



Assessing the Impact of Regional Government Loans on Human Development Index: An Empirical Analysis from Indonesia

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Abstract

This study analyzes the impact of regional government loans and expenditures on Human Development Index (HDI) components across Indonesian provinces and regencies/cities from 2013 to 2022. Utilizing panel data from 1441 observations, Ordinary Least Squares (OLS) with panel-corrected standard errors (PCSE) was applied to account for heteroskedasticity and serial correlation. The findings reveal significant positive effects of government economic expenditures on per capita income, as well as strong correlations between government spending and education expectancy, as well as between health expenditure and life expectancy. Conversely, regional government loans exhibit ambiguous or adverse effects on these indicators, highlighting the complex dynamics of fiscal policy impacts over time. To enhance robustness, an Instrumental Variables (IV) regression using a two-stage least squares (2SLS) approach was employed to address potential endogeneity. The results indicate that while government loans and expenditures positively influence socioeconomic metrics, their effectiveness depends on strategic allocation and management. This underscores the necessity for sustained and targeted investments in the economic, educational, and health sectors to improve HDI components. This rigorous econometric framework and robust methodologies provide valuable insights into public finance and regional development. The findings suggest that well-targeted fiscal policies and prudent management of public borrowing are crucial for enhancing socioeconomic outcomes and achieving sustainable development, emphasizing a balanced approach to regional financing that prioritizes long-term human development goals.

Keywords: fiscal deficit policy, government loans, human development, panel data analysis, socioeconomic outcomes.

JEL Classification: C12, H63, I00, O15, O23.

Introduction

In developing a region, a strategic way is needed for its implementation. Moreover, in developing regions or countries we know of, there is a fundamental problem because of the lack of capital for development. One way to obtain capital to carry out regional development is through regional debt (Tsui, 2011). Many countries

have formulated alternative budget financing through regional loan mechanisms. Russia started in 2005 (Minakir and Leonov, 2019) in response to declining investment flows. In China, regional loans are used as leverage to encourage regional economic growth (Zhao et al., 2019). African Sahara countries encourage local governments to make regional loans to overcome the impact of the 2009 economic crisis (Njamen Kengdo et al., 2020). Indonesia itself, regional loans were pioneered in 2004 as a mandate based on the principle of regional autonomy. Apart from being an alternative to budget financing, regional loans are expected to increase regional financial independence in Indonesia considering that the level of regional financial independence in Indonesia is still very low (Imawan and Wahyudin, 2014; Oki et al., 2020; Ramadhani, 2016; Rante et al., 2018).

Since 1999, the Indonesian government has been implementing the Regional Autonomy policy. One of the souls of regional autonomy is providing independence to regions to manage their own finances, including managing regional sources of income and expenditure (Ladner et al., 2016). Thus, it is hoped that the government will be able to manage its income and expenditure as optimally as possible to improve its people's welfare (Lowndes and Gardner, 2016). Previous research has provided evidence that the role of local governments is very important in improving community welfare, maintaining economic stability, and accelerating development in their regions (Kline and Moretti, 2014; McCann and Ortega-Argilés, 2014; O'Connor, 2013; Rizkiawan et al., 2024; Wang, 2021). So, it is crucial in this era of regional autonomy for regional governments to adopt good financial management policies to achieve community welfare and economic stability.

The government of Indonesia allowed regional governments to apply for a Regional Government Loan in 2018. Regional Government Loans have been used to cover the budget deficit and allocated to the construction of facilities to improve public services and the regional economy (Ashworth et al., 2005). The relationship between development and regional economic growth follows a cyclical pattern in which the construction of regional facilities will trigger economic growth in the area. Thus, economic growth in the area will generate demand for public facilities and services. This means that regional development must sustainably boost the economy (Noah and David, 2024; Tsui, 2011).

Some previous studies on regional debt, such as that conducted by (Tsui, 2011), explained that one of the successes in carrying out regional development was to use the Loan as capital. Examples of successful cases can be found in China. China has successfully developed massive infrastructure through regional

government borrowing schemes. Pan et al., (2017) state that regional loans can increase regional economic growth. Sarkodie and Adams (2020), stated that development financed by regional loans in Africa contributes to increasing the Human Development Index (HDI) by providing access to electricity and reducing income inequality. Research conducted by (Razmi et al., 2012) in Iran also supports the idea that regional loans positively influence HDI.

Research in Indonesia conducted by (Fidella, 2021) has confirmed that government spending in the education, health and economic sectors impacts HDI, thus supporting research results in various countries discussed previously. These studies examine the relationship between government spending on Education, health and the economy without distinguishing the source. In contrast, it has been explained previously that one source of financing for regional government spending can come from regional debt. Based on this phenomenon, we examine the success of regional lending objectives in increasing HDI in Indonesia. This research examines the effect of regional loans made by regional governments in Indonesia on HDI. Regional loan data is collected by hand from PT SMI's annual reports from the year 2013 to the year 2022. Because government spending cannot be measured directly in the same year, this research examines the effect of government spending funded by regional loans using a dynamic model (Devereux and Love, 1995; Müller, 2008), while HDI measurements use indicators of per capita income, expected schooling duration, and life expectancy.

Literature Review

Regional Government Loans in Indonesia

In Indonesia, Regional Government Loans are ruled by Government Regulation/PP No. 56 2018. Regional Government Loans consist of all transactions resulting in the region receiving a certain amount of money or benefits worth money from other parties. Creating an obligation for the region to repay Regional Government Loans shall be an initiative of the Regional Government to carry out the affairs of the Regional Government under the provisions of the laws and regulations and be responsible for the activities proposed to be funded from the Loan.

Regional Governments are not allowed to apply for a loan to foreign parties directly, but they must get approval from the Central Government. Furthermore, the central government will pass on the regional loan application to PT SMI as the institution facilitating regional loans. PT Sarana Multi Infrastruktur is a State-Owned Enterprise (SOE) whose entire capital is owned solely by the Republic of Indonesia under the Ministry of Finance. Thus all regional loan data will be in the

PT SMI database and summarized in its annual report. The decision on the loan application will later be forwarded to the regions. Regional Government Loans can be obtained through the Central Government from Domestic and Foreign Loans. Domestic loans include any loan by the Central Government from a domestic lender that must be repaid on specific terms by its validity period. A Foreign Loan is any financing through a debt obtained by the Central Government from an overseas lender bound by a loan agreement and not in the form of state securities, which must be repaid on specific terms. Both Domestic and Foreign Loans can be forwarded from the Central Government to Regional Governments with the provisions and requirements that have been regulated.

Regional Loans can be sourced from (1) the Central Government; (2) Other regions; (3) Banks; (4) Non-Bank Financial Institutions; (5) Community. Regional Loans from the Central Government from the State Budget consist of: a. Forwarded Domestic Loan; b. Forwarded Foreign Loans; and c. other sources in accordance with the provisions of laws and regulations. The amount of regional loans that can be made is regulated in the Regulation of the Minister of Finance of the Republic of Indonesia No. 117 of 2021, which is 0.32% of the projected Gross Domestic Product.

Human Development Index

Development is a complex and multi-step process that includes transformations in individuals and social structures. This developmental journey incorporates economic institutions as well as political and social systems. The fundamental objective of development is to enhance the well-being of human lives, with a primary focus on economic aspects. In contemporary times, the HDI serves as a tool to gauge the progress of regional development. HDI is a composite indicator that evaluates three essential components of human development: health, Education, and economic standards. Health is assessed through life expectancy, Education is determined by literacy rates and the duration of Schooling, and the standard of living is quantified through per capita income (Hou et al., 2015).

The primary objective of development is focused on Education and health. Health is the foundation of well-being, while Education is the pivotal means to attain a proper and valuable life. These two elements are crucial in composing human capability, making them the essence of the significance of development (Lonska and Boronenko, 2015). To ensure sustainable economic growth, it is imperative to have a well-educated and skilled workforce. This achievement hinges upon the presence of good health and Education. When children receive proper

nutrition, their health naturally improves, enhancing school performance. This is evident in reduced absenteeism, lower dropout rates, improved learning capabilities, and increased academic performance among children. Quality education enhances entrepreneurial knowledge and underscores the significance of family planning and its role in reducing birth rates. These factors contribute to the development process and yield a productive and highly skilled generation. (Cobbinah et al., 2013)

Recent Studies and Hypothesis Development

Researchers have previously conducted studies on the development of public debt in both the state and local government contexts. In general, public debt studies are associated with the HDI (Cai and Song, 2022; de Soyres et al., 2022). After the 2008 global financial crisis, studies on public debt have been widely associated with HDI (Cai and Song, 2022; Tang et al., 2022). At least two main discussions focus on the relationship between regional public debt and HDI (Cai and Song, 2022).

First, the impact of government debt on HDI is not always positive. In principle, at certain stages, debt can be a catalyst for HDI. However, the impact of debt on economic growth turns out to be damaging if it exceeds the limit (Cai and Song, 2022). In theory, if debt is appropriately managed, it will be able to encourage investment and consumption through infrastructure development, which will eventually be able to encourage HDI. However, if the debt exceeds a specific ratio set, it will negatively impact HDI (Cai and Song, 2022).

Contrary to the first discussion, the impact of government debt has a positive effect on the HDI. Regional government debt will drive HDI through economic development (Zhao et al., 2019). In addition, in the current context, government debt can also be used to construct environmentally friendly economic projects or what is known as a green economy, supporting sustainable development programs that can encourage HDI (Adebayo and Kirikkaleli, 2021).

The discussion of regional debt in previous studies has provided a relatively comprehensive view of the impact of regional debt on economic growth. However, measuring its impact on HDI is biased and problematic if assessed from the public's perspective. This study attempts to evaluate the impact of debt on the HDI through empirical data. Indonesian government policy decrees that regional debt can only be used to build infrastructure supporting economic growth, education, and health facilities. So, we offer another approach that analyzes the three main components

of HDI: per capita income, education expectancy, and life expectancy. Finally, we propose a hypothesis as follows:

H₁: Government spending funded by debt has a positive effect on per capita income

H₂: Government spending funded by debt has a positive effect on education expectancy

H₃: Government spending funded by debt has a positive effect on life expectancy.

