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Ekonomikalia Journal of Economics

Vol. 1, No. 1, 2023



Decrypting the Relationship Between Corruption and Human Development: Evidence from Indonesia

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Article History

Received 8 May 2023
 Revised 30 May 2023
 Accepted 11 June 2023
 Available Online 17 June 2023

Keywords:

Human development index
 Corruption perception index
 Fully-modified ordinary least squares
 Dynamic ordinary least squares
 Moderated regression analysis
 Path analysis
 Vector error correction model

Abstract

Corruption is considered endemic in a large part of the world's population and is believed to be a factor that disrupts market behavior and distorts competition, thereby hindering economic growth and human development. This study aims to unveil the impact of corruption on Indonesia's human development through various approaches, utilizing Fully-Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), Moderated Regression Analysis (MRA), Path Analysis, and Vector Error Correction Model (VECM) methods, with data covering the period from 1995 to 2022. The results of the estimation are discussed in three parts: 1) Dynamic Impact, by analyzing the long-term direct effect of corruption on human development; 2) Indirect Impact, by examining the role of government expenditure, tax revenue, and public debt in mediating the effect of corruption on human development; and 3) Causal Impact, by determining the unidirectional and bidirectional relationships between all variables studied. The findings indicate that corruption does not have a lasting direct impact on human development. Moreover, government expenditure and public debt play a role in moderating the impact of corruption on human development. Additionally, there is no causal link between corruption and human development, whereas there are causal connections between human development, government expenditure, tax revenue, and public debt. The results of this study will be valuable in assessing the extent of corruption's impact on human development, particularly in Indonesia, and aim to raise awareness of policymakers, hence encouraging individuals to participate in combating corruption.



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1. Introduction

Corruption is a critical problem in all countries and one of the main causes that hamper development. Many people assume that corruption is endemic to a large part of the

world's population, leading to poverty, low life expectancy, poor environmental quality, and large disparities in income and human development [1–3]. Although corruption has many meanings and concepts, in general economic terms, corruption is understood as a

factor that disrupts market behavior and is capable of distorting the expected function of economic competition. It hinders economic growth and the competitiveness of international trade when the costs of conducting business activities increase due to inflated prices resulting from bribery. Corruption also reduces the government's ability to implement regulations and take action to correct market failures, while providing an opportunity to impede government intervention due to motivations arising from corrupt behavior [4–9].

The latest annual report by Transparency International offers a glimpse into Indonesia's current corruption status. According to the 2022 Corruption Perceptions Index (CPI), Indonesia is still grappling with significant difficulties in combating corruption. With a score of 34/100, the country ranks 110th out of 180 countries surveyed. This represents a decline of 4 points from the previous year's score of 38/100 [10]. The sharp drop in the 2022 CPI score highlights the inefficacy of the Indonesian government's efforts and initiatives to curb corruption, impacting the country's prospects for improved national human development.

This study analyzes the impact of corruption on human development based on three reasons. Firstly, it is known that the concept of the relationship between corruption and human development has been widely discussed in international forums. However, there are still very few empirical references that corroborate this issue [1, 2, 11]. Secondly, there are two different opinions. On one side, it is argued that corruption has a direct effect on human development, while on the other side, it is argued that corruption has an indirect effect, particularly through government's macroeconomic variables [12–14]. Thirdly, there are also two opinions. The first is the concept of "sand the wheel", which suggests that corruption impedes economic activity and can reduce people's living standards. The second is the idea of "grease the wheel", which argues that corruption actually facilitates economic activity, leading to increased economic growth and human development [4, 15].

Previous studies have provided findings on the direct effect of corruption on human development. A study conducted in 74 countries found that corruption worsens human development [2]. Similarly, a study conducted in 28 European countries provided empirical evidence of the negative effect of corruption on human development [11]. Furthermore, a study conducted in Egypt has demonstrated that corruption has a negative impact on human development, both in the short and long-term [1].

In this study, it is important to emphasize that the CPI solely focuses on corruption cases within the government

sector. Consequently, we have selected three variables, namely government expenditure, tax revenue, and public debt, which are associated with government macroeconomic variables. These variables are chosen to examine the indirect impact of corruption on human development.

The empirical literature provides evidence that corruption hampers both private and government investment spending, leading to lower economic growth and human development [14]. However, some studies argue that corruption can improve the efficiency of resource allocation in the economy, encouraging new investment and stimulating government expenditure, ultimately promoting economic growth and human development [12, 13, 16, 17].

Empirical evidence also demonstrates that corruption reduces tax revenue. In fact, some studies have revealed that more than 50 percent of tax revenue goes uncollected due to corruption, which can have a substantial negative impact on economic growth and result in decreased human development [6, 18–21]. On the other hand, corruption affects public debt by lowering bond ratings, which in turn leads to higher costs of debt. This situation makes economic growth and human development vulnerable to negative impacts [22–26].

