

Analysis of The Human Development Index in Jambi Province

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ABSTRACT

This study analyzes the effects of the expenditure index, population density, poverty rate, unemployment rate, and investment on the Human Development Index (HDI) across regencies and cities in Jambi Province from 2018 to 2024. Using a quantitative approach with secondary panel data, the study applies panel data regression. The results show that the expenditure index, population density, and poverty rate have statistically significant effects on HDI, whereas the unemployment rate and investment are not statistically significant during the study period.

Keywords: *Expenditure Index, Population Density, Poverty, Unemployment, Investment, Human Development Index*

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1. INTRODUCTION

An increase in the Human Development Index (HDI) often accompanies broader improvements in economic and social conditions. Inclusive economic development can help reduce poverty and inequality while improving quality of life. Regional development therefore requires local governments and communities to manage available resources, strengthen public services, and create economic opportunities that support long-term human development.

Economic development is a long-term process aimed at improving productive capacity and population welfare. It encompasses initiatives such as infrastructure investment, improvements in education and health, and technological advancement. Sustainable development therefore is not limited to income growth; it also concerns improvements in human capabilities and living standards (Todaro, 2014).

Economic development aims to improve the quality of human resources in a region. Annual population growth provides potential capital but also poses development challenges. Enhancing human resource quality is crucial because it positively affects public welfare (Todaro, 2014).

The Human Development Index (HDI) is influenced by three main indicators: health, education, and a decent standard of living. Health is reflected in life expectancy, which depends on access to healthcare services, nutrition, and sanitation. Education is measured through average and expected years of schooling, depending on school availability, teaching quality, and families' socio-economic support. Meanwhile, a decent standard of living is determined by per capita expenditure, reflecting income levels, employment opportunities, and access to basic needs such as electricity and clean water. Additional factors including government policies, regional disparities, gender equality, and technological advancement also influence HDI achievement at both national and regional levels.

Several interrelated factors drive the slowdown in Human Development Index (HDI) growth, including unequal access to basic services, economic crises that reduce public purchasing power, and uneven education quality despite rising school participation rates. Furthermore, high stunting rates and health issues hinder improvements in healthy life expectancy, while natural disasters, pandemics, or social conflicts can disrupt the delivery of education and health services. In addition, poorly targeted public policy implementation reduces the effectiveness of national efforts to enhance human resource quality.

Previous studies have examined several determinants of the Human Development Index. Population density has been linked to HDI outcomes in studies by Ahmad and Resha (2023), Antara and Suryana (2020), Ugroseno (2023), and Dey et al. (2024). Unemployment and poverty have also been widely examined as HDI determinants (Anggy et al., 2024; Irpan, 2022; Kasnelly & Jannatin, 2021; Dewi, 2021; Nugraeni, 2021; Ningrum et al., 2020; Maulana et al., 2022). Public expenditure and related development spending have likewise been associated with human development outcomes (Nasution et al., 2025; Nursita et al., 2025; Ningrum et al., 2020; Magdalena et al., 2020). Investment has also been examined in relation to human development (Al-Maadid et al., 2025; Lian et al., 2023).

Other studies have considered economic growth and related labour-market conditions as factors associated with HDI (Primandari, 2020; Izzah & Hendarti, 2021; Indriani & Arif, 2022; Arisman, 2018; Mburamatatare et al., 2025). Taken together, this literature indicates that demographic conditions, poverty, unemployment, expenditure-related measures, investment, and broader economic performance can be relevant to regional human development.

From these studies, several factors influencing the Human Development Index have been identified, including population density, population growth, unemployment, poverty, investment, government expenditure policy, inflation, dependency ratio, labor force, and wage levels.