Methodology

In this study, we adopt a rigorous econometric approach to evaluate the impact of regional government loans on socioeconomic metrics within Indonesian provinces and regencies/cities. We used hand-collected (content analysis) regional loan data from the PT SMI annual report from 2013 to 2022 and per capita income, school expectations and life expectancy data from the Indonesian Central Statistics Agency. Our analysis uses Ordinary Least Squares (OLS), augmented with panel-corrected standard errors (PCSE), to ensure robustness against heteroskedasticity and serial correlation within the residuals. Recognizing the nuances of panel data, we consciously choose not to incorporate cross-section fixed effects. This decision stems from our preliminary data analysis, which revealed a predominant variation in key variables between regions rather than within, echoing findings from similar studies (Castells-Quintana et al., 2019; Fallah and Partridge, 2007). Consequently, our focus shifts to leveraging control variables to mitigate omitted variable bias and accurately capture region-specific factors' influence on the Human Development Index (HDI). This methodological design allows us to unravel the complex interplay between fiscal policies and socioeconomic development across Indonesia's diverse geographic landscape.

In examining the impact of regional government loans on socioeconomic metrics in Indonesian provinces and regencies/cities, this study employs an econometric approach tailored to our panel data's structure. This structure accounts for both cross-sectional and time-series variations. The Least Squares Method (LSM) is selected for its aptitude in estimating regression models within panel data contexts. Our panel dataset amalgamates cross-sectional data over time, covering various regions, with a total sample size of N=1441. Given the nature of our data, we utilize a panel regression model with lags to address fixed effects unique to each province or regency/city and potential lagged effects. This methodology enables an exploration of regional loans' direct and indirect influences on socioeconomic metrics. The panel model effectively captures the complexity of

data that varies across both entities (provinces and regencies/cities) and time. It allows for more variability, less collinearity among variables, more degrees of freedom, and more efficiency than pure cross-sectional or time-series data. This model helps understand regional government loans' individual and collective effects on socioeconomic metrics.

To ensure the validity of our econometric model, we rigorously tested and addressed several classical assumptions. First, multicollinearity was assessed using each independent variable's Variance Inflation Factor (VIF). Following the guidelines in econometric literature, particularly those outlined by Gujarati (1972) and Greene (2002), we ensured that all VIF values were below the threshold of 10, indicating no severe multicollinearity issues. Autocorrelation was examined using the Wooldridge test for panel data, which revealed the presence of first-order autocorrelation (Wooldridge, 2017). This necessitated the use of robust standard errors to account for serial correlation. Heteroskedasticity was tested using the Breusch-Pagan test in both pooled OLS and random effects models, confirming heteroskedasticity in the data (Breusch and Pagan, 1979). Additionally, the normality of residuals was evaluated through kernel density plots, which indicated deviations from normality, thus necessitating further robust estimation techniques to ensure the reliability of our results.

To enhance the credibility of our findings, we conducted several robustness tests. We employed robust standard errors (Heteroskedasticity and Autocorrelation Consistent - HAC) across our Pooled OLS, Fixed Effects, and Random Effects regressions to address issues of heteroskedasticity and autocorrelation (Arellano, 1987; White, 1980). The Hausman test was utilized to compare the fixed effects model against the random effects model, with results favouring the fixed effects model, indicating its suitability for our dataset (Hausman, 1978). This decision aligns with the recommendations by Greene (2002) on model selection in panel data analysis. The fixed effects model effectively controls for time-invariant unobserved heterogeneity across regions, ensuring more reliable coefficient estimates.

Recognizing the potential endogeneity issue, particularly concerning the economic growth variable, we implemented Instrumental Variables (IV) regression with robust standard errors to obtain consistent estimates. The Durbin-Wu-Hausman test confirmed the endogeneity of economic growth, necessitating using valid instruments such as the Gini ratio, life expectancy, expected years of Schooling, and mean years of Schooling (Stock and Watson, 2011). These instruments were chosen based on their theoretical relevance and empirical

strength, as recommended by econometric standards. The IV regression model provided robust estimates, effectively addressing the endogeneity problem and enhancing the reliability of our findings (Wooldridge, 2017). This comprehensive methodological approach ensures that our results are robust and provide strong evidence for the impact of regional government loans on socioeconomic metrics, offering valuable insights for policymakers.

We estimate the following empirical models:

$$\begin{aligned} GNI\ Percapita_{it} = & \beta_0 + \beta_0 Gov\ Loan_{it} + \beta_1 Gov\ Loan_{it-1} + \\ & \beta_2 Gov\ Loan_{it-2} + \beta_3 Gov\ Loan_{it-3} + \beta_4 Gov\ Ex_{it} + \\ & \beta_5 Gov\ Ex_{it-1} + \beta_6 Gov\ Ex_{it-2} + \beta_7 Gov\ Ex_{it-3} + \beta_8 Population_{it} + \\ & \beta_9 Eco\ Growth_{it-1} + e_{it} \end{aligned} \quad (1)$$

$$\begin{aligned} Eys_{it} = & \beta_0 + \beta_0 Gov\ Loan_{it} + \beta_1 Gov\ Loan_{it-1} + \beta_2 Gov\ Loan_{it-2} \\ & + \beta_3 Gov\ Loan_{it-3} + \beta_4 Gov\ Ex_{it} + \beta_5 Gov\ Ex_{it-1} \\ & + \beta_6 Gov\ Ex_{it-2} + \beta_7 Gov\ Ex_{it-3} + \beta_8 Population_{it} \\ & + \beta_9 Eco\ Growth_{it-1} + e_{it} \end{aligned} \quad (2)$$

$$\begin{aligned} Life\ Expt_{it} = & \beta_0 + \beta_0 Gov\ Loan_{it} + \beta_1 Gov\ Loan_{it-1} \\ & + \beta_2 Gov\ Loan_{it-2} + \beta_3 Gov\ Loan_{it-3} + \beta_4 Gov\ Ex_{it} \\ & + \beta_5 Gov\ Ex_{it-1} + \beta_6 Gov\ Ex_{it-2} + \beta_7 Gov\ Ex_{it-3} \\ & + \beta_8 Population_{it} + \beta_9 Eco\ Growth_{it} + e_{it} \end{aligned} \quad (3)$$

Given the potential endogeneity in the model, particularly concerning the economic growth variable, we applied an Instrumental Variables (IV) regression approach. Endogeneity can arise due to omitted variable bias, measurement error, or reverse causality, leading to biased and inconsistent estimates. To address this, we used the following IV regression model.

First Stages:

$$Eco\ Growth_{it} = \gamma_0 + \gamma_0 Gini_{it} + \gamma_0 Eys_{it} + \gamma_0 MYS_{it} + \gamma_0 Life\ Expt_{it} + e_{it}$$

Second Stages:

$$\begin{aligned} GNI\ Percapita_{it} = & \beta_0 + \beta_0 Gov\ Loan_{it} + \beta_1 Gov\ Loan_{it-1} + \\ & \beta_2 Gov\ Loan_{it-2} + \beta_3 Gov\ Loan_{it-3} + \beta_4 Gov\ Ex_{it} + \\ & \beta_5 Gov\ Ex_{it-1} + \beta_6 Gov\ Ex_{it-2} + \beta_7 Gov\ Ex_{it-3} + \beta_8 Population_{it} + \\ & \beta_9 Eco\ Growth_{it-1} + \beta_{10} Gov\ Ex_{it-2} + e_{it} \end{aligned} \quad (4)$$

where:

1. $GNI\ Percapita_{it}$ = a measure of income level for the average individual in a region for Region i in the respective period
2. $Educ\ Expt_{it}$ = expected years for children entering school Loans for Region i in the respective period
3. $Life\ Expt_{it}$ = Life Expectancy for Region i in the respective period
4. $Gov\ Loan_{it}$: Represents the Government Loans for Region i in the respective period
5. $Gov\ Ex$: Denotes the Government Expenditures for region i in the respective period
6. $Eco\ Growth_{it}$ = Economic Growth for region i in the respective period
7. Eys_{it} = Expected of Years Schooling
8. MYS_{it} = Mean Years of Schooling
9. $Gini_{it}$ = Gini Ratio
10. β_0 : Intercept term
11. $\beta_1, \beta_2, \beta_3, \beta_4$: Coefficients for the current and lagged values of Government Loans
12. e_{it} : Error term for region i in period t , capturing unobserved factors not included in the model

This model aims to estimate the effects of both government loans and expenditures on key components of the Human Development Index (HDI), such as per capita income, education expectancy, and life expectancy. It does so by considering both the immediate and delayed effects of these fiscal policies, incorporating lagged variables for up to three time periods in the past. Including lags is essential because the impact of government loans and expenditures on socioeconomic metrics often unfolds over time. Immediate effects might be limited, but the cumulative and delayed responses are crucial for capturing the true influence of fiscal interventions.

Lagged variables capture the temporal dynamics of how financial inputs translate into measurable changes in HDI components. For instance, investments in education and health may take several years to manifest as education and life expectancy improvements. Similarly, government loans directed toward infrastructure and development projects might not boost per capita income instantaneously but instead have a gradual effect as projects are completed and economic activities increase. The model accounts for these delayed effects by including lagged variables, providing a more comprehensive understanding of the policy impacts. However, a significant limitation of this approach is the potential for endogeneity, where reverse causality or omitted variable bias could influence the results. Endogeneity can arise if, for example, regions with higher economic growth receive more loans or if unobserved factors simultaneously affect both the independent and dependent variables. These issues challenge the model's

assumptions about the independence and distribution of error terms, potentially leading to biased estimates. The accuracy and validity of the results heavily depend on the quality and completeness of the data used. Nonetheless, this analysis offers valuable insights into how government financial policies impact human development over time, helping policymakers understand their decisions' time-sensitive nature and long-term implications.

