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The Effect of Capital Expenditure, Labor,and Human Development Index Gross Regional Domestic Product Per Capita In East Java Province from 2013 to 2023

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ABSTRACT
This study aims to analyze the effect of capital expenditure, infrastructure and the Human Development Index (HDI) on Gross Regional Domestic Product (GRDP) in East Java Province. Using secondary data obtained from the Central Statistics Agency (BPS) and related agencies during the period 2013_2023, the analysis was conducted using the Panel Data regression method the results show that capital expenditure has a significant positive effect on GRDP, indicating that labor contributes to economic growth. In addition, good labor is also proven to contribute positively to GRDP, while HDI shows a significant effect, reflecting the importance of human resource quality
in driving economic growth. This study recommends increasing capital expenditure and labor as the main strategies in driving economic growth in East Java Province

Keyword*: Economic Growth, Gross Domestic Product, Capital Expenditure, Human Development Index, Labor.*

INTRODUCTION

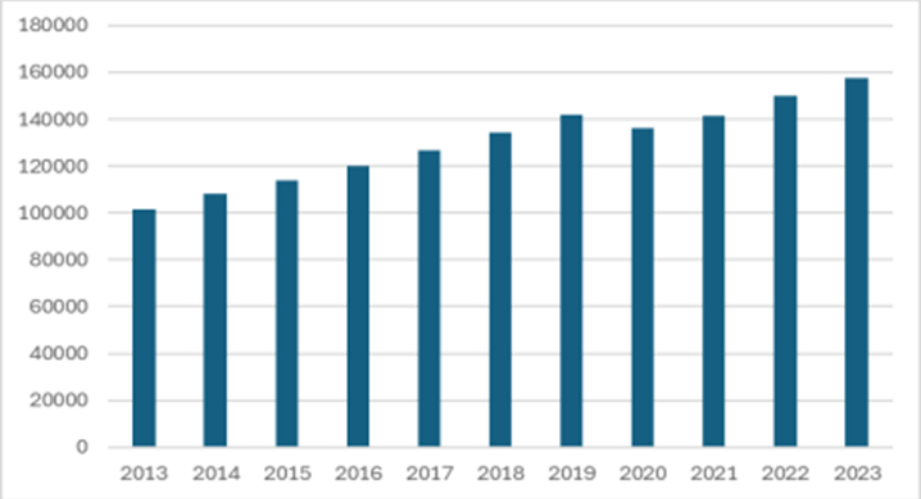
Economic growth is one of the main indicators in assessing the welfare of a country or region. In Indonesia, Regional Gross Domestic Product(RGDP) is an important measure that reflects the total value of goods and services produced in periodhg. East Java Province, as one of the provinces with the largest economic contribution in Indonesia, faces challenges and opportunities in its efforts to accelerate its economic growth from year to year (Ramadhan et al., 2023). With a dense population and abundant natural resources, East Java has great potential to increase its GRDP through effective management of various growth drivers (Muzzakar et al., 2023). Previous studies by Yuswara (2020) and Chandra & Badrudin (2024) show that capital expenditure has a significant positive effect on GRDP, while several other studies find insignificant results. These differences in results indicate an empirical gap regarding the effect of capital expenditure on regional economic growth.

Labor and HDI are also important factors in driving economic growth, but there are still disparities between districts/cities in East Java in terms of labor productivity and human resource quality. Research by Mukkaramah and Zulkarnain (2004) shows that HDI has a positive effect on GRDP in Aceh, but similar research in East Java is still limited, especially with the latest data after the Covid- 19 pandemic. Therefore, this study aims to analyze the effect of capital expenditure, labor and HDI on GRDP in East Java Province for the period 2013-2023, as an effort to fill the research gap and provide the latest empirical

