Research Article

FDI and Performance: An Investigation of EU Manufacturing Industries

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Abstract.
This paper investigates the impact of foreign direct investment (FDI) on the performance of companies in low- and high-technologically intensive industries in the manufacturing sector in EU member countries, using datasets covering the period between 2010 and 2020. The industries were selected according to the EU High-tech classification of manufacturing industries based on NACE Rev.2 at 2-digit codes. The performance of companies in our study was measured based on turnover. We used a set of independent variables, such as inward and outward FDI stocks, imports and exports of goods and services, gross domestic product (GDP) at market prices, real effective exchange rate, gross domestic expenditure on research and development, and gross fixed capital formation. On applying the panel data methodology, our findings indicated that inward FDI stocks, imports of goods and services, and real effective exchange rates have a significant impact on the performance of companies in high-technologically intensive industries. For low-tech companies, exports of goods and services are important driving factors behind their performance.

Keywords: high-tech industries, low-tech industries, foreign direct investment, performance, European Union

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1. Introduction

According to the definition, direct investment aims to obtain a long-term interest by a direct investor from one economy in a direct investment enterprise in another economy [1, 2]. That usually implies a long-term relationship between the two parties and a significant degree of influence over the latter's management. Furthermore, a direct investor is someone who owns ten per cent or more of a company's capital, advising that this proportion to be used as the main dividing line between direct and portfolio investment in the form of shareholdings [3].

Since the 1960s, the role of foreign direct investment (FDI) in generating growth has been debated, with proponents and detractors highlighting economic growth and development on the one hand, and the dangerous assumption of local governments' inability to utilize resources, on the other.

In terms of type, economic policies and business characteristics, nations have begun to feel the good effects of FDI in recent decades, leading to instances such as FDI motivation to enhance efficiency in high-value-added industrial production structures (as the case of Asian countries). FDI has proven to be better in terms of money and technology, frequently aiding local economic development.

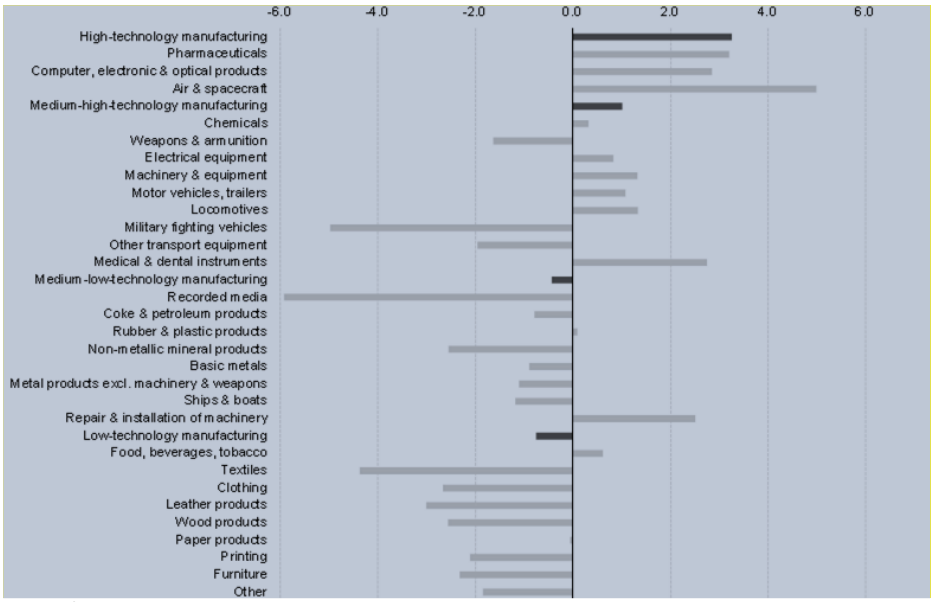
When it comes to company's performance, we first have to define what a company is. The company, according to the definition of neoclassical economics [4, 5, 6], represents a microeconomic concept that argues that a business exists and makes decisions to maximize profits by focusing on the determination of commodities, outputs, and income distribution on the market using supply and demand. Neoclassical theories additionally focused on large sectors and began to explore basic issues about why corporations chose to produce and what drives their capital allocation and labor decisions. Modern inquiries concern either short-term or long-term motivation, as lasting interest. Employment, turnover, profitability, productivity, innovation (R&D – Research and Development) are some of the often-used indicators when analyzing firm performance [7].

