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THE LINK BETWEEN FOREIGN DIRECT INVESTMENTS AND ECONOMIC GROWTH: EMPIRICAL STUDY FROM SELECTED EU COUNTRIES

ABSTRACT

Purpose: The main focus of this research is the relationship between Foreign Direct Investments (FDI) and economic growth in 22 member countries of both the European Union (EU) and the Organization for Economic Co-operation and Development (OECD). The study aims to ascertain if FDI significantly impacts economic growth within these countries and to determine the extent of differentiation in this impact across different countries.

Methodology/approach: Utilising the Granger causality test, FDI's influence on GDP in the Granger sense was identified in a substantial portion of the investigated countries. This relationship's depth and direction were further delineated using multiple regression models with distributed lags (DL). Additionally, each country's data was individually assessed to spotlight variations in FDI's influence on GDP. Integral macroeconomic control variables – such as inflation, the unemployment rate, and the public debt to GDP ratio – were included, ensuring a more holistic understanding of GDP determinants.

Findings: Results indicated that approximately half of the countries display a statistically significant positive impact of FDI on GDP. Notably, no country exhibited a negative, significant relationship. An ensuing cluster analysis conveyed that not the least devel-

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oped countries but those marked by advanced development and relatively low indebtedness showcased pronounced FDI impacts on GDP. In my research, Poland was identified as a unique case, which, despite its relatively lower GDP per capita compared to other countries, displays a significant influence of FDI on economic growth.

Originality/value: This research delivers empirical evidence highlighting the instrumental role of FDI in amplifying GDP from the recipient country's perspective, reinforcing its essentiality in shaping economic trajectories by particular countries.

Keywords: Foreign direct investment, FDI, economic growth, cluster analysis, distributed lag model, Granger causality

1. INTRODUCTION

Exploring the nexus between Foreign Direct Investments (FDI) and economic growth constitutes a critical subject of inquiry within modern economics. This connection bears significant implications for policy formulation, international trade dynamics, and multinational corporations' strategic decisions. As empirical research shows, it is an intricate relationship often influenced by a complex interplay of macroeconomic variables, technological advancements, regulatory frameworks, and socio-political factors (Alfaro et al., 2010).

Understanding this relationship becomes even more compelling in the European Union (EU) context, where economic heterogeneity among member states prevails. With many EU countries having well-established economic and regulatory structures, the effects of FDI on their economic growth present a complex and multifaceted research question. This investigation focuses specifically on those EU countries (OECD members) for which substantial and reliable data regarding the inflow of FDI is available, allowing for a more nuanced and detailed analysis.

The primary purpose of this research is to explore the relationship between FDI and economic growth within 22 EU member countries. By utilising such methods as the Granger causality test, multiple regression models with distributed lags (DL) and cluster analysis, this study aims to shed new light on the intricate FDI implications on economic growth. A notable aspect of this study that sets it apart from previous research is its nuanced approach to evaluating the relationship between FDI and GDP across different economies. Recognising that the impact of FDI on economic growth may not always be unambiguously positive, this research analyses each country individually rather than employing a panel approach. This method allows for a more refined understanding of the varied economic contexts and provides room for each nation's economy's complex, multifaceted nature. Furthermore, the integration of cluster analysis serves to identify distinct groups within the dataset, including average GDP per capita and public debt to GDP ratio, offering an innovative means to delineate the

patterns and dynamics that may otherwise remain obscured. Furthermore, additional macroeconomic control variables, such as inflation, unemployment rate, and public debt to GDP align with recent advancements in economic analysis, ensuring a robust and comprehensive examination.

This research presents an essential step towards deepening our understanding of the complex interplay between FDI and economic growth within the selected EU countries. Its methodologies and contextual focus render it a timely and pertinent addition to the existing body of literature.

2. LITERATURE REVIEW

Foreign direct investments can be treated as one of the most influential factors of economic growth (Bostan et al., 2023; Iqbal et al., 2010; Kłysik-Uryszek, 2010; Napiórkowski, 2017). Some research shows that FDI inflows not only play an essential role in the context of economic growth but also in the context of achieving the Sustainable Development Goals, fitting in with global megatrends (Aust et al., 2020; Boguszewski et al., 2023). Nevertheless, there is no consensus on whether FDI always positively impacts a country's economic growth and what factors influence the direction and strength of this impact. As Puchalska (2010) believes, the results of empirical analyses do not allow for the unequivocal acceptance of the hypothesis of a beneficial effect of FDI on the host economy. Using data from 80 countries, Durham (2004) argues that FDI and equity foreign portfolio investment (EFPI) do not have a direct positive effect on economic growth. It can be explained by the fact that, as Adams (2009) shows in the example of Sub-Saharan African countries, FDI has an initial negative effect on domestic investment. Fratzscher and Bussiere (2004) provide evidence for a positive FDI impact on economic growth only in the medium- and long-term. Also, Bakari (2017) shows no link between FDI and GDP growth in the short run.

