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Public Spending, Growth, and Human Development Index: Understanding from a Global Panel

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Abstract **Original Research Article**

The study examined how public spending affected the Human Development Index using fixed effects and system GMM. Using Fixed Effects estimators from 1991 to 2020 for 65 countries, the results indicate that government expenditure on education, healthcare, and final consumption significantly enhances the Human Development Index, while investment growth consistently contributes more to the HDI than economic growth. To address the potential endogeneity issue, we employ System-GMM for 61 countries from 2003 to 2020. The result aligns with the fixed effect model, indicating that public spending on education, health, and final consumption expenditure is consistently a strong and persistent predictor of HDI at a 1% significance level. Additionally, women's empowerment and access to ICTs are positively and significantly influenced by HDI, demonstrating the importance of digital inclusion and women's empowerment. Income inequality significantly reduces HDI. These results demonstrate the importance of productive government expenditure in various sectors, redistribution, and human capital investment as tools for policymaking in promoting equitable and sustainable human development.

Keywords: HDI, Government Expenditure, Economic Growth, Investment Growth, Panel data, System GMM.
JEL Classification: O15, H50, H51, H52, O47, C3.

1. INTRODUCTION

Since its introduction in 1990, the Human Development Index (HDI) has been used as a key indicator of advancement that goes beyond economic output and focuses on a broader definition of development, centred on the expansion of human potential (UNDP, 1990). Amartya Sen's capability approach (Sen, 1985) formed the foundation for Mahbub ul Haq's development of the HDI, which established the core idea that "people are the real wealth of a nation." It has three important dimensions: education, health, and standard of living-designed to capture not only economic success but also the overall growth of individual choices and freedoms. Although there have been tremendous advances in global economic progress over the last three decades, significant inequalities persist in the HDI within and between countries. During the last decades, on average, the difference between the lowest and highest values of the Human Development Index (HDI) has been 0.58. For example, in 2020, the highest HDI value was for Norway at 0.96, and the lowest was for Niger at 0.40. Halving the disparities between developed and developing nations, the differences are 0.16 and 0.58, respectively. Observe that these disparities have not come down as much as expected in the last several decades. For developed countries, the gap was 0.19 and 0.55, whereas for developing countries, these disparities were 0.18 and 0.56, respectively, in the second decade. The persistence of disparities raises questions about the fundamental drivers of HDI variations and the extent to which market-driven growth can lead to equitable outcomes in countries. Although markets can be a powerful driver of the production of economic resources and the facilitation of growth, their very propensity to concentrate on short-term profits often overlooks wider social goals, particularly those related to long-term human development. Musgrave & Musgrave (1989); Stiglitz (2000) stated that due to market failure and externalities, public goods such as healthcare, social protection, and education are often undersupplied by markets. Under this paradigm, states play a significant role. Strategic government expenditure not only serves a redistributive function but can also be a vehicle for transformation, fostering inclusive and sustainable growth (Todaro & Smith, 2015; Atkinson, 2015). Public spending on the social sector (education, health, and

public services) is necessary to enhance the ability of people, especially the poor and vulnerable (UN, 2016; World Bank, 2018). The literature, however, tends to view government expenditure as a one-size-fits-all concept, failing to consider the differential effects that sector-specific investment can have on human development (Gupta, Verhoeven, & Tiongson, 2002; Baldacci *et al.,* 2008; Barro, 1991).

To bridge this research gap, the current study rigorously analyses the varied impacts of different types of public spending on the Human Development Index (HDI) using a panel structure for 65 sample countries. More specifically, the study considers Government Final Consumption Expenditure (GGFCE), government education expenditure, domestic government spending on general health, and current health expenditure-each as a distinct yet connected factor of government investment in human welfare (IMF, 2021; WHO, 2022; UNESCO, 2020; Anand & Ravallion, 1993; Ostry, Berg, & Tsangarides, 2014). The research also considers the combined effects of financial and physical investment, which can affect both the rate and the magnitude of human development. This study provides a comprehensive understanding of the financial instruments that have the greatest impact on human development by analysing their respective roles.

The rest of the study is organised as follows. The literature is reviewed in Section 2; the variables, data source, and methodology are described in detail in Section 3; the research findings and discussion are reported in Section 4; and the conclusion and implications for future research and policy are presented in Section 5.

2. LITERATURE REVIEW

A substantial body of literature examines the relationship between government expenditure and the Human Development Index (HDI). The literature provides a concise overview of empirical studies that compare the association between various types of public spending (Education, Health, and Final Consumption) and human development. Jung & Thorebeck (2001) and Ozbal (2021) stated that government expenditure on education is an essential factor in improving access to and the quality of education. Additionally, Studies by Patel and Annapoorna (2019) and Kousar et al. (2023) suggest that higher education expenditure has a positive contribution to human development and human capital formation. However, some prior studies reveal findings that are opposite to these. For example, Ruzima and Veerachamy (2023) found a negative effect of government education expenditure on HDI in India, while Patel and Annapoorna (2019) identified a unidirectional relationship from public education expenditure to HDI but no causal link to educational attainment.

