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Nonlinear effects of FDI, external debt, and corruption in shaping economic development: Evidence from lower-middle-income economies

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Abstract

Foreign direct investment (FDI), external debt, and corruption are high-priority issues in economic policymaking, especially in developing countries. This study examines the nonlinear relationships between these factors and economic development using panel data from 47 lower-middle-income countries (2012–2019). The study employs the panel corrected standard error (PCSE) regression technique, incorporating squared independent variables to test the nonlinearity of relationships with the dependent variable. Additionally, the Lind-Mehlum Utest is applied to identify the shape of the non-linear relationships and threshold level at which the direction of the relationship takes turn. The results of the study disclose that FDI has a U-shaped relationship with economic development. When FDI is below 8.11% of GDP, it negatively impacts economic development, but beyond this threshold, its effect turns positive. External debt follows an inverted U-shape relationship, positively influencing economic development up to 83.10% of per capita GNI, after which it impacts adversely. Similarly, corruption initially "greases the wheels" of economic development, facilitating growth until the corruption control percentile rank reaches 21.73. Beyond this point, corruption starts to "sand the wheels," i.e. hinders economic development. This study is unique in its exploration of the nonlinear relationships between key economic variables and economic development in lower-middle-income countries, providing valuable insights for policymakers. The policymakers in the developing world need to be threshold-sensitive in these issues, focusing on attracting quality FDI, prudent debt management, and strengthening governance structures.

Keywords: *external debt, foreign direct investment, corruption, economic development, non-linearity*

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1. Introduction

Corruption is a worldwide occurrence defined as the misuse of governmental authority for personal gain (World Bank, 1997). It is a costly phenomenon as it badly affects the social and economic conditions of a country. There are various forms of corruption including embezzlement, syndicating the market prices of commodities, artificially raising expenditure of public projects, unnecessary visits to foreign countries by the public officials, unnecessary and imprudent mega projects, bribery and nepotism. As stated by Transparency International, corruption is more prevalent in developing countries and eighty percent of world population lives in highly corruption inflicted countries. Corruption "greases the wheels" or "sands the wheels" is a long-debated question in academia. "Greasing the wheels" hypothesis of corruption states that it eases the process of government project implementation by getting rid of red tapes of bureaucracy. Corruption helps evading unnecessary regulations that gives the economy a boost. In contrast, the "sand the wheels" hypothesis of corruption states that it impedes economic growth. Bulk of the empirical studies investigating corruption-economic growth nexus advocate the "sand the wheels" hypothesis of corruption. Corruption creates barrier for foreign direct investment (Podobnik et al., 2008), destabilize political environment (Dridi, 2013), increase inflation (Gründler & Potrafke, 2019), and therefore hampers economic growth.

Foreign direct investments (FDI) are very desirable for the countries in developing nations. Theoretically, FDI has positive spillover effects of knowledge and technological knowhow. It increases production and creates employment opportunities. However, the empirical evidence of the impact of FDI on economic growth is mixed (Griffiths & Sapsford, 2004; Khaliq & Noy, 2007; Irandoust, 2001). The economic benefits of FDI are largely dependent on governance effectiveness, level of human capital and physical capital (Durham, 2004; Li and Liu, 2005; Liu, Shu and Sinclair, 2009; Solomon, 2011). Therefore, corruption might be a crucial factor affecting the effective utilization of FDI.

Besides FDI, countries in developing world look for foreign debt to expedite economic growth. However, foreign debt involves payments of timely payment of interest and principal. If the proper utilization of foreign debt cannot be ensured, it can hamper the economic progress and create a debt overhang situation (Sharaf, 2022; Ahmed et al., 2000; Krugman, 1988). It is very common that government in developing countries undertook mega projects with foreign debt. There prevails the opportunity of huge corruption as well. Adopting expensive projects

without scrutinizing its feasibility and corruption in those projects create barriers for economic growth.

Therefore, the aim of this study is to critically examine the effects of corruption, foreign direct investment, and external debt on economic development; to explore the potential non-linearities in these effects; and to estimate the thresholds at which their impacts changes direction, specifically in the context of lower-middle-income countries.

2. Literature Review

This study examined how foreign direct investment, external debt, and corruption affect economic development in developing world. The review of empirical literature is divided into the following three sections.

2.1 Foreign Direct Investment and Economic Development

Attracting FDI is one of the major focuses of the governments in lower-middle income countries. This is because FDI fills the gap in savings and investment and produce externalities like transfer of knowledge, organizational and technological knowhow (Borensztein et al., 1998). Nevertheless, the impact of FDI on economic growth is a widely debated issue. Although, theoretical prediction of the FDI-economic growth nexus is sound and positive, the results of cross-country empirical researches related to the nexus of FDI and economic growth are heterogeneous and confusing. In a study by Dinh et al. (2019), it is found that FDI has long-term stimulating impact but short-term adverse impact on economic growth in developing countries. The positive effects of Foreign FDI require time to manifest and exert a beneficial influence on economic growth (Zhang 2001; Adams, 2009). Tanna et al. (2018) studied 39 developing countries for the period 1984-2010 and showed that external debt after a threshold level limits the positive effects NFDI on economy. Choe (2003) discovered that the positive effects of economic growth on FDI and gross internal investment (GII) is more robust than the effects of FDI and GII on economic growth. Makiela and Ouattara (2018) explained that the positive impact of NFDI on economic growth is through input accumulation, however, they found no discernible impact of NFDI on total factor productivity.

