

Anti-Corruption and Human Development in Singapore: Econometric Evidence (1995–2025)

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ABSTRACT

This study investigates the impact of anti-corruption policies on human development in Singapore over the period 1995–2025. Employing a multiple linear regression model estimated through Ordinary Least Squares (OLS) with EViews 13, the analysis examines the Human Development Index (HDI) as the dependent variable and five explanatory factors: the Corruption Perceptions Index (CPI), GDP per capita (GDP-PC), inflation rate (INFR), general government final consumption expenditure (GFCE), and public expenditure on education (PSE). The results reveal that the model explains approximately 86% of the variation in HDI, underscoring its robustness. GDP per capita and education expenditure exert the strongest positive effects, while CPI and GFCE also contribute positively. By contrast, inflation demonstrates a significant negative impact, highlighting the importance of price stability for sustaining human development. Diagnostic testing confirms the absence of severe multicollinearity, heteroskedasticity, and problematic serial correlation, validating the model's reliability. Overall, the findings emphasize that Singapore's human development achievements are driven not only by economic growth but also by institutional integrity, anti-corruption measures, education investment, and macroeconomic stability. The study contributes to the literature by offering a long-term time-series analysis for an advanced economy and by incorporating the post-COVID recovery period, thereby demonstrating the decisive role of governance quality and inflation control in maintaining high levels of human development.

Keywords: Human Development; Corruption Perceptions Index (CPI); GDP per capita; Inflation; Government Expenditure; Public Spending on Education; Singapore; Multiple Linear Regression (OLS).

JEL Classification: C33; O15; O40; H52; H11; E31; D73.

INTRODUCTION

The pursuit of human well-being and the systematic improvement of quality of life represent the primary objectives of modern economic development (Ananta et al., 2023). While traditional metrics historically focused on income levels, the Human Development Index (HDI)—introduced by the United Nations Development Programme in 1990—shifted the global paradigm by emphasizing that people and their capabilities should be the ultimate criteria for assessing a nation's progress (Singh et al., 2025; Sarkar, 2024). The HDI provides a composite measure of average achievement across three fundamental dimensions: a long and healthy life, knowledge, and a decent standard of living (Farid & Setyowati, 2025; Shah et al., 2016).

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Despite the global trend toward improving these indicators, human development faces significant man-made hindrances, most notably corruption (Sarkar, 2024). Defined broadly as the "abuse of entrusted power for private gain," corruption serves as a major barrier to social and economic growth by undermining public trust and enervating democratic frameworks (Transparency International, 2020; Sarkar, 2024). Empirical research consistently demonstrates that corruption leads to the misallocation of resources, directly impacting a government's ability to invest effectively in public goods such as education and healthcare (Ananta et al., 2023; Singh et al., 2025). Consequently, there is a strong positive correlation between the Corruption Perception Index (CPI) and human development outcomes, suggesting that institutional transparency is an essential catalyst for national progress (Sarkar, 2024; Stryzhak, 2025).

Singapore serves as an exceptional case study within this global context. Consistently ranked among nations with "Very High" human development, Singapore's success is often attributed to strategic government policy efficiency and detailed resource allocation (Abdillah et al., 2023; Farid & Setyowati, 2025). Unlike many developing nations where high economic growth coexists with stagnant human development indicators, Singapore has successfully converted economic wealth into high life expectancy and educational attainment (Farid & Setyowati, 2025). However, the specific longitudinal dynamics of how anti-corruption efforts influence these human development indicators—particularly during periods encompassing global crises like the COVID-19 pandemic—require deeper empirical investigation (Farid & Setyowati, 2025; Pham, 2025).

This paper analyzes the impact of anti-corruption policies on human development indicators in Singapore during the period (1995–2025). Utilizing multiple linear regression, the study examines the relationship between the Human Development Index (HDI) as the dependent variable and several independent variables: the Corruption Perceptions Index (CPI), GDP per capita (GDP-PC), inflation rate (INFR), general government final consumption expenditure (GFCE), and public expenditure on education (PSE). By evaluating these factors over a 30-year span, this research seeks to provide insights into how institutional integrity and balanced socio-economic policies drive sustainable development in a highly advanced economy.

LITERATURE REVIEW AND SCIENTIFIC CONTRIBUTION

1. DISCUSSION OF PREVIOUS STUDIES

The relationship between corruption and development has been extensively debated through three primary theoretical frameworks. The first, the "Harmful Corruption Hypothesis," argues that corruption creates unproductive waste, misallocates talent, and discourages foreign investment, thereby inhibiting both economic growth and human development (Ifeacho & González-Parra, 2025; Sarkar, 2024). Cross-country analyses have confirmed that a higher CPI (representing less corruption) notably enhances the HDI of a nation (Sarkar, 2024; Stryzhak, 2025). This finding is consistent with early literature (Kaufmann et al., 2005; World Bank Governance Indicators), demonstrated that anti-corruption measures and institutional transparency are fundamental drivers of sustainable economic growth and improvements in human development indicators, as they foster foreign investment and expand access to social services. The World Bank (2023) reinforces this trajectory by highlighting the role of digital governance reforms in strengthening institutional integrity, reducing opportunities for corruption, and reallocating public resources toward critical sectors such as health and education. Taken together, these findings underscore those anti-corruption initiatives—whether pursued through traditional institutional mechanisms or advanced digital innovations—generate a virtuous cycle in which stronger governance enhances social outcomes, while improved human development further consolidates institutional trust and inclusive growth.

