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DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN THE LEAST DEVELOPED COUNTRIES: STATIC AND DYNAMIC PANEL DATA EVIDENCE

Abstract. *This research aim is to investigate Foreign Direct Investment (FID) complexity in less developed countries, highlighting the factors that affect FDI. Based on data collected for the period 2003–2019 an econometric model allows us to determine the relevance of traditional and non-traditional factors. We employ a panel regression, with both static and dynamic models and Granger causality. The findings reveal HDI and Governance have a significant relationship with FDI in both the static and dynamic models. The study's novelty relies both on the proposed composite governance index and the relationships identified between FDI and new factors relevant to the LDC context, such as the fertility, urbanisation, and governance that might be taken into consideration both by international organisations and national regulators and policy makers.*

Keywords*: Foreign direct investment, Less developed countries, Economic growth, Governance, Granger causality, GMM.*
JEL Classification : F21, F43, O11, C58

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1. Introduction

Since the establishment of the category least developed countries (LDCs) in 1971, these states have unfortunately followed an erratic and often fragile development trajectory (UNCTAD, 2021). In terms of social, health, economic, and foreign-trade factors, they constitute a heterogeneous group of countries (Jeníček & Grófová, 2014). LDCs are distinguished not only by their widespread poverty but also by a structural weakness of their economic, institutional, and human resources, often conditioned by geographical impediments (Hong et al., 2021). Characterised by a low level of socio-economic development (Chipalkatti et al., 2021), LDCs have limited capacity to generate their own domestic revenue and are thus economically vulnerable to external shock (Gonzalez, 2017). Although development progress has been made over the past 50 years, core challenges have persisted and become more complex and urgent (Lewis, 2000). Due to these particularities, the factors that influence foreign direct investment (FDI) evolution in this area deserves to be analysed (Popovici et al., 2021) because may bring new data to policy makers.

This study investigates the complexity of FDI in LDCs, analyses FDI patterns and more importantly, identify the key factors that influence the development of these patterns. We use a sample of LDCs evaluated for the longest available period given the data constraints. We build a panel of 22 countries analysed during 2003–2019 that we analyse by employing a panel regression, with both static and dynamic models and Granger causality. We focus on determining the relevance of the very well-known human development index (HDI) for FDI in the specific LDC context. Subsequently, we broaden our scope by considering other determinates such as urbanisation, fertility, and governance that might influence FDI but have been little explored in the literature to this point.

The study proceeds as follows. Section 2 introduces the context of LDCs, Section 3 develops the debate on factors influencing FDI in LDCs, and Section 4 explains the methodology and data used. In Section 5, we present the empirical findings and discuss the results and in Section 6conclude the study, revealing the paper's limits and suggestions for future research.

2. Least developed country context

From a historical point of view, the ending of the colonial era (latest 1950s and early 1960s for most LDCs) is the turning point in their evolution; between the transfer of power, and consequent social issues, new elites embraced the responsibility of providing their countries with strategies to govern efficiently and manage their growth. The reality that became immediately obvious is that many of these newly independent nations inherited (i) poor institutions; (ii) inadequate infrastructure, human, financial, and physical resources; (iii) a barely recognisable private sector; and (iv) fundamentally weak economies (UNCTAD, 2021).In comparison to manufacturing-based economies, LDCs were confronted with the reality of strongly competitive international trade and negative positions in commerce as their commodities continued to perform badly and showed low-income elasticity of demand (Chipalkatti et al., 2021; Hong et al., 2021).

In general, the LDCs are characterised by an accentuated economic vulnerability generated from scarce human resources and minimal revenue. However, this pattern is not present in all LDCs, even if there are numerous shared characteristics. Many LDCs share a pattern of totalitarian regimes, namely dictatorships and the vast majority of those can be found in Sub-Saharan Africa.

The population of LDCs experience a low standard of living. The scarcity of normal amenities – clean water, medical care, access to electrical energy, schooling – is recognised worldwide as a major issue to be addressed alongside the core problem of famine and the lack of adequate housing.