This study aims to contribute to the literature by investigating the impact of corruption on Indonesia's human development in three ways. Firstly, we analyze the long-term effect of corruption on human development. Secondly, we examine whether government expenditure, tax revenue, and public debt mediate the relationship between corruption and human development. Thirdly, we explore the multivariate causality between human development, corruption, government expenditure, tax revenue, and public debt to determine both unidirectional and bidirectional causality. Moreover, the results of this study will be valuable in assessing the extent of corruption's impact on human development in Indonesia and are intended to raise awareness among policymakers, thereby encouraging individuals to participate in combating corruption.

This research is structured as follows: Section 2 describes the database used and provides explanations of the methods employed, including Fully-Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), Moderated Regression Analysis (MRA), Path Analysis, and Vector Error Correction Model (VECM). Section 3 presents the empirical results and discusses them in detail. Finally, Section 4 concludes the

Table 1. Dependent and independent variable synopsis.

Variable	Indicator Name	Sources
HDI	Human Development Index (Score 1-100)	HDR
CPI	Corruption Perception Index (Score 1-100)	TI
GE	Government Expenditure (US\$)	WDI
TR	Tax Revenue (Rupiah)	WDI
PD	Public Debt (US\$)	WDI

research and offers recommendations based on the findings.

2. Materials and Methods

The time-series data used in this study span the period from 1995 to 2022 in Indonesia, generated from the United Nations Development Programme's (UNDP) Human Development Reports (HDR), Transparency International (TI), and the World Bank's World Development Indicators (WDI). The dependent variable in this study is the Human Development Index (HDI), while the independent variables include the Corruption Perception Index (CPI), Government Expenditure (GE), Tax Revenue (TR), and Public Debt (PD). The synopsis of the variables are presented in Table 1.

In this study, we utilize the HDI, published by UNDP, as a measure of human development. Despite critics arguing that the HDI assigns weights to certain factors that may not always be equally valuable, the HDI incorporates two types of social data, namely health and education, and one type of economic data. This approach ensures that the measure encompasses a broad range of information and is not solely reliant on one factor. Therefore, the HDI is considered an accurate measure of both the standard of living and quality of life in a country [27, 28].

On the other hand, to measure the level of corruption, we use an index published by Transparency International known as the CPI. While this index has faced controversies related to definition problems, perception bias, false accuracy, flawed statistical models, and limitations in capturing long-term trends, it represents the first systematic attempt to compare perceived levels of corruption across different countries through expert assessments and opinion surveys. The CPI defines corruption as the misuse of entrusted power for private gain and ranks countries on a scale from 0 (very corrupt) to 100 (very clean) [29, 30].

2.1. Fully-Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS)

The application of FMOLS and DOLS aims to estimate and quantify the long-term relationship among the variables.

These techniques, FMOLS and DOLS, address the endogeneity problem and eliminate serial correlation found in standard ordinary least squares (OLS), which is inconsistent in cointegrated time series data [31].

To measure the relationship between HDI and the main explanatory variables, this paper describes HDI as a function of CPI, government expenditure, tax revenue, and public debt. Therefore, the HDI function can be presented as:

$$HDI_t = f(CPI_t, GE_t, TR_t, PD_t) \tag{1}$$

where HDI is the human development index (used to denote the level of human development), CPI represents the corruption perception index (used as a proxy for the effect of corruption), GE is the government expenditure; TR represents the tax revenue, and PD is the public debt.

The econometric model representing the relationship is given in the equation 2.

$$HDI_t = \beta_0 + \beta_1CPI_t + \beta_2LnGE_t + \beta_3LnTR_t + \beta_4LnPD_t + \varepsilon_t \tag{2}$$

Where β_0 is an intercept, ε represents the error term, and $\beta_1, \beta_2, \beta_3,$ and β_4 are the model coefficients.

2.2. Moderated Regression Analysis (MRA)

Moderated Regression Analysis (MRA) is a special application of linear multiple regression where the regression equation includes an interaction term (multiplication of two or more independent variables). The primary objective of moderation analysis is to measure and test the differential effect of the independent variable on the dependent variable as a moderator function [32]. The basic model can be represented by Equation 3.

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_1X_2 + \varepsilon \tag{3}$$

Then, Equation 3 is extended to Equation 4.

$$HDI_t = \beta_0 + \beta_1CPI_t + \beta_2LnGE_t + \beta_3LnTR_t + \beta_4LnPD_t + \beta_5CPI_t.LnGE_t + \beta_6CPI_t.LnTR_t + \beta_7CPI_t.LnPD_t + \varepsilon_t \tag{4}$$

Where $CPI.GE$ represents the corruption effect in government expenditure, $CPI.TR$ represents the corruption effect in tax revenue, and $CPI.PD$ represents the corruption effect in public debt.

2.3. Path Analysis

Path Analysis is a technique for analyzing causal relationships through multiple linear regression approaches, where the independent variable affects the

dependent variable indirectly through mediating variables.