Conversely, a second viewpoint suggests that in systems with rigid or ineffective regulations, corruption may "grease the wheels" of the economy by circumventing bureaucratic barriers and increasing short-term market efficiency (Zhang et al., 2023; Ifeacho & González-Parra, 2025). However, even proponents of this theory acknowledge that these benefits are temporary and ultimately deleterious in the long term (Zhang et al., 2023). A third, more nuanced perspective posits that the impact of corruption depends on the environment; for instance, the relationship between corruption and HDI may differ significantly across country groups based on their specific income levels (Ananta et al., 2023; Stryzhak, 2025).

Recent empirical studies have also explored the indirect effects of corruption on social sectors. Research on middle-income countries indicates that corruption acts as a moderating variable that weakens the positive impact

of public spending on health and education (Ananta et al., 2023). In these contexts, even when governments increase spending, corruption ensures that funds do not reach intended beneficiaries, leading to poor human development outcomes (Ananta et al., 2023; Pham, 2025). As evidenced by the findings of Uddin et al. (2026), government fiscal policies directed toward promoting equality contribute directly to raising the level of human development indicators.

Furthermore, In the ASEAN region, Singapore is frequently cited as the leader in both human development and corruption control (Abdillah et al., 2023). Research indicates that while GDP per capita remains a significant predictor of HDI in many ASEAN member states, factors such as foreign direct investment and labor force participation also play vital roles (Wiranatakusuma et al., 2025). In Singapore specifically, social spending on education and health has shown a consistently positive impact on development indicators in both the short and long term (Aljepory & Alane, 2022).

However, recent studies using time-series data for Singapore have identified complex challenges, such as diminishing returns on economic growth and high multicollinearity between health, education, and GDP, suggesting that institutional quality and price stability may now be more critical for its continued progress than simple wealth accumulation (Farid & Setyowati, 2025).

In addition, mathematical models indicate that controlling inflation is a fundamental requirement for maintaining the stability of the social and economic system and ensuring that anti-corruption policies effectively translate into economic growth (Ifeacho & González-Parra, 2025). Likewise, Ramadhan and Pertiwi's (2025) study show that inflation is a decisive factor influencing the Human Development Index (HDI) in Indonesia, as rising inflation reduces purchasing power and limits the ability of low-income groups to access nutritious food, healthcare, and education. Although the Gini ratio did not demonstrate a direct significant impact on human development during the study period, the findings emphasize that controlling inflation remains a top priority for policymakers to improve quality of life and promote sustainable development. This is further confirmed by Chipunza et al. (2026), whose study on inflation, indebtedness, and human development in Africa concluded that inflation and external debt hinder human development. Based on these results, policies aimed at reducing inflation and external debt are essential for advancing human development in the Southern African Development Community (SADC) region. This conclusion highlights the importance of economic policies directed toward vulnerable groups to ensure that the benefits of development are fairly distributed across all segments of society.

2. CONTRIBUTION OF THE CURRENT STUDY

While the literature on HDI determinants is expanding, this study offers several new contributions to scientific research in this field:

- **Long-Term Time-Series Analysis for Singapore:** Most existing studies on the CPI-HDI nexus rely on broad cross-sectional data or short time frames. This study fills a critical gap by providing a high-resolution time-series analysis specifically for Singapore over a 30-year period (1995–2025), allowing for a more accurate assessment of long-term policy trends.
- **Incorporation of Recent and Projected Data (2022–2025):** By extending the analysis through 2025, this research incorporates the recovery phase following the COVID-19 pandemic, a period that many current studies have not yet fully analyzed regarding its impact on institutional integrity and human development.
- **Empirical Validation of Advanced Economy Dynamics:** While many studies focus on why corruption persists in lower-income countries, this research explores the vital importance of institutional integrity in a "Very High" HDI context. Our findings confirm that in advanced economies, institutional quality and price stability become more critical determinants than simple GDP growth.
- **Methodological Robustness:** Utilizing **EViews 13** and an **Ordinary Least Squares (OLS)** based econometric model rigorously validated through diagnostic testing—including the Variance Inflation Factor (VIF) and F-statistics—this study provides a robust framework for academic analysis and policy evaluation.

In conclusion, this study demonstrates how balanced policies targeting corruption, education, and macroeconomic stability are essential for maintaining the momentum of human development even after a nation has reached economic maturity.

3.1. Description and Specification of the Study Variables

First, it is essential to clarify that multiple independent variables are employed to explain the analyzed impact. These variables are categorized into two distinct groups:

- **Dependent Variable:** Human Development Index, which serves as the core focus of the study.
- **Independent Variables:** Corruption Perceptions Index CPI, GDP per capita, the inflation rate, general government final consumption expenditure as a percentage of GDP, and public expenditure on education as a percentage of GDP.

