Foreign Capital Inflows, Institutional Quality and Technological Innovation: Effects on GDP Per Capita in Developing Countries

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Abstract

This study examines the impact of technology innovation, institutional quality and foreign capital inflows on economic growth and per capita income in developing countries using the data from 53 developing countries from 2002 to 2021. Various econometrics techniques are used for data analysis including cross-sectional dependence test, slope homogeneity test, CIPS and CADF test of unit root, panel co-integration test, FGLS model for parameter estimations, PCSE model for robustness estimation and Granger causality test. The outcomes show that foreign capital inflows, institutional quality and technology innovations, labor force participation, capital formulation and educational expenditures are positively and significantly linked to GDP per capita in developing countries, Panel Granger causality test indicates that there is a unidirectional causality between LFPR and GDPPC, and TI and GDPPC. Moreover, no causality is observed between FCI and GDPPC, education expenditures, and GDPPC in developing countries.

Keywords: GDP Growth, Foreign Capital Inflows, Technological Innovation, Institutional Quality, Educational Expenditures, Labor Force Participation Rate, Gross Fixed Capital Formation

Introduction

Foreign capital flows are essential to a nation's development. For developing countries to manage their economies, these foreign inflows are crucial (Ali et al., 2022). Developing nations prioritize foreign direct investment (FCI) in this period of globalization since it has been shown to have positive benefits in reducing economic, commercial, and technological obstacles (Demirsel et al., 2014). Even if every nation has unique qualities and advantages to draw upon when pursuing economic expansion, foreign direct investment (FCI) continues to play a crucial part in the main variables that directly impact growth. According to Nguyen et al. (2019) FCI is essential for fostering economic growth, ensuring financial stability, and enhancing social welfare. Nonetheless, the efficiency with which foreign capital is employed is contingent upon the state and caliber of political and economic institutions (Ali et al., 2022).

Research on the importance of institutional quality is currently ongoing. According to a large body of research, poor institutions typically impede development, whereas strong institutions foster the growth of the political, social, and cultural spheres (Butkiewicz & Yanikkaya, 2006; Glaeser et al., 2004). Many emerging nations have had severe issues in recent decades with the caliber of their institutions, which have not encouraged their significant progress. Political instability, corruption, and declining government efficacy are a few of these issues. There are still nations experiencing civil war, armed warfare, and other forms of political instability. However, the

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likelihood of a nation developing is diminished by social or military instability (Aisen & Veiga, 2013). A wealth of scholarship has examined the detrimental impacts of corruption on development, which threatens many emerging nations in addition to instability.

According to Cieślik and Goczek (2018) corruption impedes development by delaying investment and growth. One of the primary reasons for the development gap in Africa is corruption, which has an impact on all economic sectors and levels (Reinikka & Svensson, 2006). To enhance the quality of their institutions, emerging nations still have a long way to go in addition to these areas. They perform the worst on measures of institutional quality on average. For instance, data from the Worldwide Governance Indicators indicates that less than 50% of developing nations receive a favorable annual score on the government effectiveness index. Other measures of institutional quality, such as rule of law, voice and accountability, and regulatory quality, show a similar tendency (Fomba et al., 2023).

Lastly, compared to developed countries, which have lower standards of living, developing countries, having transitioned from agricultural to industrial societies, have relatively low per capita income and the human development index (HDI). Their economies do not prioritize knowledge and the use of science and technology. While industrialized nations account for the majority of data production and innovation, innovations in the north strongly believe in radical development. This does not lessen the value of innovation (or research examining its processes) in developing nations, even though such innovation does not significantly advance the state of knowledge globally. At the very least, innovation should have a significant and positive impact on the developing nation and raise per capita national income (Mohamed et al., 2022).

Technology, institutional quality, and inflows of foreign capital were all essential factors in boosting economic development, particularly in developing nations. Poor governance is one of the leading causes of poverty in developing nations. Governance has a direct effect on the business sector. Ineffective governance has a negative impact on investments and the economy's growth. A nation's ability to develop its people is reliant on the social amenities that the government offers. In the end, poor governance results in a lack of human capital. These foreign inflows are crucial to the developing countries' ability to manage their economies. Nonetheless, the efficiency with which foreign money is employed is contingent upon the state and caliber of political and economic institutions. Therefore, this study intends to analyze the effect of foreign capital inflows, institutional quality and technological innovation on GDP per capita in developing countries.

