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Examining the Impacts of GDP, Trade Openness, Freedom Index and the Internet on FDI: Comparison of Countries with Panel ARDL

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Abstract

The main purpose of this study is to examine the impacts of GDP, trade openness, the freedom index and the internet on FDI in 54 countries, including developing, transition and developed countries, over the period 1995–2021. First, the variables affecting FDI are determined. Then, first- and second-generation unit root tests are conducted for panel data to investigate stationarity. Finally, long- and short-run relationships between variables that have an effect on FDI are exhibited with panel cointegration tests and panel ARDL analysis. Among 17 candidate variables, internet, GDP, the freedom index and trade openness are determined to affect FDI. GDP, the internet and the freedom index have a significant positive and trade openness has a significant negative relationship with FDI in the short run. Finally, there is a long-term equilibrium between FDI and all the variables. Trade openness also has negative coefficient in developing countries such as China, Brazil and Turkey. This is a unique study in which empirical findings are given for each country with the PMG model, which would aid the policy implications identified for the 54 countries, including developing, transition and developed countries.

Keywords: Foreign direct investment, GDP, trade openness, freedom index, internet, panel ARDL
JEL Codes: C01, C10, C22, C58, F40

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1. Introduction

Foreign direct investment (FDI) is seen as a substantial determinant of economic growth in many developing countries. FDI inflows, especially in developing countries, play a critical role in sustainable economic growth, for example, by creating and increasing employment, improving the knowledge and management skills of the local workforce, modern technology transfer and technology diffusion, human capital, capital deepening, foreign exchange, productivity increase and new production tools, R&D and integration with world economies (Anyanwu, 2011; Dankyi *et al*., 2022; Economou *et al*., 2017; Latief and Lefen, 2019). The OECD defined FDI as a "cross-border investment made by a direct investor, an enterprise located in an economy, with the aim of obtaining a permanent interest in a resident enterprise, defined as a direct investment enterprise, in another economy other than its own" (OECD, 2009). In other words, FDI is the provision of capital by an enterprise located in one country to an existing or newly established enterprise located in another country (Jones and Wren, 2006). These capital-providing firms, often referred to as "multinational corporations" (MNCs), have direct control or managerial influence over value-added and revenue-generating facilities in at least two countries (Cohen, 2007). The fact that FDI has significant benefits for MNCs, as well as for host countries' economies, has increased the interest in FDI. MNCs, while engaging in FDI to obtain resources, reduce their competition risks and increase their sales. Governments prefer FDI for factors that are effective in stimulating the economy such as growth, employment and human capital. Therefore, investigating the determinants of FDI and determining their effects on economic growth are effective in both the investment decisions of MNCs and the policymaking of governments.

Agiomirgianakis *et al*. (2003) defined FDI as "capital flows caused by MNC conduct". Accordingly, the size and direction of FDI may be influenced by factors that may affect the behaviour of MNCs. Higher FDI inflows lead to a faster technological diffusion from developed to developing countries. FDI plays a substantial role in many developing countries and makes these countries essential components of the global supply chain, which supports international trade (Arvin *et al*., 2021).

The main drivers of FDI inflows include factors such as market size (GDP), trade and tourism. FDI, which plays a decisive role in the development process of countries, has a positive effect on production, employment, income level, economic growth and development in countries and is effective in increasing the general welfare of countries (Azam and Haseeb, 2021). Alfaro (2003) emphasized the importance of identifying the factors that affect FDI inflows and determining which factors contribute more than others to the increase in FDI. Gupta and Singh (2016) pointed out that FDI can provide access to open markets for production processes, technology transfer, technical expertise and capital while also supporting output development in growing economies.

Another factor affecting FDI is human capital. The Solow growth model claims that human capital is a crucial element of total factor productivity, which accounts for the residuals in other models that cannot be explained (Solow, 1957). It has been stated that human capital has innovative abilities, produces and processes knowledge and uses technology, which can lead to more productivity and innovation for sustainable economic growth (World Bank, 2018). Mingyong *et al*. (2006) argued that the larger the human capital stock, the higher the ability to absorb high technology, leading to higher economic growth. Asafo-Agyei and Kodongo (2022) noted that if labour mobility is low in an economy, the human capital role may also be low in benefiting from FDI.

Based on the theoretical link between FDI, economic growth and technology, Hassan (2005) explained positive externalities that may be associated with FDI through various mechanisms such as competition, training, links and a demonstration mechanism. In accordance with the competitive mechanism, an increase in competition leads to higher efficiency, productivity, physical or human capital and investment. The training mechanism leads to increased education activities in the workforce and management. The linking mechanism states that FDI provides the transfer of technology to domestic companies. Based on the demonstration mechanism, domestic companies can imitate more advanced companies' technology use. The theoretical models that forecast the significance of FDI in economic growth in emerging countries, such as those used by Grossman and Helpman (1993), Barro and Sala-i-Martin (2004) and Romer (1990), are compatible with these theoretical viewpoints.

In the neoclassical growth theories, long-term growth is determined exogenously by population growth and technological progress, whereas endogenous growth theories model changes in technology (*e.g*., Romer, 1990). Studies supporting endogenous growth models can be divided into investment-based and research-development-based models according to two different schools of thought (Mingyong *et al*., 2006). According to the first school, which believes that aggregation of physical capital contributes to FDI, growth arises from the advantages of the accumulation of both physical and human capital. The second school states that economic growth in the long-term results from technological progression arising from endogenous innovation and is encouraged by investments in R&D (Asafo-Agyei and Kodongo, 2022). Although domestic R&D is thought to be of critical importance in endogenous innovation, some studies have revealed that international transfers of technology can play a substantial role in growth processing (*e.g*., Keller, 2004). Therefore, FDI can be considered a factor that facilitates the transfer of technology internationally. In many of the studies on developing economies in the literature, it has been revealed that when FDI interacts with some variables, such as the technology gap, financial development and human capital, it affects economic growth positively (Asafo-Agyei and Kodongo, 2022). Studies also show that these factors represent the absorptive capacity of the countries hosting FDI. For instance, Borensztein *et al*. (1998) stated that a minimum human capital level is required in order for FDI to have a positive effect on economic growth.

Nowbusting (2009) stated that several fundamental channels are effective in explaining the impact of FDI on economic growth in the existing literature. In a channel named the "direct effect", FDI makes a contribution to output growth by creating capital accumulation and an increase in labour demand while also leading to capital growth caused by domestic investment. The other channel, known as the "indirect effect", states FDI increases total factor productivity with the spillover effect on the local capital created and influences economic growth. Asghari *et al*. (2014) discussed another channel called the "export effect". According to this effect, FDI is expected to increase local productivity and product competition and lead local firms to explore foreign markets. Based on this information, although the role of FDI in economic growth is theoretically seen as a tool to create a competitive effect, aid technology transfer, develop human capital and finance development, this evidence is not definite for developing countries (Asafo-Agyei and Kodongo, 2022). For instance, Lumbila (2005), Ndikumana and Verick (2008) indicated in their studies that FDI has a significant positive impact on economic growth. Fry (1993) and Hermes and Lensink (2003) argued that FDI can affect economic growth only when it interacts with absorptive capacity variables. Nevertheless, Fry (1993) and Hermes and Lensink (2003) also stated that this situation will not occur in this way for all developing countries.

Another factor affecting FDI is trade openness. Trade openness is also another important determinant of countries' economic performance. The commercial potential of a country is generally represented by the level of GDP of the country attracting foreign investment. In this case, more opportunities for further trade can be created. Trade openness in a country helps transfer and reflect knowledge and technology to the economy and contributes to the utilization of comparative advantages. Moreover, having a liberal structure increases the level of division of labour and specialization in the country, which positively affects the country's overall economic performance. In line with these theoretical foundations, it can be argued that there is a strong positive effect between FDI, economic growth and trade openness. There are many studies in the literature examining the link between FDI and trade openness. In these studies, it is shown that an increase in trade openness increases FDI. This is due to the creation of a more favourable business environment as trade restrictions are reduced, which, in turn, encourages higher FDI inflows (Arvin *et al*., 2021). For instance, Mingyong *et al*. (2006) stated that increased trade openness increases the capacity of domestic absorption by boosting the amount of human capital spent on R&D activities. Le *et al*. (2015) stated that countries with greater trade openness have relatively higher economic growth compared to countries with less openness. Alesina and Wacziarg (1998) and Jonsson and Subramanian (2001) also reached similar results. However, there are also studies in the literature that demonstrate the opposite of these views. Numerous studies have also drawn attention to the methodological shortcomings and restrictions of research demonstrating the positive correlation between trade and growth. Trade liberalization may undermine the progress of economic

growth through various forms of macroeconomic stabilization, such as trade distortions and balance of payments crises. For this reason, the causality direction between economic growth and trade openness is ambiguous. FDI is likely to either directly or indirectly affect economic growth by trade. Therefore, there is a reciprocal causal relationship between economic growth, FDI and trade. Trade openness in the form of FDI is revealed as one of the key theories in explaining the growth phenomena in developing countries.