Additionally, the Human Development Index (HDI) is utilized as the dependent variable. The aforementioned variables are synthesized in the following table:

Table (01): Variables and the data source

Variable Category	Variable	Variable Code	Source
Dependent Variable	Human Development Index	HDI	World Bank
Independent Variables	Corruption Perceptions Index	CPI	Transparency International
	Per Capita Gross Domestic Product	GDP-PC	World Bank
	Inflation Rate	INFR	World Bank
	General Government Final Consumption Expenditure (% of GDP)	GFCE	World Bank
	Public Expenditure on Education (% of GDP)	PSE	World Bank

Source: Compiled by authors

Regarding the values of these variables, Appendix No. 01 provides a numerical overview of the variables listed in the preceding table.

3.2. Descriptive Analysis of the Study Variables

This section aims to summarize the statistical characteristics of the study variables, with particular attention to the correlation matrix of the primary factors in the raw data. This analysis is grounded in established literature on multiple regression modeling and is conducted using EViews 13 software. The relevant data are presented in the following table:

Table No. (02): Descriptive Analysis of the Study Variables

	HDI	CPI	GDP-PC	PSE	GFCE	INFR
Mean	0.915935	88.56774	48398.65	20.58387	10.02581	1.710323
Median	0.932000	88.00000	47236.68	20.30000	10.00000	1.200000
Maximum	0.948000	94.00000	92279.00	31.40000	12.30000	6.640000
Minimum	0.854000	83.00000	21699.74	11.50000	8.300000	-0.530000
Std. Dev.	0.029375	4.058603	23073.44	4.851948	0.899618	1.935127
Skewness	-0.774054	0.006581	0.484063	0.297870	0.587509	1.142953
Kurtosis	2.223154	1.279893	2.068363	3.127319	3.289305	3.469165
Jarque-Bera	3.875163	3.821966	2.331735	0.479359	1.891470	7.033747
Probability	0.144052	0.147935	0.311652	0.786880	0.388394	0.029692
Sum	28.39400	2745.600	1500358.	638.1000	310.8000	53.02000
Sum Sq. Dev.	0.025886	494.1677	1.60E+10	706.2419	24.27935	112.3415

	HDI	CPI	GDP-PC	PSE	GFCE	INFR
Observations	31	31	31	31	31	31

Source: Calculations by the authors using EViews 13

From the table, most study variables (both independent and dependent) follow a normal distribution according to the Jarque-Bera test, as their p-values exceed the 5% significance level—with the notable exception of the inflation rate.

Furthermore, GDP per capita (GDP-PC) has the highest mean value, reaching 48,398.65 million DZD with a standard deviation of 23,073.44, whereas the inflation rate (INFR) has the lowest mean at 1.710. The Corruption Perceptions Index (CPI) reaches a maximum of 94, while the Human Development Index (HDI) records a minimum of 0.854.

A key finding is that GDP-PC also exhibits the largest standard deviation, indicating wider dispersion around the mean and thus greater variability relative to its average. The remaining independent variable values are also presented in the preceding table.

3.3. Specification of the Multiple Linear Regression Model

Before specifying the optimal linear model for the intended impact, we note that although several variable selection methods exist, we employ a single method, as these techniques generally yield consistent results. Specifically, we employed the stepwise selection method to select the relevant independent variables. This procedure begins by regressing the dependent variable on a single independent variable and recording the Adjusted R^2 . A subsequent variable is then introduced, and the new Adjusted R^2 is compared with the previous one; if it increases, the variable is retained, whereas if it decreases, the variable is excluded due to a lack of explanatory power. This iterative process is repeated for the remaining variables.

Concurrently, we evaluated the statistical significance of the estimated parameters for each independent variable, retaining a variable only when its parameter was statistically significant. Furthermore, we assessed the F -statistic and its corresponding probability value, $\text{Prob}(F\text{-statistic})$. An increase in the former indicates model improvement, while the model is deemed statistically acceptable when the latter falls below the 0.05 threshold.

Applying these procedures to the explanatory models for the impact of anti-corruption policy on human development, several explanatory variables—including the unemployment rate, foreign direct investment as a percentage of GDP, gross capital formation, and life expectancy at birth—were excluded. This optimization process yielded the following final empirical model:

$$\text{HDI} = \beta_0 + \beta_1 \text{CPI} + \beta_2 \text{GDP-PC} + \beta_3 \text{PSE} + \beta_4 \text{GFCE} + \beta_5 \text{INFR} + u_i$$

3.4. Verification of Multiple Regression Assumptions and Hypotheses

This section evaluates the primary classical linear regression assumptions, focusing specifically on the linearity of the relationship between the dependent and independent variables, as well as the absence of severe multicollinearity among the regressors, as outlined below:

- **Linearity of the Relationship:** To verify this prerequisite, a correlation matrix was constructed to calculate the pairwise correlation coefficients among all variables. The results are presented below:

Table No. (03): Correlation Matrix of the Variables

Covariance Analysis: Ordinary Date: 07/02/26 Time: 11:55 Sample: 1995 2025 Included observations: 31						
Correlation Probability	HDI	CPI	GDP_PERC	PSE	GFCE	INFR
HDI	1.000000					

CPI	-0.555576	1.000000				
	0.0012	-----				
GDP_PERC	0.849526	-0.795686	1.000000			
	0.0000	0.0000	-----			
PSE	-0.214054	0.521873	-0.511602	1.000000		
	0.2476	0.0026	0.0033	-----		
GFCE	0.251713	-0.018936	0.074196	-0.210292	1.000000	
	0.1719	0.9195	0.6916	0.2562	-----	
INFR	0.266780	-0.072701	0.341993	0.247581	-0.372844	1.000000
	0.1468	0.6975	0.0597	0.1793	0.0389	-----

Source: Calculations by the authors using EViews 13

Based on the preceding table, a linear relationship exists between the dependent variable (HDI) and the included independent variables. This confirms that the explanatory variables contribute significantly to explaining the dependent variable's variance, though the magnitude of this contribution varies.