Literature Review

Studies on the Relationship between Foreign Capital Inflows and Economic Growth

Different studies examine the impact of FCI on GDPPC, the correlation between foreign aid, FCI, and economic growth in South-East Asia (SEA) and South Asia (SA) between 1980 and 2016. The study showed that foreign aid has a negative connection with both growth and FCI while FCI has a positive effect on growth. Additionally, study also demonstrates a substantial and positive correlation between growth and FCI flows and government financial assistance. Similarly, Ani and Onu (2022) examined how FCI affected the country’s GDP between 2006 and 2019. The outcome demonstrated that, between 2006 and 2019, FCI increased GNI. Additionally, research showed that during the same time period, Nigeria's gross national income was positively impacted by the GDP, exchange rate, and unemployment rate. The report suggested that trade zones, which were exclusively predicated on unrestricted economic movements and policies, be developed by the government. The data from the years 2005 to 2020 study the effect of FCI on EG in Southeastern European countries (SEE). The study discovered a strong and positive correlation

between FCI flow and EG. However, in Kosovo and Bosnia and Herzegovina, these investments have no beneficial effect on EG. Furthermore, Alam et al. (2022) explored the asymmetric effects of FCI on India's EG from 1991 to 2019. Using the non-linear ARDL model, this analysis explored the effect of FCI on EG. The findings showed that negative FCI inflows have an adverse effect on India's EG, positive shocks to FCI inflows have a beneficial effect. Additionally, the Wald test confirms that FCI has an uneven effect on GDP growth over the long and short terms. Furthermore, the rate of inflation and financial development greatly slow down the rate of EG. TO, however, only contributes to EG over the long term. The study by Nguyen (2020) investigated the connections between FCI, exports, foreign aid, and Vietnam's economic expansion. Using a linear method, the study used data from 1997 to 2018 to explore the effects of exports, foreign aid, and FCI on Vietnam's EG. The findings indicate a favorable correlation between aid, exports, FCI, and current GDP. The study suggests that Vietnam should keep looking for practical ways to sustain high rates of EG by luring FCI, increasing ODA, and expanding its exports of products and services in light of these findings. In addition, Ramzan et al. (2019) explored the connection between FCI and EG. The panel data collection of 70 developing economies from 1980 to 2015 was used for this purpose. The study demonstrated the existence of a HC threshold, over which FCI had a positive influence on EG and below which it had a negative effect. An economy with a high degree of HC development benefits from FCI. In order to encourage growth and benefit from the integrated global economy, policymakers must take the conditional effect into account. Carbonell and Werner (2018) explored the association between FCI and EG in Spain. The data for the period of 1984-2010 was used and ARDL was used to estimate the results. The outcomes exhibited that FCI, employed labor force, and money supply directly linked to the Spanish economic growth.

Relationship between Institutional Quality and Economic Growth

Different studies inspect the impact of IQ on GDPPC such as Gardezi et al. (2022) examined the relationship between Pakistan's fiscal policies, IQ, and EG. Data covering twenty-five years, from 1996 to 2020, were used in the study. The results showed that government expenditure, both efficient and inefficient, had a positive impact on EG. Inflation influences EG in a positive way in the short term but negatively in the long run. Islam (2022) used an ARDL technique to study how HC and IQ affect the relationship between EG and poverty in Bangladesh. Data covering the years 1990 to 2019 were used in this study. The ARDL analysis reveals that government spending on education has a negative long-term impact on EG rate but a positive short-term impact; IQ has a positive long-run impact on EG; and spending on health care stimulates EG rate over the long term but has no short-term impact. The causality estimates showed a one-way causal relationship between health expenditure and EG, a two-way relationship between IQ and EG, and a one-way relationship between education spending and EG. 48 Asian nations between 2005 and 2018 to examine the relationship between IQ and EG. Economic development is proven to be significantly influenced by IQ. The findings indicated that EG could not exceed a certain institutional threshold. The growth is negatively impacted if the institution indicator rises above the cutoff. Furthermore, trade openness, infrastructure, LFPR, and inflation all have an impact on the EG of Asian nations. Wandeda et al. (2021) used a two-step system GMM to examine the impact of IQ on EG for SSA nations between 2006 and 2018. The results demonstrated that EG was positively and significantly improved by IQ. The results also indicate that the impact of IQ on productivity differs depending on the SSA nations' geographic location. Abubakar (2020) determined the effect of IQ on EG in Nigeria using data spanning the years 1979 to 2018. The OLS model demonstrated that, although the effective governance index had a positive but small impact on the economy, EG was