Though most of the studies focused on less developed and developing nations, Bermejo Carbonell and Werner (2018) studied the effects of FDI on the economic growth of Spain. Their study found no evidence of the impact of FDI on economic growth. Similarly, Alvarado

et al. (2017) showed positive effects of FDI on upper income counties while negative effects of FDI on lower and lower middle-income countries. Significant and beneficial impact of FDI was found in the study by Al-Iriani (2007), Yeboah et al. (2025), Supriyanto et al. (2025), Chizema (2025), Saha et al. (2022), Islam and Beloucif (2023), Le et al. (2024), Kumar et al. (2025), and Sugiharti et al. (2022). Chakraborty and Nunnenkamp (2006), Irandoust (2001), and Chowdhury and Mavrotas (2006) also showed no causal impact of FDI on the growth of specific sectors in some countries. In contrast, Khaliq and Noy (2007) provided evidence of adverse effect of FDI in mining sector in Indonesia.

Therefore, from the evidence of prior studies, it can be stated that economic impact of FDI varies across sectors and regions (Zhang, 2001; Khdir & Cieślik, 2025). The economic effects FDI significantly dependent on political stability (Solomon, 2011), development status of financial markets (Durham, 2004), level of human capital (Li & Liu, 2005), and technology (Liu et al., 2009) among others.

2.2 External Debt and Economic Development

In the age of globalization, no country is isolated. Depending on external debt for mitigating fiscal gap and implementing crucial development projects is common affair for the emerging economies. The servicing of external debt requires payments of interest and principal when matured. Debt overhang is a situation where the current level of external debt is so high that it becomes difficult to borrow more even though the country has good investment opportunities (Krugman, 1988). Therefore, high external debt might reduce investment. However, with a prudent utilization of external debt, a country can leverage the privilege of external debt financing. This requires efficient and effective physical and human capital. As the study by Shi et al. (2025), Dawood et al. (2025), and Olamide and Maredza (2023) show the critical role of institutional quality and macroeconomic stability in the public debt and economic growth relationship. Similarly, Kim et al. (2017) claims the nexus of public debt and economic growth as a function of corruption. Mohammed (2025) studied ten African countries and reached the conclusion that government effective can harness external debt for economic growth.

Debt threshold level indicates a point after which the impact of debt on economic growth becomes adverse. This debt threshold level varies from country to country as its human capital, development status and physical capital varies. Therefore, it is pivotal to find out the

sustainable level of external debt for each country for its stimulating impact on economic growth in the long-run. Elkhalfi et al. (2024) showed that a nonlinear relationship exists between external debt and economic growth. External debt initially stirs up economic growth. However, after crossing a threshold level external debt has a downturn effect. As globalization makes every country vulnerable to external shocks, their findings suggest for cautious management for externally obtained debt. As highlighted in the study of Lau et al. (2022), insights of the debt threshold level are vital for a country. Byamungu and Zhang (2025) point out a nonlinear U-shaped nexus, claiming the adverse effect public debt on economic growth after an optimal level. External debt can produce both short-term positive and negative shocks. According to the study of Sharaf (2022), the negative shock has a greater economic impact than the positive shocks. Their study, focusing the impact of external debt on economic growth in Egypt found a long-run negative impact of external debt. Ahmed et al. (2000) investigated the external debt and economic growth causality in Asian countries. They argued that the excessive burden of debt servicing slows down the economic progress in comparatively poor countries. Decline in foreign aid forces a country to pursue more external debt. Adekunle et al. (2021) confirmed the debt overhang theory and debt Laffer curve associated with it. They also provide evidence in favor of crowding out effects of high debt servicing burden. Fosu (1999) studying the effect of external debt on economic progress in 35 sub-Saharan nations found little evidence of investment and external debt correlation. He claimed that external debt deters economic growth in such a negative way that without the burden of debt servicing, economic growth in sub-Saharan nations would be 50 percent higher.

Nevertheless, Mohd Daud and Podivinsky (2012) presented evidence contradicting the notion of reduced investment resulting from burgeoning external debt stock and demonstrated that external debt does not exhibit a flipped U-shaped relationship with economic growth. Similarly, Lau et al. (2022) examined the role of external debt on economic growth in pacific island nations. They advocated the use of concessional external funding as it promotes exports and economic growth. Chowdhury (1994) supports the proposition of Bulow and Rogoff (1990) that external debt is not primary cause rather a prodrome of economic distress.

Most of studies conducted covering various regions concluded a negative impact of external debt on economic growth. Some of them found flipped U-shaped association. A number studies concluded a severe negative impact of public external debt than public internal debt (Mohd Dauda et al., 2013; Kharusi & Ada, 2018; Ighodalo Ehikioya et al., 2020;

Manasseh et al., 2022; Mohsin et al., 2021; Silva ,2020; Adegbite et al., 2008; Shittu et al., 2018; Doganˇ & Bilgili, 2014; Schclarek, 2004).

