Relationship between foreign direct investment stock and foreign portfolio investment stock. Do they really matter for GDP in Poland, Germany, and Great Britain?

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Abstract

In this paper we discuss and investigate mutual relationship between FDI and FPI stocks in 3 countries. The standard theoretical economic paradigm sharply differentiates between the two, treating them rather as substitutes from foreign investor's perspective. Yet, some recent empirical attempts reveal that there are important similarities in their determinants and thus suggest their complementarity. Furthermore, we contribute by assessing FDI & FPI stocks' impact on real GDPs. In this paper we present estimates of vector error correction (VEC) models' parameters for three countries, in various settings. We find a number of interesting points – in case of Poland there seem to exist some significant long-run dependences between real GDP and stocks of FDI and FPI, which to some extent stands in opposition to inferences derived from analogical models constructed for two well-developed countries, the United Kingdom and Germany.

Keywords: foreign direct investment, foreign portfolio investment, economic growth.

JEL Codes: C32, F21, G11.

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1. Introduction

Foreign direct investment (FDI) has received considerable attention from researchers worldwide. This fact is not surprising given the surge in FDI flows into emerging market economies (EMEs) over the last two decades and a general perception that FDI stock is conducive to higher economic growth. Much less effort has gone into studying foreign portfolio investment (FPI), i.e. investment by which an investor controls less than 10% of shares of a company (whereas FDI is defined as exceeding this threshold if only it is related to a stock market). It is customary to treat these two forms of investment as different in terms of investor's motivation and financial capability, their liquidity impacting feasibility of exit strategies, and, thus, time horizon. Yet, as argued by Marcin Humanicki, Robert Kelm, and Krzysztof Olszewski in their paper *Foreign Direct Investment and Foreign Portfolio Investment in the contemporary globalized world: should they be still treated separately?* (2013), it can be insightful to view them as interconnected phenomena. The present paper constitutes an assessment and extension of their and similar contributions.

We pose similar hypotheses as the authors of the corresponding analysis for Poland (Humanicki et al. 2013). Those are the following: primarily, FDI and FPI inflows are correlated; second, the two types of foreign investment are complementary and possibly FDI might be found as a Granger cause of FPI (this is supplemented, as explained below, by the supposition that in times of crisis FPI may be volatile with FDI remaining more stable – therefore in such times the relation may reverse and FPI and FDI may become more of substitutes); finally, both FDI and FPI stimulate GDP in hosting countries. We aimed at verification of all these statements in real terms by applying vector error correction (VEC) models to the data on Poland, Germany, and the United Kingdom, which should allow us to infer about relationships potentially occurring between non-stationary variables. Therefore, we extend Humanicki et al.'s approach by considering other countries (as well as by treating GDP as endogenous, an aspect absent from their analysis). While the abovementioned suppositions were partly confirmed by applying a VEC model to Polish balance of payments data (Humanicki et al. 2013), it turned out that FDI and FPI tend to substitute for each other, which stands in contrast to the second hypothesis. In light of these results there seems to be some basis for the claim that the standard approach to the FDI-FPI division requires revision. In any case, in what follows we also discuss some debatable aspects of our and similar studies and, therefore, argue that this research should be treated as preliminary and should not constitute basis for any strong claims such as policy recommendations.

Before we turn to the analysis itself, one question remains to be answered, namely: why should we even care about this problem? Part of the answer was already outlined in the first paragraph: flows of capital into EMEs over the last two decades have been unprecedented (a rise from about 30 billion USD in the 1980s to 1.2 trillion USD in 2007) and this occurrence alone warrants scientific interest. What is more, as noted by Humanicki et al. (2013), after the initial surge of only FDI inflows – generally considered by host countries as a safe and long-lasting source of financing – FPI soon followed suit. This fact can be ascribed, *inter alia*, to the development of local financial markets and improved institutional setting in recipient regions, as well as to the increased presence of institutional investors (insurance companies, hedge and pension funds, etc.) on the foreign investment market. Developed countries also experienced growth of mutual capital exchange lately, but in their case domination of FPI is clearly visible. Because of these developments, a question arises of whether FDI and FPI should be treated as elements of one diversified investment strategy or rather as separate modes of capital transfer. This is the theoretical aspect of the issue, related to discovering patterns of investment that exist in the global financial and industrial system, but, of course, its practical relevance should not be underestimated. A general sentiment towards FDI among policymakers in developing countries is rather positive, which can be attributed to expectations of unemployment reduction, increased tax revenues, and technological spillover effects (for one of the first theoretical expositions of the possibility of spillovers, see Romer 1993). On the other hand, FPI, with its short time horizon and much greater liquidity, is seen as what may be called "hot money" (Claessens et al. 1995), "unhealthy" speculation, and an overall destabilizing activity. Hence, to show substantial level of complementarity between "good" FDI and "bad" FPI would be to likely influence this perception and, consequently, political decisions in EMEs[1]. Furthermore, signs of individual (separate) impacts of FDI and FPI stocks on GDP might be formally verified. As pointed in this short introduction, both theoretical and practical considerations gave basis for this research.

The paper is organized as follows. In the next section we briefly review literature on foreign investment, providing a context for this report. Section 3 contains details on the data used in our analysis. Section 4 consists of results of our research, where we are especially interested in comparing signs of parameters of cointegration equations, estimated separately for each of three countries of interest.

2. Literature review

While the economic literature on FDI is extensive, studies on FPI remain scarce and so, consequently, do studies on relationships between these two types of in-

[1] This seems particularly important in light of accounts such as Evans (2002). Hers is not a technical paper, but it highlights a general negative view of FPI among politicians and stresses that it is misguided as both forms of foreign investment can contribute to growth given right incentives. See also Dunning & Dilyard (1999).

vestment. Therefore, in this section, instead of restricting ourselves to commenting on the narrow issue of interactions between FDI and FPI, we try to provide a broader context for our research.

First of all, it has to be noted that the truth of the assertion that FDI helps the host economy to grow is far from obvious. There exists a considerable number of studies, both theoretical (Brecher 1983) and empirical (Aitken & Harrison 1999, Carkovic & Levine 2002, Hsu & Wu 2008), that do not support this claim. In case of FPI results are also inconclusive (e.g. Durham 2003, Shen et al. 2010), which in turn is in line with popular claims. This is not directly related to the topic at hand (although we report on the influence of investment on GDP). It is nevertheless important to remember that general presumption – exhibited, among others, by politicians – that FDI is conducive, and FPI detrimental, to growth, is not a well-established result in economic science (specifically and interestingly, Errunza (2002) argues that concerns about macroeconomic volatility induced by FPI appear to be unwarranted).

Humanicki et al. (2013) are mainly concerned not with growth effects of foreign investment, but with investor's decisions. Basing on Goldstein & Razin (2006), they see the main differences between FDI and FPI in this respect as relating to profitability-liquidity trade-off. FDI means that the investor has relatively high degree of control over the firm and more information about its fundamentals, whereas FPI investor relatively lacks such information. As a result, there is a possibility of obtaining higher profits with FDI than with FPI. This possibility comes at a cost, though. FDI is much less liquid than portfolio investment, which may be a considerable burden in times of liquidity problems, leading, for example, to fire-sales. This means that FDI should generally be a domain of more liquid entities, such as multinational enterprises (MNEs), and FPI should be dominated by liquidity-shock prone institutions, such as global investment funds. And traditionally it has been exactly so. However, recently – and authors are aware of this fact – these less liquid firms also became involved in FDI and international investors generally tend to hold a mix of FDI and FPI, thus combining the best of two approaches (see e.g. Pfeffer 2008). This gives basis for our hypothesis that FDI and FPI should exhibit some non-trivial degree of complementarity, while maybe behaving more like substitutes in times of financial distress.

The fact that the underlying theoretical model is concerned with investor's decisions should not be overlooked. While our analysis is purely empirical, its idea is easily traceable to exactly this – decision-making process of individual investors. Thus, even if in our VEC model only macroeconomic aggregates are used, it would be unwise to try and support this analysis with a purely macro model. Simply speaking, without micro fundaments such analysis does not make much sense. On the other hand the precise decision-making mechanism by which the hypotheses and the intuition for the VEC model are generated is not crucial for the present study. Decisions of investors do not need to be modeled with profitability-liquidity trade-off in mind. Albuquerque (2003) differentiates between FDI and other forms of capital using the assumptions of imperfect enforcement of financial contracts and inalienability of FDI, which results in investor's concern about expropriation risk. Razin & Sadka (2003) use the hands-on management feature of FDI as contrasted with other capital inflows to model investor's decisions and conclude, for instance, that this model can explain why most of capital flows to EMEs in the form of FDI. Our hypotheses stem directly from the model of Goldstein & Razin (2006), but to the extent that similar hypotheses can be formulated on the basis of some other research, we can remain indifferent when it comes to the choice of theory. The important thing is that, ultimately, it all follows from the decisions of individual investors.

The researchers in the field tend to concentrate on a rather narrow set of variables. For example VEC model for Poland presented in Humanicki et al. (2013) includes variables related to yield, market size, macroeconomic conditions, occurrence of the crisis, EU accession, degree of privatization and banking sector development. While this set of regressors seems extensive at face value, a number of studies show the importance of broader institutional factors in shaping the behaviour of international investors. Blomstrom & Kokko (2003) and Asiedu (2005) argue for inclusion of variables related to corruption and political stability in models explaining patterns of FDI flows. While strictly understood political instability is not a serious problem in Poland after 1990 (not to speak about Germany and the UK), corruption and bureaucracy are still an issue, as is visible for example in Corruption Perception Index. Perhaps most saliently, Amiram & Frank (2012) show that also tax incentives matter greatly in attracting foreign capital, which is, of course, a very intuitive proposition. Admittedly, constructing relevant tax-related variables might prove troublesome and we do not undertake this task here, but it is an issue that deserves serious consideration in future research.