statistically significant and positively correlated with institutional quality. The empirical findings also demonstrated that EG is significantly impacted by the factors of foreign direct investment and local investment, both favorably and negatively. Radulovic (2020) examined the influence of IQ on EG in South East Europe, drawing comparisons between EU and non-EU nations for the years 1996 to 2017. The findings demonstrated that, for all significant variables, there is a long-term association between IQ and EG in EU countries; in non-EU countries, the only variables that showed statistical significance were voice and accountability, political stability, government effectiveness, and the absence of violence. Moreover, no correlation was found in the near term between IQ and EG in EU member states. Nguyen et al. (2018) examined how institutional quality affects economic expansion using data of 29 emerging economies between 2002 and 2015. The substantial benefits of high-quality institutions for EG have been discovered. The favorable benefits of trade openness and FCI on EG are hampered by the IQ. To maximize their spillover effect, FCIs can operate in areas where trade openness creates competition, although institutional quality improvement can lessen this effect.

Studies on the Relationship between Technological and Economic Growth

Different studies examine the impact of technological innovation on GDPPC and economic growth Rahman et al. (2023) analyzed the effects of trade, HC, FCI and TI on Bangladesh's EG based on data years from 1990 to 2020. The study's findings demonstrated a long-term, symmetric relationship between TI and HC and Bangladesh's economic progress. A robust short-term correlation with EG was found for each metric. Similarly, Rahman et al. (2023) explored how various R&D spending categories affected the chosen OECD nations' EG. The GMM framework was employed in the study, which employed data spanning from 2003 to 2014. Although the impacts vary in size, it was discovered that all R&D expenditures have a positive and significant impact on EG in a subset of OECD countries. Mohamed et al. (2022) examined the influence of TI on the economies of emerging countries between 1990 and 2018. The analysis also discovered that TI has a direct effect on a country's capacity to maintain EG. Because of this, it is essential to have strong laws that encourage foreign investors to contribute money to the development of underdeveloped countries, which in turn encourages more R&D. Jammeh (2022) used the data of ECOWAS from 2008 and 2020 to analyze how TI affects EG. Due to their weak institutions and governments' incapacity to create and carry out policies that will foster the development of HC, which will lead to the creation of meaningful TI and the efficient use of already existing ones, the study found that TI has a negative effect on EG in these countries. Wang and Xu (2021) used Chinese data from 1990 to 2019 to investigate the relationship between TI and EG. The theoretical analysis's findings demonstrate that a nation's economy can grow steadily as long as technology advances. The study, which developed the OLS and WLS models, discovered that increased government funding for scientific and TI greatly enhance EG. This demonstrated that government support and TI are essential for a nation's economy to expand, with financial support having the biggest impact on growth. Ali et al. (2021) explored the relationship between R&D spending and EG in developed and emerging economies. Data from the top 100 economies in the world spanning 21 years, from 1995 to 2015, were utilized in this context. The results demonstrated a strong positive long-term association, ceteris paribus, between R&D spending and GDP growth. Maradana et al. (2017) explored the long-term association between innovation and per capita economic development in the 19 European countries from 1989 to 2014. The study discovered both unidirectional and bidirectional causality between innovation and EG. Most notably, the research discovered a strong correlation between per capita economic growth and each of these

innovation indices. Khan and Khattak (2014) explored the relation between R&D and EG in Pakistan's developing economy using data covering the years 1971 to 2008. The OLS method's findings demonstrated that R&D had a major impact on Pakistan's Real GDP per capita. Other factors that affect Real GDP per capita include physical capital, labor force participation, and health. The findings also demonstrated that the two main variables influencing R&D are real GDP per capita and the caliber of educational institutions.

Crucks of the literature is that foreign capital inflows, institutional quality, and technological innovation are crucial yet inter-reliant determinants of GDP per capita and economic growth. Evidence across regions explains that foreign direct investment generally promotes growth, but its efficacy depends on supportive domestic conditions such as human capital, macroeconomic stability, and governance structures, while foreign aid often produces mixed outcomes in the absence of strong institutions. Studies further endorse that high institutional quality through effective governance, political stability, and regulatory strength constructs an empowering environment for growth, though nonlinear and threshold effects are frequently witnessed. Similarly, technological innovation and Research and Development considerably enhance long-term economic performance, but their benefits are limited in countries with weak institutional and human capital basics. Jointly, the reviewed studies propose that these factors do not operate in separation rather, their collective and provisional interactions form economic performance, emphasizing a research gap that permits an combined experimental analysis of how foreign capital, institutional quality, and technological innovation mutually influence GDP per capita.