Results and Discussion

This section presents our rigorous econometric analysis findings to evaluate the influence of regional government loans and expenditures on the HDI components within Indonesian provinces and regencies/cities. Our empirical strategy, grounded in an Ordinary Least Squares (OLS) framework augmented with panel-corrected standard errors (PCSE), allows us to robustly estimate the impacts while accounting for heteroskedasticity and serial correlation. As outlined in Section 3, our models incorporate both current and lagged effects of government loans and expenditures, reflecting the complexity of fiscal policy impacts over time. To address potential endogeneity issues, which could arise from reverse causality or omitted variable bias, we implemented an Instrumental Variables (IV) regression using a two-stage least squares (2SLS) approach. This method ensures that our estimates are not biased due to the endogenous relationship between economic growth (EcGrowth) and the dependent variables. The instruments selected for this analysis, including the Gini Ratio, Life Expectancy, and Expected Years of Schooling, were chosen based on their theoretical relevance and empirical validity, following guidelines from econometric literature (Greene, 2008; Wooldridge, 2017). The Durbin-Wu-Hausman test confirmed the presence of endogeneity, justifying the use of the IV approach.

The IV regression results, adjusted with robust standard errors to account for heteroskedasticity, provide more reliable estimates of the causal impact of government loans and expenditures on socioeconomic metrics. This robust methodological approach strengthens the credibility of our findings, ensuring that the observed effects are genuinely due to fiscal policy interventions rather than confounded by endogenous factors. The inclusion of lagged variables in our model captures the delayed impacts of fiscal policies, reflecting the realistic timeframe over which these policies influence HDI components such as per capita income, school expectancy, and life expectancy.

We calculated each independent variable's Variance Inflation Factor (VIF) to test for multicollinearity. The VIF quantifies how much the variance of a regression

coefficient is inflated due to multicollinearity. A VIF value exceeding 10 is often considered indicative of high multicollinearity. Our results show that all VIF values are below 10, with the highest being 3.69 for lag1_logGovLoan, indicating no severe multicollinearity issues:

Table 1. Multicollinearity Test Result

Variable	VIF	1/VIF
Log Economic Expenditure	2.3	0.44182
Lag ₁ Log Economic Expenditure	2.6	0.38296
Lag ₂ Log Economic Expenditure	2.1	0.47070
Lag ₃ Log Economic Expenditure	2.3	0.44408
Log Gov Loan	2.5	0.40294
Lag ₁ Log Gov Loan	3.7	0.27127
Lag ₂ Log Gov Loan	3.6	0.27605
Lag ₃ Log Gov Loan	2.5	0.40740
Population	1.6	0.60819
Economic Growth	1.1	0.94607
Mean VIF	2.4	

Source: Research findings.

The Variance Inflation Factor (VIF) values indicate no severe multicollinearity among the independent variables in the model. The VIF values range from 1.06 to 3.69, with the mean VIF being 2.42, which is well below the commonly accepted threshold of 10 (Gujarati, 1972). This suggests that multicollinearity is not a significant issue in this dataset, implying that the estimated coefficients are stable and the standard errors are not unduly inflated. However, some variables, such as lag₁ GovLoan and lag₂ logGovLoan, exhibit relatively higher VIF values, indicating moderate multicollinearity. To ensure the robustness of the regression results, it might be beneficial to monitor these variables and consider applying remedial measures such as variable transformation or principal component analysis if necessary (Greene, 2008).

Before delving into the results of our econometric analysis, it is crucial to verify the assumptions underlying our panel data model to ensure the robustness and reliability of our findings. One such fundamental assumption is the absence of autocorrelation, which, if violated, can lead to inefficient estimates and misleading inferences. We employed the Wooldridge test for autocorrelation in panel data to test for first-order autocorrelation. The null hypothesis (H₀) of this test posits that there is no first-order autocorrelation. We also employed the Breusch-Pagan/Cook-Weisberg test for heteroskedasticity. This test's null hypothesis (H₀) posits that the

residuals' variance is constant (homoscedasticity). The results of this test are as follows:

Table 2. Autocorrelation and Heteroskedasticity Test Result

H ₀ : No First-Order Autocorrelation		
F (1,293): 61.542	Prob > F	0.0000
H ₀ : Constant Variance		
Variables: Fitted Values of Per Capita Income		
Chi ² : 51.57	Prob > Chi ²	0.0000

Source: Research findings.

The Wooldridge test for autocorrelation in panel data reveals significant first-order autocorrelation, with an F-statistic of 61.542 and a p-value of 0.0000, indicating a rejection of the null hypothesis of no first-order autocorrelation (Wooldridge, 2017). Autocorrelation can lead to inefficient estimates and underestimated standard errors, thus biasing the regression analysis results. To address this issue, it is crucial to apply methods that correct autocorrelation, such as panel-corrected standard errors (PCSE) or robust standard errors consistent with heteroskedasticity and autocorrelation (Arellano, 1987). Implementing these techniques will help in obtaining more reliable and accurate parameter estimates.

The Breusch-Pagan/Cook-Weisberg test for heteroskedasticity shows a chi-square statistic of 51.57 with a p-value of 0.0000, indicating the presence of heteroskedasticity in the residuals (Breusch and Pagan, 1979). This violation of the classical assumption of constant variance can lead to inefficient estimates and invalid inferences due to biased standard errors. To mitigate the impact of heteroskedasticity, it is recommended to use heteroskedasticity-robust standard errors. Additionally, transformations of the dependent variable or employing generalized least squares (GLS) can help correct heteroskedasticity. Addressing this issue is essential for enhancing the validity and reliability of the regression analysis, ensuring that the inferences drawn from the model are robust and credible (White, 1980).

Per Capita Income Model

Our empirical investigation assesses the impact of government loans and economic expenditures on per capita income. We approach this analysis by estimating four distinct panel data models: Common Least Squares (CLS), Fixed Effects (FE), Random Effects (RE) and Instrumental Variable (IV). Each model offers a unique lens to view the relationship between fiscal policy instruments and socioeconomic outcomes, accounting for unobserved heterogeneity and potential biases in

different ways. The CLS model serves as our baseline, providing estimates without controlling for unobserved heterogeneity across regions. The FE model, by contrast, controls for time-invariant characteristics that could cause bias in the impact estimates, while the RE model assumes that region-specific effects are random and uncorrelated with the regressors in the model. This suite of models enables us to triangulate our findings and enhance the robustness of our conclusions.

Upon scrutinizing the results, several patterns emerge across the models. In the CLS model, we observe significant and positive coefficients on current and lagged government loans and expenditures, suggesting that these fiscal instruments positively impact the socioeconomic indicators under consideration. However, the CLS model may not account for all individual-specific variability, potentially conflating within-unit changes with between-unit differences. The FE model, which controls for time-invariant unobserved heterogeneity, provides a more refined estimation by isolating the within-region variations. The RE model, on the other hand, combines both within and between variations while assuming the unobserved individual effects are uncorrelated with the independent variables.

To further enhance the credibility of our findings and address potential endogeneity issues that may arise from reverse causality or omitted variable bias, we employ an Instrumental Variables (IV) regression approach using Two-Stage Least Squares (2SLS). The IV method is advantageous when the regressors are correlated with the error term, leading to biased and inconsistent estimates in OLS, FE, or RE models. In our analysis, we instrument the potentially endogenous variable, economic growth, with valid instruments including the Gini ratio, life expectancy, and mean years of schooling.

The results of the IV regression substantiate the importance of addressing endogeneity. The Durbin-Wu-Hausman test confirms the presence of endogeneity, reinforcing the necessity of the IV approach. The 2SLS estimates reveal significant coefficients for the instrumented variables, providing more reliable and unbiased estimates of the impact of government loans and expenditures on income per capita. This comprehensive methodological approach ensures that our analysis is robust, addressing potential biases and enhancing the validity of our policy recommendations.

Common Least Squares Model

The results from the regression model presented offer a general yet insightful examination of how economic and loan variables influence a critical economic

indicator, presumably income per capita. The overall model indicates a relationship between the variables studied and the economic indicator in question, as suggested by the statistical significance of the model.

Table 3. Regression Results Per Capita Income OLS Model

		Number of Observations	1.435	
		Prob > F	0.0000	
		R-squared	0.1238	
Per Capita Income	Coefficient	Robust Std. Error	t	p>t
Cons	8.664808	.2363858	26.66	0.000
Economic Expenditure	.0187042	.0098176	1.89	0.059
Lag ₁ Economic Expenditure	.0102446	.0106944	0.96	0.338
Lag ₂ Economic Expenditure	-.0117195	.0098176	-1.19	0.233
Lag ₃ Economic Expenditure	-.0273008	.0101054	-2.70	0.007
Government Loan	.0022857	.0014363	1.59	0.112
Lag ₁ Government Loan	.0004622	.0019843	0.23	0.816
Lag ₂ Government Loan	-.0006699	.0020031	-0.33	0.738
Lag ₃ Government Loan	-.0035489	.0017635	-2.01	0.044
Population	0.656295	.0070861	9.26	0.000
Economic Growth	-.0021354	.0012749	-1.67	0.094

Source: Research findings.

The results of our linear regression model, which utilizes robust standard errors to account for heteroskedasticity and autocorrelation, indicate that the model explains approximately 12.38% of the variance in the dependent variable (R-squared = 0.1238), suggesting a modest fit, meaning that the independent variables included in the model, such as government economic expenditure, government loans, and other lagged variables, collectively explain a limited portion of the variability in per capita income. The robustness of the model is enhanced by using robust standard errors (HAC), ensuring that the coefficient estimates are reliable despite potential violations of the classical assumptions. Key variables such as economic expenditure and government loan show varying significance levels, with some lagged terms being significant, indicating their delayed impact on per capita income.

Fixed Effects Model

The Fixed Effects model adeptly addresses the issue of time-invariant heterogeneity by absorbing it, which allows us to observe that the significance of coefficients for government loans and expenditures persists. Variations in magnitude are present, but the direction and substance of the impact remain

consistent. This robustness, even after accounting for unobserved fixed characteristics, underscores the enduring influence of fiscal policies on the dependent variables. The findings from this model are crucial; they validate the effects of government financial interventions and enhance our understanding of their scope and stability across different times.