The health dimension of HDI has received considerable scholarly attention. Numerous studies underscore the importance of public health investment in enhancing human development. Nixon & Ulmann (2006), Asiskovitch (2010), Novignon *et al.,* (2012), Fujii (2018), Railaite & Ciutiene (2020), and Banik *et al.,* (2023) all stated that government expenditure significantly enhances HDI by investment in healthcare infrastructure, illness prevention, and public health initiatives. Similarly, Ramzi *et al.,* (2012) found that public health expenditure significantly contributes to boosting HDI in Iran, while Ndaguba and Hlotywa (2021) found similar results for South Africa. However, the findings are not universally conclusive. Sijabat (2022) examined the Indonesian provincial context and found that government health expenditure does not significantly impact HDI. Maaharda and Aulia (2020) also found a similar result from an Indonesian perspective: education expenditure significantly contributes to HD, while health expenditure had no significant effect. Public investment in infrastructure and broader social welfare also appears to have a significant influence on human development. Government infrastructure expenditure has a positive and significant impact towards HDI components (income and education) through economic growth (Fadilah *et al.,* 2018). Similarly, Rahaman *et al.,* (2022) argued that social sector spending, including on poverty alleviation and welfare programs, has both direct and indirect effects on HDI.

Several studies established that government expenditure significantly enhances economic growth (Brenpong & Wilson, 2004; Musila & Belassi, 2004; Blankenau *et al.,* 2007; Mercan & Sezer, 2014). Alternatively, other scholars, such as Landau (1983, 1985), Barro (1991), Mo (2007), and Pelinescu (2014), speculate that excessive spending in the public sector can retard economic performance, thus stifling income growth.

Across the Indian states, a bi-directional causality exists between economic growth and human development, indicating regional convergence in HDI, as noted by Ghosh (2006) and Gopalakrishnan and Rao (2012). However, Bhanumurthy *et al.,* (2016) found, in a district-level analysis in Madhya Pradesh, that development expenditure alone was sufficient to enhance the HDI. In the Indian and Pakistani contexts, Ali *et al.,* (2012) and Das *et al.,* (2019) stated that social sector expenditure makes a positive and significant contribution to the HDI. Raj *et al.,* (2023) also explore various dimensions of the growth-development relationship in India, while Onabote *et al.,* (2023) reported that in Nigeria, there is no visible relationship between sectoral spending and HDI in Nigeria. Omodero (2019) further argued that, in Nigeria, recurrent (revenue) expenditure is more effective than capital expenditure in improving HDI.

There is a relative paucity of studies examining the triadic relationship between HDI, economic growth, and specific government expenditures at the global level. Ntogwa (2012), who demonstrated that a reciprocal relationship exists between economic growth and human development, and Ullah *et al.,* (2014), who determined that the investment profile is the primary driver of HDI, are notable exceptions. Prasetyo and Zuhdic (2013) evaluated the contribution of government expenditure on health, education, and transfers to human development outcomes per capita.

The large size of existing prior studies on the role of government expenditure in human development, particularly at the country and sub-country levels, remains largely unexplored, especially in comparative and cross-country contexts. Furthermore, several studies have explored the impact of government expenditure in various fields on the global HDI. To address this research gap, this paper examines how disaggregated government spending on general public services, healthcare, and education affects the HDI from a global perspective.

3. DATA AND METHODOLOGY

This study examines the Human Development Index in relation to several economic, social, and political variables using a balanced panel data approach across 65 countries, spanning the period from 1991 to 2020. Based on the availability and consistency of the data, we determined the sample of countries. Except for Human Development Index, Inequality, and Democracy data, the source of all the variables is the World Development Indicators. The Human Development Index is sourced from the UNDP. Income inequality data are extracted from the World Inequality Database, and Democracy data are obtained from the Freedom House data. All expenditures are used in their logarithmic form to ensure consistency and to make the elasticities more interpretable. It is presumed that economic growth, government spending on different sectors, and the control variables mentioned above will be positively related to HDI and hence capture their contribution towards overall development outcomes. The selected countries are present in the Appendix.

Table 1: Definitions and measurements of variables

Variable	Definitions and Measurements	Source
HDI	The Human Development Index is measured on a scale of 0 to 1, with 1 representing the highest achievement.	United Nations Development Programme
PCGEDUEXP	Per capita government's education spending is measured in constant 2015 USD.	World Development Indicators, World Bank
PCDGGHEXP	Per capita domestic general government health spending is measured in constant 2015 USD	World Development Indicators, World Bank
PCCHEXP	Current health spending per capita, including both private as well as public spending, is expressed in constant 2015 USD.	World Development Indicators, World Bank
PCGGFCEXP	General government final consumption expenditures per capita are expressed in constant 2015 USD.	World Development Indicators, World Bank
PCGDP	The growth rate of per capita GDP is expressed in constant 2015 USD.	World Development Indicators, World Bank
PCGFCF	Per capita gross fixed capital formation growth rate is expressed in constant 2015 USD.	World Development Indicators, World Bank
ICT	Number of mobile phone subscriptions per 100 individuals.	World Development Indicators, World Bank
GE	It is used as a stand-in for good governance (Government Effectiveness), which is measured on a scale of -2.5 to 2.5; a positive number denotes good governance.	World Development Indicators, World Bank
EMPWNT	The percentage of parliamentary seats occupied by women is a proxy for women's empowerment.	World Development Indicators, World Bank
GINI	A frequently used indicator of inequality, the GINI has a range of 0 to 1, where a value close to 1 indicates high inequality.	World Inequality Database
DEMOCRACY	The average of civil and political liberties, as defined by Freedom House, is used to calculate this democracy indicator. The value lies between 1 and 7, where 1 denotes the highest level of freedom.	Freedom House

