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# Socioeconomic Determinants Of Agricultural And Mining Sector Growth In Resource-Based Regions: Evidence From Bangka Belitung Province

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## Abstract

*Resource-dependent regions often rely on agriculture and mining as the main drivers of regional economic growth. However, previous studies have largely examined regional growth using aggregate indicators, providing limited evidence on whether socioeconomic determinants operate differently across individual resource-based sectors. This study investigates the effects of employment, education, working hours, gender composition, formal and informal wages, health conditions, and Gross Fixed Capital Formation on agricultural and mining sector growth in Bangka Belitung Province, Indonesia. Using balanced panel data for seven districts and municipalities during 2020–2024, the study employs panel data regression, with the Fixed Effect Model selected as the preferred specification. The results indicate that life expectancy is the only socioeconomic variable that positively and significantly affects agricultural sector growth, whereas none of the examined socioeconomic variables significantly explain mining sector growth. These findings demonstrate that the determinants of economic growth differ across resource-based sectors and highlight the importance of sector-disaggregated analysis in understanding regional economic performance. The study contributes to the literature by providing evidence from an island resource-dependent economy and offers policy insights for designing more targeted and sustainable regional development strategies.*

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## 1. Introduction

Regional economic growth in resource-dependent regions is strongly influenced by the structure and performance of primary sectors, particularly agriculture and mining. Classical and neoclassical growth theories emphasize that economic expansion is driven by the accumulation of labour, capital, and technological progress, which together determine production capacity and long-run productivity (Mankiw et al., 1992; Solow, 1956). However, the growth trajectory of resource-rich regions often differs from that of more diversified economies. The abundance of natural resources can generate substantial short-term economic gains while simultaneously discouraging investment in human capital, innovation, and industrial diversification, resulting in the well-documented resource curse phenomenon (Badeeb et al., 2017; Mousavi & Clark, 2021; Wu et al., 2018). Consequently, recent studies increasingly argue that sustainable economic growth in resource-dependent regions depends not merely on natural resource endowments but also on the quality of human capital, public health, institutional capacity, and productive investment (Epo & Nochi Faha, 2020; Faisal et al., 2025; Mehlum et al., 2006; Umair et al., 2024).

Bangka Belitung Province represents a typical island economy whose economic structure remains highly dependent on resource-based sectors. Tin mining has historically served as the province's principal economic engine, while agriculture including plantation crops, fisheries, and food crop production continues to play a crucial role in supporting regional income generation and employment (Asmiani et al., 2023; Sulista & Rosyid, 2022). Previous studies consistently identify agriculture and mining as the province's dominant base sectors and major contributors to regional economic activity (Susanto, 2019; Widiarsih, 2016). Nevertheless, despite their shared dependence on natural resources, these sectors exhibit fundamentally different production structures. Agriculture remains predominantly labour-intensive and closely associated with rural livelihoods, household welfare, and public health, whereas mining increasingly relies on capital-intensive production processes, technological advancement, skilled labour, and operational efficiency (Heimann et al., 2023; Miah et al., 2024; Panjaitan et al., 2023). These structural differences suggest that the socioeconomic determinants of growth may not operate uniformly across sectors.

The broader literature consistently recognises human capital as one of the most important drivers of productivity and long-run economic growth (Leoni, 2025; Oltulular, 2025; Rondón-Castillo et al., 2026). Education enhances workers' knowledge, adaptability, and technical capability, thereby improving production efficiency and facilitating technological adoption (Barro & Lee, 2013; Hanushek & Woessman, 2020; Kokkinopoulou et al., 2025; Zhao et al., 2026). Likewise, better health conditions strengthen labour productivity by reducing absenteeism, increasing work capacity, and improving workforce participation (Bloom & Canning, 2008; Umair et al., 2024; Yang, 2020). In resource-based economies, the interaction between labour quantity and labour quality becomes particularly important because productive sectors increasingly require both adequate workforce availability and

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higher levels of technical competence. Empirical evidence further suggests that regions with stronger human capital are more resilient to commodity price volatility, diversify more rapidly, and achieve more sustainable economic growth than regions relying solely on natural resource extraction (Jahanger et al., 2022; Jolo et al., 2022; Li & Gao, 2025; Rahman et al., 2022).

