A Meta-Analysis of the indirect impact of Foreign Direct Investment in Old and New EU Member States: Understanding Productivity Spillovers

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Abstract. In this paper we summarise, combine and explain recent findings from firm-level empirical literature focusing on the indirect impact of foreign direct investment (FDI) on economic performance, measured as productivity, in the Enlarged Europe. We have reviewed 52 quantitative studies, released between 2000 and 2015, and codified 1,133 estimates. We run a regression of regressions which measures the strength of the FDI-productivity relationship. Taking advantage of large number of high-quality studies on FDI and its role in explaining the growth in firms' productivity in Europe, we adopt recent meta-regression analysis methods – *funnel asymmetry and precision estimate tests* (FAT-PET) and *precision-effect estimate with standard errors* (PEESE) – to explain the heterogeneous impact of FDI. This paper assesses the country-specific impact of FDI on firms' performance, after taking publication selection bias, econometric modelling and the individual studies' characteristics fully into account. Our results show that on average FDI has a positive indirect impact on productivity. The impact is especially significant in selected European countries and we interpret this as a sign of better absorptive capacities in those countries.

Keywords: Foreign Direct Investment; Firm Performance; Enlarged Europe, Meta-Regression Analysis.

JEL Classification: C10; F23.

1. INTRODUCTION

Recent literature widely suggests that foreign direct investment (FDI) may have a favourable impact on the host economy, directly or indirectly. In the former case, multinational corporations (MNCs) bring new capital to the economy and thereby contribute directly, for example by increasing inputs into the production function of firms partially or fully owned by foreign shareholders. In the latter, FDI might produce positive externalities – spillovers - towards domestic firms in the host country by enhancing their productivity, ultimately leading to economic growth[1]. In recent years, policymakers across many countries have decided to liberalise capital inflow policies in order to attract investments from foreign MNCs, seeking to stimulate growth on a wider scale, i.e. for both foreign and domestically owned companies. As a consequence of this renewed interest in FDI among scholars, policymakers, practitioners as well as businessmen, there seems to be an attempt to lower entry barriers for MNCs and to offer incentive schemes (e.g. tax breaks, subsidies, co-investments, crowding-in) in order to attract more and more FDI[2]. In other words, governments increasingly recognise the importance of cultivating FDI given the mounting evidence of how knowledge brought in by foreign investors could 'spill over' into indigenous firms, upgrade their technological capabilities, bolster skills in the local workforce, and consequently increase the overall competitiveness of the host economies (World Bank Group, 2010). As a result, many countries' have been moving towards liberalisation, promotion and facilitation of investment. Indeed, in 2014 more than 80 per cent of investment policy measures aimed to improve entry conditions and reduce restrictions (UNCTAD, 2015).

From 2010 to 2014, global foreign direct investment rose sharply, after having dropped drastically due to the global financial crisis. It is interesting to note that while historically, FDI had

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[1] For a survey see Bruno and Falk, *European Competitiveness Report* (2012).

[2] For example, the Executive Agency for Small and Medium-sized Enterprises (EASME, https://ec.europa.eu/easme/) has financed research on "Towards a Foreign Direct Investment attractiveness scoreboard – study with a special focus on international investments and competitiveness to help improve the cross/intra-border supply chains in the EU" (2014/06), signalling the potential spill-over benefits of FDI on SMEs too.

long been concentrated in advanced economies, which have acted as both senders and recipients, since the 2007-2008 global financial crisis the contribution of developing countries to worldwide FDI has become more and more pronounced. In fact, in 2012 the share of FDI inflows in developing countries became higher than the share in developed countries. Developed countries in Europe and elsewhere experienced a drop in FDI inflows between 2010 and 2013, while transition economies saw a relative increase from low levels and developing countries saw a stable trend in their overall high figures (UNCTAD, 2013). However, in 2014 most major regional groupings and groups of economies engaged in regional integration initiatives experienced a fall in inflows. Geopolitical risk and regional conflict weighed heavily on FDI flows towards the transition economies of south-east Europe, where in 2014 FDI fell by more than half from the previous year (UNCTAD, 2015).

Changes in global FDI trends and their macroeconomic impact have attracted substantial research. There is an expanding literature on the relationship between FDI and economic performance[3] and a quite substantial number of empirical studies on European countries, both for old (EU-15) and new member states (NMS) (Meyer and Sinani, 2009; Havránek and Iršová, 2010, 2011; Iwasaki and Tokunaga, 2014, 2016 and Tokunaga and Iwasaki 2017). In particular, we would like to highlight three recent meta regression analyses by Iwasaki and Tokunaga focusing on transition countries, i.e. the "Macroeconomic Impact of FDI in transition economies" (IT 2014), "The Determinants of FDI in Transition Economies" (TI 2017), and "Technology transfer and spillovers from FDI in transition economies" (IT 2016). We regard these articles as comparable to our analysis as far as methodological choices are concerned. However, we complement them in three different ways: firstly we look at micro (i.e. firm-to-firm) impact of FDI by exploiting firm level estimates from the literature whereas IT 2014 focuses on macro cross countries/panel or time series studies; secondly we are interested in the impact (FDI as independent variable), and not the determinants of FDI as in TI 2017; finally we have a similar research question of IT 2016 but we use a different sample of countries (only partially overlapping), i.e. all high quality micro studies on European Union countries we could find *via* a thorough selection (not only transition ones). In other words this is the first meta-regression analysis focusing on the comparison of Old EU vs. New Member states (i.e. a sub-set of former transition economies), therefore touching upon both the comparative economics as well as the European Union literature. This is therefore a timely contribution in an era of increased challenges faced by the whole EU compact, Old EU and NMS alike.

Despite the theoretical rationale for positive FDI spill-overs on host country productivity and economic growth, empirical analyses have provided inconclusive or at least mixed evidence on the growth/productivity enhancing effect of FDI[4]. Empirical literature is very large and diverse showing different relationships (positive, negative or none). This is evidence that the impact is indeed ambiguous (Clark et al., 2011; Rojec and Knell, 2017). The lack of robust empirical evidence is partly due to relevant differences between studies in terms of data sets, sample sizes, model specification, precision of estimates, etc.

This paper provides a viable way of evaluating and combining the empirical results on the economic impact of FDI observed in a group of studies, released between 2000 and 2015, on the enlarged European Union (EU-15 vis-à-vis NMS) and it measures the strength of the FDI-performance relationship by drawing to firm-level econometric studies on the indirect impact of FDI on economic performance[5]. Given the considerable number of empirical studies dealing with this subject matter, we have limited our review as follows:

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[3] Regarding the estimated coefficients of the impact of FDI, comprehensive surveys are provided by Görg and Strobl (2001), Meyer and Sinani, (2009), Havránek and Iršová (2010, 2011, 2012), Hanousek et al. (2011), Iršová and Havránek (2013) and more recently, Iwasaki and Tokunaga (2014, 2016) and Tokunaga and Iwasaki (2017).

[4] For a comprehensive survey of literature see De Mello (1997), Clark et al. (2011) and Rojec and Knell (2017).

[5] There is already a broad consensus on the existence of a positive relationship between the direct impact of FDI (e.g. capital accumulation) and growth, but the literature understanding of the indirect impact is much less clear.

(a) firstly, we concentrate on the *indirect* impacts of FDI on host countries; therefore, we disregard all other possible *direct* impacts on the host country's productivity and growth, i.e. the direct accumulation of capital in the affiliates companies;
(b) secondly, we take into account studies based on *firm-level data sources* only: while rapid growth and high ratios of inward FDI to GDP tend to be witnessed together, causality mechanisms are not easily discernible through aggregate cross-country analysis because FDI is often associated with other growth-promoting factors, such as the investment to GDP ratio and the degree of openness of the economy.[6] We posit that studies using data at firm level take into account potential heterogeneity in the effect of FDI on growth depending on firm specific characteristics and better evaluate the channels through which FDI may influence economic growth;
(c) thirdly, we *focus on the EU*, given the recent surge in FDI, and the political and economic resources devoted by EU governments to remove the lingering restrictions, both explicit and implicit, to foreign investment (World Bank Group, 2010). This paper will shed some light on the economic impact of FDI in Europe, which remains one of the main recipients of FDI in the advanced economic world (UNCTAD, 2013);
(d) finally, by taking advantage of the large number of high-quality firm-level studies on FDI and firm performance in Europe, we explain these findings by looking at the heterogeneous impact of FDI on growth in each and every country, which are affected by FDI positively, negatively or not significantly.

Our sample is composed of 52 quantitative studies providing 1,133 point estimates measuring the strength of the FDI-performance relationship. The countries analysed in the selected sample are: Belgium, Bulgaria, Czech Republic, Estonia, France, Greece, Hungary, Ireland, Italy, Lithuania, Poland, Portugal, Romania, Spain, Sweden and the UK. Five studies included in the MRA cover a group of countries instead of a single nation, namely: (i) the Baltic countries; (ii) Bulgaria, Poland and Romania; (iii) central Europe; (iv) central and eastern Europe (CEE), Turkey and the Commonwealth of Independent States (CIS); and (v) the 15 EU members.

Table 1 shows the whole reference list for the MRA papers and mean values of the estimated coefficients of the indirect effect of FDI on the performance of domestic firms. The overall average of the indirect effect is 0.623 with large differences across countries.

[Insert Table 1 about here]

Despite a large number of theoretical models highlighting the channels through which FDI can enhance productivity, results summarised in table 1 show how the empirical evidence on EU has so far failed to provide clear-cut evidence. There is weak evidence that FDI generate positive impacts for host countries: about two-thirds of point estimates are negative and around half of positive results refer to very low impact (below to 0.1).