The mathematical equation of Path Analysis in this study is divided into two sub-structural models. The first sub-structural model is represented by equation 2, while the second sub-structural model is represented by equations 5, 6, and 7.

$$\text{LnGE}_t = \beta_0 + \beta_1 \text{CPI}_t + \varepsilon_t \tag{5}$$

$$\text{LnTR}_t = \beta_0 + \beta_1 \text{CPI}_t + \varepsilon_t \tag{6}$$

$$\text{LnPD}_t = \beta_0 + \beta_1 \text{CPI}_t + \varepsilon_t \tag{7}$$

Furthermore, after obtaining the estimation results of the two sub-structural models, the Sobel test is conducted to determine the significance of the indirect effect of the independent variable on the dependent variable through the mediating variable. The calculation formula for the Sobel test is presented in equation 8.

$$t = \frac{ab}{\sqrt{(b^2 \cdot SEa^2) + (a^2 + SEb^2)}} \tag{8}$$

where a is the coefficient value of the CPI influence on GE, PD and TR, b is the coefficient value of the path of

$$\Delta \text{HDI}_t = \theta_1 + \sum_{k=1}^m \theta_{11k} \Delta \text{HDI}_{t-k} + \sum_{k=1}^m \theta_{12k} \Delta \text{CPI}_{t-k} + \sum_{k=1}^m \theta_{13k} \Delta \text{LnGE}_{t-k} + \sum_{k=1}^m \theta_{14k} \Delta \text{LnTR}_{t-k} + \sum_{k=1}^m \theta_{15k} \Delta \text{LnPD}_{t-k} + \lambda_1 \text{ECT}_{t-1} + v_t \tag{9}$$

$$\Delta \text{CPI}_t = \theta_2 + \sum_{k=1}^m \theta_{21k} \Delta \text{CPI}_{t-k} + \sum_{k=1}^m \theta_{22k} \Delta \text{HDI}_{t-k} + \sum_{k=1}^m \theta_{23k} \Delta \text{LnGE}_{t-k} + \sum_{k=1}^m \theta_{24k} \Delta \text{LnTR}_{t-k} + \sum_{k=1}^m \theta_{25k} \Delta \text{LnPD}_{t-k} + \lambda_2 \text{ECT}_{t-1} + v_{2t} \tag{10}$$

$$\Delta \text{LnGE}_t = \theta_3 + \sum_{k=1}^m \theta_{31k} \Delta \text{LnGE}_{t-k} + \sum_{k=1}^m \theta_{32k} \Delta \text{HDI}_{t-k} + \sum_{k=1}^m \theta_{33k} \Delta \text{CPI}_{t-k} + \sum_{k=1}^m \theta_{34k} \Delta \text{LnTR}_{t-k} + \sum_{k=1}^m \theta_{35k} \Delta \text{LnPD}_{t-k} + \lambda_3 \text{ECT}_{t-1} + v_{3t} \tag{11}$$

$$\Delta \text{LnTR}_t = \theta_4 + \sum_{k=1}^m \theta_{41k} \Delta \text{LnTR}_{t-k} + \sum_{k=1}^m \theta_{42k} \Delta \text{HDI}_{t-k} + \sum_{k=1}^m \theta_{43k} \Delta \text{CPI}_{t-k} + \sum_{k=1}^m \theta_{44k} \Delta \text{LnGE}_{t-k} + \sum_{k=1}^m \theta_{45k} \Delta \text{LnPD}_{t-k} + \lambda_4 \text{ECT}_{t-1} + v_{4t} \tag{12}$$

$$\Delta \text{LnPD}_t = \theta_5 + \sum_{k=1}^m \theta_{51k} \Delta \text{LnPD}_{t-k} + \sum_{k=1}^m \theta_{52k} \Delta \text{HDI}_{t-k} + \sum_{k=1}^m \theta_{53k} \Delta \text{CPI}_{t-k} + \sum_{k=1}^m \theta_{54k} \Delta \text{LnGE}_{t-k} + \sum_{k=1}^m \theta_{55k} \Delta \text{LnTR}_{t-k} + \lambda_5 \text{ECT}_{t-1} + v_{5t} \tag{13}$$

It is important to note that in a multidimensional scenario, the Engle-Granger suffers from omitted variable bias. Therefore, in such cases, it is more efficient to use the Johansen cointegration test. The null hypothesis of the Johansen cointegration test is "HDI, CPI, GE, TR, and PD are not cointegrated". If the critical value is greater than the trace statistic, we can reject the null hypothesis. This implies that "HDI, CPI, GE, TR, and PD are cointegrated".

The 5-VECM model, written in equations 9, 10, 11, 12, 13, can be defined, where Δ denotes the first difference, and k is the optimal lag length determined by the Schwarz Bayesian Criteria. Short-term causality tests among other variables can also be carried out in a similar manner. The presence or absence of long-term causality can be determined by testing the significance of the coefficient λ from the error correction term, ε_{t-1} , using the t-test in the

influence of GE, PD, TR on HDI, SE is the standard error value.

2.4. Vector Error Correction Model (VECM)

This study also employs the vector error correction model (VECM) framework to examine the multivariate causality relationship among the variables. The VECM regresses the changes in both dependent and independent variables on lagged deviations. Before conducting VECM regression, it is important to conduct stationary and cointegration tests.

The unit root test is the initial test for checking the stationarity of variables. Augmented Dickey-Fuller (ADF) is the necessary test of the unit root because the ADF is used at the level form as well as the first difference of each series, and the ADF test includes lag length to address the issues of robustness and autocorrelation.