This study has three novelties. Firstly, it consists of a panel dataset covering 27 years and 54 countries. Secondly, rather than focusing on a single geographical region or a single development level, we compare countries from different continents with different development levels. Thirdly, empirical findings are given for each country with the pool mean group (PMG) model, which allows the policy implications identified for each of the 54 countries, including developing, transition and developed countries.

The main purpose of this study is to examine the effects of GDP, trade openness (TOP), the freedom index (FIN) and the internet (INT) on FDI in 54 countries, including developing, transition and developed countries, over the period 1995–2021. Comparing the short-term and long-term effects of these indicators on FDI for countries with different levels of development and in different geographical regions helps determine general policy implications. However, the main motivation of this study is to apply the PMG method for each country separately. This approach enables policy implications for each country, in both the short and long term.

Moreover, in line with the purpose of the study and the findings, we propose the following hypotheses to measure the factors that may affect FDI in developing, transition and developed countries discussed in the study. The main purpose of this study is to test the following five main hypotheses.

H_1*:* GDP has a significant and positive impact on FDI in both the long and short run.

H_2*:* The internet has a significant and positive impact on FDI in the long run and a non-significant negative effect on FDI in the short run. A positive and negative short-term impact is generally observed in developing and transition economies.

H_3*:* There is a significant and positive relationship between the freedom index and FDI in the long run, but a non-significant positive relationship in the short run. This relationship varies in countries on different continents.

H_4*:* Trade openness and FDI have a negative relationship in both the short and long term. Trade openness has a negative coefficient in developing countries in general.

H_5*:* The impact of GDP, TOP, FIN and INT on FDI varies at the country level, depending on the country's development level.

All these hypotheses are explained in depth on a country basis in the discussion and implication sections by relating them to the literature and our findings. The rest of the study is organized as follows. Following the introduction, Section 2 delves deeper into the existing literature. Section 3 outlines the methodology and selection of variables. Section 4 offers the dataset, Section 5 explores the empirical test results, Section 6 presents a discussion, and lastly, Section 7 presents a conclusion that includes implications and limitations and suggestions for future research.

2. Existing Literature

The relationship between FDI and a wide variety of variables has been the subject of many studies in the literature and has been analysed with a wide range of methods. These studies have generally focused on the determinants of FDI and its relationship with economic growth and other macroeconomic outcomes. The literature on the determinants of FDI in developed and emerging economies is extensive but also controversial. Although there are significant studies in the literature on the determinants of FDI, there is no consensus on the generally accepted determinants. The lack of consensus on the results of empirical studies on the importance and impact of the determinants of FDI can be explained by the methodological differences in the studies and the effects of different perspectives.

Sunde (2017) applied the autoregressive distributed lag (ARDL) model bounds testing method, known as the ARDL model, to cointegration for long-run relationships among FDI, exports and economic growth for South Africa. They investigated the short-term dynamics using the error correction model. The VECM Granger causality method was used to examine the causality direction. In accordance with their results, both FDI and exports promote economic growth. The analysis of VECM Granger causality demonstrates that there is a one-way causal relationship between economic growth and FDI that runs from FDI to economic growth.

Asongu and Odhiambo (2020) assessed how ICT modifies the impact of FDI on the dynamics of economic growth in 25 sub-Saharan African countries between 1980 and 2014 by using the generalized method of moments. According to their findings, the adoption of mobile phones and the internet both significantly modulate FDI, leading to generally favourable net impacts on all three dynamics of economic growth.

Arvin *et al*. (2021) revealed the causal relationship among trade openness, FDI, ICT penetration and connectivity and economic growth on the case of G20 countries over the period 1961–2019. They examined whether international trade, ICT and FDI are drivers of economic growth, and they investigated the links between those variables in the long and short run. They demonstrated that these economies' long-term economic growth depends on FDI, ICT and trade openness.

Dankyi *et al*. (2022) investigated the link between FDI, economic growth, human capital development, urbanization, CO_2 emissions and renewable energy in the ECOWAS. By using the panel data analysis, they clustered 14 countries as low and lower-middle-income countries for the period 1990–2017. According to their results, across all the panel grouping, FDI and human capital have a significant effect on GDP. Moreover, their results show that CO_2 emissions, urbanization, FDI and human capital affect economic growth in low and lower-middle-income countries.

Asafo-Agyei and Kodongo (2022) analysed the relationships between economic growth and FDI for sub-Saharan African countries using a threshold regression model. Based on their findings, in order for FDI to positively affect the average region's economy, the countries in the region should reach an annual threshold level in FDI inflows of 44.67 USD per person. Consequently, they stated that reaching the threshold level of FDI is required, but not sufficient, for economic growth.

Tag and Degirmen (2022) argued that the expected return on FDI is high in environments with a corporate structure that develops and protects economic liberties. They used the system GMM estimation approach and considered 127 countries in the period 2000–2018. Their analysis indicates that although economic freedom is correlated with FDI (net inflow) per capita in general, only a small number of economic freedom institutions drive this relationship.

Wehncke *et al*. (2022) aimed to investigate the causal and long-term relationships between FDI, official development assistance (ODA) and economic growth in 20 African countries in 2000–2018 using the ARDL and error correction model. They found that economic growth encourages ODA, while FDI promotes economic growth, and ODA supports economic growth in the long term.

Aromasodun (2022) investigated the determinants of FDI inflow in West Africa. According to the findings of the study, while financial development negatively affects FDI inflow in West Africa, the institutional composite index, trade openness and corruption control positively affect FDI and increase the globalization tendency.

Sookram *et al*. (2022) aimed to identify the factors affecting FDI flows in Caribbean countries between 2000 and 2019 using the ARDL model. They found that the important factors affecting the growth in the Caribbean region are gross capital formation, GDP growth, population growth and natural resource rent.

Kenh and Wei (2023) identified a twofold purpose in their study. Firstly, they evaluated the consistency between Cambodia's sectoral inward FDI and its comparative advantage in exports. They used instrumental variable two-stage least squares regression to analyse the effect of industry-level FDI on economic growth between 1994 and 2017. Their findings reveal that

FDI in Cambodia was attracted to the sectors that had a comparative advantage during the study period.

Ranjan and Agrawal (2011) evaluated the factors affecting FDI flows to BRIC countries in 1975–2009 and stated that market size can be measured by labour costs, physical structure, national income, trade openness, economic development and macroeconomic stability. Similarly, Hoang and Bui (2015) revealed that the key drivers of FDI in ASEAN countries in 1991–2009 are labour productivity, infrastructure, trade openness, human capital and market size. Jadhav (2012), on the other hand, examined the BRIC countries for the period 2000–2009 and stated that the determinants of FDI in these countries are natural resources, voice and responsibility, trade openness and regulations. Arawomo and Apanisile (2018) indicated that factors such as inflation rate, government spending, market size, real interest rate and trade openness in the telecommunications sector are potential determinants of FDI in Nigeria. Saini and Singhania (2018) found different results for developed and developing countries in their study conducted on a total of 20 countries, 11 of which were developed and nine were developing. Asiamah *et al*. (2019) found that exchange rate, inflation and interest rate had negative effects on FDI inflows in the short and long term in Ghana in 1990–2015, while telephone usage, GDP and electricity consumption had positive effects.

3. Methodology

The dataset utilized within this research encompasses multiple years and countries, thereby warranting the application of panel data estimators to enhance the robustness of findings. Employing panel estimation techniques facilitates the incorporation of both cross-sectional and temporal dimensions, thereby augmenting variability and expanding the pool of observations. Additionally, the utilization of panel estimation serves to mitigate noise relative to conventional time series analyses, thereby engendering greater confidence in the reliability of outcomes. A panel ARDL model is used in this study because of these advantages.

ARDL was introduced initially in the time series domain by Pesaran and Smith (1995) and further extended by Pesaran *et al*. (2001). Later, Pesaran (2006) employed the ARDL framework in a panel setting. Distinguished from conventional time series analyses, the ARDL methodology enables the simultaneous prediction of short-term and long-term causal relationships within a unified model, obviating the necessity for separate model specifications for each relationship type. This attribute proves particularly advantageous when examining cointegrated time series data, as emphasized by Pesaran *et al*. (2001).

One of the notable advantages of ARDL methods is their capability to address non-stationarity in variables, a feature which sets them apart from other econometric models (Pesaran

et al., 2001; Pesaran and Smith, 1995). Furthermore, to investigate the relationships among variables, these methods facilitate the estimation of cointegration, along with testing for cointegration (Pesaran, 2021). Additionally, ARDL methodologies accommodate stochastic and deterministic trends in data, as highlighted by Pesaran *et al*. (1999). The inherent simplicity of the method contributes to its ease of implementation and interpretation, rendering it accessible to researchers, as observed by Pesaran (1997).