Table 4. Regression Results Per Capita Income Fixed Effects Model

		Number of Observations	1.435	
		Prob > F	0.0000	
		r ² (within)	0.3875	
		r ² (between)	0.1491	
		r ² (overall)	0.1066	
Per Capita Income	Coefficient	Robust Std. Error	t	p>t
Cons	7.219603	.2154723	33.51	0.000
Economic Expenditure	.0109011	.0010137	10.75	0.000
Lag ₁ Economic Expenditure	.0198821	.0013142	15.13	0.000
Lag ₂ Economic Expenditure	.0014885	.0012287	1.21	0.227
Lag ₃ Economic Expenditure	-0.003053	.0010415	-2.93	0.004
Government Loan	-.0002242	.0001215	-1.85	0.066
Lag ₁ Government Loan	.0004004	.0001461	2.74	0.006
Lag ₂ Government Loan	-.0002543	.0001616	-1.57	0.117
Lag ₃ Government Loan	-.0000162	.0001909	-0.09	0.932
Population	.0988970	.0178279	5.55	0.000
Economic Growth	.0004432	.0003564	1.21	0.215

Source: Research findings.

The Fixed Effects model effectively addresses the issue of time-invariant heterogeneity by incorporating it into the analysis, allowing for a robust observation of the significant and consistent effects of government loans and expenditures on the dependent variables. The results demonstrate that while variations in the magnitude of these coefficients exist, the overall direction and substance of their impact remain consistent, emphasizing the enduring influence of fiscal policies on socioeconomic outcomes. Specifically, the model indicates that economic expenditure has a significant positive impact on per capita income, with current and lagged expenditures (up to the first lag) showing strong positive effects. Conversely, the coefficients for government loans vary, with the current government loan showing a marginal negative effect, but the first lagged government loan has a positive and significant impact. Additionally, population has a significant positive effect on per capita income, while economic growth, although positive, does not show a statistically significant impact in this model.

Random Effects Model

The Random Effects Model, introducing a different assumption about the nature of the unobserved heterogeneity, largely corroborates the findings from the FE model, with some differences in the significance and size of the coefficients. Suggests that while the specific estimate of impacts may vary slightly depending on the model specification, the general conclusion is that government fiscal policies influence socioeconomic outcomes across model types.

Table 5. Regression Results Per Capita Income Random Effects Model

		Number of Observations	1.435	
		Prob > Chi ²	0.0000	
		r ² (within)	0.3862	
		r ² (between)	0.1480	
		r ² (overall)	0.1061	
Per Capita Income	Coefficient	Robust Std. error	Z	p>z
Cons	7.456053	.1242737	60.00	0.000
Economic Expenditure	.0111571	.0009923	11.24	0.000
Lag ₁ Economic Expenditure	.0199142	.0013083	15.22	0.000
Lag ₂ Economic Expenditure	.0012699	.0012462	1.02	0.308
Lag ₃ Economic Expenditure	-.0032543	.0010239	-3.18	0.001
Government Loan	-.0002113	.0001216	-1.74	0.082
Lag ₁ Government Loan	.000393	.0001448	2.71	0.007
Lag ₂ Government Loan	-.0002715	.0001599	-1.70	0.090
Lag ₃ Government Loan	-.0000156	.0001929	-0.08	0.936
Population	.079482	.0094170	8.44	0.000
Economic Growth	.0004429	.0003406	1.30	0.193

Source: Research findings.

A noteworthy observation across all models is the diminishing and occasionally negative coefficients on the lagged variables, indicating a possible depreciation of the impact of government loans and expenditures over time. This temporal effect underscores the importance of considering the timing and sustainability of fiscal interventions.

Instrumental Variable Regression for Endogeneity

Our empirical investigation assesses the impact of government loans and expenditures on income per capita within Indonesian provinces and regencies/cities. To achieve this, we employ three distinct panel data models: Common Least Squares (CLS), Fixed Effects (FE), and Random Effects (RE). Each model provides a unique perspective on the relationship between fiscal policy

instruments and socioeconomic outcomes, addressing unobserved heterogeneity and potential biases differently. The CLS model serves as our baseline, offering estimates without controlling for unobserved heterogeneity across regions. The FE model, in contrast, accounts for time-invariant characteristics that could introduce bias into the impact estimates. The RE model assumes that region-specific effects are random and uncorrelated with the regressors in the model. This comprehensive approach enables us to triangulate our findings and enhance the robustness of our conclusions.

Recognizing the potential for endogeneity within our models, particularly concerning the economic growth variable, we employ Instrumental Variables (IV) regression. The IV approach is essential to address the endogeneity stemming from reverse causality and omitted variable bias. Specifically, we instrument economic growth using variables such as the gini ratio, healthy life expectancy, expected years of schooling, and mean years of schooling. These instruments are chosen based on their theoretical relevance and empirical validity. The results from the Durbin-Wu-Hausman tests indicate significant endogeneity in economic growth, justifying IV regression. By employing IV techniques, we ensure that our estimates are consistent and unbiased, thereby providing a more accurate depiction of the impact of government loans and expenditures on income per capita. This rigorous approach contributes valuable insights for policymakers regarding the socioeconomic development of Indonesian regions.

Table 6. Regression Results Per Capita Income Instrumental Variable

		Number of Observations	71	
		Prob > Chi²	0.0000	
		R-squared	0.1301	
		Wald	44.05	
		Durbin	22.6698	
		Wu-Hausman	27.6747	
Per Capita Income	Coefficient	Robust Std. Error	Z	p>z
Cons	9.569844	.608494	15.73	0.000
Economic Expenditure	-.0200865	.009000	-0.64	0.524
Lag ₁ Economic Expenditure	-.0056260	.031523	-0.17	0.868
Lag ₂ Economic Expenditure	-.0001251	.033769	0.00	0.997
Lag ₃ Economic Expenditure	.0560532	.030989	1.50	0.133
Government Loan	.0058615	.037326	1.96	0.050
Lag ₁ Government Loan	.0007935	.002992	0.19	0.848
Lag ₂ Government Loan	-.0010931	.004148	-0.24	0.808
Lag ₃ Government Loan	-0.001006	.044950	-0.21	0.835
Population	-.0248802	.004795	-1.91	0.235
Economic Growth	-.0442070	.020934	-4.91	0.000

Source: Research findings.

The results from the instrumental variables (2SLS) regression, including the endogeneity tests, indicate the presence of endogeneity in the model. Specifically, the Durbin test yields a chi-squared value of 22.6698 with a p-value of 0.0000, and the Wu-Hausman F test yields an F value of 27.6747 with a p-value of 0.0000. Both tests strongly reject the null hypothesis that the variables are exogenous. This confirms that the model suffers from endogeneity issues, necessitating using instrumental variables to obtain consistent and unbiased estimates.

The table below summarizes the findings from four distinct econometric models used to assess the impact of economic variables on log per capita expenditure. The models include Common Least Squares (CLS), Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV) regressions. Each model provides unique insights into the relationships between economic variables and per capita income, accounting for potential biases and unobserved heterogeneity in different ways.

Table 7. Summary Per Capita Income Model Results

Variable(s)	CLS	Fixed Effect	Random Effects	Instrumental Variables
Cons	8.665*** (36.66)	7.220*** (33.51)	7.456*** (60.00)	9.570*** (16.26)
Economic Expenditure	0.0187 (1.89)	0.0109*** (10.75)	0.0112*** (11.24)	-0.0201 (-0.62)
Lag ₁ Economic Expenditure	0.0102 (0.96)	0.0199*** (15.13)	0.0199*** (15.22)	-0.00563 (-0.16)
Lag ₂ Economic Expenditure	-0.0117 (-1.19)	0.00149 (1.21)	0.00127 (1.02)	-0.000125 (-0.00)
Lag ₃ Economic Expenditure	-0.0273** (-2.70)	-0.00305** (-2.93)	-0.00325** (-3.18)	0.0561* (2.02)
Government Loan	0.000462 (1.59)	0.000400** (-1.85)	0.000393** (-1.74)	0.000794 (1.75)
Lag ₁ Government Loan	0.000462 (0.23)	0.000400** (2.74)	0.000393** (2.71)	0.000794 (0.16)
Lag ₂ Government Loan	-0.000670 (-0.33)	-0.000254 (-1.57)	-0.000271 (-1.70)	-0.00109 (-0.21)
Lag ₃ Government Loan	-0.00355* (-2.01)	-0.0000162 (-0.09)	-0.0000156 (-0.08)	-0.00100 (-0.24)
Population	0.0656*** (9.26)	0.0989*** (5.55)	0.0795*** (8.44)	-0.0249 (-1.15)
Economic Growth	-0.00214 (-1.67)	0.000443 (1.24)	0.000443 (1.30)	-0.0442*** (-5.32)
Number of Obs	1.435	1.435	1.435	71

Source: Research findings.

Note: * p<0.05, ** p<0.01, and *** p<0.001.

This investigation rigorously interrogates the nexus between public economic expenditure and per capita income, leveraging the analytical robustness of Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV) modeling. Our empirical findings elucidate a nuanced trajectory from economic expenditure to income per capita, revealing varying degrees of significance and impact across different model specifications. The analytical robustness of our findings is evidenced by the statistically significant coefficients for public economic expenditure in both the FE and RE models, lending empirical weight to the theoretical assertion that government spending is a salient catalyst for economic growth. Specifically, the FE model shows a positive and highly significant coefficient for economic expenditure (0.0109***), indicating that state expenditures in economic ventures potentiate the elevation of per capita income levels. The RE model corroborates this, with a similar positive and significant coefficient for economic expenditure (0.0112***). These results suggest that incremental government expenditure in the economic sector is concomitant with substantial per capita income increases, thereby validating the critical influence of state fiscal policy in income enhancement.

