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Does Foreign Direct Investment always Generate Economic Growth? Evidence from the Panel Quantile Regression Model

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Abstract

This paper concentrates on the impact of foreign direct investment (FDI) on economic growth at different levels of country income. This study was conducted based on 79countries in four income groups (31 High income, 18 Lower middle income, 21 Upper middle-income, and 9 Low-income countries) for the period 1990-2019. Our estimates use quantitative panel regression techniques. The results of this paper 'show that the impact of FDI on economic growth changes with a country's growth level. The empirical results show that in countries with high income, medium-upper income levels, the influence of FDI on economic growth is always positive. Of course, there is a negative relationship between FDI and economic growth in the lower-income and the 30th percentile in medium-lower income. We obtained evidence that the growth effect of FDI is conditional upon the level of income and growth in host countries. The impact of FDI on economic growth depends on the countries income level. FDI is particularly suitable for economic growth in countries with higher GDP growth. In countries with medium-upper income levels, the influence of FDI on economic growth is greater than other income groups.

Highlights

- FDI can affect economic growth.
- The relationship between FDI and economic growth depends on the economic conditions of the host country.
- The amount of economic growth of the host is significant to identify the impact of capital on the economic growth of the host country.

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1. Introduction

With increasing globalization and the opening up of 'countries' economies, and developing international trade, the role of foreign direct investment (FDI) in the world economy increased rapidly. For this reason, many countries sought to attract more FDI. But the amount of FDI attracted is too unequal among the world. The total FDI inflow in the world in 2019 was equal to 1540 Billion dollars. Of this amount, the share of high-income countries was 66 percent, and least developed countries have only a one percent share of the total FDI globally. Fig 1 and 2 show the dispersion of FDI in the world.
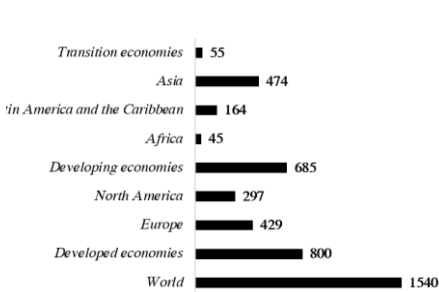
Figure 1. FDI inflows, by region **Figure 2. FDI inflows, by income group**
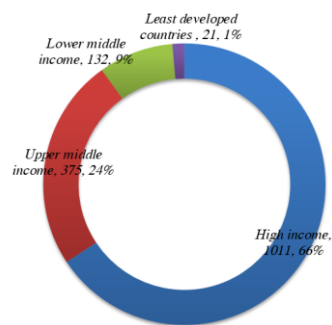
Note: *(Billions of dollars and percent), 2019.*
Source: *UNCTAD 2019*

The impact of FDI on economic growth had first taken focus in the new endogenous growth model. The new endogenous growth models suggest a framework in which FDI can perpetually raise the rate of economic growth in the host country via technology transfer, diffusion, and spillover effects. Under neoclassical growth models, FDI can be an exogenous factor contributing to change through improvements in investment or its efficiencies (Sala-I-Martin, 1996)[1]. According to this framework, capital accumulation contributes directly to economic growth in proportion to ' 'capital's share of the country's output. The neoclassical growth model explains that FDI increases economic growth by improving capital accumulation and increasing investment efficiency in the host country. There are generally two primary views regarding how FDI affects economic growth: 1- modernization theory 2-dependency theory. The modernization theory, involving exogenous and endogenous growth models, demonstrated that FDI increases economic growth in developing countries (Adam, 2009). In this way, FDI improves economic growth and increases capital accumulation and spillovers. But, Experimental studies have not reached similar

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[1] Solow (1956) emphasizes the increase in FDI and technological progress as important variables in the growth (Solow, 1956). See too (Romer, 1986), (Lucas, 1988).

conclusions in this regard. Sometimes FDI led to increased economic growth, and in some regions, it caused a recession. Therefore, it is necessary to consider when foreign investment can lead to economic growth. Are countries' levels of economic growth as effective as the impact of foreign capital on growth? If the answer to this question is yes, then the impact of foreign capital on economic growth depends on the conditions of each country.

In this paper, we attempt to establish a relationship between FDI and economic growth. This paper examines the potential different impact of FDI on economic growth across countries depending on their income level, thus empirically, it shows a differential effect among High income, Lower middle income, Upper-middle income, and Low-income countries.

 Following this introduction, Section 2 describes a lecture review of FDI and economic growth; Section 3 reviews previous studies, Section 4 describes the dataset, Methodology, and estimation strategy. Section 5 is devoted to the empirical results and concludes.