Considering the EU15 as a whole, Lesher and Miroudot (2008) find a negative impact (mean value – 0.76) of FDI on the operating revenue. The EU member that collects more negative results is the UK, in which FDI appear to affect negatively TFP and output growth (Girma and Wakelin, 2000; Girma et al., 2007; Driffield and Love, 2005; Driffield et al., 2009; McVicar, 2002). Castellani and Zanfei (2003) also find a negative impact on output growth of FDI in France, Italy and Spain; while Braconier et al. (2001) find a negative impact on TFP growth in Sweden. The indirect effect of FDI seems to be negative on labour productivity in Ireland (Barry et al., 2005; Haller, 2011). Looking at the NMS, negative impact of FDI is registered for; TFP growth in Czech Republic, Hungary, Romania and Poland (Altomonte and Pennings, 2009; Görg et al., 2009; Kinoshita, 2000; Nicolini and Resmini, 2010); output growth in Hungary (Görg et al., 2009); and value added growth in Romania (Javorcik and Spatareanu, 2005).

[6] For a MRA on macroeconomic studies see Iwasaki and Tokunaga, 2014.

As far as the results on the positive impact of FDI across countries is concerned, we find a mixed picture, depending on the variable of interest. The highest impact of FDI is found on labour productivity and TFP growth in Poland and Portugal (Crespo et al., 2009 and Hagemeje and Kolasa, 2011, for Poland; Proença et al., 2006, and Flôres et al., 2007, for Portugal). FDI seems to strongly affect the TFP growth in Belgium and Romania (Javorcik and Spatareanu, 2011; Belderbos and Van Roy, 2010; Merlevede et al., 2014). However, it is not easy to summarise the FDI effects highlighted in the literature. The meta-regression analysis (MRA) adopted in this paper represents a way to combine and analyse these results. It also provides funnel asymmetry-precision effect tests (FAT-PET) as well as precision-effect estimate with standard error estimates (PEESE) for the growth/productivity enhancing effect of FDI in the EU-15 vis-à-vis NMS.

It is worth recalling that the MRA is a methodology for reviewing the literature, not an alternative approach to studying the effect of a particular economic phenomenon (Anderson and Kichkha, 2017). Our goal does not lie in the quest for the "true" value of the parameter under investigation, but rather to review a large literature and to help explain why we observe variations in the empirical results reported in the studies, which supposedly investigate the same phenomenon. Regression analysis of the existing regression analyses represents a methodology for quantitatively combining all these estimates (commonly referred to as the "effect size"), investigating the sensitivity to variations in the underlying assumptions, identifying and filtering out possible biases (e.g. publication selection bias), and explaining the diversity in the studies' results in terms of the heterogeneity of their features (Rose and Stanley, 2005; Stanley, 2005).

This paper is organised as follows. Section two briefly reviews the empirical literature on the impact of FDI on growth. Section three presents key methodological underpinnings employed during data collection in order to validate the research design and characteristics. Section four introduces the meta-regression analysis approach and provides a rationale for controlling for publication bias. Section five discusses the econometric results of our meta-regressions. Finally, in section six, we draw some conclusions, policy implications and venues for future research.

2. LITERATURE REVIEW: EFFECTS OF FDI ON PRODUCTIVITY AND PERFORMANCE

FDI can provide direct financing for the acquisition of new plants and equipment (fixed assets), and be an important catalyst for economic restructuring. It can also directly transfer 'embedded' technology to foreign affiliates, and technology can also indirectly spread or "spill over" into local economies. The impact can be direct (on the foreign subsidiary receiving the investment) or indirect (on domestic firms affected by the foreign firms' presence). In the latter case, the indirect effect can be horizontal (within an industry) or vertical (between industries). Finally, the vertical effect can be divided into forward linkages (towards downstream domestic customers) and backward linkages (towards upstream domestic suppliers).

Although FDI is potentially capable of producing all the aforementioned effects, this does not necessarily mean that those effects happen under any circumstances. Whatever direct or indirect impact FDI has on the host economy, the effect produced is conditional upon the form of FDI and the reasons why MNCs make such investments (e.g. market, resource, efficiency, and strategic assets seeking FDI), the nature and capacity of the host country (broadly speaking, its *absorptive capacity*), the mode of entry (greenfield project, takeover or merger and acquisition) as well as the size of entry (majority/minority shares in domestic firms) (Magai, 2012).

As far as the *direct* effect of FDI on growth is concerned, i.e. when FDI brings capital to the host country, there is quite a widespread consensus on the existence of a positive effect on the host countries' domestic firms and the empirical literature provides robust findings (Blömstrom and Kokko, 1998; Eichengreen and Kohl, 1998; Holland et al., 2000; Navaretti and Venables, 2004).

On the other hand, studies on the *indirect* impact (spillovers or positive externalities) on host countries have been characterized by less conclusive findings. The impact crucially depends on the level of development, on the employment/working conditions, on environmental standards, and more broadly on the potential for technological transfers towards host country firms. The indirect effect of FDI on host countries has largely been studied from the perspective of economic growth and development (e.g. in low income countries, see Bruno and Campos, 2013), employment/working conditions (such as labour mobility), the business environment, technology transfer from foreign to domestic firms, etc. It has been widely documented that FDI inflows have the potential to upgrade the technological capabilities, skills, and competitiveness of domestic firms in the host countries when they generate positive externalities.

The channels through which FDI may 'spill over' from foreign affiliates to other domestic firms in an economy have been analysed in detail in numerous papers (e.g. Markusen and Venables, 1999; Kokko, 1992; Blömstrom and Kokko, 1998; Greenaway et al., 2004; Javorcik, 2004). The main channels identified by the literature are imitation/demonstration, movement of workers and competition. Let us analyse these routes of spillovers in order:

a) *via* adoption or imitation (sometimes through cooperation), domestic firms can learn how to export and reach foreign markets. In other words, their proximity to foreign firms facilitates their learning process;
b) *via* increasing labour mobility ("movement of skills") MNCs train the employees in the host country and then transfer practices or technology to affiliates (inter-firm mobility and intra-firm training). In fact, a number of empirical studies suggest that the movement of workers within and between firms is one of the most important channels for technology and knowledge spill-overs (Barry et al., 2004 for Ireland; Pesola, 2011 for Finland; and Martins, 2011 for Portugal);
c) *via* the so-called "competition effect", the entrance of a MNC (which owns better technology and has better managerial practices) will force the host country's firms in comparable sectors to use existing technology and resources more efficiently and/or upgrade to more efficient technologies. If domestic firms fail to catch-up, the externality will be negative, that is, they will be hindered by competition from MNCs. Indeed, not all associated effects are positive and competitive pressure can force domestic firms to exit the industry due to crowding-out or business-stealing effects (Dunning, 1994).

The closer an economy is to the forefront of global technology, the greater its uptake of innovations *via* imitation. Keller and Yeaple (2008) show that the complexity of technology makes knowledge costly to transfer, and the problem is exacerbated if the affiliate does not have the absorptive capacity to adopt and adapt the new technical knowledge. In the context of the EU-28, these concepts can be considered particularly relevant for NMS, which have implemented very serious and rapid economic reforms in the last three decades in order to catch up with their neighbouring old EU-15 members.

While FDI flows may go hand-in-hand with economic success, they do not tend to exert an independent effect on growth (Choe, 2003; Carkovic and Levine, 2005; Alfaro et al., 2009).[7] For example, the macro-level and industry-level literature has focused on human capital (Borensztein et al., 1998), on financial development (Alfaro et al., 2004), on differences in the variety of intermediate goods, on the impact the communication distance between headquarters and production plants and, more in general, on *absorption capacity* (Rodriguez-Clare, 1996). Using a meta-regression analysis, Meyer and Sinani (2009) study the simultaneous effect produced by level of development, institutional frameworks and human capital in the context of countries hosting FDI. Recent studies have explored more specific transmission channels: level and rate effect of spill-overs (Liu, 2008), mediating factors and FDI heterogeneity (Smeets, 2008), and multiple simultaneous channels (Javorcik, 2004), to name just a few. Furthermore, recent systematic meta-

[7]Using a panel VAR model to explore the interaction between FDI and economic growth in 80 countries from 1971 to 1995, Choe (2003) found evidence that FDI Granger-causes economic growth, but the opposite is also true and it is economically and statistically stronger. Carkovic and Levine (2005) use GMM to study a large sample of countries between 1960 and 1995, and find no robust causal effect between foreign investment inflows and economic growth. Similarly, Alfaro et al. (2009) find no significant evidence of a positive impact of FDI on growth, except in some financially developed countries.

regression analyses of the updated evidence further dissect the differential impact of horizontal, backward and forward spill-overs (Havránek and Iršová, 2010, 2011; 2012; Bruno and Falk, 2012; Iršová and Havránek 2013; Bruno and Campos, 2013; and Iwasaki and Tokunaga, 2014). With respect to existing meta-analyses, our goal here is to investigate the relationship between FDI and firm performance in terms of productivity and to explain the diversity in the results between the old EU-15 and the NMS.