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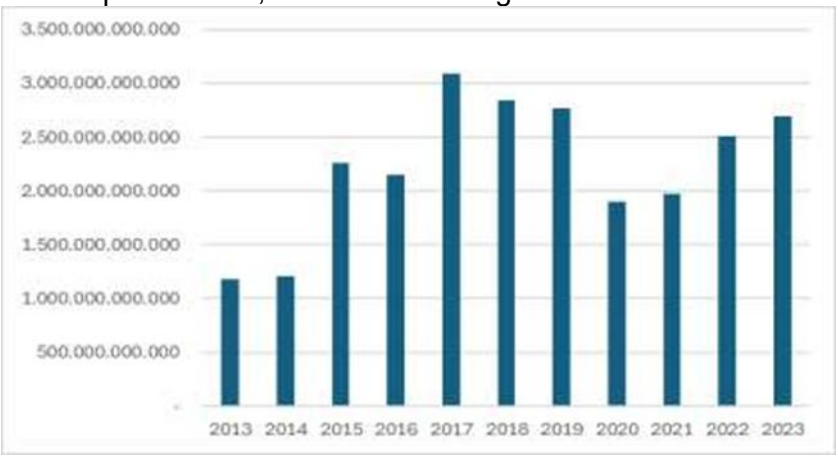
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evidence on the factors that influence regional economic growth.



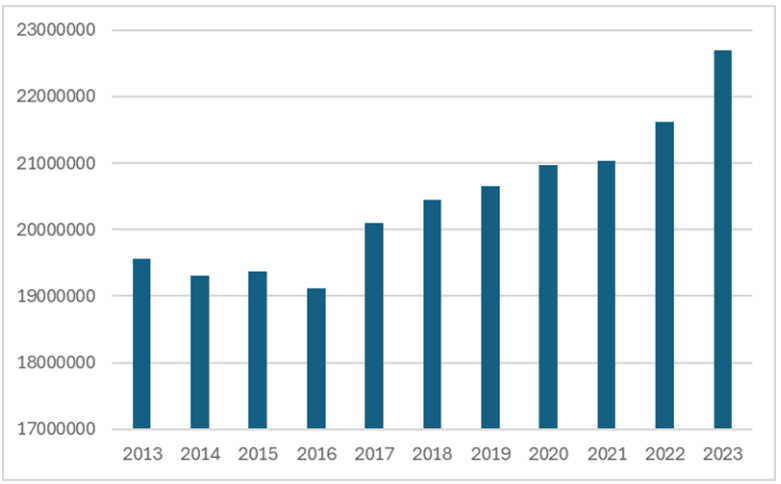
Graph 1
Constant Price Per Capita GRDP of
East Java Province for the Period 2013-2023

The graph above shows the development of per capita GRDP in East Java Province from 2013-2023. Overall, the value of per capita GRDP has increased from year to year. This shows that the economy of East Java continues to grow and the welfare of its people is also improving. Although there was a slight decline or slowdown in 2020 due to Covid-19 (Wulandari, 2025), the economy in East Java recovered and showed significant growth until 2023. This trend illustrates positive and sustainable economic growth over the last decade (Hapsari, 2022). A study by (Bayliss et al., 2021) shows that although private involvement can accelerate infrastructure development, the largest contribution still comes from public financing, especially in developing countries with fiscal constraints. Thus, the role of local governments through efficient capital expenditure allocation is crucial in ensuring inclusive an sustainable infrastructure development. Effective infrastructure development can create jobs, enhance regional competitiveness, and facilitate the growth of other economic sectors.



Graph 2
Capital Expenditure of East Java Province for the period 2013-2023

The graph shows the development of East Java Province's capital expenditure form 2013-2023. At the beginning of the period, namely in 2013 and 2014, the value of capital expenditure was still relatively low, entering 2015 to 2017, there was a significant increase, reaching its peak in 2017, indicating an increase in local government investment in infrastructure and public facilities. However, after that, capital expenditure declined slightly in 2018 and 2019. A sharper decline was seen in 2020 to 2021, possibly due to the impact of the covid-19 pandemic, which made the government more focused on health care and social assistance. After the pandemic subsided, in 2022 and 2023 capital expenditure increased again, indicating economic recovery and local government efforts to strengthen development in various sectors. Overall, East Java's capital expenditure tends to fluctuate but has shown a positive trend in recent years (Chandra & Badrudin, 2024). (Yuswara, 2020) research shows that capital expenditure has a positive and significant effect on the Gross Regional Domestic Product (GRDP) in regencies and cities in East Java Province. An increase in local government capital expenditure, especially for the development of public facilities and infrastructure, has proven to be able to drive economic activity and increase regional output. Eith the availability of adequate infrastructure, the efficiency of goods and service distribution increases, community productivity is boosted, and ultimately there is an increase in GRDP.