It may be insightful to express the main tenet of the theory backing ours and similar studies with the use of notions from other economic disciplines. Gorton (2010) uses the term "information sensitivity" when discussing money, assets, and bank deposits in the context of the recent economic crisis. In short, this notion is applied mainly to money and money substitutes understood as claims on assets. Money is thought of as conveying certain knowledge about these assets, and the more complete this knowledge, the better the money is. When knowledge conveyed by some currency or other liquid asset is incomplete, this currency is said to be information sensitive and it pays off to acquire this knowledge. It is important to note that this idea is not necessarily equivalent to asymmetric information – the latter is concerned with incentives to withhold information, while the presence of the former may be a result of pure uncertainty. Furthermore, this notion is easily applicable outside the realm of banking and money. In its light the hypothesis that in times of risk FPI should substitute for FDI - because seller of the firm may be suspected to withhold certain information about it - may be supplanted by additional argument: that FDI becomes relatively more information sensitive when there is a crisis on the horizon and, therefore, the preference of FPI over FDI should be even greater. The importance of information constraints and uncertainty in such contexts is underscored by Kim & Wei (2002). After examining the trading behaviour of foreign portfolio investors in Korea before and during the 1997 currency crisis, they found that investors remaining outside the country were more susceptible to herding than branches of foreign institutions located in Korea. They explain this by invoking differences in information.

As mentioned before, literature on relationships between FDI and FPI is scarce and we are therefore only beginning with this strand of research. There is, however, a preliminary study by Dunning & Dilyard (1999) which argues for a common paradigm for explanations of two types of investment. Authors show that there are important differences, but also salient common characteristics across determinants of each, both in developed (United States) and developing (East Asia and Latin America) regions. Moreover, they give foundation for our second hypothesis by claiming that FDI and FPI complement, rather than substitute for each other (but, as noted before, Humanicki et al. (2013) had to reject this hypothesis for Poland in light of their estimation outcomes). It is worth noting that in a polemical paper Wilkins (1999) argues that such common paradigm is not possible, but, given the fact that it is an analysis from 14 years ago, we are in position to suspect that his conclusions may not hold today.

3. Data

On the next pages we present results of our study in which we exploit the following variables: *fdi_stock* representing current foreign direct investment stock in a country, *fpi_stock* standing for current foreign portfolio investment stock in a country, *gdp* incorporating seasonally adjusted nominal value of GDP - all three in millions of national currency; *3m* measuring a short-run interest rate in a country which is actually 3-month interbank loan interest rate expressed in percentage points, and finally *ulc* capturing unit labour costs in a country according to the Eurostat methodology. Actually, all abovementioned variables have been deflated by a country-specific GDP deflator calibrated at the value of 100 for year 2005 and thus we finally used them expressed in real terms and added the *r* letter at the beginning of their names to underline that fact. Variables' names were naturally extended by an adequate suffix *_pl*, *_uk,* or *_ger* indicating their country of origin - Poland, the United Kingdom, or Germany, respectively. Moreover, each logarithmically transformed variable was further renamed with a letter *l* in front of the full name of original variable. To point that a variable has been differenced x times further on we make use of a symbol 'Δ_x' in tables containing results of tests for stationarity and 'dx' or 'Dx' in graphs and outputs coming from Stata. Below we present more details on the data and our concerns related to the dataset with a short statistical summary of all abovementioned variables in their levels.

In this study we decided to make use of an approach corresponding to that of Humanicki et. al (2013) (with an additional feature of GDP endogeneity, as permitted by the VEC approach). As far as Polish data are concerned, we make use of the same dataset as Humanicki et. al, delivered by the authors themselves. We also gathered necessary variables for the United Kingdom and Germany from Eurostat and GDP deflators calibrated at the value of 100 for year 2005 from Federal Reserve Bank of St. Louis database. However, we admit that by following the approach of Humanicki et al. we disregard the account of errors and omissions in respective countries' BoPs. It is a substantial part at least in case of Polish BoP, amounting to as much as -21.2 billion PLN in the 2011q4-2012q3 period. This is equivalent, in absolute terms, to 78% of the value of FDI in Poland for that time. So, a natural question arises: how much of this total can be attributed to foreign investment? Granted, this is a very difficult question, and every estimate would be, at best, a guess. Nevertheless, it has to be pointed out that it might be a source of some bias in our results. Furthermore, we decided to cope with the issue of valuation effects by conducting the analyses in national currencies for every country. While this should make our research robust to fluctuations of exchange rates, at least as long as we care about purely economic inferences, we do not control for changes in statistical reporting approaches of particular national banks. Another important econometric issue is related to a small number of degrees of freedom in the estimated models caused by the shortness of time series available. This, in turn, may lead to some unpredictable inaccuracy, casting an additional shadow of a doubt on our final results. All things considered, concerns listed above should be treated just as a reminder that one should approach conclusions of our paper with a grain of salt, as we did our best to ensure proper statistical and economic inference.

As stated above, we make use of data delivered by the authors of the corresponding paper (Humanicki et al. 2013), data obtained on our own from Eurostat, and data coming from Federal Reserve Bank of St. Louis database. The raw dataset delivered by the authors consisted of 45 series for a few economic variables for Poland, each measured on the macro-level, and one time-representing series. In-sample period covered time interval from January 2000 to June 2012 in quarterly frequency and we enriched the dataset by the related variables of the same frequency for the United Kingdom and Germany, with limited in-sample period for the latter, covering only the January 2004-June 2012 interval. Below we present a short statistical summary of all variables of interest.

variable	N	min	max	mean	p50	sd	skewness	kurtosis
rgdp_pl	50	208785.8	329706	262106.4	256453.5	40237.14	.1867183	1.585404
r3m_pl	50	3.344978	22.01117	7.425069	5.245872	5.611693	1.711348	4.408759
rulc_pl	50	94.47566	119.2222	103.6591	100.2242	7.708168	.7813231	2.118874
rfpi_stock_pl	50	55113.69	304773.4	148685.1	157498.6	71758.66	.4736485	2.350558
rfdi_stock_pl	50	122052.2	483554.1	304051	293533.8	115682.3	.0550801	1.57974
rgdp_uk	50	269401.9	339405.3	311245.4	319000.9	20517.79	-.5994518	2.060683
r3m_uk	50	.539768	7.054837	3.897703	4.527939	2.083326	-.5321346	1.967136
rulc_uk	50	98.99646	105.8868	101.9686	101.8713	1.474681	.4978842	3.004846
rfpi_stock_uk	50	953194.6	2243056	1560136	1534726	439074.3	.2022543	1.524795
rfdi_stock_uk	50	288751.9	687687.3	498019.5	508416.2	125686.1	.068016	1.484523
rgdp_ger	34	549746.2	618080.4	584238.4	588800.3	22773.52	-.1682182	1.662895
r3m_ger	34	.6300406	4.846486	2.323502	2.126501	1.366627	.481855	1.944173
rulc_ger	34	94.93177	102.6923	99.10247	99.53956	2.194711	-.4670823	2.153131
rfpi_stock_ger	34	1433516	2384511	1996913	2064087	276235.2	-.5965975	2.321127
rfdi_stock_ger	34	507742.9	677503.9	617268.4	644303.9	59991.49	-.7497287	1.869236

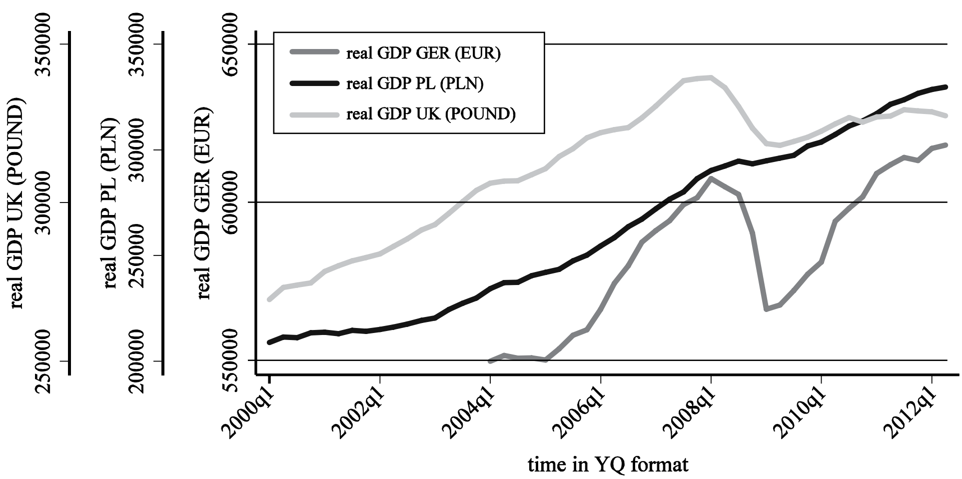
Humanicki et. al (2013) state that variables of interest in their study probably possess I(2) property, i.e. they would need to differenced twice to obtain stationary series (although, curiously, they do not provide results of any tests determining integration order of any variable), and that is their reason to employ a VEC instead of a VAR model. Specifically, their VEC model is constructed in terms of second differences. However, according to econometric theory and practice it is crucial to take second differences of only I(2) regressors, as taking second difference of an I(1) (trend) or I(0) (stationary) variable does not make much sense. In this light, we find proper determination of the order of integration to be an important point of the whole analysis, and thus we treat this issue quite comprehensively. Furthermore, we make use of this integration order analysis as a tool for determining whether variables require logarithmic transformation. If variables tend not to reveal a decrease in order of integration after being logarithmised, then we would argue to use them in their raw form. Below we present graphical representation of real GDPs and real unit labour costs series.

We start our research with analysis of integration orders of exploited variables. In the appendices we present graphical analysis and tables containing results of 3 most commonly applied formal tests for integration order determination and our conclusions for 15 raw variables which were supposed to be used in subsequent analysis. Furthermore, we present corresponding tables of results for logarithmically transformed data.