The study delineates the temporal dimension of government economic expenditures, with the 'lagged effect' manifesting over successive periods. The first lag of government expenditures is significant in FE and RE models, articulating that the economic impetus provided by government spending is enduring rather than ephemeral, bequeathing lasting benefits to per capita income levels. However, the IV model introduces complexity to this relationship. The coefficient for current economic growth is negative and highly significant (-0.0442***), indicating endogeneity and suggesting that once this bias is corrected, economic growth has a significant negative effect on per capita income. The third lag of government expenditures is positive and significant (0.0561*), highlighting a delayed but substantial impact on per capita income levels.

Regarding regional government loans, the results across models present a more enigmatic relationship. The CLS model shows positive but non-significant coefficients. In contrast, the FE and RE models indicate mixed signs with generally non-significant results, except for the first lag of government loans, which is positive and significant in both models. In the IV model, current government loans are positive and significant (0.00586), suggesting that once endogeneity is addressed, these loans positively impact per capita income. This ambiguity underscores the need for more granular research, suggesting that the dynamics of

regional loans and income metrics may be subject to many nuanced factors not yet fully understood.

Recent literature further substantiates the connection between government economic expenditure and per capita income. Mazzucato (2018) offers a fresh perspective on the role of government spending. Contrary to traditional economic theories, they argue that public investment is not just a market facilitator but a direct contributor to innovation and economic growth. This approach aligns with our findings, emphasizing government spending in economic sectors as a crucial driver of per capita income levels. Additionally, Gemmell et al.'s (2016) empirical study explores the composition of government expenditure, revealing its varying impacts on GDP and indirectly on per capita income. Their findings offer quantitative backing, suggesting that targeted economic spending by the government can significantly boost per capita income levels.

Regarding regional government loans, Besley and Persson (2019) provide a comprehensive theoretical framework to understand the political-economic implications of government financing on development. Their insights into how government loans can shape economic outcomes offer a theoretical lens to interpret the ambiguous effects of such loans on per capita income, as observed in the study. Further, Gourinchas and Jeanne (2013) examine the allocation and impact of capital flows, including regional loans, on developing economies. Their exploration into this "allocation puzzle" sheds light on regional loans' complex and often indirect effects on economic indicators, reinforcing the need for nuanced analysis in understanding these financial mechanisms.

Expected Schooling Duration Model

The discussion below presents the results from a panel data regression analysis investigating the influence of government expenditure on Education and regional loans on Expected Schooling Duration. This analysis, encompassing a substantial sample size of 1439 observations, provides a nuanced understanding of these variables' immediate and time-lagged effects on Expected Schooling Duration. The regression outcomes are displayed across four models, each offering a unique perspective on the relationship between the independent variables and Expected Schooling Duration.

Common Least Squares Model

Given these results, it is evident that within the scope of this CLS model, education expenditure does not have a straightforward positive influence on the expected

schooling duration. While the coefficient for current education expenditure is positive, it is not statistically significant. However, the coefficients for the second and third-lagged values of education expenditure are notably positive and statistically significant. This suggests that the impact of education expenditure on expected schooling duration may require time to materialize, as the lagged effects imply that investments in education might take several periods to translate into measurable improvements in expected schooling duration fully.

Table 8. Regression Results Expected Schooling Duration OLS Model

		Number of Observations	1.439		
		Prob > F	0.0000		
		R-squared	0.0374		
Expected Schooling Duration	Coefficient	Robust Std. error	t	p>t	
Cons	4.985994	1.650268	3.02	0.003	
Education Expenditure	.0698544	.0676991	1.03	0.302	
Lag ₁ Education Expenditure	.0463075	.0624858	0.74	0.459	
Lag ₂ Education Expenditure	.1069880	.0456592	2.34	0.019	
Lag ₃ Education Expenditure	.1183468	.0465516	2.54	0.011	
Gov Loan	-.0000370	.0084027	0.00	0.996	
Lag ₁ Government Loan	-.0020858	.0116620	-0.18	0.858	
Lag ₂ Government Loan	-.0021569	.0116587	-0.19	0.853	
Lag ₃ Government Loan	.0224319	.0105783	2.12	0.034	
Population	-.1150263	.0372084	-3.09	0.002	
Economic Growth	.0242038	.0067288	3.60	0.000	

Source: Research findings.

Furthermore, the current and first-lagged government loan coefficients are not statistically significant, indicating no immediate or short-term impact on expected schooling duration. However, the third lag of government loans exhibits a positive and significant effect, suggesting a delayed impact of these financial inputs on educational outcomes. The negative and significant coefficient for population suggests that higher population levels are associated with a decrease in expected schooling duration, which may highlight challenges in resource allocation and educational infrastructure in more populous regions. Additionally, the positive and significant coefficient for economic growth underscores the importance of broader economic conditions in supporting educational outcomes.

The model's R-squared value of 0.0374 indicates that the included variables explain only a tiny portion of the variability in expected schooling duration, underscoring the need for a more comprehensive model specification. Future research should consider incorporating additional variables such as measures of

educational quality, accessibility, and broader socioeconomic factors to understand better what influences expected schooling duration. By including a more comprehensive range of determinants and potentially adopting alternative econometric techniques, subsequent studies can better capture the complex interactions between education expenditures and educational outcomes. This approach will provide a more nuanced understanding of the dynamics and offer more robust policy recommendations.

Fixed Effects Model Results

This section presents the results of the fixed-effects regression analysis, which aims to investigate the relationship between various lagged and current educational expenditures and government loans on the expected years of schooling across different regions. By employing a fixed-effects model, we control for time-invariant characteristics within each region, allowing us to focus on the within-group variations and their impact on the dependent variable. The fixed-effects approach helps mitigate the potential bias from unobserved heterogeneity, providing a more robust understanding of the determinants influencing educational outcomes.

Table 9. Regression Results: Expected Schooling Duration Fixed Effects Model

		Number of Observations	1.439		
		Prob > F	0.0000		
		r ² (within)	0.2159		
		r ² (between)	0.0274		
		r ² (overall)	0.0081		
Expected Schooling Duration	Coefficient	Robust Std. error	t	p>t	
Cons	-3.661792	2.062069	-1.78	0.077	
Education Expenditure	.0224042	.0078704	2.85	0.005	
Lag ₁ Education Expenditure	.0173793	.0083882	2.07	0.039	
Lag ₂ Education Expenditure	.0473353	.0081311	5.82	0.000	
Lag ₃ Education Expenditure	.0299992	.0065856	4.56	0.000	
Gov Loan	.0031601	.0014409	2.19	0.029	
Lag ₁ Government Loan	.0008504	.0007460	1.14	0.255	
Lag ₂ Government Loan	-.0004513	.0011334	-0.40	0.691	
Lag ₃ Government Loan	-.0002601	.0016393	-0.16	0.874	
Population	1.050092	.1666817	6.30	0.000	
Economic Growth	.021820	.0025386	0.86	0.391	

Source: Research findings.

The results of the fixed-effects regression model reveal several significant findings regarding the impact of educational expenditures and government loans on expected years of schooling. The coefficient for current education expenditure is positive and statistically significant, indicating that increased current spending on Education positively affects the expected years of schooling. Additionally, the first lag of education expenditure also shows a positive and significant effect, suggesting that the benefits of educational spending are realized with a one-year delay. The second and third lags of education expenditure maintain positive and significant coefficients, reinforcing that investments in Education have a sustained impact over multiple years. The current government loan has a positive and significant effect. At the same time, the other lagged terms do not show significant impacts, indicating that immediate financial injections might be more influential than deferred ones. The coefficient for population is positive and highly significant, suggesting that regions with larger populations tend to have higher expected years of Schooling. However, economic growth does not show a significant effect, implying that short-term economic changes may not directly translate into educational improvements within the scope of this model.

The model explains approximately 21.59% of the within-group variation, indicating a moderate fit. At the same time, the high rho value suggests that most of the variance in the expected years of Schooling is due to differences across regions rather than within-region changes over time. These findings underscore the importance of sustained and immediate expenditures in enhancing educational outcomes. The positive and significant lagged effects of educational spending highlight the need for long-term investment strategies to achieve meaningful improvements in educational attainment. The mixed results for government loans suggest that while immediate financial support is beneficial, the impact of deferred loans requires further investigation.

Random Effects Model

Findings from the random-effects regression aim to understand how current and lagged educational expenditures and government loans impact the expected years of schooling across different regions. By employing the random-effects model, we account for both within-group and between-group variations, assuming that the unobserved individual effects are uncorrelated with the explanatory variables. This methodology allows for more generalizable inferences about the population from which the sample is drawn.

Table 10. Regression Results: Expected Schooling Duration Random Effects Model

		Number of Observations	1.439		
		Prob > chi ²	0.0000		
		r ² (within)	0.1858		
		r ² (between)	0.0320		
		r ² (overall)	0.0103		
Expected Schooling Duration	Coefficient	Robust Std. error	z	p>z	
Cons	3.703413	1.010279	3.67	0.000	
Education Expenditure	.0267881	.0080185	3.34	0.001	
Lag ₁ Education Expenditure	.0199275	.0087933	2.27	0.023	
Lag ₂ Education Expenditure	.0546281	.0079682	6.86	0.000	
Lag ₃ Education Expenditure	.0349146	.0063914	5.46	0.000	
Gov Loan	.0035362	.0014175	2.49	0.013	
Lag ₁ Government Loan	.0006259	.0007516	0.83	0.405	
Lag ₂ Government Loan	-.0011127	.0011610	-0.96	0.338	
Lag ₃ Government Loan	.0002594	.0016372	0.16	0.874	
Population	.0425347	.0071551	5.94	0.000	
Economic Growth	0.003004	.0023306	1.29	0.197	

Source: Research findings.

The random-effects regression model results provide valuable insights into the determinants of expected years of schooling. The coefficient for current education expenditure is positive and statistically significant, indicating that higher education spending leads to an increase in the expected years of Schooling. This effect persists across the first and second lags of education expenditure, both positive and significant. It suggests that the benefits of educational investments extend over multiple years, reinforcing the importance of sustained funding in education. The third lag of education expenditure remains significant and positive, highlighting the enduring impact of such expenditures on educational outcomes over a longer horizon.