Data and Methodology

Data Sources

To analyze the role of foreign capital inflows, technological innovation, and institutional quality in GDP per capita, data from 53 developing countries from 2002 to 2021 is used in the study. The data was collected from World Development Indicators and World Governance Indicators. For empirical work, the developing countries are selected based on the availability of data.

Model Specification

To investigate the influence of FCI, TI and IQ on GDP per capita in developing countries, the following models are developed:

Model Functional Form

$$GDPPC = f(LFPR, GFCF, FDI, IQ, TI, EDUE) \quad (1)$$

Model Econometric Form

$$GDPPC_{it} = \beta_o + \beta_1 LFPR_{ij} + \beta_2 GFCF_{ij} + \beta_3 FCI_{ij} + \beta_4 IQ_{ij} + \beta_5 TI_{ij} + \beta_6 EDUE_{ij} + u_{ij} \quad (2)$$

Similarly, the interaction terms of FCI, IQ and TI are also added into a model to estimate the combined effect of these factors on GDP per capita.

$$GDPPC_{it} = \beta_o + \beta_1 LFPR_{ij} + \beta_2 GFCF_{ij} + \beta_3 FCI_{ij} + \beta_4 IQ_{ij} + \beta_5 TI_{ij} + \beta_6 EDUE_{ij} + \beta_7 IQ*TI_{ij} + u_{ij} \quad (3)$$

$$GDPPC_{it} = \beta_o + \beta_1 LFPR_{ij} + \beta_2 GFCF_{ij} + \beta_3 FCI_{ij} + \beta_4 IQ_{ij} + \beta_5 TI_{ij} + \beta_6 EDUE_{ij} + \beta_7 IQ*FCI_{ij} + u_{ij} \quad (4)$$

$$GDPPC_{it} = \beta_o + \beta_1 LFPR_{ij} + \beta_2 GFCF_{ij} + \beta_3 FCI_{ij} + \beta_4 IQ_{ij} + \beta_5 TI_{ij} + \beta_6 EDUE_{ij} + \beta_7 FCI*TI_{ij} + u_{ij} \quad (5)$$

Where GDPPC is GDP per capita, LFPR indicates labor force participation rate, FCI represents foreign direct investment, IQ indicates institutional quality, TI represents technological innovation, EDUE is the educational expenditures, IQ*TI is the interaction term of IQ and TI, IQ*FCI indicates interaction term of IQ and FCI, FCI*TI represents interaction term of FCI and TI, u_{ij} is the error term.

Table 1: Description of Variables

Variables	Descriptions	
GDPPC	GDP per capita Growth rate	Percentage(Annual)
FCI	Foreign Capital inflows(net)	Index is developed by using PCA analysis
TI	Technological innovation	Number of patent applications
IQ	Institutional quality	Index is developed using PCA analysis. Governance indicators such as rule of law, voice and accountability, government effectiveness, political stability, regulatory quality, and control of corruption are used for index development
EDUE	Educational expenditures	Percentage of GDP
LFPR	Labor force participation rate	Percentage of employed labor force to the total labor force
GFCF	Gross fixed capital formation	Percentage of GDP

Data Analysis

This section presents the detailed data analysis of foreign capital inflows, institutional quality, technological innovation and GDP per capita in developing countries. The results and discussions of the estimates are given as follows:

Cross Sectional Dependence and Slope Homogeneity Test Analysis

In this study, different cross-sectional dependence tests are employed and their estimates are shown in Table 2. The results show that all three tests are found to be statically significant indicating that the variables GDPPC, LFPR, GFCF, FCI, IQ, TI and EDUE are cross-sectional dependent in developing countries. These outcomes point out that any shock that happens in one country can influence other countries' economies.

Table 2: Cross Sectional Dependence Test

Variables	Breusch-Pagan LM	Pesaran scaled LM	Pesaran CD
GDPPC	22792.52***	407.9140***	150.3706***
LFPR	7804.874***	122.4222***	2.1523**
GFCF	19981.80***	354.3741***	134.2675***
FCI	6686.681***	101.1223***	56.98329***
IQ	7626.802***	119.0302***	9.576204***
TI	7149.475***	109.9378***	4.846279***
EDUE	6351.012***	94.7283***	2.05626**

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively

The slope homogeneity test suggested by Pesaran and Yamagata (2008) is used to test the slope homogeneity in a model. The results shown in Table 3 point out that the delta and delta adjective values are statistically significant in four models, indicating that the null hypothesis of no slope heterogeneity is rejected. Therefore, it is concluded that there is a presence of heterogeneity in a model.

