

The relationship between foreign direct investment and international trade

A Panel data analysis for the major OECD countries

by

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Las relaciones entre inversión extranjera directa y comercio internacional :

Un análisis de datos de panel para los principales países de la OCDE

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Abstract

This paper explores the impact of FDI (inward and outward) on trade (imports and exports) using panel time series (2005-2020) data for 38 OECD countries. Our empirical results show that that when a country receives \$1 million in FDI more than it invests, exports increase by \$0.405 million. In contrast, when a country invests \$1 million in FDI and receives no FDI, its exports decrease by \$0.324 million. The inward FDI (i.e., host country) increased imports when it combined with outward FDI. When a country receives \$1 million in FDI, imports increase by \$0.231 million. The impact of outward FDI is negative but insignificant.

Key words: FDI, inward, outward, exports, imports

Resumen

Este trabajo explora el impacto de la IED (entrante y saliente) en el comercio (importaciones y exportaciones) utilizando datos de series temporales de panel (2005-2020) para 38 países de la OCDE. Nuestros resultados empíricos muestran que cuando un país recibe 1 millón de dólares de IED más de lo que invierte, las exportaciones aumentan en 0,405 millones de dólares. Por el contrario, cuando un país invierte 1 millón de dólares en IED y no recibe IED, sus exportaciones disminuyen en 0,324 millones de dólares. La IED entrante (es decir, el país anfitrión) aumenta las importaciones cuando se combina con la IED saliente. Cuando un país recibe 1 millón de dólares en IED, las importaciones aumentan en 0,231 millones de dólares. El impacto de las salidas de IED es negativo pero insignificante.

Palabras clave: IED, entradas, salidas, exportaciones, importaciones

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1. Introduction

In recent decades, the world economy has become more integrated. The relationship between international trade and foreign direct investment (FDI) is a result of this increased globalization. The aim of the present study is to empirically investigate the relationship between FDI (inward and outward) and trade (exports and imports) in OECD area.

An increasing outward FDI improve the access for the external resources and markets, for which increases the foreign affiliates' employment and financial transfers to the local economy. Attracting FDI and reducing imports are in focus of decision makers in the host countries. In fact, inward FDI augmentation increase local production and improve the macroeconomic indicators, such as unemployment. Therefore, the nature of the relationship of the two variables is very essential for policymakers.

The relationship between FDI and trade is complex since there are several aspects that must be taken into account. The nature of the relationship is controversially discussed in the literature, if the theory strongly supports the *substitution* hypothesis, the *complementary* case is supported by much empirical research.

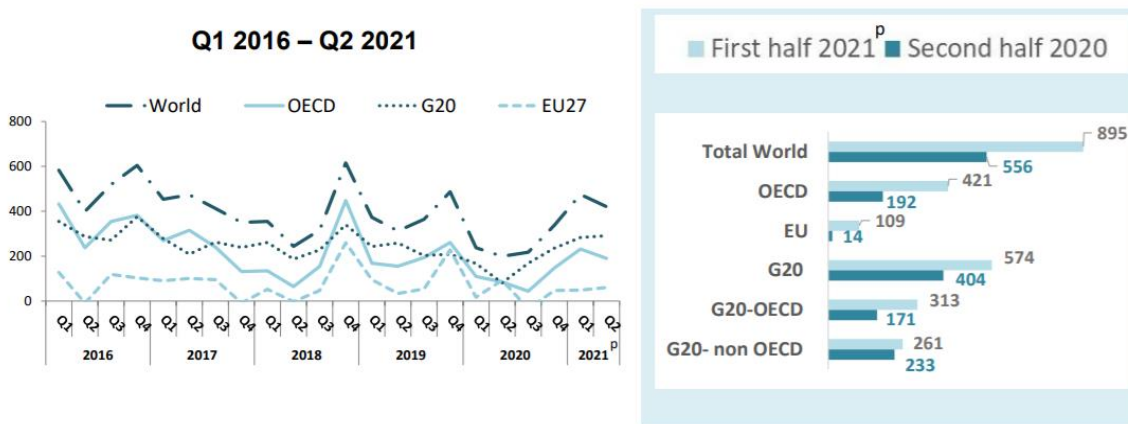
The present research contributes to the existing literature in the following ways. First, it considers a nation as the unit for analysis and uses data on aggregate FDI inflows into a country from the rest of the world and aggregate FDI outflows from a country to the rest of the world. Second, this study concentrates on developed OECD countries as inward/outward FDI might be an important engine to their economic growth and they are the major sources and recipients of FDI. This complements the majority of existing studies on developing countries. Furthermore, many empirical studies pool both developed countries and developing countries into one sample and do not distinguish them in their analysis. Blonigen and Wang (2005) argue that FDI plays a different role in developed countries compared to developing countries such that pooling developed and developing countries in an empirical analysis leads to incorrect inferences.