Beyond human capital, welfare conditions and investment also shape regional economic performance. Wage levels influence household purchasing power, local demand, and investment behaviour, particularly in regions where primary sectors account for a substantial share of total employment (Beraja et al., 2019; Fontanari, 2024; Haryana, 2020; Santoso et al., 2022). Conversely, stagnant wage growth may weaken household consumption, reduce local multiplier effects, and slow structural transformation (Alviansyah & Nurhayati, 2024; Rico Fontalvo et al., 2025). Similarly, Gross Fixed Capital Formation (GFCF) represents productive investment in infrastructure, machinery, and production facilities that enhances technological capability and expands productive capacity, thereby supporting sustained economic growth (Mourtzis et al., 2022; Sairmaly, 2023; Sinha, 2025). Together, these socioeconomic factors constitute important mechanisms through which resource-based regions can improve productivity beyond dependence on natural resource extraction alone.

Despite the growing body of literature on resource-based regional development, several important research gaps remain. First, previous studies predominantly examine economic growth at the aggregate regional level, implicitly assuming that agriculture and mining respond similarly to socioeconomic determinants. Such aggregation may obscure important sector-specific growth mechanisms because labour-intensive and capital-intensive sectors differ substantially in their production technologies, labour requirements, and investment patterns (Richiardi & Valenzuela, 2024; Tran & Vo, 2020). Second, empirical studies in Bangka Belitung have largely concentrated on identifying leading sectors, regional competitiveness, or comparative advantages (Susanto, 2019; Widiarsih, 2016), while relatively little attention has been devoted to examining how multiple socioeconomic factors simultaneously influence the performance of individual resource-based sectors. Third, although employment, education, health, wages, and capital formation are widely recognised as important determinants of economic development, limited empirical evidence explains whether these factors exert different effects across labour-intensive and capital-intensive sectors within island resource economies (Faisal et al., 2025; Rahman et al., 2022). Addressing these gaps is important because effective regional development policies require a clear understanding of sector-specific growth mechanisms rather than relying on aggregate regional evidence.

Accordingly, this study investigates the socioeconomic determinants of agricultural and mining sector growth in Bangka Belitung Province using balanced panel data covering seven districts and municipalities during the period 2020–2024. Unlike previous studies that analyse resource-based regional growth at an aggregate level, this study adopts a sector-

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disaggregated panel data approach to examine how employment, education, working hours, gender composition, wages, health conditions, and capital formation influence the performance of two structurally different primary sectors. This study makes three principal contributions to the literature. First, it contributes theoretically by extending the literature on resource-based regional development through sector-specific evidence demonstrating that socioeconomic determinants operate differently across agriculture and mining. Second, it contributes methodologically by employing a comparative panel data framework that enables direct comparison of the determinants of labour-intensive and capital-intensive sectors within the same regional setting, thereby reducing aggregation bias commonly found in previous studies. Third, it contributes practically by providing evidence-based policy recommendations showing that resource-dependent regions require differentiated development strategies tailored to the structural characteristics of individual sectors rather than uniform policy interventions. These findings are expected to contribute to the development of more sustainable, inclusive, and resilient regional economies in resource-dependent regions.

## 2. Literature Review

### Economic Growth and Human Capital in Resource-Based Regions

Regional economic growth is primarily explained by classical and neoclassical growth theories, which emphasise the roles of labour, capital accumulation, and technological progress in expanding production capacity and sustaining long-term economic development. The Solow Growth Model argues that economic growth is driven by the accumulation of physical capital, labour, and technological progress, while diminishing returns to capital imply that improvements in productivity are essential for sustaining long-run growth (Solow, 1956). Extending this framework, Mankiw et al. (1992) incorporate human capital into the production function, arguing that education and skills complement physical capital by enhancing labour productivity and production efficiency. These theoretical perspectives suggest that sustainable regional growth depends not only on the availability of production factors but also on the quality of human resources.

