The Feldstein-Horioka Puzzle: Modern Aspects[1]

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Abstract

The primary purpose of this paper is to test the hypothesis of capital mobility reduction in the wake of the global financial crisis of 2008-2009. Through the constructed models we tested hypotheses about the long- and short-term mobility of global capital by estimating the correlation between savings and investment rates. The paper also deals with the question of capital mobility in Russia. Recommendations on monetary policy in Russia in the coming years based on the obtained findings were made.

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Key words: Feldstein-Harioka puzzle, capital mobility, monetary policy

The Feldstein-Horioka Puzzle: Modern Aspects

Ever since the publication of the [Feldstein, Horioka, 1980] paper, economics literature has continued a discussion on the mobility of capital in the global economy and the relationship between domestic investment and domestic saving. The activities of the developed world's financial markets and the gradual removal of restrictions on the movement of capital in recent decades imply a high degree of capital mobility. In this case it is logical to assume that there is an absence of correlation between saving and investment within a country because domestic investments can be financed by capital inflow, and any excess of domestic savings will be invested abroad. However, the results of many studies [Feldstein, Horioka, 1980; Krol, 1996] indicate that there is a significant correlation between these variables.

At the same time, some works [Krol, 1996; Fouquau, Hurlin, Rabaud, 2008] contain an explanation of the high correlation discovered, and provide arguments in favour of the claim that the results obtained do not necessarily conflict with a high degree of mobility of global capital. Firstly, many researchers separate the mobility of short-term and long-term capital investments [Krol, 1996; Coiteux, Oliver, 2000]. Free movement of long-term investments in the global economy may be limited by various institutional barriers. Secondly, even in respect of the short-term investments, there is an observed tendency to invest into one's own economy due to information asymmetry. Moreover, many studies [Giannone, Lenza, 2004; Fouquau, Hurlin, Rabaud, 2008] note the weakening of correlation between the rates of saving and investment over time.

The purpose of this paper is to study the correlation between the rates of saving and investment in the last two decades, in both developed and developing economies. In order to achieve this we used inter-country data for which both spatial and panel regressions were estimated.

1. REVIEW OF LITERATURE

In their pioneering work [Feldstein, Horioka, 1980] the authors made an attempt to answer the question of the extent to which an increase in domestic saving affects the increase in investment within a country. It was the authors' opinion that an answer to this question would allow an assessment of the degree of mobility of international capital.

In order to test their hypothesis that a change in domestic saving is almost fully reflected in changes in domestic investment (the hypothesis of lack of global capital mobility) M. Feldstein and C. Horioka used data from21 OECD countries for 1960-1974. For each country the authors used data on the average saving rate for the period (the savings to GDP ratio) and the average investment rate for the period (the ratio of domestic investments, consisting of the increase in the cost of fixed assets and the net change in inventory, to GDP). The authors estimated the inter-country regression, where the average investment rate was the dependent variable and the average saving rate and the constant were the independent variables.

As a result of the regression estimation for the entire period the authors obtained a coefficient for the saving rate equal to 0.887, which differs significantly from 0 but insignificantly from 1. The paper also contains estimates of regressions for the average rates of investment and saving for three, five-year, sequential sub-periods. As a result, the following coefficients were obtained: 0.909, 0.872 and 0.871. All these coefficients differ significantly from 0 and insignificantly from 1.

The authors conclude that there is no perfect mobility of global capital, due to the high sensitivity of the domestic investment rate to the saving rate. It should be noted that the use, by the authors, of average indicators for the period, represents the long-term development between the variables in question. The authors assert that the low degree of long-term mobility of global capital does not contradict the high mobility of short-term capital.

The Feldstein-Horioka puzzle was further studied in a later work [Krol, 1996]. The author criticises the study by M. Feldstein and C. Horioka and their interpretation

of the dependency discovered. Firstly, as has already been noted, Feldstein and Horioka, by using time-averaged indicators, found only a long-term dependency without taking into account short-term temporary changes in the saving-investment ratio. Secondly, the microeconomic justification for the correlation obtained, is the fact that, even with a small current account balance of payment and investment savings will inevitably be highly correlated, including in cases where domestic savings are exported and domestic investments are financed by the inflow of capital.

In order to analyse the above problems the author estimated models with individual and temporary effects on the panel data for 21 OECD countries for 1962-1990. As a result, the coefficient of savings was found to be equal to 0.2 for the entire period and to 0.16 for the last 15 years. Although they do not differ significantly from zero, according to the author, these estimates evidence higher capital mobility than would be anticipated from the results of the pioneering work.

No effects of the business cycle (through temporary effects) on capital mobility were discovered. Individual fixed effects were found to be significant and a random-effects model gave identical results. The authors also discovered significant positive and negative influence, respectively, of the saving and investment rates on the current account, and this also counts in favour of a high degree of mobility of global capital.

The calculations of R. Krol were criticised in [Coiteux, Oliver, 2000]: here the authors thought it expedient to exclude Luxemburg from the sample because it is an obvious “outlier”. In this paper the authors estimated a panel model with error correction, using data on 22 OECD countries for 1960-1995.

In two different models (developed on the basis of results from a determination of the cointegration rank) the authors obtained identical coefficients, of 0.63, for the long-term ratios. These results were close to those obtained in the paper by M. Feldstein and C. Horioka. However, the coefficients of the long-term ratios in the two models were much lower (0.14 and 0.33). Based on the results of these estimates the authors came to the conclusion that there is lower capital mobility in the long term compared to that in the short term.

The paper [Ho, 2002] estimated panel data for 20 OECD countries for 1961-1997, using the FMOLS and DOLS methods. Regardless of the inclusion of Luxemburg, these models showed coefficients for the saving rate at the levels of 0.84 and 0.47, respectively. We should note that in the FMOLS models the determination coefficient was found to be higher, whilst the DOLS was asymptotically more effective. Owing to this, the authors prefer the results of the DOLS mode,l which evidence a lower degree of capital mobility compared to the findings of the pioneering work of Feldstein and Horioka, but a higher degree when compared to those of R. Krol.