2.3 Corruption and Economic Growth

Developing and less developed countries in the world usually face the "sand the wheel" effect rather the "grease the wheel" repercussions of corruption on economic growth. Corruption eats up the government expenditure on health, education, social welfare and promotes money laundering. Corruption instigates political instability and cuts up the expenditure on human capital development (Dridi, 2013). Spyromitros and Panagiotidis (2022) examined the impact of corruption on the eighty-three developing countries in different parts of the world. The results are mixed. For the countries in MENA region, corruption has negligible effect on economic growth. While countries in Latin America have favorable impact of corruption on economic growth. For the other developing countries, the impact of corruption is negative. The nations suffering from autocratic government, lacking effective governance and rule of law are badly affected by corruption by means of decline in FDI and increase in inflation (Gründler & Potrafke, 2019). Similar adverse effects of corruption on economic growth are found in the study of Anh et al. (2016). Farooq et al. (2013) noted long-run negative relation between corruption and economic growth while stimulating effect of financial development and trade openness on corruption. Kim et al. (2017) and Mohammed (2025) provide evidence that corruption is the reason of adverse effect of external debt on economic growth. Podobnik et al. (2008) reported that by reducing corruption, it is possible to boost economic growth and FDI. Anoruo and Braha (2005) studied the economic effects of corruption in African countries and noted that corruption impedes economic growth by impeding foreign investment and reducing productivity. However, the impact of corruption on economic growth is heterogeneous and dependent on natural resource endowment, political stability and form of governance (d'Agostino et al., 2016).

2.4 Gap in the Literature

Countries in the developing world make efforts to attract foreign direct investment to ameliorate production, employment and economic growth. At the same time, these countries are highly dependent on foreign debt. However, empirical evidence shows that the association of FDI and external debt with economic growth is heterogeneous. Like political instability,

governance ineffectiveness, high corruption is a major threat to the sustainable development in the developing world. Therefore, it is of crucial importance to examine non-linear relationship of corruption, foreign direct investment, external debt and economic growth in developing countries. To the best of the author's knowledge, no existing study has examined the nonlinear dynamics among corruption, foreign direct investment, external debt, and economic development in the context of lower-middle-income countries.

3. Methodology

3.1 Data and Variables

To explore the research questions, this study utilizes a panel dataset comprising 47 countries classified by the World Bank as lower-middle-income economies in 2025, covering the period from 2012 to 2019 (World Bank, 2025). The study uses dataset ending in 2019 to enhance the generalizability of its findings. The ontset of Covid-19 forced many developing and emerging countries to alter their macroeconomic policies in order to survive including reallocation of FDI, increasing reliance on unsustainable external funding, postponing development projects, all of these lowers economic growth (Mehar, 2021; Elkhishin & Mohieldin, 2021; Olamide & Maredza, 2023; Arjun & Mishra, 2024; Dawood et al., 2025). The researcher deliberately includes data only up to 2019 to exclude the impact of the Covid-19 shock, which affected the majority of countries. The World Bank defines lower-middle-income countries as those with a gross national income (GNI) per capita ranging between USD 1,136 and USD 4,465. All variables have been obtained from World Bank's World Development Indicators. The GDP per capita in constant 2015 USD (GDPPC) is the explained variable in the study, utilized as a substitute measure for economic development.

Control of corruption percentile rank, foreign direct investment and external debts are the explanatory variables. According to World Bank, control of corruption measures "the perceived degree to which governmental authority is utilized for personal benefits, encompassing various scales of corruption, as well as the influence of elites and private interests on state governance". The percentile rank signifies a particular country's position relative to all countries evaluated by the composite index, where 0 denotes the lowest rank and 100 denotes the highest rank. The study uses corruption control percentile rank (CCPR), Net inflow of foreign direct investment and external debt as the explanatory variables. Net foreign direct investment (NFDI) represents the net amount of foreign capital flowing into a nation,

expressed as a percentage of Gross Domestic Product (GDP). According to World Bank, "Total external debt comprises obligations to non-residents that are repayable in currency, goods, or services. It encompasses public, publicly guaranteed, and private non-guaranteed long-term debt, IMF credit, and short-term debt. External debt (EDEBT) may take several forms including multilateral debt (debt from multilateral institution like World Bank), bilateral debt (debt from another country, commercial and bank debt (debt from a foreign bank or financial institution)". The study defines EDEBT as total outstanding debt as a percentage of Gross National Income (GNI) per capita. The control variables are trade openness, gross capital formulation, General government final consumption expenditure as a percentage of GDP, broad money, population growth rate.

Table 1 provides the introduction of the variables used in the study. Table A1 (see Appendix A) shows the list of countries with average GDPPA, NFDI, EDEBT, and CCPR over the period from 2012 to 2019.

Table 1

Definition of variables

Acronym	Definition	Source	References
GDPPC	GDP per capita in constant 2015 USD	WBI	Ibrahim (2021), Méon & Sekkat (2005), Hakimi & Hamdi (2017), Saengchai et al. (2019)
NFDI	Net foreign direct investment, percentage of GDP	WBI	Trabelsi (2024), Méon & Sekkat (2005), Shittu et al. (2018), Hakimi & Hamdi (2017), Ibrahim (2021), Jamsheed (2024)
EDEBT	External debt stock, percentage of GNI	WBI	Eberhardt & Presbitero (2015), Ibrahim (2021), Jamsheed (2024), Adegbite et al. (2008), Shi et al. (2025)
CCPR	Corruption control percentile rank	WBI	Méon & Sekkat (2005), Menard & Weill (2016), Oyekale et al. (2024), Spyromitros & Panagiotidis (2022)
TO	Trade openness, calculated as the total value of exports and imports as a percentage of GDP.	WBI	Trabelsi (2024), Méon & Sekkat (2005), Spyromitros & Panagiotidis (2022)
GCF	Gross capital formulation, percentage of GDP	WBI	Eberhardt & Presbitero (2015), Shittu et al. (2018), Saengchai et al. (2019)
GFCE	General government final consumption expenditure, percentage of GDP	WBI	Spyromitros & Panagiotidis (2022), Easterly & Rebelo (1993)
BM	Broad money, percentage of GDP	IMF	Spyromitros & Panagiotidis, (2022), Song et al. (2020)
POPG	Annual population growth rate	WBI	Eberhardt & Presbitero (2015) Méon & Sekkat (2005) Ibrahim (2021)