The first step in the analysis is to address the selection of variables. This is assessed by applying pairwise correlation analysis (Appendix C) and by using a variance inflation factor (VIF) to check multicollinearity (Appendix D). The second step is to check the stationary of the variables as the ARDL model requires I(0) or I(1) level of stationarity (Appendix E). Fisher's ADF unit root test (I. Choi, 2001) and Im, Pesaran and Shin's IPS panel unit root test (Im *et al*., 2003) are utilized for the first-generation unit root tests and Pesaran's (2021) cross-sectional dependence test and Pesaran's (2007) cross-sectional augmented Dickey-Fuller (CADF) panel unit root test are applied for the second-generation unit root tests (Appendix E). Following the identification of variables integrated at levels I(0) or I(1), the next step is to conduct panel cointegration tests, using methodologies proposed by Kao (1999), Pedroni (1999, 2004) and Westerlund (2007) (Appendix G). These tests are instrumental in discerning the existence of a long-run relationship between FDI and the independent variables. The last phase of the analysis entails the implementation of the ARDL model (Appendix H). This model serves to examine both short-term and long-term relationships between the independent and dependent variables. The final estimated model can be given as follows:

$$\begin{aligned}\ln\Delta FDI_{it} &= a_i + \sum_{j=1}^{p} a_{1,ij} \ln\Delta FDI_{i,t-j} + \sum_{j=0}^{q_1} a_{2,ij} \ln\Delta INT_{i,t-j} + \sum_{j=0}^{q_2} a_{3,ij} \ln\Delta GDP_{i,t-j} + \\ &+ \sum_{j=0}^{q_3} a_{4,ij} \ln\Delta FIN_{i,t-j} + \sum_{j=0}^{q_4} a_{5,ij} \ln\Delta TOP_{i,t-j} + \theta_i ECT_{i,t-1} + \varepsilon_{it}\end{aligned} \tag{1}$$

In Equation (1), the first difference of the variables is denoted with Δ, α_1 _ α_5 denote the short-run coefficients of *FDI*, *INT*, *GDP*, *FIN* and *TOP*, and θ_i denotes the coefficients of *ECT*, which serve as indicators of the speed of adjustment towards long-run equilibrium. The *ECT* captures the extent to which deviations from the equilibrium relationship between variables are corrected in each period, thereby shedding light on the dynamics of adjustment processes over time. To ascertain the optimal lag length for the *ECT*, the Akaike information criterion (AIC) is employed. In this context, a maximum lag length of two is chosen, reflecting a balance between capturing sufficient temporal dependences and avoiding overfitting the model to the data.

The panel estimation model denoted with Equation (1) employs the PMG technique. Specifically, the PMG technique allows the differentiation of short-run coefficients, intercepts and error variances among the countries within the panel dataset. Consequently, separate inferences can be drawn for each country, enhancing the granularity and specificity of the analysis. In the context of examining the relationship between FDI and exploratory variables, the PMG approach not only entails the construction of a PMG model incorporating panel ARDL specifications but also involves the derivation of short-term relationships for individual countries.

4. Data

The panel dataset employed in this study encompasses data spanning 54 countries from 1995 to 2021, chosen to represent diverse continents and varying levels of development, as classified by the World Bank (United Nations, 2018). The main purpose of this study is to examine the relationship between foreign direct investment and GDP, trade openness, the freedom index and the internet in the countries that are developing, in transition and have just attained the developed status. Many countries in Europe are considered developed due to their participation in the European Union. The time interval of 1995–2019 was chosen because the former Soviet and Balkan countries in the study were founded in the 1990s and there was a significant increase in FDI starting in 1995. The list of countries, along with their continents and levels of development, can be found in Appendix A (Table A).

Initially, the data consisted of 18 variables: *FDI* and 17 candidate variables thought to influence FDI (Appendix B: Table B). Among those variables, exchange rate, the political right index, the civil liberty index and inflation were removed from the dataset as they have no significant correlation with FDI. Population and employment are not used in the analysis because they have high multicollinearity with *GDP*. The corruption perception index and the KOF globalization index are not preferred due to their high multicollinearity with the *FIN*. Human capital and output per worker are omitted from the dataset, as they have high multicollinearity with the *INT*. Secondary education and tertiary education are not used in the analysis because, at the I(1) and I(0) levels, these variables are not stationary, which is necessary to perform analysis following an ARDL approach. Finally, energy productivity is removed from the data because its Lag(1) and Lag(2) values have multicollinearity with *TOP*.

The final dataset contains the variables of *FDI*, *INT*, *GDP*, *FIN* and *TOP*. The natural logarithm of the variables is used. Appendix B (Table B) shows variable names, descriptions and sources.

5. Results

Appendix F (Table F) provides the descriptive statistics for the data. The number of observations differs among variables because of missing values. The missing value percentage for the variables is between 1% and 6%, which is not very high and, thus, does not pose any problem in data analysis. The descriptive statistics for the variables reveal that the mean value of the logarithm of *FDI* stands at 9.65, with a range between 2.87 and 14.54. Similarly, the logarithm of *GDP* exhibits an average value of 11.22, ranging from 7.72 to 16.58. Additionally, the mean values of the logarithms of *INT*, *FIN* and *TOP* are 2.09, 4.06 and 4.30, respectively. The logarithm of *INT* spans from −10.95 to 4.57, while the logarithm of *FIN* ranges between 3.17 and 4.37. Moreover, the logarithm of *TOP* varies from 2.65 to 5.76.

Appendix C (Table C) denotes the matrix of pairwise Pearson correlation coefficients for the datasets. There are significant positive relationships between *INT* and *FDI* (ρ = 0.59.59), *GDP* and *FDI* (ρ = 0.79) and *FIN* and *FDI* (ρ = 0.30). A significant negative relationship was also detected between *TOP* and *FDI* (ρ = −0.11).

Correlation coefficients between independent variables are also significant. There are significant correlation coefficients between *GDP* and the *INT* (ρ = 0.21), between *FIN* and *INT* (ρ = 0.46), between *TOP* and *INT* (ρ = 0.25), between *TOP* and *GDP* (ρ = −0.47) and between *FIN* and *TOP* (ρ = 0.31).

The presence of multicollinearity must be examined by checking the relation between independent variables. In Appendix D (Table D), VIF and tolerance metrics are provided for the dependent variable *FDI* and the independent variables *INT*, *GDP*, *FIN* and *TOP*. With VIF values below 5 and tolerance values exceeding 0.25 for all the variables, no evidence of multicollinearity is observed among the independent variables.

The ARDL methodology demands that variables exhibit stationarity at either the I(0) or I(1) level. To verify this requirement, three widely used panel unit root tests are employed: the IPS test and Fisher's ADF test for first-generation unit root tests, and the CADF test for second-generation unit root tests. The outcomes are summarized in Appendix E (Table E2). According to the IPS panel unit root test, *FDI* and *GDP* initially exhibit unit roots at the I(0) level, but achieve stationarity at I(1). Conversely, *INT*, *FIN* and *TOP* demonstrate stationarity at both I(0) and I(1). The results of the Fisher ADF test align with those of the IPS, with *FDI* and *GDP* stationary solely at I(1), while the other variables are stationary at both levels. Additionally, according to the CADF test, *INT* and *TOP* display unit roots at I(0), yet all the variables attain stationarity at I(1). This collective evidence confirms that the prerequisites for ARDL analysis are satisfied, laying the foundation for robust and reliable model estimations.

Appendix E (Table E1) presents the cross-sectional dependence test results. The cross-sectional dependence test results indicate that *FDI*, *GDP*, *INT*, *FIN* and *TOP* all have *p*-values of less than 0.001, meaning that the data are correlated across panel groups. Thus, all the considered variables have cross-sectional dependence across countries.

Appendix G (Table G) presents results of the panel cointegration test derived from the Pedroni, Kao and Westerlund tests. Remarkably, these tests offer disparate conclusions regarding the existence of cointegration among the selected variables. While the Pedroni test suggests no cointegration, both the Kao and Westerlund tests indicate the presence of a long-term relationship among the variables.

The optimal number of lags for the model and variables was determined across all the countries using the AIC, with a maximum of two lags considered. Consequently, the prevailing lag structure identified for the countries was ARDL (1 1 1 1 1).

Table 1: Estimation outcomes using the PMG estimator

Variables	Coefficient	Std. error	Z	*p*
Dependent variable: *FDI*	**Long run**			
GDP	1.1921*	0.1018	11.71	0.0000
Internet	0.1469*	0.0157	9.36	0.0000
Freedom index	1.4649*	0.1970	7.44	0.0000
Trade openness	−0.2330*	0.0690	−3.37	0.0010
Dependent variable: *FDI*	**Short run**			
ECT	−0.2493*	0.0467	−5.34	0.0000
Δ *GDP*	0.7053*	0.1969	3.58	0.0000
Δ *Internet*	−0.0709	0.0613	−1.16	0.2480
Δ *Freedom* index	0.0134	0.1866	0.07	0.9430
Δ *Trade openness*	−0.2435*	0.0998	−2.44	0.0150
Constant	−2.1409*	0.4005	−5.35	0.0000
Hausman chi²	1.84			0.7646

Note:* $p < 0.05$.

Source: Authors´own calculations

Table 1 presents the results of the PMG panel ARDL analysis, examining the short-term and long-term relationships between FDI and GDP, INT, FIN and TOP across 54 countries. Additionally, the Hausman test is performed to determine the appropriate estimation method between PMG and mean group (MG) estimation. With a *p*-value of 0.7646 for the Hausman test, indicating a lack of significant difference between the estimators, the PMG estimator is favoured over the MG estimator.