Much of the study of the world economy's impact on national processes is based upon two opposing theoretical perspectives: modernisation theory and dependency/world-systems theory. Modernisation theory (Hoselitz, 1960) argues that development is a process that all countries go through, and assistance from developed countries will speed up this process. Even if this process of modernisation has some negative consequences for developing countries, these are only temporary "growing pains" that all countries experience. The traditional approaches thus produce the same results: impoverished nations keep on being poor. Modernists argue that only through substantial economic growth will poor countries succeed in decreasing poverty. By contrast, dependency theorists (Frank, 1978) assert that development is not an invariant process. They argue that the current economic, political, military, and social environment is very different from that experienced by developed countries and inhibits the ability of less developed countries to grow. Moreover, the assistance of developed countries actually retards economic growth in less developed countries. LDCs thus become "dependent" upon developed countries for manufactured goods and capital, enabling "core" countries to obtain favourable (unequal) trade relationships, resulting in a net outflow of capital from the periphery to the core of the world economy and the "underdevelopment" of LDCs.

3. Debates concerning the factors influencing FDI in the LDC context

FDI is foremost an incentive to economic growth for any country, and this is especially the case for developing countries and LDCs. For LDCs, FDI is considered one of the core economic sources for development and economic stability through improving the capacity of the production process, growing business networks and access to foreign natural resources or knowledge and employee expertise (Ahlquist, 2006). It can provide substitute products and increase the supply of top products in a country through imports. It creates employment for locals, enhances the development of local infrastructure (Buchanan et al., 2012) and enables locals to access products that are not produced within their country (Dunning, 2009). Through participation in cross-border supply chains, FDI creates the conditions for indigenous enterprises in LDCs to be integrated into international production networks and reach overseas markets.

Other benefits of FDI are reflected in an increase in domestic investments, an inflow of superior technology, and increasing competition in the host country (Jensen, 2003; Hong et al., 2021). At the same time, FDI increases challenges faced

by local traders and may add to pollution and inequality. FDI is also an incentive for employment creation, technology distribution, economic growth and, finally, sustainable growth (Lewis, 2000). Thus, the strategy that governments should follow to minimise risk is through good governance and competent administrative organisations, an effective supervisory structure and increased capabilities in raising or attracting funds.

Many countries struggle to attract foreign investors. Some possible causes for this situation may be related to governmental regulations and policies on investment, availability of raw materials (e.g. African countries), trade-facilitation instruments, availability of appropriate human resources, economic growth, political stability and security and cost and ease of doing business (Asiedu & Lien, 2011). In the case of LDCs, only some of these nations have succeeded in their endeavour to attract substantial FDI flows. For these countries, FDI must overcome two main challenges: first, the lack of financial sources and second, shortages of technology and know-how (Jeníček & Grófová, 2014).

A wide range of indicators from various areas (economic performance, social, human capital, welfare, and poverty) are used in FDI modelling. Attempting to identify a complete set of explanatory factors for FDI is an unsustainable approach, given the dynamics of economic phenomena, the heterogeneity of studied countries or regions and the imperfections and limitations of the various indicators. Because investment is intimately linked to macroeconomic dynamics, published studies offer a vast number of approaches to examining the features desired by investors, considering crucial factors such as market size, degree of openness, and overall stability (Popovici et al., 2021).

In capturing the level of economic development of a country, the market size of the host country (measured by per capita GDP) is found to be the most important factor in attracting FDI (Hong et al., 2021).A larger market size attracts FDI as per capita GDP growth is positively and substantially correlated with levels of FDI inflows (Cleeve et al., 2015).Local funding climate, per capita GDP growth and trade openness, are positive and significantly correlated for commodities in exporting countries (Chipalkatti et al., 2021).

There has been criticism in the literature on the use in FDI modelling of the classic indicators of welfare and standard of living based exclusively on GDP variation. In response, new indicators are starting to be used, such as maximum GDP Shock and HDI (Cleeve et al., 2015). According to the UNCTAD (2021**)**, supplementary graduation indicators are needed to cover vulnerabilities and elements that are relevant but not properly reflected in the LDC criterion; the indicator GDP Shock was nominated for this purpose.

The HDI was conceived in the late 1980s and introduced in 1990 to assign a proper place to the human element within the development paradigm; by contrast, until that moment, economic growth alone was considered relevant (Noorbakhsh et al., 2001). The construction of HDI takes into consideration three key dimensions: a long and healthy life, being knowledgeable and having a decent standard of living. The HDI was meant not only to present but to enhance the role of the

human element. There is no generally accepted opinion in the literature concerning the relation between HDI and FDI. Some studies reveal a significant negative association of HDI with FDI. For example, Chipalkatti et al. (2021) argue that higher levels of HDI daunt FDI inflows, in the case of countries with emerging markets. The main reasons for this effect are first, labour regulations and second, higher employment costs. Using only the educational component of HDI, other authors find an association between FDI and such human development indicators as the adult literacy rate and education using a sample of developing countries and LDCs in sub-Saharan Africa (Cleeve et al., 2015).

