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Foreign Direct and Portfolio Investment in the Contemporary Globalized World: Should They Be Still Treated Separately?

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Abstract

Foreign direct investment (FDI) and foreign portfolio investment (FPI) have been long considered as independent forms of international capital flows. This paper analyzes the mutual relationship between FDI and FPI and attempts to answer the question whether they complement or substitute for each other from a foreign investor's point of view. The paper describes the main characteristics of FDI and FPI in terms of their volatility and profitability. We analyze the long-run and short-run relationships between FDI and FPI using vector error correction (VEC) regressions on data for Poland as it is the largest country in Central and Eastern Europe and receives the lion's share of these two forms of capital in the region. Our investigation suggests that FDI and FPI may be regarded as substitutes. In economically stable periods FDI tends to dominate over FPI but during insecurity and economic distress FPI starts to gain importance.

Keywords: foreign direct investment, foreign portfolio investment, emerging market economies, econometric modeling, cointegration

JEL Classification: F21, F41, O1

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1 Introduction

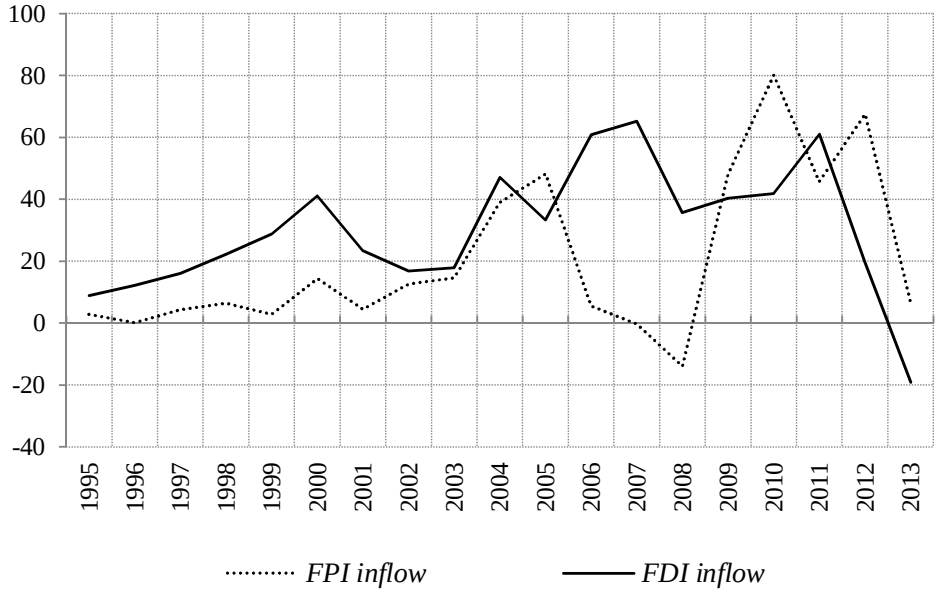
Over the last two decades the financial integration of emerging market economies (EMEs) with international markets has gained momentum. According to the Institute of International Finance, Washington-based think tank, the value of net private capital inflows to EMEs grew from about 30 billion US dollars during the 1980s to around 320 billion of US dollars during 2000-2005, before reaching an all-time high of 1.2 trillion US dollars in 2007. This phenomenon has been influenced by a number of factors, which can be divided into two groups: country-specific/pull and external/push drivers. The first group reflects the relatively high expected profitability of EMEs' assets adjusted by the perceived risk due to an improved fundamentals of these economies. The second group mirrors common global conditions at that time such as both low interest rates and returns on financial assets in the developed countries. The aforementioned factors have encouraged foreign investors to increase their participation in the emerging markets economies, which in turn helped to foster the development of their financial markets and assets, such as local currency-denominated sovereign debt. Thanks to this, many EMEs managed to shift from issuing hard currency external debt to local currency domestic debt and as a result they partially overcame so-called *original sin*, which made them more vulnerable to sudden stops of capital.

Since the early 1980s private foreign capital has been flowing to EMEs primarily in the form of direct investment (FDI). This resulted from the fact that historically FDI has been considered as a safe source of external financing and a factor stabilizing the financial system of the recipient countries. The abovementioned view has been reflected in the EMEs approach to as they have lifted, in the first place, restrictions on long-term flows and then gradually on short-term flows. Along with the development of local financial markets in EMEs and their greater openness to foreign investors, the composition of capital inflows has shifted towards the rising share of foreign portfolio investment (FPI) in total flows. An increase in the volume of FPI flows to EMEs has been also connected with the growing importance of so-called *institutional investors* (pension funds, insurance companies, sovereign wealth funds, central banks, private equity funds, etc.), as they added liquidity to global securities markets.

In the initial decades of globalization empirical studies have made a clear cut between FDI and FPI as *multinational corporations* channeled their money abroad mainly through a direct investment, while aforementioned *institutional investors* focused on a portfolio investment. However, today in the contemporary globalized world it can be also hypothesized that there are serious reasons to analyze them jointly. Firstly, as it was indicated earlier, the integration of EMEs with the world economy and the development of their local financial markets attracted foreign capital. Secondly, the new type of international investors (*institutional investors*) has appeared, which changed the nature and dynamics of capital flows worldwide. These *institutional investors* increased holdings of EMEs' financial assets both equities and bonds (especially in the form of local currency-denominated government debt securities).

According to Arslanalp and Tsuda (2014) around 50% of local currency-denominated government bonds is held by these type of investors (IMF 2014). What is more, the government debt accounts for the lion's share of FPI in those countries. In Poland the share of government debt in FPI exceeds even 95%. Institutional investors began also to invest directly in FDI in emerging market economies and thus compete with multinational corporations (UNCTAD 2015). An interest in direct investing has increased since the global financial crisis of 2007-2009, as this new group of investors wanted to increase long-term returns and diversify their portfolios in the times of historically low interest rates (WEF 2014).

Figure 1: FDI and FPI inflows in Poland (PLN, billions, current prices)



Our research question is whether FDI and FPI complement or substitute for each other from an investor's point of view. In Poland the FDI and FPI inflows during the initial period 1995-2004 moved in the same direction, but after Poland joined the EU in 2004, we observe that both flows move in opposite directions in a systematic way (see Figure 1). This behavior seems to be motivated *inter alia* by the performance of the global economy and the risk perception of foreign investors. We perform the empirical analysis on the Polish data due to the following reasons. Firstly, Poland is the biggest country in Central and Eastern Europe (CEE), which successfully underwent the transition to an open market economy two decades ago and saw a continuous inflow of foreign capital. Secondly, Poland is considered by investors as a core market in CEE region, due to the fact that *inter alia* has relatively large and deep financial

markets, thus many multinational firms located their headquarters for CEE just in it. According to foreign investors both already present and new ones, Poland is regarded as the attractive destination in Europe for manufacturing projects and shared services centers, mainly due to competitive labor costs and well-educated workers. This is also confirmed by the international investment position data showing that Poland attracts around 40% of all FDI coming to the whole CEE region.