3. DATA COLLECTION AND LITERATURE SEARCH

We will describe below how we have built a database of point estimates of the FDI-growth relationship. First and foremost, the research design, search detailed strategy, hand-picked collection and fine-tuned coding follows the MAER-NET protocols as outlined in Stanley et al. (2013). We selected papers using several criteria:

(i) as far as the search engines are concerned, data points were selected *via* an extensive search in Google Scholar (http://scholar.google.com) to identify both unpublished and published papers, as well as research published in peer-reviewed journals of the major commercial publishers using EconLit, Web of Science and Scopus databases. We searched for certain keywords in the title, abstract, or subject: “foreign direct investment”, “FDI” and “FDI and EU”;

(ii) the use of keywords within ‘official’ search engine did not exhaust the search. We have also identified some papers cross-referenced and cross-cited in other works, this being commonly known as ‘snowballing’ methodology. It allows a fine grained investigation of the complex publication network of citations that contains invaluable information;

(iii) we have focused on papers written in English. There is a wide supply of papers not-published in English which are available in different formats (on line resources, on-line libraries, paper-based etc.) for specific countries or thematic areas (e.g. economics, management, international business, etc.). We have purposely avoided to enter in this wider than strictly-English literature in order to allow for a homogeneous pool of sources. It is in fact common practice to concentrate the research on English publication, to avoid further ‘visibility’ problems. This is in line with many other meta-regression analyses implemented in the past;

(iv) we focus on papers made available to the public in or after 2000 and the search for studies was completed in June 2016; we are therefore aware that studies published after such date are not included in our database;

(v) we focus on firm-level data and firm-level data *only* and this means that we purposely exclude papers based on data drawn from aggregate cross-country level sources;

(vi) we included data based on papers on single EU countries, on papers focusing on some EU countries only (i.e. a limited EU sample) or, possibly, on all EU countries. As far as the papers on all EU countries are concerned, we have not found any paper which had analysed FDI for *all of them* at the firm level[8] on the specific research question we have identified. In other words the two types of papers we identified are: 1) single EU country, 2) some EU countries;

(vii) with reference to the distinction between the direct and indirect effects of FDI, we consider only papers estimating *indirect* impact.

The heterogeneity of approaches and specifications among academic papers studying the host country effects of FDI at the firm level is impressive, but it is possible to consider the “representative” FDI spill-over regression as follows (z, s and t subscripts stand for firm, sector and time, respectively):

$$\ln\left(productivity_{zst}\right) = ß^{h} horizontal_{st} + ß^{b} backward_{st} + ß^{f} forward_{st} + ß^{X} X_{zst} + \varepsilon_{zst} \qquad (1)$$

[8] At the macro level it is actually possible to find such type of articles.

where *horizontal* is usually defined as the ratio of foreign presence in firm z's own sector s; *backward* is the ratio of z's output sold to foreign firms (foreign presence in downstream sectors) and *forward* is the ratio of z's output purchased from foreign firms (foreign presence in upstream sectors). Using the MRA approach, we evaluate and combine empirical results from different studies and test the null hypothesis that different point estimates, treated as individual observations ($ß^{fdi}$), are equal to zero when the findings from this entire set of estimates are combined.[9]

Our research led to the construction of a final sample of 52 papers released between 2000 and 2015 providing 1,133 point estimates (36 published academic journal articles with a total of 807 point estimates, 16 working papers or unpublished studies with 326 point estimates).[10] Over the considered period we have found a fast-moving literature, 17 studies have been published from 2000 to 2005; 21 studies from 2006 to 2010; and 14 studies from 2011 to 2015.

All studies are organised in panel data form[11] and the empirical analyses covers 35 years from 1973 to 2007 as a whole; the average estimation period of collected estimates concerning the indirect effect of FDI is 7.7 years (standard deviation 3.3). Almost 48% of all estimates refer to the time period over 1990s and 2000s, 34% focus on data of 1990s, only 8% are estimates of the FDI impact in recent period (after 2000), all remaining estimates refer at a period before 1990. As far as the sector is concerned, 45 out of the 52 studies focus on the manufacturing industry, while 7 studies cover also the service sector. Only 22 studies look exclusively at the horizontal effect of FDI, while all others studies estimate the vertical effect too (the only exception is Barry et al., 2005, who provide only estimates of the vertical effect). Therefore, we collect 572 estimates of the horizontal effect, 198 of the vertical/forward effect, 318 of the vertical/backward effect and, finally, 45 estimates refer to vertical effect in general.

All selected papers contain one or more equations which estimate the indirect effect of FDI on one of the following left-hand side variables: a measure of firm efficiency (such as TFP), firm output, value added, or labour productivity. Estimates of the indirect effect of FDI on the total factor productivity (TFP) account for 46% of the data, followed by the impact on growth of output accounting for 28%, on the labour productivity for 9%, and on other measure (i.e. value added, sales, operating revenue, revenue efficiency) accounting for something less than 5% each.

To compare the estimates, we need standardised effect sizes. The metric commonly used in economic meta-analyses is partial correlation coefficients (PCCs) (Doucouliagos, 2005; Doucouliagos and Ulubasoglu, 2006; Doucouliagos, 2011; Efendic et al., 2011; Stanley and Doucouliagos, 2012). Then, we convert each estimated coefficient into the PCC following the formula:

$$r_{ij} = \frac{t_{ij}}{\sqrt{(t_{ij}^2 + df_{ij})}} \tag{2}$$

with "t" being the t-statistic of the effect under study and "df" being the degrees of freedom for the "j^{th}" estimation in the "i^{th}" paper. Standard errors of the partial correlation, SE, are calculated as:

$$se_{PCC} = \sqrt{(1 - r_{ij}^2) / df_{ij}} \quad (3).$$

[9] If a study includes among the explanatory variables both FDI and FDI*X, where X is a moderator variable of the relationship between FDI and productivity, we do not use these estimates in our meta-regression analysis.
[10] A complete reference list for the MRA papers and an exhaustive set of general information on each paper can be found in Appendix A.
[11] This statistical property is quite important. Cross-section estimates, e.g. drawing from macro studies, would be upwardly biased and would be less suitable for a conclusive assessment of the impact.

Table 2 contains information on the mean, median, maximum and minimum values of the distribution of computed PCCs.

[Insert Table 2 about here]

When a study provides multiple estimates of the same effect under consideration, the assumption that multiple observations from the same study are independent draws might be problematic. Important information is lost in the grouping process and it is not clear which estimate we should choose as 'preferred' for each study (Jeppensen et al., 2002). According to MRA practise, we must collect all estimates in a study and then consider the dependence of estimates obtained in the same study. In order to obtain correct standard errors in our estimation, we adopt a "robust within cluster" procedure, adjusting standard errors for intra-study correlations. Each cluster identifies the study to which the estimate belongs: this modifies the variance–covariance matrix and the standard errors of the estimators, but not the estimated coefficients themselves (Cipollina and Salvatici, 2010).

4. META-REGRESSION METHODOLOGY

4.1 Building the meta-analysis (MA)

The first step of our analysis is an investigation of meta-averages, which in many cases differ substantially from the mean. Pooling different estimates into a large sample for MA raises the question of within-study versus between-study heterogeneity. In order to account for this, we distinguish between a fixed effects model (FEM) and a random effects model (REM).

A FEM assumes that differences across studies are only due to within-variation. The single, 'true' effect is calculated as a weighted average of the individual estimates, where the weights are inversely proportional to the square of the standard errors ($1/se_i^2$), so that studies with smaller standard errors have greater weight than studies with larger standard errors (Higgins and Thompson, 2002). The REM assumes that the studies are a random sample from the universe of all possible studies (Sutton et al., 2000). The individual studies are not assumed to be estimating a true single effect size, but the true effects in each study are assumed to have been sampled from a distribution of effects under a normal distribution with mean 0 and variance τ^2. In the REM, the weights incorporate an estimate of between-study heterogeneity, $\hat{\tau}^2$, and are equal to $(1/se_i^2 + \hat{\tau}^2)$.

The partial correlation coefficient allows studies with different dependent variables to be compared directly; nevertheless, its distribution of the partial correlation is truncated at +1 and -1 and, in some cases, such truncation might cause an asymmetry. A way to solve this problem is to compute the Fisher z-transformed correlation effect size as follows (Stanley et al., 2015):

$$z = \frac{1}{2}\ln\left(\frac{1+r}{1-r}\right) \tag{4}$$

Table 3 displays the results of the basic meta-analysis and displays simple means, weighted averages, FE and RE estimates, for both partial correlation and Fisher's z-transformed correlation.

[Insert Table 3 about here]

The usual way of combining the empirical results from the literature estimating the effect of FDI on firms' performances would be to take the simple average. The average effect is around 0.02; however, an unweighted average is not the most appropriate summary measure when the distribution of the estimated effects is highly skewed. If we look at the fixed effects and the weighted least squares (WLS) estimates, we can see the same 0.006 average but the confidence interval is wider for the WLS estimate. The random effect estimate gives a pooled effect size

(0.019) closer to the simple mean. As already widely established by the literature, the confidence intervals with FEE are too narrow due to high heterogeneity, while the REE can be biased in the presence of publication bias risk (Stanley and Doucouliagos, 2015). We reach the same conclusions if Fisher's z-transformed correlation is used instead of the partial correlation coefficient[12].

Estimates of the impact of FDI would seem to indicate a low but positive effect on firm performances. It is a widespread belief that publication bias occurs when researchers, referees or editors have a preference for statistically significant results. Publication bias may greatly affect the magnitude of the estimated effect. The simplest and conventional method to detect publication bias is the funnel graph, which is a scatter diagram presenting a measure of sample size or precision of the estimate on the vertical axis and the measured effect size, the partial correlation coefficients, on the horizontal axis.

[Insert Figure 1 about here]

Asymmetry is the mark of publication selection bias. The funnel graph diagram (Figure 1) clearly shows that the plot is over-weighted on the right-hand side, so the publication selection favours a particular direction of the effect. Several meta-regressions and graphical methods have been envisaged in order to differentiate genuine empirical effect from publication bias (Stanley 2005). In the next section we will further investigate the presence of publication bias and how it might affect our analysis.

4.2 Publication Bias

Researchers, referees, and editors tend to have a preference for publishing results that are statistically significant, which could greatly influence the magnitude of the estimated effect. In order to correct for publication bias we might use an MRA model regressing estimated coefficients (let us call it effect $\hat{\beta}_{ij}$) on their standard errors, $se(\hat{\beta}_{ij})$ (Card and Krueger, 1995; Ashenfelter et al. 1999):

$$\hat{\beta}_{ij} = \beta_0 + \alpha_1 se(\hat{\beta}_{ij}) + \mathrm{u}_{ij} \tag{5}$$

where the effect is the partial correlation coefficient PCC $\hat{\beta}_{ij} = r_{ij}$ and $se(r_{ij}) = se_{PCC}$,

$$r_{ij} = \beta_0 + \alpha_1 se_{PCC} + \mathrm{u}_{ij} \tag{6}$$

Meta-regression errors are likely to be heteroscedastic when studies in the literature differ greatly in data sets, sample sizes, independent variables, so the OLS estimates of the MRA coefficients might fail to be unbiased and consistent.