Even preliminary graphical analysis of 15 time series that could be considered to be logarithmically transformed before estimation of our model indicates that such an action would at most leave integration order at the same level as without logarithmic transformation and thus we would argue in favour of leaving time series in their raw figures. Moreover, graphical analysis suggests no significant improvement in terms of stationarity upon switching from first to second differences in all cases but *gdp_pl* for the raw data, and in all cases but *r3m_pl* for logarithmised data.

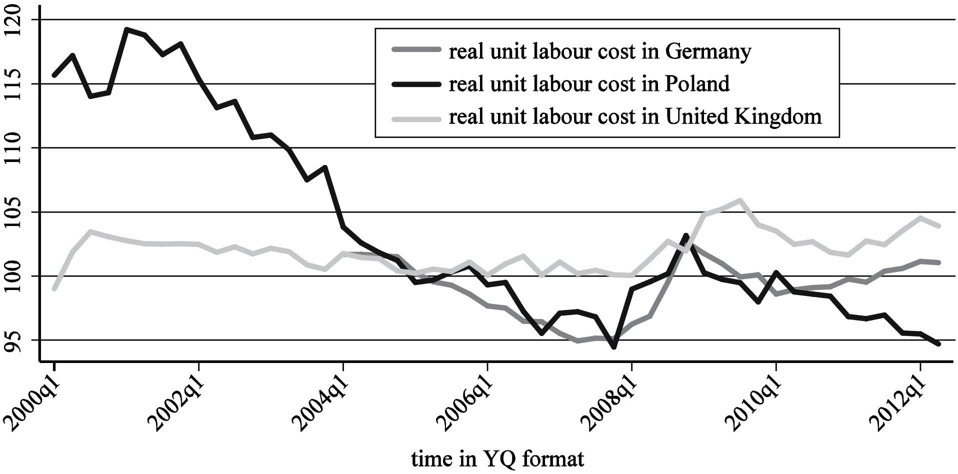
Formal tests for stationarity indicate that only in case of *r3m_pl* logarithmic transformation allows achieving lower order of integration, but at the same time it would increase order of integration for *rfdi_stock_pl* and *rgdp_uk*. Furthermore, we do not intend to interpret obtained results quantitatively but rather qualitatively, so the usually convenient use of elasticities (which can be expressed with the use of logarithms) is not of high importance in this paper. In light of abovementioned issues we argue against employing this kind of econometric operation because according to state-of-the-art econometrics, researchers should make use of raw data if only it does not disturb statistical inference and this is just the case here.

Figure 1. Real GDPs in millions of national currencies



Note: Deflated with national GDP deflator (2005=100).

Figure 2. Real unit labor costs



Note: Deflated with national GDP deflator (2005=100).

4. Model estimation

Finally, on the basis of both graphical (variables seem not to be mean-reversing) and formal analysis (tests for stationarity) we decided to conclude this part with a presumption that all variables of interest are I(1) processes (integrated of order 1). As a consequence, since we were interested in verifying existence of any relationships potentially occurring between three variables (FDI, FPI, GDP), we aimed at looking for VEC models specifications, such that we would be able to include at least 2 cointegrating equations standing for long run relationships in the data. In order to proceed with the analysis of these long run dependences we conducted a series of Johansen's trace tests for the number of cointegration relations in different VEC settings with all 5 variables being endogenous. Results of those tests are presented in Table 1. Because of the nature of the problem, we finally decided to care only about the *restricted trend*, *constant* and *restricted constant* approaches. Quadratic trends seem to be absent in the dataset (both due to graphical analysis and due to formal conclusions on variables' order of integration), which disqualifies the *trend* approach that puts no restrictions on cointegrating equations (whereas in the absence of quadratic trend we would at least like to set $\tau=0$, as this is the parameter that ultimately gives way to such trend in the equation). At the same time we would like to include a constant in cointegrating equations allowing for fluctuations around some estimated value in the long-run relationship, which rules out the *none-trend* approach.

In accordance with what was mentioned before, we finally decided to employ three VEC approaches with lowest possible number of lags in the underlying

VAR model allowing for at least 2 cointegrating equations. This is not a standard decision rule for lag-order selection in a VEC model, thus we do not report e.g. information criteria corresponding to VEC models estimated, not to overwhelm the reader. We followed the procedure of estimating 3 VEC models for each approach, applying Johansen's normalization constraints towards different pairs of three variables – *rgdp*, *rfdi_stock* and *rfpi_stock* – in cointegrating equations, thus obtaining inference for one variable's impact on the others in each such estimation (Rothenberg 1971, Johansen 1995). E.g. normalization constraints towards a pair *rgdp* and *rfdi_stock* resulted in first cointegrating equation being composed of *rgdp* and *rfpi_stock* with *rfdi_stock* excluded, and the second cointegrating equation being composed of *rfdi_stock* and *rfpi_stock* with *rgdp* excluded. From a VEC model estimated with such normalization constraints we evaluated impact of *rfpi_stock* on both *rgdp* and *rfdi_stock*. As a result, we have estimated 54 VEC models in total. Table 2. forms a summary of results of interest – indicating statistical significance and signs of adequate estimates in the given setting of a VEC model.

All cointegrating equations were exactly identified and statistically significant. Other diagnostics of all models indicated that there is no autocorrelation up to sixth order – according to LM test – and residuals from separate equations seemed to have normal distribution in the Jarque-Bera test sense, both at 5% significance level. Finally, all estimated VEC models seemed to be stable, exhibiting exactly 3 unit roots. Results of all abovementioned diagnostics are available from authors upon request. We finally decided to briefly sum up our research without conducting random shocks response analysis.

Table 1. Number of cointegrating equations indicated by Johansen's trace statistic test ('-' indicates that the test was not conclusive)

Country	Restrictions in equation:		p=2	p=3	p=4	p=5	p=6	p=7
Poland	none	(*trend* approach)	2	3	3	-	-	-
	τ=0	(*restricted trend* approach)	2	3	3	-	-	-
	τ=0, ρ=0	(*constant* approach)	1	2	2	3	-	4
	τ=0, ρ=0, γ=0	(*restricted constant* approach)	2	2	3	-	-	-
	τ=0, ρ=0, γ=0, μ=0	(*none-trend* approach)	1	1	2	4	4	4
United Kingdom	none	(*trend* approach)	1	1	3	2	3	4
	τ=0	(*restricted trend* approach)	1	1	4	3	-	-
	τ=0, ρ=0	(*constant* approach)	2	2	-	-	-	-
	τ=0, ρ=0, γ=0	(*restricted constant* approach)	3	3	3	4	-	-
	τ=0, ρ=0, γ=0, μ=0	(*none-trend* approach)	1	2	3	3	4	4
Germany	none	(*trend* approach)	1	3	-	-	-	-
	τ=0	(*restricted trend* approach)	2	4	-	-	-	-
	τ=0, ρ=0	(*constant* approach)	1	2	4	4	-	-
	τ=0, ρ=0, γ=0	(*restricted constant* approach)	2	4	-	-	-	-
	τ=0, ρ=0, γ=0, μ=0	(*none-trend* approach)	2	3	-	-	-	-

Table 2. Signs of long-run relationships between variables (stemming from cointegrating equations) at 5% significance level – without parentheses – and marginally significant – in parentheses

Country	VEC model form	Impulse variable	rgdp	rfdi_stock	rfpi_stock
Poland	τ=0 (restricted trend approach)	rgdp	.	+	–
		rfdi_stock	(+)	.	–
		rfpi_stock	(–)	–	.
	τ=0, ρ=0 (constant approach)	rgdp	.	+	insignificant
		rfdi_stock	(+)	.	insignificant
		rfpi_stock	(+)	+	.
	τ=0, ρ=0, γ=0 (restricted constant approach)	rgdp	.	(+)	insignificant
		rfdi_stock	(+)	.	insignificant
		rfpi_stock	(+)	(+)	.

United Kingdom	τ=0 (restricted trend approach)	rgdp	.	(+)	(–)
		rfdi_stock	(+)	.	(–)
		rfpi_stock	(–)	(–)	.
	τ=0, ρ=0 (constant approach)	rgdp	.	+	(+)
		rfdi_stock	(+)	.	(+)
		rfpi_stock	(+)	+	.
	τ=0, ρ=0, γ=0 (restricted constant approach)	rgdp	.	insignificant	insignificant
		rfdi_stock	insignificant	.	insignificant
		rfpi_stock	insignificant	insignificant	.
Germany	τ=0 (restricted trend approach)	rgdp	.	+	–
		rfdi_stock	insignificant	.	–
		rfpi_stock	(–)	–	.
	τ=0, ρ=0 (constant approach)	rgdp	.	insignificant	insignificant
		rfdi_stock	insignificant	.	insignificant
		rfpi_stock	(+)	insignificant	.
	τ=0, ρ=0, γ=0 (restricted constant approach)	rgdp	.	insignificant	insignificant
		rfdi_stock	insignificant	.	insignificant
		rfpi_stock	insignificant	insignificant	.

5. Conclusions

In this short report we contribute to the scarce literature on mutual relationships between two forms of foreign investment and their real impact on GDP. It must be said that results differ across sampled countries.

Generally, we observe quite strong snowball effect in case of GDP's positive impact on FDI stock and a positive feedback in the opposite direction. The first of these results means that our model indicates that the bigger the country (in economic terms), the more likely it is to attract FDI. This seems to be in line with historical insight that developed countries tend to attract more foreign investment. The second gives some support to the standard view that FDI seems to be conducive to growth (and stands in contrast to studies mentioned at the beginning of section 2). A little less significant discouraging effect of economy's development on speculative capital inflows (FPI) might be spotted as well. The fact that as the country grows, it attracts more FDI and relatively less FPI, may point to some degree of intertemporal substitution between the two in the process of economic growth. But as economic growth is usually associated with higher-quality institutions, this result may be the residual of the following fact – in more developed countries investors are relatively more willing to commit to long-run investments with more difficult exit strategies, as they are, e.g., less concerned about expropriation risk or economic and legal instabilities. Nonetheless, some degree of substitution can be inferred from this analysis, even if generally relationship between FDI and FPI seems to be ambiguous. In some VEC specifications they turned out to be complements and in the others they appear as substitutes or there is no statistical evidence for any significant link between the two. Yet, any of this results might have been a residual of the specific period of time covered by the dataset used in this study.