In a later work [Ho, 2003] the author attempted to test the effect of the size of the country (the country's GDP as a proportion of the total GDP of all the countries considered) on the relationship between the investment and saving rates, when using threshold panel regressions. The paper used data on 23 OECD countries for 1961-1997. The author considered the specification with two threshold values. The estimated coefficients were significant, and tests on the thresholds did not reject the null hypothesis of their significance. The author came to the conclusion that the larger the size of a country the greater the coefficient of the saving rate. For countries, the relative size of which was above than an upper threshold, the coefficient was equal to 0.74. For a cluster of the smallest countries it was 0.31. This result is consistent with the hypothesis that large countries may affect the global interest rate: by increasing its saving a large economy causes a decrease in the world interest rate which results in an increase in investments in its economy. The relationship between investment and saving, taking into account other factors, was studied in [Fouquau, Hurlin, Rabaud, 2008]. The authors use a panel smooth transition regression technique on data from 24 OECD countries for 1960-2000. As threshold variables the authors used per capita GDP, the current account balance to GDP ratio and other proxies for the country size and the openness of its economy.

The authors demonstrated that high GDP growth rates increase the correlation between saving and investment because they can lead to an increase in both variables. Openness of the economy reduces this correlation: it is easier for such economies to

borrow money on the international market. A larger size of country increases the correlation between saving and investment. This result is consistent with the study by T.-W. Ho. Another important result of this work was its confirmation of the reduction of the correlation between saving and investment over time.

A similar conclusion, that the coupling of the coefficients of the saving and investment rates decreased over time (right down to a loss of significance in certain instances), was obtained in [Giannone, Lenza, 2004]. The results of this work do not reject the existence of the Feldstein-Horioka puzzle, but speak in favour of an increase in the mobility of global capital from the 1970s to the present day.

The dependence of the relationship between investment and saving on country size and the period being analysed has been studied in certain other works. For instance, in their paper [Coakley, Fuertes, Spagnolo, 2004] the authors found quite high capital mobility in the period from 1980 to 2000 when using data on 12 OECD countries. In the papers by [Helliwell, 2004] and [Feldstein, 2005] these authors showed that the correlation between saving and investment rates from the mid 1990s was reducing for the small OECD economies, but remained significant for the large OECD countries. This was explained by possible segmentation of the global capital market which, in turn, could result from the ability of larger economies to influence the world interest rate through their savings volumes.

A range of works studied the capital mobility issue in terms of the relationship between investment and saving in less developed countries. For example, [Kasuga, 2004] analysed a sample of less developed countries. The author came to the conclusion that the correlation between saving and investment in developed economies is much higher than that in developing countries. The higher correlation is also observed in countries where the primary securities markets are more developed than the banking sector. This is explained by the fact that the better developed primary financial market transforms a change in savings into a change in wealth more effectively than does the banking sector. Hence, the higher correlation between saving and investment in developed countries may be explained by the relatively high degree of development of their financial markets.

The issue of capital mobility and a high correlation between saving and investment has also been studied in the economics literature on theoretical models. For example, [Baxter, Crucini, 1993] analysed of a two-country one-sector stochastic growth model, driven by exogenous shocks to productivity. Within the context of this model the authors showed that an assumption of capital mobility may result in a high correlation between, investment and saving. This results from the fact that the dominating influence on the saving-investment correlation is the investment-output correlation (which is also exposed to shocks, which quickly expand to the other economy).

[Barro, Mankiw, Sala-i-Martin, 1995] analysed a neoclassic growth model. In this, countries are considered to differ only in tax rate, while the real interest rate in the long run equilibrium is the same for all economies. Within the context of their model the authors concluded that countries with a lower level of equilibrium capital show a higher marginal product of this capital. However, due to the higher tax rate in such countries the after-tax marginal product of the capital becomes aligned with that of other countries. Thus, in the equilibrium the real interest rate and after-tax marginal product of the capital do not depend on the desired level of capital in the long-run equilibrium. Therefore, when markets are opened, capital does not flow from one country to another so there remains a perfect correlation between saving and investment.

[Feldstein, 1994] and [Obstfeld, Rogoff, 2001] offer the following explanation of the high correlation between saving and investment: managers of various financial funds tend to invest in domestic securities, perhaps due to the greater availability of information, and to the political and currency risks.

Based on the results of the above works on the relationship between capital mobility and the correlation between saving and investment, we shall analyse corresponding dependencies over the last 15 years.

2. PROBLEM STATEMENT AND DATA DESCRIPTION

The analysis of empirical and theoretical works devoted to the Feldstein-Horioka puzzle is helpful in drawing conclusions on trends in the level of international capital mobility and suggesting possible lines of further research. An important trend identified in many studies is the weakening of the relationship between these variables over time, and this is often interpreted as an increase in capital mobility.

The purpose of this article is to test the existence of a relationship between domestic saving and investment rates in the last 15 years, with the study focusing on both the long-term and short-term relationships. This paper also compares the level of capital mobility for developed and developing economies. It should be noted that the econometric models described above are directly useful in testing the hypothesis of the relation between saving and investment. The results of testing the hypothesis may be interpreted in terms of mobility if a major part of the domestic investment is financed particularly from domestic savings. The situation where the entire domestic savings volume goes abroad, while investments are fully financed from outside the country, is characterised by high capital mobility, although in this case we may still observe a significant correlation between saving and investment. It can be assumed here that, in most countries, a major part of investment is financed from domestic savings, because the asymmetry of information between domestic and foreign investors often forces the former to make investments in their own economy. The main hypothesis of this paper is that there were changes in the nature of the relationship between saving and investment rates both before and after the global financial crisis of 2008. Firstly, this may be associated with an increased avoidance of risk by investors due to economic problems in developed countries (see, for example, [Drobyshevsky, Sinel'nikov-Murylev, Trunin, 2011]). Secondly, in the post-crisis period the information asymmetry increased, and many investors preferred to invest in their own economies due to the easier risk assessment for such investment projects. All this should lead to a reduction in the level of international mobility of capital, and

therefore, increase the correlation between the rates of domestic saving and investment in the post-crisis period.

The ratios of total domestic investment and of savings to GDP are used as the key variables in this paper. Net domestic investment consists of the fixed capital formation costs and the net changes in inventory. Total domestic savings are defined as GDP minus final consumption expenditure.