2. FDI and Economic Growth

In the past two decades, FDI has been studied as an important factor for growth and development. Theory provides conflicting predictions concerning the growth effects of FDI. Different theories are discussing the influence of FDI on economic growth Which For example can be referred to the following theories: Marginal Efficiency of Investment, Accelerator Theories, Keynesian Theory of Economics, and neoclassical theory (Osano and Koine, 2016). There are generally two views regarding the effect of FDI on economic growth: modernization theory and dependency theory. The modernization theory was a predominant paradigm between the 1950s and early 1960s and was developed largely in Africa and Asia. The modernization theory discussed that FDI increases economic growth in developing countries. The modernization theory is involving both exogenous and endogenous growth models. (Adams, 2009). In the neoclassical growth model without technical progress, the capital accumulation is simultaneous to decreasing returns to the scale (Barro and Sala-i-Martin, 2004). The exogenous-growth theory was pioneered by Solow (1956 and 1957). The theory believes that economic growth is created through the accumulation of exogenous factors of production, such as the accumulation of capital and labor. Following Hicks (1932), the aggregate production function is modelled against: Domestic and foreign capital input, labor input, and the rate of changes technological progress over time. Here we see that economic growth depends on the improvement of the labor force and technological progress. According to this view, FDI increases the capital accumulation in the host country and through this channel will affect economic growth (Mahembe & Odhiambo, 2014). However, the neoclassical growth models, assume technological progress to be exogenous. the new growth models assume that are two factors (human capital and technological changes) contributing to economic growth. (Romer, 1986, 1990

and 1994; Lucas, 1988). In this formwork, FDI can, through technology transfer, diffusion, and spillover effects, increase the economic growth in the host country.

Neoclassical models of growth, and endogenous growth models, provide the basis for most of the empirical work on the FDI effect on economic growth. This relationship can be explained based on the following four main channels : 1-determinants of growth, where FDI is put as one of the explanatory variables 2-determinants of FDI, where GDP is one of the explanatory variables 3- the role of multinational firms in host countries, and 4- the causal relation between the two variables. Figure 3 shows the most important channels of influence of foreign direct investment on economic growth.
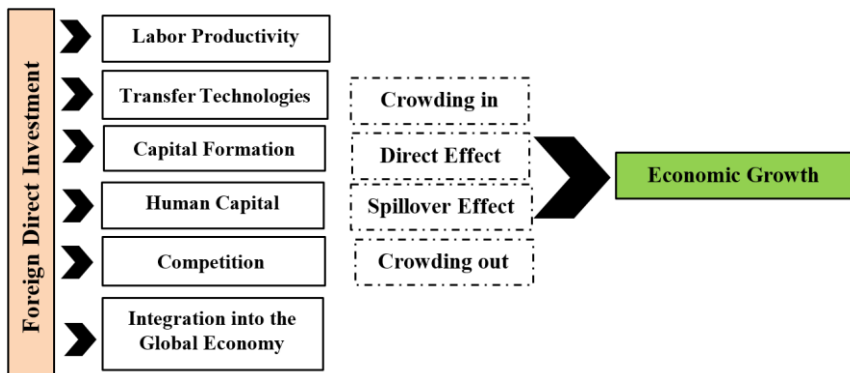
Figure 3. FDI and Economic Growth
Source: Article results

Labor Productivity: The effects of FDI on host countries' economies growth are essentially related to the improvement of labor productivity (Boghean & State, 2015). Labor productivity in the host country will increase due to working in multinational companies. Because they can use the knowledge and experience of multinational companies. When these workers move to domestic firms, they bring some of the knowledge acquired from multinational enterprises (Cuyvers et al., 2008; Mebratie, 2010). Theoretical studies have shown that FDI has a positive impact on the Labor Productivity of the host country (see, for example, Markusen & Venables, 1999; Wacker & Vadlamannati, 2011; Thiam Hee Ng, 2007; Bodman & Le, 2013; Crescenzi et al., 2020; Vujanović et al., 2021; Ali et al., 2021) through direct introduction of technology, capital, and skills and indirectly through spillover effects on domestic production factor and firm (Liu et al., 2001). Technology transfer from FDI reduces the X-inefficiency of the firms in the host country and improves productivity (See Gorg & Greenway, 2004; Smeets, 2008). Li and Tanna (2019) shows that FDI has a weak direct effect on total factor productivity growth. But when the role of human capital and institutions in this relationship is involved, it can be concluded that the total factor productivity has an important effect on economic growth. Also, FDI promotes entrepreneurial activities (Hong et al., 2021)

Transfer Technologies and knowledge: Many studies stress the role of FDI as a channel for technology transfers from developed to developing countries. transfer of skills, labor training, and the transfer of new managerial practice are the channels that make FDI effect on host countries growth. In addition, FDI can increase knowledge accumulation in host countries. (De Mello, 1997, 1999). Wang and Blomstrom (1992). FDI has contributed to not only the catch-up effect[2] but also in terms of productivity, due to technological innovations and the frontier-shift effect (Bruhn et al., 2020). Konstandina et al. (2020) demonstrate that FDI plays an important role in technology transfer in Albania.

Capital Formation: Foreign capital plays an important role in financing. Financing is done in two ways, direct and indirect. There are three possible effects of FDI on domestic capital formation: 1- crowding-in effect, 2- crowding-out effect, 3- neutral effect. Different experimental studies have each confirmed one of these three effects (see Borensztein et al.,1998; Deok & Kim, 2003; Agosin & Machado, 2005; Ahmed et al., 2015). FDI can cause negative economic growth The effect of crowding out in the host country can reduce innovation (Lipsey, 2004). Similarly, Leahy and Montagna (2000) argue that increased competition in the host country could lead to the closedown of domestic companies and thus limit economic growth.

Human Capital: many empirical and theoretical literature emphasizes the role of human capital on economic growth. FDI Foreign capital plays an important role in building human capital and increasing skills in the workforce. In this way, FDI is becoming a determinant factor for education and training. Li and Liu (2005) show that FDI affects (both directly and indirectly) economic growth through the human capital channel. Empirical studies have revealed that FDI have a positive effect on the human capital formation of the host country (see Blomstrom & Kokko, 2002; Su & Liu, 2016).

