

Is FDI into China Crowding Out the FDI into the European Union?*

Laura Resmini^a and Iulia Siedschlag^b

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Abstract: We estimate an augmented gravity model to analyse the effects of FDI into China originating in OECD countries on FDI into EU and other countries over the period 1990-2004. Our results suggest that on average, *ceteris paribus*, over the analysed period, FDI inflows into China have been complementary to FDI inflows into EU15 countries but they have substituted FDI into the new EU countries in Central and Eastern Europe. In particular, small economies such as Bulgaria and the Baltic countries have been affected negatively by the surge in the FDI into China. This FDI diversion appears in the case of efficiency-seeking FDI.

Key words: Foreign direct investment, China, European Union

JEL classification: F15, F36, F41

Corresponding Author: iulia.siedschlag@esri.ie

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^a University of Valle d'Aosta, Aosta, and ISLA, University "Luigi Bocconi", Milan, Italy. l.resmini@univda.it

^b The Economic and Social Research Institute, Dublin, Ireland.

1. Introduction

In this paper we examine whether and to what extent the surge in the foreign direct investment (FDI) into China in recent years has come at the expense of FDI inflows into European Union (EU) countries.

China has recently become a leading destination for FDI. In a recent survey on FDI prospects, transnational companies rank China as the most attractive global business location (UNCTAD, 2005). In 2003, China has overtaken the US as the number one destination for FDI (Prasad and Wei, 2005).

The FDI inward stock in China has increased dramatically since early 1990s, from 20.7 billion US dollars in 1990 to 292.6 billion US dollars in 2006. While the annual average of FDI inward flows over the period 1990-2000 was 30.1 billion US dollars, FDI inward flows into China in recent years have been much higher, 72.4 billion US dollars in 2005 and 69.5 billion US dollars in 2006¹. This surge in FDI in China has followed the opening of the economy to the world economy, the selective easing of capital controls and an available pool of labour (Prasad and Wei, 2005).

The success of China in attracting FDI has raised concerns that this has come at the expense of other countries and regions. This paper aims to bring empirical evidence to answer this concern. In particular the focus of this paper is on the impact of FDI to China on FDI into EU countries. Has the surge in the FDI into China in recent years come at the expense of FDI inflows into EU countries? Has this impact changed over time? Are spillover effects from FDI to China different for horizontal and vertical FDI?

To our knowledge, this is the first analysis of the effects of FDI into China on the FDI inflows into EU countries. Previous analyses have focused on the effects of FDI into China in developing countries, in particular the Asian countries and the Latin America and Caribbean (LAC) countries (Eichengreen and Tong, 2006a, 2006b; Cravino, Lederman and Olarreaga, 2007).

We estimate the effects of FDI inflows into China originating from OECD countries on FDI inflows into EU countries and other countries by using a panel of cross-country annual observations over the period 1990-2004. We have data for 35 host

¹ UNCTAD (2007)

countries, including the EU member states before the enlargement of 2004 (EU15), and the ten new EU countries in Central and Eastern Europe (CEE)². In addition, we identify spillover effects to horizontal and vertical FDI. In comparison with existing studies, we employ improved econometric techniques to control for unobserved country heterogeneity and simultaneity effects.

Our results suggest that on average, *ceteris paribus*, FDI inflows into China have been complementary with FDI inflows into other countries. However, while the effect on FDI into EU15 has been positive, it appears that FDI inflows into China have crowded out the FDI inflows to CEE countries. In particular, small economies such as Bulgaria, the Baltic countries and Malta have been affected negatively by the surge in the FDI into China. This FDI diversion appears in the case of efficiency-seeking (vertical) FDI.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical and empirical background for our analysis. Section 3 explains our empirical strategy and the model specifications. In section 4 we describe the data set that we use. The results of our empirical analysis are presented and discussed in Section 5. Finally we summarize our findings and conclude in Section 6.

² EU15: Austria, Belgium, Denmark, France, Finland, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and United Kingdom; CEE countries: Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia; The other host countries are: Brazil, China, Cyprus, India, Japan, Malta, Mexico, the Russian Federation, Switzerland and the United States.

2. Theoretical and Empirical Background

The theoretical framework of our analysis is the theory of multinational enterprises (MNEs) which has been formalized in several seminal papers by Markusen (1984), Helpman (1984), Markusen and Venables (1997, 1998). The theoretical models of MNEs explain the volume of production of MNEs as a function of the characteristics of the home and host countries such as size, relative endowments, and transaction costs.

The theoretical literature distinguishes between foreign direct investment driven by “horizontal” and “vertical” motivations. Horizontal MNEs or market-seeking FDI produce the same goods and services in multiple locations. Models of horizontal MNEs (Markusen, 1984; Horstmann and Markusen, 1987, 1992; and Markusen and Venables, 1998, 2000) predict that MNEs production will concentrate in large countries and in countries with similar relative endowments.

Vertical MNEs, or “efficiency-seeking FDI”, imply the geographic fragmentation of production into stages. Models of vertical MNEs (Helpman, 1984; and Helpman and Krugman, 1985) predict that MNEs production will locate in relatively labour abundant countries.

Existing empirical studies have used a standard gravity model applied to FDI to explain bilateral FDI flows (Brenton, and al., 1999; Egger and Pfaffermayr, 2004; Brainard, 1997, Ekholm, 1995, 1997, 1998; Stein and Duade, 2007). They find empirical evidence showing that:

- i) FDI is concentrated among countries relatively similar in size and in relative endowments
- ii) Capital abundant countries conduct more outward FDI and receive less FDI
- iii) Labour-abundant countries receive more FDI and conduct less outward FDI

Several empirical studies focus on the quality of institutions to explain bilateral FDI flows (Wei, 1997, 2000; Duade and Stein, 2001; Globerman and Shapiro, 2002; Habib and Zurawicki, 2002; Benassy-Quere et al, 2007). Good quality institutions in

the home and host countries have a positive effect on bilateral FDI flows via productivity growth and reduced uncertainty.