Table 3: Slope Homogeneity Test

Slope Homogeneity	Model-I	Model-II	Model-III	Model-IV
Δ Test	17.377*** (0.000)	14.842*** (0.000)	14.673*** (0.000)	15.060*** (0.000)
Δ Adj Test	22.433*** (0.000)	20.013*** (0.000)	19.785*** (0.000)	20.306*** (0.000)

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively

Panel Unit Root Test Analysis

In the presence of cross-sectional dependence and slope heterogeneity, the second-generation unit root tests can produce better results. For this purpose, CIPS and CADF tests are used to check data stationarity in developing countries as shown in Table 4. The results of CIPS and CADF tests show that GDPPC, GFCF, FCI, IQ, TI and EDUE are integrated at order zero I(0) while LFPR is integrated at order I(1) indicating the mixed integration order of variables in a model.

Table 4: Panel Unit Root Test

	CIPS		CADF		Outcomes
	I(0)	I(1)	I(0)	I(1)	
GDPPC	-2.143**		-3.095***		**I(0)**
LFPR	--	-2.983***	--	-2.513**	**I(1)**
GFCF	-2.186**	--	-2.606***		**I(0)**
FCI	-2.648***	--	-2.083***	--	**I(0)**
IQ	-2.072**	--	-2.556***	--	**I(0)**
TI	-2.710***	--	-2.572***	--	**I(0)**
EDUE	-2.019*	--	-2.549**	--	**I(0)**

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively

Cointegration, Heteroskedasticity and Autocorrelation Tests Analysis

To check the heteroskedasticity, autocorrelation and cointegration in a model-modified Wald test, the Wooldridge test and Westerlund test are used respectively and the estimates of these tests are given in Table 5. The results show that Modified Wald test values of all four models are statistically significant at the one percent significance level. It points out that the null hypothesis of heteroskedasticity in a model is accepted. In addition, the Wooldridge test values of all four models are also statistically significant at the one percent significance level representing that there is an issue of autocorrelation in a model. Lastly, long-run cointegration among variables is analyzed using the variance ratio of the Westerlund cointegration test. The outcomes suggest that all four models have long-run cointegration among variables in a model.

Table 5: Heteroskedasticity, Autocorrelation and Cointegration Test Estimates

Problem	Model-I	Model-II	Model-III	Model-IV
Modified Wald test for GroupWise heteroskedasticity	12480.24*** (0.000)	14352.98*** (0.000)	18421.35*** (0.000)	8904.16*** (0.000)
Wooldridge test for autocorrelation in panel data	229.746*** (0.000)	229.796*** (0.000)	231.050*** (0.000)	229.708*** (0.000)
Westerlund test for cointegration	2.4731*** (0.000)	2.8389*** (0.000)	2.2067*** (0.000)	3.0808*** (0.001)

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively

FGLS Analysis

The estimates of the FGLS model to analyze the influence of foreign capital inflows, institutional quality and technological innovation on GDP per capita in developing countries are discussed in this section. The FGLS model effectively addressed the issues of heteroskedasticity, autocorrelation and cross-sectional dependence. It produces reliable estimates when the model faces similar issues. Therefore, the FGLS model is adopted in a study for data estimation and outcomes are given in Table 6. Firstly, examining the relationship between LFPR and GDPPC, the result shows that LFPR is positively and significantly related to GDPPC in developing countries. The LFPR's coefficient displays that the GDPPC increases by 45.96 percent as LFPR in developing countries increase by one percent. These findings confirm the classical growth model that states that labor is an essential factor to boost the output of the economy. These findings are also validated by Shah et al. (2020); Cung and Hung (2020); Haque et al. (2019). The result shows that GFCF is positively and significantly related to GDPPC in developing countries. The GFCF's coefficient displays that the GDPPC increases by 9.93 percent as GFCF in developing countries increase by one percent. These outcomes point out that an economy's capacity for capital formation fosters technological development, which bolsters the benefits of large-scale production and encourages economic specialization. Furthermore, when wealth increases as a result of the development of various industries and the wise use of natural resources, more people will be able to have their numerous needs satisfied so it promotes citizens' financial well-being and acts as an indicator of economic growth (Ongo & Vukenkeng, 2014). The positive link between capital and GDPPC was also found in the studies of Nadeem et al. (2015); Asghar et al. (2023) and Shah et al. (2020).