The relationship between the stage of economic growth and the motivations behind the influx of FDI has been elaborated in the dynamic theory of economic development and the country's competitive advantage (Porter, 1990). According to this theory, as the type of a country's economic growth evolves, so too do the motives for locating foreign investments (Rynarzewski & Zielińska-Głębocka, 2006, p. 220). Foreign investments contribute to economic growth by enabling further investment and accelerating development. In some cases, if the FDI is concentrated in sectors not aligned with the domestic economy's comparative advantages, it might lead to inefficient resource allocation. Such misalignments can impede growth rather than foster it. Furthermore, excessive reliance on FDI can lead to foreign capital and technology dependency, limiting domestic innovation and technological advancement. The dynamic interplay between investment and growth provides valuable insights for policymaking, indicating the nuanced ways in which FDI can be harnessed to support sustainable economic development.

Table 1
Types of economic growth and motives of foreign investments inflow

Economic growth types	Motives of foreign investors
Resource growth	Investors are mainly looking for cheap labour and raw material resources.
Investment growth	Investors are looking for a skilled workforce.
Innovative growth	Investors seek strategic resources such as cutting-edge technology, research facilities, and human capital, locating capital in innovative industries.
Welfare growth	Investors are mainly looking for strategic alliances.

Note: own elaboration based on Kłysik-Uryszek's (2010, p. 32) book.

As seen from Table 1, FDI can flow to highly developed countries (offering advanced infrastructure and high levels of innovation) as well as developing countries (offering access to raw material resources and lower labour costs). Therefore, it is reasonable to inquire into the differences in the impact of FDI on EU countries with varying degrees of economic development. As other research shows, the heterogeneity of host economies along the absorption capability spectrum and the heterogeneity of FDI benefits can be a significant source of contradicting results (Napiórkowski, 2017). These results urge that when conducting empirical research on the impact of FDI on economic growth, it is crucial to focus on individual countries separately rather than building panel models that ignore those important variations of individual countries. According to Zhang's (2001) research findings based on 11 economies in East Asia and Latin America, we can expect that the extent to which FDI is growth-enhancing depends on country-specific characteristics. For example, FDI tends to be more conducive to economic growth when host countries adopt a liberalised trade regime, improve education and human capital conditions, encourage export-oriented FDI and maintain macroeconomic stability (Zhang, 2001). Moreover, as available research shows, FDI has a more substantial positive impact on economic growth in countries with a higher openness to international trade, higher financial market development, lower population growth rate and lower risk level (Batten & Vo, 2009). According to Borensztein et al. (1995), FDI contributes to economic growth even more than domestic investment. However, higher FDI productivity holds only when the host country has a minimum threshold stock of human capital. Also, other authors emphasise the importance of human capital in the context of FDI's impact on economic growth and firms' productivity (Santos, 2023). Finally, political stability is essential to boost FDI-induced economic growth (Gnangnon & Iyer, 2017). The absence of civil conflict or violence in the host economy is paramount for the direct

and indirect growth-enhancing benefits of FDI inflows (Li et al., 2023). In line with other authors, also Różański (2010) thought that the quality of human capital, the investment system, the degree of openness of the economy, economic and technological conditions, legislation or political stability determine the positive impact of FDI on economic growth in host countries. The impact of foreign direct investment on economic growth also involves stimulating investment activity by domestic manufacturers cooperating and competing with foreign-owned companies. In addition, domestic enterprises, influenced by the competitive pressures of foreign enterprises, try to keep up with technical progress to reduce costs in time, improve quality and enrich the range of products (Puchalska, 2010).

Li and Liu's (2005) study considers FDI and human capital to impact GDP positively. Some authors also argued that human capital induces a higher FDI impact on economic growth (Hanushek, 2013; Solomon, 2011; Teixeira & Queirós, 2016). Hermes and Lensik (2003) prove that the developed financial system enhances the positive relationship between FDI and economic growth. In their results, 37 of 67 analysed countries have a sufficiently developed financial system to let FDI contribute positively to economic growth. Regarding Hermes and Lensik's (2003) study, it is also reasonable to analyse how the developed financial market can enhance the impact of FDI on economic growth. These findings are also confirmed by Osei and Kim (2020), who have found that FDI enhances GDP growth. However, the growth effect of FDI becomes negligible when the ratio of private sector credit to gross domestic product exceeds 95.6%. This may suggest that in countries with high – but not too high – levels of financial market development, the impact of FDI on GDP will be higher.