The annual data on the above variables for 71 countries for the period from 1996 to 2011 were taken from the World Bank and OECD databases. The sample of countries for which the required variables are available includes 30 OECD countries[2] and 41 developing countries[3] with high and above-average incomes. The sample of countries is limited to the specified set, either due to the lack of data for some countries or due to poor quality statistics.

Table 1 presents the average values and standard deviations of saving and investment rates for the OECD countries. It can be noted that in the more developed economies (with the exception of the USA and UK) saving exceeds investment, whilst in less developed countries, investment exceeds saving. This evidences a flow of capital from more developed to less developed countries.

Table 1. Average values and standard deviations of saving and investment rates for OECD countries for the period from 1996 to 2011

	Investment rate		Saving rate	
Country	Average	Standard deviation	Average	Standard deviation
Luxembourg	21.56	1.92	46.18	4.81
Ireland	21.54	5.08	35.51	3.29
Norway	22.09	2.43	34.72	3.98
Switzerland	21.90	1.25	29.11	2.09
Sweden	18.01	1.27	24.96	1.37
Netherlands	20.34	1.66	27.11	0.98
Finland	20.19	1.44	25.98	3.28
Denmark	20.23	1.93	24.84	1.74

[2]Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States of America.

[3] Angola, Argentina, Azerbaijan, Belarus, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Gabon, Hong Kong, Kazakhstan, Kuwait, Latvia, Lithuania, Macedonia, the former Yugoslav Republic, Malaysia, Malta, Mauritius, Mexico, Namibia, Panama, Peru, Romania, Russia, Saudi Arabia, Singapore, South Africa, St. Kitts and Nevis, St. Lucia, Thailand, Tunisia, Turkey, Turkmenistan, Uruguay, Venezuela.

Germany	19.29	1.92	23.03	1.27
Belgium	21.30	1.31	24.81	1.24
Austria	23.31	1.26	26.33	1.34
Korea, Rep.	30.18	3.24	32.76	2.33
Canada	21.03	1.57	23.56	2.01
Japan	23.41	2.66	24.49	2.93
Italy	20.54	0.96	21.31	1.74
Czech Republic	28.03	2.49	28.41	1.81
New Zealand	21.96	1.72	22.25	1.30
France	19.38	1.49	19.51	1.25
Hungary	23.70	2.92	23.78	1.71
Slovenia	26.08	3.11	25.14	2.31
Australia	26.21	1.65	25.27	1.69
Israel	19.29	2.67	17.78	1.66
United Kingdom	16.92	1.21	15.12	1.57
Iceland	21.79	5.99	19.28	2.34
Spain	26.02	3.21	23.28	1.31
United States	18.40	2.05	14.64	2.38
Slovak Republic	27.68	4.10	23.29	1.75
Estonia	29.67	5.64	24.77	3.47
Portugal	24.15	3.27	15.77	2.16
Greece	22.69	3.16	11.11	2.06

Source: World Bank.

The main tool for testing the hypothesis that the existence of long-term capital mobility is a regression of the time-averaged investment rates per saving rate for each country has the following form:

$$I_i = \alpha + \beta S_i + \varepsilon_{\mathrm{i}}$$

where I_i — average investment rate for country i for the period, S_i — average saving rate for country i for the period, ε_i — error. This will hereinafter be referred to as the cross-sectional[4] specification. This equation will be evaluated separately for the OECD countries and the others. This long-term relationship will also be considered for different time intervals, in particular, before and after the world financial crisis, as this will help in testing the proposed hypothesis.

Another model evaluated in this paper is the panel regression with individual fixed effects as follows:

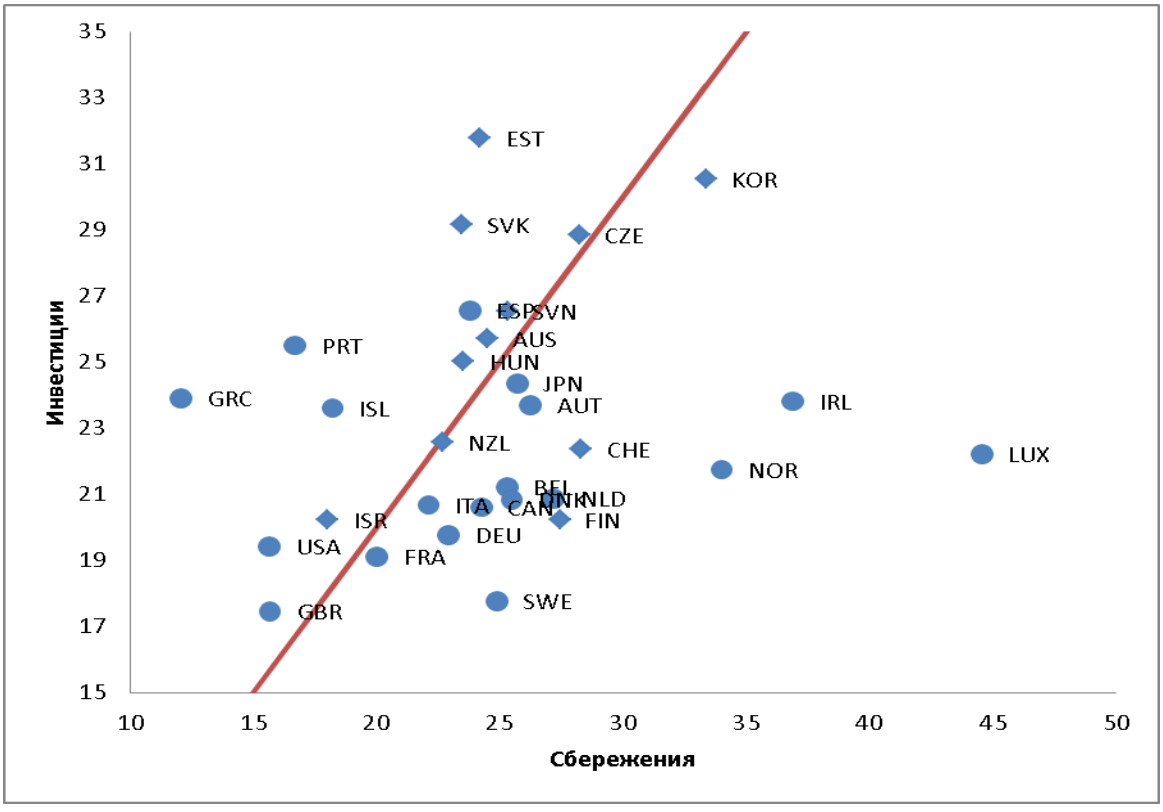
$$I_{i,t} = \alpha_i + \beta S_{i,t} + \varepsilon_{\mathrm{i,t}}$$