To be more specific: as far as Polish case is concerned, estimated models reveal a significantly positive bilateral relationship between FDI and GDP in real terms, which is in line with our expectations based on economic theory. On the other hand, FPI seems to impact the rest ambiguously, itself being rather independent from the others. The same snowball effect emerges in case of the United Kingdom, where at the same time FPI's impact on FDI and GDP, as well as FDI and GDP's impact on FPI, are even more ambiguous than in Polish example. This lack of clear-cut connection between FPI (although note the discussion above about some connection between FPI and GDP) and other variables once again most probably points to the fact that money invested in this way moves way faster than FDI money. Applying once more the term "hot money" we could say that the hotness is visible not only because FPI escapes the country in troubled times, but also because it tends to seek profit opportunities at a frequency much higher than that of FDI.

Models constructed for German economy seem not to be that insightful nor conclusive. When these results are significant they are in line with those obtained for Poland and the UK. However, they frequently turn out to be insignificant. We would ascribe this result to much shorter dataset used in case of this economy.

However, there are certain facts that should compel any reader to view our results with a considerable degree of reserve. In our VEC estimations we decided to make all variables endogenous to control for probable feedbacks in the analyzed system. As a consequence, we lost additional degrees of freedom. Also, we do not include any proxy for institutional setting in the model – which may be of great importance when it comes to attracting foreign investors – and that might be the reason for obtaining mostly insignificant results for German economy, which is broadly known of well-established institutional setting. We comprehensively discussed potentially significant biases resulting from our data-collection method in the third section. All this may bear on reliability of obtained results.

For this kind of analysis there is always one obviously desired direction of extension for the future. It is connected with utilization of longer dataset as soon as it becomes possible. Moreover, there is for sure a lot of technical issues that we have not raised in this short study and which might significantly contribute to the quality of obtained results as the methodology of integrated VAR systems, despite its present complexity and sophistication, is still being developed.

Bibliography

Aitken B. J., A. E. Harrison. 1999. "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela." *American Economic Review*, vol. 89, no. 3, pp. 605-618.

Albuquerque R. 2003. "The composition of international capital flows: risk sharing through foreign direct investment". *Journal of International Economics,* vol. 61, pp. 353-383.

Amiram D., M. M. Frank. 2012. *The Effects of Investor-Level Dividend Taxes on the Allocation of Foreign Portfolio Investment around the World*. On-line: http://ssrn.com/abstract=1539422

Asiedu E. 2005. *Foreign Direct Investment in Africa: The Role of Natural Resources, Market Size, Government Policy, Institutions and Political Instability.* Available at SSRN: http://ssrn.com/abstract=717361

Blomstrom M., A. Kokko. 2003. *The Economics of Foreign Direct Investment Incentives*. NBER Working Paper No. w9489.

Brecher R. A. 1983. "Second-best Policy for International Trade and Investment". *Journal of International Economics*, vol. 14, no. 3-4, pp. 313-320.

Carkovic M., R. Levine. 2002. *Does Foreign Direct Investment Accelerate Economic Growth?* Available on-line: http://www.worldbank.org/research/conferences/financial_globalization/fdi.pdf

Claessens S., M. Dooley, A. Warner. 1995. "Portfolio capital flows: hot or cold?". *The World Bank Economic Review*, vol. 9, no. 1, pp. 153-174.

Dunning J. H., J. R. Dilyard. 1999. "Towards a general paradigm of foreign direct and foreign portfolio investment". *Transnational Corporations*, vol. 8, no. 1, pp. 1-52.

Durham J. B. 2003. *Foreign Portfolio Investment, Foreign Bank Lending, and Economic Growth*. FRB International Finance Discussion Paper No. 757.

Errunza V. 2002. "Foreign Portfolio Equity Investments, Financial Liberalization, and Economic Development". *Review of International Economics*, vol. 9, no. 4, pp. 703-726.

Evans K. 2002. *Foreign Portfolio and Direct Investment: Complementarity, Differences, and Integration.* Prepared for Global Forum on International Investment in Shanghai.

Goldstein I., A. Razin. 2006. "An information-based trade-off between foreign direct investment and foreign portfolio investment". *Journal of International Economics*, vol. 70, no. 1, pp. 271-295.

Gorton G. B. 2010. *Slapped by the Invisible Hand: The Panic of 2007*. Oxford University Press. New York.

Humanicki M., R. Kelm, K. Olszewski. 2013. *Foreign Direct Investment and Foreign Portfolio Investment in the contemporary globalized world: should they be still treated separately?* NBP Working Paper no. 167.

Hsu C.-C., J.-Y. Wu. 2008. "Does Foreign Direct Investment Promote Economic Growth? Evidence from a Threshold Regression Analysis." *Economics Bulletin*, vol. 15, no. 12, pp. 1-10.

Johansen S. 1995. "Likelihood-Based Inference in Cointegrated Vector Autoregressive Models". *Oxford University Press*.

Kim W., S.-J. Wei. 2002. "Foreign portfolio investors before and during a crisis". *Journal of International Economics*, vol. 56, no. 1, pp. 77-96.

Pfeffer B. 2008. *FDI and FPI – Strategic Complements?* MAGKS Joint Discussion Paper Series in Economics, 12. Universität Marburg.

Razin A., E. Sadka. 2003. "Gains from FDI inflows with incomplete information". *Economic Letters*, vol. 78, no. 1, pp. 71-77.

Romer P. 1993. "Idea gaps and object gaps in economic development". *Journal of Monetary Economics*, vol. 32, pp. 543-573.

Rothenberg, T. J. 1971. "Identification in parametric models". *Econometrica*, vol. 39, pp. 577–591.

Shen C.-H., C.-C. Lee, C.-C. Lee. 2010. "What makes international capital flows promote economic growth? An international cross-country analysis". *Scottish Journal of Political Economy*, vol. 57, pp. 515-546.

Wilkins M. 1999. "Two literatures, two storylines: is a general paradigm of foreign portfolio and foreign direct investment feasible?". *Transnational Corporations*, vol. 8, no. 1, pp. 53-116.

Appendices

Appendix 1. Results and conclusions from DF, ADF, KPSS and PP tests for non-logarithmically transformed Polish data

Series	DF statistic	ADF statistic	KPSS statistic	Rho statistic of Phillips-Perron test	Conclusions at 5% significance level
rfdi_stock_pl	-0.552	-	1.350	-0.224	rfdi_stock_pl is at least I(1)
Δ1rfdi_stock_pl	-6.329***	-	0.140+++	-42.669###	Δ1rfdi_stock_pl is I(0)
Δ2rfdi_stock_pl	autocorrelation	-4.679***	0.073+++	-53.077###	Δ2rfdi_stock_pl is I(0)
rfpi_stock_pl	1.428	-	1.200	0.992	rfpi_stock_pl is at least I(1)
Δ1rfpi_stock_pl	-4.779***	-	0.224+++	-33.861###	Δ1rfpi_stock_pl is I(0)
Δ2rfpi_stock_pl	-11.094***	-	0.050+++	-60.623###	Δ2rfpi_stock_pl is I(0)
r3m_pl	autocorrelation	-6.261***	0.858	-3.943	mixed
Δ1r3m_pl	-2.622*	-	0.384++	-13.605##	mixed
Δ2r3m_pl	-7.556***	-	0.083+++	-52.593###	Δ2r3m_pl is I(0)
rulc_pl	-1.162	-	1.090	-1.734	rulc_pl is at least I(1)
Δ1rulc_pl	-8.274***	-	0.129+++	-58.864###	Δ1rulc_pl is I(0)
Δ2rulc_pl	autocorrelation	-5.583***	0.047+++	-63.339###	Δ2rulc_pl is I(0)
rgdp_pl	autocorrelation	0.409	1.340	0.490	rgdp_pl is at least I(1)
Δ1rgdp_pl	autocorrelation	-3.206**	0.334+++	-31.216###	Δ1rgdp_pl is I(0)
Δ2rgdp_pl	autocorrelation	-3.363**	0.054+++	-69.502###	Δ2rgdp_pl is I(0)

Note:

Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.594 for α=1%, -2.936 for α=5% and -2.602 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -18.696 for α=1%, -13.204 for α=5% and -10.660 for α=10%.

*, **, *** stands for statistical inference to reject H_0 in DF or ADF test at significance level 1%, 5% and 10%

+,++,+++ stands for lack of statistical inference to reject H_0 in KPSS test at significance level 1%, 5% and 10%

#, ##, ### stands for statistical inference to reject H_0 in Phillips-Perron test at significance level 1%, 5% and 10%

autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

Appendix 2. Results and conclusions from DF, ADF, KPSS and PP tests for logarithmically transformed Polish data