Competition: FDI can have an actual effect in terms of increasing the contestability of host countries, enhancing the production of the local industry, and diminishing prices. It may provide directly to the competitiveness of local industry by being the channel by which they penetrate international production and marketing networks. Swenson (2004) contend that FDI improves its competitiveness through technology transfer. Evidence suggests that FDI yields the greatest improvements in local industry competitiveness and market shares.

3. A Review of the Related Literature

Several empirical studies find a positive relationship between FDI inflows and economic growth in the host countries. Hansen and Rand (2006), for a group of 31 developing countries during 1970-2000, and De Mello (1997) for the countries with high-income point out that FDI had a significantly positive effect on economic growth (De Mello, 1999) and (Lipsey, 2002), (Choe, 2003), (Carkovic & Levine, 2005), (Li & Liu, 2005) (Akisik & Mangaliso, 2020; Sahu,

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[2] i.e. to continuous improvements in production processes and products using the same technology.

2021; Shittu et al., 2020). Fon et al. (2021) investigate the impact of FDI flows on institutional quality in African countries by separating investments from developed versus developing economies. He guesses FDI can generate an institutional change in the countries. Osei and Kim (2020) find significant evidence that FDI promotes growth, but the growth effect of FDI becomes negligible when the ratio of private sector credit to GDP exceeds 95.6%. Azolibe (2021) indicates that outward FDI could also positively impact the industrial sector of a country. Thi An and Yeh (2021) show new findings of two distinct thresholds of FD in the FDI growth nexus. The growth-enhancing effect of FDI is recognized only when the FD lies between the two threshold values. Ibhagui (2020) shows that the direct impact of FDI on growth is ambiguous primarily.

While some point to the weakness or lack of a direct impact of FDI on economic growth. (Jyun-Yi, 2008), no relationship was identified between FDI and economic growth for 62 countries during the period 1975–2000. It is argued by modernization theory that FDI plays a dual role by contributing to capital accumulation and by increasing total factor productivity. Some stud'ies detect an inverted-U-shaped relationship between countries' income levels and the size of FDI impact growth (Baiashvili & Gattini, 2020). In addition to the common implications of the significant effects of FDI on growth in developing countries, there are also negative outcomes (Baharumshah et al., 2017). Some theories predict that FDI will hurt resource allocation and slow growth in the face of pre-existing trade, price, financial, and other distortions (Boyd & Smith, 1992) (Carkovic, 2002). So, FDI may crowd out local investment and have a negative impact on economic growth (Denisia, 2010). The Dependency theory argues that if a nation depends on FDI, its economic growth would face a negative impact. The dependency theory gives general awareness of the important roles of external factors to the domestic economic and political systems. The conclusion after several empirical studies on the relationship between FDI and economic growth is that the effects of FDI are complex (Denisia, 2010).

Numerous studies have examined the impact of FDI on economic growth. But they often do not consider the impact of the size of countries' economic growth. This article examines the impact of FDI on economic growth in different categories of countries whether the size of economic growth affects the relationship between economic growth and FDI.

4. The Study Model
4.1 Methodology

This paper uses the panel quantile regression with fixed effects to explore the FDI effect on economic growth into four income group countries. Quantile regression, albeit officially introduced by Koenker and Basset in their seminal paper "Regression Quantiles" (Koenker & Bassett, 1978) in Econometrica in 1978, has a long history, dating back to 1755, earlier than the widespread least squares regression (Furno & Vistocco, 2018). One of the advantages of using quantitative regression to estimate the mean, rather than the ordinary least squares

regression to estimate the mean, is that quantitative regression will be stronger in response to high temperatures.. The mean is rarely a satisfactory end-in-itself, even for statistical analysis of a single sample (Koenker, 2005). Therefore quantile regression permits to approximation of the whole conditional distribution of a response variable (Davino et al., 2014). Another advantage of quantitative regression is that any value can be estimated (Koenker & Hallock, 2001).

We consider the following regression equation, equation 1

$$g_{it} = \alpha_i + \beta x_{it} + \varepsilon_{it} \tag{1}$$

Where g_{it} is gross domestic production (GDP) per capita growth rate, x_{it} represents a vector of conditioning variables and ε_{it} is a well-behaved error term. Empirical studies assessing the impact of FDI on economic growth typically assumes the eq. 2 econometric models:

$$g_{it} = \alpha_i + \beta_1 FDI_{it} + \beta_2 DI_{it} + \beta_3 \pi_{it} + \beta_4 tot_{it} + \beta_5 P_{it} + \varepsilon_{it} \tag{2}$$

where g_{it} GDP per capita growth rate for country i and year t, the share of FDI in GDP FDI_{it}, the share of gross fixed capital accumulation in GDP DI_{it}, CPI inflation rate π_{it}, terms of trade tot_{it}, and population growth P_{it}. In particular, our empirical panel quantile regression (PQR) can be specified as:

$$g_{it} = \alpha_i(q) + \beta(q)x_{it} + \varepsilon(q)_{it} \tag{3}$$

Where $\beta(q)$ represents unknown parameters associated with the qth quantile, $q \in (0,1)$. As q increases monotonously from 0 to 1, we can investigate the influence of FDI on the whole conditional distribution of economic growth. In particular, the qth conditional quantile function of g_{it} can be formulated as eq 4:

$$Q_{yit}(q|\alpha_i, x_{it}) = \alpha_i(q) + \beta(q)x_{it} + \varepsilon_{it} \quad i = 1,..,n; t = 1,..,T \tag{4}$$