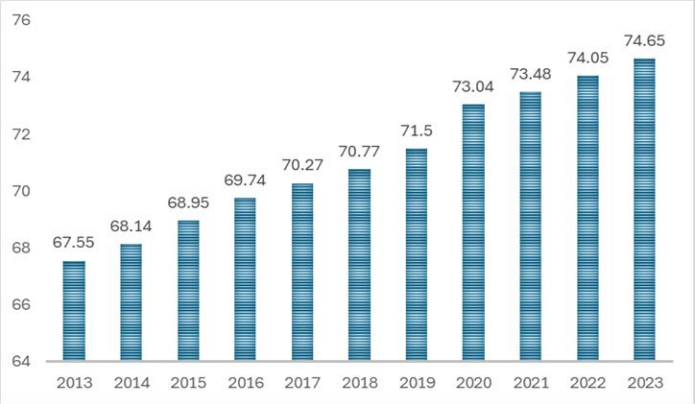
Graph 3
East Java Labor Force in 2013-2023

The graph shows that the number of workers in East Java Province Continued to increase from 2013 to 2023. At the beginning of period,specifically between 2013 and 2016, the number of workers tended to be stable and even declined slightly in 2016. However, after that, starting in 2017, the number increased significantly and continued to grow every year, the number increased occurred 2023, indicating that East Java's economic conditions are improving and more jobs are becoming available. Overall, it can be said that since 2017, labor force growh in East Java has been quite strong and continues to show positive development. The result of research by Siwi et al., (2022) found that the workforce has a significant contribution to economic growth on the island of Java, including in East Java. Through a Cobb-Douglas growth model analysis, the study shows that

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an increase in the number of workers has a positive impact on the increase in Regional Gross Domestic Product (PDRB). This indicates that labor force growth not only reflects improving economic conditions but is also one of the main factors driving regional output growth. Thus, the increase in the labor force in East Java since 2017 can be attributed to strong economic expansion and increased productivity in key sectors in the region.



Graph 4
East Java Province Human Development Index 2013-2023

The graph shows the development of the Human Development Index (HDI) of East Java Province in 2013 and 2014. In 2013, the HDI value was recorded at 67.55, then increased to 68.14 in 2014. This increase indicates an improvement in the quality of life of the community, especially in terms of education, health, and decent living standards. The increase in the HDI reflects that the local government has begun to succeed in improving community access to basic services such as education and health. Although the increase is not too significant, this positive trend indicates gradual progress in human development in East Java from year to year (Awary & Nilasar, 2025).

The results of research by (Mukarramah et al., 2024) show that the HDI has a positive and significant effect on the Gross Regional Domestic Product (GRDP) in districts and cities in Aceh Province, with a coefficient of determination of 49.8 percent. This means that an increase in the HDI can explain almost half of the variation in GRDP growth in the region. The study also confirms that the better the level of health, education, and income of the community, the higher the ability of the population to produce and contribute to regional economic growth. In this context, it is important to understand how HDI can affect GRDP, as well as how capital expenditure and infrastructure development can play a role in increasing HDI and strengthening the regional economic foundation.

This study has gaps compared to previous studies. Several previous studies, such as(Handayani et al., 2019), (Arisma & Robertus, 2024), and (Ariyadi & Nilasari, 2025), examined the influence of economic variables on regional growth in general, but none specifically examined the regencies and cities of East Java Province. This has created a regional gap, as East Java has a large and diverse economy but has not been studied in depth. In addition, there is a variable gap, as previous studies have not simultaneously combined the variables of capital expenditure, labor, and human development index (HDI) as determinants of economic welfare. This study also fills a time gap by using data

from 2013 to 2023, covering the periods before, during, and after the COVID-19 pandemic, thereby providing a more complete picture of regional economic changes. In terms of methodology, the use of a panel data model with per capita GRDP variables is a more representative innovation in measuring community welfare compared to previous studies that only looked at total economic growth. Thus, the novelty of this study lies in its focus on the East Java region, its long analysis period, its more comprehensive integration of variables, and its use of panel data methods that are able to describe regional economic dynamics more accurately and relevantly for regional development policies. According to (Becker, 1965) Human Capital Theory argues that investment in human resources has a major influence on increasing productivity, and that this increase in labor productivity can be encouraged through education and training. Education is a thoughtful and organized process that creates a learning environment and experience where students actively work on developing their abilities in areas like religious and spiritual strength, self-discipline, personality, intelligence, good character, and the skills they need for themselves, their community, their country, and the nation.