The paper is organized as follows. Section 2 discusses the empirical literature on the determinants of FDI and FPI, and presents the theoretical models on the mutual relationship between these two forms of investment. Section 3 highlights the premises for using time series models instead of the commonly used panel models and outlines the basic research hypotheses. The properties of the data about FDI and FPI in Poland are discussed in section 4, whereas the results of the empirical investigations are presented in section 5. We investigate which factors determine the FDI and FPI inflow in Poland and we analyze the long- and short-run relationships between those two types of capital inflows employing the vector error correction model (VEC). The last section concludes the results and gives some policy recommendations.

2 Modelling the global investor's decisions: literature review

According to the balance of payments methodology (IMF 2013), cross-border capital flows are divided into three distinct and mutually exclusive forms: FDI, FPI and other foreign investment; the other foreign investment flows are trade loans, bank loans and deposits. In general FDI and FPI consist of equity- and debt-related flows. As regards equity flows, international standards set by OECD and IMF define FDI as foreign investment which accounts for more than 10% of shares or voting rights. In case the voting rights are below 10%, the investment is classified as FPI. Debt transactions between the parent and affiliate companies are classified as FDI, while issuing bonds to repay credit from the parent company are recorded as FPI. A detailed description of the abovementioned accounting standards can be found in Duce (2003). At a first glance the statistical properties of FDI and FPI suggest that the two types of capital flows are substitutes by definition. However, we need to stress that the majority of portfolio flows into emerging markets take the form of government bonds (in Poland the figure is around 95%), thus they are debt-related flows (IMF 2014, p.72). FDI is composed mainly of equity-related flows that do not generate debt. Thus, the stylized fact that FDI and FPI are substitutes does not hold and needs to be empirically examined. Both types of investment can be used by investors to build a portfolio that balances between higher profits (FDI) and more liquidity (FPI).

Goldstein and Razin (2006) analyze this question from the investor's point of view. The main difference between FDI and FPI origins from a trade-off between profitability and liquidity. FDI allows investors to make decisions in the firm as they

are not only the owner, but also the manager of it. Thus, in relation to portfolio investors, FDI investors have a higher control over the firm and more information about its fundamentals that enables them to run it more efficiently and to maximize profits. However, the privileged position of FDI investors comes with a cost. Because FDI is less liquid than FPI, investors might find it difficult to sell their project prematurely when faced with a liquidity shock. Even if FDI investors manage to find a potential buyer, they might sell their shares at a lower price than they are indeed worth. An important assumption is that market participants know that the FDI investor has insider knowledge about the firm he owns. If FDI investors decide to exit the investment project, potential buyers assume that there are some risks concerning the investment or that it generates only limited returns. However, as authors point out, potential buyers will be more willing to pay the full price if they know that the sale is a fire-sale caused by the owner's liquidity needs. The authors show also that investors with a sound liquidity position prefer to invest in FDI. In general, FDI is the domain of multinational corporations, while FPI are the choice of firms that are subject to liquidity shocks, like global investment funds. Goldstein and Razin (2006) conclude that investors prefer FDI over FPI if the transaction and entrance cost is low, if production costs abroad are low and if they have a sound liquidity position. This helps to explain, why FDI are more dominant in developing or emerging countries, where transaction and production costs are much lower than in developed countries.

Another study that deals with the question whether to invest in FDI or FPI was performed by Pfeffer (2008). According to the author, the decision depends on whether the investor prefers a high-yield, but less liquid asset or one that is less profitable, but allows to withdraw money quite fast. Author finds that international investors prefer to have a mix of FDI and FPI. This strategy combines the best aspects of both kinds of investment and leads to a relatively high yield and a good liquidity position of the investors. The investors are able to deal with liquidity problems by selling FPI, thus FPI is used to stabilize the FDI investment position.

The theoretical model of Goldstein and Razin (2006) is empirically tested by Goldstein *et al.* (2010). They assume that liquidity shocks of individual investors are caused by aggregate shocks in the source country. Usually aggregate liquidity problems force individual investors to sell their assets, but they do not reveal to the market what has caused the need to sell. The information asymmetry persists and buyers think that sellers have some additional information about the state of the investment project. Goldstein *et al.* (2010) find, for a broad set of countries, that whenever liquidity problems seem to be likely in the source country, the ratio of FPI to FDI increases. Thus, their empirical findings confirm their theoretical model. While Goldstein *et al.* (2010) focus on the source country, Daude and Fratscher (2008) investigated the determinants of FDI and FPI flows from the host country perspective. They find, using a broad set of bilateral capital stocks for 77 countries, that FDI reacts stronger to information problems than FPI. On the other hand, the quality of institutions in

the host country has little effect on FDI, but a quite strong impact on FPI.
For Central and Eastern European countries the main determinants of inward FDI are notably, according to Bevan and Estrin (2004), the market size of both the host and source country, their geographic proximity and unit labor costs. Surprisingly, they find that the impact of host country risk on capital inflows is insignificant. Carstensen and Toubal (2004) perform a similar analysis as Bevan and Estrin (2004). Their empirical analysis shows that FDI is determined by the market size, relative unit labor costs, the share of secondary and tertiary educated workers in total labor force and relative capital endowments, measured as investment per worker in the source and host country.
Fratzscher (2012) analyzes micro-level data on portfolio capital flows to 50 developed and emerging economies and finds that common push factors (crisis events, changes to global liquidity, risk) have had a large effect on capital flows both in the crisis and in the recovery. However, these effects have been highly heterogeneous across countries due to differences in the quality of domestic institutions, country risk and the strength of domestic macroeconomic fundamentals. To be exact, common push factors were the main drivers of capital flows during the crisis, while country-specific pull factors have played bigger role in explaining the dynamics of capital flows in 2009 and 2010, in particular for emerging markets.
The long-run and short-run adjustments in international capital flows were also studied by Mody *et al.* (2001), who applied the Fernandez-Arias and Montiel (1996) model and analyzed the push and pull factors of capital flows (bonds, equity and syndicated loans) to 32 developing countries applying the VEC model. Their regressions show that the pull factors have a significantly higher strength for the capital inflow than the external factors, but the latter can add short term fluctuations.
The theoretical and empirical work mentioned above lead us to a conclusion that there might exist a long-term relationship between FDI and FPI. Thus this gives us a strong ground to analyze the determinants of FDI and FPI for Poland, which is a preferred investment destination in the CEE region.