The impact of FDI inflows into China on FDI inflows in other countries has been examined in a number of recent papers. Eichengreen and Tong (2006a, 2006b) find that the emergence of China as a leading FDI destination has encouraged FDI flows to other Asian countries via supply chain production linkages. They also find evidence suggesting that FDI inflows into China have substituted FDI inflows into European countries. They explain this diversion effect by the negative effect of distance on supply-chain production linkages. In contrast, Mercereau (2005) shows that on average, the FDI into China has had a negative effect on FDI into other Asian countries. However, his estimates of country-specific effects indicate that the diversion effect is driven by two countries, namely Singapore and Myanmar. It appears that the FDI inflows into China have not affected the other Asian countries. Cravino, Lederman and Olarreaga (2007) examine the effect of foreign capital stock in China on the Latin American and Caribbean (LAC) countries and they find no evidence for a FDI diversion from OECD countries, in particular from the US to China at the expense of the LAC countries. While the growth of capital stocks in China originating from the OECD especially from the US was faster than in LAC countries over the period 1990-1997 this relative growth has slowed down since 1997.

To our knowledge our contribution is the first analysis of the effects of the FDI inflows into China originating from OECD countries on the FDI inflows into European Union countries. In particular we identify the average effect on the EU15-the member countries prior the 2004 and 2007 EU enlargements and the EU10-countries in Central and Eastern Europe. Furthermore, we distinguish spillover effects to horizontal and vertical FDI.

3. Empirical Methodology

We first estimate the following baseline gravity model to identify determinants of bilateral FDI flows:

$$\ln(FDI_{ij,t+1}) = a_0 + a_1 \ln MP_{ijt} + a_2 |\ln GDPCAP_{it} - \ln GDPCAP_{jt}| + a_3 INST_{jt} + \alpha_i + \beta_j + \tau_t + \varepsilon_{ijt}$$

All regressors are lagged by one year to account for the fact that the implementation of investment decisions is in practice lagged³. Further, lagging the regressors avoids potential endogeneity arising from the effect of FDI on some of the explanatory variables.

The above model estimates the real FDI flows from country *i* to country *j* at time *t*+1 as a function of the following explanatory variables:

- market potential (MP_{ijt}): the sum of the GDP at time *t* in the home (GDP_{it}) and host country (GDP_{jt}) over the distance between the home and host country ($DIST_{ij}$); this variable is a proxy for horizontal (market-seeking) FDI incentive;
- relative endowments (capital/labour ratio): the absolute difference at time *t* of the GDP per capita in the home ($GDPCAP_{it}$) and host country ($GDPCAP_{jt}$); this variable is a proxy for vertical (efficiency-seeking) FDI incentive;
- the quality of institutions at time *t* in the host country ($INST_{jt}$);
- home and host country fixed effects (α_i, β_j)
- time specific effects (τ_t)

ε_{ijt} is the error term.

Recent literature on FDI and growth (Borensztein et al., 1998; Rodriguez-Clare, 1996 and Zhang, 2001) suggests that FDI and GDP might be simultaneously determined and this could bias the estimates. However, this literature usually considers aggregate FDI inflows and not bilateral flows, as we do in this paper. As shown Baier and

³ See also Mercereau (2005)

Bergstrand (2007) potential endogeneity of bilateral FDI flows and in GDP is negligible.

To estimate the effect of FDI flows into China to FDI flows in other countries we include in the above model a measure of FDI flows into China at time t from each home country ($FDICN_{it}$). Unobserved global shocks can affect both the attractiveness of FDI to China and other countries. To correct for this potential endogeneity we instrument $FDICN_{it}$ with the market potential between the home country i and China (the sum of GDP in the origin country and the GDP in China at time t over the distance between the home country i and China), and the absolute difference in the GDP per capita in the home country i and the GDP per capita in China at time t .

We estimate the following system of simultaneous equations:

$$\ln(FDI_{ij,t+1}) = b_0 + b_1 \ln MP_{ijt} + b_2 |\ln GDP_{it} - \ln GDP_{jt}| + b_3 INST_{jt} + b_4 \ln FDICN_{it} + \alpha_i + \beta_j + \tau_t + \varepsilon_{ijt}$$

$$\ln FDICN_{it} = c_0 + c_1 \ln MP_{i,CN,t} + c_2 |\ln GDP_{it} - \ln GDP_{CN,t}| + \psi_{it}$$

The coefficient of interest is b_4 in the primary equation: $b_4 > 0$ suggests that the FDI flows to China and FDI flows to other countries originating from the OECD countries were complementary; $b_4 < 0$ suggests that the FDI flows to China and FDI flows to other countries were substitutes.

We estimate first the average effects of FDI flows into China on FDI flows into other countries and next we allow the coefficient for FDI flows into China to be different for EU15, CEE and the rest of the countries. In addition we allow the coefficient of FDI into China to vary over time.

To identify spillover effects from horizontal and vertical FDI into China on other countries we include in the previous model two interacted terms⁴: we interact the

⁴ These interacted terms have been suggested in previous studies on bilateral FDI flows, for example Markusen and Maskus (2002). Eichengreen and Tong (2006a) use this approach to identify spillover effects from FDI into China on horizontal and vertical FDI into other countries.

instrumented FDI into China with our proxy for market size, the market potential of home and host countries, MP_{ijt} (horizontal FDI incentive); also, we interact the instrumented FDI into China with a proxy for relative labour costs, the absolute difference in the GDP per capita in the home and host countries (vertical FDI incentive). The coefficients of these interacted terms capture whether and to what extent the attractiveness of China for horizontal (vertical) FDI might discourage horizontal (vertical) FDI in other host countries.