The neoclassical economic growth theory developed by Solow and Swan explains that economic growth is determined by three main factors, namely capital (K), labor (L), and technological progress (A), which are formulated in the production function Y f(K. L. A). In the context of this study, capital and infrastructure spending represent physical capital (K), which plays a role in increasing regional production capacity, while the Human Development Index (HDI) reflects human capital (L), which drives increased labor productivity. When supported by efficiency and technological progress, these two factors will increase regional economic output as reflected in the GRDP. Thus, this theory

RESEARCH METHOD

This research focuses on the East Java Province area, which administratively consist of 38 districts and cities. The analysis examines how capital expenditure, labor, and the Human Development Index (HDI) influence the Gross Regional Domestic Product (GRDP) across these regions during 2013-2023. The dataset combines ten years of time series data with cross sectional information for all districts/cities, forming a balance panel.

Data on capital expenditure were compiled from several official documents, including the realization reports of the East Java Regional Budget (APBD) available through the Directorate General of Fiscal Balance, supplemented by publications such as East Java in Figures and other statistical releases from Badan Pusat Statistik (BPS)). Meanwhile, HDI and GRDP indicators were gathered from the BPS East Java portal and supported by secondary materials (academic papers and government reports) to ensure consistency and completeness.

The study applies a quantitative approach using panel data regression. To identify the most appropriate model, three specifications Common Effect, Fixed Effect, and Random Effect were estimated and compared based on their statistical fit and explanatory capability regarding interregional economic variation.

Panel data regression refers to a statistical technique applied to datasets that contain both time-series and cross-sectional dimensions. In other words, this approach enables researchers to analyze multiple observational units across

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different time periods simultaneously. According to Gujarati (2013), this method provides a framework for integrating variations that occur between entities and over time, offering richer information than using either data type alone.

Common Effect Model (CEM)

In the Common Effect Model (CEM), all data are combined without considering time and individuals, so that there is only one data set consisting of dependent and independent variables. Thus, this model is similar to a general linear regression model.

The model equation for CEM is shown in the equation

Yit = b0 + xitβ + eit ;i = 1, 2,..., N;t = 1, 2,...,T

Where:

Yit = value of the dependent variable for cross-section unit i for period t

b0 = the intercept or cross-section constant

xit = vector of independent variables sized (1 x k)

β = [b1 b2 ... bk] slope vector or regression coefficient for k independent variables of size (k x 1)

eit = unit cross section error term for the i-th unit in the t-th period; eit ~N (0,s 2)

Fixed Effect Model (FEM)

To address differences that may exist among individual cross-sectional units in a panel dataset, one approach is to allow each unit to have its own intercept term while maintaining a commonly referred to as the Fixed Effect Model (FEM), which caputres unobserved heterogeneity trough the variation in intercepts.

Yit = b0 + xitβ + eit

Yit = b0 + xitβ + eit

Where:

Yit: the value of the dependent variable of the i-th cross-section unit for the t-th period

β0 = intercept or constant of the i-th cross-section unit

Xit = [xit1, xit2, …, xitk] independent variable vector of size (1 x k)

β = [b1 b2 ... bk] slope vector or regression coefficient for k independent variables of size (k x 1)

εit = unit cross section error for the i-th unit for the t-th period; eit ~N (0,s 2) The equation model in this study is:

$$\ln (PDRBpcit) = \beta 0 + \beta 1 \ln(BMit) + \beta 2 \ln(TKit) + \beta 3 IPMit + \varepsilon it$$

Explanation:

PDRB = Gross Regional Domestic Product

ln = natural logarithm

a0 = Constant

a1a2a3= regression coefficients for each variable

BM =Capital Expenditure

TK = Labor

HDI = Human Development Index

e = error term

Random Effect Model (REM)

In the Random Effects Model (REM) framework, it is assumed that the intercept term (β_{0i}) for each cross-sectional unit is not fixed but rather behaves as a random variable that follows a distribution with a mean value of β_0 and a variance denoted by σ_e^2. This formulation implies that individual-specific effects are randomly drawn from a common distribution, and the resulting model can be expressed as shown in the following equation.