A weighted least square (WLS) corrects the MRA for heteroscedasticity. It can be obtained dividing equation (6) by the standard errors of each estimate. The MRA regression coefficients can be used to test for the presence of publication selection (H_0: $\alpha_1 = 0$), and a genuine effect beyond publication selection bias (H_0: $\beta_0 = 0$). According to the Funnel Asymmetry – Precision Estimate Test (FAT-PET), in the absence of publication selection the magnitude of the reported effect will vary randomly around the 'true' value, β_0, *independently* of its standard error; therefore, α_1 will be zero.

Since each study reports more than one estimate, it is important to account for the fact that estimates within one study are not statistically independent (Disdier and Head, 2008; Cipollina and

[12] The Fisher z-transformation is taken to test the robustness of results; since we see no substantive difference between these two measures of effect, partial correlation coefficients are used in the analyses that follow.

Salvatici, 2010). Therefore, the meta-regression -equation (6)- is likely to be mis-specified. A common remedy is to treat the data set as a panel or a multilevel structure (as we will show in columns 2 and 3 in table 4). The estimated unbalanced panel version of WLS-MRA is (Stanley and Doucouliagos, 2012):

$$\frac{r_{ij}}{se_{PCC}} = \alpha_1 + \beta_0(1/se_{PCC}) + \mu_j + v_{ij} \qquad (7)$$

The FAT-PET, in the event of a genuine effect, is downwardly biased (Stanley and Doucouliagos, 2014), whereas the use of the variance, $(se_{PCC})^2$, gives a better estimate of the size of the genuine effect corrected for publication bias:

$$r_{ij} = \beta_0 + \alpha_1(se_{PCC})^2 + u_{ij} \qquad (8)$$

The MRA model in equation (8) is called "precision-effect estimate with standard error" (PEESE) and provides the best Taylor polynomial approximation of the expected value of a truncated distribution (Stanley and Doucouliagos, 2012; 2014). The WLS version of PEESE is[13]:

$$\frac{r_{ij}}{se_{PCC}} = \alpha_1 se_{PCC} + \beta_0(1/se_{PCC}) + v_{ij} \qquad (9).$$

Results are reported in Table 4 for all 1,133 estimates. We explore publication bias by implementing a full comparison of the FAT-PET and PEESE, as also suggested by Reed (2015). Multiple methods are used for sensitivity analysis and to ensure the robustness of findings. Column 1 presents the results of the 'simple' WLS model to deal with heteroscedasticity (Stanley and Doucouliagos, 2012).

[Insert Table 4 about here]

Table 4 provides evidence of publication bias. The estimated coefficient $\hat{\alpha}_1$ is statistically significant in all cases and there is insufficient evidence of a genuinely positive effect (accept $H_0: \beta_0 = 0$), except for multilevel estimates that is significant only at the 10% level. The PEESE results, however, suggest a significant and positive FDI effect after correcting for publication bias if we use panel or multilevel estimators.

4.3 Sample of single-country estimates

We will now focus on the studies that have used data from single countries to assess the impact of FDI on growth in the EU-15 and in NMS. Therefore, we exclude five studies from the dataset that cover groups of countries instead a single nation (see section 3), corresponding to 34 estimates.

[Insert Table 5 about here]

Let us start with the overall sample (pooling EU-15 and NMS together). Table 5 shows the results of FAT-PET meta-regressions and the PEESE corrections for publication selection bias. Results of the FAT-PET show that the coefficient α_1 (FAT) does not deviate from zero, confirming that the reported effect does not depend on its standard error. The PET results provide evidence of an impact of FDI on firms' performance. The positive and significant impact is confirmed by the results of PEESE: the size of the genuine effect ranges between 0.013 and 0.019.

[13] Note that there is no intercept in this meta-regression model by construction.

We have then decided to split the sample, as this highlights how the overall mean masks two different pictures, one of the 'old' EU-15 and another of the NMS. We then conduct separate meta-analyses for the estimated effects of FDI on firm-level productivity in the EU-15 and in the NMS. For the EU-15, the graph in Figure 2 (Panel A) slightly resembles a funnel, but it does not show evidence of symmetry that is crucial to rule out potential bias.

[Insert Figure 2 about here]

Figure 2 (Panel B) represents the funnel graph of individual estimates of the FDI effect in the NMS. It clearly shows that the plot is over-weighted on the right-hand side, implying that publication selection, a priori, favours positive results.

Column 1 in Table 6 shows combined meta-estimates of the FDI effect. The null hypothesis (H_0: $\beta_0 = 0$) is rejected, confirming the existence of an FDI impact equal to 0.018 in EU-15 and 0.012 in NMS.

[Insert Table 6 about here]

The impact is still significantly different from zero, except for NMS if we use the WLS model. However, when the WLS model is implemented, there appears to be evidence of publication bias in both the NMS and EU-15 samples (based on FAT coefficients). The estimated effects of FDI corrected for publication selection bias (PEESE correction in the row below) are always positive and significant; the coefficients are higher for EU-15, ranging between 0.018 and 0.023, than they are for NMS, where the impact ranges between 0.011 and 0.019.

We have to interpret the results obtained so far with caution: Table 6 cannot gauge the real impact of FDI on growth because we are averaging out effects measured across many different countries. We believe that the inclusion of country dummies is important from a methodological point of view. Suppose there are some country characteristics, constant over time, which impinge on the FDI-growth relationship, and also suppose that we cannot measure these from the data collected[14]. Because these country-level omitted characteristics are constant over time, we will take them into account by means of respective country dummies. In Table 7, we show the results of the WLS model after including country dummies as controls. In columns 1, 2 and 3 we do not include any publication selection bias correction, as we do in columns 4, 5 and 6.

[Insert Table 7 about here]

Looking at results from the simple MRA many of country dummies in the first three columns turn out to be significant and it is a sign that countries' heterogeneity is an important part of the whole story of the FDI-growth nexus. Now looking at columns 4-6, FAT coefficients estimates do not show evidence of publication bias, and in fact the results of the simple MRA are quite similar to those accounting for the publication bias. As suggested by Stanley and Doucouliagos (2014) we can therefore trust the simple MRA results. There are two noteworthy results. Firstly, a large portion of the heterogeneity in the FDI-growth relationship appears to be attributable to country-specific characteristics. The Cohen and Levinthal (1990) absorptive capacity argument is crucial in this context. In order to understand the relationship between FDI and growth, we do need high-quality data, but we also need appropriate statistical tools to measure (or at least take into account) different absorptive capacity in different countries. The results of this paper are precisely a step in this direction. However, above and beyond the country specific absorptive capacity's component, the literature has now moved into a deeper investigation of dynamic component of the absorptive capacity phenomenon, which in turn can impact the FDI-economic performance relationship.

[14] Some studies do not report many details on the estimation strategy, neither on control variables, for example.

Secondly, countries are not only heterogeneous, but receive different benefits from FDI, some of them positive, some none and some even negative. This is where the heterogeneous impact of FDI on growth comes into play.

In the wake of the last decade of ‘catching-up’ processes, some NMS seem to have equipped themselves with a higher FDI impact potential than others and this might be the fruit of their continuous efforts towards a more FDI-friendly environment (World Bank Group, 2010). However, it is too soon to draw any general conclusions on the improved dynamic absorptive capacity of these countries, and this should open further avenues of research.

Furthermore, we have to bear in mind that the regressions we have run do not take the specific models or methodologies into account, so the average effects calculated still hide a lot of relevant information and we cannot draw any conclusions from our analysis up to this point. This leads us to the next section, in which we run a multiple meta-regression analysis to account for study characteristics and differences from a methodological point of view.

5. MULTIPLE META-REGRESSION ANALYSIS: ECONOMETRIC RESULTS

In this section we attempt to determine the impact of FDI on firms' productivity by adding a set of explanatory variables (X) that filter out possible biases and explain the diverse findings in the literature in terms of differences in the features of the various studies. Our set of variables X can be divided into two groups: the first includes dummies regarding the features of the studies considered, and the second includes dummies explaining the diversity in the results from an empirical methodological point of view.

The moderators dummy variables describing different features of the studies considered are: *published* versus *unpublished* papers; dummies for periods — *before 1990, 1990s, and after 2000* — in order to collect studies using data related only to specific time periods; *commercial* versus *official* databases[15]; dummies for level of disaggregation of data (*firm, industry* or *plant* level data); *manufacturing* versus *non-manufacturing* databases; and dummies for *backward*, *forward* and *horizontal* spill-overs. With regard to the dummies describing different features of the studies considered from a methodological point of view, the WLS MRA includes dummies for *estimators* adopted, as well as for the definitions of the *dependent variable* and the *independent FDI variable* used in the original estimation. Results for old EU-15, NMS and the overall sample are shown in Table 8.

[Insert Table 8 about here]

In addition to country dummies, we have now added 27 dummy variables in total (excluding the eight omitted categories listed at the bottom of the table), which capture the heterogeneity in the partial correlation coefficients. Some evidence of publication bias appears in the sample of NMS, the reason being that the FAT coefficient is negative and significant at the 10% level (column 5). Indeed, without filtering out publication bias (column 2), the simple MRA confirms a positive but lower indirect effect of FDI than column 5.