Considering all the factors that may affect the relationship between FDI and economic growth, I assume that this relationship varies considerably from country to country, which is another reason to show this variation based on selected EU countries. Moreover, the cited research results confirm that GDP growth is influenced not only by FDI but also by domestic investment, financial market development, human capital, labour force participation rate, and unemployment rate. Thus, it is reasonable to include other control macroeconomic variables in research. According to some research results, there is a significant negative impact of income on foreign investment onto the formation of external debt in some countries like the Czech Republic, Poland, Chile, and Argentina, where investment income outflows of almost 100% of received foreign direct investments (Yakubovskiy et al., 2019). Based on that, I considered it reasonable to include a variable presenting the public debt ratio to GDP in my model. Regarding Próchniak's (2011) research in CEE countries to model economic growth, it is reasonable to include such variables as FDI, inflation, interest rate, financial sector development, GDP structure, IT&C development, education level perspective, public debt, and budget deficit. In modelling economic growth, the labour force and the unemployment rate were often considered control variables (Bostan et al., 2023). Based on that, selected available macroeconomic variables were included in my models as a control variable.

3. MATERIAL AND METHODS

3.1. DATA AND SCOPE

The analysis encompasses the period from the fourth quarter of 2014 (Q4 2014) to the fourth quarter of 2022 (Q4 2022), determined by data availability. Significantly, this timeframe includes the global market disruptions associated with COVID-19 and the war in Ukraine. Both events have negatively impacted Foreign Direct Investment (FDI) volumes worldwide, with effects depending on various factors, including the geographical location of the analysed countries, particularly in the context of the geopolitical factor represented by the Ukraine conflict. The study was conducted on 22 EU member states, also part of the Organization for Economic Co-operation and Development (OECD). The selection of these countries was conditioned by access to uniform and high-quality data concerning the inflow of foreign direct investments to OECD member states. A detailed range of the data used, including their description and source, is presented in Table 2.

Table 2
Macroeconomic variables used in research from Q4 2014 to Q4 2022

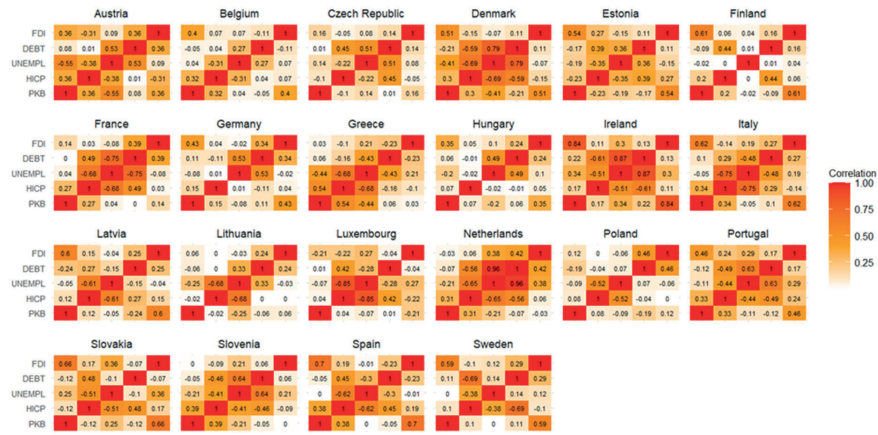
Data	Abbreviation	Description	Source
Gross Domestic Product (% change)	GDP	GDP Chain linked volumes, percentage change compared to the same period in the previous year.	Eurostat data (https://ec.europa.eu/eurostat/data-browser/view/)
Unemployment rate (%)	UNMEMPL	The number of people unemployed as a percentage of the labour force.	
Harmonised Index of Consumer Prices (%)	HICP	HICP change to the same period of the previous year.	
Public debt to GDP (%)	DEBT	Government consolidated gross debt as a percentage of GDP.	
Foreign Direct Investment (% change)	FDI	Percentage change of FDI inward value in local currency (the same period in the previous year).	OECD data (https://stats.oecd.org/Index.aspx?QueryId=64238)

Note: own elaboration.

All variables, separated by individual countries, were tested for stationarity using Augmented Dickey-Fuller (ADF), Phillips-Perron unit root (PP), and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests. At least two of the three tests confirmed each country's stationarity of the FDI variable. Most other variables for all countries were also stationary (except for HICP in Italy, which was non-stationary based on all three tests). The subsequent step in assessing the data quality for the model was the correlation analysis. As Figure 1 shows, a reasonably significant correlation (usually negative) was observed among the explanatory variables between UNEMPL and HICP. Besides, FDI and GDP (the explained variable) were significantly and positively correlated.

Figure 1

Correlation matrix of variables used in the DL model using Pearson's coefficient



Note: own elaboration in R.

Importantly, no exceptionally high and recurring interdependencies were identified among the explanatory variables across countries that could adversely affect the quality of the model. This observation ensures that the integrity of the research framework remains unblemished, as high multicollinearity could otherwise bias the results.