In further creating a vector x_{it} and denoting $\beta(\tau)$ as the regression quantiles, Regarding the panel quantile regression with fixed effects and its estimator, the econometric model is shown as eq. 5:

$$Q_{yit}(\tau_k|\alpha_i, x_{it}) = \alpha_i(\tau) + \beta(\tau)x'_{it} + e_{it} \quad i = 1,..,n; t = 1,..,T \tag{5}$$

Where $Q_{yi}(\tau_k|\alpha_i, x_{it})$ is the conditional τ-quantile of y_{it} given x_{it}. $\alpha_i(\tau)$, $\beta(\tau)$ is considered to be dependent on τ as the regression quantiles in eq 6

$$min \sum_{k=1}^{K} \sum_{t=1}^{T} \sum_{i=1}^{N} w_k \rho_{\tau k} \left(y_{it} - \alpha_i - x_{it}^T \beta(\tau_k) \right) + \gamma \sum_{i}^{N} |\alpha_i| \tag{6}$$

Where $\rho_{\tau k}$ is the quantile loss function which is a tilted absolute value function yielding the qth sample quantile.

4.2 Data

To investigate the relationship between FDI and economic growth, this study employs panel data for 79 countries (31 High income, 18 Lower middle income, 21 Upper-middle income panels, and 9 Low-income countries) over the 1990–2019 period. Data are collected from the world development indicators (WDI). Table 1 presents the descriptive statistics and definition of the key variables used in this study.

Table 1. The statistical characteristics of the variables

Variable	Definition	Mean	Std. Dev.
G	GDP per capita growth (annual %)	2.404357	3.878719
FDI	FDI, net inflows (% of GDP)	2.98672	6.292119
DI	Direct investment (% of GDP)	22.74275	6.503672
INF	Inflation, consumer prices (annual %)	17.08521	187.8071
TOT	Terms of trade adjustment	-6.61e+12	7.70e+13
POP	Population growth (annual %)	1.52044	1.133894

Source: Research findings

Also, Appendix 1 demonstrates the distribution of the economic growth in the sample countries. As shown in Appendix 2, histogram plots, skewness, and kurtosis statistics hint that the time series may not be normal. This observation provides a genuine case for the use of quantile regression over traditional OLS estimates. Appendix 2 shows the quantiles of the dependent variable (economic growth) and indicates symmetry. Table 2 shows the test results for the normality of the variables. According to the results, the assumption of normality of model variables is rejected.

Table 2. Normality Test

	G	FDI	DI	inf	ToT	pop
All countries	12.845*	16.407*	12.676*	18.368*	18.204*	9.655*
High income	10.378*	13.225*	8.015*	14.709*	14.893*	9.544*
Lower middle income	7.753*	12.982*	9.991*	11.152*	12.983*	6.848*
Upper middle income	7.003*	11.152*	7.353*	14.360*	13.912*	7.934*
Low income panel	8.855*	10.238*	5.611*	10.540*	9.162*	10.469*

*Note: *, represent %1 statistical significant, and ** represent %5 significant statistical **Source:** Research findings*

5. Empirical Results

In this section, we investigate the impact of FDI on growth across different country income levels. We employ the World Bank classification to divide countries into four income groups (high, upper-middle, lower-middle, and low).

Since this country panel contains large significant outliers and the distribution of the disturbances is non-normal, applying conditional mean estimators to this equation would not be suitable since these estimators are not robust to departure from normality or long-tail error situations. Therefore OLS is likely to produce inefficient and biased estimates. Before estimating the empirical PQR model, we first comprise the following steps to avoid the possibility of spurious regressions. We first test for a panel unit root. According to the results in Table 3. All four tests (Fisher test) strongly reject the null hypothesis that all the panels contain unit roots, except terms of trade, population growth, and direct investment in some group. These variables are also to be stationary in the first difference.

Table 3. Fisher unit root test for panel data

	G	FDI	DI	INF	TOT	POP
All countries	1323.07*	676.64*	281.74*	1063.73*	133.11	369.91*
Difference 1	-	-	-	-	1764.04*	-
High income	386.16	292.59	422.21	422.21	37.47	75.17
Difference 1	-	-	-	-	661.69*	507.25*
Lower middle	342.34*	200.18*	66.27*	157.39*	23.57	61.00*
Difference 1	-	-	-	-	428.65*	-
Upper middle	326.82*	138.57*	58.96**	364.07*	39.57	143.07*
Difference 1	-	-	-	-	420.19*	-
Low income	267.73*	45.28*	18.28	120.04*	32.48**	90.65*
Difference 1	-	-	158.08*	-	-	-

Note: *, *Inverse chi-squared, represent %1 statistical significant, and ** represent %5 statistical significant*

Equation 5 is estimated for different values of q, which allows us to examine the impact of explanatory variables on different economic growth and income group. In Table 4-7, for the four income group countries ('using the World Bank'' 's Bank's country income classifications system), the plots of FDI coefficients from the quantile functions for each panel regressors are provided in Figure 4.