Source: Author's collected information.

In the following Table 2, we present descriptive statistics for 65 countries across three periods. The Average value of HDI is 0.726, considering limited within-country variation and dispersion across countries.

Government expenditure variables exhibit moderate variation across countries, while economic and investment growth display wide disparities both across and within countries. Income inequality and women's empowerment values indicate significant disparities across countries. Among other control variables, government effectiveness and democracy have relatively low variation across countries. Following the nature of the variables, we conclude that the presence of cross-sectional heterogeneity and limited within-country variation in most of the variables, to control time-invariant unobserved heterogeneity, fixed effect estimation is more appropriate, and System GMM is used to control the presence of potential endogeneity and reverse causality between HDI and Government expenditure, which control dynamic as well as cross-country variation, addressing simultaneity bias (Arellano & Bover, 1995; Blundell & Bond, 1998).

Table 2: Descriptive Statistics

Variables		Mean	Std. dev.	Min	Max	Obs.
HDI	Overall	0.726	0.167	0.24	0.954	N=195
	between		0.162	0.307	0.92	n=65
	within		0.045	0.626	0.822	T=3
PCGEDUEXP	Overall	5.81	1.726	1.862	8.647	N=195
	between		1.712	2.025	8.506	n=65
	within		0.284	4.581	6.923	T=3
PCDGGHEXP	Overall	5.493	2.178	0.682	8.751	N=195
	between		2.165	1.34	8.554	n=65
	within		0.324	4.358	6.742	T=3
PCCHEXP	Overall	6.219	1.793	2.572	9.164	N=195
	between		1.784	3.029	8.96	n=65
	within		0.255	5.588	7.024	T=3
PCGGFCEXP	Overall	7.089	1.683	3.268	9.769	N=195
	between		1.674	3.747	9.615	n=65
	within		0.241	6.207	7.969	T=3
PCGDP	Overall	1.76	1.933	-3.521	9.929	N=195
	between		1.5	-1.646	8.492	n=65
	within		1.227	-2.651	6.077	T=3
PCGFCF	Overall	2.353	4.73	-15.148	24.308	N=195
	between		2.547	-1.322	10.822	n=65
	within		3.994	-14.701	24.755	T=3
ICT	Overall	62.343	49.851	0.005	154.641	N=195
	between		20.702	11.03	97.945	n=65
	within		45.397	-17.826	148.577	T=3
GE	Overall	0.469	1.014	-1.692	2.218	N=195
	between		1.01	-1.496	2.146	n=65
	within		0.138	0.083	0.83	T=3
EMPWNT	Overall	18.204	11.36	0.615	45.616	N=195
	between		10.125	4.205	44.059	n=65
	within		5.251	5.468	32.525	T=3
GINI	Overall	42.539	11.21	23.806	71.264	N=195
	between		11.124	24.981	69.171	n=65
	within		1.791	36.16	49.827	T=3
DEMOCRACY	Overall	2.72	1.804	0	6.85	N=195
	between		1.764	0	6.617	n=65
	within		0.419	0.736	4.453	T=3

Source: Authors' estimation.

3.1 ECONOMETRICS METHODOLOGY

Panel Fixed Effects and Panel system Generalised Method of Moments are widely used to

address key econometric problems faced in panel data analysis, such as unobserved heterogeneity, endogeneity, and dynamic relationships. The FE model balances the influence of time-invariant unobserved heterogeneity by utilising variation within entities, thereby eliminating omitted variable bias (Baltagi, 2008). However, Fixed Effects estimators are biased in dynamic panel scenarios where the model uses lagged dependent variables because of the correlation between the error term and the lagged regressor (Nickell, 1981). The Arellano-Bond difference GMM (Arellano & Bond, 1991) and system GMM (Blundell & Bond, 1998) are two GMM estimators that are used to address this problem. To overcome the issues of serial correlation and endogeneity, these techniques employ lagged instruments, which produce reliable and effective estimates for panels with large N and small T (Roodman, 2009). These methods collectively provide a robust framework for valid inference in panel data models.