$$\beta 0i=\beta 0+\varepsilon i;\varepsilon i\sim N(0,\sigma 2)$$

Explanation :
β0i : Intercept specific to unit i
β0 : General average intercept for all units
εi : Random component describing the deviation of the intercept of the i^(th) unit from the overall mean
εi~N(0,σ2) : Indicates that the random component (\varepsilon_i) is normally distributed with mean zero and variance (\sigma^2)

RESULTS AND DISCUSSION

Results

The data analysis was conducted using Stata 17 based on the predetermined model specification. The output presents the estimated relationship between the independent and dependent variables, describing how each explanatory variable influences the response variable

Table 1 Common Effect Test Estimation Results

ln_Y	Coef	Std. Err.	t	P>|t|	[95% Conf. Interval]	
ln_X1	.2588947	.0452517	5.72	0.000	.1699429	.3478465
ln_X2	.0570676	.0279418	2.04	0.042	.0021422	.1119931
X3	.0041824	.0004003	10.45	0.000	.0033955	.0049693
_cons	2.675096	.3000231	8.92	0.000	2.085338	3.264855

Sourch: data processed

As shown in Figure 1, the coefficient for capital expenditure is 0.2539 with a probability level of 0.000, suggesting a strong and statistically significant positive relationship between government spending on capital projects and regional income per capita. The labor variable yields a coefficient of 0.0571 (p = 0.041), indicating that a higher level of labor absorption tends to correspond with higher per capita GRDP. Similarly, the Human Development Index (HDI) registers a coefficient of 0.0048 (p = 0.000), underscoring that improvements in education, health, and overall human capacity contribute positively to regional output.

The F-statistic of 40.22 (p = 0.000) confirms the joint significance of all three explanatory variables, meaning that they collectively influence the economic performance of East Java Province during the 2013–2023 period. However, the R^2 value of 0.2357 implies that the model accounts for approximately 23.57% of the variation in per capita GRDP, while the remaining variation may be attributed to other macroeconomic or institutional factors not captured within this specification.

Table 2. Fixed Effect Data Analysis Results

ln_Y	Coef.	Std. Err.	T	P>|t|	[95% Conf. Interval]	
ln_X1	.1265157	.0226296	5.59	0.000	.0820196	.1710119
ln_X2	.0070061	.0122392	0.57	0.567	-.0170596	.0310717

X3	.0053025	.0003399	15.60	0.000	.0046342	.0059707
cons	3.359444	.1484976	22.62	0.000	3.067457	3.651431

Sourch: data processed

The results of the fixed effect estimation reveal varying levels of influence from each independent variable on East Java's per capita GRDP during 2013–2023. Capital expenditure shows the largest contribution, indicated by a coefficient value of 1.1265 with a probability of 0.000. This suggests that an increase in regional government spending tends to raise the per capita income level significantly. In contrast, the labor variable has a coefficient of 0.0071 with a probability of 0.567, implying that employment growth does not exert a statistically meaningful impact on regional income within the observed period. Meanwhile, the Human Development Index (HDI) demonstrates a positive and strong relationship with economic growth, reflected by a coefficient of 0.6153 and a probability value of 0.000. Jointly, the model produces an F-statistic of 52.53 ($p < 0.05$), confirming that capital expenditure, labor, and HDI together influence GRDP per capita significantly. The R-squared value of 0.4241 indicates that about 42.41% of the variation in per capita GRDP is explained by these three predictors, while the remaining portion is influenced by other unobserved economic or social factors. These findings highlight that fiscal allocation and human development play more dominant roles compared to labor in driving economic performance at the regional level.