[4] Technically this model is fully equivalent to a 'between' estimation of the panel regression.

where $I_{i,t}$ — investment rate of country i at time t, $S_{i,t}$ — saving rate of country i at time t, $\varepsilon_{i,t}$ — error. This model will be used for testing the hypothesis of there being short-term capital mobility in the countries studied. It will hereinafter be referred to as the panel regression.

3. EVALUATION RESULTS

As seen from Table 1, Luxemburg is an obvious outlier in the sample which may be explained by its special economic status: its attractive tax regime facilitates a substantial inflow of funds from other countries and these accumulate in bank accounts held there. Figure 1 therefore illustrates the considerable estrangement of Luxemburg from other countries which results from the high level of savings. Based on the above a decision was made to exclude it from the sample in estimating the models[5].



Source: World Bank. Round markers denote the original OECD members. The straight line is the bisector of the axes.

[5] A similar solution has been used in many other works, such as [Krol, 1996].

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Инвестиции	Investments
Сбережения	Savings

Figure 1. Average values of saving and investment rates for the period from 1996 to 2007 for OECD countries

Following from the results of [Phillips, Moon, 1999], it should be noted that, within the current study, there was no necessity to test the investment and saving rates series for time invariance. The referenced work showed the consistency and asymptotic normality (over time with a finite number of objects) of estimates of the coefficients for the panel regression for non-stationary time series, regardless of whether cointegration was present or not.

Table 2 contains the results of the regression of time-average investment rates on time-averaged saving rates for 29 OECD countries. The four models differ in the periods over which the data were averaged.

Table 2. Cross-sectional models for OECD countries

	(1)	(2)	(3)	(4)
Variables	1996-2001	2002-2007	1996-2007	2009-2011
Savings	0.194	0.195	0.180	0.249**
	(0.134)	(0.127)	(0.125)	(0.101)
Constant	18.59***	18.55***	18.91***	14.08***
	(3.276)	(3.153)	(3.082)	(2.341)
Number of observations	29	29	29	29
R-squared	0.072	0.080	0.071	0.184

Standard errors are specified in brackets

*** p<0.01, ** p<0.05, * p<0.1

The first three models in Table 2 correspond to the pre-crisis period and its two sub-periods. It may be noted that the estimated coefficients of the saving rates in these three models are close in value but, what is more important, insignificant. The corresponding coefficient in the model estimated for the post-crisis period was found to be significant, so this indicates a significant correlation between saving and investment in OECD counties after the world financial crisis. This result is consistent with the hypothesis that there was a reduction in the level of capital mobility after the crisis. This reduction could have been caused by the increased asymmetry of

information on investment project risks between domestic and foreign investors, the general increase of uncertainty in the world economy and the growth of financial protectionism.

Next we shall analyse similar cross-sectional models for non-OECD countries with high and above-average per capita income. Table 3 contains the results of estimation of the models for the different periods.

Table 3. Cross-sectional models for non-OECD countries with high and above-average income

	(1)	(2)	(3)	(4)
Variables	1996-2001	2002-2007	1996-2007	2009-2011
Savings	0.319***	0.107	0.197**	0.238***
	(0.0810)	(0.0833)	(0.0768)	(0.0743)
Constant	16.32***	20.85***	18.79***	18.00***
	(2.054)	(2.460)	(2.090)	(2.371)
Number of observations	41	41	41	41
R-squared	0.285	0.040	0.144	0.208

Standard errors are specified in brackets

*** p<0.01, ** p<0.05, * p<0.1

As follows from Table 3, in the period from 1996 to 2001 the coefficient of the saving rate was significant, indicating limited capital mobility during this period which could be due, amongst other things, to the Asian and Russian financial crises. In the following six-year period the corresponding coefficient is insignificant. This result may be explained by increased investment flows into the less developed countries during the global economic boom, followed by the global economic crisis.

In the post-crisis period from 2009 to 2011, the correlation between saving and investment again becomes significant. This result is equivalent to the result obtained from the sample of OECD countries. In this case the significant coefficient should also be interpreted as a decrease in the mobility of long-term capital, which could have been caused by the outflow of investments from the less developed countries due to the financial difficulties which investors faced after the world crisis, and to the increased information asymmetry between countries.

Thus, the results obtained are consistent with the stated hypothesis of a change in the post-crisis level of international capital mobility. The increased saving to investment correlation may evidence a reduction in the level of long-term capital mobility in the world economy.

It should be noted that the significant coefficients of the saving rate obtained in the models for the post-crisis period do not exceed 0.3, which is approximately two times less than the estimates obtained in earlier works, including in [Feldstein, Horioka, 1980]. Thus, it can be concluded that the post-crisis capital mobility still remains at a higher level than that observed in the 1970and1980s. The results of the estimations of the cross-sectional models for developing countries also argue in favour of the hypothesis of an increase in capital mobility over time. In these models a significant coefficient for the six-year period until 2001 was replaced by an insignificant value in the equivalent period until 2007.

After analysing the models in order to test the hypothesis relating to long-term capital mobility we shall now proceed to models for studying the nature of short-term capital mobility. For this purpose we shall use the panel regressions described in the previous section. Table 4 reports the results of the evaluation of the models for OECD countries.