3.2 Research Design

Before conducting the econometric analysis, some important pre-estimations tests have been carried out. The Pesaran cross sectional dependence (CD) test (Pesaran, 2007) is carried out to check the presence of cross-sectional dependence in the series. The null hypothesis that there is no cross-sectional dependence (CSD) can be rejected at the 1 percent, 5 percent, and 10 percent significance levels is expressed as:

$$\text{CD} = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=t}^{N-1}\sum_{k=i+1}^{N}\hat{\rho}_{i,k}\right)$$

Wooldridge test for autocorrelation (Wooldridge, 2010) and Breusch-Pagan test for heteroscedasticity (Breusch & Pagan, 1979) has been conducted to test the presence of autocorrelation and heteroscedasticity. The presence of a long-run relationship among the explained and independent variables is checked through the second-generation panel cointegration tests introduced by Westerlund (Westerlund, 2007). This method is appropriate when cross-sectional dependence (CSD) is present in the data.

The study applies of panel-corrected standard errors (PCSE) regression method following Beck and Katz (1995) and Trabelsi (2024). The PCSE regression method can address cross-sectional dependence (CSD), heteroscedasticity and autocorrelation problems. PCSE method is also more appropriate when number of panels (N) is higher than time periods (T) (Hoechle, 2007). Moundigbaye et al. (2018) claimed that PCSE regression method is suitable for panel estimation in all cases. As endogeneity is concerned, repeated observations overtime on a set of countries used in this study is better resolved by model like PCSE estimator than GMM method (Trabelsi, 2024).

The study hypothesizes that the association between FDI and economic development is first negative and then positive (U-shape), the association between external debt and economic development is first positive and then negative (Inverted U-shape), the association between corruption control and economic development is first negative and then positive (U-shape). The econometric equations are as follows:

$$lnGDPPC_{i,t} = \beta_0 + \beta_1 NFDI_{i,t} + \beta_2 NFDI * NFDI_{i,t} + \beta_3 TO + \beta_4 GCF + \beta_5 GFCE + \beta_6 BM + \beta_7 POPG + \varepsilon_{i,t}$$

$$lnGDPPC_{i,t} = \beta_0 + \beta_1 EDEBT_{i,t} + \beta_2 EDEBT * EDEBT_{i,t} + \beta_3 TO + \beta_4 GCF + \beta_5 GFCE + \beta_6 BM + \beta_7 POPG + \varepsilon_{i,t}$$

$$lnGDPPC_{i,t} = \beta_0 + \beta_1 CCPR_{i,t} + \beta_2 CCPR * CCPR_{i,t} + \beta_3 TO + \beta_4 GCF + \beta_5 GFCE + \beta_6 BM + \beta_7 POPG + \varepsilon_{i,t}$$

Following Canarella and Miller (2022), the Utest (Lind & Mehlum, 2010) is conducted after estimating PCSE regression model to test for the existence of a relationship that takes the form of a U-shaped or inverted U-shaped curve between an explanatory variable and the outcome variable within a particular range. This test determines the threshold level at which the direction of the association between the explanatory and outcome variable flips.

Based on equation (1), the data indicate a U-shaped connection between lnGDPPA and NFDI, provided that we can reject the joint null hypothesis of

$$H_0 = \hat{\beta}_1 + \hat{\lambda}_1 \text{NFDI}_L \geq 0 \text{ and/or } H_0 = \hat{\beta}_1 + \hat{\lambda}_1 \text{NFDI}_H \leq 0$$

for the combined alternative

$$H_1 = \hat{\beta}_1 + \hat{\lambda}_1 \text{NFDI}_L < 0 \text{ and/or } H_1 = \hat{\beta}_1 + \hat{\lambda}_1 \text{NFDI}_H > 0$$

Based on equation (2), the data indicate an inverted U-shaped connection between *lnGDPPA* and *EDEBT*, provided that we can reject the combined null hypothesis of

$$H_0 = \hat{\beta}_2 + \hat{\lambda}_2 \text{EDEBT}_L \leq 0 \text{ and/or } H_0 = \hat{\beta}_1 + \hat{\lambda}_2 \text{EDEBT}_H \geq 0$$

for the combined alternative

$$H_1 = \hat{\beta}_1 + \hat{\lambda}_2 \text{EDEBT}_L > 0 \text{ and/or } H_1 = \hat{\beta}_1 + \hat{\lambda}_2 \text{EDEBT}_H < 0$$

Based on equation (3), the data indicate a U-shaped connection between lnGDPPA and CCPR, provided that we can reject the joint null hypothesis of

$$H_0 = \hat{\beta}_3 + \hat{\lambda}_3 \text{CCPR}_L \geq 0 \text{ and/or } H_0 = \hat{\beta}_3 + \hat{\lambda}_3 \text{CCPR}_H \leq 0$$

for the combined alternative

$$H_1 = \hat{\beta}_3 + \hat{\lambda}_3 \text{CCPR}_L < 0 \text{ and/or } H_1 = \hat{\beta}_3 + \hat{\lambda}_3 \text{CCPR}_H > 0$$

The subscripts L and H denote the lowest (minimum) and highest (maximum) values within the observed data range.