After filtering out potential PSB and by looking at the total sample in column six, we gauge that the overall FDI effect on firm-level productivity is for example positive and statistically significant for Belgium ($\hat{\beta}_0$ =0.246 with p-value < 0.01), one of the founding countries of the EU. This effect is still very large for Belgium (column 4 Old EU-15) in the split sample ($\hat{\beta}_0$ =0.442 with p-value < 0.05), while in the NMS split sample reported in column 5 for Estonia the FDI effect appears much lower ($\hat{\beta}_0$ =0.246 with p-value < 0.10)[16]. We can also confirm that the whole sample (Old EU-15 and NMS) allows for higher accuracy in the SE estimation given the higher degrees of

[15] There is no study using “original” databases compiled by the authors. This quite normal in a field of study where long longitudinal dataset are needed.

[16] The omitted categories for each dummy in the regression are listed at the bottom of Table 8.

freedom; as such, we regard column six as our ‘preferred’ model, where we mainly focus henceforth: the higher degrees of freedom and the PSB term allow for a comprehensive statistical reliability and power. Let us analyse the main results in order.

The insignificant coefficient found for the *published* dummy confirms there is no general “publication impact”, so the peer-review process does not exert any influence on the impact direction found in the results. The significant negative coefficient associated with the dummy for the 1990s period (vis-à-vis pre-1990s) signals that the impact of FDI on growth does change over time, and possibly in non-monotonous patterns. The use of official databases, such as data from the Central Statistical Office, tends to produce higher effects, whereas the opposite is true for Amadeus data. In the case of the old EU-15 (Column 4), the use of data at *industry level* yields lower results, whereas looking at the overall sample (Column 6), it emerges that the use of *plant-level* data tends to overestimate FDI impacts. When studies focus on firms operating in the *service sector* only, the estimated FDI effect in NMS tends to be larger, the reason being that the associated coefficient of the dummy is positive and highly statistically significant (Column 5). As far as the dummies for FDI spill-overs are concerned, we find that in the EU-15 sample, the coefficient is negative when the collected estimates refer to *backward* vis-à-vis forward FDI spill-overs[17]. With regard to methodological dummies, the use of a variety of estimators differently affects the FDI-growth relationship. For FDI impact estimates in the old EU-15, estimators such as *Heckman*, *IV/ GMM*, *NLSQ* and *OLS-panel* yield lower results than others, whereas the opposite is true in the NMS sample. This difference might reflect the wide variety of methodological choices in the vast (and ever-growing) literature on FDI. Finally, dummies for the definitions of *dependent* and *independent* variables are statistically significant only for the overall sample (Column 6), which, as mentioned, enjoys higher degrees of freedom.

Let us now move on to comment on the country dummies in the overall sample, the only model where we can gauge the relative positioning of each country vis-à-vis *both* old and new member states. Three key observations can be made. Firstly, the inclusion of country dummies does not undermine the significance of the set of controls on the characteristics and methodological choices of the studies, thus confirming the need for a thorough set of controls in the MRA. Secondly, the impact found in each paper could be positive, null or even negative depending on the specification model and the country selected[18]. Finally, and most importantly, countries do differ substantially from one another in terms of FDI impact on productivity, even within relatively similar economic zones such as the EU-15 and the new member states.

Summing up, by looking at the most complete set of multiple meta-regression analyses, we do find a convincing argument for controlling for the widest set of variables possible (especially geographical ones) when looking at the FDI-productivity nexus in the literature. We regard our results as an important methodological underpinning for future research on this important question that European policymakers are watching closely.

6. CONCLUSIONS

The aim of this paper is to summarise, combine and explain a large number of results on the indirect or ‘spill-over’ impact of FDI on economic performance in the EU by using a multiple meta-regression analysis approach drawing from high-quality firm-level studies only. This paper discusses some of the recent findings from the related empirical literature, concentrating on the FDI-growth relationship in an Enlarged Europe by comparing the EU-15 to new member states. Our results show that FDI does indeed have an indirect spill-over impact on productivity and ultimately on economic growth, even after rigorously controlling for publication bias, the methodology

[17] This result is somewhat different from what Javorcik (2004) found when looking at data on Lithuania (which does not belong to the EU-15 though).

[18] The whole effect for each and every country should be computed by adding each single dummy to the constant. So the value attached to each dummy is the effect above (if +) or beyond (if -) Belgium (columns 1, 3, 4 and 6) and Estonia (column 2 and 5) *ceteris paribus*.

adopted by different studies, the various characteristics of the studies and, most importantly, 'fixed' country-related effects. Our results also show that these effects might be more or less substantial in some countries compared to others. One size does not fit all. The main contribution of this paper is therefore methodological. We regard as inappropriate any attempt to summarise the dispersed evidence of the literature on the FDI-growth relationship unless it is accompanied by a full assessment of the heterogeneous nature of the studies conducted. In other words, the detailed analysis of the channels through which FDI impinges on growth, the complexity of the economic environment in which this relationship operates, and the wider geographical context in which spill-overs may or may not manifest themselves, are key and indispensable ingredients of an appropriate and robust research design. Shortcomings in methodical rigour would bring about spurious results, unsatisfactory research and, consequently, bad policy advice.

In light of our results and previous results in the literature, we can therefore argue that policies promoting inflows of FDI can be a useful tool to enhance productivity and economic growth, for both the old EU-15 and NMS. From a policy perspective, this paper provides evidence that policymakers should discuss removing what are still cumbersome explicit and implicit access restrictions experienced by foreign investors (World Bank Group, 2010). In fact, the European Union is thoroughly investigating the role of foreign investment in "reaping the benefits of globalisation" (see e.g. European Commission, 2012) for policy purposes. At the same time, the quality of data available for empirical estimation is increasing whereas the quality of study design is still varied and in some cases unsatisfactory. This seems to be a favourable time to make renewed efforts in research on FDI and economic growth and it is a particularly important question given the conditionality of the results (notably, the role of absorptive dynamic capacity) and given the fact that externalities are not always beneficial (there appear to be spill-over effects in some cases but negative 'stealing' effects in others). More country studies using high-quality firm-level data would be welcome and extremely useful. Better coding of dynamic absorptive capacity is also needed, but a better synthesis of the existing literature is equally important. This study falls in the latter approach and we believe it can potentially be a very important methodological tool and, ultimately, useful towards policy recommendations.

Finally, this study has some limitations and some implications for further research. The possibility to purge the estimates of publication bias is indeed a prerogative of meta-regression analyses studies. However, this comes at a cost: the true effect can be different depending on the publication bias type selected (see table 6). The limitation of this study lies in the need to find statistical properties that simplify this choice (e.g. FAT-PET and PEESE corrections). Future research should be devoted to this task. Furthermore, one of the strength of this study, the focus on the indirect effect spanning from firm-level empirical works, is also a possible limitation, the reason being that the micro vis-à-vis macro wedge or the direct vis-à-vis indirect wedge cannot be estimated by limiting the sample 'by construction' to firm level studies on the indirect effect. On the difference between direct and indirect see the excellent Iwasaki, I., Tokunaga, M., (2016). On the micro versus macro further research has been conducted by Bruno et al. (2017), Rojec and Knell (2017), Alfaro et al. (2009). This is the frontier of research and more effort should be devoted by the whole MRA scholars' community in these important research venues.

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TABLES

TABLE 1

Firm-level studies: Dependent Variable; Country; mean of estimated coefficients; observations

Paper	Dependent variable	Country	Mean	Obs.
Altomonte & Pennings (2009)	TFP growth	Romania	-0.089	14
Barbosa & Eiriz (2009)	Output growth	Portugal	0.021	60
Barrios & Strobl (2002)	TFP growth	Spain	0.140	16
Barrios et al. (2002)	Labour productivity	Greece	0.314	4
	labour productivity	Ireland	0.459	5
	Labour productivity	Spain	0.487	7
Barrios et al. (2011)	Output growth	Ireland	0.216	18
	TFP growth	Ireland	0.139	55
Barry et al. (2005)	Output growth	Ireland	-0.267	3
	Labour productivity	Ireland	-0.111	3
	TFP growth	Ireland	0.045	3
Bekes et al. (2009)	TFP growth	Hungary	0.025	3
Belderbos & Van Roy (2010)	TFP growth	Belgium	1.749	4
Bijsterbosch & Kolasa (2010)	Labour productivity	Baltic countries	0.186	1
	Labour productivity	Central Europe	0.127	1
	Labour productivity	Central and Eastern Europe	0.121	18
Braconier et al. (2001)	Labour productivity	Sweden	0.020	5
	TFP growth	Sweden	-0.066	1
Castellani & Zanfei (2003)	Output growth	France	-0.102	6
	Output growth	Italy	-0.063	6
	Output growth	Spain	-0.233	6
Crespo et al. (2009)	Labour productivity	Poland	9.584	16
Dimelis (2005)	Output growth	Greece	0.164	28
Driffield (2004)	Value Added growth	UK	0.004	18
Driffield and Love (2005)	TFP growth	UK	-0.001	12
Driffield et al. (2009)	TFP growth	UK	-0.012	9
Flôres et al. (2007)	TFP growth	Portugal	2.225	6
Girma & Wakelin (2000)	Output growth	UK	-0.014	10
Girma, et al. (2007)	Output growth	UK	-0.001	42
	TFP growth	UK	-0.031	6
Görg et al. (2009)	Output growth	Hungary	-0.047	16
	TFP growth	Hungary	-0.069	8
Gorodnichenko et al. (2014)	Revenue Efficiency	CEE, Turkey and CIS	0.057	18
Gorodnichenkou et al. (2007)	Revenue Efficiency	CEE, Turkey and CIS	0.056	42
Hagemeje & Kolasa (2011)	TFP growth	Poland	1.338	72
Haller (2011)	Labour productivity	Ireland	-0.002	8
	TFP growth	Ireland	0.121	16
Halpern & Muraközy (2007)	TFP growth	Hungary	0.644	44
Higon & Vasilakos (2011)	TFP growth	UK	0.083	6
Jabbour & Mucchielli (2007)	TFP growth	Spain	0.030	29
Javorcik & Spatareanu (2005)	Value Added growth	Czech Republic	0.007	2