Developing countries and LDCs need external resources that allow them to capitalise their economy, increasing investment spending and generating industrialisation as a way of overcoming underdevelopment. These resources can be very different in nature: FDI, ODA, external debt or remittances (Donaubauer et al., 2016). ODA is particularly important to the flow of FDI to LDCs; an increased inflow of public aid attracts FDI (Quazi et al., 2014). Among the various kinds of ODA, infrastructure assistance has been shown to increase private capital inflows by improving the capital productivity of physical infrastructure (infrastructure effects) in the recipient country (Donaubauer et al, 2016). Moreover, ODA mitigates the risk of FDI expropriation (Asiedu & Lien, 2011). Several studies identify a matching correlation between ODA and FDI, claiming that ODA's FDI-promoting effects are stronger in countries where the investment environment is unfavourable (Quazi et al., 2014).

Economic instability, proxied by the volatility of prices, is also an important factor affecting the flow of FDI (Saini & Singhania 2018). The other important variables that influence FDI are cost factors (such as wage cost) and the investment climate in the host country (represented by such variables as per capita debt). Higher wage costs, poor investment climate, and economic instability in the host country reduce the inflow of FDI (Saini & Singhania 2018).

Population health is one of the basic indicators of qualitative human capital. It is both a reason and consequence of LDC economic development. The decline in fertility in LDCs has been markedly slower than in other developing countries, and the most significant decrease has been recorded in upper-middle-income countries. The LDCs are a very heterogeneous group as regards this indicator (Jeníček & Grófová, 2014).

Numerous studies focus on the positive effects of FDI inflows growth via improved competition, capital productivity, and positive technological externalities (Balasubramanyam et al., 1996; Dunning, 2009). FDI inflows enhance economic expansion, which, in turn, promotes urbanisation (Yang et al., 2019). A bidirectional causal link has been identified between growth and urbanisation, mostly for LDCs (Brantley & Massinis, 2015). Several studies focus on the effects of FDI inflows on urbanisation in China (Chen et al., 2017). FDI inflows feed urbanisation by providing greater job opportunities, services, and growth. In the African region, FDIs play a significant role in accelerating it (Cang-Ming& Jin-Jun, 2015; Yang et al. 2019).

Concerning the relation between FDI and unemployment for LDCs, Lewis (2000), finds evidence of a statistically significant negative relationship between FDI and unemployment. However, recent studies examining both long-term and short-term effects in a vector error correction model return mixed results. The study's findings clarify that the variable influence is felt more in the long run (Widia et al., 2019).

The association between institutional development, governance and FDI is at the core of numerous recent studies (Bailey, 2018; Canh et al., 2020). The general assumption is that institutional development expressed as good governance plays a key role in shaping an environment that is attractive for FDI (Buchanan et al., 2012; Chipalkattiet al., 2021). Many studies take this into consideration in their analyses of FDI determinants (Dunning, 2009; Lucke & Eichler, 2015) since good governance reduces transaction costs and uncertainty. There is a positive relationship between FDI and the quality of institutions in developing countries and emerging economies (Basemera et al., 2012). When different facets of good governance are analysed, however, results are mixed. Lucke and Eichler (2015) find that investors seek out developed-country hosts with a strong democracy, more corruption, and less political stability than their home country. By contrast, for developing countries, a lower level of corruption is desired, and the markets should be free and provide less of a regulatory burden than in home countries.

Economic and financial hazards, as well as corruption, are important in FDI spread in East Africa, but governance in term of law and order play a comparatively small role (Basemera et al., 2012). Other evidences, reveals that rule of law enhancement and financial development has a negative effect on FDI inflows in African countries (Bailey et al, 2018). In any context, inefficient institutions and corruption result in lower levels of FDI (Buchanan et al., 2012, Mengistu &Bishnu, 2011; Saini et al., 2018). Civil stability, the rule of law and democratic organisation attract FDI, but such investment is deterred by corruption, social remoteness and high tax rates (Bailey, 2018). Therefore, we expect the proxies for institutional quality to be significant in developing countries, where a leap in quality could improve FDI flows.

4. Data and methodology

The main objective of our research is to identify the variables influencing investments, namely FDI, in LDCs.