The European Union divides industries into four core categories based on their degree of technological intensity – relied on R&D expenditure per unit of value added – and divides them into high-technology, medium high-technology, medium low-technology, and low-technology industries [8]. The yearly average growth rates for the different technical manufacturing levels in the EU-27 are shown in Figure 1, along with a breakdown of the NACE (Nomenclature statistique des activités économiques dans la Communauté européenne) divisions and groups that these technological levels are made up of.

We remark that between 2005 and 2011, all components of high-tech manufacturing saw positive average growth rates. In terms of low-tech manufacturing, we notice that the growth in food, beverages, and tobacco products (which account for 47 percent of low-tech production) partially offset the high average reductions in other low-tech areas, particularly in textiles and clothing.

In light of this, our research proposes a new approach for the study of high-tech and low-tech industries, with the aim of determining the impact of foreign direct investment on the performance of companies in these industries.

The rest of the paper is structured as follows: the following section shows domain research direction and results in the existing literature. Section 3 focuses on data and authors research methodology, while the main findings discussion comes in section 4. The final part comprises conclusions, the research limitations and directions to investigate in future research.



Source: Eurostat [9].

Figure 1: Index of production, annual average growth rates 2005-2011, EU27, working day adjusted.

2. Literature Review

FDI analysis is based on a number of theoretical foundations that have been in place since the 1960s, when the notion of multinational company began to emerge and play an increasingly important role in the global economy [10].

An important argument for the existence of FDI is that if economies did not produce goods and services for which they have comparative advantages, they would leave room for trade in the case of other goods, transforming the two (trade and FDI) into substitutes or complements. Access to technology is hampered by market chaos while exchange rate variations were found to be a determinant of FDI [11].

Some studies look at both of these relationships: from performance to FDI and from FDI to performance. Borin and Mancini [12], for example, argue that there is a link between efficiency/productivity/performance and international participation. The authors looked at manufacturing companies and employed a panel of over 100,000 observations. To measure overall factor productivity, a Cobb-Douglas production function log was also employed. A simple linear regression for the variable performance (productivity, value added, turnover, profits) revealed that multinationals are three times larger than domestics in terms of turnover, owing to a higher intensity in the usage of intermediate products. The research also points out that multinationals have greater turnover growth rates after the first investment. Furthermore, their findings show that new multinational enterprises (MNEs) drive positive efficiency growth differentials in

specialized and high-tech sectors in advanced economies, but traditional sectors are the strongest.

In general, FDI is a composite bundle of capital stocks, knowledge (know-how), and technology [13], that influences output and boosts the value-added of FDI-related production in the receiving nation. The author discussed the most recent research on the influence of inbound FDI on development in developing nations.

Armutlulu et al. [14] improved FDI theory by presenting fresh data for recently industrialized economies in terms of external determinants that are quite distinct from those of developing-country enterprises (based on the experiences of developed countries investors engaging in outward investment). Typically, substantial degrees of economic and political risk are involved with this form of investment.

Bruno and Cipollina [15] focused on the impact of foreign direct investment on company performance, using quantitative research to run a regression and looking at the expanded EU. Their findings demonstrate that FDI has a limited positive indirect influence on productivity and growth, with the effect being higher for new EU (European Union) members. The closer a country's economy is to the global technological frontier, the more crucial innovation in terms of imitation or collaboration becomes.