Table 6: Feasible Generalized Least Square Estimates (FGLS)

Dependent Variable: GDP Per Capita				
Variables	**Model-I**	**Model-II**	**Model-III**	**Model-IV**
LFPR	0.45961*** [0.1283] (3.58)	0.4707*** [0.1262] (3.73)	0.4064*** [0.1281] (3.17)	0.2874** [0.1251] (2.30)
GFCF	0.0993*** [0.0264] (3.76)	0.0968*** [0.0259] (3.73)	0.1050*** [0.0262] (4.00)	0.1782*** [0.0269] (6.62)
FCI	0.0823*** [0.0414] (3.95)	0.0765*** [0.0205] (3.73)	0.0558*** [0.0218] (2.56)	0.1994*** [0.0239] (8.34)
IQ	0.2658*** [0.0112] (23.550)	0.4167*** [0.0276] (15.09)	0.7204*** [0.1184] (6.08)	0.2678*** [0.0108] (24.62)
TI	0.0550*** [0.0158] (3.47)	0.0761*** [0.0159] (4.77)	0.0707*** [0.0162] (4.35)	0.7450*** [0.0780] (9.55)
EDUE	0.2753*** [0.0539] (5.10)	0.2455*** [0.0533] (4.60)	0.2813*** [0.0536] (5.24)	0.2677*** [0.0520] (5.15)
IQ*TI	--	0.0312*** [0.0052] (5.97)	--	--
IQ*FCI	--	--	0.0224*** [0.0058] (3.86)	--
FCI*TI	--	--	--	0.0319*** [0.0035] (9.02)
C	4.9415*** [0.6534] (7.56)	5.1015*** [0.6432] (7.93)	5.0605*** [0.6496] (7.79)	-0.0528 [0.8385] (-0.06)

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively.
The values in [] are standard error, values in () are z-statistic values

Similarly, FCI is believed to be an important factor in economic development, but its impact varies from country to country. The result shows that FCI is positively and significantly related to GDPPC in developing countries. The FCI's coefficient displays that the GDPPC increases by 8.23 percent as FCI inflows in developing countries increase by one percent. These findings suggest that by contributing a share of the capital to the overall investment, FCI inflows are crucial to the economic growth of the host nations. Technology, money, expertise, management skills, refined materials, and other components are contributed by FCI to development investments in the host nations (Nguyen, 2020). The positive relationship between GDPPC and FCI was also found by the studies of Asghar et al. (2023), Shah et al. (2020) and Kanu and Ozurumba (2014). In addition, better institutional quality is imperative to improve the welfare of the people and per capita GDP of any country. The result shows that IQ is positively and significantly related to GDPPC in developing countries. The IQ's coefficient displays that the GDPPC increases by 26.58 percent as

IQ in developing countries increases by one percent. Strong institutional quality has been suggested to be a driving force behind economic growth because it encourages investment and consumption, increases efficiency, allocates resources more wisely, upholds property rights, and promotes individual freedom of choice (Nguyen et al., 2018). The positive relationship between institutional quality and GDP was also established in the findings of Utile et al. (2021); Nadeem et al. (2015); Abubakar (2020). Technological innovation is also imperative to boost the economic development of any country. The result shows that TI is positively and significantly related to GDPPC in developing countries. The TI's coefficient displays that the GDPPC increases by 5.50 percent as TI in developing countries increases by one percent. It suggests that technological innovation improves the efficiency of production investment, fuel savings, cost savings, and reasonable technology transfer are all reflected in the positive effects of innovation on growth, and patents improve business practices' efficiency (Thi & Do, 2024). These results are also found by Jammeh (2022); Wang and Xu (2021); Awan and Yaqoob (2023). Education is essential in improving the wellbeing of people and economic development of countries. The result shows that EDUE is positively and significantly related to GDPPC in developing countries. The EDUE's coefficient displays that the GDPPC increases by 27.53 percent as EDU in developing countries increase by one percent. It suggests that investing in education enhances human capital and is associated with the hope of obtaining high-profile positions and lucrative salaries (Gylfason & Zoega, 2003). Education also modifies the modern production function (Rashid, 2014) and leads to promoting the production level of the country. These outcomes are also found by Jammeh (2022); Amini (2018); Thi and Do (2024).