The analysis reveals a statistically significant and positive association between GDP and FDI, persisting in both the long and short run. Specifically, a one-unit increase in the logarithm of GDP corresponds to a substantial increase of 1.19 units in the logarithm of FDI in the long run. Moreover, in the short run, each additional unit increase in the lagged value of the logarithm of GDP results in a noteworthy rise of 0.70 units in the logarithm of FDI.

The analysis reveals a positive and statistically significant relationship between INT and FDI in the long run. Specifically, a one-unit increase in INT results in a substantial increase of 0.14 units in the logarithm of FDI in the long run. However, in the short run, the relationship between INT and FDI is non-significant and negative.

The analysis uncovers a statistically significant positive relationship between FIN and FDI in the long run, while a non-significant positive relationship is observed in the short run. Specifically, a one-unit increase in the logarithm of FIN corresponds to a substantial increase of 1.46 units in the logarithm of FDI in the long run.

The analysis reveals a significant negative relationship between TOP and FDI, evident in both the short and long run. Specifically, a one-unit increase in the logarithm of TOP results in a noteworthy decrease of 0.23 units in the logarithm of FDI in the long run. Similarly, in the short run, each additional unit increase in the lagged value of the logarithm of TOP is associated with a reduction of 0.24 units in the logarithm of FDI.

The error correction term (ECT) serves as an indicator of the long-term equilibrium relationship among all the exploratory variables. Notably, the coefficient of ECT is statistically significant and negative, with a value of −0.249. This coefficient signifies that approximately 25% of any deviation from the equilibrium state is corrected annually, indicating the speed of convergence towards the equilibrium.

Table 2: Short-run estimation results for each country with PMG

Country	*ECT*	Δ *GDP*	Δ *Internet*	Δ *Freedom index*	Δ *Trade openness*
Albania	−0.1776	0.314	0.0589	0.2279	−0.9817
Algeria	**−0.1686***	−0.0137	**−0.0565***	0.2164	**−0.2588***
Angola	0.1338	0.4519	−0.0418	−2.4479	−0.2203
Argentina	**−0.5269***	0.3345	0.0529	−0.5196	**−0.4635***
Armenia	−0.0888	1.3687	**0.4707***	0.7984	−0.3581
Azerbaijan	−0.1044	**−1.6776***	**0.2381***	1.6275	−0.2837
Belarus	**−0.4814***	1.0007	**−0.2103***	**−1.5388***	0.1775
Bosnia and Herzegovina	**−0.2151***	2.1809	0.0335	−0.4364	−0.667
Brazil	−0.1432	2.1365	−0.1204	0.5423	**−1.0034***
Bulgaria	**−0.2423***	0.3873	**−0.3563***	−1.1221	0.131
Cameroon	**−0.4338***	0.8425	−0.0875	−0.7524	−0.3018
China	0.0618	0.872	−0.0291	0.0084	**−0.3343***
Croatia	−0.2386	1.6499	−0.3433	−1.7889	−0.5387
Cyprus	**−0.1529***	−0.554	−0.0917	0.027	0.9303
Czechia	−0.0735	0.1268	0.1815	−1.208	−0.1006
Egypt	**−0.1717***	**3.4917***	**−0.0966***	−0.1631	−0.005
Estonia	**−0.1608***	0.3727	−0.0932	0.4779	−0.2535
Ethiopia	**−0.4392***	−0.8869	**−0.1154***	0.5405	**0.4246***
Georgia	**−0.299***	0.8317	**−0.1909***	0.5004	−0.4187
Ghana	−0.0343	**1.7639***	−0.0308	1.0322	0.0663
Hungary	**−0.3023***	−1.2031	0.0012	**−2.3013***	0.1884
India	**−0.1173***	0.5087	−0.0263	−0.4721	−0.2341
Indonesia	−0.1487	2.0256	−0.1503	0.9457	0.3689
Ivory Coast	−0.0633	−0.935	0.009	−0.6302	0.1843
Kazakhstan	−0.1986	0.7927	**0.2077***	−0.1086	−0.015
Kenya	−0.1544	2.4194	−0.0532	1.5523	−0.0641
Kyrgyzstan	−0.0648	−0.0128	−0.0829	−0.9147	0.4281
Latvia	−0.0972	0.7296	0.0011	0.8308	−0.0479
Lebanon	0.0015	−0.0123	**0.1714***	0.194	**0.0834***
Lithuania	**−0.2019***	0.5636	0.0581	−0.5756	−0.3105
Macedonia	**−0.4002***	**−2.8642***	**1.1971***	0.7296	**0.2884***

Country	*ECT*	Δ *GDP*	Δ *Internet*	Δ *Freedom index*	Δ *Trade openness*
Malaysia	−0.2243	**1.1421***	**0.1426***	**2.0954***	0.2564
Malta	**−0.1144***	−1.1542	−0.2952	1.2173	1.2323
Mexico	**−0.2044***	1.1344	−0.0971	0.3721	**−0.9703***
Moldova	**−0.2396***	0.3047	0.0326	−0.4714	0.5124
Morocco	**−0.2847***	0.3779	−0.0264	0.6841	0.1554
Nigeria	0.0043	**3.2457***	−0.1341	0.3448	0.1876
Pakistan	**−0.2465***	**4.3526***	**0.1053***	−1.1261	**−0.851***
Peru	−0.0088	**1.1532***	−0.0061	**0.8884***	0.0759
Poland	−0.1199	0.5018	0.2192	−1.1319	0.278
Romania	**−0.1877***	0.3852	−0.057	**1.9899***	−0.2588
Russia	**−0.2981***	1.2148	−0.0071	1.6582	**−2.8349***
Senegal	−0.0434	−1.5064	**−0.3051***	1.8009	0.5154
Serbia	−0.4471	1.2765	0.0032	**−2.2154***	**−1.6362***
Slovakia	**−0.1662***	0.4947	0.1335	1.3128	0.0802
Slovenia	**−0.1877***	1.3324	**−0.5056***	0.2243	−0.4828
South Africa	**−0.2231***	**4.3065***	0.1337	**−3.3684***	**−2.6113***
South Korea	**−0.4457***	0.5693	−0.1515	**3.6894***	**−0.993***
Tajikistan	**−2.4358***	−3.2064	**−2.7651***	−3.2036	0.0384
Tunisia	−0.1706	1.083	−0.0315	0.4517	−0.4642
Turkey	**−0.4154***	0.7828	−0.3444	1.5035	**−1.7921***
Ukraine	**−0.1707***	**0.7222***	0.0492	**−1.5746***	−0.2595
Uzbekistan	**−0.7601***	2.0168	**−0.6103***	0.3926	0.0136
Venezuela	**−0.37***	0.5532	0.1861	−0.0816	0.2468

Note: * $p < 0.05$.

Source: Authors´own calculations

In Table 2, the coefficients of the PMG model are presented for each country, offering insights into the specific policy implications tailored to each country's context. Within this table, the ECT represents the long-term equilibrium relationship among all the explanatory variables.

For Albania, Angola, Croatia, Czechia, Indonesia, Ivory Coast, Kenya, Kyrgyzstan, Latvia, Poland and Tunisia, none of the variables are significant for FDI. For Bosnia and Herzegovina, Cameroon, Cyprus, Estonia, India, Lithuania, Malta, Moldova, Morocco, Slovakia and Venezuela, the only variable that affects FDI is *ECT*, with a negative coefficient. For Ghana and Nigeria,

only *GDP* has a significant positive effect on FDI. For Armenia, Kazakhstan and Senegal, only *INT* has a significant effect on FDI; the coefficient for Armenia and Kazakhstan is positive and the coefficient for Senegal is negative. On the other hand, the only variable that has a significant impact on FDI is *TOP* for China and Brazil, with a negative coefficient.

ECT and *INT* are the only variables that are significantly related to FDI in Bulgaria, Georgia, Slovenia, Tajikistan and Uzbekistan, with a negative coefficient. Meanwhile, *ECT* and *TOP* are the only two significant variables with a negative sign in Argentina, Mexico, Russia and Turkey.

For Algeria, *ECT*, *GDP* and *TOP* have significant relationships with FDI, with negative coefficients. For Azerbaijan, *GDP* has a significant negative relationship and *INT* has a significant positive relationship with FDI. *ECT*, *INT* and *FIN* have significant negative coefficients for Belarus and *ECT* and *INT* have significant negative coefficients while *GDP* has a significant positive coefficient for Egypt. In Ethiopia, *ECT* and *INT* have a negative significant effect and *TOP* has a positive significant effect on FDI. In Hungary, both *ECT* and *FIN* have significant negative coefficients, whereas in Lebanon, *INT* and *TOP* have significant positive coefficients with FDI. In Macedonia, *ECT* and *GDP* have significant negative coefficients, whereas *INT* and *TOP* have significant positive coefficients.