Also in this paper, the Johansen cointegration test is used to investigate the existence of cointegration between HDI, CPI, GE, TR, and PD.

equation. Finally, we performed a combined test of ε_{t-1} and interactive terms to check for strong causality.

3. Results and Discussion

Table 2 presents the descriptive statistics, which are used to provide a clearer and easier understanding of the data. It offers an overview of the variables included in the study during the research period from 1995 to 2022.

The mean value of Indonesia's HDI score appears to be quite favorable at 68.8, with a maximum value of 72.9 and a minimum value of 64.3. However, the standard deviation of 2.499 indicates that the distribution of HDI data is spread a little far from its mean value. This suggests that the HDI data during the study period exhibited significant volatility.

On the other hand, the mean value of the CPI score, which is 27.8, indicates a high level of corruption in Indonesia. Even the highest score achieved in the study

Table 2. Synopsis of descriptive statistics.

Variable	Mean	Median	Maximum	Minimum	Std. Dev.
HDI	68.8354	68.8650	72.9100	64.3000	2.49965
CPI	27.8214	27.5000	40.0000	17.0000	7.54764
LnGE	24.3707	24.5768	25.4752	22.4160	0.93063
LnTR	33.8507	34.0910	35.1937	31.8508	1.01330
LnPD	34.9089	35.0621	36.5844	32.4784	1.11878

Table 3. Results of FMOLS and DOLS estimation.

Variable	FMOLS	DOLS
CPI	-0.1921	-0.1480
LnGE	4.0932***	3.5344***
LnTR	-5.7844***	-3.9137
LnPD	4.8740**	3.4172

Note: Significant *(1%), **(5%), and ***(10%)

Table 4. Results of OLS and MRA estimation.

Variable	OLS	MRA
constant	19.3489	-33.2904
CPI	-0.0561	3.2075***
LnGE	2.9498***	20.1253*
LnTR	-3.6692	14.6045***
LnPD	2.9609	-25.4619*
CPI.LnGE	-	-1.0050*
CPI.LnTR	-	-0.2767
CPI.LnPD	-	0.8861*

Note: Significant *(1%), **(5%), and ***(10%)

period, which is 40, is still categorized as a risk of corruption. Similarly, the lowest CPI score of 17 highlights the prevalence of corrupt practices in Indonesia. The standard deviation value of 7.547 suggests that the CPI score in Indonesia tends to fluctuate throughout the study period.

Data on government expenditure, tax revenue, and public debt used in this study are in the form of natural logarithms.

3.1. Dynamic Impact

In our first hypothesis test, we analyze long-term dynamic effects using FMOLS and DOLS approaches that are considered to be better than OLS because the bias-corrected OLS model does not improve the estimation results of the model in general. The FMOLS model is able to effectively remove endogeneity and autocorrelation problems using a non-parametric approach, while the DOLS model removes the constraints using a parametric approach and lag & lead of the explanatory variables [33].

As seen in Table 3, it is evident that CPI does not have a long-term effect on HDI according to both the FMOLS and DOLS approaches. This finding aligns with previous research, which supports the perception that there is no direct effect of corruption on HDI [13, 14, 17, 18, 25].

Furthermore, government expenditure is found to have a positive long-term effect on HDI, which is consistent with previous studies [34–37], although the level of significance is weak. According to the FMOLS results, a 1.0% increase in government expenditure has the potential to increase the HDI score by 4.09, while based on the DOLS results, it can increase the HDI score by 3.53.

Then, tax revenue is found to have a negative long-term effect on HDI, which contradicts previous research evidence of a positive relationship between tax revenue and HDI [38–42]. However, this negative effect has a weak level of significance. According to the FMOLS approach, a 1.0% increase in tax revenue has the potential to reduce the HDI score by 5.78.

On the other hand, based on the DOLS approach, public debt is found to have no effect, whereas it has a positive and significant long-term effect based on the FMOLS approach. This finding contradicts previous studies suggesting a negative relationship between public debt and HDI [43–45]. Furthermore, the result indicates that an increase in public debt by 1.0% has the potential to increase the HDI score by 4.87.

3.2. Indirect Impact

In our second hypothesis test, we aimed to examine the effect of CPI on HDI, mediated by government expenditure, tax revenue, and public debt, using the MRA approach, while also comparing it with OLS estimation. The results presented in Table 4 indicate that, based on OLS estimations, all variables do not have a strong direct significant effect on HDI, except for government expenditure, which shows a weak probabilistic significance on HDI. However, the MRA estimation results on the role of government expenditure, tax revenue, and public debt in mediating the effect of CPI on HDI yielded the following findings:

- 1) The government expenditure variable was found to have a significant effect as both a predictor variable and a moderating variable, with a probability value of <0.05. This indicates that it functions as a quasi moderating variable, interacting with the predictor variable CPI while also acting as a predictor variable itself.

Table 5. Results of Sobel test.