In Table 4 and Fig 4 A, it is evident that the relationship of FDI with economic growth is also significant and positive, while the positive effect is more prominent in the quantile 90 than quantile 10. In High-income countries, the FDI effect being more pronounced as one moves up the quantiles. FDI further increases economic growth at all quantitative levels, and as economic growth increases, so does its impact. In lower middle income (Table 5, and Fig 4 B), however, there is a negative relationship between FDI and economic growth in the 30th percentile. This result shows that the FDI estimates are positive for all quantiles except the $q = 0.3$. Thus, FDI has significantly positive effects at the center of the conditional distribution of economic growth and over the entire conditional distribution.

Table 4. The results of the panel quantile regressions in Panel A: high-income panel

Quantile	Panel A: High income panel				
	FDI	DI	Inf	d.ToT	d.pop
10%	.031576	.1113299	.0058835	-1.47e-14	-.4597891
	(0.000)	(0.000)	(0.538)	(0.035)	(0.004)
20%	.023736	.0462926	.0043025	-4.61e-15	.6687899
	(0.000)	(0.000)	(0.678)	(0.623)	(0.000)
30%	.0168491	.0511584	.0270183	6.00e-15	.3873148
	(0.000)	(0.000)	(0.000)	(0.632)	(0.059)
40%	.0129616	.0420426	-.0158033	1.63e-14	.5755858
	(0.000)	(0.000)	(0.170)	(0.000)	(0.002)
50%	.0276846	.0732451	.0545671	7.54e-15	.0295667
	(0.003)	(0.000)	(0.000)	(0.000)	(0.090)
60%	.0344557	.0092384	.077979	1.02e-14	.0781479
	(0.000)	(0.028)	(0.000)	(0.000)	(0.048)

Table 4 (Continued). The results of the panel quantile regressions in Panel A: high-income panel

70%	.0512339	.0335551	.0631927	-1.54e-15	.2040751
	(0.520)	(0.000)	(0.000)	(0.000)	(0.000)
80%	.1164985	.0773488	.110607	1.95e-14	.2947959
	(0.000)	(0.156)	(0.000)	(0.000)	(0.000)
90%	.09577	.0063755	.1298844	2.85e-14	.0931705
	(0.000)	(0.827)	(0.000)	(0.021)	(0.000)
Obs			894		

Source: Research findings

Table 5. The results of the panel quantile regressions in Panel B: lower middle-income panel

Quantile	Panel B: Lower middle income panel				
	FDI	DI	Inf	d.ToT	pop
10%	.2479278	-.0562252	-.0821657	5.08e-13	-.4439106
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
20%	.1368104	-.0564748	-.0683769	-7.89e-14	-.6215976
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
30%	-.0299927	-.0541937	-.0645524	3.11e-14	-.6298333
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
40%	.0475203	-.027006	-.0526872	1.14e-14	-.5535229
	(0.000)	(0.000)	(0.000)	(0.844)	(0.000)
50%	.0626427	-.0044849	-.0490902	-1.22e-14	-.4032522
	(0.000)	(0.010)	(0.000)	(0.713)	(0.000)
60%	.1530115	.0177438	-.0484484	-3.29e-15	-.5903524
	(0.000)	(0.038)	(0.000)	(0.903)	(0.000)
70%	.0709975	.0546746	-.0354959	-1.49e-13	-.9246189
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
80%	.2401589	.082176	-.0596881	-1.19e-13	-.4026128
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
90%	.058047	.1380041	.0250246	-2.05e-13	-.019036
	(0.194)	(0.000)	(0.063)	(0.000)	(0.883)
obs			512		

Source: Research findings

Table 6. The results of the panel quantile regressions in the Panel C: Upper middle-income panel

	Panel C: Upper middle income panel				
Quantile	FDI	DI	Inf	ToT	pop
10%	.2411161	.1116777	-.0126563	1.91e-15	-.7395872
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
20%	.2615152	.0772303	-.0140472	2.71e-15	-.6828107
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
30%	.1184941	.1448011	-.008906	1.11e-15	-1.230963
	(0.000)	(0.000)	(0.000)	(0.819)	(0.001)
40%	.1316306	.1609612	-.0063634	-6.51e-15	-.8920475
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
50%	.0766223	.1533505	-.0077269	-5.16e-15	-1.047703
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 6 *(Continued). The results of the panel quantile regressions in the Panel C: Upper middle-income panel*

60%	.1189239	.1533165	-.0031333	-3.45e-15	-1.040855
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
70%	.1167555	.1854713	.0018538	-1.02e-15	-1.438835
	(0.000)	(0.000)	(0.001)	(0.401)	(0.000)
80%	.1386259	.161253	-.0002152	-5.74e-15	-1.639223
	(0.000)	(0.000)	(0.758)	(0.000)	(0.000)
90%	.1339947	.14285	.0002065	-1.48e-14	-1.719872
	(0.000)	(0.000)	(0.212)	(0.000)	(0.000)
obs			602		