3 Empirical framework: assumptions and working hypotheses

Although the empirical literature on determinants of FDI and FPI is quite substantial, it still does not give unequivocal answers to the question concerning the drivers of these two forms of foreign investment – different theoretical assumptions justify different model specifications comprising rich sets of explanatory variables and often lead to different conclusions on FDI and FPI determinants. Unlike the majority of the empirical research on the financial flows, our analysis is country-specific and it focuses on outstanding amounts of the FDIs and FPIs. There are two reasons for carrying out a such predefined analysis. Firstly, panel regressions give a broad picture of potential

FDI and FPI drivers but they usually are of limited use for the economic policy of a single country. A good example of the consequences of panel heterogeneity is the analysis performed by Jevčák *et al.* (2010), who find that both external (e.g. interest rates, business cycle and risk sentiment in the euro area) and domestic factors (e.g. host-country's output growth, interest rates, house price growth and its perceived risk) influence FDI inflows to CEE countries. Surprisingly none of the pull variables for Poland is found to be significant. Such a finding may raise a substantial criticism against panel regressions. Secondly, most of empirical analyses deal rather with capital flows than stocks of foreign investment and, therefore, they focus solely on the short-run determinants and do not allow, even if large panels are applied, to capture the long-run properties of the modeled system. Using capital stocks brings another problem, however. For emerging economies and especially for the CEE catching-up countries, many of the stock variables may show not only 'habitual' I(1) properties, but they also may be driven by the stochastic trends with moderate I(2) properties in the analyzed periods. All in all, the lack of detailed cointegration analysis would mean that one disregards the differences between the persistence of several shocks affecting host-country economies and thus it may lead to a misinterpretation of estimated parameters.

In the paper we focus on relatively general theoretical model developed by Barrell and Pain (1996). The model formalizes the statement by Jun (1990, p.56) that 'the profit-maximizing international firm will try to optimize over the capital allocation between the parent and the subsidiaries, given different rates of returns and sources of funds between countries'. In the Barrell and Pain (1996) model the multinational firm can produce domestically and abroad, and additionally the production abroad can be financed through FDI as well as by lending from third parties. The firm chooses an optimal production function taking into account the different labor and capital costs as well as the exchange rate (Cushman 1995). To make the model empirically operational we assume that the accumulation and diffusion of the FDI and a higher total factor productivity dynamics in the European catching-up economies is driven mostly by differences in unit labor costs (ULC). In the long-term the accumulation of FDI leads to 'saturation' of the economy with new technologies, closes the ULC gap and brings down the host country's price competitiveness. Finally, the FDI-to-GDP ratio stabilizes at a level that may be intuitively interpreted in line with some of the stylized Kaldor facts. The same reasoning is adopted in the case of FPI modeling – it is assumed that there exists a certain level of the FPI-to-GDP ratio, which is consistent with a long-run equilibrium and that the deviations from this equilibrium are caused by varying relative capital costs. Finally, in line with Fratzscher (2012) the influence of global push factors and risk on inward FDI and FPI is accounted for. Three hypotheses are tested in the paper. Firstly, we hypothesize that FDI inflows is determined by the host market size and/or differences of the real unit labor costs (RULC hereafter) at home and abroad. Secondly, we verify hypothesis about the existence of cause-effect relations linking FPI inflows with the host country GDP

and the relative real interest rates. Thirdly, we check if both FDI and FPI tend to substitute each other in periods of greater risk aversion or – conversely – if the increased FDI inflows is coupled with rising FPI inflows. To sum up, the long-term equilibrium conditions of the FDI–FPI model are defined by the following equilibrium (cointegrating) relations:

$$f^{DI} = \varphi_1 x - \varphi_2(r_{ULC} - r^*_{ULC}) \pm \varphi_3 f^{PI} + \varphi_4 f^*, \tag{1}$$

$$f^{PI} = \phi_1 x + \phi_2(r_{3M} - r^*_{3M}) \pm \phi_3 f^{DI} + \phi_4 f^*, \tag{2}$$

where f^{DI}, f^{PI} are logs of cumulated nominal FDI and FPI inflows in host country, x stands for log of the nominal GDP in host country, r_{ULC}, r^*_{ULC} are real unit labor costs at home and abroad (ULCs deflated by GDP deflators), r_{3M}, r^*_{3M} – three-month real interest rates, f^* – proxy of global liquidity, φ_k, ϕ_k – equilibrium parameters. In the empirical investigations we also allow for some linear combinations of the above two equilibrium relations. For instance, the long-term properties of the FDI-FPI model with equilibrium relations (1)–(2) can be equivalently described by the VEC model with the mixed relation:

$$\begin{aligned}(1 \mp \varphi_3) f^{DI} + (1 \mp \phi_3) f^{PI} = (\varphi_1 + \phi_1)x - \varphi_2(r_{ULC} - r^*_{ULC}) + \\ + \phi_2(r_{3M} - r^*_{3M}) + (\varphi_4 + \phi_4) f^*\end{aligned} \tag{3}$$

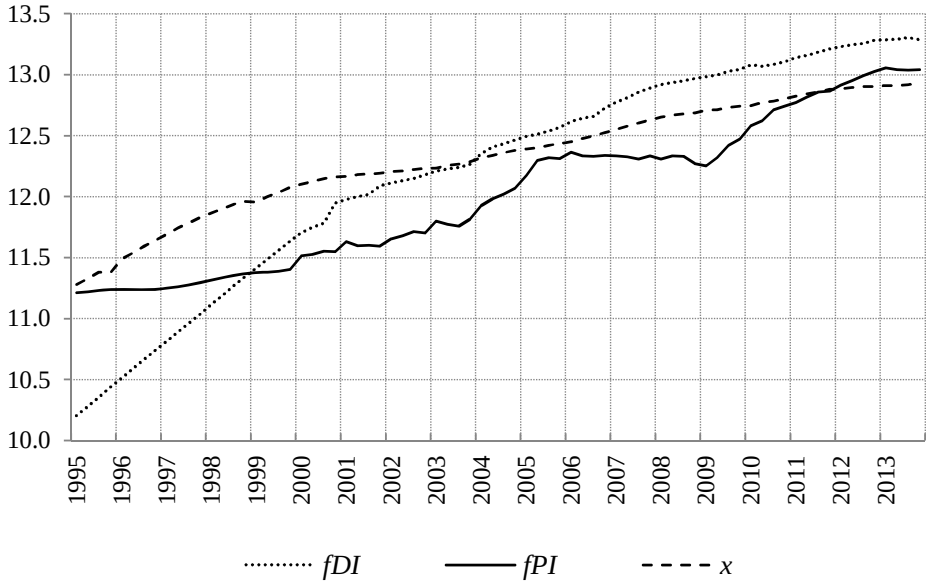
and equation (1) or (2).