3.2. GRANGER CAUSALITY

An essential dimension of the comprehensive analysis undertaken in this study is the application of Granger causality tests. Granger causality is not causality in the traditional philosophical sense but rather a predictive causality. In mathematical terms, if variable X Granger causes variable Y, the past values of X contain information that helps predict Y:

$$Y_t = \alpha + \sum_{i=0}^{p} \beta_i X_{t-1} + \sum_{j=0}^{q} \gamma_j Z_{t-j} + \varepsilon_t, \quad (1)$$

[1]

In the context of this research, the Granger causality tests were utilised to ascertain if FDI has predictive power over GDP. This layered approach enhances the research's robustness, ensuring that findings are statistically significant, economically meaningful, and validated across different testing methodologies.

3.3. THE DISTRIBUTED LAG (DL) MODEL

The Distributed Lag (DL) model can be a valuable tool for economists seeking to understand the temporal dynamics of relationship relationships between variables. One of the primary advantages of employing a DL model lies in its capacity to discern how a change in an independent variable, such as Foreign Direct Investment (FDI), impacts the dependent variable – GDP – over a series of time lags. This proves particularly pertinent for the study of economic growth, where the repercussions of fiscal or monetary actions often unfold over an extended period rather than manifesting instantaneously. Mathematically, a general DL model with a single lagged independent variable can be represented as:

$$Y_t = \alpha + \sum_{i=0}^{p} \beta_i X_{t-1} + \sum_{j=0}^{q} \gamma_j Z_{t-j} + \varepsilon_t, \quad (2)$$

Where:
- Y_t is the dependent variable at time t;
- α is a constant term;
- X_{t-1} *and* Z_{t-j} are the independent variables with i and j lags (respectively);
- β_i *and* γ_j are coefficients corresponding to each lag of the independent variable;
- *p and q* are the maximum lag lengths for the independent variables;
- ε_t represents the error term.

For this study, the DL model has been fine-tuned to assess the influence of foreign direct investments (FDI) and the control variables, such as the harmonised index of Consumer prices (HICP), unemployment rate (UNEMPL), and public debt (DEBT) – on a country's GDP. In line with the study's objectives, only a single lag for each independent variable was incorporated, leading to the equation:

$$GDP_t = \alpha + \beta_1 FDI_{t-1} + \beta_2 HICP_{t-4} + \beta_3 UNEMPL_{t-4} + \beta_4 FDI_{t-4} + \varepsilon_t, \quad (3)$$

[1] The null hypothesis of the Granger causality test asserts that the coefficients of the lagged X terms, Y_i, are zero.

Opting for a single lag for each variable was a deliberate choice to ensure interpretability and to pave the way for subsequent cluster analysis. The specific lags were selected based on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) and in line with economic intuition (Burnham & Anderson, 2004).

3.4. CLUSTER ANALYSIS

Cluster analysis is a statistical method designed to classify objects into "clusters", where objects in the same cluster are more similar than those in other clusters. The aim is to uncover hidden patterns in the data, often leading to new insights and knowledge discovery or to further deeper analysis in these fields. One of the most widely used techniques for partitioning a dataset into k clusters is the K-means clustering method, where each observation belongs to the cluster with the nearest mean. An iterative algorithm seeks to partition the dataset into K pre-defined non-overlapping distinct subgroups, where each data point belongs to only one group. The procedure follows a simple and easy way to classify a given data set into a certain number of clusters

The K-means algorithm is favoured for its simplicity and speed, allowing it to run on large datasets. However, the value of k needs to be known beforehand, which can be determined using the elbow method (Celebi et al., 2013). The elbow method – used in this study – is employed in cluster analysis to find the optimal number of clusters for the k-means algorithm. This method involves computing the within-cluster sum of squares (WCSS) for different values of k (number of clusters). When plotted graphically, the point where the reduction in WCSS becomes less pronounced, resembling an 'elbow', indicates the optimal number of clusters (Ketchen Jr. & Shook, 1996). Nevertheless, although the elbow method suggested three clusters as the optimal solution, a detailed examination revealed that Poland notably deviated from other countries in one of the clusters. Hence, to better capture the data structure, I chose to work with four clusters (k=4), which provided a more accurate representation of Poland's specificity in the context of the examined variables.

4. RESULTS AND DISCUSSION

4.1. GRANGER CAUSALITY

As a first step, Granger causality tests were applied to assess the influence of Foreign Direct Investment (FDI) on Gross Domestic Product (GDP). The results of the tests are shown in Table 3. Of the 22 countries examined, 12 showed a statistically significant impact of FDI on GDP in the Granger sense. The countries where FDI was found to be a Granger cause of GDP are Austria, the Czech Republic, Denmark, Finland, France, Italy, Latvia, Luxembourg, Poland, Slovakia, Spain, and Sweden. These results are mostly consistent with the Distributed Lags (DL) model of the impact of FDI on GDP, presented in the next section.