In Malaysia, *GDP*, *INT* and *FIN* have a significant positive effect on FDI, whereas in Peru, only *GDP* and *FIN* have a significant positive effect on FDI. In Pakistan, while *ECT* and *TOP* have a significant negative effect on FDI, *GDP* and *INT* have a significant positive effect on FDI. In Romania, a significant negative coefficient is detected for *ECT* and a significant positive coefficient is detected for *FIN*. In Serbia, only *FIN* and *TOP* are significant, with a negative effect on FDI. In South Africa, *ECT*, *FIN* and *TOP* have a significant negative effect on FDI and *GDP* has a significant positive effect on FDI. In South Korea, FDI is negatively affected by *ECT* and *TOP* and is positively affected by *FIN*. In Ukraine, *ECT* and *FIN* negatively affect FDI and *GDP* positively affects FDI.

6. Discussion

It is seen from the literature review that many studies have been conducted to determine the factors that affect FDI flows to developed and developing countries. The findings of these studies and the determinants of FDI differ according to the period and countries covered in the studies and the statistical methods used. In this study, we investigated the determinants of FDI for 54 countries over the period 1995–2021 using the ARDL model. The study aimed to reveal changes according to the development levels of the countries' determinants of FDI. We analysed the relationships between FDI and INT, GDP, FIN and TOP. A significant negative relationship was detected between TOP and FDI. We found significant positive relationships between INT and FDI, GDP and FDI and between FIN and FDI.

It is observed from the literature that there is generally a positive relationship between FIN and FDI, similar to our study. Moreover, the results in the literature support hypothesis H_3, which says that there is a significant and positive relationship between FIN and FDI in the long run, but a non-significant positive relationship in the short run, and that this relationship varies in countries on different continents. For instance, similarly to Caetano and Caleiro (2009), we found that economic freedom and FDI are positively associated in the long run. Caetano and Caleiro (2009) showed that inward FDI and economic freedom are positively associated, especially in countries with high levels of economic freedom. Similarly, Singh and Gal (2020) found that economic freedom affected FDI inflow in South and East Asia, Northern, Southern, Western and Eastern Europe, Latin America, North Africa, sub-Saharan Africa and the Middle East over the period 1999–2018. They found that economic freedom had a significant positive effect on FDI in East and South Asia, West and North Europe and Latin America. However, economic freedom had an insignificant effect on FDI inflow in Southern and Eastern Europe, North Africa and the Middle East.

In our study, the effect of FIN on FDI varies depending on the development levels of countries and is both negative and positive. We can indicate Malaysia, Peru, South Korea and Romania as examples of countries where FIN positively affects FDI. Belarus, Hungary, South Africa and Ukraine can be given as examples of countries where FIN has a negative effect on FDI.

Malaysia as a developing country, ranked 45th in the freedom index with a score of 65.7 in 2024. Malaysia decreased its rating by 1.6 points from the previous year and rated 9th out of 39 countries in the Asia-Pacific area. However, its score on economic freedom is greater than both the regional and global averages. The Malaysian economy is regarded by the 2024 index as "moderately free". Investment flows and the dynamism of entrepreneurial vitality have increased as a result of the implementation of policies that promote open markets and a thriving private sector. Nevertheless, policy must prioritize better public finance management. Government integrity is jeopardized by the susceptibility of the judicial system to political interference, which poses a serious threat to the efficient and impartial administration of justice. Although the Malaysian government has made efforts to liberalize its regulations regarding foreign investment, several industries remain subject to limitations. One example of regulatory changes in the financial sector is the relaxation of restrictions on foreign ownership.[1]

South Korea ranks 14th in terms of economic freedom, scoring 73.1 in the 2024 Index of Economic Freedom. It is rated 5th out of 39 countries in the Asia-Pacific area, a slight drop from last year. Its economic freedom score is greater than both the regional and global averages. The South Korean economy is regarded as "mostly free" on the 2024 index. A dynamic private sector that benefits from the country's openness to international trade is supported by a highly educated

1 https://www.heritage.org/index/pages/country-pages/malaysia

labour force and innovative capabilities. The integrity of the government is compromised by corruption, despite the robust legal structure. The structure of regulations encourages innovation and entrepreneurship. Although the labour market is dynamic, there are still legislative obstacles to overcome and strong trade unions raise the costs of doing business. Foreign investment is facilitated by an efficient and contemporary regulatory environment in the country.[2]

Belarus, a transition country, ranks 153rd with a score of 48.4 in the 2024 Index of Economic Freedom. It is placed 44th out of 44 countries in Europe; its ranking has dropped by 2.6 points from the previous year. The country's economic freedom score is below both the regional and world averages. The Belarusian economy is rated as "repressed" by the 2024 index. Lower scores for freedom from corruption and property rights reflect poor foundations of economic freedom in the country. Widespread corruption, excessive bureaucracy and an ineffective judiciary affect the enforcement of property rights in the country. Its regulations are ineffective and rigid and the government is heavily involved in the economy. The lack of policies aimed at enhancing productivity and opening up markets undermines both competitiveness and robust investment development.[3]

As can be seen from the country examples, the risk perceived by foreign investors when investing in a foreign country is very important in their investment decisions. This investment risk is closely related to factors such as the level of transparency, corruption rates, rule of law and governance in the target country. Potential foreign investors want to make sure that the policies in their target country are transparent enough. Therefore, as countries' levels of freedom and transparency increase, they are more likely to attract higher levels of FDI. A stable and active legal framework against corruption and policies that promote economic freedom are important factors in attracting FDI. One of the reasons for the positive interaction between economic freedom and FDI is that open markets encourage factor allocation, productivity and profitability of investments. Therefore, the liberalizing aspect of investment and trade, as well as clear and predictable economic policies, can be powerful tools to attract FDI.

Moreover, Caetano and Caleiro (2009) tried to reveal the relationship between economic freedom and FDI by analysing MENA countries and European countries comparatively. Their study showed that economic freedom and inward FDI have a positive relationship, especially in country clusters with higher levels of economic freedom. This result also coincides with our study findings and supports our hypothesis H_3.

2 https://www.heritage.org/index/pages/country-pages/korea-south

3 https://www.heritage.org/index/pages/country-pages/belarus

In order to test our hypothesis H_1 "GDP has a significant and positive impact on FDI in both the long and short run", we analysed the results of some studies in the literature, similar to our study, and we found that GDP has a positive and significant impact on FDI in both the long and short run (Baiashvili and Gattini, 2020; Mamingi and Martin, 2018; Zghidi *et al*., 2016).

Most of the studies that have investigated the relationship between trade openness and FDI have reported either a positive or insignificant relationship. Contrary to these studies, we identified a negative relationship between TOP and FDI, in both the short and long run. There are also some other studies that found a negative relationship between FDI and TOP (Cantah *et al*., 2018; Kandiero and Chitiga, 2006; NGO *et al*., 2020; Rathnayaka Mudiyanselage *et al*., 2021). These studies support hypothesis H_4 "Trade openness and FDI have a negative relationship in both the short and long term. Trade openness has a negative coefficient in developing countries in general". One reason for the negative relationship is the potential for FDI to replace imports. When a foreign company invests in a host country, it may choose to produce goods that were previously imported, leading to a reduction in the host country's imports. This can be seen as a substitution effect, by which FDI replaces imports, leading to a negative relationship between FDI and TOP. Another reason is that TOP can reduce the profitability of FDI. When a host country reduces its trade barriers, it becomes easier for foreign firms to enter the market and compete with domestic firms. This can lead to increased competition and reduced profits for foreign firms, making FDI less attractive. As a result, an open economy may discourage FDI, leading to a negative relationship between FDI and TOP.

In this study, which aimed to identify the factors affecting FDI in countries located on four different continents, similarities and differences are observed across continents. As a result of the analysis, for example, TOP has a significant negative relationship with FDI in both the short and long run. Based on these observations, we tested our hypothesis H_4 "Trade openness and FDI have a negative relationship in both the short and long term. Trade openness has a negative coefficient in developing countries in general", specifically considering the negative coefficients in developing countries. Evaluating on a country basis, for example, TOP is the sole significant variable in China and Brazil with a negative coefficient, while it is also significant but has a negative coefficient in Mexico, Russia, Argentina and Turkey. Looking at the common characteristics of the countries, it is seen that Turkey is located on the Asian and European continents, the other countries are located on the American and Asian continents and all these countries are in the category of developing countries. In general, considering that developing countries started to liberalize trade in the 1980s, it can be said that the reduction of trade restrictions in these countries since that decade and the creation of a more favourable business environment have encouraged higher FDI inflows. The negative relationship between TOP and FDI in these countries can also be seen as a common point. One reason for the negative relationship can be seen as a substitution

effect in which FDI substitutes for imports, leading to a negative relationship between FDI and TOP. Another reason is that TOP may reduce the profitability of FDI. Therefore, these countries should focus on policies that will turn this negative relationship into a positive one and increase the profitability of FDI, avoid policies that will cause existing FDI to leave their countries and discourage potential FDI inflows and develop policies that ensure macroeconomic stability and infrastructure development.