4 Data

We start our empirical analysis from 2002q1, even though the data on FDI and FPI stocks in Poland are available since 1995 (Fig. 2), due to reasons we explain below. The first years of the transformation process, which was launched in January 1990, saw a negligible volume of foreign capital inflows. A moderate increase in FDI flows was recorded for the first time in 1995. In 1996 Poland became an OECD member state and agreed with the Paris and London clubs to reduce its external debt, moreover some restrictions on capital flow were lifted. During the first period of transformation state-owned enterprises (e.g. banks, insurance companies, retailers, wholesalers, etc.) were privatized and foreign investors played a crucial role in this process. As a result, there was some increase in FDI inflow to the services sector. However, those times were turbulent. In 1998 there was the Russian crisis which hit the Polish economy, and later there was the dot.com crash and the 9/11 attack on the US, which has shaken the global economy. In the next years the country was preparing for the EU accession. As the still relatively high corporate income tax (CIT) rate was hindering FDI inflows, improvements in the law and the tax systems attracted FPI and other foreign investment. After joining the EU in May 2004 the CIT rate was lowered significantly and as a result an increase of FDI inflow was observed, to a large degree

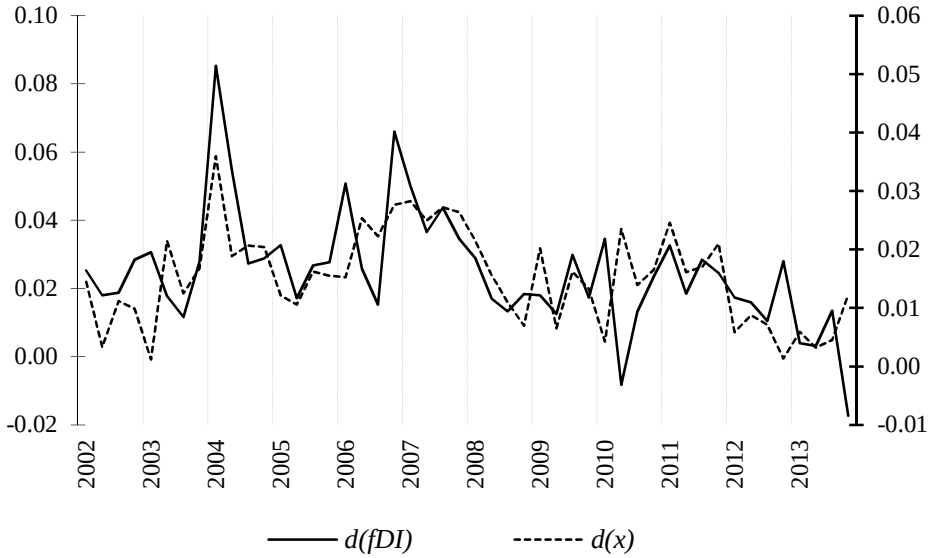
in form of reinvested earnings. In the aftermath of the global financial and economic crisis FDI inflows dropped first, but in the subsequent years foreign capital started to grow again.

Figure 2: FDI, FPI stocks and quarterly GDP in Poland (billions of PLNs, current prices, natural logarithms)



Nominal variables are used in the research for three reasons. Firstly, the choice of deflators for both types of capital flows is not obvious. Secondly, FDIs' and FPIs' dynamics unequivocally dominate price inflation and a deflation method has nearly no impact on the estimation results. Thirdly, the long-term homogeneity restriction is positively verified in the paper. It means that we finally model the FDI-to-GDP and the FPI-to-GDP ratios and the 'price bias' shrinks. A visual inspection of outstanding amounts of FDI reaffirms the heterogeneity of the analyzed period 2002-2013 (Fig. 2-3), while FPI's heterogeneity is more pronounced. It should be underlined that more than 90% of the FPI inflow to Poland takes the form of sovereign debt securities and, therefore, an overall increase in the liabilities reflects a permanent disequilibria in its fiscal sector. The supply of government debt securities was limited in the period 2006-2008 only, when a strong GDP growth and rising tax incomes were observed. The increase of issuances of the Treasury bonds in the abovementioned period, compared with the previous years, was, among other things, the result of a prepayment of a part of Poland's debt to the Paris club in 2005. During the recent world crisis Poland saw an increase in FPI inflows and this form of capital played a significant role in

Figure 3: FDI and FPI inflows and GDP in Poland (PLN, current prices, growth rates)