Table 3
Results of the Granger causality test assessing the influence of FDI on GDP

Country	p-value	Influence of FDI on GDP in Granger sense
Austria	0,0020	Yes
Belgium	0,1067	No
Czech Republic	0,0407	Yes
Denmark	0,0000	Yes
Estonia	0,5941	No
Finland	0,0113	Yes
France	0,0000	Yes
Germany	0,1278	No
Greece	0,7599	No
Hungary	0,8582	No
Ireland	0,3536	No
Italy	0,0002	Yes
Latvia	0,0133	Yes
Lithuania	0,9144	No
Luxembourg	0,0100	Yes
Netherlands	0,8694	No
Poland	0,0305	Yes
Portugal	0,6281	No
Slovakia	0,0000	Yes
Slovenia	0,9906	No
Spain	0,0000	Yes
Sweden	0,0027	Yes

Note: own elaboration.

Even if the Granger causality test is only an introduction to the complete analysis, the causality between FDI and GDP strengthens the argument that FDI is correlated with economic growth and plays a crucial role in shaping it in many of the countries

studied. Countries with significant p-values below the conventional 0.05 threshold, indicating a causal relationship, highlight the effectiveness of FDI in shaping economic growth. It is also reasonable for governments in countries with significant influence to consider policies encouraging and protecting FDI, as it can be an essential driver of economic growth. On the other hand, countries with no Granger causality between FDI and GDP may require a more nuanced understanding of their economic dynamics and the various factors influencing GDP.

4.2. THE DISTRIBUTED LAG (DL) MODEL

The impact of Foreign Direct Investment (FDI) on Gross Domestic Product (GDP) across 22 European countries through a Distributed Lag (DL) examined by the DL model is shown in Table 4. The results show varying effects with considerable implications. Out of the 22 countries, 13 have model p-values lower than 0.05, indicating that the overall model is statistically significant for these countries. Within these countries, 9 demonstrate a significant influence of FDI on GDP, as their p-values for the FDI variable fall below the conventional threshold of $\alpha = 0.05$. Moreover, three additional countries demonstrate the influence of FDI on GDP significance level $\alpha = 0.10$ (Belgium, Germany, Latvia). It is worth noting that in most countries, the FDI directional coefficient describing the impact of this variable on GDP was positive. For countries such as Greece, Hungary, Luxembourg, and the Netherlands, the coefficients are negative, although not statistically significant. Furthermore, the findings of this study are a valuable complement to research by Ericsson and Irandoust (2001), which concluded that FDI had no significant impact on economic growth in Finland and Denmark. My study confirmed that this relationship is now statistically significant, as confirmed by the DL model and the Granger causality test.

Table 4
Results of the distributed lag (DL) model and coefficients for the FDI variable

Country	Model parameters		FDI variable parameters	
	p-value	Adjusted R-squared	p-value	coef FDI(1)
Austria	0,000	0,847	0,010	3,632
Belgium	0,004	0,463	0,093	5,746
Czech Republic	0,003	0,478	0,035	2,921
Denmark	0,000	0,688	0,000	5,929
Estonia	0,000	0,583	0,860	0,347
Finland	0,000	0,572	0,008	4,230

Table 2 (continued)

Country	Model parameters		FDI variable parameters	
	p-value	Adjusted R-squared	p-value	coef FDI(1)
France	0,000	0,693	0,000	4,801
Germany	0,011	0,409	0,051	5,873
Greece	0,002	0,485	0,311	-2,595
Hungary	0,323	0,171	0,922	-0,570
Ireland	0,760	0,072	0,216	5,371
Italy	0,000	0,556	0,005	4,277
Latvia	0,000	0,555	0,053	2,589
Lithuania	0,282	0,183	0,580	0,203
Luxembourg	0,004	0,461	0,254	-0,814
Netherlands	0,025	0,359	0,159	-2,464
Poland	0,000	0,776	0,002	5,661
Portugal	0,002	0,486	0,846	0,707
Slovakia	0,030	0,349	0,113	6,568
Slovenia	0,000	0,589	0,865	0,027
Spain	0,000	0,610	0,003	26,690
Sweden	0,000	0,527	0,015	13,910

Note: own elaboration.

Table 5 presents the results for the control variables: inflation (HICP), unemployment (UNEMPL) and debt to GDP ratio (DEBT) in the DL models. Overall, the impact of control variables on GDP and their significance varied considerably between countries. In the majority of countries (19), debt growth had a positive effect on GDP. It is worth noting that, as the literature review shows, this relationship only holds when there is a rational level of debt that does not imply difficulty repaying it. Variation was noted in the case of the unemployment rate, which could have a different impact on economic growth depending on the labour market situation prevailing in the country concerned. Furthermore, a differential effect of inflation on GDP was noted. It is significant that only in six countries the p-value coefficient for this variable was below 0.10 (of which, in four cases, it suggested a negative impact of inflation on GDP and, in two cases, a positive one). Given the economic correlations, a better explanatory var-

iable for GDP could be the level of interest rates (reference or market rates). However, as this variable was not stationary for most countries, it could not be used in the study.