In this study, we also focused on the relationship between FDI and INT. Our results show that INT has a significant positive relationship with FDI in the long run but a non-significant negative relationship in the short run. This is an expected result because creating internet infrastructure and policies is difficult in the short term, but they provide significant economic benefits in the long term. To verify our hypothesis H_2 "The Internet has a significant and positive impact on FDI in the long run and a non-significant negative effect on FDI in the short run. A positive and negative short-term impact is generally observed in developing and transition economies", we examined the effects of the INT on FDI in the short run and found that this effect is mostly observed in developing and transition countries. Bulgaria and Slovenia are the only developed countries where INT has a short-term effect on FDI. The short-term effect is negative in Algeria, Belarus, Bulgaria, Egypt, Ethiopia, Georgia, Senegal, Slovenia, Tajikistan and Uzbekistan and the effect is positive in Armenia, Azerbaijan, Kazakhstan, Lebanon, Macedonia, Malaysia and Pakistan. This is another situation that needs to be examined in depth by policymakers. Studies examining the relationship between INT and FDI in the literature (C. Choi, 2003; Yin and Choi, 2022) have shown that INT encourages more FDI by increasing productivity; however, it is a necessary but not sufficient factor in increasing FDI. It has been indicated that factors such as the degree of government intervention in commercial activities, human capital and financial development are among the factors that increase the impact of INT on FDI. In addition, it has been stated that a better internet infrastructure and an increase in internet usage rates will cause an increase in export volumes. In this case, the internet is an important factor in attracting FDI for several reasons, such as having a good internet infrastructure, using the internet to increase transaction efficiency for foreign investors, reducing transaction and production costs and increasing economic performance. The internet can also optimize the allocation of technology, capital, labour and other resources, which can foster economic growth and labour productivity. Therefore, countries should focus on policies that improve the internet and ICT infrastructures, remove barriers to trade, increase transaction efficiency and promote trade.

In order to evaluate the countries on the African continent in the study, first of all, the unique characteristics of the African continent's socioeconomic, cultural and institutional structure, which are different from other continents, should be taken into account. In Africa, it can be said that there are several factors that may be attractive for FDI, such as market size, natural resource deposits,

return on investment, financial development and human capital development. In this respect, for example, it has been seen that GDP has a significant positive effect on FDI in Ghana and Nigeria which are discussed in the study. UNCTAD reports in 2019 and 2022 also support these results. According to the World Investment Report for 2019 (UNCTAD, 2019), although FDI inflows to Ghana declined by 8% to 3 billion dollars, Ghana was the largest recipient of FDI in West Africa. FDI flows to Ghana in 2022 also increased by 39% and reached 2.6 billion dollars (UNCTAD, 2022).

7. Conclusion

Due to the fact that FDI has a positive impact on countries through factors such as growth, employment, productivity and deepening capital, while also providing advantages for MNCs, such as obtaining resources, reducing competitive risks, increasing sales and making effective investment decisions, we were motivated to identify the determinants of FDI in the 54 countries considered in this study.

Since the study covers a long time period of 27 years and examines 54 countries, including developing, transition and developed economies on four different continents, it is a comprehensive study and is important in terms of identifying the determinants of FDI in these countries and revealing the commonalities and differences between them. Each of the countries considered in this study has a variety of problems that can affect them depending on their economic structures, market sizes, individual characteristics and susceptibility to exogenous shocks. Despite the unique dynamics of each country and the differences between them, there are also common features across them. Therefore, it is important to identify the determinants of FDI inflows that support sustainable economic growth and development in these countries.

Another contribution of this study is that it analysed developing, transition and developed economies as a whole and identified the determinants of FDI separately for each of the countries using the PMG model. The PMG estimator also shows the heterogeneity between results across countries and the short-term PMG estimate on a country basis offers a significant advantage in revealing the difference between countries. In this regard, each country can make plans for regulations regarding its political system, economic policies and economic reforms in the short term, depending on its unique characteristics and dynamics, and develop the infrastructure to realize these regulations in the long term. The existence of a potential market size in a country is attractive for FDI, but it can also offer various opportunities to countries. However, due to macroeconomic instability, foreign direct investors may abandon their investments in these countries. Identifying the factors affecting FDI inflows on a country-specific basis and determining which factors are most effective for FDI inflows may be instructive for countries, and countries will be able to improve their infrastructure to become attractive for FDI by eliminating their deficiencies.

In addition, the technology transfer that will take place with FDI will enable them to produce their own technology thanks to improved technical expertise.

Moreover, although many studies have been conducted on this issue, this study contributes to the literature because, to the best of our knowledge, there is a limited number of studies that cover all developing, transition and developed economies together, evaluate them country-specifically and cover a long and recent period.

7.1 Policy implications

The results of this study reveal important implications for the investigated countries and their policymakers, as they identify the factors that attract FDI to developing, transition and developed economies. Based on the findings of the study, it is important to identify deficiencies in FDI in the countries under consideration in order to better understand the effects of government interventions and how these interventions affect foreign investment decisions.

Since the countries considered in the study have different levels of development and are located in different geographical regions, identifying the determinants of FDI separately by using the PMG method will help make short-term and long-term policy implications.

This study is important not only for the countries under consideration but also for the MNCs that will invest in these countries. The study may help MNCs understand what motivates them and how they can further increase their profits by investing on emerging markets and assessing potential opportunities. The findings of the present study may help MNCs make better decisions and assist policymakers in the countries under consideration in forming policies based on the determinants of FDI that emerged in the study findings. By comparing countries' performance, policymakers will be able to see the areas where they are lagging behind and develop policies to improve these areas.

This study may also guide the countries in terms of determining the factors related to how to make the performance and trends of the incoming FDI sustainable and what kinds of policies should be followed in order to attract more FDI in the future, as well as how to optimize the economic situation.

There is a consensus in the literature that FDI is a source of capital, investment and growth, mostly for developing countries. In this case, a competitive environment may arise among developing countries to attract more FDI. In this competitive environment, understanding the key factors behind FDI inflows can motivate developing countries to move to the category of developed countries.

In particular, if developing and transition economies follow a more open and liberalized trade philosophy or provide tax incentives, it will give foreign investors more confidence in directing their capital to these countries. In addition, these countries should control inflation, unemployment rates, labour costs and exchange rate movements in order to ensure macroeconomic stability; if they do not, it will be a disincentive for FDI inflows. Moreover, the rule of law, independence of the judiciary and protection of intellectual property rights are important factors for FDI inflows.

7.2 Limitations and future research

The limitations of the study include the unavailability of data for many countries, the fact that many of the 17 variables initially considered in the model do not have a significant correlation with FDI, which resulted in the exclusion of some variables from the model due to multicollinearity. Therefore, other variables affecting the FDI that would be used in future studies may give a clearer picture of the relationships between FDI and those variables and suggest possible ways of dealing with these variables to attract more FDI to the developing, transition and developed countries. Hence, performing more comprehensive analyses with different models, methods and variables may be the subject of future studies. A comprehensive study regarding NARX and machine learning models may also be interesting to detect the relationships between FDI and other variables.

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Appendixes

Appendix A: List of Countries

Table A: List of countries by continent and level of development

Africa	America	Asia	Europe
Algeria [dg]	Argentina [dg]	Armenia [tn]	Albania [tn]
Angola [dg]	Brazil [dg]	Azerbaijan [tn]	Bosnia and Herzegovina [tn]
Cameroon [dg]	Mexico [dg]	Belarus [tn]	Bulgaria [dd]
Egypt [dg]	Peru [dg]	China [dg]	Croatia [dd]
Ethiopia [dg]	Venezuela [dg]	Georgia [tn]	Cyprus [dd]
Ghana [dg]		India [dg]	Czechia [dd]
Ivory Coast [dg]		Indonesia [dg]	Estonia [dd]
Kenya [dg]		Kazakhstan [tn]	Hungary [dd]
Morocco [dg]		Kyrgyzstan [tn]	Latvia [dd]
Nigeria [dg]		Lebanon [dg]	Lithuania [dd]
Senegal [dg]		Malaysia [dg]	Macedonia [tn]
South Africa [dg]		Moldova [tn]	Malta [dd]
Tunisia [dg]		Pakistan [dg]	Poland [dd]
		Russia [tn]	Romania [dd]
		South Korea [dg]	Slovakia [dd]
		Tajikistan [tn]	Slovenia [dd]
		Turkmenistan [tn]	Ukraine [tn]
		Turkey [dg]	
		Uzbekistan [tn]	