Singh [16] investigated the influence of R&D intensity, royalty intensity, export intensity, import intensity, capital series, labor days, and gross value added on productivity of businesses in three Indian manufacturing industries using panel data technique. To choose which model to employ, the author uses the Hausman test, and finds that the random effects model is the best match for his study.

To test prediction in the theory of international commerce, Arnold and Hussinger [17] employed a representative sample of German manufacturing enterprises. German exporters outperform enterprises that exclusively service the local market, while German multinational corporations outperform both domestically oriented and exporting firms in Germany, according to the authors. It allows formalizing comparisons between subsets by constructing a ranking by transitivity and inferring that exporter businesses' efficiency dominates domestic firms, while FDI firms' distribution dominates both exporter and local enterprises.

When studying industry and country-based characteristics that explain their performance, Horobet et al. [18] presented a new approach for the analysis of high-tech vs low-tech industries. When it comes to business profitability and its determinants, the findings of a machine-learning-based Random forest regression revealed considerable variations in terms of both industry and country-related factors. The findings demonstrated that in higher-tech businesses, FDI intensity is more essential for profitability than

in lower-tech industries. The study adds to the body of knowledge on the problem, as there are currently too few articles on the subject that focus on specific locations such as Canada, Italy, and Germany.

3. Data and Research Methodology

Our paper's objective refers to the impact of foreign direct investment (FDI) on the performance of companies in low and high technologically intensive industries in the manufacturing sector in EU member countries. Two industries from the manufacturing sector have been selected, according to the EU High-tech classification of manufacturing industries based on NACE Rev.2 at 2-digit codes: high-tech – C26 (Manufacture of computer, electronic and optical products) and low-tech – C11 (Manufacture of beverages). Table 1 presents the description of these two selected industries taking into account two key indicators: number of enterprises and number of persons employed in 2018.

TABLE 1: Description of selected high-tech and low-tech industries, 2018.

	No. of enterprises (thousands)	Share in manufacturing sector No. of enterprises at EU level (%)	No. of persons employed (thousands)	Share in manufacturing sector No. of persons employed at EU level (%)
C11	29.0	1.43	420.7	1.41
C26	36.4	1.80	1 000.0	3.35

Source: Eurostat Database - Annual detailed enterprise statistics for industry(Available online at https://ec.europa.eu/eurostat/databrowser/view/SBS_NA_IND_R2__custom_2646271/default/table.).

The period covered is 2010-2020, excluding the years of the global financial crisis, but including the pandemic year. According to Sun et al. [19], who estimated the dynamic impact of the COVID-19 pandemic on global manufacturing industry, the low-tech manufacturing industries will suffer massive shocks in the short run, while some high-tech manufacturing sectors will see a growth trend.

Our sample, based on data availability from Eurostat and International Monetary Fund (IMF), includes 24 EU member countries. Malta and Estonia have been removed from our sample due to missing data for turnover (the dependent variable) for all years, while other countries have been kept even if for some years, we do not find available data. Also, Luxembourg has not been included in the sample regarding high-tech industry due to missing data for all the investigated years. In order to ensure accuracy of data, Cyprus was excluded from the whole sample. The problem is that global statistics on FDI

are blurred by offshore centers with enormous inward and outward investment positions [20]. Moreover, for statistical purposes, all variables were logged, except REER, which was collected as percentage change. Table 2 describes the set of variables used for our study.

Table 2: Data description.

Variable	Significance	Measurement	Data source
TURN	Turnover or gross premiums written	million euro	Eurostat
FDI_IN	Inward FDI stocks	million euro equivalent	IMF
FDI_OUT	Outward FDI stocks	million euro equivalent	IMF
IMP	Imports of goods and services	million euro	Eurostat
EXP	Exports of goods and services	million euro	Eurostat
GDP	Gross domestic product at market prices	current prices, million units of national currency	Eurostat
REER	Real effective exchange rate	percentage change (t/t-1)	Eurostat
RD	Gross domestic expenditure on research and development (R&D)	million units of national currency	Eurostat
GFCF	Gross fixed capital formation	current prices, million euro	Eurostat