	Value Added growth	Romania	-0.001	2
	TFP growth	Czech Republic	0.005	2
	TFP growth	Romania	0.000	2
Javorcik & Spatareanu (2011)	TFP growth	Romania	4.626	66
Javorcik (2004)	Output growth	Lithuania	0.007	38
	TFP growth	Lithuania	0.011	26
Kinoshita (2000)	TFP growth	Czech Republic	-0.011	10
Lenaerts & Merlevede (2013)	TFP growth	Romania	0.426	30
Lenaerts and Merlevede (2015)	Production Function	Romania	0.103	12
	TFP growth	Romania	0.687	12
Lesher & Miroudot (2008)	Operating revenue	EU15	-0.763	35
Liu et al. (2000)	Labour productivity	UK	0.099	10
Marcin (2008)	Output growth	Poland	0.110	7
Mariotti et al. (2011)	TFP growth	Italy	0.272	7
McVicar (2002)	TFP growth	UK	-0.121	1
Merlevede et al. (2014)	Labour productivity	Romania	0.528	2
	Production Function	Romania	0.709	6
	TFP growth	Romania	1.486	6
Monastiriotis & Alegria (2011)	Output growth	Bulgaria	0.293	6
Nicolini & Resmini (2010)	TFP growth	Bulgaria	0.050	8
	TFP growth	Poland	-0.024	8
	TFP growth	Romania	0.019	8
Nicolini & Resmini (2011)	TFP growth	Bulgaria, Poland, Romania	0.035	20
Proença et al. (2006)	Labour productivity	Portugal	6.128	4
Reganati & Sica (2007)	Value Added growth	Italy	0.073	6
Ruane & Ugur (2012)	Labour productivity	Ireland	0.008	12
Sabirianova et al. (2005)	Productivity Gap	Czech Republic	0.269	4
Sgard (2001)	TFP growth	Hungary	0.174	5
Simionca (2013)	Labour productivity	Sweden	0.046	6
Smarzynska (2002)	Output growth	Lithuania	0.023	12
Stancik (2010)	Growth in sales	Czech Republic	0.218	42
Vacek (2010)	Output growth	Czech Republic	0.278	62
Vahter & Masso (2006)	TFP growth	Estonia	0.264	10
Total sample			0.623	1,133

TABLE 2

Summary of firm-level studies of the distribution of computed Partial Correlation Coefficients.

Paper	**Mean**	**Median**	**Min**	**Max**	**Obs.**
Total sample	0.024	0.009	-0.593	0.966	1,133
Altomonte & Pennings (2009)	-0.023	-0.031	-0.055	0.016	14
Barbosa & Eiriz (2009)	0.006	0.006	-0.046	0.109	60
Barrios & Strobl (2002)	-0.006	0.017	-0.153	0.021	16
Barrios et al. (2002)	0.058	0.038	-0.042	0.320	16
Barrios et al. (2011)	-0.004	0.002	-0.466	0.057	73
Barry et al. (2005)	-0.022	-0.027	-0.047	0.039	9
Bekes et al. (2009)	0.005	0.005	0.000	0.009	3

Belderbos & Van Roy (2010)	0.136	0.137	0.028	0.241	4
Bijsterbosch and Kolasa (2010)	0.138	0.120	0.051	0.255	19
Braconier et al. (2001)	0.024	0.059	-0.178	0.084	6
Castellani & Zanfei (2003)	-0.019	-0.018	-0.059	0.017	18
Crespo et al. (2009)	0.004	0.002	-0.034	0.037	16
Dimelis (2005)	0.034	0.033	-0.023	0.068	28
Driffield (2004)	0.051	0.000	-0.047	0.884	18
Driffield and Love (2005)	-0.073	-0.037	-0.336	0.134	12
Driffield et al. (2009)	-0.038	0.173	-0.593	0.259	9
Flôres et al. (2007)	0.290	0.262	0.233	0.370	6
Girma & Wakelin (2000)	-0.002	-0.004	-0.019	0.024	10
Girma et al. (2007)	0.000	-0.001	-0.054	0.050	48
Görg et al. (2009)	-0.010	-0.009	-0.032	0.035	24
Gorodnichenko et al. (2007)	0.023	0.020	-0.001	0.061	42
Gorodnichenko et al. (2014)	0.022	0.021	0.009	0.041	18
Hagemeje & Kolasa (2011)	0.014	0.011	-0.017	0.058	72
Haller (2011)	0.006	0.009	-0.027	0.029	24
Halpern & Muraközy (2007)	0.032	0.001	-0.023	0.101	44
Higon & Vasilakos (2011)	0.027	0.026	0.013	0.046	6
Jabbour & Mucchielli (2007)	0.012	0.002	-0.036	0.129	29
Javorcik & Spatareanu (2005)	0.003	0.007	-0.008	0.013	8
Javorcik & Spatareanu (2011)	0.008	0.007	-0.008	0.021	66
Javorcik (2004)	0.084	0.018	-0.035	0.961	64
Kinoshita (2000)	-0.004	0.018	-0.577	0.254	10
Lenaerts & Merlevede (2013)	0.002	0.001	-0.007	0.013	30
Lenaerts & Merlevede (2015)	0.001	0.001	-0.011	0.009	24
Lesher & Miroudot (2008)	-0.001	-0.006	-0.130	0.092	35
Liu et al. (2000)	0.192	0.170	0.065	0.382	10
Marcin (2008)	0.006	0.006	0.006	0.006	7
Mariotti et al. (2011)	0.020	0.013	0.003	0.076	7
McVicar (2002)	-0.009	-0.009	-0.009	-0.009	1
Merlevede et al. (2014)	0.008	0.009	0.004	0.011	14
Monastiriotis & Alegria (2011)	0.026	0.010	-0.020	0.139	6
Nicolini & Resmini (2010)	-0.011	0.011	-0.337	0.026	24
Nicolini & Resmini (2011)	0.079	0.076	0.010	0.154	20
Proença et al. (2006)	0.093	0.062	0.048	0.202	4
Reganati & Sica (2007)	0.030	0.017	-0.003	0.119	6
Ruane & Ugur (2012)	0.005	0.004	0.000	0.011	12
Sabirianova et al. (2005)	0.079	0.092	0.026	0.107	4
Sgard (2001)	0.033	0.037	0.006	0.044	5
Simionca (2013)	0.068	0.042	0.009	0.185	6
Smarzynska (2002)	0.010	0.008	-0.006	0.024	12
Stancik (2010)	0.005	0.008	-0.038	0.046	42
Vacek (2010)	0.081	0.058	-0.345	0.966	62

Vahter & Masso (2006)	0.059	0.064	0.005	0.082	10

TABLE 3
Basic meta-analysis

	Partial correlations			Fisher's z-transformed		
	averages	95% CI		averages	95% CI	
Simple mean	0.024	0.018	0.029	0.027	0.019	0.034
FEE	0.006	0.006	0.006	0.006	0.006	0.007
REE	0.019	0.016	0.022	0.023	0.019	0.027
WLS	0.006	0.003	0.009	0.006	0.003	0.010

Notes: N. of obs. 1,133. N. of studies 52. All weighted by the PCC precision squared.

TABLE 4
FAT-PET MR model of publication selection and PEESE corrections. All studies.

	Weighted Least Squares model	Panel MRA model (Random-effects ML)	Multilevel mixed-effect model
Standard Error	1.495**	1.150**	1.120**
(FAT): $\hat{\alpha}_1$	(0.567)	(0.551)	(0.549)
Constant	0.002	0.004	0.004*
(PET): $\hat{\beta}_0$	(0.003)	(0.003)	(0.002)
PEESE correction:			
$\hat{\beta}_0$	0.005	0.007***	0.008***
95% C.I.	[-0.002,0.013]	[0.003,0.012]	[0.004,0.012]
Observations	1,133	1,133	1,133
N. of studies	52	52	52

Notes: Weights: PCC precision squared, $(1/se^2_{PCC})$; Standard errors adjusted for studies/clusters are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

TABLE 5
FAT-PET MR model of publication selection and PEESE corrections. Selected studies

	Weighted Least Squares model	Panel MRA model (Random-effects ML)	Multilevel mixed-effect model
Standard Error	0.435	-0.687	-0.725
(FAT): $\hat{\alpha}_1$	(0.662)	(0.698)	(0.687)
Constant	0.011**	0.021***	0.021***
(PET): $\hat{\beta}_0$	(0.004)	(0.004)	(0.004)
PEESE correction:			
$\hat{\beta}_0$	0.013***	0.018***	0.019***
95% C.I.	[0.006,0.020]	[0.013,0.024]	[0.013,0.024]
Observations	999	999	999

N. of studies	47	47	47

Notes: Weights: PCC precision squared, $(1/se_{PCC}^2)$; Standard errors adjusted for studies/clusters are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

TABLE 6

Test for publication selection bias – Single Country Estimates

	Simple MRA		Weighted Least Squares model		Random-effects panel MRA model		Multilevel mixed-effect mode	
	Old EU15	NMS	Old EU15	NMS	Old EU15	NMS	Old EU15	NMS
Standard Error			-0.936**	2.309**	-0.389	-0.290	-0.373	-0.609
(FAT): $\widehat{\alpha}_1$			(0.433)	(0.975)	(0.773)	(1.550)	(0.815)	(1.304)
Constant	0.018***	0.012***	0.023***	0.001	0.024***	0.016*	0.024***	0.018***
(PET): $\widehat{\beta}_0$	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.008)	(0.004)	(0.007)
PEESE correction:								
$\widehat{\beta}_0$	-	-	0.018***	0.011***	0.023***	0.018***	0.023***	0.019***
95% C.I.			[0.010,0.026]	[0.003,0.019]	[0.016,0.030]	[0.008,0.028]	[0.016,0.030]	[0.010,0.02
Observations	438	561	438	561	438	561	438	561
N. of studies	25	22	25	22	25	22	25	22