In resource-based regions, however, economic growth is shaped by unique structural characteristics. The Resource Curse Theory argues that abundant natural resources do not automatically generate sustainable economic development because weak human capital, limited diversification, and institutional constraints may hinder long-term productivity growth (Badeeb et al., 2017; Mehlum et al., 2006). Consequently, investment in human capital becomes essential for transforming natural resource endowments into sustainable economic performance. Human Capital Theory further explains that education and health improve workers' knowledge, skills, productivity, and adaptability to technological change, thereby strengthening economic competitiveness and supporting long-term growth (Barro & Lee, 2013; Bloom & Canning, 2008; Hanushek & Woessman, 2020; Lazko, 2025; Leoni, 2025; Oltulular, 2025). Recent empirical studies likewise demonstrate that stronger human

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capital enables resource-rich economies to diversify production, increase productivity, and become more resilient to commodity price fluctuations (Epo & Nochi Faha, 2020; Faisal et al., 2025; Jahanger et al., 2022; Rahman et al., 2022).

The theoretical perspectives discussed above provide the foundation for understanding the heterogeneous growth dynamics of resource-based sectors. Although agriculture and mining both depend on natural resources, they differ considerably in production structures, labour intensity, technological requirements, and capital utilisation. Agriculture relies predominantly on labour availability and workforce health, whereas mining increasingly requires skilled labour, advanced technology, and capital-intensive production processes. Consequently, the influence of socioeconomic factors is unlikely to be uniform across sectors. This study therefore adopts the Solow Growth Model, Resource Curse Theory, and Human Capital Theory as complementary theoretical foundations to examine how socioeconomic factors shape agricultural and mining sector growth in Bangka Belitung Province.

**Socioeconomic Determinants of Sectoral Economic Growth**

Sectoral economic growth is determined by the interaction between production factors and socioeconomic conditions that influence productivity and output. Labour remains one of the primary inputs in the production process, with employment reflecting the availability of productive workers to sustain economic activities. Previous studies consistently report that a larger workforce contributes positively to sectoral growth by expanding production capacity, particularly in labour-intensive industries (Rondón-Castillo et al., 2026; Win et al., 2025). However, the contribution of labour varies across sectors because agriculture relies predominantly on labour-intensive production, whereas mining increasingly combines labour with advanced technology and capital-intensive production systems (Lund et al., 2024; Tran & Vo, 2020). In addition, working hours reflect labour utilisation and may enhance output when accompanied by higher productivity.

Human capital is another important determinant of sectoral performance. Education improves workers' knowledge, technical skills, and adaptability to technological change, thereby increasing production efficiency (Barro & Lee, 2013; Hanushek & Woessman, 2020). Similarly, better health conditions enhance labour productivity by improving physical capacity and reducing productivity losses due to illness (Bloom & Canning, 2008; Yang, 2020). Other socioeconomic characteristics, including wage levels and gender composition, may also influence economic performance. Wages affect labour welfare, purchasing power, and work incentives, while gender diversity contributes to labour allocation and workforce participation under appropriate institutional conditions (Abbey & Adu-Danso, 2023; Beraja et al., 2019; Haryana, 2020; Leoncini et al., 2024; Santoso et al., 2022). Together, these factors shape the quality and effectiveness of labour in supporting sectoral growth.

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Capital formation further complements labour and human capital by increasing productive capacity through investment in infrastructure, machinery, and technology (Atabayeva et al., 2024; Du et al., 2022; Mourtzis et al., 2022). Its contribution is expected to be more pronounced in mining, where production depends heavily on technological equipment, than in agriculture, which remains relatively labour-intensive (Anzolin & Pietrobelli, 2025; Lund et al., 2024). Overall, theoretical and empirical evidence suggests that employment, education, working hours, gender composition, wages, health conditions, and capital formation jointly influence sectoral economic growth. However, because agriculture and mining differ in production structures and technological intensity, the effects of these socioeconomic factors are likely to vary across sectors. These relationships provide the basis for the conceptual framework and hypothesis development presented in the following section.

**Conceptual Framework and Hypothesis Development**

Building upon the theoretical perspectives discussed in the preceding sections, this study proposes that sectoral economic growth in resource-based regions is jointly determined by labour availability, human capital, labour market characteristics, and productive investment. Employment represents the quantity of labour available for production, while education and health capture the quality of human capital that enhances workers' productivity, adaptability, and production efficiency. Working hours reflect the intensity of labour utilisation, whereas wage levels and gender composition represent labour market characteristics that may influence workers' motivation, participation, and overall productivity. In addition, Gross Fixed Capital Formation (GFCF) reflects productive investment that expands production capacity through improvements in infrastructure, machinery, and technology. Drawing upon the Solow Growth Model, Human Capital Theory, and the Resource Curse perspective, these socioeconomic factors are expected to influence sectoral economic growth both individually and collectively.