Variable	Path Analysis Model 1		Path Analysis Model 2		Path Analysis Model 3	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
CPI	0.1113	0.0104	0.1121	0.0145	0.1244	0.0158
LnGE	1.5841	0.8425	-	-	-	-
LnTR	-	-	0.8377	0.6238	-	-
LnPD	-	-	-	-	0.8365	0.5688
Sobel test: t = 1.8519**		Sobel test: t = 1.3231		Sobel test: t = 1.4456		

Note: Significant *(1%), **(5%), and ***(10%)

2) The tax revenue variable has no significant effect either as a predictor variable or as a moderating variable, with a probability value of both >0.05. Therefore, it is categorized as potential moderating variable, indicating that the tax revenue variable does not interact with the predictor variable CPI and is not capable of being a predictor variable either.

3) The public debt variable has a significant effect both as a predictor variable and as a moderating variable, with a probability value of <0.05. It is categorized as a quasi moderating variable, indicating that the public debt variable interacts with the predictor variable CPI and can also function as a predictor variable itself.

The three points conclude that besides significantly influencing HDI, both government expenditure and public debt can mediate the effect of CPI on HDI. These findings align with previous research [13, 14, 17, 25, 26]. The estimation results also demonstrate that the significance of the influence of CPI on HDI increases from a weak 10% level to a strong 1% level when it is mediated by government expenditure and public debt.

The interesting finding is that the coefficient of CPI's influence on HDI, when mediated by government expenditure, is negative. This indicates that a 1% increase in corrupt practices in the execution of government expenditure will decrease the HDI by 1 score. On the other hand, the role of public debt in mediating the effect of CPI on HDI provides the expected coefficient value. A 1% decrease in corrupt practices in public debt activities will increase the HDI by 0.8 scores.

The next model in our second hypothesis test explores the indirect effect of CPI on HDI, mediated by government expenditure, tax revenue, and public debt, using the Path Analysis approach. Path Analysis incorporates the Sobel test, which determines the significance of the independent variables' effect on the dependent variable through the mediating variable, based on the coefficients and standard error values obtained from the OLS regression estimation results.

In Table 5, it can be observed that only the Path Analysis Model 1 is significant, as indicated by the results of the

Sobel test. This suggests that government expenditure significantly mediates the effect of CPI on HDI, which aligns with the findings of previous studies [13, 14, 17]. However, it is found that tax revenue and public debt are unable to moderate the effect of CPI on HDI.

This finding is relevant to the corruption indicator used in the study. Transparency International, the institution that publishes the CPI, explains that the index only encompasses corruption cases that occur within the government environment. This finding also suggests that corruption practices in Indonesia are highly likely to occur in the realm of governance, particularly in the aspect of government expenditure. Such practices can diminish the effectiveness and quality of public goods, consequently impacting the overall HDI.

3.3. Causal Impact

We also conducted multivariate causality tests on all variables to reinforce the findings of the dynamic impact and indirect impact in this study. Prior to analyzing with the VECM approach, we performed stationarity tests using the Augmented Dickey-Fuller (ADF) unit root tests on each variable, as shown in Table 6. The results indicate that all variables, except government expenditure, are non-stationary at the level. However, after taking first differences, all variables become stationary. Therefore, it can be concluded that the VECM approach can be applied.

The cointegration test was also conducted to determine whether all variables are cointegrated in the long-term. The Johansen Cointegration test approach was used in this study to identify the cointegration condition by comparing the trace statistic with critical values or by examining the probability value. As shown in Table 7, the trace test indicates three cointegrating relationships at the 0.05 level. This is evident from the trace statistic value being greater than the critical value or the probability value being <0.05, indicating a strong long-term cointegration. Therefore, it can be concluded that the VECM approach is appropriate for further analysis.

Results of VECM In Table 8 by using the Wald Test can be seen that there is bidirectional causality between

Table 6. Results of stationary test.

Variable	ADF Statistical Value	
	Level	First Difference
HDI	0.8035	0.0022*
CPI	0.7092	0.0012*
LnGE	0.0003*	0.0000*
LnTR	0.1262	0.0203**
LnPD	0.4494	0.0000*

Note: Significant *(1%), **(5%), and ***(10%)

Table 7. Results of cointegration test.

Hypothesized No. Of CE(s)	Trace Statistic	0.05 Critical Value	Prob.
None *	0.9032	138.0371	0.0000
At most 1 *	0.7867	77.3347	0.0000
At most 2 *	0.5735	37.1595	0.0059

Note: Significant *(1%), **(5%), and ***(10%)

Table 8. Results of multivariate VECM estimation.