Tabel 3. Random Effect Test Results

ln_Y	Coef.	Std. Err.	T	P>|t|	[95% Conf.	Interval]
ln_X1	.1304817	0225103	5.80	0.000	.0863622	.1746011
ln_X2	.0090741	.012182	0.74	0.456	-.0148022	.0329504
X3	.0051989	.00033	15.75	0.000	.0045521	.0058457
_cons	3.349666	.1995363	16.79	0.000	2.958582	3.74075

The estimation results using the Random Effect Model (REM) illustrate how each explanatory variable contributes to changes in East Java's per capita GRDP during the 2013–2023 period. The capital expenditure variable shows a coefficient of 1.1346 with a probability value of 0.000, signifying that increases in government capital spending are strongly associated with higher regional income levels. In contrast, the labor variable records a coefficient of 0.0097 and a probability of 0.426, suggesting that fluctuations in employment do not produce a statistically significant impact on GRDP per capita, as the p-value exceeds the 0.05 significance threshold. Furthermore, the Human Development Index (HDI) exhibits a coefficient of 0.6152 with a probability value of 0.000, confirming that improvements in human development contribute positively and significantly to the rise in per capita GRDP in East Java. The Chi-square statistic of 283.56 ($p < 0.05$) implies that, collectively, capital expenditure, labor, and HDI jointly explain variations in regional economic performance over the observed decade. These results reinforce the notion that fiscal capacity and human capital development remain the most influential components of regional economic growth.

Table 4. Chow Test Results

F test that all u_i=0: F(37, 377) = 73.09

Prob > F = 0.0000

The result of the Chow test shows an F-statistic value of 73.09 with a significance level of 0.000. This indicates that the null hypothesis, which assumes that the common effect model is sufficient, must be rejected at the 5% level. Therefore, the fixed effect model is statistically more suitable for capturing the individual variations in the dataset.

Table 5. Hausman Test Results Hypothesis

	---- Coefficients -			
	(b)	(B)	(b-B)	Sqrt (diag(V_b V_B))
	Fe	Re	Difference	S.E.
ln_X1	.1265157	.1304817	-.0039659	.0023208
ln_X2	.0070061	.0090741	-.002068	.001182
X3	.0053025	.0051989	.0001036	.0000813

Based on the Hausman specification test, the null hypothesis (H_0) assumes that the random effects estimator is consistent and therefore more suitable, while the alternative hypothesis (H_1) suggests that the fixed effects model should be applied. The test yielded a Chi-square statistic of 3.94 with a probability value of 0.2684, which exceeds the 0.05 significance threshold. Consequently, there is insufficient evidence to reject H_0, indicating that the random effects model provides a more efficient and appropriate estimation for this panel data set.

Table 6. Lm Test Result

	Var	sd = sqrt(Var)
ln_Y	.9475308	.9734119
e	.0992895	.3151024
u	.6829425	.8264034

Hypothesis formulation:
H0: The data fit better under the common effect model.
H1: The data fit better under the random effect model.
Based on the test output, the chi-square statistic is 1457.52 with a significance level of 0.000. Since the p-value is below the 0.05 threshold, the null hypothesis (H0) is rejected. Consequently, the random effect model is considered the most suitable specification for this panel data analysis.

DISCUSSION

The results of the Common Effect Model (CEM) test show that this model assumes there are no differences in characteristics between regions or over time, so all data is treated as the same. In other words, every district or city in East Java is thought to have the same effect on the dependent variable, such as GRDP. The numbers for each variable show whether the variable helps or hurts GRDP, where a positive number means it helps and a negative number means it

hurts. The p-value tells us how important a variable is. If the p-value is less than 0.05, it means the variable has a strong effect on GRDP with 95% confidence. The R-squared value shows how well the model explains changes in GRDP using the other variables, with higher values meaning the model explains more. Overall, the Common Effect test is the first step in analyzing panel data, and it helps decide whether to use Common Effect, Fixed Effect, or Random Effect models in further testing like the Chow Test and Hausman Test.

Based on the estimation results using the Fixed Effect Model (FEM), the constructed model demonstrates a very high level of explanatory capability (R^2 = 0.995792; Prob(F-statistic) = 0.0000). This finding implies that variations in Gross Regional Domestic Product (GRDP) can be largely explained by the combined influence of capital expenditure, infrastructure development, and the Human Development Index (HDI). When these factors are examined individually, each shows a positive and statistically significant relationship with GRDP. In practical terms, regions that allocate greater spending on productive infrastructure and invest in improving human resources tend to experience stronger economic performance. This supports the notion that fiscal and social investment policies are crucial in sustaining regional growth dynamics.