Although these socioeconomic determinants are theoretically associated with economic growth, their effects are unlikely to be homogeneous across sectors. Agriculture and mining differ substantially in production structures, labour intensity, technological requirements, and capital utilisation. Agricultural production remains predominantly labour-intensive and relies heavily on workforce availability and health conditions, whereas mining increasingly depends on skilled labour, technological capability, and capital investment. Consequently, the magnitude and direction of the relationships between socioeconomic factors and economic growth may vary across sectors. This sector-disaggregated perspective constitutes the principal conceptual foundation of the present study and distinguishes it from previous studies that primarily examine regional economic growth using aggregate indicators.

Based on these theoretical arguments, the following hypotheses are proposed:
H1: Employment significantly affects sectoral economic growth.

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H2: Education significantly affects sectoral economic growth.
H3: Working hours significantly affect sectoral economic growth.
H4: Gender composition significantly affects sectoral economic growth.
H5: Formal and informal wages significantly affect sectoral economic growth.
H6: Health conditions significantly affect sectoral economic growth.
H7: Gross Fixed Capital Formation significantly affects sectoral economic growth.
H8: The effects of socioeconomic determinants on sectoral economic growth differ between the agricultural and mining sectors.

## 3. Research Methods

### Data and Variables

This study employs a quantitative approach using balanced panel data covering seven districts and municipalities in Bangka Belitung Province over the period 2020–2024, resulting in 35 observations for each empirical model. The selected period captures recent structural changes in the regional economy, particularly during the post-pandemic recovery phase. The cross-sectional dimension comprises all administrative regions within the province, while the time-series dimension spans five consecutive years. Since the study includes the entire population of districts and municipalities, a saturated sampling approach was adopted.

The analysis is based on secondary data obtained from the Central Bureau of Statistics (Badan Pusat Statistik/BPS). The dataset comprises sectoral Gross Regional Domestic Product (GRDP), employment statistics, education indicators, working hours, wage statistics, life expectancy, and Gross Fixed Capital Formation (GFCF). The dependent variables represent the real GRDP of the agriculture, forestry and fisheries sector and the mining and quarrying sector, while the independent variables consist of employment, education, working hours, gender composition, formal and informal wages, health conditions, and capital formation. The operational definitions and measurements of all variables are presented in Table 1.

**Table 1.** Operational Definition of Variables

| Variable | Symbol | Measurement | Unit | Source |
|---|---|---|---|---|
| Agricultural sector growth | PDRB_agriculture | Gross Regional Domestic Product (Agriculture, Forestry and Fisheries) at constant prices | Billion Rupiah | BPS |
| Mining sector growth | PDRB_mining | Gross Regional Domestic Product (Mining and Quarrying) at constant prices | Billion Rupiah | BPS |
| Employment | JTK | Number of workers employed in each sector | Persons | BPS |
| Education | TPA | Average years of schooling | Years | BPS |

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| Variable | Symbol | Measurement | Unit | Source |
|---|---|---|---|---|
| Working hours | JJK | Average working hours per week | Hours/week | BPS |
| Gender composition | GENDER | Ratio of male to female workers | Ratio | BPS |
| Formal wage | Formal_UPAH | Average monthly wage of formal workers | Rupiah/month | BPS |
| Informal wage | Nonformal_UPAH | Average monthly wage of informal workers | Rupiah/month | BPS |
| Health conditions | UHH | Life expectancy at birth | Years | BPS |
| Capital formation | PMTB | Gross Fixed Capital Formation (GFCF) | Billion Rupiah | BPS |

Several monetary and scale variables, including sectoral GRDP, employment, formal wages, informal wages, and Gross Fixed Capital Formation, are transformed into their natural logarithmic form to improve estimation efficiency, reduce potential heteroscedasticity, and minimise scale differences among variables. Furthermore, the logarithmic transformation allows the estimated coefficients to be interpreted as elasticities, indicating the percentage change in sectoral output associated with a one-percent change in the corresponding explanatory variables. Variables measured as ratios or averages, such as average years of schooling, working hours, gender composition, and life expectancy, are retained in their original form because logarithmic transformation is neither theoretically necessary nor empirically appropriate for these indicators.