Table 4. Panel regressions for OECD countries

	(1)	(2)	(3)
Variables	1996-2007	1996-2011	2008-2011
Savings	0.382***	0.439***	0.736***
	(0.0667)	(0.0597)	(0.144)
Constant	14.06***	12.18***	3.849
	(1.605)	(1.421)	(3.303)
Number of observations	348	464	116
R-squared	0.094	0.111	0.233
Number of countries	29	29	29

Standard errors are specified in brackets

*** p<0.01, ** p<0.05, * p<0.1

Our calculations show that the model for the period which includes the crisis, and which corresponds to the second estimated regression, shows a more significant

coefficient than the model estimated for the pre-crisis period (regression 1). It indicates an increase in the correlation between investments and savings during the crisis and post-crisis period.

The panel regression estimated in the period from 2008 to 2011 shows a considerably higher coefficient for the saving rate. This result, as with the results of the cross-sectional models, is consistent with the hypothesis of a reduction in capital mobility, following the world financial crisis. It should be noted that, in this case, the nature of the models being used for estimation relates particularly to discussion of capital mobility over the short term, which is why one should not compare the coefficient values from these models to the cross-sectional results. We note than the estimates obtained for 2008-2011 should be interpreted with caution because they are calculated for quite a short time period and may not be sufficiently stable and sensitive to changes in that time interval.

Based on the results of estimation of the cross-sectional models and panel regressions for the OECD countries and the conclusions drawn in earlier studies, it can be concluded that the long-term relationship between savings and investment has almost disappeared by the mid-2000s, while the estimates of the panel regressions show a significant dependency during the entire period included in the study of this puzzle. This result can be explained by the fact that, in accordance with the above theoretical models, a correlation between saving and investment over a short period may arise through the channel of influence of various economic shocks for these variables, whilst the averaging smoothes over the influence of such shocks on these variables, so this influence becomes less obvious.

Although the evaluation of the regressions on the averaged data enables us to draw conclusions regarding the long-term capital mobility, while the assessment of panel regressions characterises short-term mobility, it would not be entirely correct to compare the values of the coefficients from these two types of regression in order to draw conclusions in favour of either greater short-term, or greater long-term mobility. The fact is, that these models represent substantively different specifications, so it is more reasonable to make quantitative conclusions only within the framework of each

specification, separately. The transition, from testing the hypothesis of the significance (or equality to a certain value) of the saving-investment correlation coefficient, to a hypothesis indicating the degree of capital mobility may be performed only within the context of a single model, assuming a negative dependence of the level of capital mobility on the extent of correlation between saving and investment. However, this approach does not imply any assumptions on the functional form of the dependence of the level of capital mobility on the correlation being analysed. For example, when we assume a different convexity of the functional dependence of the long-term capital mobility on the correlation between savings and investments in the cross-sectional model, or the effect of short-term capital mobility on the estimate of correlation in the model with individual fixed effects, equality of the correlation estimates in the two different modules will actually correspond to different degrees of capital mobility.

Let us now turn to the evaluation of panel regressions in the sample of developing countries. The evaluation results are laid out in Table 5. The results of the panel regressions estimated for developing economies, over the same periods, illustrate similar trends to those of the coefficients for the OECD countries. However, it should be noted that the coefficients for the saving of developing economies are significantly lower than those for developed economies. Thus, these results are consistent with the hypothesis of greater capital mobility in developing economies. This could be the result of the capital market segmentation among large developed countries described in [Feldstein, 2005].

Table 5. Panel regressions for non-OECD countries

	(1)	(2)	(3)
Variables	1996-2007	1996-2011	2008-2011
Savings	0.0541	0.112***	0.168***
	(0.0353)	(0.0272)	(0.0590)
Constant	22.36***	21.20***	20.43***
	(0.912)	(0.730)	(1.697)
Number of observations	492	656	164
R-squared	0.005	0.027	0.062
Number of countries	41	41	41

Standard errors are specified in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 6 contains, for the purpose of comparison, both the results of the regressions which we estimated and those of other authors. As seen from the Table, our results are consistent with those of earlier years.

Table 6. Results of studying the relationship between investment and saving

Paper	Sample	Results
M. Feldstein and C. Horioka, 1980	21 OECD countries	0.909 (1960-1964), 0.872 (1965-1969), 0.871 (1970-1974); BE
R. Krol, 1996	21 OECD countries	0.20 (1962-1990), 0.16 (1075-1990); FE
M. Coiteux and S. Olivier, 2000	22 OECD countries	0.63 (1960-1995); ECM
T.-W. Ho, 2002	20 OECD countries	0.84 (1961 — 1997 FMOLS), 0.47 (1961 — 1997 DOLS)
T.-W. Ho, 2003	23 OECD countries	0.74 for large countries and 0.31 for small countries, the threshold regression was estimated for 1961-1997
J. Fouquau et al., 2008	24 OECD countries	Various coefficients from 0.29 to 0.85 depending on the specification, panel smooth transition regressions were used for 1960-2000
G. Giannone, M. Lenza, 2004	20 OECD countries	0.51 (1970–1979), 0.28 (19890-1989), 0.51 (1990-1998), 0.26 (1999-2007); FE
J. Coakley et al., 2004	12 OECD countries	0.68 (1980-2000); BE
J. Helliwell, 2004	24 OECD countries	0.6 (1986-1990), 0.42 (1991-1995), 0.17 (1996-2000); BE
H. Kasuga, 2007	23 OECD countries	0.46 (1980-1984), 0.66 (1985-1989), 0.36 (1990-1994); BE
H. Kasuga, 2007	79 developing countries	Coefficients are insignificant; BE
Results of this work	29 OECD countries	Estimates are insignificant for 1996-2007, 0.249 for 2009-2011; BE
Results of this work	41 developing countries	0.32 (1996-2001), coefficient is insignificant for 2002-2007, 0.238 for 2009-2011; BE
Results of this work	29 OECD countries	0.38(1996-2007), 0.74(2008-2011); FE
Results of this work	41 developing countries	Coefficient is insignificant for 1996-2007, 0.168 (2008-2011); FE

Numbers in brackets indicate the corresponding period analysed; abbreviations FE, BE, DOLS and FMOLS indicate the econometric methods used in evaluation concerned.

Now let us consider the issue of the relationship between saving and investment in Russia. Table 6 contains the results of evaluating the model using Russian data.