In order to determine the impact of FDI on the performance of companies in low and high technologically intensive industries in the manufacturing sector in EU member countries, the panel data was used as econometric model. In the last twenty years, many empirical studies used the same methodology. For instance, Hunter and Isachenkova [21] investigated the failure of English industrial companies using this type of methodology. Later on, Lalinsky [22] explored the determinants of business competition using the same methodology. Another study belongs to Migliardo and Schiliro [23], who examined the profitability of medium-sized companies from Italy. More recently, Belascu [24] investigated FDI and economic growth in the CEE countries using this methodology.

Baltagi [25] states that “Panel data suggests that individuals, firms, states or countries are heterogeneous. Time-series and cross-section studies not controlling this heterogeneity run the risk of obtaining biased results”. Furthermore, this methodology is more competent when it comes to determine and measure effects that are not so simply detectable in pure cross-section or time-series data. On the top of that, panel data models provide more informative data, as well more variability, less collinearity among the explanatory variables and also, more degrees of freedom for the purpose of producing more efficiency. Last but not least, this type of methods permits us to establish and evaluate more difficult behavioral models than purely cross-section or time-series data.

The panel equations parameters were estimated using EViews 10. Three types of panel models were applied: panel with no effects, panel with fixed effects in the cross-section dimension and panel with random effects. The first type is a highly restrictive specification that avoids the possible presence of some differences in the coefficients between countries or time. The intercept α is allowed to vary depending on the country in the cross-section fixed effects model. Thus, the heterogeneity hypothesis is introduced in the sample of countries, induced by the different characteristics. In the random effects model, the variation across countries is assumed to be random and uncorrelated with the predictor or independent variables included in the model. This last model treats the individual effects as part of error term; hence variance becomes non constant. This model has the advantage of greater efficiency compared to the fixed effects model because it leads to smaller standard errors and higher statistical power to detect effects [26].

The panels were estimated based on the following general equation:

$$Y_{it} = \alpha + \beta_{it} X'_{it} + \delta_{it} + \gamma_{it} + \varepsilon_{it} (1)$$

Where Y_{it} is the dependent variable represented by TURN, i denoting countries (the cross-section dimension), while t denoting time, α is is the overall constant of the model that captures the effects of those variables that are constant over time, β_{it} represents the exposure coefficients, X'_{it} is a vector which includes independent variables: FDI_IN, FDI_OUT, IMP, EXP, GDP, REER, RD, GFCF, δ_{it} and γ_{it} capture the cross-section specific fixed effects and ε_{it} represents the error terms.

Empirical work with panel data models requires a decision on how to treat individual specific effects: whether to use a fixed or random effects model. The decision depends on the correlation between unobserved effect variable and explanatory (independent) variables. The Hausman specification test represents the standard test for discriminating between fixed versus random effects in panel data models [27]. The null hypothesis is that the preferred model is random effects versus the fixed effects:

$$H0 : \beta_{RE} = \beta_{FE} (2)$$

If we do not reject H0 ($\beta_{RE} = \beta_{FE}$), then the fixed and random effects estimators are consistent. In this case, we may choose the random effects estimator because it is more efficient. If we do not reject H0 ($\beta_{RE} \neq \beta_{FE}$), then the fixed effects estimator is the only consistent and must be chosen. If p-value is greater than 0.05, we accept the null hypothesis. If p-value is less than 0.05, we reject the null hypothesis.

Most researchers have made the choice between fixed versus random effects model based on the Hausman test since the 1980s. Even recently, many authors still use this

test. For example, Singh [16], Doryab and Salehi [28] or Sankaran [29] conduct Hausman test in their studies.

In their study, Doryab and Salehi [28] use gray models to predict abnormal stock returns and apply Hausman test to establish the appropriate estimator between fix effects and random effects estimators. Based on the results of the Hausman test, the fixed effects estimator is chosen as appropriate.