The remainder of the study proceeds as follows. Section 2 provides some information about the development of FDI inflows and outflows in the OECD countries. Section 3 presents the relevant literature. Section 4 describes the data and the methodology of this study. Section 5 provides the empirical results of this study and section 6 draws some conclusions.

2. Recent development of FDI inflows and outflows in the OECD area

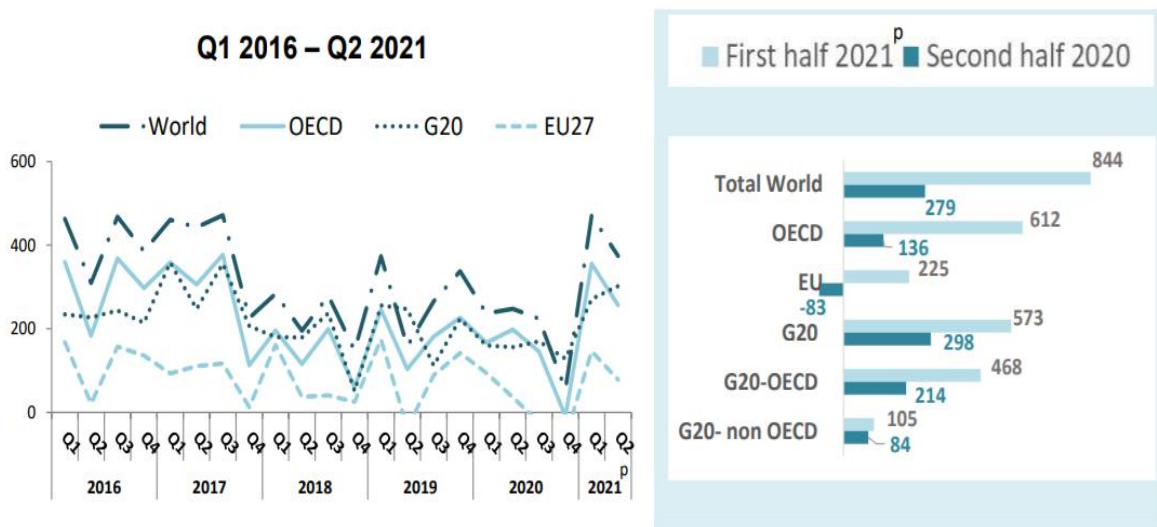
According to the latest OECD figure (Oct. 2021). In the OECD area, FDI inflows more than doubled to USD 421 billion in the first half of 2021, as a result of significant growth in the vast majority of OECD countries (Figure 1). At the same period, China was the largest recipient of FDI in the world, followed by the United States and the United Kingdom. The United States and the United Kingdom recorded increases of more than USD 20 billion. Rebounds from large negative inflows in some EU countries in the second half of 2020 also contributed to the overall increase. In contrast, FDI inflows decreased by more than USD 20 billion in Belgium. While increases in the United States can be attributed to higher reinvested earnings, the rebound in the United Kingdom reflects higher equity inflows, partly driven by large M&A transactions. FDI flows into EU27 countries surged from extremely low levels recorded in the second half of 2020, influenced by disinvestments in Italy, the Netherlands and other selected EU countries. FDI inflows to G20 economies increased by 42% in H1 2021 compared to the previous half-year. They were up by 83% in OECD G20 economies and 12% in non-OECD G20 economies. The increases were common to all non-OECD G20 countries except India, where FDI inflows were only half their record level of equity flows in the third quarter, the latter driven by large deals such as Facebook Inc.'s acquisition of Indian wireless telecom company Jio Platforms and Unilever's merger with GSK, an Indian pharmaceutical manufacturer.

Figure 1: FDI inflows for selected areas, Q1 2016-Q2 2021 (USD billion)



Compared to the last half of 2020, FDI outflows from the OECD area increased four-fold to USD 612 billion (Figure 4). In the first half of 2021, the United States was by far the major source of FDI worldwide, followed by Japan and Germany (Figure 2). Increases in the Netherlands, which recorded major disinvestments in the last part of 2020, as well as higher outflows from the United States (USD 231 bn), Germany (USD 63 bn) and Japan (USD 88 bn) contributed to this positive outlook for outward FDI flows. However, partly offsetting this expansion were decreases (of more than USD 10 bn) from Switzerland, Australia and Luxembourg. EU27 outflows switched from very negative levels in the second half of 2020, due to large disinvestments in the Netherlands and Ireland, to positive levels. FDI outflows from G20 economies went up by 92%; while they more than doubled in OECD G20 economies, they increased by nearly a quarter in non-OECD G20 economies, led by larger outbound FDI flows from Russia, Brazil and India.