We address the question of LDCs development by referring to the HDI. The HDI is a composite index to measure the three aspects of human development. First, economic growth is captured in the Income Index, which acts as a stand-in for the material resources that enable a set of basic capabilities that broaden people's horizons. Thereafter, the HDI covers the important factors of people's capabilities, living a healthy life and degree of education in the remaining two indices. The Education Index is based on mean years of schooling, and the Life Expectancy Index reflects life expectancy at birth (UNDP, 2020).

We also considered the traditional indicators: Human Assets (*unemployment rate, urbanisation*) and Governance (*political stability and absence of violence/terrorism, regulatory quality, rule of law, control of corruption*).

We considered the important issue of LDC development status by introducing non-traditional supplementary graduation indicators (NTSGI) because they cover vulnerabilities and relevant elements not properly reflected in the LDC criterion (UNCTAD (2021). We took into consideration the following NTSGI: for Economic Vulnerability (*maximum GDP shock, ODA (as a percentage of GNI)*, Human Assets (*fertility rate*) and Governance (*voice and accountability and government effectiveness*). The variables' definition is that given by their creators World Bank and United Nations.

Thus, we consider four main categories of indicators, that include indicators for Development (*HDI*), Economic Vulnerability (*Maximum GDP shock; ODA*), Human Assets (*fertility rate, unemployment rate, urbanisation*) and Governance (*voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law, control of corruption*).

The sample consists of 22 LDCs classified by UNCTAD after allowing for data availability (Asiedu & Lien, 2011) for the period 2003 to 2019. The data used are from the open sources of international organisations as World Bank and United Nations.

Calculating the composite index

Good governance requires broad consensus in society on political, social, and economic issues. It should also be efficient, equitable, and promote the rule of law. Consequently, the views of the poorest and most vulnerable should be heard when it comes to development resource allocation decisions. Good governance includes six quantifiable dimensions that must be taken into consideration, hence we apply a mathematical model to construct a composite index for the six variables. We used the weights given by the principal components analysis (PCA), corresponding to the standardised scores on the first factorial axis to build a composite Governance Index, which can be written as follows:

$$GI_i = \frac{1}{k}\left(W_1 I_{i1} + W_2 I_{i2} + \cdots + W_p I_{ip}\right) \quad (1)$$

We used panel regression (static model and dynamic model) to highlight the variables influencing FDI in LDCs.

Static panel data

The following specification was used to study the determinants of FDIs using static modelling:

$$FDI_{it} = c + \sum_{j=1}^{J} \beta_i X_{it}^{j} + \sum_{k=1}^{K} \beta_k Y_{it}^{k} + \sum_{l=1}^{L} \beta_i Z_{it}^{l} + e_{it} \quad (2)$$

$$e_{it} = v_i + u_{it} \quad (3)$$

where X, Y and Z are vectors of pull and push determinants. This equation represents the static nature of the model (Saini and Singhania, 2018).

FDI is the dependent variable and is expressed as a percentage of GDP (Jensen, 2003; Ahlquist, 2006). The fact that FDI is scaled by GDP makes the series stationary.

First, we tested the stationarity of the variables using the following tests: Levin, Lin&Chu (LLC), Im, Pesaran & Shin W-Stat (IPS), ADF-Fisher Chi-Square, and PP-Fisher Chi-Square. In order to investigate the existence of structural breaks, we checked robustness on single cross-section units and on the whole panel dataset. According to the panel unit root test, all variables rejected the null hypothesis of a common unit root. The most common tests used for checking stationarity are the LLC and IPS; the former assumes homogeneity in the dynamics of the autoregressive coefficients for all panel members, and the latter permits heterogeneity in these dynamics, allowing for different orders of serial correlation through averaging the augmented Dickey–Fuller statistics.

Three different models are used to analyse the static panel data: common constant, fixed effects (FEs), and random effects (REs). The common constant method considers no differences among the data matrices of the cross-sectional dimension (N). In FE models, differences between units can be accommodated from a different intercept. In the case of the RE model, interference variables may be interconnected between time and units (Apostu et al., 2022). Baltagi (2008) consider FE models appropriate when the focus is on a specific set of entities and the RE model as appropriate when inferences are based on entities randomly drawn from a large sample.

The Hausman test was used to select between REs and Fes; this detected the presence of statistically significant unobserved FEs. Robustness checks (heteroskedasticity of residues, autocorrelation of residues and dependence of residues between the panels) were conducted by the Wooldridge autocorrelation, Wald (heteroskedasticity of residues), Pesaran (dependence of residues between the panels), Greene heteroscedasticity and LM (autocorrelation of residues) tests.