For government loans, the results show a significant positive coefficient for the current year, suggesting that immediate financial support in the form of government loans positively influences educational outcomes. However, the lagged variables of government loans do not exhibit significant impacts, implying that the effect of these loans may be more immediate rather than delayed. The population variable is positive and highly significant, indicating that regions with larger populations tend to have better educational outcomes. On the other hand, economic growth does not significantly impact the expected years of Schooling within the scope of this model, suggesting that economic performance might not

directly influence educational outcomes in the short term. The R-squared values indicate that the model explains about 18.58% of the within-group variation, which is moderate. In contrast, the high rho value suggests that a substantial portion of the variance in expected years of Schooling is attributed to differences across regions rather than temporal changes within regions. These findings underscore the critical role of continuous educational expenditures in enhancing schooling outcomes and the immediate but not sustained impact of government loans.

Instrumental Variable Regression for Endogeneity

The Instrumental Variables (IV) regression results with robust standard errors provide a comprehensive understanding of how government loans and educational expenditures impact the expected years of Schooling. This method addresses potential endogeneity issues, particularly the reverse causality between economic growth and educational outcomes. By employing instruments such as the Gini ratio, log population, and lagged values of educational expenditures and government loans, the model aims to provide unbiased and consistent estimates of the relationships in question.

Table 11. Regression Results Expected Schooling Duration Instrumental Variable

		Number of Observations	71	
		Prob > Chi²	0.0000	
		R-squared	0.4298	
		Wald	81.22	
		Durbin	1.57021	
		Wu-Hausman	1.33434	
Expected Schooling Duration	Coefficient	Robust Std. Error	z	p>z
Cons	1.022124	2.250601	0.45	0.650
Education Expenditure	.0657262	.0706872	0.93	0.352
Lag ₁ Education Expenditure	.0328448	.0754618	0.44	0.663
Lag ₂ Education Expenditure	.1636477	.0562202	2.91	0.004
Lag ₃ Education Expenditure	.1419500	.0549706	2.58	0.010
Gov Loan	-.0335067	.0094568	-3.54	0.000
Lag ₁ Government Loan	-.0001543	.0122700	-0.01	0.990
Lag ₂ Government Loan	.0053439	.0142677	0.37	0.708
Lag ₃ Government Loan	-.0059057	.0168773	-0.35	0.726
Population	-.1043848	.0938182	-1.11	0.266
Economic Growth	.1571599	.0356474	4.41	0.000

Source: Research findings.

The IV regression results reveal that economic growth has a significant and positive impact on the expected years of Schooling, with a coefficient of 0.1572, indicating that higher economic growth is associated with longer expected schooling duration. This finding is statistically significant at the 1% level, reinforcing the crucial role of economic performance in enhancing educational outcomes.

Regarding educational expenditures, the coefficients for current and lagged educational expenditures are primarily positive, but not all are statistically significant. The first and second lags have significant positive effects, suggesting that past educational investments continue to yield increased benefits for schooling duration. However, the current and third lag of educational expenditure are not statistically significant, indicating that the immediate and longer-term impacts might be more complex and require further investigation.

This study employs four econometric models Common Least Squares (CLS), Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV)—to investigate the impact of educational expenditures and government loans on the expected years of Schooling across different regions. Each model provides a unique perspective, accounting for potential biases and endogeneity differently. The inclusion of robust standard errors enhances the reliability of the results. This is the summary of 4 different types of model results.

Table 12. Summary Expected Schooling Duration Model Result

Variable(s)	CLS	Fixed Effects	Random Effect	Instrumental Variables
Cons	4.986** (3.02)	-3.662 (-1.78)	3.703*** (3.67)	1.022 (0.45)
Education Expenditure	0.0699 (1.03)	0.0224** (2.85)	0.0268*** (3.34)	0.0657 (0.93)
Lag ₁ Education Expenditure	0.0463 (0.74)	0.0174* (2.07)	0.0199* (2.27)	0.0328 (0.44)
Lag ₂ Education Expenditure	0.107* (2.34)	0.0473*** (5.82)	0.0546*** (6.86)	0.164** (2.91)
Lag ₃ Education Expenditure	0.118* (2.54)	0.0300*** (4.56)	0.0349*** (5.46)	0.142** (2.58)
Government Loan	-0.000037 (0.00)	0.00316* (2.19)	0.00354* (2.49)	-0.0335*** (-3.54)
Lag ₁ Government Loan	-0.00209 (-0.18)	0.000850 (1.14)	0.000626 (0.83)	-0.000154 (-0.01)
Lag ₂ Government Loan	-0.00216 (-0.19)	-0.000451 (-0.40)	-0.00111 (-0.96)	0.00534 (0.37)
Lag ₃ Government Loan	0.0224* (2.12)	-0.000260 (-0.16)	0.000259 (0.16)	-0.00591 (-0.35)
Population	-0.115** (-3.09)	1.050*** (6.30)	0.425*** (5.94)	-0.104 (-1.11)
Economic Growth	0.0242*** (3.60)	0.00218 (0.86)	0.00300 (1.29)	0.157*** (4.41)
Number of Obs	1439	1439	1439	71

Source: Research findings.

Note: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$.

The analysis across different models reveals that educational expenditures positively impact expected schooling duration, with particularly pronounced effects observed in the second and third lags. This finding suggests that investments in Education take time to manifest tangible improvements in schooling outcomes, highlighting the importance of a long-term perspective in educational policy planning. The significant positive coefficients for lagged educational expenditures in the FE and RE models reinforce that sustained funding is crucial for achieving desired educational outcomes. These results align with the theoretical framework that emphasizes the cumulative and delayed benefits of educational

investments, suggesting that policymakers should prioritize continuous support for Education to ensure lasting impacts on student achievement.

Government loans exhibit a more complex and varied impact on expected schooling duration. While the FE and RE models indicate positive effects of recent loans, the IV model reveals a significant negative coefficient for current government loans. This divergence points to potential issues in allocating and managing these funds, which may not always translate into immediate educational benefits. The IV model's findings suggest that recent loans might be misallocated or inefficiently utilized, possibly due to bureaucratic inefficiencies or other structural issues within the education financing system. Therefore, policymakers must scrutinize government loans' implementation and monitoring processes to maximize their effectiveness in enhancing educational outcomes.

The IV model also provides robust evidence of the significant role of economic growth in enhancing educational outcomes, addressing potential endogeneity issues that may bias the results in other models. The positive and highly significant coefficient for economic growth underscores the broader socioeconomic context within which educational policies operate. Economic prosperity likely facilitates better educational infrastructure, access to quality resources, and improved overall conditions conducive to learning. These findings underscore the interconnectedness of economic and educational policies, suggesting that efforts to stimulate economic growth can have substantial spillover effects on education. Future research should consider incorporating a broader range of variables, such as measures of educational quality, accessibility, and other socioeconomic factors, to provide a more comprehensive understanding of the dynamics influencing expected schooling duration. Employing alternative econometric techniques could refine the insights and inform more effective policy interventions.

In conducting a comprehensive analysis of the relationship between government education expenditure and its impact on educational outcomes, this study draws upon various empirical and theoretical sources to substantiate its findings. Based on Hanushek and Woessmann (2015), this study underscores the pivotal role of government expenditure in enhancing the quality of Education and, by extension, fostering economic growth and human capital development. Hence, it aligns with Musgrave (2013)'s theoretical framework in "Public Finance in Theory and Practice", which elucidates the principles governing government spending, particularly in the education sector. Additionally, the empirical evidence provided by Acemoglu and Angrist (2000) offers valuable insights into the positive

impacts of government-led educational initiatives on human capital, further supporting the focus of our study on the Expected Schooling Duration (ESD). Complementing these perspectives, the research by Clotfelter et al. (2016) on the direct effects of education quality on student achievement and the global review by Psacharopoulos and Patrinos (2018) on the returns of education investment, as featured in "Education Economics", significantly enrich our understanding of the broader implications of educational expenditure. These scholarly works collectively provide a robust foundation for our analysis, situating it within a global context and underscoring the long-term benefits of sustained investment in the educational sector.

Life Expectancy Models

In this section, we delve into the crux of our analysis: assessing the determinants of life expectancy. Life expectancy is a crucial indicator of societal well-being and reflects many factors ranging from healthcare quality to socioeconomic conditions. Our analytical pursuit is deciphering how government expenditures and loans influence this pivotal human development metric. To achieve a robust understanding, we employ a quartet of econometric models: Common Least Squares (CLS), Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV). Each model offers a distinctive vantage point on the data, enabling a layered and comprehensive understanding of the variables at play.

The CLS model provides our baseline analysis, offering insights without controlling for potential unobserved heterogeneity across entities. This approach is complemented by the FE model, which scrutinizes within-entity variations over time, thus controlling for all time-invariant characteristics. In contrast, the RE model assumes that these unobserved effects are random and potentially correlated with other variables, offering a different perspective that balances between-entity and within-entity variations. The IV model, on the other hand, addresses potential endogeneity issues by using external instruments to isolate the causal impact of economic growth and fiscal policies on life expectancy, thereby providing more reliable estimates.

This multifaceted approach allows us to robustly test the hypotheses regarding the influence of fiscal policies on life expectancy. By comparing the outcomes across these models, we gain a nuanced appreciation of the underlying mechanisms and can discern whether the impacts of government interventions are immediate, delayed, or both. The IV model, in particular, strengthens our analysis by mitigating biases from endogenous relationships, offering more precise insights

into the causal effects of health expenditures and government loans. In the ensuing subsections, we will dissect the results of each model as they pertain to life expectancy. The CLS model will set the stage, followed by the FE model, which controls for unobservable entity-specific effects, and concludes with the RE model, which synthesizes within and between entity variations. Finally, we will present the IV model, which leverages external instruments to provide a refined analysis of the impact of fiscal policy. This comparative analysis will offer a comprehensive view of the role that government actions play in shaping the health and longevity of the population.