In addition, in model-II, the interaction term of IQ*TI is added to analyze the combined influence of IQ and TI on GDPPC. The outcomes of variables LFPR, GFCF, FCI, TI, IQ and EDUE are similar to the model-I outcomes. The coefficient of the interaction term of IQ*TI is found to be positive indicating that it is positively and significantly related to GDPPC in developing countries. The IQ*TI coefficient displays that the GDPPC increases by 3.12 percent as IQ*TI in developing countries increases by one percent. It suggests that technological innovation combined with better institutional quality can be helpful in improving the GDPPC of developing countries. Furthermore, in model-III, the interaction term of IQ*FCI is added to analyze the combined influence of IQ and FCI on GDPPC. The outcomes of variables LFPR, GFCF, FCI, TI, IQ and EDUE are similar to the model-I and model-II outcomes. The coefficient of the interaction term of IQ*FCI is found to be positive indicating that it is negatively and significantly related to GDPPC in developing countries. The IQ*FCI coefficient displays that the GDPPC increases by 2.24 percent as IQ*FCI in developing countries increases by one percent. It suggests that foreign capital inflows combined with better institutional quality can be helpful in promoting GDP per capita in developing countries. Lastly, in model-IV, the interaction term of FCI*TI is added to analyze the combined influence of IQ and FCI on GDPPC. The outcomes of variables LFPR, GFCF, FCI, TI, IQ and EDUE are similar to the model-I, model-II and model-III outcomes. The coefficient of the interaction term of FCI*TI is found to be positive indicating that it is positively and significantly related to GDPPC in developing countries. The FCI*TI coefficient displays that the GDPPC increases by 3.19 percent as FCI*TI in developing countries increases by one percent. It suggests that foreign capital inflows combined with technological innovation in a country can produce fruitful outcomes. It not only improves the GDP per capita of the country but can be supportive in eradicating poverty in developing countries.

Robustness Analysis

For robustness estimation, in this study, the PCSE model is used. The PCSE model produces better estimates when the model faces the issues of heteroskedasticity, autocorrelation and cross-sectional dependence similar to the FGLS model. Therefore, PCSE model is adopted in a study for robustness estimation and outcomes are given in Table 7. The dependent variable used in model-I, II, III and IV is GDPPC whereas the independent variables are LFPR, GFCF, foreign direct investment (FCI), institutional quality (IQ), technological innovation (TI) and educational expenditures (EDUE). In addition, the interaction terms IQ*TI, IQ*FCI and FCI*TI are added in model-II, model-III and model-IV, respectively, to analyze the mutual influence of these variables on GDPPC in developing countries. The outcomes of PCSE model also confirm the outcomes of the FGLS model indicating that LFPR, GFCF, FCI, IQ, TI and EDUE are positively and significantly related to the GDPPC in developing countries. Similarly, the interaction terms IQ*TI, IQ*FCI and FCI*TI are also found to be positively and significantly related to the GDPPC validating the estimates of the FGLS model.

Table 7: Panel Corrected Standard Error (PCSE) Estimates

Dependent Variable: GDP Per Capita				
Variables	**Model-I**	**Model-II**	**Model-III**	**Model-IV**
LFPR	0.4596*** [0.0720] (6.38)	0.4707* [0.0680] (6.91)	0.4064*** [0.0765] (3.17)	0.2874*** [0.0797] (3.61)
GFCF	0.0993** [0.0487] (2.04)	0.0968* [0.0517] (1.87)	0.1050** [0.0480] (2.19)	0.1782*** [0.0445] (4.00)
FCI	0.0823*** [0.0231] (3.56)	0.0765*** [0.0226] (3.38)	0.0558** [0.0237] (2.35)	0.1994*** [0.0237] (8.41)
IQ	0.2658*** [0.0082] (32.04)	0.4167*** [0.0185] (22.46)	0.7204*** [0.1085] (6.64)	0.2678*** [0.0079] (33.50)
TI	0.0550** [0.0254] (2.17)	0.0761*** [0.0290] (2.62)	0.0707*** [0.0290] (2.43)	0.7450*** [0.0699] (10.64)
EDUE	0.2753*** [0.0269] (10.24)	0.2455*** [0.0234] (10.48)	0.2813*** [0.0242] (11.58)	0.2677*** [0.0216] (12.38)
IQ*TI	--	0.0312*** [0.0034] (9.09)	--	--
IQ*FCI	--	--	0.0224*** [0.0051] (4.34)	--
FCI*TI	--	--	--	0.0319*** [0.0024] (13.14)
C	4.9415*** [0.6732] (7.34)	5.1015*** [0.7233] (7.05)	5.0605*** [0.7095] (7.13)	-0.0528 [0.6179] (-0.09)

Note: ***, **, * represents 1%, 5% & 10% significance level, respectively
The values in [] are standard error, values in () are z-statistic values

Panel Granger Causality Analysis

The panel Granger causality test is used to test the causation relationship between the variables. Table 8 reports the outcomes of the Granger causality test. The results show that there is a unidirectional causality between GFCF and GDPPC, and IQ and GDPPC. In addition, bidirectional causality is found between LFPR and GDPPC, and TI and GDPPC. Lastly, no causality is observed between FCI and GDPPC, and EDUE and GDPPC in developing countries.