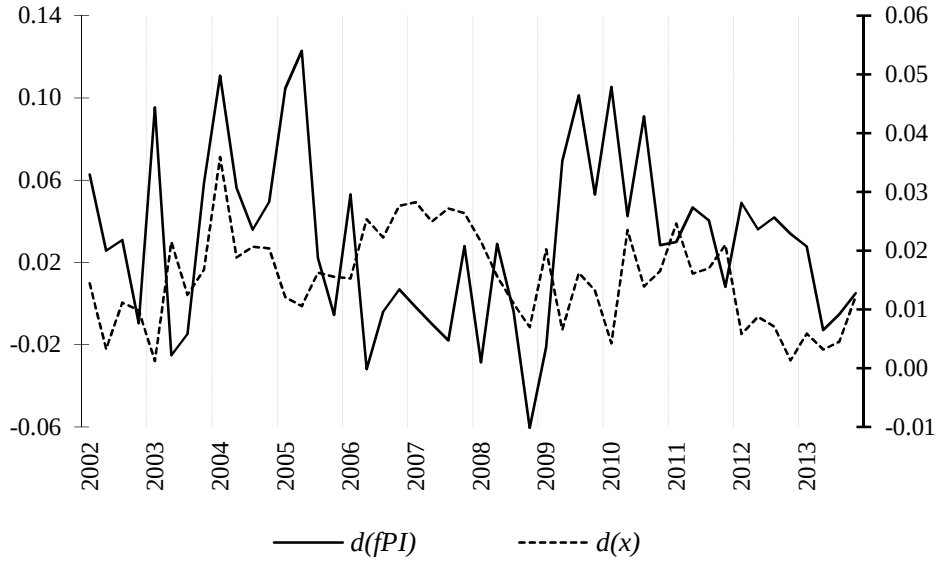


Table 1: Univariate integration tests 2002q1–2013q4

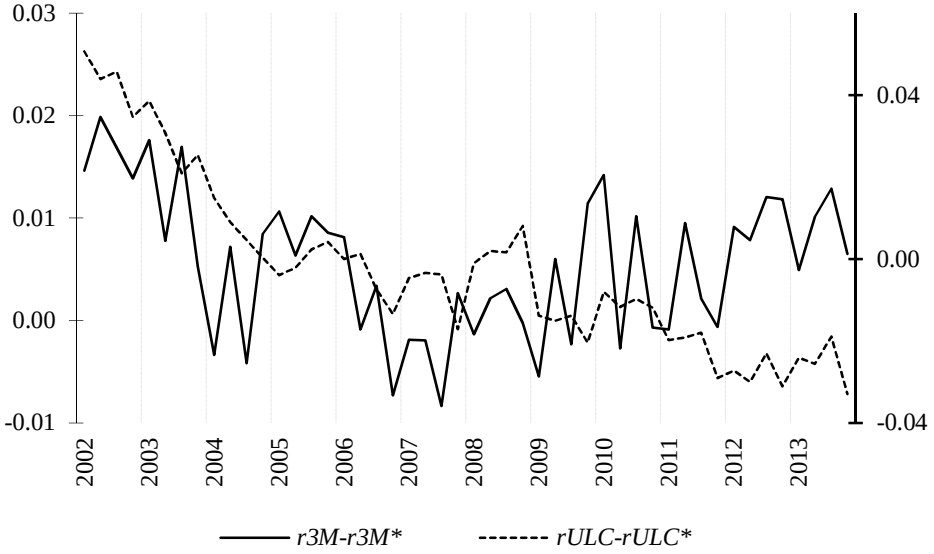
	I(1) vs. I(0)		I(2) vs. I(1)		Order of integration	
Test	μ	μ, t	μ	μ, t	μ	μ, t
			f^{DI}			
ADF	–2.90*	0.92	–4.70***	–5.39***	1	1
DF-GLS	0.55	–0.13	0.61	–5.33***	2	1
ERS	1803.2	80.2	6.56	6.18*	2	2/1
			f^{PI}			
ADF	–1.02	–1.99	–4.93***	–4.91***	1	1
DF-GLS	0.45	–2.01	–4.58***	–4.85***	1	1
ERS	163.7	12.2	1.55***	4.71**	1	1
			x			
ADF	–0.97	–1.02	–3.51**	–3.56**	1	1
DF-GLS	0.05	–1.38	–3.50***	–3.56**	1	1
ERS	1215.4	16.9	0.35***	1.50	1	2
			$r_{ULC} - r^*_{ULC}$			
ADF	–2.75*	–3.47*	–8.32***	–9.61***	1	1
DF-GLS	–0.25	–2.40	–0.96	–1.90	2	2
ERS	97.8	13.2	1.62***	5.12**	1	1
			$r_{3M} - r^*_{3M}$			
ADF	–3.12**	–2.66	–3.66***	–4.01**	1	1
DF-GLS	–0.82	–1.36	–3.66***	–3.62**	1	1
ERS	5.1	13.1	8.7	16.6	2	2

Notice: ADF – augmented Dickey-Fuller test, DF-GLS – GLS based Dickey-Fuller test, ERS – Elliot-Rothenberg-Stock test (Elliot *et al.* 1996). ***, ** and * indicate rejection of the null hypothesis at 0.01, 0.05 and 0.10 significance level, respectively.

shaping total inflows. At that time the country was considered by foreign investors as an attractive destination given its low risk and relatively high yield of the government bonds compared with both advanced economies and other emerging regional peers.

In the initial analysis of the properties of the data generation process a battery of standard univariate Dickey-Fuller-type unit root tests was employed (Tab. 1). The results of the tests appeared to be symptomatic: they mostly pointed to I(1)-ness of the variables in the models (1)-(3) but in some cases they did not reject variable's I(2)-ness against the difference-stationarity. A visual inspection of the quarterly growth rates of the GDP and FDI reinforced a presumption that some of the variables in (1)-(3) might be driven by I(2) stochastic trends. Fig. 3 allows to point out sub-periods of similar moderately decreasing dynamics of the two variables and gives sufficient ground to formulate a scenario of shocks diffusion in the models (1)-(3) according to which FDI and GDP share the same I(2) stochastic trend, whereas an autonomous I(1) trend drives FPI as well as FDI and GDP. In the alternative scenario, which assumes FDI's I(2)-ness and the difference-stationarity of the GDP and FPI, the three variables do not cointegrate unless the non-linearly trending relative real ULC or real interest rate differential are taken into account (Fig. 4).

Figure 4: Real ULC differential and real interest rates differential (natural logarithms)



Summing up, the very preliminary discussion on the data properties and results of some routine URTs shows that the choice of the empirical framework for the analysis of FDI-FPI loop may seem ambiguous. An occurring of I(2) variables in VEC systems is rather uncommon and usually follows from the fact that in short samples some I(1) variables may show strong I(2) properties but ignoring variables' near-I(2)-ness leads to misleading estimates of the equilibrium parameters. On the other hand, Juselius (2015) underlines that the DF-type univariate unit root tests fail to detect moderate I(2) components in time series with low signal-to-noise ratios and that the possible presence of the double unit roots should be investigated within a broader framework of fully-specified VEC models. In the next section we follow this recommendation.