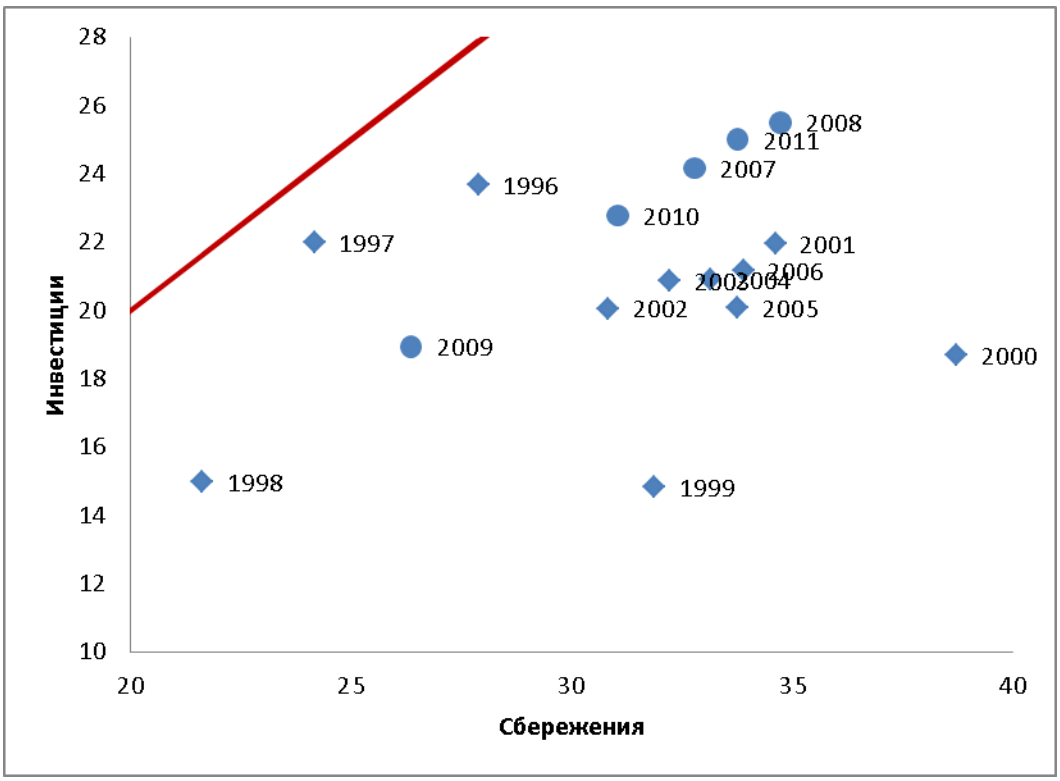
Table 7. Estimates for Russia

	(1)	(2)
Variables	1996-2011	2007-2011
Savings	0.221	0.800***
	(0.181)	(0.0193)
Constant	14.03**	-2.113**
	(5.726)	(0.614)
Number of observations	16	5
R-squared	0.097	0.998

Standard errors are specified in brackets

*** p<0.01, ** p<0.05, * p<0.1

The results of the model estimation for Russia show that, over the entire period, the coefficient of saving was insignificant, however, a stable dependency is observed for the sub-period from 2007 to 2011. This result is consistent with the insignificant coefficient of the saving rate obtained earlier, in a similar model estimated for the period from 1995 to 2004 [Drobyshevkii, Trunin, 2006], indicating the absence of significant correlation between the variables studied for the pre-crisis period. The estimated coefficients indicate the proportion of the increase in investment that was financed through the increase in savings: in particular, from 2007 to 2011 a savings rate increase of 1 percentage point conduced an investment rate increase of 0.8 of a percentage point. For illustrative purposes Figure 2 depicts the values of investments and savings in Russia during the period under review. It should be noted that in Russia saving considerably exceeded investment in this period. In the 2000s this fact can be explained by the existence of sovereign wealth funds generated from revenues resulting from the taxation of mineral resources. A similar situation can be observed for another large oil exporter, Norway, as seen from figure 1.



Source: World Bank. Round markers denote points corresponding to the period of 2007 to 2011. The straight line is the bisector of the axes.

Инвестиции	Investments
Сбережения	Savings

Figure 2. Saving and investment rates in Russia

The absence of correlation between investment and saving before 2007 may evidence high capital mobility in Russia in this period. At the start of the 2000s Russia was gradually liberalising capital transactions which, under conditions of explosive economic growth, increased the country's attractiveness for foreign investors, so an influx of capital to the country was observed (for more information see [Drobyshevskii, Kadochnikov, Sinel'nikov-Murylev, 2007]). The minor share (about 10-15%) of foreign investments in the total investment volume within the country[6] in the 2000s makes it possible to interpret the correlation between saving

[6] According to the Russian Federal State Statistic Service, in 2010 and 2011 the share of foreign investment in the total volume of investment in fixed capital was 7.9% and 5.7%, respectively, which is less than, for example, the 11.2% in 2005. It should be noted that these indicators reflect only a part of the foreign investments in the Russian economy, in particular, the part relating to the investment in fixed capital.

and investment as representing the level of capital mobility because the probability of a complete withdrawal of domestic savings out of the country and a development of national investments solely using foreign capital, is unlikely.

After 2007 the economic growth in the RF slowed down, and the global economic crisis resulted in a decrease of investors' tolerance of risk, so this caused an outflow of capital (see [Drobyshevskii, Sinel'nikov-Murylev, 2012]. The high correlation between saving and investment in the period from 2007 to 2011 is consistent with the hypothesis of a low level of capital mobility between Russia and the rest of the world since the increase in investment was directly due to the increase in domestic saving.

CONCLUSION

In this article we have demonstrated that long-term capital mobility has decreased considerably following the world financial crisis. This result is true for both OECD countries and for the developing economies. However, despite the evidence in favour of limited capital mobility in the global economy after the financial crisis of 2008, evaluation of the models shows a significantly lower correlation between saving and investment compared to the results obtained in the pioneering work of M. Feldstein and C. Horioki. In general, the results obtained are consistent with the hypothesis of an increase in the level of long-term capital mobility in the global economy over time.