Model	Dependent Variable	Independent Variable (Lag Length Criteria=1)					[t-statistics]
		(F-statistics)					
		Δ HDI	Δ CPI	Δ LnGE	Δ LnTR	Δ LnPD	ECT
1	Δ HDI	-	0.7016 (0.5114)	0.5878 (0.5679)	1.7521 (0.2071)	0.3815 (0.6893)	-0.4339*** [0.0800]
2	Δ CPI	0.6112 (0.5557)	-	1.1169 (0.3531)	0.7026 (0.5109)	0.2594 (0.7749)	-0.2480 [0.5728]
3	Δ LnGE	0.0059 (0.9941)	1.4606 (0.2633)	-	5.7507** (0.0140)	23.4414* (0.0000)	-0.3836*** [0.0813]
4	Δ LnTR	1.7992 (0.1993)	1.2364 (0.3184)	4.2349** (0.0348)	-	7.0076* (0.0071)	-0.8553* [0.0003]
5	Δ LnPD	0.6266 (0.5478)	0.6896 (0.5170)	4.7751** (0.0248)	10.0460* (0.0017)	-	-0.9351** [0.0234]

Note: Significant *(1%), **(5%), and ***(10%)

government expenditure and tax revenue, between government expenditure and public debt, also between tax revenue and public debt. This is relevant because the three variables fall under the same umbrella of government macroeconomics, indicating that there is a significant influence between them.

Table 8 also indicates that there is no multivariate causality between CPI and HDI, as these two variables theoretically do not have a direct effect. The CPI used as an indicator of corruption in this study only includes cases of corruption in the government sector. Therefore, CPI has an indirect effect on HDI through government macroeconomic variables, as proven by the MRA and Path Analysis approaches, where government expenditure and public debt significantly mediate the effect of CPI on HDI.

Long-term multivariate causality analysis also provides evidence that there is no causality relationship in the long term between CPI and other variables in the model. However, significant long-term multivariate causality is

observed in other models for HDI, government expenditure, tax revenue, and public debt.

4. Conclusions and Recommendations

The relationship between corruption (as measured by the CPI) and human development (as measured by the HDI) has been widely discussed in international forums. However, there is a limited amount of empirical evidence available to support this claim. This study provide evidence regarding the influence of corruption on Indonesia's human development, considering both its direct and indirect effects.

In the initial examination of the direct effect of corruption on human development, we explored the long-term impact and discovered that corruption does not directly influence human development. This finding supports the notion that there is no direct correlation between corruption and human development, thus necessitating the inclusion of mediating variables to evaluate the significance of the relationship between corruption levels and human development. Conversely, government expenditure, tax revenue, and public debt have been

shown to exert a long-term influence on human development, as effective policy implementation by the government in economic matters is a key indicator of human development.

Furthermore, since there is no direct effect of corruption on human development, we proceeded to examine the mediating role of government expenditure, tax revenue, and public debt in the relationship between corruption and human development. The findings indicate that corruption has a strong negative impact on human development, particularly through its effect on government expenditure. This suggests that the level of corruption within the public sector significantly influences Indonesia's human development. The estimation results align with the concept of "sand the wheel," revealing that a 1 percent increase in corruption in government expenditure has the potential to decrease the level of human development by 1 score.

In order to reinforce the findings of this study that corruption has no direct impact on human development and that corruption, when mediated by government expenditure, significantly affects the dynamics of human development, we also conducted tests to examine the causal relationship between all the variables under study. The results indicated that there is no causal relationship between corruption and human development. However, there is a strong causal relationship between human development, government expenditure, tax revenue, and public debt. Therefore, the selection of moderating variables to investigate the indirect effect of corruption on human development in this study is appropriate.

This study demonstrates that corruption has a detrimental impact on human development, particularly through its influence on government expenditure. In light of these findings, we recommend that policymakers prioritize addressing the root causes of corruption rather than its effects. Efforts should be made to address potential corrupt behaviors in areas such as the credibility, selection, and recruitment of civil servants. Implementing a system of incentives and penalties can help to reward good performance and deter poor behavior, particularly in cases of corruption. Additionally, it is crucial to raise public awareness through the use of mass media to educate the general population about corruption prevention.

Author Contributions: Conceptualization, I.H. and G.M.I.; methodology: I.H., G.M.I. and A.R.R.M.; software: I.H., G.M.I. and A.R.R.M.; validation: I.H., J.S., G.M.I., A.R.R.M. and R.H.; formal analysis: I.H. and G.M.I.; investigation: I.H. and G.M.I.; resources: I.H. and G.M.I.; data curation: I.H.; writing—original draft preparation, I.H.; writing—review and editing: I.H. and G.M.I.; visualization: A.R.R.M. and R.H.; supervision: J.S.; project

administration: I.H. and G.M.I.; All authors have read and agreed to the published version of the manuscript.

Funding: This study does not receive external funding.

Data Availability Statement: The data is available by request.

Acknowledgments: The authors express their gratitude to their individual institutions and universities.

Conflicts of Interest: All the authors declare that there are no conflicts of interest.