Notes: Weights: PCC precision squared, $(1/se^2_{PCC})$; Standard errors adjusted for studies/clusters are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

TABLE 7
WLS-MRA with country-dummies

	Simple MRA			Publication selection		
	Old EU15	NMS	Total sample	Old EU15	NMS	Total sample
Standard Error				0.222	-1.813	-0.870
(FAT): $\widehat{\alpha}_1$				(0.489)	(2.407)	(1.278)
Constant	0.121***	0.056***	0.121***	0.120***	0.066***	0.127***
(PET): $\widehat{\beta}_0$	(0.000)	(0.000)	(0.000)	(0.003)	(0.013)	(0.009)
Country dummies:						
Belgium	-		-	-		-
Bulgaria		-0.033***	-0.099***		-0.026**	-0.096***
		(0.004)	(0.004)		(0.010)	(0.004)
Czech Rep.		-0.031	-0.096***		-0.020	-0.092***
		(0.027)	(0.026)		(0.032)	(0.029)
Estonia		-	-0.065***		-	-0.066***
			(0.000)			(0.002)
France	-0.130***		-0.130***	-0.131***		-0.129***
	(0.000)		(0.000)	(0.001)		(0.003)
Greece	-0.083***		-0.083***	-0.086***		-0.072***
	(0.004)		(0.004)	(0.007)		(0.017)
Hungary		-0.040***	-0.105***		-0.037***	-0.105***
		(0.011)	(0.011)		(0.012)	(0.011)
Ireland	-0.121***		-0.121***	-0.122***		-0.117***
	(0.003)		(0.003)	(0.004)		(0.006)
Italy	-0.098***		-0.098***	-0.097***		-0.102***
	(0.004)		(0.004)	(0.004)		(0.007)
Lithuania		0.076**	0.011		0.089*	0.016
		(0.033)	(0.032)		(0.046)	(0.038)
Poland		-0.043***	-0.108***		-0.045***	-0.110***
		(0.003)	(0.003)		(0.003)	(0.004)
Portugal	-0.111***		-0.111***	-0.113***		-0.105***

	(0.008)		(0.008)	(0.008)		(0.012)
Romania		-0.051***	-0.117***		-0.055***	-0.119***
		(0.002)	(0.002)		(0.005)	(0.005)
Spain	-0.120***		-0.120***	-0.121***		-0.119***
	(0.009)		(0.009)	(0.009)		(0.009)
Sweden	-0.060***		-0.060***	-0.074**		-0.006
	(0.006)		(0.006)	(0.031)		(0.080)
UK	-0.117***		-0.117***	-0.118***		-0.113***
	(0.006)		(0.006)	(0.005)		(0.008)
PEESE correction:						
$\widehat{\beta}_0$	-	-	-	0.121***	0.056***	0.121***
95% C.I.				[0.120,0.121]	[0.054,0.058]	[0.120,0.122]
Observations	438	561	999	438	561	999
N. of studies	25	22	47	25	22	47

Notes: Weights: PCC precision squared, $(1/se_{PCC}^2)$; Standard errors adjusted for studies/clusters are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The omitted country in columns 1, 3, 4 and 6 is Belgium, in column 2 and 5 is Estonia.

TABLE 8
WLS Multiple MRA

	Simple MRA			Publication Selection		
	Old EU15	NMS	Total sample	Old EU15	NMS	Total sample
Standard Error				0.028	-9.407*	-3.151
(FAT): $\widehat{\alpha}_1$				(1.253)	(5.000)	(2.591)
Constant	0.447***	0.158***	0.234***	0.442**	0.183*	0.246***
(PET): $\widehat{\beta}_0$	(0.085)	(0.053)	(0.050)	(0.192)	(0.099)	(0.070)
Dummies for features of the studies considered:						
Dummy for published	0.011	0.005	0.004	0.011	0.004	0.004
	(0.021)	(0.005)	(0.005)	(0.022)	(0.006)	(0.005)
Dummies for periods:						
1990s	-0.081	-0.067**	-0.056***	-0.081	-0.076**	-0.056**
	(0.062)	(0.030)	(0.021)	(0.061)	(0.032)	(0.022)

after 2000	-0.003	-0.027	0.012	-0.003	-0.146*	0.026
	(0.082)	(0.035)	(0.016)	(0.098)	(0.081)	(0.033)
Dummies for data sources:						
Amadeus	0.004	-0.100**	-0.079***	0.003	-0.036	-0.066**
	(0.032)	(0.043)	(0.019)	(0.034)	(0.095)	(0.027)
Central Statistics Office	0.003	0.032**	0.039***	0.003	0.070**	0.049**
	(0.090)	(0.014)	(0.012)	(0.096)	(0.030)	(0.019)
Dummies for level of disaggregation:						
Industry-level	-0.061***	-0.028***	-0.052**	-0.061***	0.130	-0.024
	(0.019)	(0.008)	(0.021)	(0.019)	(0.082)	(0.047)
Plant level data	-0.016	0.000	0.041**	-0.016	0.000	0.080*
	(0.087)	(0.000)	(0.018)	(0.100)	(0.000)	(0.046)
Dummies for sectors						
Manufacturing	-0.010	-0.052	-0.020*	-0.010	-0.147	-0.029
	(0.018)	(0.055)	(0.012)	(0.018)	(0.140)	(0.021)
Services	0.015	0.052***	0.008	0.015	0.059***	0.002
	(0.018)	(0.005)	(0.008)	(0.018)	(0.012)	(0.015)
Dummies for FDI impact:						
Backward	-0.022***	0.011	0.000	-0.022***	0.012	0.001
	(0.003)	(0.010)	(0.010)	(0.003)	(0.009)	(0.010)
Horizontal	-0.018	0.003	-0.006	-0.018	0.003	-0.006
	(0.018)	(0.005)	(0.007)	(0.018)	(0.005)	(0.008)
Methodological dummies						
Dummies for estimators:						
2SLS	0.000	0.073***	0.081***	0.000	0.082***	0.093***
	(0.000)	(0.000)	(0.010)	(0.000)	(0.005)	(0.023)
Heckman	-0.114***	0.000	0.072***	-0.113*	0.000	0.072***
	(0.030)	(0.000)	(0.005)	(0.059)	(0.000)	(0.010)
IV/ GMM	-0.113***	0.060**	0.069***	-0.112*	0.147**	0.085***
	(0.031)	(0.024)	(0.015)	(0.054)	(0.071)	(0.024)
NLSQ	-0.154***	0.000	0.075**	-0.152*	0.000	0.038

	(0.026)	(0.000)	(0.029)	(0.082)	(0.000)	(0.044)
OLS-panel	-0.121***	0.071***	0.068***	-0.120*	0.070***	0.064***
	(0.029)	(0.000)	(0.005)	(0.060)	(0.000)	(0.010)
Dummies for the dependent variable:						
Productivity Gap	0.000	-0.191**	-0.171**	0.000	-0.229	-0.207*
	(0.000)	(0.070)	(0.066)	(0.000)	(0.147)	(0.108)
Gross Value Added	0.096	-0.016	-0.002	0.096	-0.033	-0.010
(productivity growth)	(0.075)	(0.014)	(0.019)	(0.068)	(0.029)	(0.024)
Growth in sales	0.000	-0.188***	-0.174***	0.000	-0.254	-0.222**
	(0.000)	(0.066)	(0.060)	(0.000)	(0.154)	(0.109)
Growth of output	-0.034*	-0.017	-0.015**	-0.034	-0.033	-0.025*
	(0.019)	(0.010)	(0.006)	(0.021)	(0.025)	(0.013)
Production function	0.000	-0.010	-0.008	0.000	-0.023	-0.014
	(0.000)	(0.010)	(0.006)	(0.000)	(0.023)	(0.012)
TFP Growth	0.006	-0.009	-0.007	0.006	-0.015	-0.011
	(0.012)	(0.010)	(0.007)	(0.012)	(0.022)	(0.011)
Dummies for independent variables						
Foreign capital	-0.210***	-0.307***	-0.110***	-0.206	-0.056	-0.092**
	(0.026)	(0.085)	(0.032)	(0.177)	(0.196)	(0.043)
Foreign employment	-0.191***	-0.087**	-0.071***	-0.187	-0.058	-0.068**
	(0.024)	(0.040)	(0.021)	(0.184)	(0.087)	(0.027)
Foreign equity/	-0.194***	-0.100**	-0.079***	-0.190	-0.059	-0.075**
capital participation	(0.012)	(0.042)	(0.024)	(0.187)	(0.090)	(0.031)
Foreign output/	-0.190***	-0.102**	-0.085***	-0.186	-0.076	-0.084***
sales (share)	(0.023)	(0.041)	(0.022)	(0.184)	(0.088)	(0.031)
N° of FDI/firms	-0.119	-0.163**	-0.104***	-0.114	-0.205	-0.107**
	(0.088)	(0.059)	(0.032)	(0.164)	(0.135)	(0.041)
Country Dummies						
Belgium	0.000		0.000	0.000		0.000