Specifically, GDP per capita (GDP_PERC) exhibits the strongest correlation with HDI, exceeding 84%. This indicates a highly significant, strong positive relationship at the 95% confidence level, with a p -value of 0.00. This is followed by the Corruption Perceptions Index (CPI), with a correlation of -55.55% , indicating a statistically significant, moderate inverse relationship (p -value = 0.0012). Notably, this inverse relationship becomes positive within the regression model when control variables are included; a similar pattern is observed for public expenditure on education (PSE). While the remaining control and explanatory variables display weaker correlations, they remain statistically acceptable for establishing a linear relationship.

• **Absence of Severe Multicollinearity Among Independent Variables:** To ensure the absence of perfect or severe multicollinearity, the Variance Inflation Factor (VIF) was calculated. The empirical results are presented below:

Table No. (04): Variance Inflation Factor (VIF) Results

Variance Inflation Factors Date: 07/02/26 Time: 12:20 Sample: 1995 2025 Included observations: 31			
Variable	Coefficient Variance	Uncentered VIF	Centered VIF
CPI	7.99E-07	1640.358	3.326738
GDP_PERC	3.48E-14	25.99422	4.686557
PSE	3.14E-07	36.64775	1.869990
GFCE	6.41E-06	169.6986	1.312032
INFR	2.21E-06	3.783662	2.093667
C	0.006904	1803.010	NA

Source: Calculations by the authors using EViews 13

The VIF test results indicate that the model suffers from no severe multicollinearity among the independent variables, as all centered VIF values remain well below the critical threshold of 10 (and mostly below 5). GDP_PERC exhibits the highest value at 4.69, reflecting a mild correlation that does not require remediation. The remaining variables—CPI (3.33), INFR (2.09), GFCE (1.31), and PSE (1.87)—fall within safe, acceptable

thresholds. Consequently, the model is statistically valid and reliable, confirming the absence of multicollinearity issues.

3.5. Model Estimation

To bridge economic theory with empirical measurement, we construct an econometric framework. A model is a set of mathematical equations that numerically expresses the relationships among economic variables, thereby summarizing their underlying nature. To estimate the parameters, we applied Ordinary Least Squares (OLS) using EViews software. The empirical results of the multiple linear regression are presented in the following table:

Table No. (05): Estimation Results of the Linear Model for the Impact of Anti-Corruption on Human Development in Singapore

Dependent Variable: HDI Method: Least Squares Date: 07/02/26 Time: 12:19 Sample: 1995- 2025 Included observations: 31				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI	0.002175	0.000894	2.433177	0.0225
GDP_PERC	1.74E-06	1.87E-07	9.313584	0.0000
PSE	0.002520	0.000561	4.495642	0.0001
GFCE	0.005261	0.002533	2.077279	0.0482
INFR	-0.003359	0.001487	-2.258639	0.0329
C	0.540278	0.083092	6.502197	0.0000
R-squared	0.885355	Mean dependent var		0.915935
Adjusted R-squared	0.862426	S.D. dependent var		0.029375
S.E. of regression	0.010895	Akaike info criterion		-6.028985
Sum squared resid	0.002968	Schwarz criterion		-5.751439
Log likelihood	99.44927	Hannan-Quinn criter.		-5.938512
F-statistic	38.61285	Durbin-Watson stat		0.955614
Prob(F-statistic)	0.000000			

Source: Calculations by the authors using EViews 13

Hence, the model is specified as follows:

$$\text{HDI} = 0.00217512865218 \cdot \text{CPI} + 1.73824070053\text{e-}06 \cdot \text{GDP_PERC} + 0.00252042515139 \cdot \text{PSE} + 0.00526123281707 \cdot \text{GFCE} - 0.00335946246391 \cdot \text{INFR} + 0.540278310667$$

Model Statistical Analysis

This subsection covers the adjusted coefficient of determination, tests of overall model significance, and diagnostic checks.

3.5.1. Coefficient of Determination

The Adjusted R-squared value ($R^2=0.8624$) indicates that approximately 86.24% of the variance in Singapore's Human Development Index (HDI) is explained by the included independent variables, led by the Corruption Perceptions Index (CPI). This high explanatory power reflects the model's robustness and goodness-of-fit.

Because the Adjusted R-squared penalizes unnecessary predictors, this high value confirms that the model is both powerful and parsimonious. The inclusion of control variables (GDP_PERC, INFR, GFCE, and PSE) significantly enhanced the model's capacity to explain HDI. The remaining 13.76% of the variance is attributed to

omitted factors (e.g., institutional, political, or social variables) or random error. Overall, the model demonstrates that corruption, public expenditure, and economic policies are major determinants of human development.