3.1.1 Fixed-Effect Model

The Fixed Effects model is used to account for time-invariant, unobserved individual-specific characteristics that might be connected to the regressors. The model exploits within-entity (i.e., within firm, country, or individual) time variation and eliminates time-invariant heterogeneity from the estimation (Baltagi, 2008). The traditional Fixed Effects specification is specified as:

$$Y_{it} = \alpha_i + \beta\, X_{it} + \varepsilon_{it} \qquad (1)$$

Where α_i is the country-specific unobserved time-invariant effect, X_{it} is the vector of explanatory variables, Y_{it} is the country *i* at time *t*-dependent variable and ε_{it} is the error term. When the regressors X_{it} and the country-specific effect (α_i), are correlated, the fixed effect model is justified, which is frequently tested using the Hausman test (Hausman, 1978).

The baseline specification of the regression can be given as follows

$$HDI_{it} = \alpha_i + \gamma_t + \beta_1 PCGOVEXP_{it} + \beta_2 GROWTH_{it} + \sum_{k=3}^{7} \beta_k\, Z_{kit} + \varepsilon_{it} \qquad (2)$$

Where, in this specification, HDI is the Human Development Index of country i at time t. PCGOVEXP is the per capita government expenditure (such as Education, Health, and Final Consumption). Z denotes control variables (such as Government Effectiveness, Number of mobile phone subscriptions per 100 individuals, women's empowerment, Income inequality, and Democracy). Additionally, *GROWTH* represents PCGFCF and PCGDP.

However, the presence of a lagged dependent variable in dynamic models leads to bias in fixed effects estimators, as the lagged variable is correlated with the error component (Nickell, 1981). Therefore, to overcome this issue, we use a dynamic panel data approach.

3.1.2 Endogeneity and Dynamic: System GMM

The System Generalised Method of Moments (System GMM) technique (Blundell & Bond, 1998) is a popular estimation technique for dynamic panel data models with individual effects, endogeneity, and correlation. The method is most appropriate for panels with a large cross-sectional dimension *(N)* but a relatively small-time dimension *(T)*. The standard dynamic panel data model is given as:

$$Y_{it} = \alpha Y_{it-1} + \beta' X_{it} + \lambda_i + \varepsilon_{it} \qquad (3)$$

t = 2, 3, …., T, i = 1,2, 3,…., N

Where Y_{it} is the dependent variable, Y_{it-1} is its lagged value (imposing a dynamic structure), X_{it} is a vector of exogenous or endogenous regressors, λ_i is the unobserved time-invariant individual-specific effect, and ε_{it} is the idiosyncratic error term. The worst problem is that Y_{it-1} is correlated with ε_{it}, which makes OLS estimators inconsistent and biased.

To remove the unobserved fixed effects λ_i, the model is first differenced:

$$\Delta Y_{it} = \alpha\, \Delta Y_{it-1} + \beta' \Delta X_{it} + \Delta\varepsilon_{it} \qquad (4)$$

While differencing adds another problem: ΔY_{it-1} is correlated with $\Delta\varepsilon_{it}$, as Y_{it-1} is a function of ε_{it-1}. Hence, OLS on the differenced equation also provides biased estimates. Difference GMM escapes this by utilising the appropriate internal instruments. Given that the error terms ε_{it} are serially uncorrelated and that the regressors X_{it} are weakly exogenous, the right instruments can be obtained from lagged levels of the variables. To be specific, for t ≥ 3, the following moment conditions hold:

$$E[Y_{it-s} \,.\, \Delta\varepsilon_{it}] = 0 \text{ for } s \geq 2$$

And if X_{it} is predetermined or endogenous, the same moment conditions apply for its lagged levels. Moment conditions are the basis of GMM estimation. The estimator will be minimising a quadratic form in sample moments:

$$\hat{\tau}_{GMM} = \arg\min_{\tau} \left(\sum_{i=1}^{N} Z_i'\, \Delta\hat{\varepsilon}_i(\tau)\right)' \pi \left(\sum_{i=1}^{N} Z_i'\, \Delta\hat{\varepsilon}_i(\tau)\right)$$

Where Z_i is the instrumental matrix of individual *i,* $\Delta\hat{\varepsilon}_i(\tau)$ is a vector of residuals of the equation in differences, and π is a weighting matrix, ideally chosen to obtain efficiency. The estimator thus obtained is consistent and asymptotically normal under regular conditions. Second-order serial correlation tests and the Hansen (or Sargan) test of overidentifying restrictions are important specification tests that confirm the set of instruments and the lack of serial correlation in ε_{it} (Hansen, 1982 &

The dynamic specification of the model is expressed as:

$$HDI_{it} = \rho HDI_{it-1} + \beta_1 PCGOVEXP_{it} + \beta_2 GROWTH_{it} + \sum_{k=3}^{7} \beta_k Z_{kit} + \alpha_i + \gamma_t + \varepsilon_{it} \quad (5)$$

Here, ρ represent the degree of path dependence in the HDI.

In Table 3, we present the Variance Inflation Factor (VIF) results for the explanatory variables, including different government expenditure variables (Education, Health, Current Health, and Final Consumption), with models A, B, C, and D, respectively. Mean VIF is less than 3 across all the models, with the highest value of different types of government expenditure, followed by Government effectiveness, and the remaining other variables' VIF values are well below 3, indicating that the multicollinearity problem is not a serious issue in our estimated model as our result aligns with conventional threshold VIF < 10 (Gujarati & Porter, 2009).