We first estimate the average spillover effects and subsequently we allow the coefficients of the interacted terms to be different for EU15, CEE and the other host countries. The estimated model is the following system of simultaneous equations:

$$\ln(FDI_{ijt}) = d_0 + d_1 \ln MP_{ijt} + d_2 \left| \ln GDP_{it} - \ln GDP_{jt} \right| + d_3 INST_{jt} + d_4 \ln FDICN_{it} + d_5 \ln FDICN_{it} * \ln MP_{ijt} + d_6 \ln FDICN_{it} * \left| \ln GDP_{it} - \ln GDP_{jt} \right| + \mu_i + \nu_j + \lambda_t + \xi_{ijt}$$

$$\ln FDICN_{it} = e_0 + e_1 \ln MP_{i,CN,t} + e_2 \left| GDP_{it} - GDP_{cn,t} \right| + \psi_{it}$$

4. The Data

The data on FDI that we use in this paper is from the OECD *International Direct Investment Statistics Yearbook*, published by OECD (2004). OECD defines FDI as an international investment by a firm in one country (the home country) with the objective of establishing a long lasting interest in an enterprise located in another country (the host country) different from that of the investing firm.

Direct investment involves either the initial transaction between the two firms or all subsequent capital transactions between them. Given our specific focus on the dynamics of the impact of FDI into China on the FDI into other countries, we use annual bilateral outward FDI *flows* rather than stocks. We have data for bilateral FDI flows originating in 23 OECD countries disaggregated on 35 OECD and non-OECD host countries, over the period 1990 to 2004.⁵ As pointed out in the literature, FDI

⁵ Source countries are Austria, Belgium, Czech R., Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Luxembourg, Mexico, Netherlands, Poland, Portugal, Slovak R., Spain, Sweden, Switzerland, United Kingdom and the United States. The recipient countries include, besides

stocks are indeed less volatile than flows since the re-direction of FDI from one country to another requires a significant amount of time.

The original FDI data were obtained in current US dollars. We deflate these data by using the US price deflator for investment (2000=100) taken from the AMECO data base of the European Commission. Real GDP, and GDP per capita in constant 2000 US dollar are obtained from the World Bank Development Indicators data base. The distance between the home and host countries ($DIST_{ij}$) is measured as the great circle distance between the capital cities in the home and host countries. The source for these data is the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII). Our proxy for the quality of institutions (INST) is the mean of three indicators measuring the quality of institutions, namely: "corruption", "law and order", and "bureaucracy quality". The index takes values from 0 (the lowest quality) to 1 (the highest quality). The data source is the International Country Risk Guide (ICRG). Further details about the data and variable description are given in Table A1 in the Appendix.

Following conventional practice used in the gravity model literature, we add one to FDI flows before transforming them in log, in order to avoid the problems with zero observations.⁶

the 23 OECD countries just mentioned, Brazil, Bulgaria, Cyprus, Estonia, India, Latvia, Lithuania, Malta, Romania, Russia Federation, and Slovenia, too.

⁶ Nearly 11 per cent of our observations have a zero value for bilateral flows of FDI and 15 per cent record a divestiture from the host countries. After the transformation, we restricted the sample to include only observations with strictly positive values for our dependent variables. Alternatively, we might have considered zero flows as missing values and directly dropped them from the sample. We use both strategy and found minimal differences in the estimated coefficients. Results are available upon request.

5. Estimation Results

Determinants of bilateral FDI flows and the impact of FDI into China on FDI into other countries

The estimates of bilateral FDI flows obtained with our baseline model are shown in column (1) of Table 1.

Table 1: Bilateral FDI flows and the impact of FDI into China on FDI into other countries

	Bilateral FDI flows (OLS)	The impact of FDI to China on FDI to other countries	The impact of FDI to China on FDI to EU countries
Ln MP _{ijt}	0.442*** (0.042)	0.430*** (0.044)	0.425*** (0.052)
Abs diff GDP per capita i,j	-0.294*** (0.024)	-0.260*** (0.027)	-0.093*** (0.031)
INST _{it}	0.206*** (0.457)	0.054 (0.480)	0.430 (0.470)
Ln FDICN _{it}		0.587*** (0.032)	0.359*** (0.062)
Ln FDICN _{it} *EU15			-0.105*** (0.032)
Ln FDICN _{it} *CEE			-0.475*** (0.039)
EU15			0.133 (0.504)
CEE			-4.475 (0.463)
Home country fixed effects	F(21, 4730) = 144.99 Prob>F = 0.000	$\chi^2(18) = 740.34$ Prob> $\chi^2 = 0.000$	F(20, 4124) = 8.09 Prob>F = 0.000
Host country fixed effects	F(32,4730)=55.14 Prob>F 0.000	$\chi^2(32)=1703.84$ Prob> χ^2 0.000	F(31,4124)=6.20 Prob>F 0.000
Time specific fixed effects	F(13,4730) = 33.20 Prob >F = 0.000	$\chi^2(12) = 133.26$ Prob > $\chi^2 = 0.000$	F(13,4124) = 7.98 Prob >F = 0.000
Hansen J test H ₀ = all instr. valid		0.041 Prob > $\chi^2 = 0.839$	
Obs.	4802	4197	4197
R ²	0.7031	0.6910	0.7141

Robust standard errors in parenthesis. ***, **, * indicates significance at 1%, 5%, and 10%, respectively