References

- Mohamed Emara, A. (2020). The Impact of Corruption on Human Development in Egypt, *Asian Economic and Financial Review*, Vol. 10, No. 5, 574–589. doi:10.18488/journal.aefr.2020.105.574.589
- Ortega, B., Casquero, A., and Sanjuán, J. (2014). GROWTH IN HUMAN DEVELOPMENT: THE ROLE OF CORRUPTION, *Journal of International Development*, Vol. 26, No. 7, 974–998. doi:10.1002/jid.2963
- Akçay, S. (2006). Corruption and human development, *Cato J.*, Vol. 26, 29
- Malanski, L. K., and Póvoa, A. C. S. (2021). Economic growth and corruption in emerging markets: Does economic freedom matter?, *International Economics*, Vol. 166, 58–70. doi:10.1016/j.inteco.2021.02.001
- Rocha, L. A., Khan, A. S., de Lima, P. V. P. S., and Poz, M. E. S. D. (2016). Corrupção e Crescimento: os impactos da corrupção ponderados pelos diferentes graus de eficiência entre as firmas, *Estudos Econômicos (São Paulo)*, Vol. 46, No. 4, 783–822. doi:10.1590/0101-4161464782lapm
- Baum, M. A., Gupta, M. S., Kimani, E., and Tapsoba, M. S. J. (2017). *Corruption, Taxes and Compliance*, International Monetary Fund
- Mo, P. H. (2001). Corruption and Economic Growth, *Journal of Comparative Economics*, Vol. 29, No. 1, 66–79. doi:10.1006/jcec.2000.1703
- Kurniawan, Y., Ratnasari, R. T., and Mustika, H. (2020). THE CORRUPTION AND HUMAN DEVELOPMENT TO THE ECONOMIC GROWTH OF OIC COUNTRIES, *Jurnal Ekonomi Dan Bisnis Islam (Journal of Islamic Economics and Business)*, Vol. 6, No. 2, 189. doi:10.20473/jebis.v6i2.20472
- Hardi, I., Dawood, T. C., and Syathi, P. B. (2021). Determinants Comparative Advantage of Non-Oil Export 34 Provinces in Indonesia, *International Journal of Business, Economics, and Social Development*, Vol. 2, No. 3, 98–106. doi:10.46336/ijbesd.v2i3.137
- Transparency International. (2022). Corruption Perceptions Index, from <https://www.transparency.org/en/countries/indonesia>
- Sarabia, M., Crecente, F., del Val, M. T., and Giménez, M. (2020). The Human Development Index (HDI) and the Corruption Perception Index (CPI) 2013–2017: analysis of social conflict and populism in Europe, *Economic Research-Ekonomska Istraživanja*, Vol. 33, No. 1, 2943–2955. doi:10.1080/1331677X.2019.1697721
- Montes, G. C., and Piñeiro, W. E. (2022). Participatory Budgeting, Corruption and Government Spending on Education: Evidence Based on Panel Data Analysis for Developed and Developing Countries, *The Journal of Developing Areas*, Vol. 56, No. 1, 117–142
- Ali, H. E., and Solarin, S. A. (2020). Military Spending, Corruption, and the Welfare Consequences, *Defence and Peace Economics*, Vol. 31, No. 6, 677–691. doi:10.1080/10242694.2019.1567181
- D'Agostino, G., Dunne, J. P., and Pieroni, L. (2016). Government Spending, Corruption and Economic Growth, *World*