Note: dg: developing, tn: transition, dd: developed

Source: Authors´own calculations

Appendix B: Variable Explanation

Table B. Definitions, sources of data, list of variables and exclusion reasons

Variables used	Description	Source	Drop reason
FDI	Logarithm of foreign direct investment (FDI) stocks in millions of US dollars, measured at current prices	UNCTAD	–
GDP	Logarithm of gross domestic product (GDP) in millions of constant 2015 US dollars	UNCTAD	–
INT	Internet usage rate per 100 individuals	WDI	–
FIN	The Economic Freedom Index ranges from 0, indicating no freedom, to 100, indicating complete freedom.	Heritage Foundation	–
TOP	Sum of imports and exports divided by the total gross domestic product (GDP)	UNCTAD	–
Variables excluded	Description	**Source**	**Exclusion reason**
EXR	Real effective exchange rate	Bruegel Datasets	No correlation with FDI
PR	The Political Right Index ranges from 1, indicating high political rights, to 7, indicating low political rights.	Freedom House	No correlation with FDI
CL	The Civil Liberty Index ranges from 1, indicating high civil liberty, to 7, indicating low civil liberty.	Freedom House	No correlation with FDI
KOF	The Index of Globalization ranges from 1, indicating no globalization, to 100, indicating total globalization.	KOF Institute	Multicollinearity with freedom index and internet
CPI	The Corruption Perception Index ranges from 0, indicating highly corrupt, to 10, indicating no corruption.	Transparency International	Multicollinearity with freedom index and internet
HC	Human capital index	PWT 10.0	Multicollinearity with internet
EMP	Number of individuals engaged in employment, measured in millions with logarithmic transformation	PWT 10.0	Multicollinearity with GDP
LAB	Labour productivity measured in constant 2010 US dollars	ILO	Multicollinearity with internet
POP	Logarithm of absolute values of population, measured in thousands	UNCTAD	Multicollinearity with GDP
INF	Average consumer prices	WEO	No correlation with FDI
SED	Percentage of working-age population with secondary education	CEPII Database	Not stationary at level I(0) and I(1)
TED	Percentage of working-age population with tertiary education	CEPII Database	Not stationary at level I(0) and I(1)
EPR	Logarithm of energy productivity	CEPII Database	Lagged values have multicollinearity with trade openness

Source: Authors´own calculations

Appendix C: Pairwise Correlation

High correlation values between independent and dependent variables and low correlation values between independent variables themselves are desired. *EXR* ($\rho = 0.0581$), *PR* ($\rho = -0.2076$), *CL* ($\rho = -0.2366$) and *INF* ($\rho = -0.1783$) are removed from the dataset as they have low or no corelations with the FDI. *KOF* (*KOF-INT*: $\rho = 0.7654$; *KOF-FIN*: $\rho = 0.6281$) and *CPI* (*CPI-INT*: $\rho = 0.5309$; *CPI-FIN*: $\rho = 0.6689$) are removed from the dataset to avoid the multicollinearity problem with *FIN* and *INT*. *HC* ($\rho = 0.5434$) and *LAB* ($\rho = 0.5487$) are removed due to their high correlation with *INT*, and *EMP* ($\rho = 0.8349$) and *POP* ($\rho = 0.8190$) are removed due to the high correlation with GDP to avoid the multicollinearity problem. *EPR* is dropped from the dataset as its lagged values have multicollinearity with *TOP*.

Table C. Pairwise correlation results

	FDI	INT	GDP	FIN	TOP	EXR	PR	CL	KOF	CPI	HC	EMP	LAB	POP	INF	SED	TED	EPR
FDI	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
INT	0.5815*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
GDP	0.7871*	0.2050*	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
FIN	0.2986*	0.4557*	−0.0081	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–
TOP	−0.1110*	0.2486*	−0.4692*	0.3053*	1	–	–	–	–	–	–	–	–	–	–	–	–	–
EXR	0.0581*	0.035	0.0283	−0.0731*	−0.2055*	1	–	–	–	–	–	–	–	–	–	–	–	–
PR	−0.2076*	−0.3212*	−0.0212	−0.4821*	−0.3247*	0.1716*	1	–	–	–	–	–	–	–	–	–	–	–
CL	−0.2366*	−0.3951*	0.045	−0.5176*	−0.4312*	0.1263*	0.9090*	1	–	–	–	–	–	–	–	–	–	–
KOF	0.6045*	0.7654*	0.2442*	0.6281*	0.4498*	−0.1033*	−0.5970*	−0.6591*	1	–	–	–	–	–	–	–	–	–
CPI	0.3595*	0.5309*	0.0421	0.6689*	0.4127*	−0.0808*	−0.6691*	-0.6893*	0.7384*	1	–	–	–	–	–	–	–	–
HC	0.1955*	0.5434*	−0.0204	0.4014*	0.4540*	−0.0767*	−0.4790*	−0.5280*	0.6846*	0.4470*	1	–	–	–	–	–	–	–
EMP	0.4812*	−0.1162*	0.8349*	−0.2622*	−0.6592*	0.0601*	0.2799*	0.3858*	−0.1886*	−0.3028*	−0.3645*	1	–	–	–	–	–	–
LAB	0.5250*	0.5487*	0.2762*	0.4403*	0.3798*	−0.0653*	−0.5571*	−0.6240*	0.7649*	0.6238*	0.5796*	−0.2823*	1	–	–	–	–	–
POP	0.4522*	−0.1380*	0.8190*	−0.2857*	−0.6925*	0.0626*	0.3203*	0.4327*	−0.2217*	−0.3232*	−0.4036*	0.9902*	−0.3050*	1	–	–	–	–
INF	−0.1783*	−0.3681*	0.0672*	−0.5465*	−0.2125*	−0.0603*	0.2383*	0.2976*	−0.3834*	−0.4267*	−0.1251*	0.2026*	−0.2292*	0.2043*	1	–	–	–
SED	0.1729*	0.4628*	−0.0483	0.2744*	0.4423*	−0.0463	−0.3227*	−0.3738*	0.5180*	0.3461*	0.9292*	−0.3260*	0.4747*	−0.3642*	−0.0528	1	–	–
TED	0.2311*	0.4518*	0.0324	0.2816*	0.3862*	−0.0209	−0.2313*	−0.2981*	0.5440*	0.3241*	0.7891*	−0.2782*	0.5316*	−0.3088*	−0.1072*	0.7771*	1	–
EPR	0.4302*	0.4093*	0.1504*	0.4410*	0.1450*	−0.0877*	−0.4269*	−0.4758*	0.5307*	0.4868*	0.1547*	−0.2270*	0.6842*	−0.2464*	−0.3089*	0.0630*	0.0818*	1

Source: Authors´own calculations

Appendix D: Multicollinearity

VIF is a metric that is commonly used to detect multicollinearity; as a rule of thumb, VIF values lower than 5 indicate no multicollinearity. Variables that have a high correlation with FDI and no multicollinearity problem are used in the next step of the analysis.

Table D: Multicollinearity test results

	GDP	***INT***	***FIN***	***TOP***
VIF	1.46	1.41	1.30	1.58
1/VIF (tolerance value)	0.6860	0.7100	0.7677	0.6348

Source: Authors´own calculations

Appendix E: Unit Root Tests

The ARDL methodology necessitates that variables exhibit stationarity at either the I(0) or I(1) level. It should also be noted that the robustness of the outcomes within the ARDL framework may be compromised if integrated variables at the I(2) level are included in the ARDL model.

Therefore, several unit root tests such as Fisher's ADF unit root test (I. Choi, 2001) and Im, Pesaran and Shin's IPS panel unit root test (Im *et al*., 2003) are utilized to ascertain the stationarity status of the variables. The application of these tests aids in identifying and subsequently excluding variables that do not meet the required stationarity criteria, thereby ensuring the robustness and validity of the ensuing ARDL analysis.

For panel unit root tests, the initial equation typically adopts an augmented Dickey-Fuller (ADF) regression framework, which can be characterized as:

$$\Delta y_{it} = \phi_i y_{i,t-1} + \sum_{j=1}^{p} \varphi_j \Delta y_{i,t-j} + \varepsilon_{it} \quad \text{(E.1)}$$

where $\phi_i = \rho_i - 1$. In the IPS test, $H_0 = \phi_i - 1(\rho_i = 1)$, while $H_1 = \phi_i < 0$ $(\rho_i < 1)$. Rejection of the null hypothesis provides evidence in favour of stationarity for the variable under consideration. By fitting a regression for each panel denoted with ϕ_i, the IPS test computes the average *t*-statistics. It is pertinent to note that this approach differs from certain other panel unit root tests, such as the LLC test (Levin *et al*., 2002).

The Fisher-type test amalgamates all the *p*-values acquired from individual unit-root tests conducted on each series to check the existence of a unit root across the panel. This study employs the inverse-χ^2 Fisher-type, inverse-normal Fisher-type, modified inverse-χ^2 Fisher-type and inverse-logit Fisher-type panel unit root tests. The primary objective of the Fisher-type panel unit root test is to assess the null hypothesis

H_0 : *All panels contain unit root*, contrasted against the alternative hypothesis.

H_1: *At least one panel is stationary*.

Both the IPS test and the Fisher test are first-generation unit root tests and do not consider cross-sectional dependences that may arise due to macroeconomic links, unaccounted residual independence and unobserved common variance (Attard, 2019). Where cross-sectional dependence exists, second-generation unit root tests, which are robust to cross-sectional dependence, should be applied. For that purpose, Pesaran's cross-sectional dependence test (2021) and Pesaran's (2007) cross-sectional augmented Dickey-Fuller (CADF) panel unit root test are applied. The CADF test takes cross-sectional dependence into account and tests whether the stationarity levels of the variables are still I(0) or I(1), even if there is a cross-sectional dependence among variables.

Table E1: Results of cross-sectional dependence testing

	FDI	***GDP***	***INT***	***FIN***	***TOP***
CD-test	**172.59***	**173.97***	**180.72***	**38.95***	**25.78***
p	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**

SED and *TED* are dropped from the dataset as they are not stationary at I(0) (*SED*: $p = 0.4638$; *TED*: $p = 0.5631$) and I(1) (*SED*: $p = 0.9426$; *TED*: $p = 0.7248$) levels.