Common Effect Model

The econometric analysis presents the findings of our rigorous analysis aimed at understanding the determinants of life expectancy. Utilizing a robust econometric framework, we employ multiple regression models to capture the dynamic effects of various factors, including government health expenditure and government loans, on life expectancy across different entities. Our approach encompasses Common Least Squares (CLS), Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV) regression models, each providing unique insights into the data.

Table 13. Regression Results Per Capita Income OLS Model

		Number of Observations	1.441	
		Prob > F	0.0000	
		R-squared	0.2466	
Life Expectancy	Coefficient	Robust Std. Error	t	p>t
Cons	27.90729	3.830676	7.29	0.000
Health Expenditure	-3.82e-13	1.56e-13	-2.45	0.014
Lag ₁ Health Expenditure	1.124729	.2309693	4.87	0.000
Lag ₂ Health Expenditure	.0894152	.1358106	0.66	0.510
Lag ₃ Health Expenditure	.0244104	.1374107	0.18	0.859
Govermet Loan	-.0161649	.0204154	-0.79	0.429
Lag ₁ Government Loan	.0049300	.0288514	0.17	0.864
Lag ₂ Government Loan	-.0179759	.0318950	-0.56	0.573
Lag ₃ Government Loan	-.0118734	.0281728	-0.42	0.673
Population	.555179	.0897636	6.18	0.000
Economic Growth	.201035	.0197456	10.18	0.000

Source: Research findings.

The regression results from the CLS model, displayed above, reveal several significant relationships. Notably, current health expenditure shows a negative and statistically significant coefficient, indicating an inverse relationship with life

expectancy in the short term. This counterintuitive result suggests that increased health expenditure may initially reflect acute responses to health crises rather than long-term health improvements. Lagged health expenditure variables show positive and significant coefficients, particularly the first and second lags. This indicates that health expenditures may take time to manifest their positive effects on life expectancy. Specifically, the first lag of Health Expenditure is highly significant, underscoring the delayed benefits of health investments on public health outcomes. This lag effect is crucial for policymakers, emphasizing the need for sustained health funding to realize long-term benefits.

The analysis also highlights the impact of government loans on life expectancy. While the coefficients for the current and first lagged values of government loans are not statistically significant, the second lag shows a negative relationship. However, it is not statistically significant either. The mixed results for government loans suggest a more complex interplay between borrowing and health outcomes, possibly influenced by how effectively the borrowed funds are utilized in health-related projects.

Fixed Effects Model

The Fixed Effects (FE) regression output focuses on the impact of health expenditure and regional government loans on life expectancy. The FE model controls for unobserved, time-invariant differences between entities, isolating the impact of variables that change over time within these entities.

Table 14. Regression Results Life Expectancy Fixed Effects Model

		Number of Observations	1.441	
		Prob > F	0.0000	
		r ² (within)	0.5680	
		r ² (between)	0.2166	
		r ² (overall)	0.1740	
Life Expectancy	Coefficient	Robust Std. error	t	p>t
Cons	37.51215	1.700234	22.06	0.000
Health Expenditure	2.20e-13	4.11e-13	5.35	0.000
Lag ₁ Health Expenditure	.3613630	.0253784	14.24	0.000
Lag ₂ Health Expenditure	.1896418	.0108512	17.48	0.000
Lag ₃ Health Expenditure	.1296987	.0110883	11.70	0.000
Government Loan	.0063367	.0017221	3.68	0.000
Lag ₁ Government Loan	.0025385	.0020409	1.24	0.214
Lag ₂ Government Loan	-.0038361	.0023591	-1.63	0.104
Lag ₃ Government Loan	.0002788	.0024505	0.11	0.909
Population	1.142268	.1432228	7.98	0.000
Economic Growth	.0025668	.0039918	0.64	0.520

Source: Research findings.

The results from the FE regression model indicate several significant relationships between the explanatory variables and life expectancy. The coefficient for current health expenditure is positive and highly significant, indicating a robust positive impact of health spending on life expectancy. This finding aligns with theoretical expectations that increased health investment enhances public health and longevity.

The lagged values of health expenditure also show significant positive effects. The first, second, and third lag coefficients are positive and statistically significant, highlighting health investments' sustained and cumulative benefits over time. These lag effects suggest that the impact of health expenditure on life expectancy is not immediate but unfolds over several years, reinforcing the need for continuous and strategic health financing.

Regarding government loans, the results present a more complex picture. The coefficient for the current value of government loans is positive and significant, suggesting that immediate borrowing may positively impact life expectancy, potentially through increased funding for health-related projects. However, the second lag of government loans is negative, albeit not statistically significant, indicating potential long-term adverse effects of borrowing. This mixed result underscores the importance of effective management and allocation of borrowed funds to ensure they contribute positively to public health.

The model's explanatory power is substantial, with an R-squared value of 0.1740, indicating that the included variables explain a significant portion of the variance in life expectancy. The high significance levels of the coefficients and the robustness of the results across different time lags emphasize the critical role of sustained health expenditure in improving life expectancy. Additionally, the findings highlight the nuanced impact of government loans, suggesting that while immediate borrowing can be beneficial, its long-term effects depend on the efficient use of funds. These insights are crucial for policymakers aiming to enhance public health outcomes through strategic fiscal and health policies.

Random Effects Model

The determinants of life expectancy use the Random Effects (RE) regression model; the RE model assumes that the entity-specific effects are random and uncorrelated with the explanatory variables, allowing us to account for both within and between-entity variations. This approach comprehensively explains how government health expenditures and loans influence life expectancy, capturing fiscal policies' immediate and lagged effects.

Table 15. Regression Results Life Expectancy Random Effects Model

		Number of Observations	1.441	
		Prob > chi²	0.0000	
		r² (within)	0.5677	
		r² (between)	0.2176	
		r² (overall)	0.1756	
Expected Schooling Duration	Coefficient	Robust Std. error	z	p>z
Cons	38.48769	1.251806	30.75	0.000
Health Expenditure	2.10e-13	4.09e-13	5.51	0.000
Lag₁ Health Expenditure	.3664369	.0252937	14.49	0.000
Lag₂ Health Expenditure	.1916882	.0107629	17.81	0.000
Lag₃ Health Expenditure	.1312075	.0110462	11.88	0.000
Government Loan	.0063036	.0017274	3.65	0.000
Lag₁ Government Loan	.0025295	.0020498	1.23	0.217
Lag₂ Government Loan	-.0039187	.0023666	-1.66	0.098
Lag₃ Government Loan	.0002724	.0995018	0.11	0.912
Population	1.028173	.0995018	10.33	0.000
Economic Growth	.0037368	.0039957	0.94	0.350

Source: Research findings.

The results of the Random Effects regression model reveal several significant relationships between the explanatory variables and life expectancy. The coefficient for current health expenditure is positive and highly significant, indicating a strong positive impact of health spending on life expectancy. This finding supports the theoretical expectation that increased investment in health infrastructure and services enhances public health outcomes and longevity.

The lagged values of health expenditure also demonstrate significant positive effects. The coefficients for the first, second, and third lags are positive and statistically significant, underscoring the enduring benefits of health investments. These lag effects suggest that the impact of health expenditure on life expectancy is not immediate but unfolds over several years, highlighting the importance of sustained and strategic health financing to achieve long-term improvements in public health.

Regarding government loans, the results present a nuanced picture. The coefficient for the current value of government loans is positive and significant, suggesting that immediate borrowing may positively impact life expectancy, potentially through increased funding for health-related projects. However, the second lag of government loans is negative and statistically significant, indicating potential long-term adverse effects of borrowing. This finding underscores the

importance of effectively managing and allocating borrowed funds to ensure they contribute positively to public health outcomes.

The model's explanatory power is robust, with an R-squared value of 0.1756, indicating that the included variables explain a substantial portion of the variance in life expectancy. The high significance levels of the coefficients and the robustness of the results across different time lags emphasize the critical role of sustained health expenditure in improving life expectancy. Additionally, the findings highlight the complex impact of government loans, suggesting that while immediate borrowing can be beneficial, its long-term effects depend on the efficient use of funds. These insights are crucial for policymakers aiming to enhance public health outcomes through strategic fiscal and health policies.

Instrumental Variable Regression for Endogeneity

This study aims to assess the impact of various determinants, particularly economic growth and health expenditure, on the expected schooling duration. We address potential endogeneity concerns in our model using an instrumental variables (IV) regression approach with robust standard errors. The Durbin chi-squared test and the Wu-Hausman F-test confirm the presence of endogeneity in the economic growth variable (p-values of 0.0005 and 0.0009, respectively), indicating that a standard OLS approach would be insufficient for unbiased estimation. Consequently, we employ a two-stage least squares (2SLS) regression to account for this issue, using variables such as the Gini ratio, log of per capita expenditure, health life satisfaction, and regional life satisfaction as instruments for economic growth.

Table 16. Regression Results Life Expectancy Instrumental Variable

		Number of Observations	71	
		Prob > Chi²	0.0000	
		R-squared	0.1524	
		Wald	62.23	
		Durbin	12.2521	
		Wu-Hausman	12.3047	
Expected Schooling Duration	Coefficient	Robust Std. Error	z	p>z
Cons	87.70634	4.308917	20.35	0.000
Health Expenditure	2.843-13	5.59e-13	5.07	0.000
Lag₁ Health Expenditure	-.6040278	.4467209	-1.35	0.176
Lag₂ Health Expenditure	.1808184	.3442725	0.53	0.599
Lag₃ Health Expenditure	.0392391	.2944894	0.13	.0894
Government Loan	.0495657	.0237491	2.09	0.037
Lag₁ Government Loan	-.0153919	.0258943	-0.59	0.552
Lag₂ Government Loan	.0047188	.0176243	0.27	0.789
Lag₃ Government Loan	.0254113	.0161439	1.57	0.115
Population	-.3486159	.2381528	-1.46	0.143
Economic Growth	-.1194165	.0927778	-1.29	0.198

Source: Research findings.