5 Estimation results and discussion

Due to the possible moderate I(2)-ness of certain variables the point of departure in the empirical investigation was the vector error correction model:

$$\begin{aligned}\Delta^2 y_{(m)t} &= \Pi y_{(m)t-1} + \Gamma \Delta y_{(m)t-1} + \textstyle\sum_{s=1}^{S-2} \Phi_s \Delta^2 y_{(m)t-s} + \mu_{(m)} + \varepsilon_{(m)t} \\ &= \alpha(\beta' y_{(m)t-1} + \delta' \Delta y_{(m)t-1}) + \zeta \tau' \Delta y_{(m)t-1} + ST_{(m)t} + \varepsilon_{(m)t},\end{aligned} \tag{4}$$

where: Π– long-term multipliers, Γ– medium-term multipliers, Φ_s– short-term parameters; $ST_{(m)}$ stands for the short-term part of the VEC model, $\varepsilon_{(m)} \sim n.i.d.$ The equilibrium conditions of the VEC model (4) are defined by the polynomial

cointegrating relations $\beta' y_{(m)t} + \delta' \Delta y_{(m)} \sim I(0)$, where $\beta' y_{(m)t} \sim I(1)$, and the medium-term equilibrium conditions $\tau' \Delta y_{(m)t} \sim I(0)$; for a detailed description of the I(2) model see Johansen (1995a), Juselius (2006) and references therein. The dimensions of the parameters' matrices β, δ, τ and adjustment parameters α and ζ depend on the number of the variables (M) and the numbers of the I(2) and autonomous I(1) stochastic trends (S_2 and S_1, respectively).
The VEC-I(2) model (4) was employed to analyze equilibrium relations between the components of the vector $y_{(m)} = [f^{DI}, f^{PI}, x, r_{ULC} - r^*_{ULC}, r_{3M} - r^*_{3M}; t]'$ in the quarterly sample 2002q1–2013q4. Empirical investigation consisted in: (i) cointegration test, (ii) structuralization of the long-term relations $\beta' y_{(m)t}$ and their economic interpretation and (iii) identification of the potential I(2) sources as well as identification of the I(2) shocks' absorbers. Tab. 2 reports the results of the cointegration test proposed by Johansen (1995) and Paruolo (1996). The conclusions are clear-cut: there are two relations $\beta' y_{(m)t} + \delta' \Delta y_{(m)t} \sim I(0)$ in the system and the model's variables are driven by two I(2) common trends and one autonomous I(1) trend.

Table 2: The cointegration test in the FDI-FPI model, 2002q1–2013q4

	s_2					
v	5	4	3	2	1	0
0	259.1 (0.000)	216.1 (0.000)	176.8 (0.000)	149.0 (0.000)	134.3 (0.000)	130.0 (0.000)
1	–	151.2 (0.01)	114.4 (0.062)	92.0 (0.073)	78.7 (0.035)	74.4 (0.004)
2	–	–	85.3 (0.095)	57.5 (0.335)	44.3 (0.288)	36.1 (0.204)
3	–	–	–	32.5 (0.677)	20.6 (0.709)	18.1 (0.345)
4	–	–	–	–	9.0 (0.751)	5.0 (0.609)

v – number of cointegrating vectors, s_2 – number of I(2) trends; p-values in parentheses

Even though the cointegration test results are unequivocal, the estimation results of the VEC model with two multi-cointegrating vectors turn out unacceptable. In particular, it is impossible to impose structuralizing restrictions which would even roughly be similar to the restrictions in the long-term relations (1)–(3). The estimates of the long-term parameters are very sensitive to any restrictions' revision. Therefore, the VEC model with three multi-cointegrating vectors was considered as well. The estimates of equilibrium parameters β, adjustment parameters α and the most important diagnostics of the model are summarized in Tab. 2. The interpretation of the first relation:

$$f^{DI} = \underset{(11.8)}{1.042}\, x + \underset{(8.2)}{0.008}\, t + \delta' \Delta y_{(m)t-1} \tag{5}$$

Table 3: The estimation of FDI-FPI model ($V = 3$, $S_1 = 0$, $S_2 = 2$), 2002q1-2013q4

	f^{DI}	f^{PI}	x	$r_{ULC} - r^*_{ULC}$	$r_{3M} - r^*_{3M}$	t
β'_1	**1**	0	−1.042 (11.8)	0	0	−0.008 (8.2)
β'_2	0.46 (4.2)	**1**	−1.460 (0)	7.407 (13)	−41.1 (27.4)	0
β'_3	0.237 (35.5)	0	−0.341 (50.3)	0.098 (6.3)	**1**	0
α'_1	**−0.088** (1.2)	0.551 (2.6)	−0.126 (4)	0.219 (2.2)	0.17 (7.1)	–
α'_2	.	**−0.336** (5.8)	0.035 (4.1)	.	−0.016 (2.4)	–
α'_3	.	−5.120 (2.9)	1.316 (5.1)	.	**−1.440** (7.3)	–
$\beta'_{\perp 2,1}$	0.081	−0.595	0.077	0.085	−0.010	0
$\beta'_{\perp 2,2}$	0.446	3.816	0.428	−0.153	0.055	0
$\alpha'_{\perp 2,1}$	1	.	0	.	.	
$\alpha'_{\perp 2,1}$	0	0.095 (2.9)	1	.	0.575 (2.6)	
LR = 0.264						
AR(1) = 0.272		AR(2) = 0.291		DH = 0.383		
AR(3) = 0.106		AR(4) = 0.451		ARCH(1) = 0.259		

Notes: t-ratios are reported in parentheses. Dots stand for the parameters with t-ratios smaller than 2. p-values are reported for LR, AR, DH and ARCH tests; LR – over-identifying restrictions test, AR(s) – test of the errors autocorrelation of order s, DH – Doornik-Hansen normality test, ARCH(s) – test of the ARCH effect of order s

is straightforward: there is nearly one-to-one mapping between FDI and domestic GDP (with a mark-up approximated by the deterministic trend) and it is not possible to find any stable relation between FDI and the ULC differential. The structure of the second cointegrating vector:

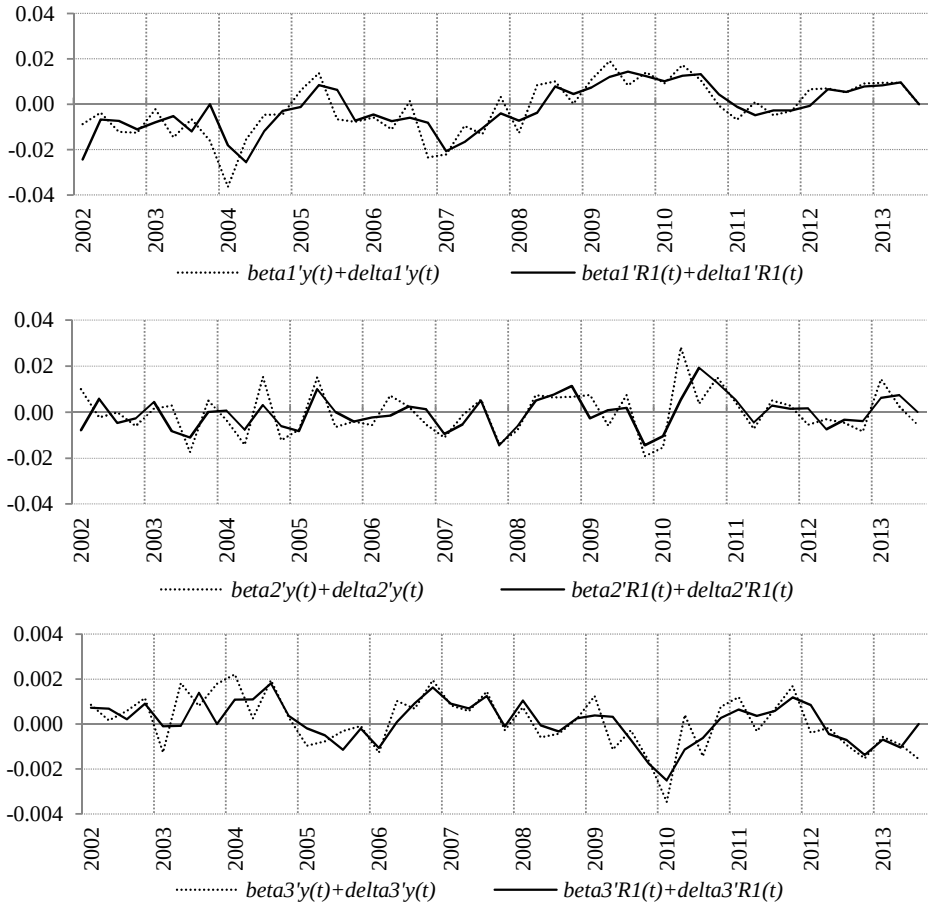
$$(f^{PI} - x) + \underset{(4.2)}{0.450}(f^{DI} - x) = -\underset{(13.0)}{7.41}(r_{ULC} - r^*_{ULC}) + \underset{(27.4)}{41.1}(r_{3M} - r^*_{3M}) + \delta' \Delta y_{(m)t-1} \quad (6)$$

corresponds to the 'mixed' relation (3). According to a slightly simplified interpretation the estimated parameter on f^{DI} supports the hypothesis that FDI and FPI are substitutes whereas the portfolio investment are strongly related to interest rates; there is also a long-term dependence of FDI flows on the relative real ULC. However the long-term estimation results should be interpreted with caution because the relation (6) resembles an implicit function without a clear-cut causality relation between $r_{ULC} - r^*_{ULC}$ and f^{PI} as well as between f^{DI} and $r_{3M} - r^*_{3M}$. The interpretation of the last cointegrating vector:

$$r_{3M} = r^*_{3M} + \underset{(50.3)}{0.341}\, x - \underset{(35.5)}{0.237}\, f^{DI} - \underset{(6.3)}{0.098}(r_{ULC} - r^*_{ULC}) + \delta' \Delta y_{(m)t-1} \quad (7)$$

that closes the system is not straightforward. It should be underlined here that due to the 'open structure' of almost every VEC model, one has often to allow at least one 'residual' cointegrating vector to capture net effects of mechanisms that are not analysed in the model explicitly. If so, the equation (7) may be interpreted in terms of an empirical Taylor rule that is 'concentrated-out' of the first two cointegrating vectors and according to which an increase of demand (*via* GDP) forces monetary authorities to increase the central bank's interest rate whereas an increase of the potential output (*via* FDI) closes the output gap.

Figure 5: $\beta'_{v(m)}y_{(m)t} + \delta'_{v(m)}y_{(m)t}$ and $\beta'_{v(m)}R_{1t} + \beta'_{v(m)}R_{1t}$ deviations from the relations (5)-(7)



Summing-up, the estimates of the equilibrium parameters give a bit mixed picture.

There are two results that do not raise doubts, however. First, both FDI and FPI are driven by the increasing size of the Polish economy. The long-term homogeneity $f^{DI} + \beta \cdot f^{PI} = (1 + \beta) \cdot x + ...$ finds an empirical confirmation (p-value = 0.340 in the homogeneity test) and the assumption on the one-to-one mapping between both kinds of capital inflows and GDP may be perceived as a default reference point in the structuralization of the cointegrating vectors. Second, the analysis of the relation (6) suggests that there is a relatively strong (and statistically significant) substitutability between FDI and FPI in the analyzed period. Finally, a visual inspection of the deviations from the cointegrating trajectories (Fig. 5) does not provide serious arguments against the stationarity of the linear combinations (5)–(7). However, the above conclusions may seem to be premature if we confront them with the outcomes of the analysis of the adjustment parameters α. In fact, the estimates of the adjustment parameters formally confirm weak exogeneity of f^{DI} whereas the estimated speed of f^{DI}'s adjustments to the equilibrium path is well over zero (8.8% of the deviation observed in the preceding quarter). Thus one can argue that the lack of the estimate accuracy may be symptomatic for the relatively short sample used, and, in our opinion, it should not lead to 'automatic' conditioning the VEC model on f^{DI}. An interpretation of the loadings' in $\Delta^2 f^{PI}$'s equation is not simple because the FPI-to-GDP ratio adjusts to all identified equilibrium relations. An excess of FPI inflow decelerates FPI in the next quarter (parameter's estimate of –0.336) and this property of the model does not rise reservations – the relation (6) can be given interpretation of the 'core' long-term relationship describing foreign portfolio investments. The estimate of the adjustment parameter on the first cointegrating vector (estimate of 0.551) suggests an occurrence of an error equilibrium increasing mechanism (Juselius 2015). More precisely, a positive deviation of f^{DI} from the equilibrium path (5) accelerates f^{PI} what pushes FPI away from the trajectory (6) and induces 'normal' counterbalancing along the trajectory (5).