Source: Research findings

Table 7. *The results of the panel quantile regressions in the Panel D: low-income panel*

| Quantile	Panel D: Low income panel				
	FDI	D.DI	Inf	ToT	pop
10%	.0060414	.3326808	.0332885	2.08e-12	-.24284
	(0.227)	(0.000)	(0.000)	(0.000)	(0.000)
20%	-.029686	.2647617	.020555	1.92e-13	-.3336109
	(0.040)	(0.000)	(0.000)	(0.005)	(0.000)
30%	.0029176	.1944112	.0141938	1.52e-13	-.4042416
	(0.376)	(0.000)	(0.000)	(0.000)	(0.000)
40%	.0855693	.1060308	.0081453	-5.72e-15	.0211132
	(0.000)	(0.000)	(0.000)	(0.898)	(0.328)
50%	-.0245418	.1723598	.0028394	-1.45e-13	-.3499366
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
60%	-.0138247	.1458518	.0173691	-4.24e-13	-.6100903
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
70%	-.0381156	.2542699	.0172526	5.26e-14	-.89526
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
80%	.0362583	.147381	.0191139	-3.97e-13	-1.12344
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
90%	.078336	-.1520381	.0430436	1.75e-12	-.3183225
	(0.263)	(0.000)	(0.001)	(0.099)	(0.360)
obs			253		

Source: Research findings
Note: (), represent p-value

In the upper-income panel (Table 5, and Fig 4 C), quantile regression results indicate that More FDI increases economic growth at all quantile levels. The results also show that FDI has a significant impact on economic growth at all quantiles. The degree of the effects rises while the considered quantile index is 10th, and impacts reduce while the considered quantile index increases.

In the Low-income panel (Table 7, and Fig 4 D), the quantile regression results indicate that in countries with high levels of economic growth, the influences of FDI on economic growth are higher than in countries with low levels of economic growth. Also, there is a negative between FDI and economic growth in the 10th, 20th, and 50th percentile whereas the coefficients are positive and

highly significant at the remaining quantiles. The results also show that FDI has a positive impact on economic growth in 40th, and 80th quantile and has a negative impact in 20th, 50th, 60th and 70th quantile. In panel D, in countries with a low level of economic growth, FDI growth will reduce economic growth. In other words, in countries with unfavorable characteristics, higher FDI tends to be associated with lower growth. This negative relationship may be due to the fact that FDI has concentrated domestic investment.

Other results reported in Table 3, High-income panel, include a significant coefficient on inflation, a significant coefficient on population, and a positive and significant coefficient on terms of trade. In Tables 4 and 5, inflation negatively impacts growth, whereby higher inflation is frequently associated with unstable systems not conducive to sustained growth.

panel A: High income   *panel B: Lower middle income panel*

panel C: Upper middle income panel   *panel D: Low income panel*
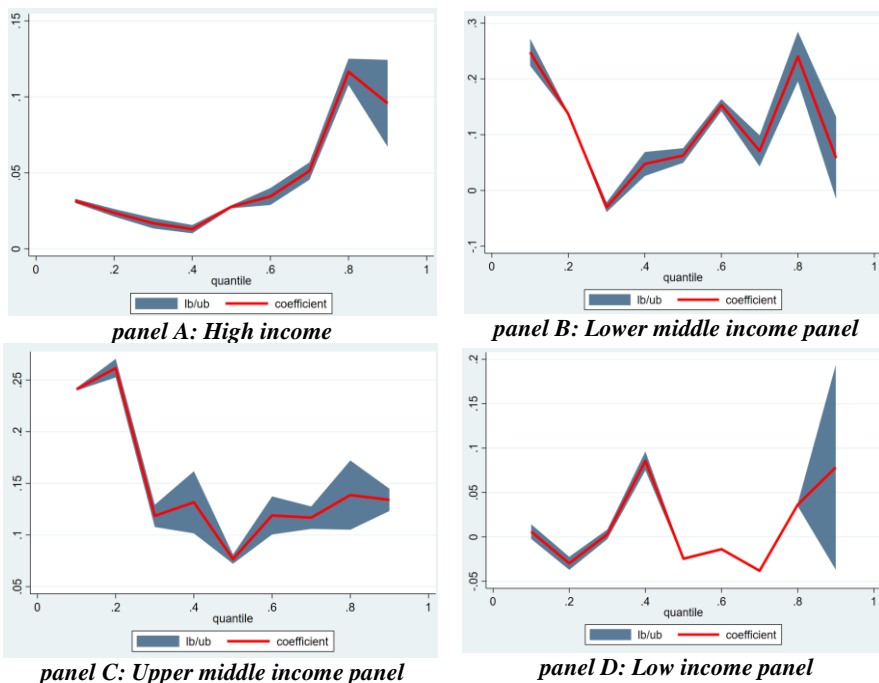
Figure 4. The coefficients of FDI from 5% to 95% quantiles

Source: Research findings

Table 8 presents the results of the panel analyses estimation for quantile regressions in all sample countries. In a panel of 79 countries, the impact of FDI on economic growth appears to change with a country's level of growth. Moreover, its impact on economic growth tends to increase as the quantile index increases. For example, the estimated coefficient of FDI is 0.0127 when $q = 0.1$. In contrast, it increases to 0.0497 when $q = 0.9$, implying that the impact of FDI on economic growth is larger when the growth rate is higher over its conditional

distribution. Table7 further shows that inflation has a negative impact and domestic investment positively impacts economic growth at all quantiles.