Although prior studies have examined population density, unemployment, poverty, investment, and various expenditure-related measures as determinants of HDI, the specific expenditure index operationalized in this study has received limited direct attention in the reviewed literature. Because living standards are already a

core dimension of HDI, the expenditure index should be interpreted as a measure related to household purchasing power rather than as government expenditure. This study therefore examines the expenditure index alongside population density, poverty, unemployment, and investment in explaining regional HDI differences in Jambi Province.

Based on the preceding discussion, variations in HDI across Jambi Province may be associated with differences in population density, poverty, unemployment, investment, and household purchasing power. Accordingly, this study examines the effects of the expenditure index, population density, poverty rate, unemployment rate, and investment on the Human Development Index across regencies and cities in Jambi Province.

2. LITERATURE REVIEW

2.1. Human Development Index (Dependent Variable)

According to the United Nations Development Programme (UNDP), the level of a region's development index can be described through several factors: longevity and health, assessed from a health perspective; literacy rate, school participation, and average years of schooling to measure development performance from an educational standpoint; and the community's ability to purchase basic necessities to meet daily needs, evaluated based on average per capita expenditure. The index value ranges from 0 to 100. The UNDP's definition of the Human Development Index (HDI), or Indeks Pembangunan Manusia (IPM), states that HDI is one approach used to measure the level of human development. Since 1990, the UNDP has consistently researched the HDI and published an annual series in a publication titled Human Development Report to assess a country's human development achievements. Although it does not capture all aspects of development, the HDI is considered capable of measuring the fundamental dimensions of human development that reflect the population's basic capability status (UNDP, 2009).

2.2. Independent Variables

2.2.1. Expenditure Index

In this study, the expenditure index represents the standard-of-living dimension associated with household purchasing power rather than government expenditure. Within the HDI framework, living standards are reflected through adjusted per capita expenditure, which captures households' capacity to meet basic needs. A higher expenditure index therefore indicates stronger purchasing power and may be associated with higher human development outcomes (UNDP, 2009).

2.2.2. Population Density

Population density increases when the number of people in a given area rises relative to that area (Rahman, 2023). Population density compares the number of people to the land area they inhabit (Mantra, 2010). Population density indicates the pressure on an area's resources. Density in an area, compared to the land area occupied, is expressed as the number of people per square kilometer.

2.2.3. Poverty

Poverty is a condition in which individuals, households, or families cannot adequately meet basic living needs. Its causes may arise from internal constraints, such as limited education and skills, as well as structural constraints, such as restricted access to economic resources and employment opportunities. Persistent poverty can therefore limit access to education, health services, and an adequate standard of living, all of which are closely related to human development.

2.2.4. Unemployment

Unemployment refers to members of the labour force who are not currently working but are available for work and are actively seeking employment or preparing to start a business. Open unemployment captures individuals seeking work, while underemployment refers to workers whose working hours or employment opportunities remain below their desired level. These labour-market conditions may affect household income and access to resources that support human development.

2.2.5. Investment

Investment refers to expenditure on capital goods that adds to or maintains productive capacity. It includes spending on machinery, infrastructure, buildings, and other durable assets used in production. By expanding productive capacity and supporting employment and income generation, investment can contribute to wider economic and human development outcomes (Mankiw, 2016).

3. METHODOLOGY

This study used a quantitative approach based on secondary annual panel data for the period 2018–2024. The research covered 11 regencies and cities in Jambi Province. We used panel data regression to examine the effects of the expenditure index, population density, poverty rate, unemployment rate, and investment on the Human Development Index. The estimated model is specified as follows:

$$HDI_{it} = \beta_0 + \beta_1 EI_{it} + \beta_2 PD_{it} + \beta_3 PR_{it} + \beta_4 UER_{it} + \beta_5 INV_{it} + e_{it}$$

Description:

- HDI : Human Development Index (Index)
- EI : Expenditure Index (Index)
- PD : Population Density (People/Km²)
- PR : Poverty Rate (%)
- UER : Open Unemployment Rate (%)
- INV : Investment (Rp)
- β_0 : Constant
- $\beta_1 - \beta_5$: Regression Coefficients
- i : Cross-section data of 11 regencies and cities in Jambi Province
- t : Time Series (2018 – 2024)
- e : error term (Residual Error)

The F-statistic assessed whether the independent variables jointly explain variation in the dependent variable, while the t-statistic evaluated the statistical significance of individual regression coefficients. The coefficient of determination (R^2) indicated the proportion of variation in HDI explained by the model. We evaluated statistical significance at $\alpha = 0.05$.