Series	DF statistic	ADF statistic	KPSS statistic	Rho statistic of Phillips-Perron test	Conclusions at 5% significance level
lrfdi_stock_pl	-3.001^{**}	-	1.340	-1.363	mixed
Δ_1*lrfdi_stock_pl*	-6.352^{***}	-	0.650^{+}	$-43.350^{\#\#\#}$	mixed
Δ_2*lrfdi_stock_pl*	autocorrelation	-5.156^{***}	0.055^{+++}	$-54.959^{\#\#\#}$	Δ_2*lrfdi_stock_pl* is I(0)
lrfpi_stock_pl	-0.524	-	1.230	-0.603	*lrfpi_stock_pl* is at least I(1)
Δ_1*lrfpi_stock_pl*	-5.900^{***}	-	0.093^{+++}	$-43.300^{\#\#\#}$	Δ_1*lrfpi_stock_pl* is I(0)
Δ_2*lrfpi_stock_pl*	autocorrelation	-4.659^{***}	0.058^{+++}	$-59.936^{\#\#\#}$	Δ_2*lrfpi_stock_pl* is I(0)
lr3m_pl	autocorrelation	-3.239^{***}	0.998	-3.499	mixed
Δ_1*lr3m_pl*	-3.456^{**}	-	0.265^{+++}	$-20.715^{\#\#\#}$	Δ_1*lr3m_pl* is I(0)
Δ_2*lr3m_pl*	-8.624^{***}	-	0.052^{+++}	$-56.003^{\#\#\#}$	Δ_2*lr3m_pl* is I(0)
lrulc_pl	-1.122	-	1.100	-1.678	*lrulc_pl* is at least I(1)
Δ_1*lrulc_pl*	-8.319^{***}	-	0.120^{+++}	$-59.228^{\#\#\#}$	Δ_1*lrulc_pl* is I(0)
Δ_2*lrulc_pl*	autocorrelation	-5.576^{***}	0.045^{+++}	$-63.807^{\#\#\#}$	Δ_2*lrulc_pl* is I(0)
lrgdp_pl	autocorrelation	-0.275	1.340	0.175	*lrgdp_pl* is at least I(1)
Δ_1*lrgdp_pl*	autocorrelation	-3.101^{**}	0.202^{+++}	$-36.446^{\#\#\#}$	Δ_1*lrgdp_pl* is I(0)
Δ_2*lrgdp_pl*	autocorrelation	-3.300^{**}	0.051^{+++}	$-69.437^{\#\#\#}$	Δ_2*lrgdp_pl* is I(0)

Note:

Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.594 for α=1%, -2.936 for α=5% and -2.602 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -18.696 for α=1%, -13.204 for α=5% and -10.660 for α=10%.

*, **, *** stands for statistical inference to reject H_0 in DF or ADF test at significance level 1%, 5% and 10%

$^{+}$, $^{++}$, $^{+++}$ stands for lack of statistical inference to reject H_0 in KPSS test at significance level 1%, 5% and 10%

$^{\#}$, $^{\#\#}$, $^{\#\#\#}$ stands for statistical inference to reject H_0 in Phillips-Perron test at significance level 1%, 5% and 10%

autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

Appendix 3. Results and conclusions from DF, ADF, KPSS and PP tests for non-logarithmically transformed British data

Series	DF statistic	ADF statistic	KPSS statistic	Rho statistic of Phillips-Perron test	Conclusions at 5% significance level
rfdi_stock_uk	-0.856	-	1.300	-1.148	*rfdi_stock_uk* is at least I(1)
Δ_1*rfdi_stock_uk*	-7.458***	-	0.053+++	-54.136###	Δ_1*rfdi_stock_uk* is I(0)
Δ_2*rfdi_stock_uk*	autocorrelation	-5.092***	0.041+++	-68.102###	Δ_2*rfdi_stock_uk* is I(0)
rfpi_stock_uk	-0.015	-	1.270	-0.097	*rfpi_stock_uk* is at least I(1)
Δ_1*rfpi_stock_uk*	-6.896***	-	0.176+++	-54.151###	Δ_1*rfpi_stock_uk* is I(0)
Δ_2*rfpi_stock_uk*	-13.904***	-	0.048+++	-70.227###	Δ_2*rfpi_stock_uk* is I(0)
r3m_uk	autocorrelation	-1.665	0.865	-2.489	*r3m_uk* is at least I(1)
Δ_1*r3m_uk*	-3.612***	-	0.082+++	-21.083###	Δ_1*r3m_uk* is I(0)
Δ_2*r3m_uk*	-7.536***	-	0.050+++	-43.521###	Δ_2*r3m_uk* is I(0)
rulc_uk	-2.718*	-	0.341+++	-15.448##	mixed
Δ_1*rulc_uk*	-7.831***	-	0.072+++	-49.119###	Δ_1*rulc_uk* is I(0)
Δ_2*rulc_uk*	autocorrelation	-5.239***	0.110+++	-68.359###	Δ_2*rulc_uk* is I(0)
rgdp_uk	autocorrelation	-1.652	1.120	-2.589	*rgdp_uk* is at least I(1)
Δ_1*rgdp_uk*	autocorrelation	-3.018**	0.365++	-15.681##	Δ_1*rgdp_uk* is I(0)
Δ_2*rgdp_uk*	autocorrelation	-4.128***	0.036+++	-47.456###	Δ_2*rgdp_uk* is I(0)

Note: Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.594 for α=1%, -2.936 for α=5% and -2.602 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -18.696 for α=1%, -13.204 for α=5% and -10.660 for α=10%.

*, **, *** stands for statistical inference to reject H_0 in DF or ADF test at significance level 1%, 5% and 10%

+,++,+++ stands for lack of statistical inference to reject H_0 in KPSS test at significance level 1%, 5% and 10%

#, ##, ### stands for statistical inference to reject H_0 in Phillips-Perron test at significance level 1%, 5% and 10%

autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

Appendix 4. Results and conclusions from DF, ADF, KPSS and PP tests for logarithmically transformed British data

Series	DF statistic	ADF statistic	KPSS statistic	Rho statistic of Phillips-Perron test	Conclusions at 5% significance level
lrfdi_stock_uk	-1.484	-	1.300	-2.036	*lrfdi_stock_uk* is at least I(1)
Δ_1*lrfdi_stock_uk*	autocorrelation	-3.632***	0.101+++	-50.970###	Δ_1*lrfdi_stock_uk* is I(0)
Δ_2*lrfdi_stock_uk*	-13.440***	-	0.053+++	-68.986###	Δ_2*lrfdi_stock_uk* is I(0)
lrfpi_stock_uk	-0.154	-	1.260	-0.295	*lrfpi_stock_uk* is at least I(1)
Δ_1*lrfpi_stock_uk*	-6.407***	-	0.163+++	-50.213###	Δ_1*lrfpi_stock_uk* is I(0)
Δ_2*lrfpi_stock_uk*	-13.510***	-	0.050+++	-69.100###	Δ_2*lrfpi_stock_uk* is I(0)
lr3m_uk	autocorrelation	-0.983	0.881	-1.697	*lr3m_uk* is at least I(1)
Δ_1*lr3m_uk*	-2.965**	-	0.103+++	-17.172##	Δ_1*lr3m_uk* is I(0)
Δ_2*lr3m_uk*	-7.310***	-	0.040+++	-49.924###	Δ_2*lr3m_uk* is I(0)
lrulc_uk	-2.742*	-	0.340+++	-15.607##	mixed
Δ_1*lrulc_uk*	autocorrelation	-3.425**	0.074+++	-49.127###	Δ_1*lrulc_uk* is I(0)
Δ_2*lrulc_uk*	autocorrelation	-5.261***	0.112+++	-68.216###	Δ_2*lrulc_uk* is I(0)
lrgdp_uk	autocorrelation	-2.669*	1.120	-2.653	*lrgdp_uk* is at least I(1)
Δ_1*lrgdp_uk*	-2.758*	-	0.428++	-15.937##	mixed
Δ_2*lrgdp_uk*	-7.050***	-	0.038+++	-47.895###	Δ_2*lrgdp_uk* is I(0)

Note: Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.594 for α=1%, -2.936 for α=5% and -2.602 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -18.696 for α=1%, -13.204 for α=5% and -10.660 for α=10%.

*, **, *** stands for statistical inference to reject H_0 in DF or ADF test at significance level 1%, 5% and 10%

+, ++, +++ stands for lack of statistical inference to reject H_0 in KPSS test at significance level 1%, 5% and 10%

#, ##, ### stands for statistical inference to reject H_0 in Phillips-Perron test at significance level 1%, 5% and 10%

autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

Appendix 5. Results and conclusions from DF, ADF, KPSS and PP tests for non-logarithmically transformed German data

Series	**DF statistic**	**ADF statistic**	**KPSS statistic**	***Rho* statistic of Phillips-Perron test**	**Conclusions at 5% significance level**
rfdi_stock_ger	-1.589	-	0.777	-2.342	*rfdi_stock_ger* is at least I(1)
Δ_1*rfdi_stock_ger*	-5.894***	-	0.180+++	-38.373###	Δ_1*rfdi_stock_ger* is I(0)
Δ_2*rfdi_stock_ger*	autocorrelation	-3.207**	0.063+++	-44.415###	Δ_2*rfdi_stock_ger* is I(0)
rfpi_stock_ger	-1.571	-	0.891	-1.628	*rfpi_stock_ger* is at least I(1)
Δ_1*rfpi_stock_ger*	-5.032***	-	0.159+++	-29.676###	Δ_1*rfpi_stock_ger* is I(0)
Δ_2*rfpi_stock_ger*	-8.728***	-	0.069+++	-39.079###	Δ_2*rfpi_stock_ger* is I(0)
r3m_ger	autocorrelation	-1.434	0.339+++	-3.467	mixed
Δ_1*r3m_ger*	-2.812*	-	0.166+++	-13.138##	mixed
Δ_2*r3m_ger*	-5.815***	-	0.068+++	-27.366###	Δ_2*r3m_ger* is I(0)
rulc_ger	autocorrelation	-2.397	0.171+++	-6.119	mixed
Δ_1*rulc_ger*	-3.727***	-	0.187+++	-20.914###	Δ_1*rulc_ger* is I(0)
Δ_2*rulc_ger*	-7.974***	-	0.060+++	-38.735###	Δ_2*rulc_ger* is I(0)
rgdp_ger	autocorrelation	-1.750	0.658+	-2.630#	*rgdp_ger* is at least I(1)
Δ_1*rgdp_ger*	-3.242**	-	0.071+++	-17.136##	Δ_1*rgdp_ger* is I(0)
Δ_2*rgdp_ger*	-6.877***	-	0.060+++	-34.887###	Δ_2*rgdp_ger* is I(0)

Note: Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.709 for α=1%, -2.983 for α=5% and -2.623 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -17.608 for α=1%, -12.962 for α=5% and -10.320 for α=10%.