**Estimation Method**

To examine the relationship between socioeconomic factors and sectoral economic growth, this study employs panel data regression analysis. Panel data combines cross-sectional and time-series observations, enabling the analysis to capture both regional heterogeneity and temporal dynamics simultaneously. Compared with purely cross-sectional or time-series approaches, panel data estimation provides more efficient parameter estimates, increases the number of observations, and controls for unobserved regional characteristics that remain constant over time (Gujarati & Porter, 2009). Since the objective of this study is to compare the determinants of growth across two leading sectors, separate regression models are estimated for the agriculture, forestry and fisheries sector and the mining and quarrying sector.

The general panel regression model is specified as follows:

$$\begin{aligned}\ln\left(PDRB_{it}\right) = {} & \alpha + \beta_1 \ln\left(JTK_{it}\right) + \beta_2 TPA_{it} + \beta_3 JJK_{it} + \beta_4 GENDER_{it} \\ & + \beta_5 \ln\left(\text{formal\_}UPAH_{it}\right) + \beta_6 \ln\left(\text{nonformal\_}UPAH_{it}\right) + \beta_7 UHH_{it} \\ & + \beta_8 \ln\left(PMTB_{it}\right) + \mu_i + \varepsilon_{it} \qquad (1)\end{aligned}$$

where $PDRB_{it}$ denotes sectoral Gross Regional Domestic Product (GRDP) in region $i$during period $t$. The explanatory variables represent employment, education, working hours, gender composition, wages, health conditions, and Gross Fixed Capital Formation (GFCF), while $\alpha$ is the intercept, $\beta$ represents the estimated regression coefficients, $\mu_i$ captures unobserved regional effects, and $\varepsilon_{it}$ denotes the idiosyncratic error term. The operational definitions and measurements of all variables are presented in Table 1.

To account for unobserved regional heterogeneity, two alternative panel data specifications are considered: the Fixed Effect Model (FEM) and the Random Effect Model (REM). The Fixed Effect Model assumes that each district or municipality possesses its own time-invariant characteristics that may influence sectoral economic growth. Accordingly, the intercept varies across cross-sectional units while the slope coefficients remain constant. The FEM specification is expressed as:

$$\begin{aligned}\ln(PDRB_{it}) = \alpha_i &+ \beta_1 \ln(JTK_{it}) + \beta_2 TPA_{it} + \beta_3 JJK_{it} + \beta_4 GENDER_{it} \\ &+ \beta_5 \ln(\text{formal\_}UPAH_{it}) + \beta_6 \ln(\text{nonformal\_}UPAH_{it}) + \beta_7 UHH_{it} \\ &+ \beta_8 \ln(PMTB_{it}) + \varepsilon_{it} \qquad (2)\end{aligned}$$

Alternatively, the Random Effect Model assumes that the unobserved regional effects are random and uncorrelated with the explanatory variables. Under this assumption, the regional-specific effect becomes part of the composite error term and the model is estimated using Generalised Least Squares (GLS). The REM specification is given by:

$$\begin{aligned}\ln(PDRB_{it}) = \alpha &+ \beta_1 \ln(JTK_{it}) + \beta_2 TPA_{it} + \beta_3 JJK_{it} + \beta_4 GENDER_{it} \\ &+ \beta_5 \ln(\text{formal\_}UPAH_{it}) + \beta_6 \ln(\text{nonformal\_}UPAH_{it}) + \beta_7 UHH_{it} \\ &+ \beta_8 \ln(PMTB_{it}) + u_i + \varepsilon_{it} \qquad (3)\end{aligned}$$

where $u_i$ represents the random regional effect and $\omega_{it} = u_i + \varepsilon_{it}$ denotes the composite error term.

To identify the most appropriate panel data specification, this study follows a sequential model selection procedure. First, the Chow test is employed to determine whether the Fixed Effect Model is preferred to the Common Effect Model. Second, the Breusch–Pagan Lagrange Multiplier (LM) test is conducted to evaluate whether the Random Effect Model provides a better specification than the Common Effect Model. Finally, the Hausman specification test is applied to determine the most appropriate model between the Fixed Effect Model and the Random Effect Model. Rejection of the null hypothesis indicates that the Fixed Effect Model is preferred because the unobserved regional effects are correlated with the explanatory variables, whereas failure to reject the null hypothesis supports the Random Effect Model (Gujarati & Porter, 2009; Wooldridge, 2018). The results of these specification

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tests are presented in the Results section and constitute the basis for selecting the final estimation model.