Figure 2: FDI outflows from selected areas, Q1 2016-Q2 2021 (USD billion)



Notes: p: preliminary estimates.

Source: OECD International Direct Investment Statistics database.

3. Literature review

The relationship between these two variables is complex and it is difficult to develop a widely acceptable theoretical argument about it (Fontagne, 1999).

The trade and FDI nexus is examined both by the theories of the international trade (macro-level) and by those of the multinational firms (micro-level). The common question in these theories is whether international trade and FDI act as complements or substitutes in the delivery of goods across borders (according to the study of Bhasin & Paul (2016) and the literature surveys done by Falk, M., & Hake, M. (2008) and Paul & Feliciano-Cestero, M. M. (2021). The answers to this question vary widely.

The substitution effect is traditionally emphasized by international trade theory. Several studies indicate that the substitution effect prevails over complementarity when countries are similar in terms of size, technology and factor endowments (Markusen, 1984; Markusen and Venables, 1999; Türkcan, 2007). In contrast, the study of Ahmed et al. (2016) reveals that the complementary effects of outward FDI on exports of the home country outweigh the substitution effects and inward FDI are also important factors for progressive home country exports. In addition, the findings of Tham et al. (2018) show that both inward and outward FDI are complementary to bilateral export trade.

The theory of multinational companies shows that through direct investments, these companies exploit natural resources that are not available in the home country. These investments are then more likely to create trade, by raising exports of capital equipment and factor services from the home country and exports of resource-based products from the host economy. Therefore, the trade and FDI are considered alternative means for entering foreign markets, underlying their complementarity (Helpman, 1984; Clausing, 2000).

The new trade theory reveals that, depending on the circumstances, the FDI can have both a substitution, as well as a complementarity effect on trade. For example, relying on the trade theory, Markusen (1997) and Carr et al. (2001) admit the complementarity, as well as the substitution, between FDI and trade. Based on the theory of firms' location, Pontes (2004), Africano, and Magalhães (2005) show that the complementarity between trade and FDI is normally found when foreign investments are vertical, meaning that the multinational companies split the production process across countries in order to reduce costs. At the same time, FDI substitutes trade when investments are horizontal.

Alternatively, the impact of FDI on international trade can be analyzed from the perspective of the home or of the host country, but also from the point of view of the inward and outward FDI (Table 1).

- From the point of view of the home country, FDI is seen as substitute for trade, as exports are replaced by local sales on foreign markets, particularly in the form of final goods.
- For the host countries, the relationship between FDI and trade can be considered symmetrical to that of the investing country.
- At the same time, we can distinguish between the influence of the inward and outward FDI on trade, which needs not to be symmetrical. Therefore, Fontagné (1999) underlines four situations:
 - i) Inward FDI influences exports if foreign firms locate in the host economy to export back home, or provide products/services in a regional market.
 - ii) Outward FDI influences exports owing to enhanced competitiveness on foreign markets or reduces exports if the opposite applies.
 - iii) Inward FDI influences imports owing to enhanced competitiveness of foreign firms on the domestic market, but they may give rise to exports when the host country gains competitiveness.
 - iv) Outward FDI influences imports in the case of backward vertical integration and/or relocation of labour-intensive activities abroad, from a capital-intensive country.

The empirical literature can be divided according to the level of aggregation studied. Therefore, it can be arranged into country-level studies, industry-level studies, firm-level studies, and product-level studies (Falk, M., & Hake, M., 2008). Empirical results are mixed, with the majority of studies showing evidence of a positive relationship between outward FDI and exports. In general, if the empirical literature asserts a substitutive relation, exports are at least partially displaced by local sales at the foreign market and it could be detrimental to the production and employment in the investor's country. However, if outward FDI and exports have a complementary link, investing abroad benefits the home country's exports.

The question of the relationship between FDI and trade is also analyzed by considering different destination countries or regions (Fontagné and Pajot, 1997). Some studies on the relationship between FDI and exports from developed to developing countries show that they are complementary. Moreover, the same relationship is found to be substitutive between developed countries. The net empirical result, however, shows, to a large extent, a complementary relationship rather than a substitution effect.