Table 3: Variance Inflation Factor (VIF)

A			B		
	VIF	1/VIF		VIF	1/VIF
PCGEDUEXP	6.95	0.1438	PCDGGHEXP	6.21	0.1610
GE	5.67	0.1764	GE	4.56	0.2192
DEMOCRACY	2.22	0.4512	DEMOCRACY	2.32	0.4313
GINI	2.07	0.4834	GINI	2.16	0.4635
ICT	1.68	0.5963	ICT	1.7	0.5886
PCGDP	1.41	0.7090	PCGDP	1.41	0.7069
PCGFCF	1.38	0.7266	PCGFCF	1.37	0.7292
EMPTWN	1.26	0.7919	EMPTWN	1.26	0.7929
Mean VIF	2.83		Mean VIF	2.62	
C			**D**		
	VIF	1/VIF		VIF	1/VIF
PCCHEXP	6.35	0.1576	PCGGFCEXP	7.14	0.1401
GE	4.88	0.2049	GE	5.51	0.1813
DEMOCRACY	2.32	0.4313	GINI	2.18	0.4590
GINI	2.12	0.4724	DEMOCRACY	2.17	0.4598
ICT	1.63	0.6142	ICT	1.69	0.5927
PCGDP	1.42	0.7054	PCGDP	1.41	0.7068
PCGFCF	1.37	0.7292	PCGFCF	1.37	0.7280
EMPTWN	1.26	0.7916	EMPTWN	1.25	0.7971
Mean VIF	2.67		Mean VIF	2.84	

Source: Authors' calculation

4. RESULT AND DISCUSSION

In this section, we present the empirical findings derived from Panel Fixed Effect (PFE) and system Generalised Method of Moments (GMM) estimation techniques to analyse what determines the Human Development Index (HDI) across various countries. Fixed effects panel regression, based on 65 countries over three distinct periods, is employed by averaging a decade of consecutive years spanning the period from 1991 to 2020 (195 observations). This approach controls for unobserved heterogeneity and yields robust results across four model specifications. The Hausman test consistently favours the fixed effects model over the random effects model, and both models are well-specified. Key determinants, including economic growth, good governance, and social indicators, have comparable and significant impacts on the HDI. To control for possible endogeneity, omitted variable bias, and dynamic development indicators, a system Generalised Method of Moments approach is employed on a 61-country panel for 18 years, using annual data from 2003 to 2020 (1,037 observations).

4.1 Fixed-Effect Analysis

Table 4 presents the fixed effects regression results on the role of per capita education expenditure in determining HDI, indicating that it is the most persistent and strongest determinant of HDI. Human capital investment plays an important role in enhancing HDI, as evidenced by the fact that a 0.05-point increase in HDI is associated with a 1% increase in per capita government education spending (Shafuda & De, 2020). Tables 5 and 6 represent the impact of government and current health expenditure on HDI, indicating that Higher health spending supports human development, as evidenced by the fact that per capita domestic general government health expenditure is significantly associated with HDI. Anand and Ravallion (1993) and Nixon and Ulmann

(2006) stated that increased public spending on health improves life expectancy, lowers mortality, and increases access to medical services. These factors are key components of the HDI. Additionally, our findings align with cross-country evidence, which suggests that increased health spending leads to significant improvements in productivity and human capital, generating long-term growth dividends (Bokhar *et al.,* 2007; Jakovljevic *et al.,* 2016). These results support the idea that investing in healthcare should be a top priority for development policy, as better population health directly leads to more capable individuals and long-term socioeconomic advancement. The role of per capita government final consumption expenditure is significant in contributing to the HDI, as shown in Table 7, demonstrating how government spending is crucial in advancing human development by increasing access to healthcare, education, and public services, thereby raising general welfare. Higher government consumption is consistently associated with improvements in life expectancy, literacy, and social protection systems on a global scale, according to empirical evidence (Anand & Ravallion, 1993; Baldacci *et al.,* 2003).

Table 4: Per Capita Government Education Expenditure and Human Development Index: Evidence from Fixed Effects Approach with Growth

	1	2	3	4
PCGEDUEXP	0.0527***	0.0532***	0.0503***	0.0509***
	(0.0077)	(0.0079)	(0.0078)	(0.008)
PCGFCF	0.0009**	0.0009**		
	(0.0003)	(0.0003)		
PCGDP			0.0015	0.0015
			(0.0012)	(0.0012)
ICT	0.0005***	0.0005***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GE	0.0103	0.0103	0.009	0.0091
	(0.0101)	(0.0101)	(0.0104)	(0.0105)
EMPWNT	0.0017***	0.0018***	0.0018***	0.0018***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GINI		-0.0001		-0.0002
		(0.0008)		(0.0008)
DEMOCRACY		0.0016		0.0014
		(0.0033)		(0.0033)
Cons.	0.3495***	0.344***	0.3618***	0.3625***
	(0.0411)	(0.054)	(0.0417)	(0.0545)
R-Squared	0.8952	0.8954	0.8909	0.8912
F-Stat	213.46***	150.4***	204.2***	143.88***
Country	65	65	65	65
Observation	195	195	195	195
Country FE	Yes	Yes	Yes	Yes
Hausman Test	26.19***	37.64***	33.8***	39.5***
CSD	2.023**	0.669	2.739***	2.003**