Sankaran et al. [29] analyzed the cointegration relation of export with manufacturing, GDP, imports and GFCF using panel estimation techniques. They estimated both the pooled mean group model and mean group model and the appropriate model was chosen taking into consideration the Hausman test. The pooled mean group model proved to be the best one for this analysis.

4. Main Results and Discussions

For each industry, three panel data models were estimated. The results of the estimations are presented in Tables 3 to 6. For all panel specifications considered are reported only statistically significant coefficients at least at 5% level.

Tables 3 and 4 present the values resulted from the equations estimated for the low-tech industry (C11). The first panel specification type is the one with no effects. It is noticed a single statistically significant regression coefficient at least at 5% level at the exports of goods and services. For the second panel type, the fixed cross-effects panel, we found statistically significant regression coefficient for the GDP. Similar to the panel with no effects, in the random effects model we found statistically significant regression coefficient for exports of goods and services. The signs of the statistically significant regression coefficients at least at 5% level indicate the link between the dependent variable (TURN) and the independent variables. Regarding the signs of the coefficients for EXP and GDP, these are positive and indicate a direct and positive relationship between the variables (TURN-EXP; TURN-GDP).

Table 3: Panel least squares results for C11.

Panel Specifications	α	FDI_IN	FDI_OUT	IMP	EXP	GDP	REER	RD	GFCF
No effects	-0.009	-0.069	-0.002	-0.311	0.374*	0.369	0.001	0.025	0.137
Fixed cross-effects	-0.014	-0.062	0.002	-0.239	0.304	0.559*	0.002	0.045	0.079
Random effects	-0.009	-0.069	-0.002	-0.311	0.374*	0.369	0.001	0.025	0.137

Note: * denotes statistical significance at least at 5% level.
Source: Authors' research results.

In statistics, the Durbin–Watson statistic (DW) is used in order to detect the presence of autocorrelation in residuals and a value of 2.0 suggests the fact that there is no autocorrelation detected in the sample. We remark in Table 4 that in all situations, the DW values are close to 2. The values are interpreted as normal and indicate that these models are correct.

Table 4: Robustness results: panels for C11.

Panel Specifications	Adj. R^2	S.E. of regression	F-statistic	Prob (F-statistic)	Akaike info criterion	Schwarz criterion	Durbin -- Watson stat
No effects	0.069	0.086	3.430	0.002	-2.037	-1.915	2.052
Fixed cross-effects	0.019	0.088	1.164	0.262	-1.905	-1.472	2.147
Random effects	0.069	0.086	3.430	0.001	-	-	2.052

Source: Authors' research results.

Table 5 and 6 illustrate the results from the equations estimated for the high-tech industry (C26). For this industry, FDI_IN (inward FDI stocks), IMP and REER display statistically significant regression coefficients in the case of all panel specifications. These results demonstrate that foreign direct investments, imports of goods and services and REER influence the performance of companies in the high-tech industry (C26). Moreover, all the signs of the statistically significant regression coefficients at least at 5% level are positive and indicate a direct and positive relationship between turnover and these variables. As in the case of the panels estimated for the low-tech industry, we see in Table 6 that for the high-tech industry, in all the panels the DW values are close to 2. These three panel data models are correct as well.

Table 5: Panel least squares results for C26.

Panel Specifications	α	FDI_IN	FDI_OUT	IMP	EXP	GDP	REER	RD	GFCF
No effects	-0.001	0.226*	-0.000	0.672*	0.063	-0.399	0.013*	0.056	-0.240
Fixed cross-effects	0.004	0.209*	-0.005	0.736*	-0.042	-0.359	0.012*	-0.014	-0.219
Random effects	-0.001	0.224*	-0.001	0.682*	0.048	-0.391	0.013*	0.047	-0.238

Note: * denotes statistical significance at least at 5% level.
Source: Authors' research results.