Table 1 : Studies on the relationship between outward and inward FDI and international trade [this table is extracted from Paul & Feliciano-Cestero, M. M. (2021)]

	Authors	Methodology/empirical settings	Main arguments/findings
Outward FDI	Kolstad and Wiig (2012)	Economic analysis of host-country determinants of Chinese OFDI (2003–2006).	Chinese OFDI is attracted to large markets.
	Ramasamy, Yeung, and Laforet (2012)	Using Malaysian data on OFDI, imports, and exports (Hausman–Taylor estimation method).	OFDI and trade linkages are not significant, as OFDI is dominated by the services sector.
	Kang and Jiang (2012)	Panel data of Chinese OFDI to eight Asian countries (13 years).	Institutional and economic factors influence the FDI location choices of Chinese MNEs.
	Stoian (2013)	Estimating home-country determinants of OFDI from 20 post-Communist, Central and Eastern European countries using Dunning’s investment development path (IDP) model.	Competition policy and institutional reforms play a crucial role in OFDI from emerging countries.
	Wei, Zheng, Liu, and Lu (2014)	Multi-dimensional analysis using survey data of Chinese private firms.	Productivity, capability, export experience, entry barriers, and national and sub-national institutions affect OFDI decisions, in comparison to exporting.
	Ali et al. (2018)	Using a nonlinear autoregressive distributive lag model, the asymmetric shortrun effects of positive and negative OFDI movements on economic growth in China was captured.	The emergence of China as a leading source of OFDI has an important implication in the economic development of this country.

Inward FDI	Lee and Rugman (2012)	Using data on Korean MNEs, they show the relationship between IFDI and MNE performance.	IFDI impacts two types of FSAs: innovation capability and marketing capability.
	Liu, Daly, and Varua (2014)	Data on FDI inflows across the four regions of China in low- and high-tech manufacturing sectors.	1. FDI inflows to China have been complementary to FDI flows to other countries. 2. The manufacturing sector attracts a maximum of FDI inflows into China. Market size, labor cost, and labor quality are the major determinants of FDI inflows. FDI has moved mainly to high-tech sectors from low-tech activities.
	Goh and Tham (2013)	Using the gravity model (Hausman–Taylor estimation method), between export and import, and inward and OFDI in Malaysia.	IFDI conforms to the observed pattern of a complementary relationship between FDI and trade.
	Villaverde and Maza (2012)	Factor analysis to list the main determinants of FDI in Spain.	Economic potential, labor conditions, and competitiveness are important for attracting FDI both at an aggregate and sectoral level.
	Gao, Liu, and Zou (2013)	Conditional Logit model of Japanese FDI location in China using a sample of 8646 Japanese FDI in China	How within-country differences, of historical factors, affect FDI location decisions and performance
	Delevic and Heim (2017)	A correlation-regression equation was used to illustrate the relationship between FDI inflows and its determinants.	Reaffirmation of the relevance of institutions for FDI and the substantial improvement of governance indicators do not describe the EU integration process (i.e., Brexit).

4. Methodology and Data

a. Methodology

The methodology used in this study is inspired from the transformed versions based on the gravity equation and referring to the econometric models of Magalhaes and Africano (2007), Zhang and Li (2007), Zhang and Song (2000). Because some data are missing, the panel regression technique can provide economic analyses when incomplete data are used. The reasons behind choosing the panel data approach are as follows (Baltagi, 2005):

- Panel data show heterogeneity across countries.
- Panel data contain many more observations than either time series or cross-sectional data as panel observations are bi-dimensional (Time and individual), which not only increases the degree of freedom and efficiency but also implies less collinearity among the variables.
- Parameters can be estimated even if the time series is too short or if cross-sectional data are limited.

The most commonly used method for panel data is the OLS method (Feliciano-Cestero, M. M., 2021) which ignores differences between individual dimensions and time. However, in some cases, the number of estimated parameters may be greater than the number of observed parameters, making it impossible to estimate the model.

To overcome this problem, one can make different assumptions about the variability of the coefficients and the characteristics of the error terms, which requires the use of different models. The specification of these models can be with a fixed effect or a random effect (Pazarlioglu and Gurler, 2007). A set of statistical tests that must be done to select among these models.

- F test will be used to choose between Fixed effect model and Pooled effect model i.e., to test if there is fixed effects in data.
- Breusch and Pagan Lagrangian Multiplier Test (LM test) is used to test for random effects.
- Hausman test (H test) is used to choose between Fixed effect model and Random effect model.