4. Findings and Discussion

4.1 Summary Statistics and Pairwise Correlations

Table 2 provides descriptive statistics of the variables. The average GDP per capita in constant 2015 USD of the sample countries over the period 2012-2019 is 2279.58. The lowest GDPPC is 719.5 USD and highest is 8920.8 USD. The average NFDI is 2.94 percent of GDP. The minimum NFDI is -11.76 percent of GDP that indicates a net outflow of foreign direct investment. The range of EDEBT is very wide from 1.76 percent to 148.08 percent of per capita GNI with the mean value of 48.27 percent. This means some countries are highly exposed to external debt. The average CCPI is 31.84 with a standard deviation of 20.05 show

high variation in corruption control among sample countries. The mean trade openness is 77.8 percent with a high standard deviation of 43.6 percent. GCF varies from -3.95 percent to 76.78 percent of GDP. GFCE, BM and POPG also show high variations.

Table 2

Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDPPC	375	2279.58	1333.20	719.51	8920.81
NFDI	374	2.95	3.89	-11.76	34.42
EDEBT	360	48.37	32.20	1.76	148.08
CCPI	376	31.84	20.05	1.90	91.43
TO	337	77.80	43.60	17.23	348
GCF	337	27.75	10.72	-3.95	76.78
GFCE	334	16.18	11.49	4.81	84.19
BM	356	51.71	36.93	12.21	260.62
POPG	376	1.86	1.26	-3.22	9.99

Table 3 shows the pairwise correlations of the variables. NFDI is not significantly correlated with GDPPC. EDEBT has significant negative correlation with GDPPC. CCPI has significant positive correlation that indicates corruption has significant negative correlation with GDPPC. Among control variables TO, BM has significant positive correlation with GDPPC. However, POPG has significant negative correlation with GDPPC. None of the pairwise correlations among explanatory variables are very high enough to be concerned about multicollinearity.

Table 3

Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) GDPPC								
(2) NFDI	-.002							
(3) EDEBT	.374***	.223***						
(4) CCPI	.316***	-.067	.183***					
(5) TO	.149***	.389***	.298***	.134***				
(6) GCF	-.017	.282***	.204***	.238***	.107**			
(7) GFCE	-.036	-.090	-.014	.310***	.270***	.172***		
(8) BM	.573***	.096*	.301***	.230***	.154***	-.019	-.016	
(9) POPG	-.127**	.037	.001	-.179***	-.039	-.004	-.042	-.084

***Notes**:* *** marks p<0.01, ** marks p<0.05, * marks p<0.1

4.2 Results of Pre-Estimation Tests

The results of pre-estimation tests are displayed in Table 4. Variance inflation factor (VIF) values indicates that there is no multicollinearity among explanatory variables as the VIF values are less than 5 (Alin, 2010; Kim, 2019). Pesaran (2007) CD-test shows that all the variables except CCPR, GCF and, GFCE are cross-sectionally dependent. The results from Wooldridge test and Breusch-Pagan test shows that problems of autocorrelation and heteroscedasticity is present in all the three regression models. Westerlund cointegration test (Westerlund, 2007) is employed to check whether the dependent and explanatory variables are cointegrated in the long run or not. The results from Westerlund cointegration test reveals that GDPPC has long-run cointegrating relationship with NDFI, EDBT and, CCPI with and without cross sectional means. The presence of cross-sectional dependence (CSD), heteroscedasticity, autocorrelation, and cointegration in the series appropriately justifies the use of panel-corrected standard errors (PCSE) regression method.

Table 4

Pre-estimation tests results

	lnGDPPC	**NFDI**	**EDEBT**	**CCPR**	**TO**	**GCF**	**GFCE**	**BM**	**POPG**
VIF									
		1.38	1.34	1.27	1.47	1.30	1.26	1.16	1.06
Pesaran (2007) CD-test									
Stat	48.02***	3.31***	24.92 ***	1.01	12.98***	-.035	.95	19.71***	11.52***
Wooldridge test									
	Model 1			Model 2			Model 3		
Stat	552.16***			426.31***			454.99***		
Breusch-Pagan test									
Stat	11.25***			12.61***			7.12***		
Westerlund Cointegration Test (Westerlund, 2007)									
lnGDPPC NFDI EDEBT CCPR									
With cross-sectional means (all panels)					5.6190***				
Without cross-sectional means (all panels)					5.4226***				

4.3 Three-Stage Least Squares Results

In Table 5, the results of the three-stage least squares regressions are displayed. The results show that a non-linear relationship exists between CCPR and GDPPC.