The estimates for determinants of bilateral FDI flows are consistent with theory predictions and other empirical studies discussed in Section 2. On average, *ceteris paribus*, bilateral FDI flows are positively related to economic size, similarity of relative endowments and the quality of institutions in the host countries. As suggested by the literature on multinational enterprise activity, FDI tends to take place among countries similar in size and relative endowments. Large countries generate and receive larger flows of FDI relative to small countries. The larger the capital/labour ratio differential is between the home and host countries the lower the bilateral FDI flows are. This result again reflects the characteristics of the countries included in our data set, in particular the similarity in relative endowments for the majority of these

countries. Furthermore, labour cost differentials captured by the absolute difference in GDP per capita may not be important for FDI attraction, which, instead, is driven by the quality of the institutions of the host countries.⁷

We turn next to the estimates of the effect of FDI inflows into China to other countries which are shown in column (2) of Table 1. These estimates are obtained with an augmented gravity model in which we added the log of FDI flows from our 23 OECD home countries into China. As discussed above, we instrument FDI inflows to China to account for potential correlation of FDI inflows to China and the error term due to unobserved factors that may increase simultaneously the attractiveness of China and other countries as FDI destinations.

The results of the first stage regression of FDI inflows into China are shown in Table A2 in the Appendix. The estimated model explains 93 percent of the variation of the FDI inflows into China originating in OECD countries. Thus these estimates indicate that the capital/labour ratio differential (labour cost differential) between home countries and China were positively associated with the FDI inflows into China originating from OECD countries.⁸ This is in line with the prediction of the vertical MNEs models and the assumed geographic fragmentation of production into stages. Market potential for China-home country pairs is negatively associated with FDI into China⁹.

The significance and magnitude of the coefficients of bilateral FDI flows are similar to those obtained with our baseline regression. The coefficient of the variable of interest in this model which measures the effect of FDI inflows into China on other countries is positive and significantly different from zero at the one percent significance level. This result suggests that on average, *ceteris paribus*, FDI inflows into China originating from OECD countries were complementary to FDI inflows originating from OECD into other destinations.

⁷ The negative sign of this variable may also be due to the fact that differences in wage levels are not compensated by productivity. See Globerman and Shapiro (2002) for a discussion on this issue.

⁸ Note that the first stage regression includes also the other exogenous variables from the second stage regression, as requested by standard econometric methodology.

⁹ The negative relationship between market potential for China-home country pairs and FDI into China might be due to spurious correlation between the market potential variable and home country dummies. Since the host country, China, is the same for FDI originating in all home countries, market potential for each China-home country pair is positively related to GDP in the home country. The smaller the home country, the lower FDI outflows to China originating in these countries are likely to be.

The main objective of this paper is to examine whether and to what extent the FDI inflows into China have affected the FDI inflows into the European Union countries. To this purpose, we re-estimate the previous model specification and allow the coefficient of the fitted value of Chinese FDI to vary across countries. We distinguish between EU15 and the new EU countries in Central and Eastern Europe (CEE). The estimates are shown in column (3) of Table 1. These results suggest that the setting up of production plants in China has discouraged additional investment in the new EU member state of Central and Eastern Europe. FDI into China appear complementary to FDI inflows into EU15 countries and into the other host countries¹⁰.

This result suggests that the advantage of the CEE countries due to their proximity to FDI source countries is not sufficient to offset the attractiveness of China as a FDI destination.

The effect of FDI inflows on FDI into other countries in particular the EU countries may have varied over the analysed period due to adaptation of foreign investors to changes either in China's investment climate or in CEE countries. To account for this potential time specific effects, we estimate our augmented gravity model separately for three periods: 1990-1994, 1995-1999, and 2000-2004.

This strategy allows us to uncover interesting results which are shown in Table 2.

Our results indicate that while FDI into China have been complementary with FDI into EU15 countries, the diversion effect of FDI into China on FDI into CEE countries has been persistent over the whole period and it has intensified since 2000. The impact of FDI inflows into China on the rest of the host countries has been positive in each of the three sub-periods and significantly different from zero.

¹⁰ The interpretation of the estimated coefficients in column (3) of Table 1 is as follows: The coefficients of $\ln FDICN_{it}$ interacted with the EU15 and the CEE dummies indicate how much the slope coefficient of the average diversion, that is, the coefficient of $\ln FDICN_{it}$, differs from the slope coefficient of the FDI flows into the EU15 countries and the CEE, respectively. The slope coefficient of the FDI effect for EU15 is $0.359 - 0.105 = 0.254$ and the effect on FDI into CEE countries is $0.359 - 0.475 = -0.116$.

Table 2: The impact of FDI to China on other countries over time

	1990-1994	1995-1999	2000-2004
Ln MP _{ijt}	0.546*** (0.110)	0.532*** (0.087)	0.461*** (0.101)
Abs diff GDP per capita i,j	0.205*** (0.76)	-0.084* (0.049)	-0.125** (0.060)
INST _{it}	2.462* (1.311)	0.010 (1.160)	1.274 (1.298)
Ln FDICN _{it}	0.442*** (0.135)	0.251** (0.110)	0.345** (0.162)
Ln FDICN _{it} *EU15	-0.341*** (0.077)	-0.139** (0.056)	-0.066 (0.049)
Ln FDICN _{it} *CEE	-0.571*** (0.102)	-0.354*** (0.067)	-0.484*** (0.057)
EU15	2.057*** (0.709)	-2.088*** (0.699)	0.887 (0.708)
CEE	3.861*** (0.728)	-0.131 (0.529)	2.568*** (0.633)
Home country fixed effects	F(14, 765) = 6.82 Prob>F = 0.000	F (16, 1400) = 6.69 Prob> F ² = 0.000	F(20, 1482) = 3.51 Prob>F = 0.000
Host country fixed effects	F(27,765)=7.49 Prob>F 0.000	F (27, 1400)=3.98 Prob> F 0.000	F(31,1482)=3.35 Prob>F 0.000
Time specific fixed effects	F(3,765) = 1.17 Prob >F = 0.3197	F (4,1400) =6.48 Prob > F = 0.000	F(3,1482) = 1.44 Prob >F = 0.229
Obs.	818	1456	1545
R ²	0.7620	0.7494	0.7249

Robust standard errors in parenthesis. ***, **, * indicates significance at 1%, 5%, and 10%, respectively

Spillover effects from FDI into China on horizontal and vertical FDI

We turn now to the role played by horizontal and vertical motivations for FDI in driving the previous results.

