been much lower than that observed before 2008. Now it depends much on the stance of domestic policies if the net flows remain positive contributing to the economic growth of the region.

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