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

The growth rate of per capita GDP has a larger coefficient, as presented in Table 4, indicating a marginally greater effect in isolation, but it is not statistically significant. In contrast, GFCF is consistently associated with a positive and significant relationship with HDI (Wasiaturrahma & Chairunissa, 2022). Although GDPPC represents aggregate economic output, its increase may not necessarily benefit everyone; however, GFCF, being an indicator of productive investment, directly relates to long-term growth. Both variables are positively related to HDI, but GFCF is a better, more consistent predictor, particularly in terms of policy aimed at inclusive development. In the European Union, panel studies show that a one percentage point increase in GFCF (as a percentage of GDP) raises HDI by about 0.058 deviation points (Borsi & Metiu, 2015), and cross-country regressions show a strong and long-lasting relationship between GFCF and economic growth

(Bakari & Tiba, 2019). The augmented Solow model (Mankiw *et al.,* 1992) emphasises the joint accumulation of physical and human capital as essential drivers of sustained development, and these findings are consistent with that model. Together, the data show that while both GFCF and GDP per capita have a positive impact on HDI, GFCF is the more reliable and policy-relevant predictor, especially when it comes to defining plans for inclusive and broad-based development (Borsi & Metiu, 2015; Wasiaturrahma & Chairunissa, 2022). Specifically, Singh *et al.,* (2025) stated that although GDP per capita and average years of education are significant predictors of HDI, investment indicators like GFCF consistently improve the model's explanatory power, confirming the importance of human development investment.

Table 5: Per Capita Government Health Expenditure and Human Development Index: Evidence from Fixed Effects Approach with Growth

	1	2	3	4
PCDGGHEXP	0.0303***	0.0325***	0.0302***	0.0324***
	(0.0074)	(0.0077)	(0.0074)	(0.0078)
PCGFCF	0.0006	0.0006		
	(0.0004)	(0.0004)		
PCGDP			0.0014	0.0015
			(0.0013)	(0.0013)
ICT	0.0006***	0.0006***	0.0006	0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GE	0.018	0.0166	0.0159	0.0145
	(0.0111)	(0.0112)	(0.0113)	(0.0114)
EMPWNT	0.0017***	0.0017***	0.0017***	0.0017***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GINI		0.0007		0.0006
		(0.0008)		(0.0008)
DEMOCRACY		0.0033		0.0032
		(0.0037)		(0.0037)
Cons.	0.4814***	0.4316***	0.4812***	0.4358***
	(0.036)	(0.0589)	(0.0362)	(0.0592)
R-Squared	0.8733	0.8745	0.8719	0.8731
F-Stat	172.26***	122.49***	170.23***	120.86***
Country	65	65	65	65
Observation	195	195	195	195
Country FE	Yes	Yes	Yes	Yes
Hausman Test	28.78***	38.33***	29.1***	38.08***
CSD	-1.185	-1.12	-1.115	-0.882

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

Consistent with evidence that investment is a more powerful driver of long-term development than aggregate income, PCGFCF exhibits a positive association with HDI at the 10% level, whereas PCGDP stays insignificant (Borsi & Metiu, 2015; Bakari & Tiba, 2019).

Table 6: Per Capita Current Health Expenditure and Human Development Index: Evidence from Fixed Effects Approach with Growth

	1	2	3	4

PCCHEXP	0.0438****	0.0446***	0.0431***	0.0441***
	(0.01)	(0.0103)	(0.0101)	(0.0104)
PCGFCF	0.0006*	0.0006*		
	(0.0004)	(0.0004)		
PCGDP			0.0013	0.0012
			(0.0013)	(0.0013)
ICT	0.0006***	0.0006***	0.0006***	0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GE	0.016	0.016	0.0143	0.0143
	(0.0111)	(0.0112)	(0.0113)	(0.0114)
EMPWNT	0.0017***	0.0017***	0.0017***	0.0017***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GINI		-0.0002		-0.0002
		(0.0008)		(0.0008)
DEMOCRACY		0.0012		0.0011
		(0.0036)		(0.0036)
Cons.	0.3787***	0.3766***	0.3822***	0.3835***
	(0.0571)	(0.0679)	(0.0576)	(0.0683)
R-Squared	0.8752	0.8754	0.8733	0.8735
F-Stat	175.3***	123.4***	172.34***	121.36***
Country	65	65	65	65
Observation	195	195	195	195
Country FE	Yes	Yes	Yes	Yes
Hausman Test	21.39***	26.15***	22.18***	21.21***
CSD	-1.221	-1.086	-1.175	-1.232

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

Across all models in tables 4, 5, 6, and 7, respectively, ICT is positive and significantly associated with HDI. Indicating the contribution of digital connectivity to human development. Broader ICT adoption improves access to information, education, and services, which in turn raises HDI, according to empirical research (Chavula, 2013; Salahuddin & Gow, 2016). Also, we find that women's empowerment and HDI are highly correlated; inclusive policies that increase gender equality and female participation in social and economic life are crucial (Duflo, 2012; Baliamoune-Lutz, 2016). Instead, democracy, inequality, and government effectiveness are not statistically significant according to current estimates, indicating that their developmental effects most likely function indirectly through other institutional or economic channels (Acemoglu & Robinson, 2012; Kaufmann *et al.,* 2010).