According to the theory, horizontal FDI usually involves the replication of the production facilities in the host countries. Given the fact that their main purpose is to serve local markets, the market potential is one of the main drivers for this type of FDI. Vertical FDI, instead, implies the fragmentation of the vertical chain of production and the relocation of production stages in low cost locations stimulated by international differences in input prices.

To distinguish between vertical and horizontal FDI in our modelling framework, we add to the previous model specification two interacted terms: the fitted FDI inflows into China variable interacted with our proxy for market potential (the sum of GDP of the host and the home countries weighted by the distance between them), and a

second interaction of the fitted FDI inflows into China variable with our proxy for labour cost differentials (the absolute difference of GDP per capita in the source and in host countries). The first interacted variable captures the effect of FDI into China on horizontal FDI, while the latter captures the spillover effect on vertical FDI.

Estimates of this latter model are shown in Table 3.

Table 3: Spillover effects from FDI into China to horizontal and vertical FDI

	Spillover effects to all countries	Spillover effects to EU countries
Ln MP_{ijt}	0.227*** (0.063)	0.348*** (0.068)
Abs diff GDP per capita i,j	-0.549*** (0.050)	-0.382*** (0.048)
$INST_{jt}$	0.356 (0.472)	0.391 (0.465)
Ln $FDICN_{it}$	-1.618*** (0.228)	-1.126*** (0.243)
$FDICN*HOR$	0.052*** (0.009)	0.065*** (0.011)
$FDICN*VER$	0.088*** (0.008)	0.019* (0.011)
$FDICN*HOR*EU15$		-0.033*** (0.005)
$FDICN*VER*EU15$		0.065*** (0.011)
$FDICN*HOR*CEE$		-0.020 (0.014)
$FDICN*VER*CEE$		0.003 (0.031)
EU15		-1.330*** (0.385)
CEE		-2.212*** (0.401)
Home country fixed effects	F(20,4124)=9.28 Prob>F=0.099	F(20,4120)=10.24 Prob>F=0.000
Host country fixed effects	F(32,4124)=5.35 Prob>F=0.000	F(31,4120)=6.78 Prob>F=0.000
Time specific fixed effects	F(13,4124)=7.80 Prob>F=0.000	F(13,4120)=7.81 Prob>F=0.000
Obs.	4197	4197
R^2	0.7124	0.7218

Robust standard errors in parenthesis. ***, **, * indicates significance at 1%, 5%, and 10%, respectively

Given the introduction of the two interacted terms into the model specification, the impact of FDI into China on other host countries is no longer constant, This implies that regression coefficients reflect conditional relationships, as indicated by the implied derivative:

$$\frac{\partial FDI_{ijt}}{\partial FDICN_{it}} = -1.618 + 0.052 * MP_{ijt} + 0.088 * |GDP_{it} - GDP_{jt}|$$

The direct effect of FDI into China is negative and significant at the one percent level, as it is shown in column (1) of Table 3. Therefore, the derivative is expected to be negative when the market potential is very small and GDP per capita are similar. This

implies that only FDI flows directed towards less attractive host countries in terms of either market potential or factor cost advantages should be negatively affected by FDI inflows into China. This negative effect, however, weakens as host countries increase their advantages, either in terms of market potential or differences in development levels with the source countries, as indicated by the coefficients of either market potential or GDP per capita difference which are both positive and significant at the conventional levels. Therefore, having a large domestic market and/or factor cost advantages may help in developing complementarities with FDI flows to China.

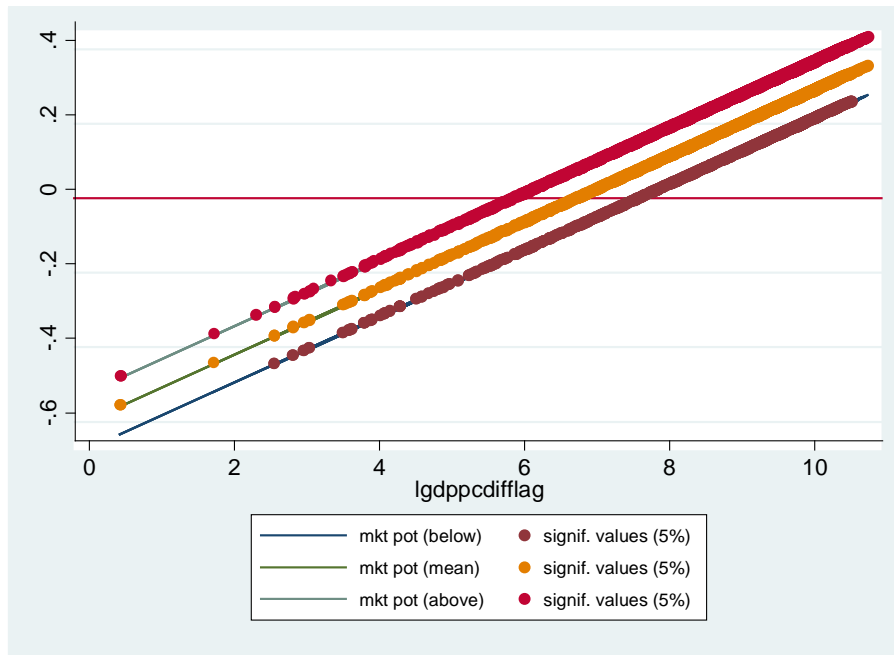
Figure 1 shows the derivative discussed above. In particular, it plots the marginal effect of FDI to China on the vertical axis and GDP per capita differences on the horizontal axis in panel a). In panel b) we replace GDP per capita with market potential. In order to show how both the explanatory variables are able to condition the marginal effect of FDI to China on the same figure, we fixed the market potential and GDP per capita differences at their mean level and one standard deviation below and above the mean, respectively.