3.5.2. Model Significance Tests

To assess statistical significance, Student's *t*-test and Fisher's *F*-test are employed.

A. STUDENT'S T-TEST

As shown in Table No. (05), the absolute calculated *t*-statistics for all independent variables exceed the critical value $T_{\text{tab}}(25, 0.05) \approx 2.06$, ($T_{\text{cal}} > T_{\text{tab}}(N-k-1, 0.05)$), so $N=31$ and $k=05$ with corresponding *p*-values below 0.05. Thus, we reject H_0 and accept H_1 , confirming a statistically significant relationship between the explanatory/control variables and HDI.

Specifically, GDP_PERC and PSE exhibit the strongest positive effects, followed by CPI and GFCE, which also show positive and significant impacts. Conversely, INFR yields a negative but statistically significant coefficient, suggesting that inflationary pressures are associated with lower human development. The intercept (*C*) is also highly significant, validating the structural model.

B. FISHER'S F-TEST

This test evaluates the overall significance of the regression model by comparing the calculated Fisher statistic ($F_{\text{Cal}} = 38.61$) with the tabulated value $F_{\text{tab}}(5, 25, 0.05) = 2.6$ at the 5% significance level. Since F_{Cal} is far greater than F_{tab} , the null hypothesis (H_0) is rejected in favor of the alternative (H_1), indicating that at least one parameter differs from zero and significantly affects the dependent variable. The probability value ($\text{Prob}(F\text{-statistic}) = 0.00000 < 0.05$) further confirms the high statistical significance of the model.

Thus, the independent variables—CPI, GDP per capita, inflation, GFCE, and PSE—explain a substantial portion of the variation in HDI. This validates the regression equation statistically and highlights its explanatory power, confirming that corruption, economic policies, public expenditure, education, and inflation are key determinants of human development in the studied context.

3.6. Diagnostic Testing of the Model

To evaluate the structural integrity of the estimated model, we conduct two post-estimation diagnostic checks: serial correlation and heteroskedasticity.

A. Autocorrelation (Serial Correlation) Test

The Breusch-Godfrey Serial Correlation LM Test yields a probability value ($\text{Prob. Chi-Square}(3)$) of 0.0697 for the $\text{Obs} \times R\text{-squared}$ statistic, which exceeds the 0.05 significance threshold. Consequently, we fail to reject H_0 , concluding that the regression equation is free from third-order serial correlation among the residuals, as detailed in the following table:

Table No. (06): Breusch-Godfrey Serial Correlation LM Test Results

Breusch-Godfrey Serial Correlation LM Test:			
Null hypothesis: No serial correlation at up to 3 lags			
0.1208	Prob. F (3,22)	2.166242	F-statistic
0.0697	Prob. Chi-Square (3)	7.069107	Obs*R-squared

Source: Calculations by the authors using EViews 13

The absence of higher-order (second- and third-order) serial correlation is further confirmed by the lack of statistically significant parameters in the Breusch-Godfrey auxiliary regression (see Appendix No. 02), supported by a low *F*-statistic of 0.8123 and an insignificant *p*-value of approximately 0.599.

Although the first-order test suggests a marginal presence of autocorrelation, the *F*-statistic remains low at 1.12 ($p = 0.375$), and the adjusted R^2 of this auxiliary model does not exceed 2.51% (see Appendix No. 02). This indicates that any serial correlation among the residuals has negligible explanatory power and does not warrant corrective measures. Consequently, the estimated model is structurally sound.

B. Heteroskedasticity Test (Variance of the Residuals)

To verify the CLRM assumptions for the estimated model, we conducted a heteroskedasticity check using the Breusch-Pagan-Godfrey test. The empirical results show that the critical Chi-Square value ($\chi^2_5(0.05) = 8.6079$) exceeds the calculated Lagrange Multiplier statistic ($LM = 3.8216$), leading us to accept H_0 and conclude the absence of heteroskedasticity. This is further supported by the *p*-value for the $Obs \times R^2$ statistic (0.1258), which exceeds the 5% significance level, confirming that the residuals are homoscedastic, as detailed in the following table:

Table No. (07): Breusch-Pagan-Godfrey Heteroskedasticity Test Results

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
0.1263	Prob. F(5,25)	1.922094	F-statistic
0.1258	Prob. Chi-Square(5)	8.607931	Obs*R-squared
0.5754	Prob. Chi-Square(5)	3.821607	Scaled explained SS

Source: Calculations by the authors using EViews 13

This is further supported by the absence of statistically significant parameters in the Breusch-Pagan-Godfrey auxiliary regression, with a low F -statistic of 1.922 and an insignificant p -value of 0.126 (see Appendix No. 02). We cross-verified this finding using White's expanded heteroskedasticity test (see Appendix No. 02). This triangulation enhances the reliability of the OLS estimators and confirms the validity of our inferences. Consequently, the estimated relationships among HDI, CPI, and the other socioeconomic control variables can be confidently utilized without robust standard error corrections.