Table 8. The results of the panel quantile regressions in all countries

	FDI	DI	Inf	ToT	pop
10%	.0127092	.0503577	-.0124693	3.73e-15	-.4788448
	(0.007)	(0.000)	(0.000)	(0.010)	(0.000)
20%	.019022	.0349137	-.0129662	1.57e-15	-.2888683
	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
30%	.0111402	.0571892	-.007997	3.91e-15	-.1185556
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
40%	.0169353	.0445484	-.0064686	5.83e-15	-.3134904
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
50%	.0237087	.044466	-.0046298	-9.96e-16	-.0538211
	(0.000)	(0.000)	(0.000)	(0.585)	(0.000)
60%	.0640085	.0636501	.0055412	-5.97e-15	-.4341872
	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)
70%	.0480748	.0836766	-.0001192	-5.29e-15	.2456879
	(0.000)	(0.000)	(0.222)	(0.030)	(0.000)
80%	.0384344	.0804181	.000816	-1.07e-14	-.6563226
	(0.008)	(0.000)	(0.000)	(0.038)	(0.000)
90%	.049724	.0738626	-.0006879	-7.37e-15	-.5186341
	(0.000)	(0.000)	(0.000)	(0.023)	(0.000)
Obs			2260		

Source: *Research findings*
Note: *(), represent p-value*

Fig 5 presents the trends of impact coefficients of quantile regression estimation at different quantiles in all country's panels. There is plenty of empirical evidence supporting the hypothesis that the links between FDI and growth seem to be different for countries at different stages of growth.
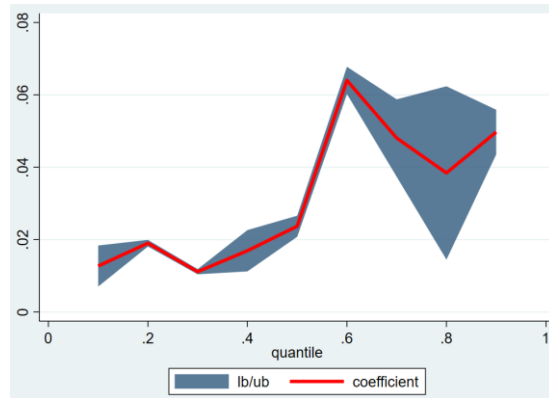
Figure 5. The coefficients of FDI from 5% to 95% quantiles in all sample
Source: *Research findings*

From the estimation results, we can argue that FDI is a powerful engine for economic growth at high quantiles of the conditional distribution of the growth rate variable. One possible implication is that FDI can be more effective for countries facing a period of high economic growth relative to other countries. Usually, developed countries have stable macroeconomic conditions, and so FDI can be beneficial to them. Moreover, we also implement a Wald statistical test to control that coefficients on the FDI effect on economic growth variable have the same value. The null hypothesis of coefficient equality is rejected at a level of 0.05.

Table 9. Test of coefficient (FDI) equality across different quantiles

Group	All countries	High income	Lower middle income	Upper middle income	Low income
Test	14699.32*	373.564*	155.203*	349.802*	465.8687*

*Note: *, represent %1 statistical significant, and ** represent %5 significant statistical **Source:** Research findings*

6. Concluding Remarks

This study is done to assess and estimate the impact of FDI on economic growth in 79 countries that are in the four income groups (31 High-income, 18 Lower-middle-income, 21 Upper-middle-income panels, and 9 Low-income countries) in 1980–2019. In this paper, we apply a PQR model to investigate the effects of FDI across economic growth.

Concerning the estimation of PQR, when economic growth is quantile, in countries with a low level of growth, the influence of FDI on economic growth is different. We find that FDI benefits do not accrue evenly across countries. The results show that more FDI increases economic growth at all quantile levels in high-income, the upper-middle-income centuries. In the low-income panel, there is a negative link between FDI and economic growth. The result of the Lower-middle-income panel shows that the FDI estimates are positive for all quantiles except the $q = 0.3$. As a result, it can be asserted that FDI is an important factor for economic growth, especially for Upper middle-income economies. FDI on both measures promotes greater economic growth across quantiles for high- and Upper middle-income countries and promotes greater growth in upper-middle-income countries, and in lower-income countries, the adverse impact of FDI on GDP growth. Fig 6 presents the most significant effect of FDI on economic growth has occurred in upper-middle-income countries, and it has the most negligible effect on economic growth in low-income countries

Estimating the PQR model in all samples (79 countries) shows that FDI has a positive impact on economic growth, and tends to increase as the quantile index increases. Figure 3 plots the coefficients of FDI influence to GDP growth across income group panels in each quantile.
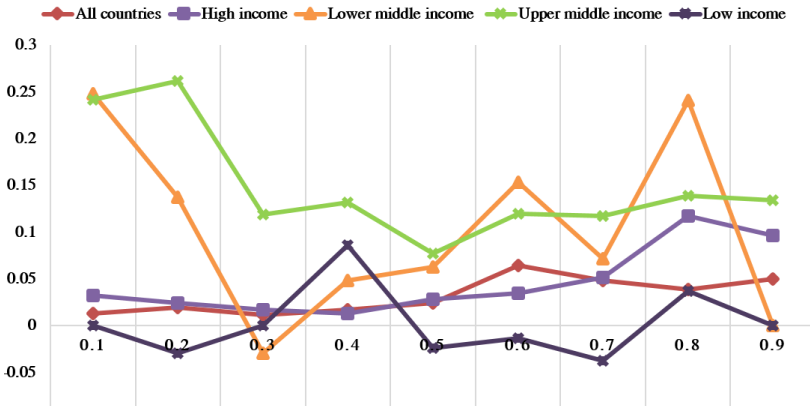
Figure 6. Comparing the coefficients of FDI effect on economic growth in income group panel from 5% to 95% quantiles.
Source: Research findings

The results show that moving from low to middle-income countries; the effect gets larger. On the other hand, it diminishes again, transitioning to high-income countries. Based on the above results, the empirical results of this study can be concluded as follows: the impact of FDI on growth depends significantly on the countries income level. FDI is perfect for economic growth in countries with higher GDP growth.