*, **, *** stands for statistical inference to reject H_0 in DF or ADF test at significance level 1%, 5% and 10%

+, ++, +++ stands for lack of statistical inference to reject H_0 in KPSS test at significance level 1%, 5% and 10%

#, ##, ### stands for statistical inference to reject H_0 in Phillips-Perron test at significance level 1%, 5% and 10%

autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

Appendix 6. Results and conclusions from DF, ADF, KPSS and PP tests for logarithmically transformed German data

Series	DF statistic	ADF statistic	KPSS statistic	Rho statistic of Phillips-Perron test	Conclusions at 5% significance level
lrfdi_stock_ger	-1.701	-	0.775	-2.404	lrfdi_stock_ger is at least I(1)
$\Delta_1$lrfdi_stock_ger	-5.971***	-	0.210+++	-38.892###	$\Delta_1$lrfdi_stock_ger is I(0)
$\Delta_2$lrfdi_stock_ger	autocorrelation	-3.303**	0.062+++	-44.379###	$\Delta_2$lrfdi_stock_ger is I(0)
lrfpi_stock_ger	-2.102	-	0.871	-2.088	lrfpi_stock_ger is at least I(1)
$\Delta_1$lrfpi_stock_ger	-4.830***	-	0.241+++	-29.926###	$\Delta_1$lrfpi_stock_ger is I(0)
$\Delta_2$lrfpi_stock_ger	autocorrelation	-4.371***	0.072+++	-39.666###	$\Delta_2$lrfpi_stock_ger is I(0)
lr3m_ger	autocorrelation	-0.983	0.455++	-2.994	mixed
$\Delta_1$lr3m_ger	-1.890	-	0.154+++	-10.169	mixed
$\Delta_2$lr3m_ger	-5.270***	-	0.091+++	-29.890###	$\Delta_2$lr3m_ger is I(0)
lrulc_ger	autocorrelation	-2.402	0.172+++	-6.155	mixed
$\Delta_1$lrulc_ger	-3.702***	-	0.187+++	-20.786###	$\Delta_1$lrulc_ger is I(0)
$\Delta_2$lrulc_ger	-8.003***	-	0.060+++	-39.026###	$\Delta_2$lrulc_ger is I(0)
lrgdp_ger	autocorrelation	-1.779	0.658+	-2.673	lrgdp_ger is at least I(1)
$\Delta_1$lrgdp_ger	-3.259**	-	0.072+++	-17.249##	$\Delta_1$lrgdp_ger is I(0)
$\Delta_2$lrgdp_ger	-6.883***	-	0.056+++	-34.793###	$\Delta_2$lrgdp_ger is I(0)

Note: Critical values for DF and ADF test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* are about: -3.709 for α=1%, -2.983 for α=5% and -2.623 for α=10%.

Critical values for KPSS test with H_0: *a series is level stationary* against the hypothesis of *its integration of order 1* are about: 0.739 for α=1%, 0.463 for α=5% and 0.347 for α=10%.

Critical values for *rho* of Phillips-Perron test with H_0: *a series is non-stationary due to a presence of a unit root* against the hypothesis of *its stationarity* in our sample are about (precise values depend on the number of observations in underlying model): -17.608 for α=1%, -12.962 for α=5% and -10.320 for α=10%.

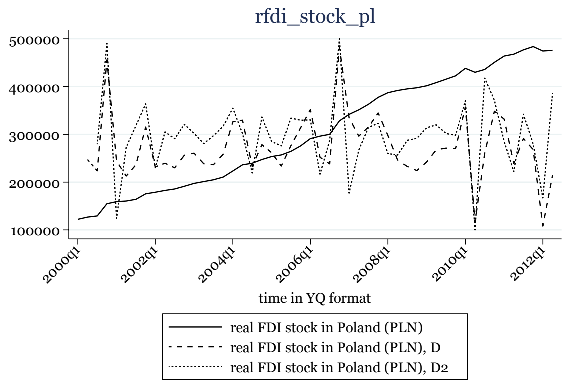
*, **, *** stands for statistical inference to reject H0 in DF or ADF test at significance level 1%, 5% and 10%

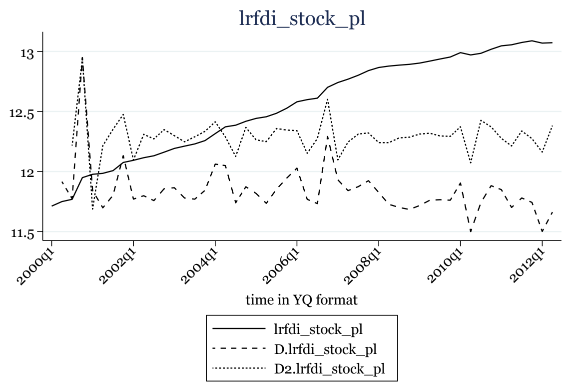
+, ++, +++ stands for lack of statistical inference to reject H0 in KPSS test at significance level 1%, 5% and 10%

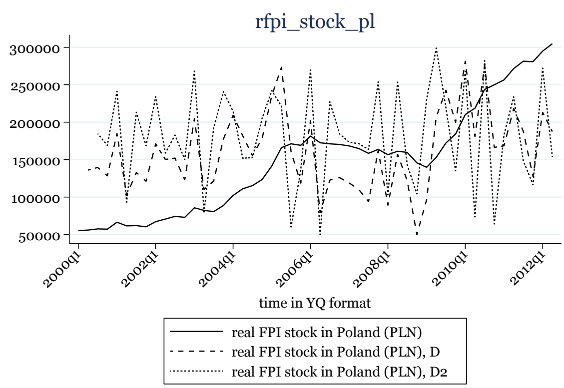
#, ##, ### stands for statistical inference to reject H0 in Phillips-Perron test at significance level 1%, 5% and 10%

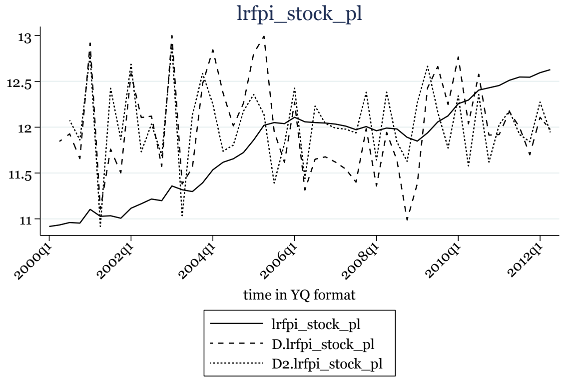
autocorrelation stands for autocorrelation in Dickey-Fuller test's underlying model on 5% significance

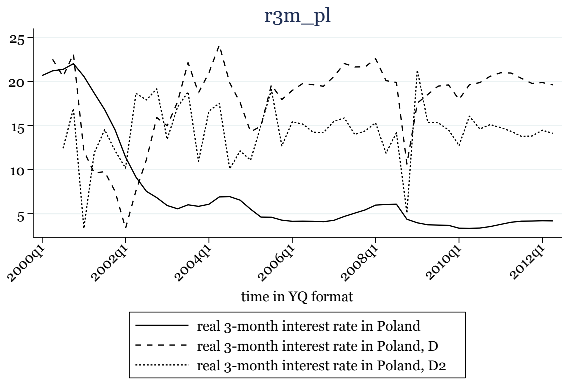
Appendix 7. Graphical analysis of the data (comparison of the data in raw form with logarithmised data in terms of integration order)

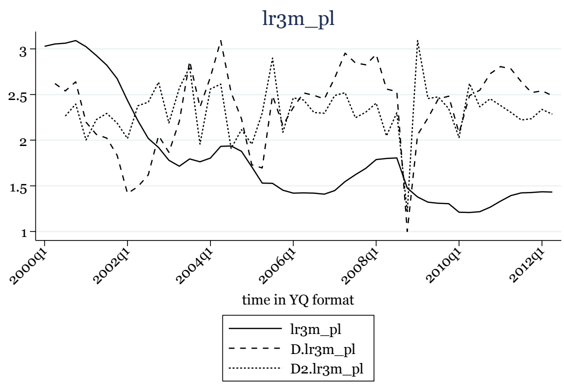


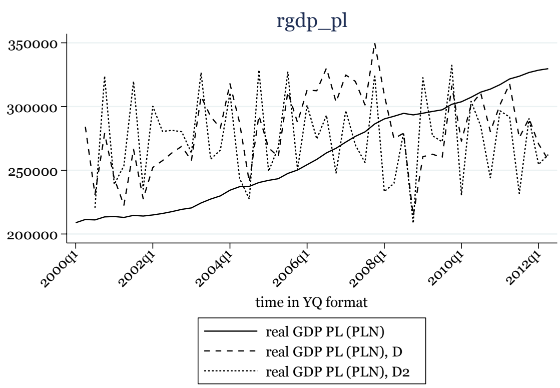


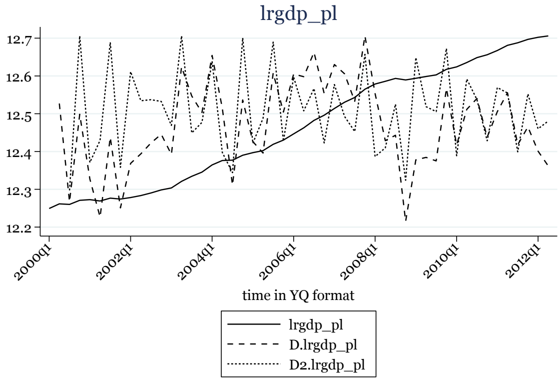


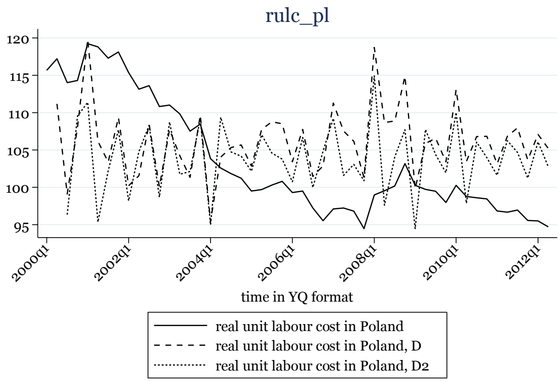

lrfpi_stock_pl
13
12.5
12
11.5
11
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrfpi_stock_pl
D.lrfpi_stock_pl
D2.lrfpi_stock_pl