Panel causality tests indicate the causality among variables, and we use the generalized method of moments (GMM) in this paper to capture endogeneity and bias. FE estimation ameliorates the bias arising from unobservable heterogeneity, assuming that explanatory variables are independent of past values of the dependent variable.

Dynamic panel data

In order to study the determinants of FDIs using dynamic modelling, it can be used the following specification

$$\Delta FDI_{it} = c + \delta \Delta FDI_{i,t-1} + \sum_{j=1}^{J} \beta_i \, \Delta X_{it}^{j} + \sum_{k=1}^{K} \beta_k \, \Delta Y_{it}^{k} + \sum_{l=1}^{L} \beta_i \, Z_{it}^{l} + e_{it} \quad (4)$$

In this case, the static effect estimators are biased if lagged values of variables affect the current value of FDI. Past realisation of the variables is required for consistent and unbiased estimates. The first step consists of converting the model in

differenced form and the second in calculating lagged values (Saini &Singhania, 2018).

The first or second lag can be used as instruments because there is no correlation with the current error term (Arellano & Bond, 1991). We use one-step GMM, and the error terms are assumed to be independent and homoscedastic across country and time. For small samples, one-step GMM is preferred (Arellano & Bond, 1991). GMM panel estimates assume there is no serial correlation between the error term and the lagged instruments being used for this Arellano–Bond test for first-order (AR1) and second-order (AR2) serial correlation. To avoid including lags to control the dynamics of the empirical relationship AR(1) is preferred. The J-Statistic and Sargan tests are used for over-identification, with the null hypothesis that all instruments are valid. We used EViews 12 University Edition &Student Version to estimate the models.

5. Empirical results

Composition of governance index

In order to realise the composite index of governance, we considered the six dimensions of governance from the WGI: *voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law,* and *control of corruption*. The method used for composing this index is based on PCA. To determine the quality of the PCA analysis, we used the Bartlett sphericity and the Kaiser–Meyer–Olkin (KMO) tests. The results measuring the adequacy of the sample of indicators in constructing a synthetic governance indicator are satisfactory as the test is statistically significant and the KMO statistic has a value higher than 0.5 (0.825). Thus, 82.5 % of the variance in our variables is common variance, which might be caused by underlying factors; the fact that this proportion is bigger than 50% suggests that the variables "factor well".

According to the results, it is worth highlighting the existence of two main components accounting for approximately 77.55 % (higher the 60% as recommended by the literature) of the variance. Analysing the correlation coefficients in the component matrix, the first main component has positive coefficients with *political stability* and *absence of violence/terrorism* (0.561), *government effectiveness* (0.857), *regulatory quality* (0.874) and *control of corruption* (0.846). The second main component is mainly dominated by *voice and accountability* (0.652)

The Governance Index is built based on the weights of each main component in the total variance:

$$Governance_{index} = \frac{61.74}{77.55} * PC1 + \frac{15.82}{77.55} * PC2 \qquad (5)$$

Based on the Governance Index, the countries in the sample were clustered into seven clusters by relevance as follows: cluster 1: Rwanda, Tanzania, and Mozambique; cluster 2: Togo, Bangladesh, and Cambodia; cluster 3: Niger, Mali, Uganda, and Madagascar; cluster 4: Mauritania, Sierra Leone, and Nepal; cluster 5: Congo, Angola, and Guinea; cluster 6: Benin and Senegal;

cluster 7: Burundi. The best results were registered by countries in Clusters 6 and 1, and the poorest results were achieved by countries in Clusters 5 and 7.

Factors influencing FDI – panel regression

To answer the research objective related to the determinants of FDI in LDCs we used the following panel data equation model:

$$FDI_{it} = \beta_{it} + \beta_1 FR_{it} + \beta_2 GDP_{it} + \beta_3 HDI_{it} + \beta_4 ODA_{it} + \beta_5 GI_{it} + \beta_6 UR_{it} + \beta_7 U_{it} + \varepsilon_{it} \quad (6)$$

The dependent variable is *FDI*. The explanatory variables included in the regression equations are *maximum GDP shock, ODA, HDI, unemployment rate, urbanisation, fertility rate* and *governance index.*

Descriptive analyses of data

We conducted descriptive analyses of the data to identify the characteristics of the countries included in the sample (Table 1).