Three facts are worth noticing in panel a). First of all, the marginal effect is negative and statistically significant when host and home countries' GDPs per capita are very similar and this is true also for host countries with very high values of market potential. This suggests that FDI inflows into China are substitutes for FDI into countries which are less attractive for vertical FDI. Secondly, very high values for market potential help in compensating the lack of cost advantages. When market potential is one standard deviation above the mean, the marginal effect of FDI into China becomes positive for lower values of GDP per capita difference than countries with market potential below the mean. Thirdly, as factor cost advantages become really important, the marginal effect of FDI into China turns out to be positive and significant even for countries whose market potential is below the sample mean. This fact is more apparent in Figure 1 panel b).

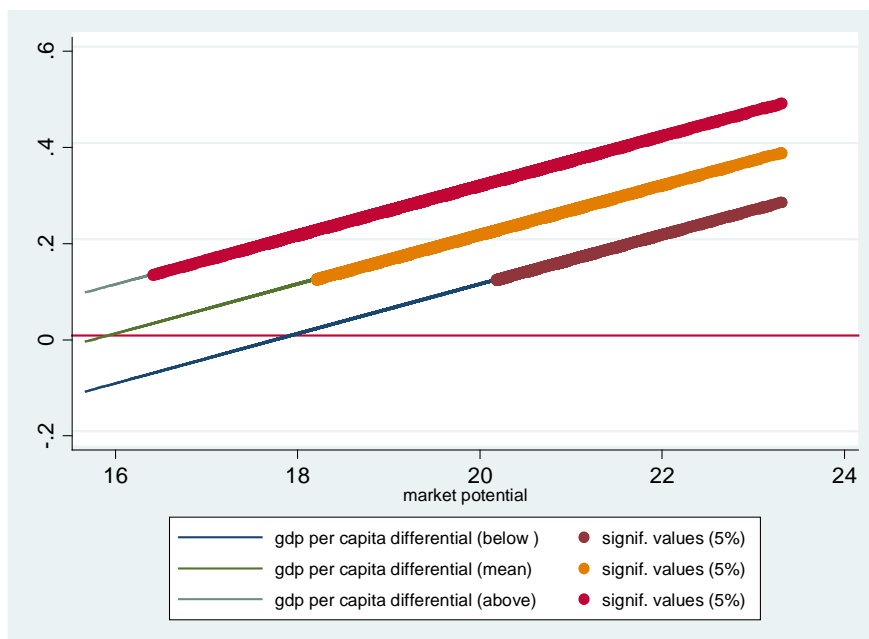
Overall, these results suggest that host countries attracting mainly horizontal FDI adjust to the competitive pressure exerted by China better than countries attracting vertical FDI. The latter, in fact, benefit from FDI into China only when GDP per capita differs substantially from that of source countries. These results indicate that FDI into China are predominantly efficiency-seeking rather than market-seeking, despite the large market size of China.

Figure 1. The marginal effect of FDI into China on other host countries

a) all values of GDP per capita differences



b) all values of market potential



The effects of FDI into China on FDI into EU countries are very similar to those in the case of the other host countries including in our sample. The main differences are in the case of EU15, where FDI into China appear to foster to a larger extent vertical FDI in comparison to horizontal FDI, as indicated by the magnitude and the sign of the coefficients of the interacted terms. The effect of FDI into China on FDI into CEE

countries is not statistically different from those of other host countries. These results suggest that FDI into China are likely to divert FDI flows from countries with small domestic markets, unless they can compensate this disadvantage with very large GDP per capita differentials.

Country-specific spillover effects from FDI into China are discussed in the next section.

Table 4: Time specific spillover effects from FDI into China on horizontal and vertical FDI

	1990-1994	1995-1999	2000-2005
Ln FDICN _{it}	-0.337 (0.776)	-1.123*** (0.425)	-1.109*** (0.395)
FDICN*HOR	0.031 (0.030)	0.058*** (0.019)	0.068*** (0.017)
FDICN*VER	0.013 (0.051)	0.021 (0.021)	0.009 (0.016)
FDICN*HOR*EU15	-0.024 (0.015)	-0.039*** (0.008)	-0.029*** (0.007)
FDICN*VER*EU15	0.024 (0.034)	0.080*** (0.020)	0.057*** (0.017)
FDICN*HOR*CEE	0.056 (0.041)	-0.013 (0.023)	-0.027 (0.023)
FDICN*VER*CEE	-0.172* (0.089)	-0.000 (0.049)	0.015 (0.047)
EU15	-1.703* (0.923)	-1.874*** (0.658)	1.355* (0.716)
CEE	0.289 (0.827)	-2.455*** (0.643)	2.413*** (0.564)
Home country fixed effects	F(14,761)=6.59 Prob>F=0.000	F(16,1396)=8.10 Prob>F=0.000	F(20,1478)=4.25 Prob>F=0.099
Host country fixed effects	F(27,761)=7.43 Prob>F=0.000	F(27,1396)=4.85 Prob>F=0.000	F(31,1478)=3.76 Prob>F=0.000
Time specific fixed effects	F(3,761)=1.08 Prob>F=0.356	F(4,1396)=6.53 Prob>F=0.000	F(3,1478)=1.37 Prob>F=0.000
Obs.	818	1456	1545
R ²	0.7639	0.7615	0.252

Robust standard errors in parenthesis. ***, **, * indicates significance at 1%, 5%, and 10%, respectively

These results are consistent over time, but only from 1995 onwards, as it is shown in Table 4. In the early 1990s, FDI to China was not able to condition FDI flows in other recipient countries. As a matter of fact, FDI flows to China show the largest increase in the second half of the 1990s.