The results of the article show that FDI cannot always increase economic growth. It depends on the economic situation of the country. Therefore, it is necessary to pay attention to these conditions.

Data Availability Statement:
The data used in the WDI: https://databank.worldbank.org/source/world-development-indicators

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Appendices

Panel A High income countries: Australia, Austria, Bahamas, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Hong Kong SAR, China, Iceland, Ireland, Italy, japan, Korea, Rep., Macao SAR, China, Mauritius, Netherlands, Norway, Panama, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, USA, Uruguay.

Panel B Lower middle income countries: Algeria, Bangladesh, Benin, Bolivia, Cameroon, Congo, Rep., Egypt, Arab Rep., Eswatini, Honduras, India, Kenya, Mauritania, Morocco, Nigeria, Pakistan, Philippines, Senegal, Sri Lanka.

Panel C upper middle income countries: Belarus, Botswana, Brazil, Bulgaria, Colombia, Costa Rica, Dominican Republic, Ecuador, Gabon, Guatemala, Indonesia, Iran, Islamic Rep., Jordan, Malaysia, Mexico, Paraguay, Peru, Russian Federation, South Africa, Thailand, Turkey.

Panel D Low income countries: Burkina Faso, Chad, Madagascar, Mali, Niger, Rwanda, Sudan, Togo, Uganda.

Appendix 2. Histogram figure of economic growth and normal distribution
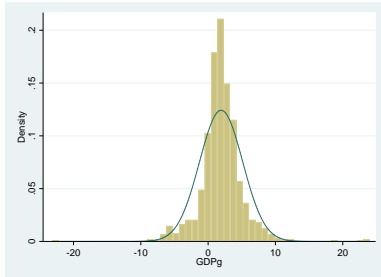
panel A: High income
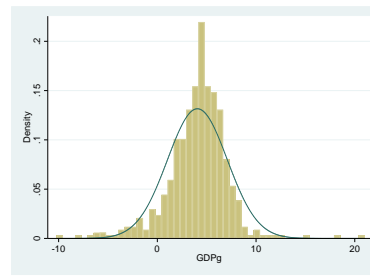
panel B: Lower middle income
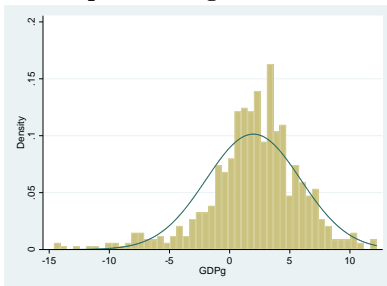
panel C: Upper middle income
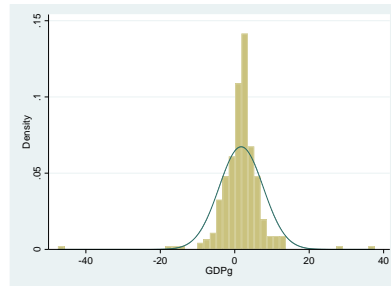
panel D: Low income panel

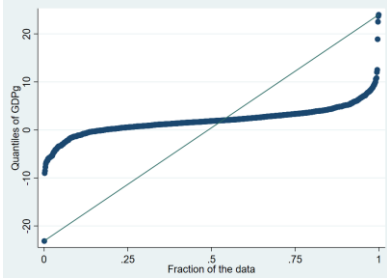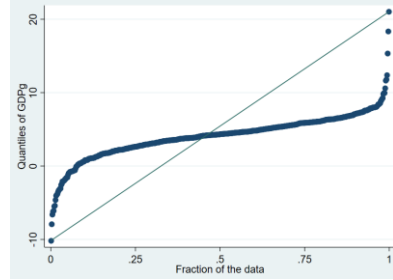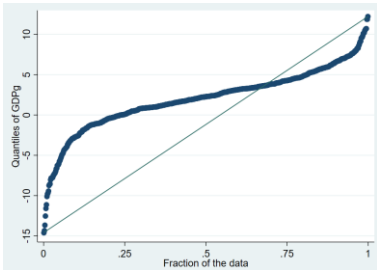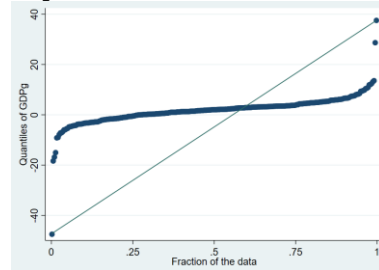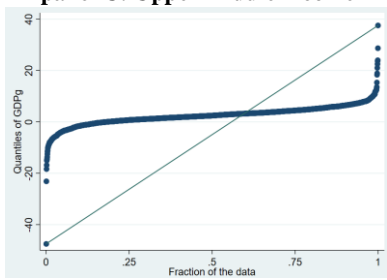**panel A: High income**

panel B: Lower middle income

panel C: Upper middle income

panel D: Low income panel

All countries