The study explores several aspects of the relationship between FDI and foreign trade in the OECD area. For the export side: First, we test whether FDI improves the competitiveness of the host country. Therefore, we test the relationship between outward FDI and exports. Second, we look for the "export feedback effect" and test the relationship between inward FDI and exports. Then, we test the both impacts of FDI (net effect) on exports. For the import side: we first test whether FDI is accompanied by an increasing volume of factors from the investing countries, factors that support the production process. These factors are expected to increase the competitiveness of foreign firms in the domestic market. Therefore, we test the relationship between inward FDI and imports. Then, we analyze upstream vertical integration and offshoring of labor-intensive activities abroad. We thus analyze the impact of outward FDI on imports. Finally, we look for the both impacts of inward and outward FDI on the imports.

In order to eliminate the problem of unobserved variables and to overcome the lack of control for the heterogeneous trading relationships, we start by estimating a panel with fixed effects as follows:

$$Export_{it} = \beta_0 + \beta_1 FDI_Inward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (1a)$$

$$Export_{it} = \beta_0 + \beta_1 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (2a)$$

$$Export_{it} = \beta_0 + \beta_1 FDI_Intward_{it} + \beta_2 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (3a)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Intward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (4a)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (5a)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Intward_{it} + \beta_2 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \varepsilon_{it} \quad (6a)$$

where:

$Export_{it}$ and $Import_{it}$ denote the exports and the imports of goods respectively;

$FDI_Outward_{it}$ and FDI_Inward_{it} are the outward and the inward FDI;

X_{it} represents the set of control variables;

β_0 is the intercept;

α_i represents all the stable characteristics of countries;

ε_{it} are the errors of the model.

However, this method does not control for all stable covariates (Allison and Waterman, 2002). Therefore, we also test a random model and we compare the fixed and random effects models based on the Hausman test.

$$Export_{it} = \beta_0 + \beta_1 FDI_Inward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (1b)$$

$$Export_{it} = \beta_0 + \beta_1 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (2b)$$

$$Export_{it} = \beta_0 + \beta_1 FDI_Intward_{it} + \beta_2 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (3b)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (4b)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Inward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (5b)$$

$$Import_{it} = \beta_0 + \beta_1 FDI_Intward_{it} + \beta_2 FDI_Outward_{it} + \beta_2 X_{it} + \alpha_i + \mu_{it} + \varepsilon_{it} \quad (6b)$$

where: μ_{it} represents between-entity errors; ε_{it} are the within-entity errors of the model.

The two main dependent variables are ***Export*** and ***Import*** which represent exports and imports of goods. While, two main explanatory variables are ***Inward and Outward FDI*** which denote the cumulative investments flow or the stock of FDI as used by (Fontagné and Pajot, 1999; Kutan and Vukšić, 2007; Fillat-Castejón et al., 2008; Chiappini, 2013). The use of FDI stocks is in general preferred due to smaller variations in data (FDI flows are extremely volatiles, especially in crisis periods) and especially due to the fact that the influence of FDI on trade is not instantaneous. Some others studies are focused on FDI flows (Zarotiadis and Mylonidis, 2005; Aydin, 2010).

The control variables used are:

1. The ***GDP***, which denotes the Gross domestic product, expressed in constant USD PPS. We use this variable to measure the economic size. We expect that the GDP will have positive effect on trade.
2. ***Wage¹*** represents the average annual wages per full-time and full-year equivalent employee in the total economy. By relocating their production abroad, multinational firms seek to produce at lower cost. Shaukat and Wei (2005) consider production costs as one of the determinants of FDI, and especially labor costs, which have been emphasized in FDI studies. A cheap and skilled labor force is a catalyst to attract FDI. Therefore, we expect a negative sign of labor cost for exports and a positive sign for imports.
3. ***Exchange*** represents the nominal effective exchange rate (NEER). The nominal exchange rate is the amount of domestic currency needed to purchase foreign currency. An increase in NEER reflects an appreciation of local currency relatively to the foreign currencies. That means local product will be relatively more expensive, which decreasing exports volumes. The effect of NEER is expected to be negative. However, the appreciation will promote purchasing power and the cost of production of a country *i*. The imports may be more attractive than produce locally. Then a positive effect of NEER on imports.

b. Data description

The effect of FDI (both outward and inward) on foreign trade is analyzed for a selected 38 OECD countries (table.2).

The annual data for the exports and imports are extracted form UNCATD database while the FDI statistics are extracted from the OECD database. The data extracted cover the period 2005-2020. The values for inward FDI, outward FDI, exports and imports are expressed in US dollars and natural logarithm. The log transformation is applied in order to use elasticity and harmonise the data and coefficients. The choice of the countries and variables included in our models as well as of the time period examined is made taking into consideration the availability of data.