Source: Authors´own calculations

Table E2: Panel unit root tests results

Im, Pesaran and Shin (IPS) test

Variables	*Wt*–bar	*p*	Variables	Wt–bar	*p*
FDI	0.0546	0.5218	**Δ*FDI***	–13.5624*	0.0000
GDP	3.2087	0.9993	**Δ*GDP***	–8.0879*	0.0000
INT	–11.5475*	0.0000	**Δ*INT***	–14.6943*	0.0000
FIN	–2.9562*	0.0016	**Δ*FIN***	–16.8283*	0.0000
TOP	–2.5822*	0.0049	**Δ*TOP***	–16.4716*	0.0000

Fisher ADF test

		Stats	*p*			Stats	*p*
	P	93.8533	0.8320		**P**	466.2715*	0.0000
FDI	**Z**	3.7605	0.9999	**Δ*FDI***	**Z**	–14.8963*	0.0000
	L	3.5503	0.9998		**L**	–17.1394*	0.0000
	Pm	–0.9626	0.8321		**Pm**	24.3773*	0.0000
		Stats	*p*			**Stats**	*p*
	P	150.6584*	0.0042		**P**	270.1103*	0.0000
GDP	**Z**	4.4981	1.0000	**Δ*GDP***	**Z**	–8.5116*	0.0000
	L	2.2119	0.9861		**L**	–8.9738*	0.0000
	Pm	2.9025*	0.0019		**Pm**	11.0302*	0.0000
		Stats	*p*			**Stats**	*p*
	P	731.7076*	0.0000		**P**	562.3250*	0.0000
INT	**Z**	–13.3587*	0.0000	**Δ*INT***	**Z**	–10.8800*	0.0000
	L	–24.5406*	0.0000		**L**	–17.5769*	0.0000
	Pm	42.4379*	0.0000		**Pm**	30.9129*	0.0000
		Stats	*p*			**Stats**	*p*
	P	303.0482*	0.0000		**P**	202.6639*	0.0000
FIN	**Z**	–5.4653*	0.0000	**Δ*FIN***	**Z**	–3.0829*	0.0000
	L	–8.1593*	0.0000		**L**	–4.3404*	0.0000
	Pm	13.2713*	0.0000		**Pm**	6.4411*	0.0000
		Stats	*p*			**Stats**	*p*
	P	162.9954*	0.0005		**P**	173.1266*	0.0001
TOP	**Z**	–2.6612*	0.0039	**Δ*TOP***	**Z**	–2.8224*	0.0024
	L	–2.9048*	0.0020		**L**	–3.2896*	0.0006
	Pm	3.7420*	0.0001		**Pm**	4.4313*	0.0000

CADF

	Stats	*p*		Stats	*p*
FDI	–3.3630*	0.0000	**Δ*FDI***	–9.5460*	0.0000
GDP	–8.1710*	0.0000	**Δ*GDP***	–13.4310*	0.0000
INT	0.0460	0.5180	**Δ*INT***	–4.1850*	0.0000
FIN	–3.4000*	0.0000	**Δ*FIN***	–11.3270*	0.0000
TOP	–0.7370	0.2310	**Δ*TOP***	–7.6870*	0.0000

H_0: All panels contain unit roots / H_A: At least one panel is stationary

* Null hypothesis rejected at the 0.05 level. Time trend and panel means are included in IPS test and CADF /(ADF: 1 lag).

Source: Authors´own calculations

Appendix F: Descriptive Statistics

Table F: Descriptive statistics for variables used in the study

Variable	*FDI*	*GDP*	*INT*	*FIN*	*TOP*
n	1 441	1 445	1 364	1 409	1 402
Minimum	2.87	7.72	–10.95	3.17	2.65
Mean ± std. dev.	9.65 ± 1.98	11.22 ± 1.70	2.09 ± 2.50	4.06 ± 0.16	4.30 ± 0.52
Maximum	14.54	16.58	4.57	4.37	5.76

Source: Authors´own calculations

Appendix G: Panel Cointegration Tests

Following the identification of variables integrated at levels I(0) or I(1), the next step is to conduct panel cointegration tests, using methodologies proposed by Kao (1999), Pedroni (1999, 2004) and Westerlund (2007). These tests are instrumental in discerning the existence of a long-run relationship between FDI and the independent variables. Each of the aforementioned tests operates within a panel data framework, assuming an I(1) dependence for the variable under examination. The null hypothesis posits no cointegration, implying the absence of a long-term relationship among the variables, while the alternative hypothesis asserts the presence of cointegration, indicating a stable long-run association within the model.

$$y_{it} = x'_{it}\beta_i + z'_{it}\tau_i + \varepsilon_{it} \tag{G.1}$$

In Equation (G.1), for each panel , it is assumed that the independent variable x_{it} is I(1), and each I x_{it} is unrelated to the other independent variables. A common $\beta_i = \beta$ is assumed in the Kao test, while panel-specific β_i 's are used in the Pedroni test.

Table G: Tests for panel cointegration

Pedroni test				
	Panel		**Group**	
	Stats	***p***	**Stats**	***p***
ADF	–1.018	0.8456	–1.689	0.0456
pp	–4.382	0.0000	–4.441	0.0000
rho	1.659*	0.0485	3.716*	0.0001
v	–0.01232	0.4951	–	–
Kao test				
			Stats	***p***
Augmented Dickey-Fuller test			–4.5429*	0.0000
Dickey-Fuller test			–4.6718*	0.0000
Modified Dickey-Fuller test			–2.1203*	0.0170
Unadjusted Dickey-Fuller test			–4.6001*	0.0000
Unadjusted modified Dickey-Fuller test			–1.9849	0.0236
Westerlund test				
Variance ratio			–2.8738*	0.0020

* Null hypothesis rejected at the 0.05 level.

Source: Authors´own calculations

Appendix H: Panel Autoregressive Distributed Lag (ARDL) Model

The last phase of the analysis entails the implementation of the ARDL model. This model serves to examine both short-term and long-term relationships between the independent and dependent variables. Specifically, it entails constructing a multiple linear regression model that captures the association between FDI and the independent variables, with the inclusion of logarithmic transformations. Logarithmic transformation is applied to ensure linearity and to mitigate the impact of extreme values.

$$\ln FDI_{it} = a + a_1 \ln INT_{it} + \ln GDP_{it} + \ln FIN_{it} + \ln TOP_{it} \quad \text{(H.1)}$$

Equation (H.2) can be derived from Equation (H.1) with parameters (p, q_1, q_2, q_3, q_4) in a panel ARDL approach where the lag of the dependent variable is expressed with p and the lag of each independent variable is denoted with $q_{i.\,i}$.

$$\ln FDI_{it} = a_i + \sum_{j=1}^{p} a_{1,ij} \ln FDI_{i,t-j} + \sum_{j=0}^{q_1} a_{2,ij} \ln INT_{i,t-j} + \sum_{j=0}^{q_2} a_{3,ij} \ln GDP_{i,t-j} + \quad \text{(H.2)}$$
$$+ \sum_{j=0}^{q_3} a_{4,ij} \ln FIN_{i,t-j} + \sum_{j=0}^{q_4} a_{5,ij} \ln TOP_{i,t-j} + \varepsilon_{it}$$

In Equation (H.2), the fixed effect for each panel is denoted with a_i, while the lagged coefficients of the independent and dependent variables are shown with $\alpha_1 - \alpha_5$. The error term ε_{it} is assumed to change for each country and each period, where $t = 1, 2 \ldots, T$ and $i = 1, 2, \ldots, N$. The panel ARDL model in Equation (H.2) can also be expressed with an error correction term (ECT) as in Equation (H.3):

$$\ln \Delta FDI_{it} = a_i + \sum_{j=1}^{p} a_{1,ij} \ln \Delta FDI_{i,t-j} + \sum_{j=0}^{q_1} a_{2,ij} \ln \Delta INT_{i,t-j} + \sum_{j=0}^{q_2} a_{3,ij} \ln \Delta GDP_{i,t-j} + \quad \text{(H.3)}$$
$$+ \sum_{j=0}^{q_3} a_{4,ij} \ln \Delta FIN_{i,t-j} + \sum_{j=0}^{q_4} a_{5,ij} \ln \Delta TOP_{i,t-j} + b_{1,ij} \ln FDI_{i,t-1} +$$
$$+ b_{2,ij} \ln INT_{i,t-1} + b_{3,ij} \ln GDP_{i,t-1} + b_{4,ij} \ln FIN_{i,t-1} +$$
$$+ b_{2,ij} \ln TOP_{i,t-1} + \varepsilon_{it}$$

The first difference of the variables is denoted with Δ in Equation (H.3), $\alpha_1 - \alpha_5$ are the short-run coefficients and $b_1 - b_5$ are the long-run coefficients of *FDI*, *INT*, *GDP*, *FIN* and *TOP*. Equation (H.3) can be interpreted with the *ECT* term which is given by Equation (1) in the main text.