Table 1. Summary Statistics of Dependent and Explanatory Variables

Variables	FDI	Fertility rate	GDP	HDI	ODA	Governance Index	Unemployment rate	Urbanisation
Mean	4.03	5.05	−7.5	0.45	9.89	−0.000187	4.63	33.88
Min.	−11.2	1.92	−48.8	0.26	0.17	−2.11	0.13	8.91
Max.	39.46	7.66	4.63	0.61	62.19	1.78	16.8	66.18
Std. Dev.	5.69	1.30	11.02	−0.38	7.72	0.82	3.55	13.33

The trends for the variables in the sample are slightly different, but in most of the cases, FDI registers an ascending trend, leading us to conclude that all countries have taken measures to attract FDI. Concerning the correlations, there is not a very high correlation among variables (Table 2).

Table 2. Correlation matrix

Variables	FDI	Fertility rate	GDP	HDI	ODA	Governance Index	Unemployment rate	Urbanisation
FDI	1	0.031	0.039	−0.12	0.107	0.087	−0.101	−0.003
Fertility rate		1	−0.154	−0.738	0.303	0.075	−0.061	0.046
GDP			1	0.224	−0.339	0.095	0.022	−0.017
HDI				1	−0.537	0.035	0.083	0.197
ODA					1	−0.034	−0.094	−0.287
Governance Index						1	−0.088	−0.002
Unemployment rate							1	0.647
Urbanisation								1

In addition, FDI shows a positive correlation with *fertility rate, GDP, ODA, governance index*, and a negative correlation with *HDI, unemployment rate* and *urbanisation*. A strong correlation exists between *unemployment* and *urbanisation*.

Cross-sectional dependence

Another important step in modelling the data is identifying the cross-sectional dependence between variables for which we performed the Pesaran cross-sectional dependence test (Table 3). The results led us to reject the null hypothesis; thus, there is no cross-sectional dependence, i.e., the variables are not correlated to each other.

Table 3. Results from cross-sectional dependence test

Test	Statistic	Prob.
Breusch–Pagan LM	633.0517	0.0000
Pesaran LM normal	18.7051	0.0000
Pesaran CD normal	7.4749	0.0000

The stationarity of the variables was tested through unit-root tests using the augmented Dickey–Fuller and IPS unit-root tests, all variables are stationary at level (Table 4).

Table 4. Unit root tests for the full sample

Variables	Levin, Lin&Chu		Im, Pesaran& Shin W-Stat		ADF-Fisher Chi-Square		PP-Fisher Chi-Square	
	Statistic	Prob.	Statistic	Prob.	Statistic	Statistic	Statistic	Prob.
FDI	−3.5055	0.0002***	−3.559	0.0002***	80.703	0.0006***	118.198	0.0000***
Fertility rate	−4.593	0.0000***	−2.061	0.0196**	142.901	0.0000***	779.693	0.0000***
GDP	−1.355	0.0877*	−2.161	0.0154*	57.858	0.0065***	45.366	0.0590*
HDI	−6.415	0.0000***	0.031	0.5123	55.8267	0.1089*	272.988	0.0000***
ODA	−7.386	0.0000***	−2.655	0.0040***	75.407	0.0022***	70.091	0.0074***
Governance index	−3.830	0.0001***	−1.297	0.0973*	−55.596	0.1129	47.7403	0.3233
Unemployment rate	−4.317	0.0000***	−1.347	0.0891*	49.175	0.2736	33.448	0.876
Urbanisation	−2.229	0.0129**	7.621	1.0000	64.894	0.0218**	29.775	0.9502

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Testing/Assessing the fixed/random effect (Hausman test)

The static results using FE/RE estimations are obtained using the Hausman specification test, which indicates that FE estimates are appropriate and the null hypothesis of Res is rejected (Chi-Sq. Statistics Cross-section random 21.35, Chi-Sq. d.f. 7, Prob. 0.0033). Static results (Table 5) indicate the relationship of macroeconomic variables with FDI attractiveness. Foreign capital inflows are influenced by *HDI, governance index and urbanisation. GDP, ODA*, and *unemployment rate* do not have a significant impact on FDI inflows. The FDI inflows are positively associated with *HDI* and negatively related to *governance index* and *urbanisation*.