Table 8: Pairwise Panel Granger Causality Tests

Null Hypothesis:	Statistic	Prob.	Outcomes
LFPR ≠ GDPPC	9.7221	0.0000	Bidirectional
GDPPC ≠ LFPR	6.7041	0.0013	
GFCF ≠ GDPPC	0.1006	0.9043	Unidirectional
GDPPC ≠ GFCF	20.0712	0.0000	
FCI ≠ GDPPC	0.8758	0.4168	No-Causality
GDPPC ≠ FCI	1.7916	0.1673	
IQ ≠ GDPPC	0.5363	0.5850	Unidirectional
GDPPC ≠ IQ	6.5601	0.0015	
TI ≠ GDPPC	9.2800	0.0001	Bidirectional
GDPPC ≠ TI	3.8383	0.0219	
EDUE ≠ GDPPC	0.2017	0.8173	No-Causality
GDPPC ≠ EDUE	0.0773	0.9256	

Conclusion and Policy Recommendations

This study analyzes the role of foreign capital inflows, technological innovation, and institutional quality in GDP per capita in developing countries. For this purpose, the data from 53 developing countries, based on data availability, from 2002 to 2021 is used in the study. For data estimation, cross-section dependence test, slope homogeneity test, CIPS and CADF tests of unit root, panel cointegration test, FGLS model for parameter estimations and PCSE model for robustness estimation is used in a study. The cross-sectional dependence test found that the variables GDPPC, LFPR, GFCF, FCI, IQ, TI and EDUE are cross-sectional dependent in developing countries. These outcomes point out that any shock that happens in one country can influence other countries' economies. The outcomes of the slope homogeneity test found that the delta and delta adjective values are statistically significant in four models, indicating that the H_o of no slope heterogeneity is rejected suggesting the heterogeneity is present in a model. The results of CIPS and CADF tests show that GDPPC, GFCF, FCI, IQ, TI and EDUE are integrated at order zero I(0) while LFPR is at I(1), indicating the mixed integration order of variables in a model. The results show that Modified Wald test values of all four models are statistically significant at the one percent significance level. It points out that the null hypothesis of heteroskedasticity in a model is accepted. In addition, the Wooldridge test values of all four models are statistically significant at the one percent significance level, representing that there is an issue of autocorrelation in a model. Lastly, long-run cointegration among variables is analyzed using the variance ratio of the Westerlund cointegration test. The outcomes suggest that all four models have long-run cointegration among variables in a model. The FGLS estimates show that the variables LFPR, GFCF, FCI, IQ, TI and EDUE are positively and significantly related to the GDPPC in developing countries. Similarly, the interaction terms IQ*TI, IQ*FCI and FCI*TI are also found to be positively and significantly related to the GDPPC in developing countries. Likewise, the outcomes of PCSE model also

validate the outcomes of the FGLS model. Lastly, the Granger causality test estimates show that there is a unidirectional causality between GFCF and GDPPC, and IQ and GDPPC. In addition, bidirectional causality is found between LFPR and GDPPC, and TI and GDPPC. Lastly, no causality is observed between FCI and GDPPC, and EDUE and GDPPC in developing countries. Therefore, keeping in view the findings, it is concluded that FCI, technological innovation and institutional quality are positively contributing to the GDP per capita of developing countries.

Keeping in view the outcomes of the study, the researcher suggests different policy suggestions. First, the study found that FCI inflows are imperative to enhance GDP per capita in developing countries, so these countries need to promote FCI inflows. For this purpose, policies should aim to improve the physical infrastructure of the country, enhance the human capital level, and ease of doing business in a country in order to enhance the FCI inflows. Second, technological innovation is also found to be an important factor in promoting GDP per capita; therefore, governments of developing countries should focus on boosting technological innovation in a country. For this purpose, investment in agri-tech innovation, increased accessibility of digital infrastructure, and access to financial technology is imperative. Third, the study also shows that institutional quality is imperative in declining poverty improving the GDPPC in developing countries. Therefore, it is suggested that the institutional quality in developing countries should be strengthened by focusing on the formation of anticorruption laws, ensuring political stability, improving the law & order situation and implementing strong social protection programs. Lastly, developing countries should invest in improving the educational infrastructure. The provision of education in rural areas should be ensured. The technical education training programs should be designed to increase the skilled and specialized labor. All these factors are crucial to eradicating poverty, strengthening the GDP per capita and improving HDI in developing countries.

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