The global financial crisis had a negative effect on short-term international capital mobility. The model estimates for the OECD countries, and for the developing economies, are consistent with this thesis. In both cases an increase in correlation between saving rates and investment rates in the post-crisis period is observed. These results are consistent with the hypothesis of a decrease in capital mobility after the 2008 global financial crisis. The possible reasons for these trends are the increased asymmetry of information concerning risk assessments of investment projects, and

the overall level of uncertainty in the global economy, together with an acceptance by many countries of new restrictions on the mobility of capital.

In the paper we have also considered the relationship between saving and investment in the Russian economy. The estimates obtained support the hypothesis of high capital mobility between Russia and the rest of the world in the period before 2007. From 2007 to 2011 an increase in correlation between saving and investment was observed, which had resulted from the financing of domestic investments primarily from internal sources. It seems that this happened as a result both of the global processes of decrease in the mobility of international capital, and the decrease in Russia's investment attractiveness in recent years. Given the instability of the global economy, Russia will have to make significant efforts in order to attract the resources of foreign investors for modernisation of the national economy.

The results we have obtained evidence that domestic investment in the Russian Federation has a leading role to play in financing fixed capital investments, which are the main driver of economic growth. Hence, the economic policy of the Russian government should be aimed at stimulation of domestic saving. We should note that the current guidance on the reduction of loan interest rates by commercial banks is contrary to this since low interest rates discourage saving. The social aspect of low interest rates, coupled with the worsening financial position of senior citizens due to the low-income returns of private pension saving, should also be taken into account.

Moreover, under the existing conditions of low unemployment rates and high monopolisation of the domestic market of the RF, stimulating monetary policy in order to cause a reduction of interest rates may result, not in an increase in economic activity, but in an acceleration of inflation, which will only discourage saving, and result in an outflow of capital to foreign countries because of the low domestic interest rates and increasing expectations of weakening of the rouble.

In our opinion the key objective of the monetary policy of the Central Bank of Russia, and one which would create the conditions for increasing domestic saving and for stable economic growth, should be the reduction of inflation to ensure increased attractiveness of saving, due to the growth of real interest rates. In this case

the decreased expectations of inflation, and of inflation volatility, will contribute to a reduction in risk for economic agents, resulting in a decreased cost of credit for them. Finally, the most important element of risk reduction for economic agents should be an increase in the quality of the institutional environment in the RF (for more information see [Vedev, Kosarev, 2012]), which will encourage the growth of, not only domestic, but also of foreign investment in Russia, including through the repatriation of the funds previously moved abroad by Russian residents.

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Feldstein-Horioka Puzzle: Modern Aspects

Abstract

The primary purpose of this paper is to test the hypothesis of reduced capital mobility after the global financial crisis of 2008-2009. Through the models constructed we have tested hypotheses regarding the long-term and short-term mobility of global capital by assessing the correlation between saving and investment rates. The paper also addresses the question of capital mobility in Russia. Based on the results, recommendations are made for the direction of monetary policy in Russia over the coming years.

Key words: Feldstein-Horioka puzzle, capital mobility, monetary policy.

References

1. *Vedev A.L., Kosarev A.E.* Nekotorye kolichestvennye otsenki vozdeistviia institutsional'nykh ogranichenii na ekonomicheskii rost v Rossii [Some

quantitative estimates of the impact of institutional constraints on economic growth in Russia]. Ekonomicheskaia politika. 2012. No. 1.

2. *Drobyshevskii S.M., Kadochnikov P.A., Sinel'nikov-Murylev S.G.* Nekotorye voprosy denezhnoi i kursovoi politiki v Rossii v 2000—2006 godakh i na blizhaishuiu perspektivu [Some questions of monetary and exchange rate policy in Russia in 2000-2006, and in the near future]. Voprosy ekonomiki. 2007. No. 2.
3. *Drobyshevskii S.M., Sinel'nikov-Murylev S.G., Trunin P.V.* Resheniia G20 o skoordinirovannoi antikrizisnoi ekonomicheskoi politike i rossiiskii opyt [G20 decisions on coordinated anti-crisis economic policy and the Russian experience]. Rossiiskii vneshneekonomicheskii vestnik. 2011. No. 5-6.
4. *Drobyshevskii S.M., Sinel'nikov-Murylev S.G.* Makroekonomicheskie predposylki realizatsii novoi modeli rosta [Macroeconomic assumptions of the new growth model]. Voprosy ekonomiki. 2012. No. 9.
5. *Drobyshevskii S.M., Trunin P.V.* Vzaimodeistvie potokov kapitala i osnovnykh makroekonomicheskikh pokazatelei v Rossiiskoi Federatsii [The interaction of capital flows and main macroeconomic indicators in the Russian Federation]. Moscow. Nauchnye trudy. 2006. No. 94P.
6. *Barro R. J., Mankiw N. G., Sala-i-Martin X.* Capital mobility in neoclassical models of growth // Domestic Bureau of Economic Research. 1995. No w4206.
7. *Baxter M., Crucini M. J.* Explaining saving–investment correlations // The American Economic Review. 1993. P. 416-436.
8. *Coakley J., Fuertes A.M., Spagnolo F.* Is the Feldstein_Horioka puzzle history? // The Manchester School. 2004. 72. 569-590.
9. *Coiteux M., Olivier S.* The saving retention coefficient in the long run and in the short run: Evidence from panel data // Journal of Interdomestic Money and Finance. 2000. 19. 535-548.
10. *Feldstein M.* Monetary policy in a changing interdomestic environment: The role of capital flows // NBER Working Paper. 2005. No 11856.
11. *Feldstein M.* Tax policy and interdomestic capital flows // Review of World Economics. 1994. 130. No 4. 675-697.