Country-specific spillover effects from FDI into China

As discussed above, it is likely that the impact of FDI into China vary across host countries. To uncover country-specific effects, we interact the fitted FDI into China

with dummy variables which take the value one for each host country and zero otherwise. We first estimate country-specific effects for total FDI and second, we distinguish between spillover effects on horizontal and vertical FDI. The results are shown in Table 5.

Consistent with the previous results shown in Table 1, we find that FDI inflows into China have been complementary with FDI into the majority of EU15 countries. The effect on FDI into Austria is not significantly different from zero. FDI inflows into China appear negatively associated with FDI into small countries such as Bulgaria, Estonia, Latvia, and Lithuania and Malta. FDI inflows into China have been complementary to FDI into the larger CEE countries, Czech Republic, Hungary, Poland, Romania. The FDI inflows into China have been not significantly different from zero in Slovenia and Slovakia.

FDI into China has been complementary to horizontal FDI in Italy, Portugal, Spain, Sweden, Bulgaria, Czech Republic, Latvia, Romania, Slovakia. It appears that FDI into China has diverted market-seeking FDI in the cases of Austria, Ireland, Luxembourg, and the United Kingdom.

In the case of vertical FDI, FDI into China has been complementary or not significantly related to FDI into EU15 countries with the exception of Portugal and Spain. Clearly, FDI into China has diverted efficiency-seeking FDI from Bulgaria, Czech Republic, Estonia, Romania, Slovakia and Cyprus.

Table 5: The impact of FDI into China on FDI in other countries

	FDI	Horizontal FDI	Vertical FDI
Ln MP _{it}	0.406*** (0.045)	0.417*** (0.056)	0.417*** (0.056)
Abs diff GDP per capita i,j	-0.009 (0.027)	-0.201*** (0.045)	-0.201*** (0.045)
INST _{it}	0.298 (0.293)	0.065 (0.291)	0.065 (0.291)
Austria	0.063 (0.108)	-0.075*** (0.026)	0.207*** (0.076)
Belgium	0.431*** (0.051)	0.002 (0.012)	0.040 (0.037)
Denmark	0.290*** (0.055)	-0.003 (0.012)	0.035 (0.031)
Finland	0.248*** (0.055)	-0.006 (0.008)	0.036* (0.019)
France	0.488*** (0.038)	-0.002 (0.004)	0.062*** (0.011)
Germany	0.491*** (0.037)	0.002 (0.004)	0.050*** (0.010)
Greece	0.252*** (0.055)	0.022 (0.029)	-0.026 (0.061)
Ireland	0.526*** (0.034)	-0.015** (0.007)	0.093*** (0.015)
Italy	0.470*** (0.037)	0.031*** (0.010)	-0.028 (0.025)
Luxembourg	0.441*** (0.057)	-0.099*** (0.028)	0.265*** (0.061)
The Netherlands	0.565*** (0.034)	-0.006 (0.004)	0.083*** (0.009)
Portugal	0.417*** (0.041)	0.064*** (0.018)	-0.098** (0.039)
Spain	0.495*** (0.035)	0.064*** (0.017)	-0.093** (0.037)
Sweden	0.459*** (0.043)	0.037*** (0.013)	-0.043 (0.032)
United Kingdom	0.555*** (0.034)	-0.011** (0.005)	0.093*** (0.013)
Bulgaria	-0.191*** (0.068)	0.152 *** (0.055)	-0.336*** (0.114)
Czech Republic	0.299*** (0.048)	0.056** (0.023)	-0.091* (0.049)
Estonia	-0.370*** (0.091)	0.172*** (0.054)	-0.399*** (0.113)
Hungary	0.390*** (0.044)	-0.012 (0.023)	0.064 (0.047)
Latvia	-0.444*** (0.100)	0.090* (0.046)	-0.233 (0.097)
Lithuania	-0.411*** (0.106)	0.034 (0.056)	-0.116 (0.117)
Poland	0.390*** (0.042)	0.024 (0.017)	-0.012 (0.036)
Romania	0.105* (0.055)	0.084** (0.035)	-0.162** (0.070)
Slovakia	0.100 (0.064)	0.181*** (0.037)	-0.374*** (0.076)
Slovenia	-0.111 (0.087)	-0.017 (0.062)	0.021 (0.137)
United States	0.600*** (0.031)	0.031*** (0.008)	-0.010 (0.017)
Switzerland	0.499*** (0.036)	0.008 (0.006)	0.035** (0.014)
Russia	0.342*** (0.049)	0.099* (0.059)	-0.168 (0.121)
Mexico	0.544*** (0.039)	0.059*** (0.022)	-0.655 (0.044)
Malta	-0.288*** (0.105)	-0.104 (0.103)	0.185 (0.220)
Japan	0.443*** (0.047)	0.078*** (0.013)	-0.124*** (0.029)
India	0.330*** (0.048)	0.088 (0.145)	-0.139 (0.117)
Cyprus	0.304 (0.193)	0.478* (0.251)	-0.938** (0.464)
Brazil	0.576*** (0.037)	0.093*** (0.035)	-0.124* (0.067)
Home country fixed effects	F(20,4126)=12.23 Prob>F=0.000		
H ₀ : Equal slope coefficients across countries	F(33,4126)=16.56 Prob>F=0.000	F(33,4092)=7.01 Prob>F=0.000	F(33,4092)=8.11 Prob>F=0.000
Time specific fixed effects	F(13,4126)=8.26 Prob>F=0.000	F(13,4092)=8.45 Prob>F=0.000	F(13,4120)=7.81 Prob>F=0.000
Obs.	4197	4197	4197
R ²	0.7231	0.7428	0.7428