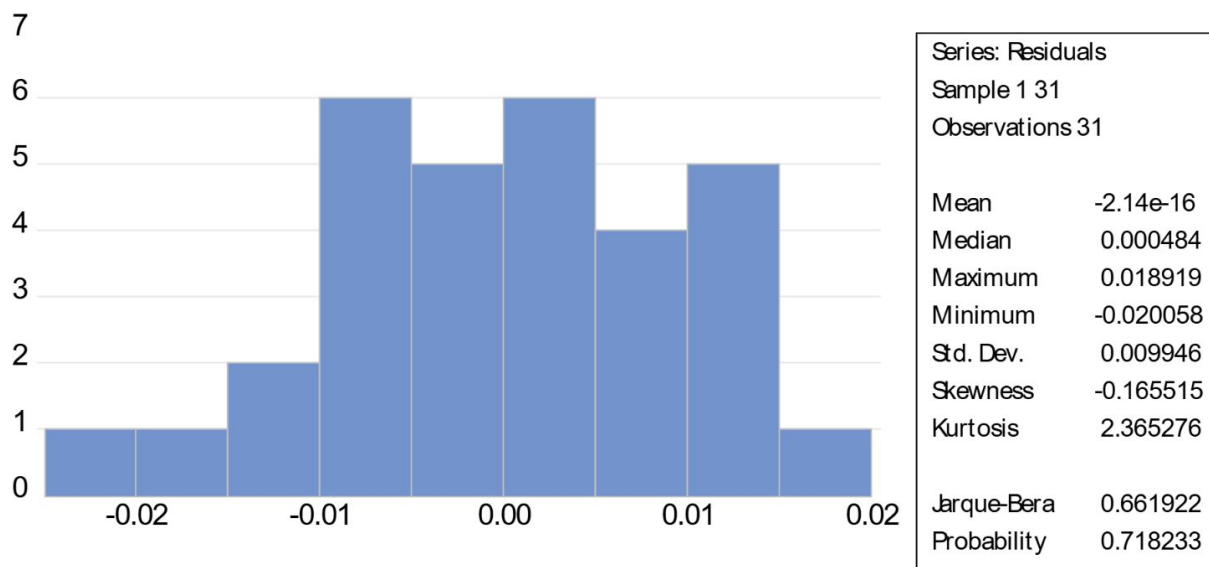
3.7. Model Specification Quality and Stability

To assess structural quality, we performed a normality test on the residuals. Additionally, we evaluated structural stability over time using both the Cumulative Sum (CUSUM) and Cumulative Sum of Squares (CUSUMSQ) tests.

A. Normality Test of the Residuals

To further verify the classical assumptions, we conducted a normality test on the residuals. The results and histogram indicate that the residuals center around zero and closely approximate a normal distribution. The distribution is symmetric and unbiased, with a mean near zero. This confirms the stability of the error terms and the absence of specification bias.

Figure No. (01): Normality Test Results (Histogram and Diagnostic Statistics)



Source: Calculations by the authors using EViews 13

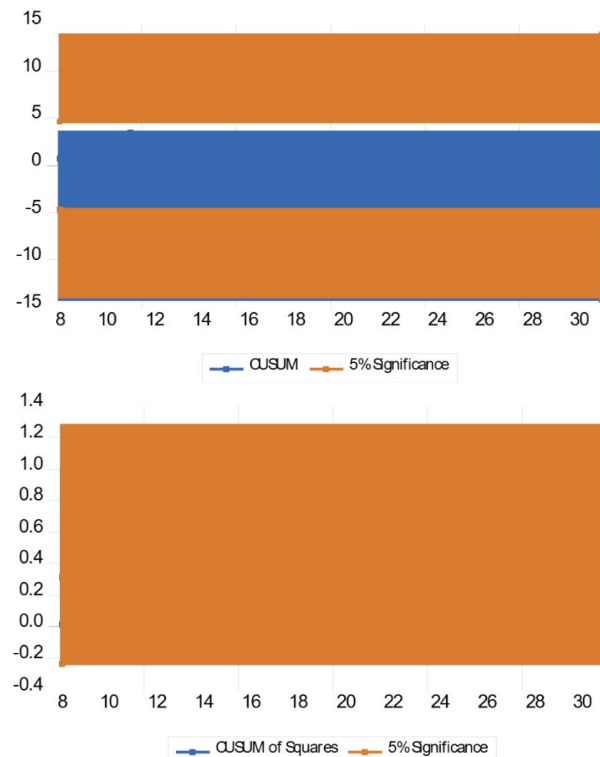
To formally verify normality, we applied the Jarque-Bera (JB) test (see figure above). The test statistic ($JB = 0.661$) falls far below the critical value of 5.99, leading us to accept H_0 that the residuals are normally distributed.

This is confirmed by the p-value of 0.718, which exceeds the 5% significance level. This confirms a critical classical assumption, enhancing parameter reliability and inference validity. Thus, findings can be confidently interpreted without requiring structural transformations.