Table 5

3SLS regression results

	(1) LGDPPC	(2) LGDPPC	(3) LGDPPC	(4) CCPR	(5) EDEBT	(6) NFDI
Trade	0.0008	0.0012**	-0.0007	0.0032	0.1938***	0.0392***
	(0.0005)	(0.0006)	(0.0006)	(0.0240)	(0.0344)	(0.0047)
GCF	-0.0042**	0.0005	-0.0017	0.3803***	0.6503***	0.1086***
	(0.0021)	(0.0024)	(0.0021)	(0.0953)	(0.1366)	(0.0187)
GFCE	-0.0030	-0.0019	0.0029	0.3719***	-0.4532***	-0.0897***
	(0.0024)	(0.0026)	(0.0026)	(0.1131)	(0.1640)	(0.0220)
BM_GDP	0.0080***	0.0087***	0.0089***	-0.0299	-0.0811	0.0069
	(0.0006)	(0.0006)	(0.0007)	(0.0409)	(0.0586)	(0.0080)
POPG	0.0253	0.0002	-0.0143	-2.8341***	1.4318	0.2708*
	(0.0177)	(0.0189)	(0.0177)	(0.8277)	(1.1824)	(0.1614)
CCPR	-0.0077**					
	(0.0038)					
$CCPR^2$	0.0002***					
	(0.0000)					
NFDI		-0.0180**				
		(0.0086)				
$NFDI^2$		0.0007				
		(0.0004)				
EDEBT			0.0171***			
			(0.0031)			
$EDEBT^2$			-0.0001***			
			(0.0000)			
GDPPC				0.0055***	0.0112***	-0.0002
				(0.0012)	(0.0017)	(0.0002)
Constant	7.1660***	7.0583***	6.6916***	10.5273***	-1.2185	-2.0380***
	(0.1003)	(0.0929)	(0.1124)	(4.0105)	(5.7258)	(0.7848)
Observations	317	315	309	317	309	315
R-squared	0.4927	0.4135	0.4818	0.2231	0.3277	0.2680

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The negative coefficient on CCPR combined with the positive coefficient on $CCPR^2$ indicates that corruption initially triggers economic growth but have negative effects at higher level. The relationship between NFDI and GDPPC also exhibits non-linearity, though with statistically weaker significance. The negative coefficient combined with an insignificant

positive squared term suggests that NFDI may initially have adverse effects on per capita income, possibly due to resource reallocation or crowding-out effects, before potentially turning positive at higher NFDI level. EDEBT displays a clear non-linear relationship with GDP per capita. The significant positive linear coefficient and negative squared coefficient indicate that moderate levels of external debt can stimulate economic growth through increased investment capacity, but excessive debt burdens become harmful to economic development as confirmed by debt overhang theory. The three stage least squares framework shows that higher GDP per capita significantly decrease corruption (increases CCPR) and external debt levels, while showing no significant relationship with net inflow foreign direct investment. These results suggest that relatively richer countries may restrict corruption practices and have greater to access international credit markets.

4.4 Results of PCSE Regressions and Lind-Mehlum Utest

Table 6 presents the results of the PCSE regression analysis and the Lind-Mehlum Utest. Panel 1 of Table 5 examines the impact of NFDI on economic development, revealing a nonlinear relationship between the two. The findings indicate that NFDI has a significant negative effect on economic development. However, the squared term ($NFDI^2$) is also significant and positively signed, suggesting a turning point in the relationship. The results from the Lind-Mehlum U-test confirm the presence of a U-shaped association between NFDI and economic development. This implies that while lower levels of NFDI negatively affect economic development, higher levels can have a positive impact. Specifically, the U-test identifies the turning point at 8.11 percent of GDP, where the effect of NFDI shifts from negative to positive, indicating that substantial NFDI inflows can contribute to economic growth in developing countries. The negative nexus of economic growth and lower level of the inflow of foreign direct investment may seems perplexing. However, this result is well supported by literature (Blomström et al.,1994; Emako & Menza, 2022; Fazaalloh, 2024). The possibles reasons are high external debt (Tanna et al., 2018), low level of financial development (Macek et al., 2020), lack of good governance (Lajuwomi, 2024), insufficient channeling of NFDI to export-oriented industries (Abdi et al., 2024). The findings of the nonlinearity of NFDI and economic growth relationship are very similar to the findings of the study conducted by Asafo-Agyei and Kodongo (2022), and Kottaridi and Stengos (2010).

Table 6

Results of PCSE regressions and Lind-Mehlum Utest

	Model 1	Model 2	Model 3
Constant	7.0938***	6.9848***	6.6635***
	(0.0766)	(0.0752)	(0.0946)
Control variables			
TO	0.0008***	0.0012***	-0.0007***
	(0.0002)	(0.0003)	(0.0002)
GCF	-0.0041***	0.0005	-0.0016
	(0.0012)	(0.0011)	(0.0011)
GFCE	-0.0027***	-0.0016	0.0029***
	(0.0008)	(0.0010)	(0.0008)
BM	0.0080***	0.0087***	0.0089***
	(0.0001)	(0.0002)	(0.0002)
POPG	0.0302***	0.0033	-0.0136
	(0.0069)	(0.0064)	(0.0103)
Independent variables with quadratic effect			
CCPR	-0.0081***		
	(0.0016)		
$CCPR^2$	0.0002***		
	(0.0000)		
NFDI		-0.0151**	
		(0.0069)	
$NFDI^2$		0.0006***	
		(0.0002)	
EDEBT			0.0169***
			(0.0015)
$EDEBT^2$			-0.0001***
			(0.00001)
Year FE	YES	YES	YES
R-squared	0.4999	0.4177	0.4830
Lind-Mehlum Utest results			
Overall test	2.26	5.76	3.54
P-value	0.0124	0.0000	0.0002
Shape of the relationship	U-shape	Inverse U-shape	U-shape
Turning point	8.1111	83.1003	21.7251