Robust standard errors in parenthesis. ***, **, * indicates significance at 1%, 5%, and 10%, respectively

6. Concluding Remarks

In this paper we analyse the effects of FDI into China originating in OECD countries on FDI into EU and other countries. In particular, we estimate an augmented gravity model using a panel of cross-country annual data over the period 1990-2004. We first examine determinants of bilateral FDI flows and the impact of FDI into China on FDI into other countries. Second, we investigate whether and to what extent FDI flows into China have occurred at the expense of FDI into European Union countries. We distinguish between the EU countries prior to the enlargements of 2004 and 2007 (EU15) and the new EU member states from Central and Eastern European (CEE) countries. Third, we estimate the spillover effects from FDI into China on horizontal and vertical FDI into other countries. Finally, we identify country-specific spillover effects from FDI into China.

Our results suggest that FDI outflows from OECD countries take place mainly among countries with similar size and factor endowments, proxied by differences in GDP per capita between home and host countries, and with high levels of institutional quality. These results are in line with the theory of multinational enterprise and consistent with previous empirical studies.

We provide empirical evidence showing that on average, *ceteris paribus*, FDI inflows into China are complementary to FDI inflows into other countries. However, while this complementarity is true for EU15 countries, it appears that FDI inflows into China originating in OECD countries have substituted FDI into CEE countries. This result suggests that the advantage of these latter countries related to their proximity to FDI source countries is not sufficient to offset the attractiveness of China as a FDI destination.

Our results also indicate that this FDI diversion effect on CEE countries has persisted and strengthened over the analysed period. The impact of FDI inflows into China on FDI into EU15 countries has been positive and significantly different from zero over the period 1990-1999 and it has become not significantly different from zero in recent years.

The large FDI into China has encouraged both horizontal and vertical FDI into the other countries included in our sample. In the case of EU15, the FDI complementarity

has been higher in comparison to non-EU host countries in the case of vertical FDI and it has been lower in the case of horizontal FDI. In comparison to other non-EU host countries, CEE countries have benefited less from this FDI complementarity. Overall, our results indicate that complementarity between FDI into China and FDI into other countries has been higher in vertical FDI in comparison to horizontal FDI. These results have been more or less constant since 1995 onwards.

We examined the country-specific spillover effects from FDI into China and found that FDI into China have diverted FDI from very small EU economies such as Bulgaria, Estonia, Latvia, Lithuania and Malta. This FDI diversion appears in the case of vertical FDI. We also found evidence on diversion in vertical FDI in other EU countries such as Portugal and Spain, but this substitution effect is offset by a strong complementarity in horizontal FDI.

In summary, our research results suggest that FDI inflows into China and FDI inflows into the majority of EU countries are complementary. However, it appears that small economies such as Bulgaria, the Baltic countries and Malta which compete with China for efficiency-seeking FDI have been affected by the surge of FDI inflows into China. To the extent that these countries will catch up, their economic size will increase and it is likely that they will attract more market-seeking FDI and less efficiency-seeking FDI.

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Appendix

Table A1: Definitions and Data Sources of Variables

Variable	Definition and source
FDI_{ijt}	Aggregate foreign direct investment outflows from source country i to host country j at time t . Data come from the OECD <i>International Direct Investment Statistics Yearbook</i>
$GDP_{i(j)t}$	Gross domestic product in USD in country i (j) at time t , constant 2000 prices. World Bank, <i>World Development indicators</i> .
$GDPCAP_{i(j)t}$	Per capita gross domestic product in USD in country i (j) at time t , constant 2000 prices. World Bank, <i>World Development indicators</i> .
$INST_{jt}$	Quality of institutions in country j at time t . The mean value of three indicators: “corruption”, “law and order”, and “bureaucracy quality”; the index ranges from 0 (lowest) to 1 (highest)lowest risk). Data source: the International Country Risk Guide (ICRG)
$DIST_{ij}$	Great circle distance between home country i and host country j . CEPII database
α_i, β_j	Source and host country dummy variables
τ_t	Time dummy variables
$FDICN_{it}$	Aggregate bilateral foreign direct investment outflows from source country i to China at time t . Data come from the OECD <i>International Direct Investment Statistics Yearbook</i> ,
$DISTCN_i$	Great circle distances between source country i and China. CEPII database
$GDPCN_t$	Gross domestic product in USD in China at time t , constant 2000 prices. World Bank, <i>World Development indicators</i> .

Table A2: Determinants of FDI to China
(Estimates from first stage IV regression)

$\text{Ln MP}_{i,\text{CN},t}$	-4.862***	(0.389)
$\text{Ln } \text{GDPCAP}_{it} - \text{GDPCAP}_{\text{CN},t} $	7.622***	(0.379)
Ln MP_{ijt}	0.027	(0.017)
$\text{Ln } \text{GDPCAP}_{it} - \text{GDPCAP}_{jt} $	0.007	(0.009)
INST_{jt}	-0.046	(0.212)
Home country fixed effects	$\chi^2(18)=740.34$ Prob > $\chi^2 = 0.000$	
Host country fixed effects	$\chi^2(32)=1703.84$ Prob > $\chi^2 = 0.000$	
Time specific fixed effects	$\chi^2(12)=133.26$ Prob > $\chi^2 = 0.000$	
Obs.	4197	
Centered R^2	0.93	
Uncentered R^2	0.98	

Robust standard errors in parenthesis.

*** indicates significance at 1%.

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