¹ Average annual wages per full-time equivalent dependent employee are obtained by dividing the national-accounts-based total wage bill by the average number of employees in the total economy, which is then multiplied by the ratio of average usual weekly hours per full-time employee to average usually weekly hours for all employees.

Table 2: The OECD's selected countries

1	Australia	14	Greece	27	New Zealand
2	Austria	15	Hungary	28	Norway
3	Belgium	16	Iceland	29	Poland
4	Canada	17	Ireland	30	Portugal
5	Chile	18	Israel	31	Slovak Republic
6	Colombia	19	Italy	32	Slovenia
7	Costa Rica	20	Japan	33	Spain
8	Czech Republic	21	Korea	34	Sweden
9	Denmark	22	Latvia	35	Switzerland
10	Estonia	23	Lithuania	36	Turkey
11	Finland	24	Luxembourg	37	United Kingdom
12	France	25	Mexico	38	United States
13	Germany	26	Netherlands		

Table 3 presents some descriptive statistics of all the variables that have been used in this study in levels and with log transformation.

To gain some insight into the relationship between trade and FDI, we explore the Granger-causality relationships between exports/imports and outward FDI/inward FDI, in a bivariate setting.

We summarize the results in table 4. We find that both variables of FDI cause the trade variables (imports and exports).

Table 3: Descriptive statistics (in level and log transformation)

	Levels					Log-transformation			
	Obs	Mean	Std. Dev	Min	Max	Mean	Std. Dev	Min	Max
Export	607	5,9E+05	1,5E+06	4,1E+03	9,9E+06	12,00	14,97	83,21	16,11
Import	607	4,6E+05	1,1E+06	4,5E+03	1,0E+07	11,88	14,16	84,19	1,61
FDI_Inward	592	4,6E+05	9,7E+05	4,7E+03	1,1E+07	12,03	14,56	84,53	1,62
FDI_outward	592	5,3E+05	1,0E+06	2,8E+02	8,1E+06	11,59	21,09	56,38	15,91
GDP	608	1,2E+09	2,5E+09	1,4E+03	2,0E+10	1,93	24,01	95,08	23,72
Wage	525	3,7E+14	1,8E+14	6,5E+11	7,3E+14	33,27	10,00	27,20	34,22
Exchange	608	113,22	413,84	1,0E-06	3694,85	0,76	3,35	-13,82	8,21

Table 4: The Granger-causality test results

Juodis, Karavias and Sarafidis (2021) Granger non-causality test results	Wald test	p-value
H0: FDI_outward does not Granger-cause ln_import. H1: FDI_outward does Granger-cause ln_import for at least one panelvar.	8,787	0,003
H0: FDI_inward does not Granger-cause ln_import. H1: FDI_inward does Granger-cause ln_import for at least one panelvar.	13,896	0,000
H0: FDI_outward does not Granger-cause ln_export. H1: FDI_outward does Granger-cause ln_export for at least one panelvar.	5,524	0,019
H0: FDI_inward does not Granger-cause ln_export. H1: FDI_inward does Granger-cause ln_export for at least one panelvar.	6,714	0,035

5. Empirical results

To avoid errors resulting from pseudo-regression problems, it is necessary to first check the stationarity of each variable concerned. Several panel unit root tests are used to test stationarity in the literature. The most widely used panel unit root tests are those developed by Im, Pesaran and Shin (IPS) and Levin, Li and Chu (LLC). In this study, the IPS test derived from Dickey- Fuller (1979) unit root tests is used. The null hypothesis is that $\rho = 0$ in the model $\Delta y_{it} = \beta_0 + \beta_1 Trend + \rho y_{it-1} + \varepsilon_{it}$, where β_0 is the fixed term, β_1 trend parameter and ρ autoregressive parameter. The trend and the constant terms are not required in all models. The null hypothesis H_0 indicates that the series have a unit root, while the alternative hypothesis H_1 indicates that the series have a unit root for some individual i . The results of the IPS test for all series used in this study are shown in table 5. As we can see, all variables are stationary in levels with log transformation. All our estimates are made using the Stata software. The associated code is reported in the appendix.