12. *Feldstein M., Horioka C.* Domestic savings and interdomestic capital flows // Economic Journal. 1980. 90. 314-329.
13. *Fouquau J., Hurlin C., Rabaud I.* The Feldstein-Horioka puzzle : A Panel Smooth transition regression approach // Economic Modelling. 2008. 25. 284-299.
14. *Giannone D., Lenza M.* The Feldstein-Horioka fact // NBER Interdomestic Seminar on Macroeconomics. 2004. 6(1). 103-117.
15. *Helliwell J.* Demographic change and interdomestic factor mobility. Global Demographic Change: Economic Impacts and Policy Changes // Federal Reserve Bank of Kansas City. 2004. 369-420.
16. *Ho T.-W.* The Feldstein-Horioka puzzle revisited // Journal of Interdomestic Money and Finance. 2002. 21. 555-564.
17. *Ho T.-W.* The saving-retention coefficient and country-size: The Feldstein-Horioka puzzle reconsidered // Journal of Macroeconomics. 2003. 25. 387-396.
18. *Kasuga H.* Saving-investment correlations in developing countries // Economics Letters. 2004. 83. 371-376.
19. *Krol R.* Interdomestic capital mobility: evidence from panel data // Journal of Interdomestic Money and Finance. 1996. 15 (3). 467–474.
20. *Mankiw N. G., Romer D., Weil D. N.* A contribution to the empirics of economic growth // The quarterly journal of economics. 1992. 107(2). 407-437.
21. *Obstfeld M., Rogoff K.* The six major puzzles in interdomestic macroeconomics: is there a common cause? // NBER Macroeconomics Annual 2000. Vol. 15. MIT press. 2001. 339-412
22. *Phillips P. C., Moon H. R.* Linear regression limit theory for nonstationary panel data // Econometrica. 1999. 67(5). 1057-1111.

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The primary purpose of this paper is to test the hypothesis of capital mobility reduction after the global financial crisis of 2008-2009. Through the constructed models we tested hypotheses about the long-term and short-term mobility of global capital by estimating the correlation between savings and investment rates. The paper also concerns the question of capital mobility in Russia. Based on the results recommendations are made on monetary policy in Russia in the coming years.

Key words: Feldstein-Horioka puzzle, capital mobility, monetary policy.

References

1. Vedev A.L., Kosarev A.E. Nekotorye kolichestvennye otsenki vozdeistviia institutsional'nykh ogranichenii na ekonomicheskii rost v Rossii [Some quantitative estimates of the impact of institutional constraints on economic growth in Russia]. Ekonomicheskaia politika. 2012. No. 1.
2. Drobyshevskii S.M., Kadochnikov P.A., Sinel'nikov-Murylev S.G. Nekotorye voprosy denezhnoi i kursovoi politiki v Rossii v 2000—2006 godakh i na blizhaishuiu perspektivu [Some questions of monetary and exchange rate policy in Russia in 2000-2006, and in the near future]. Voprosy ekonomiki. 2007. No. 2.
3. Drobyshevskii S.M., Sinel'nikov-Murylev S.G., Trunin P.V. Resheniia G20 o skoordinirovannoi antikrizisnoi ekonomicheskoi politike i rossiiskii opyt [G20 decisions on coordinated anti-crisis economic policy and the Russian experience]. Rossiiskii vneshneekonomicheskii vestnik. 2011. No. 5-6.

4. Drobyshevskii S.M., Sinel'nikov-Murylev S.G. Makroekonomicheskie predposylki realizatsii novoi modeli rosta [Macroeconomic assumptions of the new growth model]. Voprosy ekonomiki. 2012. No. 9.
5. Drobyshevskii S.M., Trunin P.V. Vzaimodeistvie potokov kapitala i osnovnykh makroekonomicheskikh pokazatelei v Rossiiskoi Federatsii [The interaction of capital flows and main macroeconomic indicators in the Russian Federation]. Moscow. Nauchnye trudy. 2006. No. 94P.
6. *Barro R. J., Mankiw N. G., Sala-i-Martin X.* Capital mobility in neoclassical models of growth // Domestic Bureau of Economic Research. 1995. No w4206.
7. *Baxter M., Crucini M. J.* Explaining saving–investment correlations // The American Economic Review. 1993. P. 416-436.
8. *Coakley J., Fuertes A.M., Spagnolo F.* Is the Feldstein_Horioka puzzle history? // The Manchester School. 2004. 72. 569-590.
9. *Coiteux M., Olivier S.* The saving retention coefficient in the long run and in the short run: Evidence from panel data // Journal of Interdomestic Money and Finance. 2000. 19. 535-548.
10. *Feldstein M.* Monetary policy in a changing interdomestic environment: The role of capital flows // NBER Working Paper. 2005. No 11856.
11. *Feldstein M.* Tax policy and interdomestic capital flows // Review of World Economics. 1994. 130. No 4. 675-697.
12. *Feldstein M., Horioka C.* Domestic savings and interdomestic capital flows // Economic Journal. 1980. 90. 314-329.
13. *Fouquau J., Hurlin C., Rabaud I.* The Feldstein-Horioka puzzle : A Panel Smooth transition regression approach // Economic Modelling. 2008. 25. 284-299.
14. *Giannone D., Lenza M.* The Feldstein-Horioka fact // NBER Interdomestic Seminar on Macroeconomics. 2004. 6(1). 103-117.
15. *Helliwell J.* Demographic change and interdomestic factor mobility. Global Demographic Change: Economic Impacts and Policy Changes // Federal Reserve Bank of Kansas City. 2004. 369-420.

16. *Ho T.-W.* The Feldstein-Horioka puzzle revisited // Journal of Interdomestic Money and Finance. 2002. 21. 555-564.
17. *Ho T.-W.* The saving retention coefficient and country-size: The Feldstein-Horioka puzzle reconsidered // Journal of Macroeconomics. 2003. 25. 387-396.
18. *Kasuga H.* Saving-investment correlations in developing countries // Economics Letters. 2004. 83. 371-376.
19. *Krol R.* Interdomestic capital mobility: evidence from panel data // Journal of Interdomestic Money and Finance. 1996. 15 (3). 467–474.
20. *Mankiw N. G., Romer D., Weil D. N.* A contribution to the empirics of economic growth // The quarterly journal of economics. 1992. 107(2). 407-437.
21. *Obstfeld M., Rogoff K.* The six major puzzles in interdomestic macroeconomics: is there a common cause? // NBER Macroeconomics Annual 2000. Vol. 15. MIT press. 2001. 339-412
22. *Phillips P. C., Moon H. R.* Linear regression limit theory for nonstationary panel data // Econometrica. 1999. 67(5). 1057-1111.