Note: Panel-corrected standard errors are in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Panel 2 of Table 6 examines the impact of EDEBT on economic development. While EDEBT serves as a crucial source for alleviating foreign exchange crises, overreliance on it can lead to substantial interest and principal repayments, which may constrain a country's development expenditure. The findings in Panel 2 indicate that EDEBT has a significant positive effect on economic growth. However, the squared term of EDEBT ($EDEBT^2$) demonstrates a significant negative impact, pointing to a nonlinear relationship. The Lind-Mehlum Utest confirms an inverse U-shaped relationship between EDEBT and economic development in developing countries. The results of the Utest suggest that external debt positively influences economic growth as long as it remains below 83.10 percent of per capita GNI. Beyond this threshold, the relationship reverses, indicating that excessive reliance on external debt begins to hinder economic development in developing countries. This part of results is consistent with the findings of study conducted by Adekunle et al. (2021), Sharaf (2022), Dogan and Bilgili (2014), Lau et al. (2022), Elkhalfi et al. (2024), Shi et al. (2025), Dawood et al. (2025), and Byamungu and Zhang (2025).

Panel 3 of Table 6 examines the impact of corruption on economic development in developing countries. The CCPR has a negative coefficient, suggesting that corruption is associated with positive effects on economic development. Conversely, the squared term of CCPR ($CCPR^2$) has a positive coefficient, indicating that corruption negatively affects economic development beyond a certain point. The significance of the $CCPR^2$ coefficient confirms the non-linear relationship between corruption and economic development, as well as the presence of a threshold. Results from the Lind-Mehlum Utest reveal an inverse U-shaped association between corruption and economic development. This implies that lower levels of corruption initially enhance economic development up to a threshold level. Beyond this threshold, however, the relationship becomes adverse, with higher corruption levels hindering economic progress. The Utest identifies the turning point at a CCPR value of 21.73, after which the impact of corruption on economic development turns negative. This part of the finding of study is similar to the findings of the study conducted by Ojolo and Singh (2025), Mah and Dinga (2025), Trabelsi (2024), Spyromitros and Panagiotidis (2022), Anh et al. (2016), and Podobnik et al. (2008).

5. Robustness Check

To ensure the robustness of the main findings, the study re-estimate the models using Gross National Income (GNI) per capita in constant 2015 USD as an alternative proxy measure for economic development, replacing GDP per capita. This approach is consistent with prior literature suggesting that GNI may better capture the income accruing to residents, particularly in economies with significant income flows from abroad (World Bank, 2025). The models are estimated using Panel-Corrected Standard Errors (PCSE), without year fixed effects, as reported in Table 6.

Table 6

Robustness Check with alternative measurement of economic development (GNI per capita in constant 2015 USD)

	Model 1	**Model 2**	**Model 3**
Constant	7.1660***	7.0583***	6.6916***
	(0.0455)	(0.0453)	(0.0529)
Control variables			
Trade	0.0008***	0.0012***	-0.0007***
	(0.0002)	(0.0003)	(0.0002)
GCF	-0.0042***	0.0005	-0.0017*
	(0.0012)	(0.0011)	(0.0010)
GFCE	-0.0030***	-0.0019**	0.0029***
	(0.0008)	(0.0009)	(0.0008)
BM	0.0080***	0.0087***	0.0089***
	(0.0001)	(0.0002)	(0.0002)
POPG	0.0253***	0.0002	-0.0143
	(0.0067)	(0.0067)	(0.0106)
Independent variables with quadratic effect			
CCPR	-0.0077***		
	(0.0016)		
$CCPR^2$	0.0002***		
	(0.0000)		
NFDI		-0.0180***	
		(0.0064)	
$NFDI^2$		0.0007***	
		(0.0002)	
EDEBT			0.0171***
			(0.0014)
$EDEBT^2$			-0.0001***
			(0.0000)
R-squared	0.4927	0.4135	0.4818

Note: Panel-corrected standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Across all three model specifications, the baseline results remain largely consistent**,** affirming the robustness of our earlier conclusions. In Model 1, the non-linear relationship between CCPR and GNI per capita is statistically significant, with a negative coefficient on CCPR and a positive coefficient on $CCPR^2$, indicating a non-linear, U-shape relationship of corruption and economic development. This supports the hypothesis that beyond a certain threshold, corruption becomes detrimental to economic development.

Model 2 examines the non-linear impact of net inflow of foreign direct investment (NFDI)**,** which also exhibits a statistically significant non-linear effect. The negative sign on NFDI and the positive sign on its squared term suggest that it takes a threshold level of FDI for a positive impact on economy, aligning with findings from Herzer (2012).

Model 3 incorporates external debt (EDEBT) and similarly reveals a non-linear relationship, where moderate levels of debt are positively associated with GNI per capita, but excessive indebtedness exerts a negative effect. This is consistent with the debt overhang theory (Krugman, 1988).

Overall, the robustness check reinforces the validity of the main results and confirms that FDI, external debt and corruption have non-linear effects on development outcomes in lower-middle-income countries.