Based on the estimation output obtained through the Random Effect Model (REM), the R-squared value of 0.9613 implies that nearly 96% of the variation in regional income (GRDP) can be explained by the explanatory variables included in the model. In other words, capital expenditure, infrastructure development, and the Human Development Index (HDI) jointly account for most of the changes in regional economic performance, while the remaining portion reflects other external factors that were not captured in this model such as demographic dynamics, local policies, or investment from the private sector.

The Prob (F-statistic) value of 0.0000 confirms that these three variables simultaneously have a statistically significant influence on GRDP at the 5% confidence level. Each variable contributes in a different way: (1) capital expenditure shows a positive and significant relationship, indicating that increased government investment in fixed assets enhances productive capacity; (2) infrastructure improvement fosters better economic accessibility and efficiency, thus accelerating regional activity; and (3) a higher HDI reflects better human capital quality, which tends to increase productivity and support sustainable economic expansion.

Collectively, these results highlight that economic growth in East Java is not only dependent on financial and physical inputs, but also on the quality of human development. Strengthening these three components simultaneously can therefore create a multiplier effect on regional output and welfare. Furthermore, the Chow test result reveals that the Cross-section F probability (0.0000) is smaller than the significance level (α = 0.05), which means that the null hypothesis is rejected. Hence, the Fixed Effect Model (FEM) is considered more appropriate than the Common Effect Model (CEM) for this study. This outcome suggests that there are unique characteristics among districts and cities in East Java such as differences in fiscal capacity, infrastructure readiness, and human capital that influence how capital expenditure, infrastructure, and HDI affect GRDP across regions. These findings underline the importance of context-sensitive policy design tailored to each region's socioeconomic conditions.

The Hausman test output presented in the results table shows a cross section random probability value of 0.0000, which is below the significance

threshold of 0.05. This statistical outcome implies that the null hypothesis (H_0) is rejected, leading to the selection of the Fixed Effect Model (FEM) as a more suitable estimation approach than the Random Effect Model (REM). The implication of this finding is that heterogeneity across districts and cities in East Java plays a crucial role in explaining variations in the Regional Domestic Product (RDP). In other words, regional characteristics such as differences in resource endowments, governance quality, and local economic structure appear to significantly influence RDP performance.

Meanwhile, the Lagrange Multiplier (LM) test results indicate a Breusch Pagan probability value of 0.0000, also smaller than the 0.05 significance level. Consequently, the null hypothesis is rejected, confirming that the Random Effect Model (REM) provides a better fit compared to the Common Effect Model (CEM). This outcome reinforces the notion that individual specific effects are present among East Java's regions, suggesting that the impact of capital expenditure, infrastructure development, and human development (HDI) on RDP is not homogeneous. Each district/city exhibits distinct economic responses, reflecting variations in policy capacity and regional development priorities.

CONCLUSION

The purpose of this research is to examine how regional capital expenditure, infrastructure development, and the Human Development Index (HDI) influence the Regional Domestic Product (RDP) in East Java Province. Through a multiple regression approach, the findings indicate that the three variables jointly play an important role in explaining variations in regional income levels.

The empirical evidence suggests that higher government capital expenditure tends to strengthen the region's economic base. Such spending generally supports the provision of infrastructure and public facilities that encourage private investment and stimulate productive activity. When capital spending is directed effectively, it contributes to better infrastructure quality and operational efficiency, which in turn enhances regional productivity.

The labor variable also shows a positive association with RDP, meaning that increased absorption of productive workers supports higher regional output. In other words, the availability of qualified labor represents one of the key inputs in sustaining economic expansion, as the growth in employment can expand production capacity and diversify local economic activities. HDI also shows a significant positive influence on GRDP. The quality of human resources, as reflected in education and health, plays an important role in increasing productivity. People who are well educated and in good health tend to be more innovative and able to contribute more to economic growth.

The findings of this study suggest that achieving sustainable economic growth in East Java requires a strategic balance between public investment and human capital development. In particular, strengthening capital spending should be directed toward infrastructure that supports productivity, while parallel efforts are needed to expand access to quality education and preventive health programs. These priorities are expected to enhance labor efficiency and regional competitiveness. Accordingly, this research emphasizes the importance of localized policy design encouraging the provincial government to align fiscal planning with community-based initiatives so that economic growth can translate more effectively into improved social welfare.

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