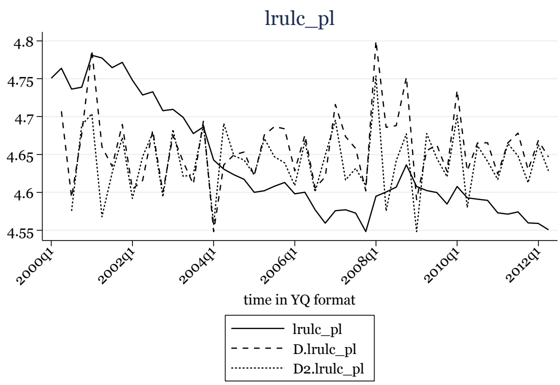

r3m_pl
25
20
15
10
5
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real 3-month interest rate in Poland
real 3-month interest rate in Poland, D
real 3-month interest rate in Poland, D2

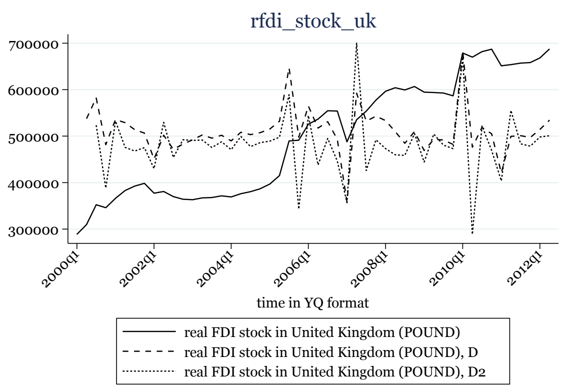

lr3m_pl
3
2.5
2
1.5
1
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lr3m_pl
D.lr3m_pl
D2.lr3m_pl

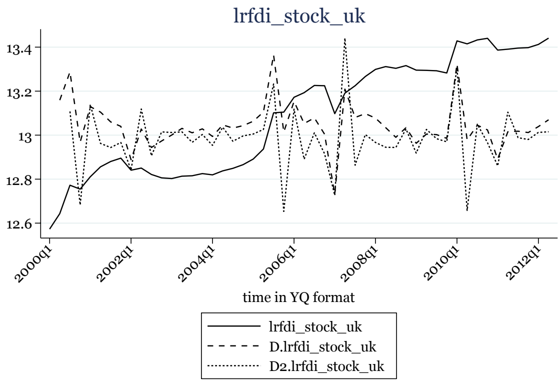

rgdp_pl
350000
300000
250000
200000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real GDP PL (PLN)
real GDP PL (PLN), D
real GDP PL (PLN), D2

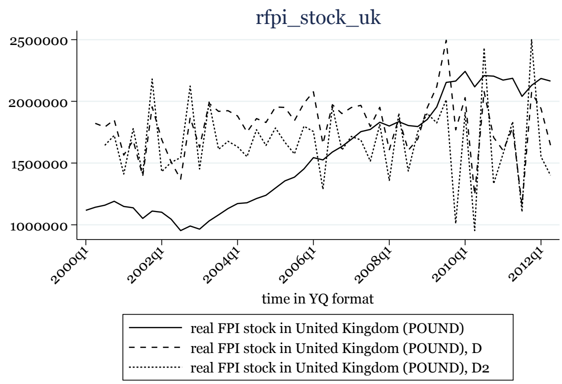

lrgdp_pl
12.7
12.6
12.5
12.4
12.3
12.2
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrgdp_pl
D.lrgdp_pl
D2.lrgdp_pl

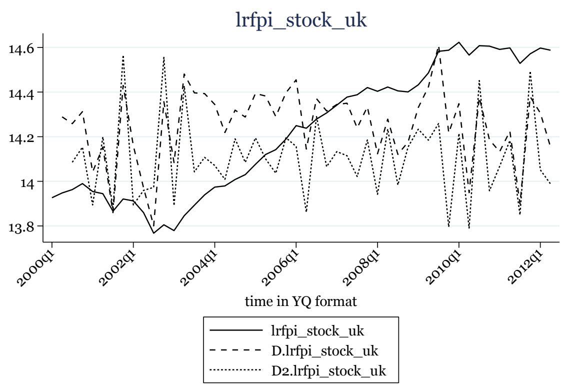

rulc_pl
120
115
110
105
100
95
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real unit labour cost in Poland
real unit labour cost in Poland, D
real unit labour cost in Poland, D2

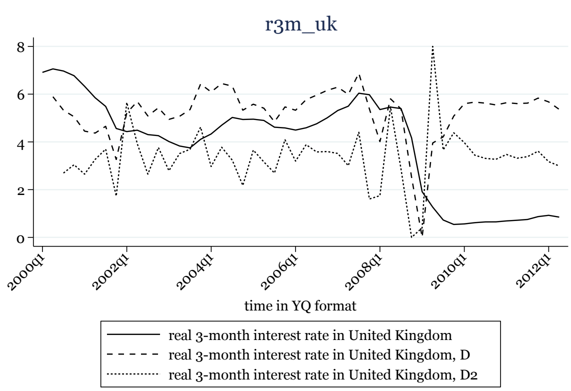

lrulc_pl
4.8
4.75
4.7
4.65
4.6
4.55
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrulc_pl
D.lrulc_pl
D2.lrulc_pl

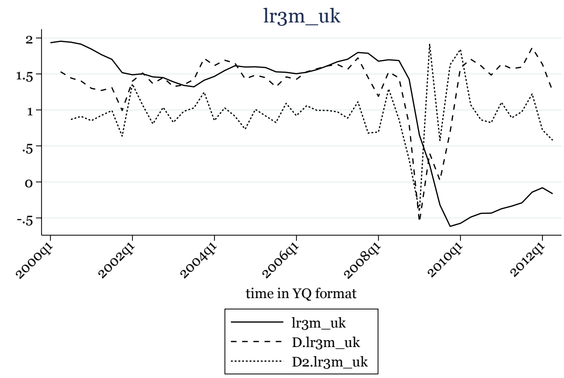

rfdi_stock_uk
700000
600000
500000
400000
300000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real FDI stock in United Kingdom (POUND)
real FDI stock in United Kingdom (POUND), D
real FDI stock in United Kingdom (POUND), D2

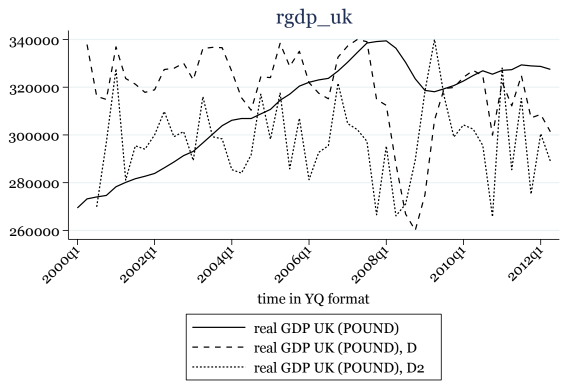

lrfdi_stock_uk
13.4
13.2
13
12.8
12.6
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrfdi_stock_uk
D.lrfdi_stock_uk
D2.lrfdi_stock_uk

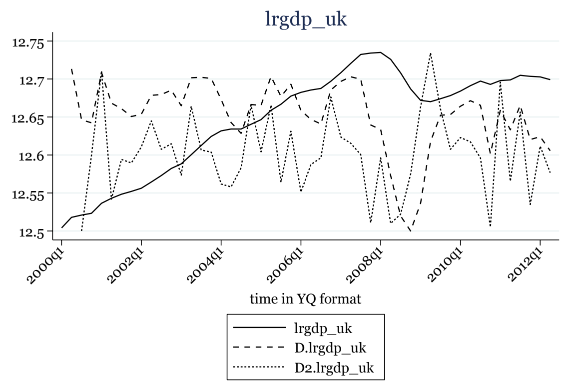

rfpi_stock_uk
2500000
2000000
1500000
1000000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real FPI stock in United Kingdom (POUND)
real FPI stock in United Kingdom (POUND), D
real FPI stock in United Kingdom (POUND), D2

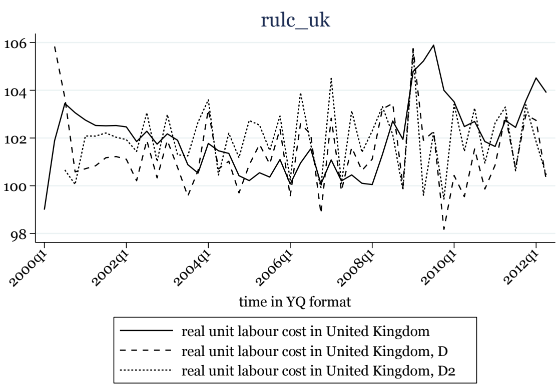

lrfpi_stock_uk
14.6
14.4
14.2
14
13.8
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrfpi_stock_uk
D.lrfpi_stock_uk
D2.lrfpi_stock_uk

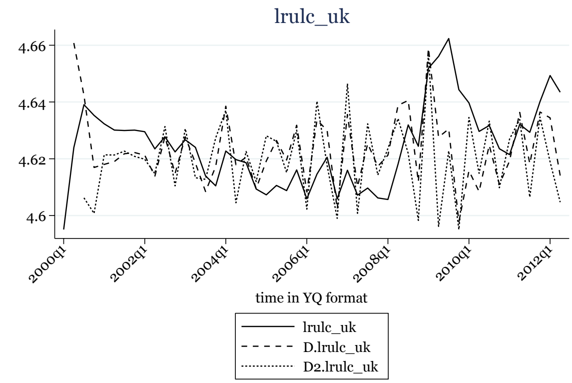

r3m_uk
8
6
4
2
0
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real 3-month interest rate in United Kingdom
real 3-month interest rate in United Kingdom, D
real 3-month interest rate in United Kingdom, D2