6. Conclusion

The study assesses the impact of net foreign direct investment, external debt, and corruption on economic development. The study uses a panel dataset covering 47 developing countries which are on the World Bank list of lower middle-income countries for the years covering 2012 to 2019. The study employs panel corrected standard error regression (PCSE) method and Lind-Mehlin Utest. The findings provide important policy recommendations for developing economies.

The study reveals that a country benefits directly and indirectly from FDI only when it surpasses a threshold level of 8.11% of GDP. However, the average level of NFDI in developing countries is 2.95 percentage of GDP only. This indicates that the countries in developing world are lagging far behind on average from the level of NFDI that contributes to the economic development. To maximize the benefits from FDI, developing economies should attract more and more high-quality FDI by implementing policies such as investing in human capital, modernizing financial markets, promoting trade openness, and ensuring a favorable

business environment. These countries also need to attract FDI in those sectors that create forward and backward linkage with local economy.

Developing countries should exercise caution in managing external debt. The study suggests a threshold level of 83.10 percent of per capita GNI. While external debt can positively contribute to economic development when managed effectively, exceeding this threshold can have detrimental effects. A possible explanation is that many developing countries struggle to increase government revenue at a pace that matches rising interest and principal repayments. To avoid debt overhang situation, lower-middle income countries should focus on fiscal prudence and strategic debt management efficiency, ensuring that external debt financing is utilized in sustainable and productive investment. Additionally, transparency and accountability in fiscal policy and governance will prevent from the adverse effects of high exorbitant debt accumulation.

Finally, corruption poses a significant challenge to economic development in lower-middle-income countries. The study suggests that while minimal levels of corruption may have a neutral or even slightly positive impact, widespread corruption beyond a certain threshold hinders development. According to the findings of Utest the threshold level of corruption control is 21.73. However, it is alarming that the average level of corruption control in developing countries is 31.84. Therefore, most of the countries in developing world are suffering the adverse effects of corruption on average. High corruption is responsible for poor institutional quality, low investment and public trust. Therefore, to sustain long term economic growth, developing nations must implement effective anti-corruption measures aiming to enhance governance quality, remove administrative bottlenecks and establish transparency and accountability to keep corruption in check.

The study is limited by the fact that its findings may not be generalizable to higher-income countries, where macroeconomic structures and characteristics differ significantly. Future research may incorporate higher-income and upper-middle-income countries and compare the dynamics of these macroeconomic variables across both groups.

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Appendix A

Table A1

Average of GDPPC, NFDI, EDEBT, and CCPR (2012-19)

Countries	GDPPC(USD)	NFDI	EDEBT	CCPR
Angola	3049.078	-2.130	67.433	6.666
Bangladesh	1279.673	1.079	17.987	19.164
Benin	1020.974	1.919	35.164	32.747
Bhutan	3028.849	0.519	108.773	85.309
Bolivia	3013.069	2.050	31.478	27.975
Cabo Verde	3593.897	6.000	99.696	78.455
Cambodia	1621.926	9.505	54.668	10.653
Cameroon	1409.446	2.030	22.640	10.538
Comoros	1353.135	0.499	17.793	24.831
Congo, Rep.	2219.835	6.418	43.166	8.808
Cote d'Ivoire	1832.692	1.170	28.601	33.177
Djibouti	2474.510	7.323	62.042	29.875
Egypt, Arab Rep.	3385.504	2.177	24.076	33.632
Eswatini	3449.009	0.836	17.629	49.403
Ghana	1787.079	5.929	56.838	52.020
Guinea	804.555	4.428	22.969	14.880
Haiti	1406.420	0.995	12.969	9.403
Honduras	2308.888	5.717	38.841	24.769
India	1637.927	1.676	21.228	42.266
Jordan	4160.069	4.152	68.696	60.477
Kenya	1506.584	1.240	30.014	16.789
Kiribati	1646.477	0.079	.	62.446
Kyrgyz Republic	1114.039	5.971	106.129	13.097
Lao PDR	2174.189	6.633	86.346	16.433
Lebanon	8210.795	5.167	138.412	15.648
Lesotho	1094.555	2.719	44.133	57.082
Mauritania	1547.453	7.664	72.868	21.898
Morocco	3146.233	2.472	39.553	45.009
Myanmar	1195.287	4.188	16.868	24.411
Nepal	903.080	0.370	17.388	27.152
Nicaragua	2046.979	7.268	98.565	19.219
Nigeria	2481.898	0.775	12.301	11.426
Pakistan	1423.991	0.607	26.585	20.187
Papua New Guinea	2426.318	0.272	88.774	17.381
Philippines	3023.193	2.151	21.532	36.967
Samoa	4198.700	1.695	56.158	66.909
Senegal	1250.559	2.631	62.664	54.830
Sri Lanka	4102.790	1.181	55.112	45.171
Tajikistan	988.132	3.365	57.200	9.173
Tanzania	954.436	2.789	36.813	31.668
Timor-Leste	1316.137	0.576	4.233	34.058
Tunisia	4030.598	2.152	70.687	54.046
Uzbekistan	2833.960	1.659	21.177	10.183
Viet Nam	2679.266	4.631	36.242	36.375
West Bank and Gaza	3348.732	1.118	.	47.558
Zambia	1296.153	4.828	67.879	39.342
Zimbabwe	1387.659	1.721	56.299	6.788