Table 5. Static panel results

Variables	Coefficients	Std. Error	t-Statistic	Prob.
Fertility rate	−1.441	1.685	−0.855	0.393
GDP	0.002	0.043	0.037	0.971
HDI	33.173	16.982	1.953	0.052
ODA	0.017	0.051	0.337	0.736
Governance Index	−1.483	0.676	−2.195	0.029
Unemployment rate	−0.258	0.265	−0.973	0.331
Urbanisation	−0.534	0.149	−3.587	0.0004
Intercept	15.523	15.983	0.971	0.332
R^2	0.4529			
F-statistic	10.2011			
Prob (F-statistic)	0.0000			
Hausman specification test (χ^2 statistics)	21.3537			
Prob	0.0033			
Applicability of model	Fixed effects			
No. of observations	374			

Testing Granger causality

The Granger causality test is employed, and the result confirm the role of HDI and ODA in attracting FDI inflows, but not vice versa, and FDI causes urbanisation. There are unidirectional causalities, flowing from *ODA* to *FDI*, from *HDI* to *FDI*, from *FDI* to *urbanisation*, from *unemployment rate* to *urbanisation*, from *GDP* to *urbanisation*, from *urbanisation* to *fertility rate*, from *HDI* to *governance index*, from *HDI* to *urbanisation*, and from *HDI*, *GDP*, and *governance index* to *fertility rate* (Figure 1).

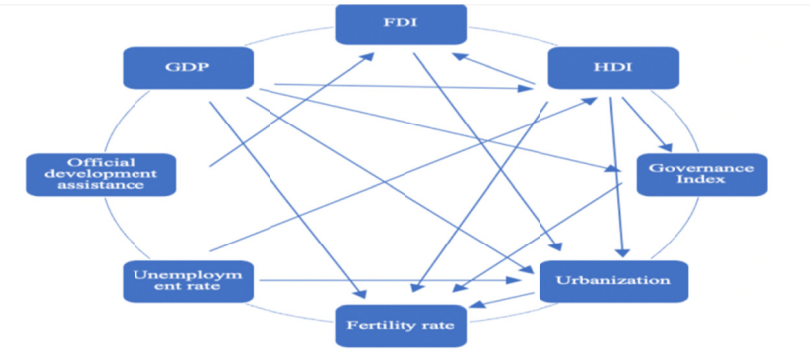

Figure 1. Results of panel causality

Note: * indicates significance at the 10% level; ** indicates significance at the 5% level; *** indicates significance at the 1% level

Dynamic panel regression – GMM

A panel causality test explains the presence of unidirectional causality among different variables. To account for endogeneity emerging from reverse causality, we use the dynamic panel regression (GMM) proposed by Arellano and Bond (1991) with a one-year lag. (Table 6)

Table 6. Dynamic panel results (one-step GMM)

Variables	Coefficients	Std. Error	t-Statistic	Prob.
FDI(−1)	0.3729	0.0255	14.6060	0.0000
Fertility rate	4.4372	4.7469	0.9347	0.3605
GDP	−0.1346	0.2711	−0.4963	0.6248
HDI	45.4095	14.2559	3.1853	0.0045
ODA	0.0719	0.0576	1.2489	0.2254
Governance index	1.0040	0.4338	2.3142	0.0309
Unemployment rate	0.0470	0.1725	0.2725	0.7879
Urbanisation	−0.2155	0.2175	−0.9907	0.3331
J-statistic	13.0052			
Prob (j-statistic)	0.5261			
Arellano–Bond serial correlation test	m-Statistic	rho	SE(rho)	Prob.
AR(1)	−0.1509	11.2603	18625.857	0.8800

According to the results in the dynamic model (Table 6), FDI registers a persistence effect because of its positive and significant past value (0.3729). FDI_{t-1} indicates a pull factor for host countries and a positive association with the current lag-specified group as an attractive destination for FDI inflows due to supportive policies and business environments in past years (Çeviş &Çamurdan, 2007). *HDI* and *governance index* also significantly influence FDI, the association being positive.

The GMM estimation results can be seen in Table 15; in the GMM model measurement, J-Statistics (J-stat) assess the validity of the variable instrument used in the model. The J-statistic reported represents the minimised value of the objective function, the null hypothesis concerning the over identifying restrictions is satisfied. The Prob (j-statistic) is 0.5261, and given that it is greater than 0.05, it indicates the use of the GMM models is valid (Saini & Singhania, 2018). Therefore, the instruments are uncorrelated with the error term and appropriate for the model.

To test the residual for the serial correlation with the variables, we used the Arrelano–Bond test to verify the characteristics of the model. The AR(1) test is the Arellano–Bond test for the existence of the first-order autocorrelation in first differences. The result of which points to accepting the non-autocorrelation, the Arellano–Bond model assumptions being satisfied.