	(0.000)		(0.000)	(0.000)		(0.000)
Bulgaria		0.091	-0.084***		0.220	-0.078***
		(0.063)	(0.011)		(0.164)	(0.020)
Czech Republic		0.173***	0.029		0.359*	0.101
		(0.054)	(0.063)		(0.186)	(0.128)
Estonia		0.000	-0.098***		0.000	-0.089*
		(0.000)	(0.034)		(0.000)	(0.050)
France	-0.097		-0.124***	-0.098		-0.102***
	(0.085)		(0.018)	(0.102)		(0.035)
Greece	-0.049		-0.151***	-0.050		-0.086
	(0.083)		(0.026)	(0.114)		(0.059)
Hungary		-0.015	-0.144***		0.082	-0.124***
		(0.058)	(0.023)		(0.142)	(0.036)
Ireland	-0.117***		-0.240***	-0.118***		-0.228***
	(0.030)		(0.029)	(0.035)		(0.040)
Italy	-0.106		-0.114***	-0.107		-0.103***
	(0.090)		(0.018)	(0.104)		(0.030)
Lithuania		0.043	-0.085**		0.178	-0.046
		(0.073)	(0.033)		(0.164)	(0.054)
Poland		-0.025	-0.160***		0.038	-0.150***
		(0.059)	(0.023)		(0.135)	(0.034)
Portugal	-0.023		-0.129***	-0.024		-0.121**
	(0.083)		(0.031)	(0.104)		(0.052)
Romania		0.094	-0.054**		0.120	-0.052
		(0.063)	(0.024)		(0.138)	(0.039)
Spain	-0.117		-0.179***	-0.118		-0.151***
	(0.084)		(0.024)	(0.103)		(0.039)
Sweden	0.053		-0.063	0.051		0.125
	(0.090)		(0.047)	(0.172)		(0.164)
UK	-0.081		-0.180***	-0.082		-0.136**
	(0.079)		(0.029)	(0.108)		(0.051)
Observations	438	561	999	438	561	999
N. of studies	25	22	47	25	22	47

Notes: Weights: PCC precision squared, $(1/se^2_{PCC})$; Standard errors adjusted for studies/clusters are reported in parentheses; *** p<0.01, ** p<0.05, * p<0.1.
The omitted country in columns 1, 3, 4 and 6 is Belgium, in column 2 and 5 is Estonia.
Other omitted dummies: *before 1990s* for periods; *other data source* for data source; *firm level* for disaggregation level of data; *Manufacturing and Services* for coverage sectors; *Forward/vertical* FDI for FDI impact; *Pooled estimator* for estimator dummies; *Labour productivity* for *dependent* variables; *VA/turnover produced by foreign firms* for independent variables.

APPENDIX A. Summary of firm-level studies on the effects of FDI on the performance of domestic firms

Article	*Dependent variable*	*FDI Impact*	*Time spam*	*Industry coverage*	*Country*	*Data Source*
Altomonte & Pennings (2009)	TFP growth	Horizontal	1995-2001	Manufacturing & Services	Romania	Amadeus
Barbosa & Eiriz (2009)	Output growth	Backward, Horizontal	1994-1999	Manufacturing	Portugal	Bank of Portugal survey
Barrios & Strobl (2002)	TFP growth	Horizontal, Vertical	1990-1998	Manufacturing	Spain	ESEE- Spanish survey
Barrios et al (2002)	Labour productivity	Horizontal	1992-1997	Manufacturing	Greece, Ireland, Spain	Greek, Irish and Spanish surveys
Barrios et al (2011)	Output growth, TFP growth	Backward, Forward, Horizontal	1983-1998	Manufacturing	Ireland	Irish Economy Expenditure Survey
Barry et al (2005)	Output growth, Labour productivity, TFP growth	Vertical	1990-1999	Manufacturing	Ireland	Irish Economy Expenditure Survey
Bekes et al (2009)	TFP growth	Backward, Forward, Horizontal	1992-2003	Manufacturing	Hungary	HU Tax Authority
Belderbos & Van Roy (2010)	TFP growth	Backward, Forward, Horizontal	2000-2007	Manufacturing	Belgium	Amadeus/Belfast database
Bijsterbosch and Kolasa (2010)	Labour productivity	Horizontal	1995-2005	Manufacturing & Services	Baltic countries Central and Eastern Europe	EU KLEMS
Braconier et al (2001)	Labour productivity TFP growth	Horizontal	1978-1994	Manufacturing	Sweden	OECD Stat
Castellani & Zanfei (2003)	Output growth	Horizontal	1992-1997	Manufacturing	France, Italy, Spain	Amadeus, Who Owns Whom.
Crespo et al (2009)	Labour productivity	Backward, Forward,	1996-2000	Manufacturing	Poland	Portuguese Ministry of Employment and Survey

		Horizontal				
Dimelis (2005)	Output growth	Horizontal	1992-1997	Manufacturing	Greece	Confederation of Greek Industries
Driffield (2004)	Value added growth	Horizontal	1983-1997	Manufacturing	UK	Central Statistical Office
Driffield and Love (2005)	TFP growth	Horizontal	1984-1997	Manufacturing	UK	Central Statistical Office
Driffield et al (2009)	TFP growth	Horizontal	1987-1996	Manufacturing	UK	Central Statistical Office
Flôres et al. (2007)	TFP growth	Horizontal	1992-1995	Manufacturing	Portugal	Central Statistical Office
Girma & Wakelin (2000)	Output growth	Horizontal, Vertical	1988-1996	Manufacturing	UK	OneSource database
Girma et al. (2007)	Output growth TFP growth	Backward, Forward, Horizontal	1992-1999	Manufacturing	UK	OneSource database
Görg et al (2009)	Output growth TFP growth	Horizontal	1992-2003	Manufacturing	Hungary	Business Environment and Enterprise Performance Survey
Gorodnichenko et al (2007)	Revenue Efficiency	Backward, Forward, Horizontal	2002-2005	Manufacturing	Central and Eastern Europe (CEE), Turkey and CIS	Amadeus
Gorodnichenko et al (2014)	Revenue Efficiency	Backward, Forward, Horizontal	2002-2005	Manufacturing	Central and Eastern Europe (CEE), Turkey and CIS	Amadeus
Hagemeje & Kolasa (2011)	TFP growth	Backward, Forward, Horizontal	1996-2005	Manufacturing	Poland	Central Statistical Office
Haller (2011)	Labour productivity TFP growth	Horizontal	2001-2007	Manufacturing & Services	Ireland	Annual Services Inquiry (ASI)
Halpern & Muraközy (2007)	TFP growth	Backward, Horizontal	1996-2003	Manufacturing	Hungary	Central Statistical Office
Higon & Vasilakos (2011)	TFP growth	Horizontal, Vertical	1997-2003	Manufacturing	UK	ARD-ABI dataset
Jabbour & Mucchielli (2007)	TFP growth	Backward, Forward, Horizontal	1990-2000	Manufacturing	Spain	ESEE- Spanish survey
Javorcik & Spatareanu (2005)	Value added growth, TFP growth	Horizontal, Vertical	1998-2000	Manufacturing	Czech Republic, Romania	Amadeus
Javorcik & Spatareanu (2011)	TFP growth	Backward, Horizontal	1998-2003	Manufacturing	Romania	Amadeus, Romanian Chamber of Commerce
Javorcik (2004)	TFP growth Output growth	Backward, Forward, Horizontal	1993-2000	Manufacturing	Lithuania	Central Statistical office

Kinoshita (2000)	TFP growth	Horizontal	1995-1998	Manufacturing	Czech Republic	Central Statistics Office
Lenaerts & Merlevede (2013)	TFP growth	Backward, Forward, Horizontal	1996-2005	Manufacturing	Romania	Amadeus
Lenaerts & Merlevede (2015)	Production function TFP growth	Backward, Forward, Horizontal	1996-2005	Manufacturing	Romania	Amadeus
Lesher & Miroudot (2008)	Operating revenue	Backward, Forward, Horizontal	1993-2006	Manufacturing & Services	EU15	Amadeus, OECD Input-Output Database
Liu et al (2000)	Labour productivity	Horizontal	1991-1995	Manufacturing	UK	Fame
Marcin (2008)	Output growth	Backward, Forward, Horizontal	1996-2003	Manufacturing	Poland	Central Statistical Office
Mariotti et al (2011)	TFP growth	Backward, Forward, Horizontal	1999-2005	Manufacturing & Services	Italy	AIDA-Bureau
McVicar (2002)	TFP growth	Horizontal	1973-1992	Manufacturing	UK	OECD ANBERD data
Merlevede et al (2014)	TFP growth Labour productivity Production function	Backward, Horizontal	1996-2005	Manufacturing	Romania	Amadeus
Monastiriotis & Alegria (2011)	Output growth	Horizontal	2002-2005	Manufacturing	Bulgaria	Amadeus
Nicolini & Resmini (2010)	TFP growth	Horizontal, Vertical	1998-2003	Manufacturing	Bulgaria, Poland, Romania	Amadeus
Nicolini & Resmini (2011)	TFP growth	Horizontal, Vertical	1998-2003	Manufacturing	Bulgaria, Poland, Romania	Amadeus
Proença et al (2006)	Labour productivity	Horizontal	1996-1999	Manufacturing	Portugal	Dun & Bradstreet database
Reganati & Sica (2007)	Value added growth	Horizontal, Vertical	1997-2002	Manufacturing	Italy	AIDA and IStAT
Ruane & Ugur (2012)	Labour productivity	Horizontal	1991-1998	Manufacturing	Ireland	Central Statistics Office
Sabirianova et al (2005)	Productivity Gap	Horizontal	1993-2000	Manufacturing	Czech Republic	Central Statistics Office
Sgard (2001)	TFP growth	Horizontal	1992-1999	Manufacturing	Hungary	Kopint-Datorg institute
Simionca (2013)	Labour productivity	Horizontal	1995-2007	Manufacturing	Sweden	OECD Stat
Smarzynska (2002)	Output growth	Horizontal , Vertical	1996-2000	Manufacturing	Lithuania	Central Statistical Office
Stancik (2010)	Growth in sales	Backward, Forward, Horizontal	1995-2005	Manufacturing	Czech Republic	ASPEKT database
Vacek (2010)	Output growth	Backward,	1993-2004	Manufacturing &	Czech Republic	Czech Statistical Office and

		Forward		Services		National Bank
Vahter & Masso (2006)	TFP growth	Horizontal	1995-2002	Manufacturing & Services	Estonia	Balance of Payments of Bank of Estonia