Table 5
DL models' control variables for each country

Country	HICP(l4)		UNEMPL (l4)		DEBT(l4)	
	p-value	coefficient	p-value	coefficient	p-value	coefficient
Austria	0,000	3,220	0,001	3,762	0,212	0,143
Belgium	0,623	-0,243	0,303	-0,587	0,002	0,544
Czech Republic	0,310	-0,840	0,678	-0,503	0,027	0,577
Denmark	0,058	0,940	0,410	0,655	0,140	0,211
Estonia	0,050	-0,468	0,007	2,150	0,281	-0,170
Finland	0,915	-0,063	0,065	0,671	0,383	0,102
France	0,138	1,492	0,008	3,153	0,049	0,256
Germany	0,124	1,011	0,140	5,589	0,479	-0,256
Greece	0,275	0,928	0,009	1,587	0,001	0,738
Hungary	0,725	-0,274	0,552	-0,983	0,075	0,594
Ireland	0,728	-0,318	0,987	-0,022	0,727	-0,069
Italy	0,372	0,864	0,668	0,358	0,300	0,160
Latvia	0,830	-0,059	0,027	0,856	0,230	0,258
Lithuania	0,148	-0,418	0,733	-0,212	0,210	0,189
Luxembourg	0,247	0,659	0,007	4,107	0,635	0,114
Netherlands	0,365	-0,586	0,004	-5,560	0,002	1,335
Poland	0,003	-1,150	0,016	-1,071	0,000	1,017
Portugal	0,859	0,201	0,071	-0,774	0,001	0,851
Slovakia	0,082	-1,322	0,308	-0,582	0,148	0,252
Slovenia	0,068	-1,057	0,005	-1,680	0,000	0,749
Spain	0,973	-0,022	0,534	0,267	0,010	0,337
Sweden	0,608	-0,259	0,010	1,268	0,304	0,175

Note: own elaboration.

Regarding models' diagnostic tests, the Anderson-Darling (AD) test determines if a given sample of data follows a specific distribution. Using the AD test, I check if the residuals from the model are normally distributed. Moreover, I use the Breusch-Godfrey test to detect the presence of autocorrelation in the residuals of a regression model and the Breusch-Pagan test to detect heteroscedasticity in a linear regression model. Test results (Table 6) show that only in Ireland heteroscedasticity was detected. For most countries (13), there was no autocorrelation in the residuals, and for ten countries, residuals were normally distributed, which requires further verification.

Table 6
DL Models verification tests for each country

Country	Anderson-Darling Test		Breusch-Godfrey Test		Breusch-Pagan Test	
	p-value	normality	p-value	autocorrelation	p-value	heteroscedasticity
Austria	0,002	No	0,312	No	0,198	No
Belgium	0,005	No	0,113	No	0,505	No
Czech	0,313	Yes	0,046	Yes	0,549	No
Denmark	0,199	Yes	0,099	No	0,219	No
Estonia	0,941	Yes	0,016	Yes	0,153	No
Finland	0,049	No	0,069	No	0,290	No
France	0,001	No	0,185	No	0,260	No
Germany	0,009	No	0,124	No	0,652	No
Greece	0,325	Yes	0,002	Yes	0,137	No
Hungary	0,000	No	0,067	No	0,243	No
Ireland	0,546	Yes	0,603	No	0,001	Yes
Italy	0,000	No	0,017	Yes	0,251	No
Latvia	0,304	Yes	0,184	No	0,751	No
Lithuania	0,040	No	0,010	Yes	0,886	No
Luxembourg	0,152	Yes	0,051	No	0,798	No
Netherlands	0,000	No	0,171	No	0,743	No
Poland	0,145	Yes	0,606	No	0,719	No
Portugal	0,000	No	0,010	Yes	0,519	No