6. Discussion

The findings remain robust under alternative settings of a substantial time lag. The advantages of the GMM estimation are the possibility of a more detailed estimation for problematic data, for example, when there are uncertain parameters such as when the dependent variable has unknown parameters and must be estimated. Inflows are voluminous, volatile, and persistent, making it more appropriate to use a lagged independent variable; this adds to the dynamic nature of the analysis, leading to endogeneity, due to the correlation with the differenced error terms (Saini & Singhania, 2018). In this case, least-squares estimation provides biased and inconsistent results (Baltagi, 2008). Arellano and Bond (1991) recommended using instrumental variables, including the lag of dependent and independent variables (García-Herrero et al., 2009) with GMM being applied to account for endogeneity.

The results presented in this paper indicate that *HDI* and *governance index* have a significant impact on FDI. The results are in line with the literature, highlighting also in the case of LDCs, FDI inflows are positively related to improvement in human development (Chipalkatti et al., 2021). In addition, a better governance have overall a positive and economically significant effect on FDI (Mengistu & Adhikary, 2011;Buchananet al, 2012; Chipalkatti et al., 2021). Opposite, the unpredictability of laws, regulations and policies, excessive regulatory burden, government instability and lack of commitment play a major role in deterring FDI (Buchanan et al., 2012).

In both the static and dynamic models, the variable *urbanisation* significantly influences *FDI* only in the case of the static model, in line with

Brantley & Massinis (2015) and Chen et al., (2017). Even if the LDCs are a very heterogeneous group as regards fertility rate (Jeníček & Grófová, 2014), based on our sample, the fertility rate influences FDI only in the setting of a dynamic model. Concerning unemployment rate the relationship with FDI the literature reveals mix results (Lewis, 2000; Widia et al. 2019). Based on our sample, the results reveal that unemployment rate influences FDI only in the static model.

Moreover, the results expose the bidirectional causality between factors; for example, FDI leads to urbanisation, affecting economic growth and welfare, like Basemera et al. (2012), Brantley &Massinis (2015), Bailey, (2018), Canh et al. (2020). Following Granger causality tests, we detected unidirectional causality, ODA and HDI causing FDI, like Quazi et al., (2014) and FDI causing urbanisation like Cang-Ming, & Jin-Jun, (2015).

Using a dynamic panel, the GMM results highlight that FDI is influenced by HDI, the unemployment rate and FDI (−1), the past value registering a positive and significant value. Although ODA is essential for infrastructure development, Donaubauer et al,(2016) representing the largest component of resource flowing into LDCs, for the countries in our sample, this does not significantly influences FDI. Also, Asiedu & Lien, (2011) and Donaubauer et al. (2016) studies shows the same.

Taking into account that FDI leads to urbanisation and urbanisation is one of the main drivers of economic growth, we consider it necessary to register its positive impact on FDI in these countries.

Conclusion

FDI has a vital role to play in economic growth, depending on factors specific to the host country. Due to the specificity of LDCs, it is thus important to find the mix of the traditional and non-traditional factors affecting FDI in these countries and test those using econometric tools. In this paper, we empirically examined FDI determinants on a sample of 22 LDC for the period 2003–2019, with a special focus on traditional factors but also non-traditional factors that influence FDI.

Our results indicate that HDI and Governance Index have a significant relationship with FDI. The fertility rate and unemployment rate influences FDI. The results expose bidirectional causality between factors reflective the complexity of the relationship between factors. For example, FDI leads to urbanisation, affecting economic growth and welfare.

The study's novelty relies both on the proposed composite governance index that reflect governance status and group countries in seven clusters and the relationships identified between FDI and traditional and new factors relevant to the LDC context. The study highlights new FDI determinants, such as the fertility rate, urbanisation, and our governance index, that might be taken into consideration by both international organisations and national regulators and policy makers.

The paper is relevant for policy makers who should understand the direction of FDI in host countries to ensure it contributes to economic growth and increases people's welfare. FDI must be directed in a specific sector where investments are more needed and must be supported by policies that ensure the

investments will be beneficial to the economy. In order to increase FDI, positive policies are needed in the host countries.

For further research, it will be interesting to examine how FDI leads to economic growth and welfare and to identify the differences between countries in this regard. According to data availability, we want to consider more social variables, highlighting if there is a gender welfare gap and which factors are more affected by this gap.

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