Table 7: Per Capita Government Final Consumption Expenditure and Human Development Index: Evidence from Fixed Effects Approach with Growth

	1	2	3	4
PCGGFCEXP	0.065***	0.0656***	0.0608***	0.0616***
	(0.0102)	(0.0104)	(0.0103)	(0.0105)
PCGFCF	0.0011***	0.0011***		
	(0.0003)	(0.0004)		
PCGDP			0.0024**	0.0024*
			(0.0012)	(0.0012)
ICT	0.0005***	0.0005***	0.0005***	0.0005***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GE	0.0117	0.0118	0.0093	0.0096
	(0.0102)	(0.0103)	(0.0107)	(0.0107)

EMPWNT	0.0019***	0.0019***	0.0019***	0.0019***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
GINI		-0.0003		-0.0004
		(0.0008)		(0.0008)
DEMOCRACY		0.0002		0.0001
		(0.0033)		(0.0034)
Cons.	0.193***	0.2015***	0.2202***	0.2325***
	(0.0684)	(0.0753)	(0.0689)	(0.0756)
R-Squared	0.8913	0.8915	0.8867	0.8869
F-Stat	205.01***	144.32***	195.59***	137.83***
Country	65	65	65	65
Observation	195	195	195	195
Country FE	Yes	Yes	Yes	Yes
Hausman Test	17.08***	25.57***	17.87***	22.92***
CSD	0.775	0.979	2.191**	2.35

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

Therefore, evidence from around the world suggests that sustained advancements in human development require both steady and focused public investment, in addition to economic growth.

4.2 System GMM

In Tables 8 and 9, we present the system GMM results, which indicate that the determinants of human development have a diverse impact on HDI. Additionally, we confirm that human development is strongly path-dependent, as indicated by the system GMM estimates, and the lagged HDI remains highly significant across all specifications. Different types of government expenditure have positively and significantly contributed to the HDI, demonstrating that social sector investment directly results in increases in welfare, literacy, and life expectancy (Anand & Ravallion, 1993; Baldacci et al., 2008). The importance of digital inclusion and productive investment in sustaining long-term growth and development is highlighted by the comparable strong drivers of ICT access and gross capital formation (Salahuddin & Gow, 2016; Borsi & Metiu, 2015).

Table 8: Impact of Government Expenditure on Human Development Index: Evidence from System GMM With Investment Growth

	1	2	3	4
HDI (-1)	0.7708***	0.6735***	0.6509***	0.7363***
	(0.0422)	(0.0967)	(0.1092)	(0.0572)
PCGEDUEXP	0.0145***			
	(0.0044)			
PCDGGHEXP		0.0154**		
		(0.0063)		
PCCHEXP			0.021**	
			(0.0089)	
PCGGFCEXP				0.0171***
				(0.0057)
PCGFCF	0.0001***	0.0001**	0.0001***	0.0001***
	(0.00003)	(0.00004)	(0.00004)	(0.00003)
ICT	0.0001***	0.0002***	0.0002***	0.0002***
	(0.00003)	(0.00007)	(0.00008)	(0.00004)
GE	0.0006	0.0051*	0.003	0.001
	(0.0023)	(0.003)	(0.0027)	(0.0025)

EMPWNT	-0.0001*	-0.0002	-0.0002*	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GINI	-0.0007***	-0.0008***	-0.0009***	-0.0006***
	(0.0002)	(0.0003)	(0.0003)	(0.0002)
DEMOCRACY	-0.0003	0.0001	0.0005	-0.0007
	(0.0009)	(0.0014)	(0.0015)	(0.001)
Cons.	0.1093***	0.1794***	0.1527***	0.0933***
	(0.0182)	(0.0431)	(0.0356)	(0.0219)
Observation	1037	1037	1037	1037
Country	61	61	61	61
Instruments	10	10	10	10
AR1	-3.64***	-2.71***	-2.18***	-3.26***
AR2	-1.12	-0.02	-0.37	-1.3
Sargan	1.13	0	0.02	0.44
Hansen	0.13	0	0	0.03

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

On the other hand, income inequality has a significant negative effect, showing that human development outcomes are compromised by unequal growth. This finding aligns with Wilkinson and Pickett's (2009) assertion regarding equity and social progress. According to Acemoglu and Robinson (2012), institutional factors such as democracy and government efficacy appear statistically insignificant, suggesting that their impact is indirect and depends on the effectiveness of public spending and policy implementation, which aligns with our findings. When combined, the findings show that equity-enhancing policies and direct investments in infrastructure and human capital are more effective at increasing HDI than either economic growth or institutional reforms alone.