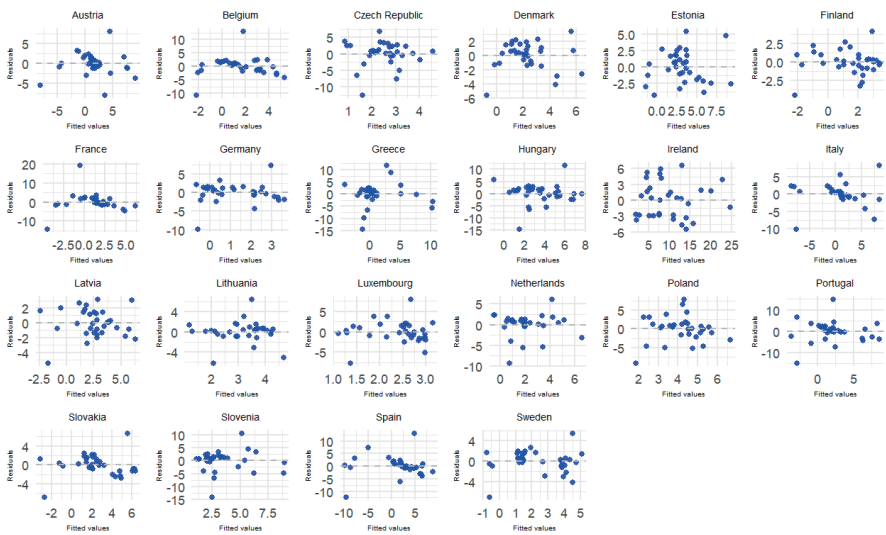
Table 2 (continued)

Country	Anderson-Darling Test		Breusch-Godfrey Test		Breusch-Pagan Test	
	p-value	normality	p-value	autocorre-lation	p-value	heterosce-dasticity
Slovakia	0,060	Yes	0,012	Yes	0,451	No
Slovenia	0,030	No	0,177	No	0,521	No
Spain	0,001	No	0,020	Yes	0,283	No
Sweden	0,126	Yes	0,025	Yes	0,499	No

Note: own elaboration.

As additional analyses have shown, the lack of a normal distribution in the residuals resulted from shocks caused by COVID-19 and the war in Ukraine, among others, when changes in the control variables initially failed to keep pace with explaining the sharp decline in GDP. This implied the creation of so-called "fat tails" in the distributions' histograms. The exact distributions of the residuals in each model are presented in Figure 2.

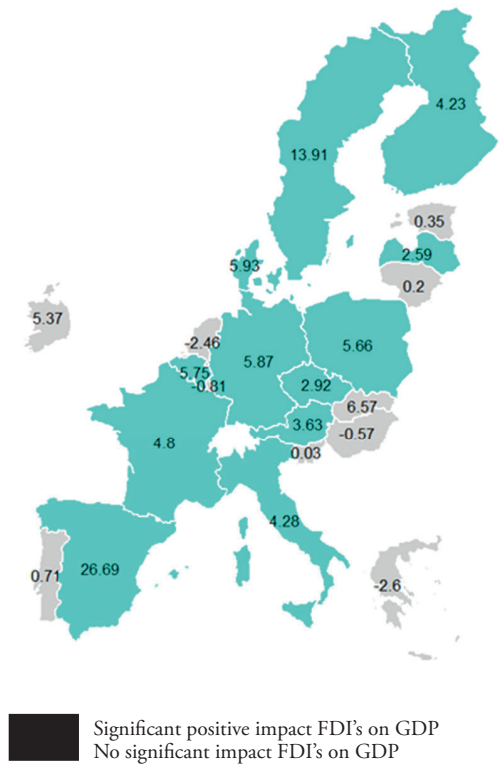
Figure 2
Residual distribution scatter plots from DL models for each country



Note: own elaboration in R.

Figure 3 presents those countries where the impact of FDI on GDP was statistically significant. As the map clearly shows, in none of these countries did FDI harm economic growth. This finding aligns with Almfraji and Almsafir's (2014) conclusion that the FDI-GDP relation is positive in most countries and, in some cases, insignificant.

Figure 3
Map of selected UE countries indicating the direction of FDI's Impact on GDP based on DL models



Note: own elaboration in R.

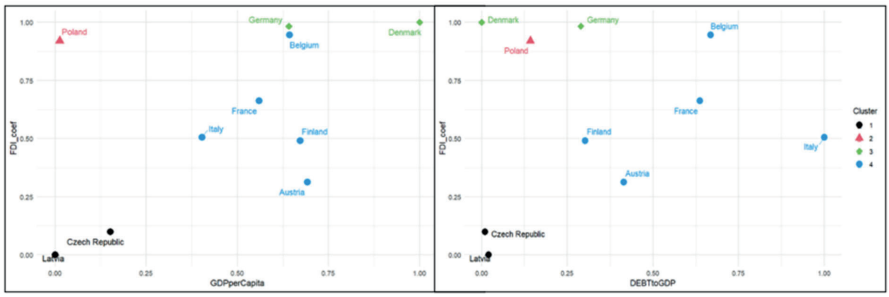
In order to increase the sample of countries with a positive impact of FDI on GDP, I decided to set a significance level of $\alpha = 0.1$. This enabled a broader cluster analysis and the elimination of outliers.