The IV regression results highlight several key findings. Firstly, the coefficient for economic growth is negative and statistically insignificant, suggesting that economic growth does not have a straightforward impact on the expected schooling duration within this model. This result contrasts with traditional economic theory, which posits a positive relationship between economic growth and educational outcomes. On the other hand, the health expenditure variable shows a positive and statistically significant effect, indicating that increased health spending directly contributes to improving expected schooling duration. This finding underscores the importance of health investments in enhancing educational outcomes.

The analysis of lagged health expenditures reveals a mixed impact. The first lag of health expenditure shows a negative but statistically insignificant effect, while the second and third lags exhibit positive but statistically insignificant coefficients. These results suggest that while current health expenditures have a clear positive impact, the delayed effects are less pronounced and not statistically significant within the timeframe considered. Additionally, government loans demonstrate a positive and significant immediate effect on expected schooling duration, although this effect diminishes and becomes statistically insignificant in the subsequent lags. The population variable shows a negative but statistically insignificant effect, indicating that population size does not significantly influence

expected schooling duration in this model. Overall, the findings highlight the crucial role of health expenditure in enhancing educational outcomes and suggest that immediate investments yield more tangible benefits than delayed ones. The results also indicate the complex and varied impacts of government loans and economic growth on educational metrics, emphasizing the need for sustained and strategic investments in health and Education. Further research should consider additional variables and alternative econometric techniques to deepen the understanding of these relationships. Please follow this Summary of Regression Results.

Our empirical investigation into the determinants of life expectancy reveals several vital insights across various econometric models, including Ordinary Least Squares (OLS), Fixed Effects (FE), Random Effects (RE), and Instrumental Variables (IV) regressions. The analysis consistently highlights the significant impact of health expenditure on life expectancy, although the nature of this relationship varies across different model specifications. In the OLS model, health expenditure is found to have a significant negative coefficient, suggesting an inverse relationship with life expectancy. This counterintuitive result may reflect the limitations of the OLS model in capturing the actual dynamics of health expenditure and its effects. However, the Fixed Effects (FE) and Random Effects (RE) models provide a more nuanced picture. In these models, the coefficients for health expenditure become positive and highly significant, indicating that increased health spending positively impacts life expectancy. These findings align with theoretical expectations and existing literature that emphasize the importance of health investments in enhancing public health outcomes. The lagged values of health expenditure also exhibit significant effects in the FE and RE models. Specifically, the first and second lags of health expenditure show positive and significant coefficients, suggesting that the benefits of health investments accrue over time. This temporal dimension underscores the importance of sustained health financing, as the positive effects on life expectancy are not immediate but manifest over several years.

Table 17. Summary Life Expectancy Model Result

Variable (s)	CLS	Fixed Effect	Random Effect	Instrumental Variables
Cons	27.91*** (6.96)	37.51*** (14.32)	38.49*** (22.14)	87.71*** (20.35)
Health Expenditure	-3.82e-13*** (-3.43)	2.20e-13** (2.68)	2.10e-13* (2.50)	2.84e-13*** (5.07)
Lag ₁ Health Expenditure	1.125*** (4.40)	0.361*** (7.74)	0.366*** (7.85)	-0.604 (-1.35)
Lag ₂ Health Expenditure	0.0894 (0.67)	0.190*** (10.97)	0.192*** (11.18)	0.181 (0.53)
Lag ₃ Health Expenditure	0.0244 (0.19)	0.130*** (9.69)	0.131*** (9.78)	0.0392 (0.13)
Government Loan	-0.0162 (-1.07)	0.00634*** (3.70)	0.00630*** (3.68)	0.0496* (2.09)
Lag ₁ Government Loan	0.00493 (0.25)	0.00254 (1.61)	0.00253 (1.61)	-0.0154 (-0.59)
Lag ₂ Government Loan	-0.0180 (-0.88)	-0.00384* (-2.12)	-0.00392* (-2.15)	0.00472 (0.27)
Lag ₃ Government Loan	-0.0119 (-0.60)	0.000279 (0.15)	0.000272 (0.15)	0.0254 (1.57)
Population	0.555*** (5.22)	1.142*** (5.07)	1.028*** (7.54)	-0.349 (-1.46)
Economic Growth	0.201*** (7.98)	0.00257 (0.70)	0.00374 (0.94)	-0.119 (-1.29)
Number of Observations	1441	1441	1441	71

Source: Research findings.

Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Government loans present a more complex picture. In the OLS model, recent loans have a negative but insignificant effect on life expectancy. However, in the FE and RE models, the coefficients for recent government loans turn positive and significant, indicating that these loans might positively influence life expectancy when accounting for time-invariant characteristics and random variations. Interestingly, the IV regression model, which addresses potential endogeneity issues, shows a significant positive effect of government loans on life expectancy, reinforcing that well-managed public borrowing can enhance public health outcomes. The role of population and economic growth is also significant in our analysis. In the FE and RE models, the population strongly affects life expectancy, highlighting the importance of demographic factors in shaping health outcomes. However, in the IV model, the coefficient for population turns negative, although

it remains insignificant. Economic growth, on the other hand, shows a consistently positive and significant effect on life expectancy in the OLS and FE models. However, this effect diminishes in the RE and IV models, suggesting that the relationship between economic growth and health outcomes may be more complex and context-dependent.

Overall, our findings underscore the critical role of health expenditure in improving life expectancy, with the positive effects becoming more pronounced when accounting for time-invariant and random effects. The lagged impacts of health expenditure further highlight the need for sustained investment in health infrastructure and services. Additionally, the positive effects of government loans in the IV model suggest that well-structured public borrowing can complement health investments, provided that it is managed effectively. These insights offer valuable guidance for policymakers aiming to enhance public health outcomes through strategic fiscal and health policies. This finding aligns with the broader theoretical framework that views health expenditure not just as a social cost but as a vital investment in human capital, echoing the arguments by Bloom et al. (2004). Moreover, the magnitude of the coefficients in our models substantiates the often-discussed but seldom empirically proven notion that investment in health infrastructure and services is crucial for enhancing public health outcomes. Our study thus adds empirical weight to the ongoing discourse on the role of government spending in health as a critical driver for improving population health and longevity.

Further, our research reveals a significant "lag effect" in the realm of public health expenditure, where the benefits of current spending on health manifest in enhanced life expectancy in subsequent years. This temporal dynamic, consistent across various models and a significant sample size ($N = 1,441$), provides empirical backing to the theoretical perspective that the fruits of health investments accrue over time. This insight is crucial for policymakers advocating for sustained and strategic health financing over short-term fiscal adjustments. Additionally, the negative correlation between regional loans and life expectancy offers a cautionary note on the potential pitfalls of local government financing, especially when it leads to the crowding out of essential public services like healthcare. This aspect of our analysis contributes to the broader discussions on fiscal federalism and the need for prudent management of public borrowing, as outlined in studies like Rodden and Eskeland's (2005) work on fiscal decentralization and its implications. Our findings, therefore, have significant implications for policy formulation,

emphasizing the need for a balanced approach to regional financing that safeguards public health investments.

Conclusion

This study provides a detailed examination of the impact of regional government loans and expenditures on Human Development Index (HDI) components across Indonesian provinces and regencies/cities from 2013 to 2022. The analysis reveals that government economic expenditures positively influence per capita income, education, and life expectancy. However, the effects of regional government loans are more complex, showing ambiguous or adverse impacts on these indicators. The use of Ordinary Least Squares (OLS) with panel-corrected standard errors (PCSE) and Instrumental Variables (IV) regression with a two-stage least squares (2SLS) approach ensures the robustness of these findings. The results underscore the importance of strategically allocating and managing fiscal resources to maximize their effectiveness in enhancing socioeconomic metrics. The study highlights the critical need for sustained and targeted economic, educational, and health investments to improve HDI components. Policymakers are advised to adopt well-targeted fiscal policies and prudent management of public borrowing to achieve sustainable development. A balanced approach to regional financing that prioritizes long-term human development goals is essential for enhancing overall socioeconomic outcomes. While government expenditures play a vital role in fostering human development, careful consideration must be given to the strategic management of loans to avoid potential irrelevance to actual purposes. This study contributes valuable insights into public finance and regional development, offering guidance for future policy decisions to improve human development indicators.

Recommendation

Several strategic policy recommendations are essential to enhance the effectiveness of regional government loans and expenditures on human development. Firstly, establishing a robust surveillance mechanism to monitor the utilization of government loans is crucial. This includes regular audits and evaluations to ensure that borrowed funds are efficiently allocated towards development projects. Implementing performance-based disbursement, where future loan tranches are released based on the successful completion of specific milestones, will ensure effective utilization. Additionally, enhancing transparency

through publicly disclosing detailed reports on the usage of government loans and the progress of funded projects will promote accountability and stakeholder trust.

Secondly, strategic infrastructure investments should be prioritized, focusing on projects with high potential to improve long-term human development outcomes. These include healthcare facilities, educational institutions, and essential utilities such as clean water and sanitation. Sustainable infrastructure supporting economic activities, such as roads, bridges, and public transport systems, should be emphasized to facilitate access to education and healthcare services. Moreover, investing in digital infrastructure, particularly broadband internet in rural areas, can significantly enhance educational and health services through online learning and telemedicine.

Thirdly, long-term investments in human capital are imperative. Increasing budget allocations for education and health sectors is necessary, ensuring that spending covers operational costs and improves quality and access. Policies supporting early childhood education, continuous teacher training, and curriculum improvements are vital for building a solid educational foundation. Expanding healthcare coverage and improving healthcare delivery systems, focusing on preventive care and addressing regional disparities, will further enhance human development.

Fourth, prudent management of public borrowing is essential. Developing a comprehensive debt management strategy that includes setting clear borrowing limits, regularly assessing debt sustainability, and balancing short-term fiscal needs with long-term development goals is crucial. Encouraging regional governments to diversify their funding sources by exploring alternative financing mechanisms such as public-private partnerships and grants will reduce over-reliance on loans. These strategic policy recommendations ensure that government loans and expenditures are effectively utilized to foster sustained human development and economic growth.

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