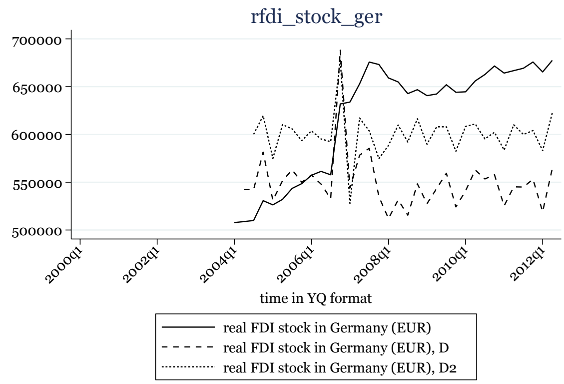

lr3m_uk
2
1.5
1
.5
0
-.5
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lr3m_uk
D.lr3m_uk
D2.lr3m_uk

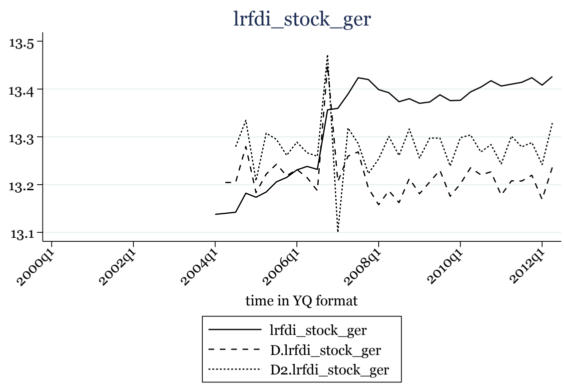

rgdp_uk
340000
320000
300000
280000
260000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real GDP UK (POUND)
real GDP UK (POUND), D
real GDP UK (POUND), D2

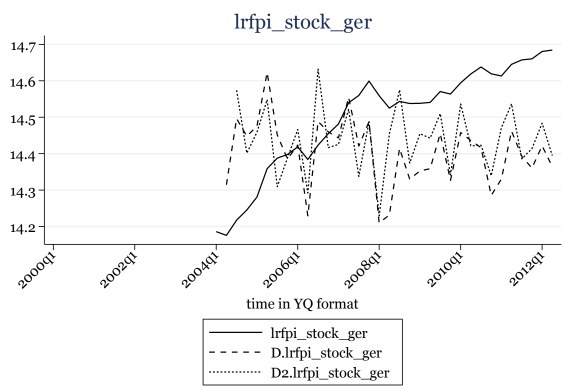

lrgdp_uk
12.75
12.7
12.65
12.6
12.55
12.5
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrgdp_uk
D.lrgdp_uk
D2.lrgdp_uk


rulc_uk
106
104
102
100
98
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real unit labour cost in United Kingdom
real unit labour cost in United Kingdom, D
real unit labour cost in United Kingdom, D2


lrulc_uk
4.66
4.64
4.62
4.6
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrulc_uk
D.lrulc_uk
D2.lrulc_uk


rfdi_stock_ger
700000
650000
600000
550000
500000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real FDI stock in Germany (EUR)
real FDI stock in Germany (EUR), D
real FDI stock in Germany (EUR), D2


lrfdi_stock_ger
13.5
13.4
13.3
13.2
13.1
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrfdi_stock_ger
D.lrfdi_stock_ger
D2.lrfdi_stock_ger


lrfpi_stock_ger
14.7
14.6
14.5
14.4
14.3
14.2
2000q1
2002q1
2004q1
2006q1
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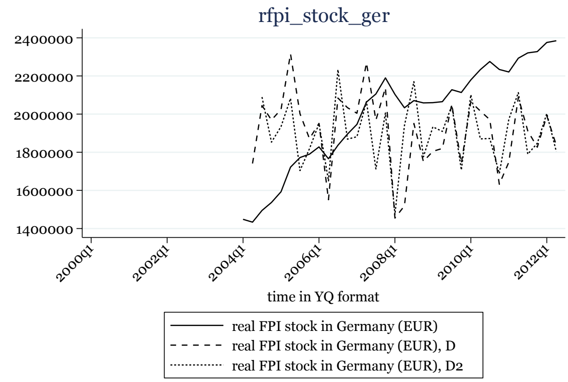
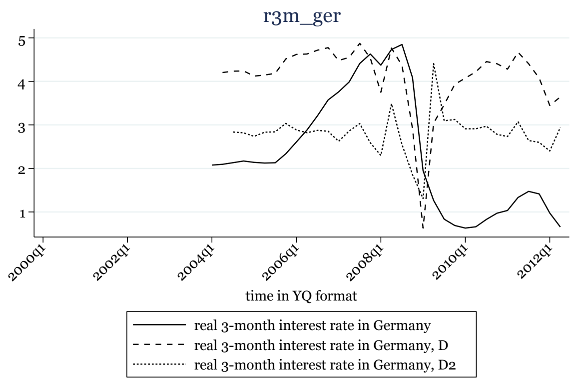
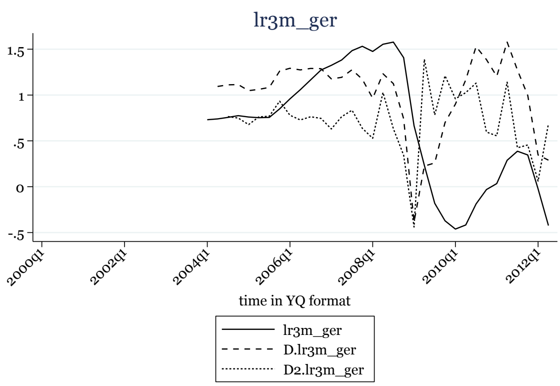
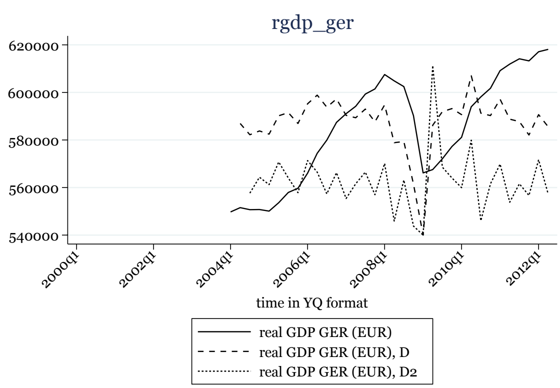
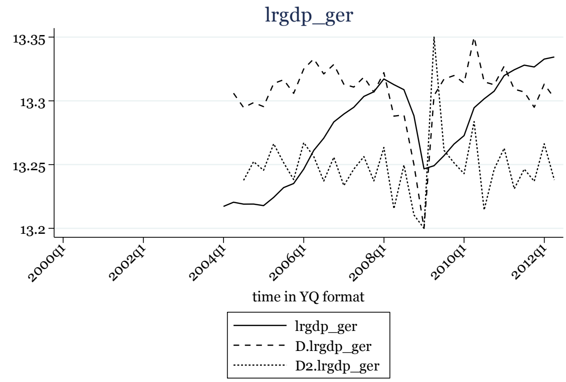
2010q1
2012q1
time in YQ format
lrfpi_stock_ger
D.lrfpi_stock_ger
D2.lrfpi_stock_ger

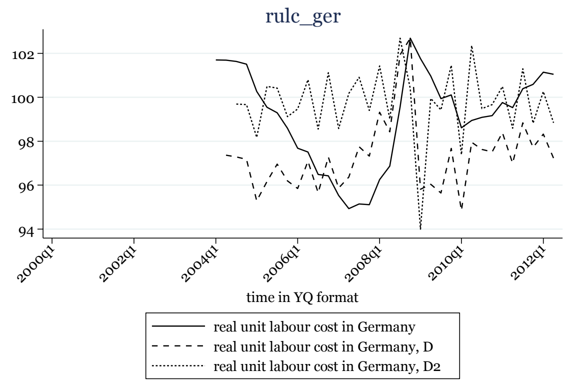

rfpi_stock_ger
2400000
2200000
2000000
1800000
1600000
1400000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real FPI stock in Germany (EUR)
real FPI stock in Germany (EUR), D
real FPI stock in Germany (EUR), D2

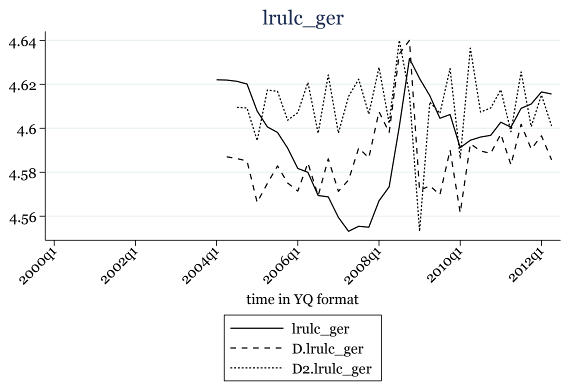

r3m_ger
5
4
3
2
1
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real 3-month interest rate in Germany
real 3-month interest rate in Germany, D
real 3-month interest rate in Germany, D2


lr3m_ger
1.5
1
.5
0
-.5
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lr3m_ger
D.lr3m_ger
D2.lr3m_ger


rgdp_ger
620000
600000
580000
560000
540000
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real GDP GER (EUR)
real GDP GER (EUR), D
real GDP GER (EUR), D2


lrgdp_ger
13.35
13.3
13.25
13.2
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrgdp_ger
D.lrgdp_ger
D2.lrgdp_ger


rulc_ger
102
100
98
96
94
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
real unit labour cost in Germany
real unit labour cost in Germany, D
real unit labour cost in Germany, D2


lrulc_ger
4.64
4.62
4.6
4.58
4.56
2000q1
2002q1
2004q1
2006q1
2008q1
2010q1
2012q1
time in YQ format
lrulc_ger
D.lrulc_ger
D2.lrulc_ger