Table 5: Panel Unit Root Test Results

	IPS test	p_value	Status
Export	-7,278	0,000	I(0)
Import	-15,217	0,000	I(0)
FDI_Inward	-1,868	0,031	I(0)
FDI_Outward	-3,065	0,001	I(0)
GDP	-3,577	0,000	I(0)
Wage	-37,493	0,000	I(0)
Exchange	-2,904	0,002	I(0)

Note: Im-Pesaran-Shin unit-root test for: H_0 : All panels contain unit roots; H_1 : Some panels are stationary

As we discussed before; we start by estimating a fixed effects mode to control for unobserved heterogeneity between the different country-pairs in our sample. We assume that the Fixed effect is the most suitable estimation method for our research. However, we conduct the Hausman test to confirm this argument.

Tables 6 presents the results of our main specifications. For all estimated equations, The Hausman test displayed a p-value equal to 0.0001 which indicates that we should reject the null hypothesis that a random effects model is more appropriate for our panel data and thus we should implement a fixed effects estimation.

Impact of FDI on exports

The first analysis examined the effect of FDI on exports. According to this analysis, inward FDI (i.e., in the host country) increases exports. We find a positive but insignificant coefficient (column 1a). The Outward FDI (i.e., home country) decreases exports but again the effect is not significant (see column 2a). The effect becomes significant when we combine inward and outward FDI (column 3a). The results show that when a country receives \$1 million in FDI more than it invests, exports increase by \$0.405 million. In contrast, when a country invests \$1 million in FDI and receives no FDI, its exports decrease by \$0.324 million.

Impact of FDI on imports

Next, we examined the effect of FDI on imports. According to this analysis, inward FDI (i.e., host country) increased imports when it combined with outward FDI. When a country receives \$1 million in FDI, imports increase by \$0.231 million. The impact of outward FDI is negative but insignificant.

Table 6: Fixed Effects estimation results

Dep. var.	Exports			Imports		
	1a	2a	3a	4a	5a	6a
Eq.						
FDI_Inward	0,052		0,405 *	-0,054		0,231 *
FDI_Outward		-0,093	-0,324 **		-0,048	-0,289
GDP	0,018	0,016	0,019	0,016	0,016	0,223 **
Wage	0,021	0,025	0,024	0,015	0,016	
Exchange	-0,023	-0,018	-0,027	0,011	0,010	0,258 **
c	10,317 ***	11,933 ***	9,732 ***	11,699 ***	11,591 ***	11,923 ***
F test	19,77	19,71	19,92	23,80	23,45	23,40
p_value	0,00	0,00	0,00	0,00	0,00	0,00
LM test	9,83	1,30	97,66	27,85	15,76	815,48
p_value	0,00	0,00	0,00	0,00	0,00	0,00
Hausman test	85,68	171,27	26148,7	-27,61	-25,59	-26,41
p_value	0,00	0,00	0,00	0,00	0,00	0,00
Fixed vs Random	(fixed)	(fixed)	(fixed)	(fixed)	(fixed)	(fixed)
Obs.	509	509	509	509	509	509

Note: *, **, *** means significance at 10 %, 5 % et 1 %.

6. Discussion and Conclusion

The present paper examines the link between FDI and foreign trade by using a panel data approach. For that purpose, we use exports and imports and data on the outward and inward FDI stock for 38 OECD countries from 2005-2020.

The results provide strong evidence that the inward FDI causes exports and the outward FDI decrease exports. The results show that when a country receives \$1 million in FDI more than it invests, exports increase by \$0.405 million. In contrast, when a country invests \$1 million in FDI and receives no FDI, its exports decrease by \$0.324 million. On the other hand, the inward FDI (i.e., host country) increased imports when it combined with outward FDI suggesting when a country receives \$1 million in FDI, imports increase by \$0.231 million. The impact of outward FDI is negative but insignificant.

Inward FDI generates exports because subsidiaries of multinational firms set up in the host country in order to re-export to third countries or to the country of origin, especially in the case of relocation, which therefore leads to a positive correlation between inward FDI flows and exports. Moreover, outward FDI negatively affects imports because the competitiveness of foreign firms in the domestic market improves, as local firms no longer export. In addition, outward FDI could substitute domestic exports of final goods by exporting intermediate and capital goods to supply domestic subsidiaries producing

The inward FDI increases imports into the host country because subsidiaries of multinational firms have a strong propensity to import intermediate and capital goods as argued in the WTO report (1996)². In addition, the outward FDI by relocating activities abroad causes imports in the country of origin, in case of vertical integration.