Next, we use Hausman test in order to determine the appropriate estimator between fixed effects and random effects. Table 7 and 8 show that p-values of cross section random effects for C11 and C26, respectively, were greater than 0.05, hence null hypothesis that random effects model estimators are more efficient was accepted, implying that random effects model was preferred to fixed cross-effects model.

TABLE 6: Robustness results: panels for C26.

Panel Specifications	Adj. R^2	S.E. of regressior	F-statistic	Prob (F-statistic)	Akaike info criterion	Schwarz criterion	Durbin -- Watson stat
No effects	0.075	0.167	3.538	0.001	-0.702	-0.577	1.986
Fixed cross-effects	0.068	0.168	1.617	0.027	-0.616	-0.183	2.160
Random effects	0.073	0.166	3.473	0.001	-	-	2.010

Source: Authors' research results.

TABLE 7: Results for Hausman test for C11.

Test	Chi-square Statistic	Chi-square d.f.	Prob.
Random Vs Fixed cross-effects for C11	5.718	8	0.679

Cross section random effects test comparisions:

TABLE 8

Variable	Fixed	Random	Var(Diff.)	Prob.
FDI_IN	-0.062	-0.069	0.000	0.666
FDI_OUT IMP EXP GDP REER RD GFCF	0.002 -0.239 0.304 0.559 0.002 0.045 0.079	-0.002 -0.311 0.374 0.369 0.001 0.025 0.137	0.000 0.003 0.004 0.020 0.000 0.001 0.001	0.531 0.174 0.249 0.182 0.246 0.469 0.074

Source: Authors' research results.

TABLE 9: Results for Hausman test for C26.

Test	Chi-square Statistic	Chi-square d.f.	Prob.
Random Vs Fixed cross-effects for C26	3.363	8	0.910

Cross section random effects test comparisions:

TABLE 10

Variable	Fixed	Random	Var(Diff.)	Prob.
FDI_IN	0.209	0.224	0.001	0.572
FDI_OUT IMP EXP GDP REER RD GFCF	-0.005 0.736 -0.042 -0.359 0.012 -0.014 -0.219	-0.001 0.682 0.048 -0.391 0.013 0.047 -0.238	0.000 0.005 0.010 0.066 0.000 0.002 0.003	0.708 0.453 0.368 0.900 0.414 0.207 0.741

Source: Authors' research results.

5. Conclusion

Our research investigated the impact of FDI on the performance of companies in two industries in the EU manufacturing sector: low-tech – C11 (Manufacture of beverages)

and high-tech – C26 (Manufacture of computer, electronic and optical products), using datasets from Eurostat and IMF for the period between 2010 and 2020. The performance of companies was measured in this study by turnover - the higher the turnover, the better the performance of the company. As independent variables, we used in our models the following indicators: inward and outward FDI stocks, imports and exports of goods and services, gross domestic product at market prices, real effective exchange rate, gross domestic expenditure on research and development and gross fixed capital formation.

For both industries, we estimated three panel data models: panel with no effects, panel with fixed effects in the cross-section dimension and panel with random effects. Moreover, in order to determine the appropriate estimator between fixed effects and random effects we used Hausman test and the results showed that for both industries, random effects model was preferred.

Our findings proved that inward FDI stocks, imports of goods and services and real effective exchange rate have a significant impact on the performance of companies in the high-tech industry (C26), while exports of goods and services play an important role for the performance of companies in the low-tech industry (C11).

We mention that this research has some limits and one of the most important of them is the small number of industries included in the sample. As a possible future direction for the research, an inclusion of more industries from the EU High-tech classification of manufacturing industries would offer better insight into the impact of FDI on the performance of companies in EU manufacturing sector. Also, we consider that it would be interesting to analyze separately the EU member states that joined after 2004 from those that joined firstly. More than sure, for those countries that joined in 2004 and after this year, FDI matters more when it comes to performance of companies, as Bruno and Cipollina (2014) indicated in their study.

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