- Development*, Vol. 84, 190–205. doi:10.1016/j.worlddev.2016.03.011
15. Aghion, P., Akcigit, U., Cagé, J., and Kerr, W. R. (2016). Taxation, corruption, and growth, *European Economic Review*, Vol. 86, 24–51. doi:10.1016/j.euroecorev.2016.01.012
 16. Nan, S. (2022). Study on the Relationship of Grassroots Corruption and Government Expenditure Based on Panel Data, *Procedia Computer Science*, Vol. 199, 1192–1197
 17. Nguyen, M.-L. T., and Bui, N. T. (2022). Government expenditure and economic growth: does the role of corruption control matter?, *Heliyon*, Vol. 8, No. 10, e10822. doi:10.1016/j.heliyon.2022.e10822
 18. Arif, I., and Rawat, A. S. (2018). Corruption, governance, and tax revenue: evidence from EAGLE countries, *Journal of Transnational Management*, Vol. 23, Nos. 2–3, 119–133. doi:10.1080/15475778.2018.1469912
 19. Epaphra, M., and Massawe, J. (2017). Corruption, governance and tax revenues in Africa., *Business & Economic Horizons*, Vol. 13, No. 4
 20. Huňady, J., and Orviská, M. (2015). The effect of corruption on tax revenue in OECD and Latin America countries, *Theoretical and Practical Aspects of Public Finance*, Vol. 1, No. 1, 80
 21. Imam, P. A., and Jacobs, D. (2014). Effect of Corruption on Tax Revenues in the Middle East, *Review of Middle East Economics and Finance*, Vol. 10, No. 1, 1–24. doi:10.1515/rmeef-2014-0001
 22. Benfratello, L., Del Monte, A., and Pennacchio, L. (2018). Corruption and public debt: a cross-country analysis, *Applied Economics Letters*, Vol. 25, No. 5, 340–344. doi:10.1080/13504851.2017.1321831
 23. Cooray, A., Dzhumashev, R., and Schneider, F. (2017). How Does Corruption Affect Public Debt? An Empirical Analysis, *World Development*, Vol. 90, 115–127. doi:10.1016/j.worlddev.2016.08.020
 24. González-Fernández, M., and González-Velasco, C. (2014). Shadow economy, corruption and public debt in Spain, *Journal of Policy Modeling*, Vol. 36, No. 6, 1101–1117. doi:10.1016/j.jpolmod.2014.10.001
 25. Kim, E., Ha, Y., and Kim, S. (2017). Public Debt, Corruption and Sustainable Economic Growth, *Sustainability*, Vol. 9, No. 3, 433. doi:10.3390/su9030433
 26. Del Monte, A., and Pennacchio, L. (2020). Corruption, Government Expenditure and Public Debt in OECD Countries, *Comparative Economic Studies*, Vol. 62, No. 4, 739–771. doi:10.1057/s41294-020-00118-z
 27. Bagolin, I., and Comim, F. (2008). Human Development Index (HDI) and its family of indexes: an evolving critical review, *Revista de Economia*, Vol. 34, No. 2, 7–28
 28. Sagar, A. D., and Najam, A. (1998). The human development index: a critical review, *Ecological Economics*, Vol. 25, No. 3, 249–264. doi:10.1016/S0921-8009(97)00168-7
 29. Paul M. Heywood. (2017). Rethinking Corruption: Hocus-Pocus, Locus and Focus, *The Slavonic and East European Review*, Vol. 95, No. 1, 21. doi:10.5699/slaveastorev2.95.1.0021
 30. de Maria, B. (2008). Neo-colonialism through measurement: a critique of the corruption perception index, *Critical Perspectives on International Business*, Vol. 4, No. 2/3, 184–202. doi:10.1108/17422040810870079
 31. Ozcan, B. (2013). The nexus between carbon emissions, energy consumption and economic growth in Middle East countries: a panel data analysis, *Energy Policy*, Vol. 62, 1138–1147. doi:10.1016/j.enpol.2013.07.016
 32. Baron, R. M., and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations., *Journal of Personality and Social Psychology*, Vol. 51, No. 6, 1173
 33. Srivastava, S., and Talwar, S. (2020). Decrypting The Dependency Relationship Between The Triad Of Foreign Direct Investment, Economic Growth And Human Development, *The Journal of Developing Areas*, Vol. 54, No. 2. doi:10.1353/jda.2020.0012
 34. Maharda, J. B., and Aulia, B. Z. (2020). Government expenditure and human development in Indonesia, *Jambura Equilibrium Journal*, Vol. 2, No. 2
 35. Fadilah, A., Ananda, C. F., and Kaluge, D. (2018). A panel approach: how does government expenditure influence human development index?, *Jurnal Ekonomi Dan Studi Pembangunan*, Vol. 10, No. 2, 130–139
 36. Haque, M. I., and Khan, M. R. (2019). Role of oil production and government expenditure in improving human development index: Evidence from Saudi Arabia, *International Journal of Energy Economics and Policy*, Vol. 9, No. 2, 251
 37. Sulistyowati, N., Sinaga, B. M., and Novindra, N. (2017). Impacts of Government and Household Expenditure on Human Development Index, *JEJAK*, Vol. 10, No. 2, 412–428. doi:10.15294/jejak.v10i2.11305
 38. Okoeguale IBADIN, P., and Toyin OLUWATUYI, B. (2021). Tax revenue, economic growth and human development index in Nigeria, *Journal of Taxation and Economic Development*, Vol. 20, No. 2, 52–76
 39. Saragih, A. H. (2018). An Analysis of Local Taxes Revenue's Effect on Human Development Index, *Jurnal Economia*, Vol. 14, No. 2, 197–211. doi:10.21831/economia.v14i2.21595
 40. Wulandari, E., Wahyudi, M., and Rani, U. (2018). Effect of original local government revenues, general allocation funds, special allocation funds, share funds, other legal revenues, budget surplus/deficit to human development index through capital expenditures: Case study of regencies/municipalities in , *Review of Integrative Business and Economics Research*, Vol. 7, 125–137
 41. Ibanichuka, E. L., Akani, F. N., and Ikebujo, O. S. (2016). A time series analysis of effect of tax revenue on economic development of Nigeria, *International Journal of Innovative Finance and Economics Research*, Vol. 4, No. 3, 16–23
 42. Ofoegbu, G. N., Akwu, D. O., and Oliver, O. (2016). Empirical analysis of effect of tax revenue on economic development of Nigeria, *International Journal of Asian Social Science*, Vol. 6, No. 10, 604–613
 43. Alaeddine, H. (2022). THE IMPACT OF PUBLIC DEBT ON INFRASTRUCTURE IN ARAB COUNTRIES, *BAU Journal - Creative Sustainable Development*, Vol. 4, No. 1. doi:10.54729/DRSK7970
 44. Oluwayemisi, A.-M. B., Akinsanmi, F. J. S., Rotimi, O., Adekunle, A. R., and Olabisi, A. (2022). An assessment of the impact of public debts on development in Nigeria (2003-2020), *EuroEconomica*, Vol. 41, No. 1
 45. Wang, Z., Bui, Q., Zhang, B., Nawarathna, C. L. K., and Mombeuil, C. (2021). The nexus between renewable energy consumption and human development in BRICS countries: The moderating role of public debt, *Renewable Energy*, Vol. 165, 381–390. doi:10.1016/j.renene.2020.10.144