4.3. CLUSTER ANALYSIS

I used cluster analysis to identify factors that differentiate the impact of FDI on GDP. In the first step of this analysis, countries for which FDI coefficients were considered outliers (i.e. Spain and Sweden) were discarded. This is justified, especially for Spain, given the lack of normal distribution of the model's residuals, the identified autocorrelation of the residuals, and the available studies that show no relationship between FDI and GDP in that country (Bermejo Carbonell & Werner, 2018). In the next step, the coefficients of FDI's impact on GDP were matched with variables – identified from the literature review – that can differentiate the strength of foreign investment's impact on economic growth, i.e. GDP per capita and public debt to GDP of individual countries. Considering the entire forecast period, the average levels of GDP per capita and debt to GDP over the entire period were used for the cluster analysis. Then, these data were normalised and thus brought to a range from 0 to 1. Finally, individual countries were assigned to one of four clusters using the K-means clustering method.

Based on Figure 4, we can observe a correlation between FDI and GDP growth impact (FDI_coef). This correlation is also confirmed in research on 19 Latin American countries, where FDI positively and significantly affects GDP only in high-income countries. In contrast, in upper-middle-income countries, the effect is uneven and non-significant (Alvarado et al., 2017). However, Poland broke out of this trend and, despite its relatively low average GDP per capita during the analysed period, had one of the highest FDI coefficients. This argued for Poland to be classified as a separate cluster. Several factors contribute to this phenomenon. First, the country's skilled workforce and lower labour costs have attracted international corporations seeking operational efficiency, which determined high work productivity. In addition, technology transfer to the Polish economy can also be observed. It is estimated that thanks to foreign investments, the Polish economy has grown by an additional 15.6% over the 25 years, from 1991 to 2016 (Łaszek & Trzeciakowski, 2017). Thus, the Polish government has implemented investment-friendly policies, providing foreign investors incentives and a favourable regulatory environment. These policies have spurred technological advancements and innovation, increasing productivity and growth in critical economic sectors (Dunning & Lundan, 2008, pp. 49–54). The overall synergy of these factors has underpinned the strong positive influence of FDI on Poland's economic growth.

Figure 4
Scatter plot of normalised GDP per capita vs. normalised FDI coefficient and DEBT to GDP vs. normalised FDI coefficient with highlighted clusters based on k-means



Note: own elaboration in R.

There is also a correlation (albeit less pronounced) between public debt to GDP and the impact of FDI on GDP. This time, three countries broke out of this trend: Poland, Denmark, and Germany, which, while having relatively low debt-to-GDP levels, were characterised by high FDI impact on economic growth. While this might suggest that countries with relatively low debt, as a rule, are characterised by a higher positive impact of FDI on GDP, this thesis is contradicted by the countries categorised in cluster 1 (the Czech Republic and Latvia), which recorded both relatively low levels of debt to GDP and FDI impact on GDP. The differentiation between Poland, Lithuania, and the Czech Republic can be justified by Osei and Kim's (2020) finding, according to which countries with a higher level of financial market (up to a certain level), such as Poland, benefit more from FDI inflows.

5. CONCLUSIONS

This empirical study investigated the relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) across 22 selected EU members. In an era marked by global economic interconnectedness, discerning the impact of FDI on economic growth is pertinent and vital for policymakers, investors, and researchers, confirmed by the rich literature in this area. The research reaffirms the instrumental role FDI plays in influencing GDP growth. Utilising rigorous methodologies such as the Granger causality test and distributed lag models, it was ascertained that approximately half of the selected countries exhibited a statistically significant positive impact of FDI on GDP growth. In contrast, no country displayed a negative impact. Furthermore, the cluster analysis confirmed strong diversification among the FDI impact on the economic growth of particular EU countries. While there may be scepticism regarding the universally positive role of FDI in GDP growth, this research addresses such concerns empirically. The absence of any significant negative correlation between FDI and

GDP across the selected EU countries studied arguably discredits views suggesting that FDI could be detrimental in developed and democratic countries. The research also acknowledges limitations in its methodological framework, notably the inability of the distributed lag models to account for extraordinary events such as the COVID-19 pandemic and the Ukraine conflict.

Given these findings, there is a need for targeted policy frameworks to harness FDI's potential effectively. This is particularly salient for countries like Poland, which, despite its lower GDP per capita, demonstrates a robust impact of FDI on economic growth. Moreover, future research avenues in this field are broad and varied. They include, but are not limited to, an in-depth exploration of qualitative factors that can determine the impact of FDI on GDP growth, such as human capital, economic openness, and political stability, which this study was not equipped to address. Finally, this study underscores the significant variance in the impact of FDI across different EU and OECD countries, providing insights valuable for customised economic strategies. It identified empirical observations, laying the groundwork for subsequent research to delve deeper into the determinants of differentiation of FDI's impact on countries' economic growth.

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