Table 9: Impact of Government Expenditure on Human Development Index: Evidence from System GMM With Economic Growth

	1	2	3	4
HDI (-1)	0.8539***	0.7825***	0.8186***	0.8374***
	(0.0296)	(0.0778)	(0.0482)	(0.0381)
PCGEDUEXP	0.0092***			
	(0.0029)			
PCDGGHEXP		0.0102**		
		(0.0049)		
PCCHEXP			0.0109***	
			(0.0039)	
PCGGFCEXP				0.0106***
				(0.0036)
PCGDP	0.0007***	0.0006***	0.0008***	0.0007***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
ICT	0.0001***	0.0001**	0.0001***	0.0001***
	(0.00002)	(0.00005)	(0.00004)	(0.00003)
GE	0.0003	0.0034*	0.0015	0.0005
	(0.0014)	(0.002)	(0.0014)	(0.0015)
EMPWNT	-0.0001*	-0.0001	-0.0001**	-0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
GINI	-0.0004***	-0.0005**	-0.0004***	-0.0003***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)
DEMOCRACY	-0.0002	0.0001	0.0002	-0.0004
	(0.0005)	(0.0009)	(0.0007)	(0.0006)
Cons.	0.0696***	0.1193***	0.0784***	0.0566***
	(0.0122)	(0.0351)	(0.0176)	(0.013)

Observation	1037	1037	1037	1037
Country	61	61	61	61
Instruments	10	10	10	10
AR1	-3.69***	-3.07***	-2.18***	-3.54
AR2	-1.99**	-1.4	-0.37**	-2.33**
Sargan	0.26	0.08	0.02	0.02
Hansen	0.04	0.01	0	0

Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.
Source: Author's Calculation.

Overall, the findings suggest that the most effective foundation for long-term advancements in human development is a combination of targeted public spending, profitable investment, economic growth, digital access, and policies that promote equity.

5. CONCLUSION AND POLICY IMPLICATIONS

The study's findings confirmed that targeted government expenditure, investment growth, and digital inclusion are essential for enhancing human development outcomes. Across all models, government expenditure on education, health, and final consumption is robust and significantly contributes to the HDI. This implies that, since social sectors, especially health and education, directly enhance human potential and produce benefits for future generations, fiscal policies should prioritise increasing and effectively allocating funds to them. Furthermore, the results demonstrate the significant path dependence of human development, with lagged HDI playing a major role. Human development is also greatly enhanced by productive investment, as measured by gross fixed capital formation (GFCF), and digital inclusion through ICT access, highlighting the complementary roles of technology connectivity and physical infrastructure.

While institutional factors, such as democracy and government effectiveness, do not directly show significance, indicating that their impact operates through the efficient allocation of resources rather than independently, income inequality consistently has a negative effect, highlighting the need for equity-focused policies. Although economic growth has a favourable impact on the HDI, its effect is rather small, suggesting that growth is insufficient to provide sustainable human development.

5.1 Policy Implication

Based on the overall findings, economic growth alone is insufficient for achieving sustainable human development. Governments must implement a multifaceted approach that includes (i) significant investments in human capital through health and education, (ii) effective reinvestment in infrastructure development and the creation of capital, (iii) expanding access to ICT to eradicate gaps in technology, and (iv) policies that promote equity. These types of integrated strategies lead to enhancements in the Human Development Index that are resilient, inclusive, and long-lasting.

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Appendix

List of Countries

Selected Sample Countries for Fixed Effects Model
Burundi, Gambia, The, Niger, Togo, Bangladesh, Cameroon, Eswatini, India, Iran, Islamic Rep., Kenya, Morocco, Pakistan, Sri Lanka, Tanzania, Tunisia, Argentina, Botswana, Brazil, Bulgaria, China, Costa Rica, Ecuador, Indonesia, Jamaica, Malaysia, Mauritius, Mexico, Paraguay, Russian Federation, South Africa, Thailand, Turkiye, Australia, Austria, Barbados, Belgium, Chile, Cyprus, Czechia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Rep., Luxembourg, Malta, Netherlands, New Zealand, Norway, Panama, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States.
Selected Sample Countries for System GMM Approach
Burundi, Central African Republic, Gambia, The, Niger, Togo, Bangladesh, Cameroon, Egypt, Arab Rep., Eswatini, India, Iran, Islamic Rep., Kenya, Morocco, Pakistan, Sri Lanka, Tanzania, Tunisia,, Albania, Argentina, Botswana, Brazil, Bulgaria, China, Costa Rica, Ecuador, Guatemala, Indonesia, Jamaica, Malaysia, Mauritius, Mexico, Paraguay, Russian Federation, South Africa, Thailand, Turkiye, Australia, Austria, Barbados, Belgium, Chile, Cyprus, Czechia, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Rep., Luxembourg, Malta, Netherlands, New Zealand, Norway, Panama, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, United States.

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