B. Model Parameter Stability Tests

The CUSUM and CUSUMSQ tests are diagnostic tools used to verify the structural stability of regression coefficients over time. These tests evaluate whether cumulative residuals remain within the critical bounds at the 5% significance level. In the CUSUM test, the cumulative sum of recursive residuals is plotted against the critical boundaries; if it remains within these bounds, the coefficients are considered stable and free from structural breaks. The CUSUMSQ test assesses the stability of residual variance, checking for abrupt shifts over the sample period. The empirical results of both tests are illustrated in the following figure:

Figure No. (02): Structural Stability Test Results (CUSUM and CUSUM of Squares)



Source: Calculations by the authors using EViews 13

The graphical plots demonstrate that both the CUSUM and CUSUMSQ statistics remain within the critical 5% bounds throughout the study period, indicating no structural breaks or parameter instability.

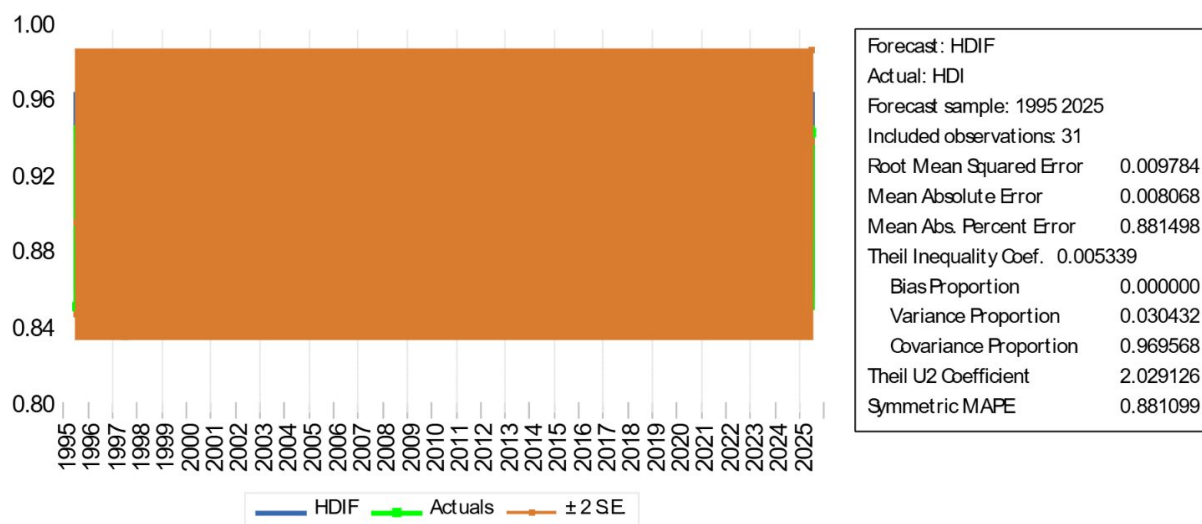
The marginal divergence around 2017 reflects brief macroeconomic headwinds. Following two consecutive years of deflation, headline inflation returned to positive territory that year due to surging energy and utility costs, which eroded purchasing power and raised living expenses. Concurrently, the long-term burden of an aging population intensified demand for public social and healthcare expenditures, while tighter foreign labor immigration policies constrained labor market flexibility and affected productive sectors.

Nevertheless, these short-term adjustments did not compromise overall parameter stability. This confirms the model's structural robustness, enhancing reliability and validating inferences. Consequently, the model robustly interprets HDI dynamics without requiring re-estimation or additional corrections. This alignment is corroborated by the following figure, which compares actual and fitted HDI values:

Figure No. (03): Graphical Representation of Actual and Fitted Values of the Human Development Index (HDI)

Source: Calculations by the authors using EViews 13

The figure plots actual versus fitted HDI values from 1995 to 2025, with ± 2 standard deviation confidence intervals. The high convergence between the two series—with actual values remaining within bounds for most



periods—demonstrates the model's precision and statistical reliability. The gradual upward trend captures improvements in anti-corruption, GDP per capita, education, and government spending, projecting continued HDI gains with particular stability throughout 2015–2025. Thus, the model offers a robust framework for academic analysis and policy evaluation.

3.8. Economic Analysis of the Model

Following the confirmation of the statistical validity of the estimated model, the impact of the explanatory and control variables—particularly the Corruption Perceptions Index (CPI)—on human development can be interpreted as follows:

- **Intercept (Autonomous Component):** In the absence of all predictors, the autonomous HDI baseline is 0.54, attributable to omitted factors such as foreign direct investment, healthcare infrastructure, social protection frameworks, and core public utilities.
- **Theoretical Alignment:** All explanatory variables are expected to positively affect HDI except inflation—a prediction fully confirmed by the empirical results.
- **Anti-Corruption:** The estimation results reveal that CPI is positively and significantly correlated with HDI. This finding is consistent with international literature emphasizing that good governance and transparency are fundamental determinants of effective public policy (Kaufmann et al., 2005; World Bank Governance Indicators). It also aligns with academic studies linking corruption to human development (Sarkar, 2024). Linear regression models demonstrate that higher CPI scores (lower corruption) significantly enhance HDI, while greater corruption undermines it. The model thus supports the “harmful corruption” hypothesis.
- **Income:** GDP per capita emerges as the most influential factor in the model. This result is consistent with UNDP Human Development Reports (2010, 2020), which identify income, alongside education and health, as the core dimensions of HDI. It also corroborates academic findings (Singh et al., 2025), which highlight GDP per capita as a fundamental determinant and predictive indicator of human development.
- **Educational Expenditure:** Public spending on education (PSE) is also shown to be a key driver of HDI. Investment in education strengthens human capital and generates long-term improvements in health and income. This conclusion is supported by sustainable development research (UNESCO, 2015) and economic studies linking education and health to HDI (Aljepory & Alane, 2022; Shah et al., 2016). Both confirm that increased spending on education and health constitutes a primary determinant of improved human development outcomes.
- **Government final consumption expenditure (GFCE):** contributes positively to HDI by providing public services and social infrastructure. This finding is consistent with OECD (2019), which emphasizes that social spending directly improves welfare indicators such as health, education, poverty reduction, and social cohesion. Quantitative evidence demonstrates that countries with higher levels of social spending achieve superior welfare outcomes. It also aligns with studies linking public expenditure to inclusive growth (Uddin et al., 2026), which show that government spending enhances income distribution,

reduces inequality, and thereby strengthens HDI.

- **Inflation:** By contrast, inflation (INFR) exerts a negative and statistically significant effect. Rising inflation erodes purchasing power and restricts access to essential goods and services. This finding is consistent with economic literature (Ramadhan & Pertiwi, 2025), which shows that inflation disproportionately harms low-income groups, limiting their access to food, healthcare, and education. Conversely, moderate inflation can stimulate economic growth and improve living standards, thereby supporting HDI. This result also corresponds with recent research (Chipunza et al., 2026), which associates inflation with improvements in human development levels in Africa.
- **Marginal Effects:** Ceteris paribus, a simultaneous one-unit change across all independent variables yields a net HDI increase of 0.006599; incorporating the intercept, the predicted baseline is $HDI \approx 0.547$.

CONCLUSION

This study successfully constructed an econometric model using the Ordinary Least Squares (OLS) method with EViews 13. The statistical and economic analysis confirmed the robustness of the model, free from issues that could undermine its validity. With an explanatory power of 86.24%, the model is suitable for assessing the impact of economic and social policies on human development in Singapore.

The findings underscore that HDI is closely linked to anti-corruption measures (good governance), GDP per capita (economic growth), investment in education, and government spending on public services. Inflation, however, remains a major challenge to improving living standards. The results support the “harmful corruption” hypothesis, which posits that corruption leads to unproductive waste, misallocation of talent, and inefficiency in governance, thereby hindering both economic growth and human development.

Accordingly, economic policies aimed at enhancing HDI should prioritize anti-corruption efforts, investment in education, sustainable economic growth, and inflation control to ensure long-term monetary, economic, and social stability.

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Appendix No: 01

Appendix No : 02

	YEAR	HDI	CPI	GDP_PERC	PSE	GFCE	INFR
1	1995	0.854	92.6	24914.85	20.3	8.3	1.72
2	1996	0.859	88.0	26232.87	20.3	9.0	1.38
3	1997	0.866	86.0	26375.87	20.3	8.8	2.00
4	1998	0.869	91.0	21829.27	20.3	9.5	-0.27
5	1999	0.875	91.0	21796.64	20.3	9.4	0.02
6	2000	0.882	91.0	23852.84	20.3	10.5	1.36
7	2001	0.885	92.0	21699.74	21.6	11.6	1.00
8	2002	0.891	93.0	22159.84	21.4	11.8	-0.39
9	2003	0.897	94.0	23730.38	24.8	11.4	0.51
10	2004	0.905	93.0	27608.08	22.7	10.3	1.66
11	2005	0.911	94.0	29961.32	22.3	9.9	0.43
12	2006	0.911	94.0	33768.45	22.5	9.9	0.97
13	2007	0.914	93.0	39432.89	23.2	9.1	2.11
14	2008	0.924	92.0	40008.57	30.1	10.1	6.64
15	2009	0.928	92.0	38926.81	21.9	9.9	0.59
16	2010	0.932	93.0	47236.68	18.6	9.7	2.83
17	2011	0.933	92.0	53891.46	28.9	9.2	5.25
18	2012	0.933	87.0	55547.56	31.4	8.9	4.58
19	2013	0.934	86.0	56967.43	28.8	9.7	2.36
20	2014	0.934	84.0	57564.80	20.5	9.6	1.03
21	2015	0.935	85.0	55645.61	17.7	10.2	-0.52
22	2016	0.934	84.0	57005.59	17.6	10.2	-0.53
23	2017	0.935	84.0	61236.25	17.3	10.2	0.58
24	2018	0.939	85.0	66881.61	20.7	10.0	0.44
25	2019	0.942	85.0	65952.04	19.5	10.3	0.57
26	2020	0.944	85.0	61410.08	19.2	12.3	-0.17
27	2021	0.948	85.0	80056.13	11.5	10.6	2.32
28	2022	0.942	83.0	90299.07	15.1	9.2	6.13
29	2023	0.946	83.0	85412.23	14.1	10.0	4.83
30	2024	0.946	84.0	90674.07	12.9	10.6	2.39
31	2025	0.946	84.0	92279.00	12.0	10.6	1.20