4. FINDINGS AND DISCUSSION

The analysis examines the effects of the expenditure index, population density, poverty rate, unemployment rate, and investment on HDI across 11 regencies and cities in Jambi Province using annual data from 2018 to 2024. The cross-sectional units comprise Batang Hari, Bungo, Merangin, Muaro Jambi, Sarolangun, West Tanjung Jabung, East Tanjung Jabung, Tebo, and Kerinci regencies, together with Jambi City and Sungai Penuh City. Based on the model-selection tests reported by the authors, the authors selected the Fixed Effects Model (FEM) for estimation.

Table 1 Estimation Results of the Fixed Effects Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.83752	3.683712	3.756408	0.0004
EI	0.822061	0.045502	18.06665	0.0000
PD	0.001088	0.000359	3.027353	0.0036
PR	-0.336243	0.110630	-3.039362	0.0035
UER	0.074676	0.048795	1.530421	0.1311
INV	-1.27E-14	1.34E-13	-0.094909	0.9247
Fixed Effects (Cross)				
BTH--C	1.331098			
BNG--C	-3.793416			
MRN--C	-0.384283			
MJ--C	2.090192			
SRN--C	-3.003971			
TJB--C	0.573617			
TJT--C	-1.071129			
TB--C	-1.362113			
KJ--C	0.849406			
KSP--C	3.387302			
KCI--C	1.383296			
Effects Specification				
Cross-section fixed (dummy variables)				
Root MSE	0.277171	R-squared		0.994254
Mean dependent var	70.99675	Adjusted R-squared		0.992841
S.D. dependent var	3.680352	S.E. of regression		0.311407
Akaike info criterion	0.687218	Sum squared resid		5.915415
Schwarz criterion	1.174242	Log likelihood		-10.45788
Hannan-Quinn criter.	0.882023	F-statistic		703.6275
Durbin-Watson stat	1.755056	Prob(F-statistic)		0.000000

Source: Processed Data, 2026

Using the FEM specification, the estimated panel-data regression equation from Table 1 is:

$$\text{HDI} = 13.83752 + 0.822061 \text{ EI} + 0.001088 \text{ PD} - 0.336243 \text{ PR} + 0.074676 \text{ UER} - 1.27\text{E-}14 \text{ INV}$$

The estimated constant is 13.83752. Because a value of zero for all predictors is outside the realistic range of the observed regional data, the constant is best treated as a model intercept rather than given a substantive interpretation. The regression coefficients are interpreted in the original units of the variables, holding the other predictors constant.

The expenditure index coefficient is 0.822061, indicating that a one-unit increase in the expenditure index is associated with a 0.822061-point increase in HDI, *ceteris paribus*. The population-density coefficient is 0.001088, indicating that an increase of one person per square kilometre is associated with a 0.001088-point increase in HDI. The poverty-rate coefficient is -0.336243, meaning that a one-percentage-point increase in poverty is associated with a 0.336243-point decrease in HDI. The unemployment-rate coefficient is 0.074676, but this relationship is not statistically significant. The investment coefficient is -1.27E-14 and is also not statistically significant; therefore, the model provides no evidence of a systematic investment effect on HDI during the study period.