Finally, the FDI could serve as an important vehicle for direct and indirect technology transfers that include scientific advances, organizational, managerial and marketing skills, and know-how. Technology transfers improve the skills of the workers of the foreign affiliate, workers who are likely

² WTO (1996) "Special Feature: Trade and Foreign Direct Investment" - Volume 1 - Annual Report of the World Trade Organization - Geneva, WTO Publication.

to be recruited later by local firms. Consequently, this improvement in competitiveness could have a positive effect on the ability of local firms to export.

The FDI could also strengthen the international specialization of the host country through the diffusion of the competitive advantages of multinational firms. It also increases the competitiveness of the home country since the internationalization of national firms allows them to better exploit their specific advantages at the international level.

Two main limitations of this work:

First: this is a macro-level study. Therefore, the effect of outward FDI on exports and imports is considered in terms of the country of origin. If a change in exports and imports occurs as capital moves abroad, this can be attributed to FDI by econometric methods. Similarly, the effect of inward FDI on exports and imports reflects host country conditions. However, a country can be both a capital exporter (i.e., outward FDI) and a capital importer (i.e., inward FDI). Further analyses should be applied to determine which capital flow has a larger effect on trade. Small-scale studies should be conducted to understand which types of capital flows have an effect on foreign trade.

Second, as Fontagne (1999) shows that trade may also cause FDI. Therefore, the estimated models do not address the endogeneity issue that may be between trade and FDI. The used of GMM method and instrumental variables may overcomes this problem.

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Appendix: Stata Code

```
///Declare data to be panel data///
xtset code_country year

///Summary statistics///
summarize export import Inward outward GDP av_an_w Ex_rate, separator(7)
summarize ln_export ln_import ln_Inward ln_outward ln_GDP ln_av_an_w
ln_Ex_rate,separator(7)

// install package xtgranger //
ssc install xtgranger

///Testing for Granger non-causality in heterogeneous panel data models, using the methodology
developed by Juodis, Karavias, and Sarafidis (2021)///
xtgranger ln_export ln_Inward, lags(1)
xtgranger ln_export ln_outward , lags(1)
xtgranger ln_import ln_Inward, lags(1)
xtgranger ln_import ln_outward , lags(1)

///Panel-data unit-root tests, Im-Pesaran-Shin test///
xtunitroot ips ln_export, lags(1)
xtunitroot ips ln_import, lags(1)
xtunitroot ips ln_Inward, lags(1)
xtunitroot ips ln_outward, lags(1)
xtunitroot ips ln_GDP, lags(1)
xtunitroot ips ln_av_an_w, lags(1)
xtunitroot ips ln_Ex_rate, demean lags(2)
```

```
///"estimation of fixed and random models "///  
///"Breusch and Pagan LM test for random effects and Hausman specification test"///  

```

```
///"equations 1a and 1b "///  

```

```
xtreg ln_export ln_Inward ln_GDP ln_av_an_w ln_Ex_rate, fe  
estimates store FE  
xtreg ln_export ln_Inward ln_GDP ln_av_an_w ln_Ex_rate, re  
xttest0  
estimates store RE  
hausman FE RE
```

```
///"equations 2a and 2b "///  

```

```
xtreg ln_export ln_outward ln_GDP ln_av_an_w ln_Ex_rate, fe  
estimates store FE  
xtreg ln_export ln_outward ln_GDP ln_av_an_w ln_Ex_rate, re  
xttest0  
estimates store RE  
hausman FE RE
```

```
///"equations 3a and 3b "///  

```

```
xtreg ln_export ln_Inward ln_outward ln_GDP ln_av_an_w ln_Ex_rate, fe  
estimates store FE  
xtreg ln_export ln_Inward ln_outward ln_GDP ln_av_an_w ln_Ex_rate, re  
xttest0  
estimates store RE  
hausman FE RE
```

```
///"equations 4a and 4b "///  

```

```
xtreg ln_import ln_Inward ln_GDP ln_av_an_w ln_Ex_rate, fe  
estimates store FE  
xtreg ln_import ln_Inward ln_GDP ln_av_an_w ln_Ex_rate, re
```

```
xttest0
estimates store RE
hausman FE RE

// "equations 5a and 5b" //
xtreg ln_import ln_outward ln_GDP ln_av_an_w ln_Ex_rate, fe
estimates store FE
xtreg ln_import ln_outward ln_GDP ln_av_an_w ln_Ex_rate, re
xttest0
estimates store RE
hausman FE RE

// "equations 6a and 6b" //
xtreg ln_import ln_Inward ln_outward ln_GDP ln_Ex_rate, fe
estimates store FE
xtreg ln_import ln_Inward ln_outward ln_GDP ln_Ex_rate, re
xttest0
estimates store RE
hausman FE RE
```