Because the interpretation of the equilibrium relations arouses some reservations a supplementary analysis of a shocks' propagation in the model was performed. To this end the VEC-I(2) model (4) was replaced with its common stochastic trend representation (CST):

$$y_{(m)t} = C_2 \sum_{i=1}^{t} \sum_{j=1}^{i} \varepsilon_{(m)j} + C_1 \sum_{i=1}^{t} \varepsilon_{(m)i} + \mathrm{T}_0(t) + e_{(m)t}, \tag{8}$$

where: $C_2 = \beta_{\perp 2}(\alpha'_{\perp 2}\Psi\beta_{\perp 2})^{-1}\alpha'_{\perp 2} = \tilde{\beta}_{\perp 2}\alpha'_{\perp 2}$ is the matrix of the parameters on twice cumulated innovations $\varepsilon_{m,i}$, i.e. I(2) stochastic trends, C_1 is matrix of the I(1) parameters and $\mathrm{T}_0(t)$ stands for the deterministic components, $e_{(m)t} \sim I(0)$. The CST representation allows to identify the sources of the I(2) shocks ($\alpha_{\perp 2}$ matrix) and to determine the directions, in which they diffuse ($\tilde{\beta}_{\perp 2}$ matrix):

$$y_{(m)t} = \tilde{\beta}_{\perp 2} \sum_{i=1}^{t} \sum_{j=1}^{i} u_{(m)j} + C_1 \sum_{i=1}^{t} \varepsilon_{(m)i} + \mathrm{T}_0(t) + e_{(m)t}, \tag{9}$$

where $u_{(m)i} = \alpha'_{\perp 2}\varepsilon_{(m)i}$.
The analysis of the CST representation confirms the conclusions about the direction of the causality-effects which link FDI and FPI inflows to Poland (see Tab. 3). The estimates of the $\alpha_{\perp 2}$ weights and $\tilde{\beta}_{\perp 2}$ loadings allow quite precisely to point-out the sources of the two stochastic I(2) trends that steer the FDI-FPI system and to identify the variables which cumulate those shocks. The estimate of $\alpha_{\perp 2}$ suggests that the first I(2) trend originates from the FDI shock and it may be interpreted in terms of the technology or supply-side mechanisms $u_i^S = \varepsilon_i^{fDI}$, whereas the second trend has essentially demand-side sources $u_i^D = \varepsilon_i^x + 0.575 \cdot \varepsilon_i^{r3m-r3m*} + 0.095 \cdot \varepsilon_i^{fPI}$. Accepting this perspective, one can arrive at a result, according to which the portfolio investment is the 'most reacting' variable in the system – the estimates of the adjustment parameters by FPI are the largest and have the intuitively accepted signs. In particular a positive demand shock induces FPI inflow (estimate of 3.816) whereas a positive supply shock has a weaker, opposite effect (–0.595). This result confirms FDI's and FPI's substitutability. FDI's and GDP's responses to both shocks have positive signs and similar scales. Such a direction of the shocks' propagation allows to identify FDI's and GDP's trends as a cause of the presence of the I(2) trends in the model.
In the last stage of the investigation the model's robustness analysis was performed and several alternative specifications of the model were considered. In particular, the short-term interest rates were replaced with their long-term counterparts; FDI, FPI and GDP in constant prices were used as well. In all considered cases the general conclusions appeared to be analogous to the ones presented above. We also verified the potential importance of the exchange rate or its volatility as a proxy for the risk premium, both in the host country and abroad. The results appear to be disappointing (and slightly surprising) as the risk proxies did not enrich the model with any significant information. The latter outcome seems to be in line with the hypothesis that in a small open economy, like Poland, one should bear in mind that the exchange rate is mainly affected by the rest of the world and is correlated with GDP growth and foreign investment. Grossman *et al.* (2009) present a broad literature overview on this topic and conclude that in case of developed countries the wealth effect, which could result from a weakened host country exchange rate, is weak and the profit-orientation dominates, thus a strong currency attracts foreign capital. It seems plausible that also for Poland and similar emerging markets the wealth effect that originates from a weak currency plays no particular role. The wealth effect is already captured in the significant differences in capital stocks. Even if the host country currency is strong, foreign investors will easily buy assets. Thus, the exchange rate can be expected to have a marginal role or be completely meaningless and indeed its inclusion did not improve the regression results. Finally, different approximations of the global liquidity f^*were taken into consideration (global FDI flows, GDP and/or money supply in US) but none of them enriched model (5)-(7) with a relevant information.

6 Conclusions

Historically, foreign direct investment (FDI) and foreign portfolio investment (FPI) have been considered as distinct and independent forms of international capital flows, but our results indicate that they are rather interconnected phenomena. To our best knowledge, this is one of the few analyses which tackles this important problem with state-of-the-art econometric techniques. We conduct the empirical analysis for Poland in the vector error correction model and cointegration analysis framework. As the available quarterly sample is short, the results should be treated as the first approximation, at most. Nonetheless, at this stage of investigation we arrive at some interesting results that may be a good starting point for the future research. We show that there exists a stable long-run equilibrium relationships between FDI, FPI, the size of the Polish market, the relative real unit labor costs and the real interest rate differential. An identification of the economically interpretable relations turned out to be problematic, but the structure of the cointegrating vectors unambiguously supports the hypothesis on the potential trade-off between FDI and FPI.
The analysis of the stochastic trends propagation delivers a complementary (but also slightly surprising) information: both forms of foreign capital inflow are driven by the same two stochastic I(2)-trends, however portfolio investment appears to be much more sensitive to the demand- and supply-side shocks. Moreover, FDI shocks appear to be the dominant ingredients of the I(2) stochastic technological trend, that cumulates in the FPI. This result leads to the rejection of the working hypothesis of the FPI's 'crowding-out' effect in favor to the alternative hypothesis that FPI is 'residual' in the modeled system.

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Data appendix

The data used in this paper origin both from the National Bank of Poland Balance of Payments and International Investment Position statistics, and the Eurostat database. The time series used in the study cover the period 2001q1-2013q4. All variables are expressed in natural logarithms and in Polish zlotys. The data set is available upon request.

We construct the FDI and FPI time series using flows, instead of applying readily available IIP data. This way we exclude the valuation effects and exchange rate fluctuations which were substantial over the analysed period, but have little economic importance.

Variable	Description	Transformation	Source
f^{DI}, f^{PI}	Foreign direct investment and foreign portfolio investment stock in Poland	Estimated stock of Poland's foreign liabilities as a sum of the International Investment Position for 1994 and quarterly flows from Poland's Balance of Payments (both FDI and FPI) since 1995	Own calculations based on NBP BoP and IIP statistics
x	Nominal Poland's GDP	No transformation	Eurostat
$r_{3M} - r_{3M}{}^*$	Difference between real 3-month interest rates in Poland and in the euro area	Nominal 3-month interest rates deflated by GDP deflator (2005=100) both in Poland and in the euro area	Own calculations based on Eurostat data
$r_{ULC} - r_{ULC}{}^*$	Difference between real unit labour costs in Poland and in the euro area	Nominal unit labour costs deflated by GDP deflator (2005=100) in Poland and in the euro area	Own calculations based on Eurostat data