F-statistic Test

The F-statistic tests whether the independent variables are jointly associated with HDI. As shown in Table 1, $\text{Prob}(F\text{-statistic}) = 0.000000$, which is below $\alpha = 0.05$. The model is therefore statistically significant overall, indicating that the expenditure index, population density, poverty rate, unemployment rate, and investment jointly explain variation in HDI across the regions and cities studied.

t-statistic Test

The t-statistic evaluates each predictor's individual contribution at $\alpha = 0.05$. Based on the FEM results, the expenditure index ($p = 0.0000$), population density ($p = 0.0036$), and poverty rate ($p = 0.0035$) are statistically significant. In contrast, the unemployment rate ($p = 0.1311$) and investment ($p = 0.9247$) are not statistically significant. Thus, the data support significant associations of the expenditure index, population density, and poverty rate with HDI, but do not provide evidence of significant unemployment or investment effects during 2018–2024.

Coefficient of Determination (R^2)

The FEM produced an R^2 of 0.994254, indicating that approximately 99.43% of the observed variation in HDI is explained by the included predictors and the model's fixed-effects structure. The remaining variation is attributable to factors not captured by the model and random error. Given the high R^2 , interpretation should focus on the estimated relationships within this sample rather than claims of universal explanatory power.

Fixed Effect Model Intercept

Based on Table 1, the estimated fixed effects capture time-invariant differences among the regencies and cities after controlling for the observed predictors. Relative to the common intercept, Batang Hari (+1.331098), Muaro Jambi (+2.090192), West Tanjung Jabung (+0.573617), Jambi City (+0.849406), Sungai Penuh City (+3.387302), and Kerinci (+1.383296) have positive entity effects, whereas Bungo (-3.793416), Merangin (-0.384283), Sarolangun (-3.003971), East Tanjung Jabung (-1.071129), and Tebo (-1.362113) have negative entity effects. These values are HDI index-point deviations, not percentage changes.

These fixed effects capture persistent regional differences not explained by the observed predictors. The significant positive association of population density is consistent with prior studies reporting links between density and HDI (Ahmad & Resha, 2023; Ugroseno, 2023; Dey et al., 2024), while the significant negative association of poverty is consistent with literature identifying poverty as an important determinant of human development (Nugraeni, 2021; Ningrum et al., 2020; Maulana et al., 2022). The positive expenditure-index result should be interpreted cautiously because purchasing power is conceptually related to the standard-of-living dimension of HDI. Unemployment and investment were not statistically significant in this regional panel, indicating that their effects may depend on other economic or institutional conditions not captured in the model.

5. CONCLUSION

The panel data regression results show that the expenditure index, population density, poverty rate, unemployment rate, and investment jointly explain HDI variation across regencies and cities in Jambi Province during 2018–2024. At the individual level, the expenditure index and population density are significantly and positively associated with HDI, while poverty is significantly and negatively associated. The unemployment rate and investment are not statistically significant in the estimated model.

The findings suggest that regional development policy should prioritize improving household purchasing power, reducing poverty, and improving the quality and accessibility of basic services such as education, health, and transportation. Policies that support investment and employment remain important for broader development objectives, although these variables were not statistically significant predictors of HDI in the present model. Future studies may incorporate additional socioeconomic and institutional variables and longer observation periods to assess the robustness of these relationships.

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7. CONFLICT OF INTEREST

The authors declare no known competing financial interests or personal relationships that could have influenced the work reported in the paper.

8. AUTHOR CONTRIBUTION STATEMENT

Lesly Ghina Devinala contributed to conceptualization, research design, and preparation of the original draft.

Syamsurrijal Tan contributed to data collection, analysis, and result validation.

Etik Umiyati contributed to supervision, critical review, and editing. Siti Khodijah and Nurhayani contributed to manuscript review and final approval.

All authors have read and approved the final version of the manuscript.

9. ETHICS STATEMENT

This study used secondary, aggregate regional data and did not involve direct interaction with human participants. No personally identifiable information was collected or analyzed; therefore, participant informed consent was not applicable. The data were used solely for academic research purposes.

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