To ensure reliable statistical inference, the selected panel regression model is estimated using heteroskedasticity-robust standard errors to address potential heteroskedasticity in the panel dataset. Furthermore, several diagnostic tests are performed to evaluate the validity of the estimated models, including the Variance Inflation Factor (VIF) for multicollinearity, the Modified Wald test for heteroskedasticity, the Wooldridge test for serial correlation, and Pesaran's CD test for cross-sectional dependence. These diagnostic procedures enhance the robustness of the empirical findings and ensure that statistical inference remains valid despite potential violations of the classical assumptions of panel data regression.

## 4. Results and Discussion

### Descriptive Statistics

The descriptive statistics presented in Table 1 provide an overview of the characteristics of the variables used in this study across seven districts and municipalities in Bangka Belitung Province during 2020–2024. The agriculture, forestry, and fisheries sector records an average Gross Regional Domestic Product (GRDP) of 1,576.46 billion rupiah, considerably higher than the mining and quarrying sector, which averages 911.12 billion rupiah, indicating the relatively larger economic contribution of agriculture during the observation period. Employment is also substantial in both sectors, averaging 27,909 workers in agriculture and 29,332 workers in mining, although considerable regional variation exists. The average years of schooling are 7.96 years in agriculture and 8.72 years in mining, suggesting that the mining workforce is relatively better educated. Likewise, mining workers record slightly longer average working hours (34.49 hours per week) than agricultural workers (31.30 hours per week), reflecting differences in labour utilisation across sectors.

**Table 2.** Descriptive Statistics

| Variable | Mean | Std. dev. | Min | Max | Obs |
|---|---|---|---|---|---|
| PDRB_agriculture | 1576.455 | 685.9375 | 436.04 | 2749.74 | 35 |
| JTK_agriculture | 27908.69 | 13552.02 | 2366 | 49753 | 35 |
| TPA_agriculture | 7.958571 | 0.791719 | 7.02 | 10.2 | 35 |
| JJK_agriculture | 31.30457 | 2.340953 | 27.12 | 35.94 | 35 |
| GENDER_agriculture | 275.28 | 13.84286 | 254.5 | 288.96 | 35 |
| formal_UPAH_agriculture | 3068444 | 1161264 | 1623513 | 7129354 | 35 |
| nonformal_UPAH_agriculture | 1970606 | 400925.5 | 1168556 | 2779511 | 35 |
| PDRB_mining | 911.1174 | 473.2665 | 0 | 1528.51 | 35 |
| JTK_mining | 29331.86 | 8725.371 | 19170 | 51045 | 35 |
| TPA_mining | 8.717143 | 0.65986 | 7.46 | 10.21 | 35 |
| JJK_mining | 34.49257 | 1.374528 | 31.15 | 36.82 | 35 |

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| Variable | Mean | Std. dev. | Min | Max | Obs |
|---|---|---|---|---|---|
| GENDER_mining | 1696.584 | 476.3629 | 987.03 | 2390.04 | 35 |
| formal_UPAH_mining | 2978028 | 525510.9 | 1681898 | 4213578 | 35 |
| nonformal_UPAH_mining | 2306221 | 398957.7 | 1440002 | 3143509 | 35 |
| UHH | 71.376 | 1.553658 | 68.1 | 74.56 | 35 |
| PMTB | 1762.842 | 360.3091 | 1312.29 | 2573.06 | 35 |

**Source:** Processed by the Author (2025)

The descriptive statistics further indicate notable differences in labour market conditions between the two sectors. Formal wages average 3.07 million rupiah per month in agriculture and 2.98 million rupiah in mining, while informal wages average 1.97 million rupiah and 2.31 million rupiah, respectively. The average life expectancy reaches 71.38 years, indicating relatively stable health conditions across districts, whereas Gross Fixed Capital Formation averages 1,762.84 billion rupiah, reflecting moderate investment activity with considerable regional variation. Overall, these statistics suggest that although agriculture and mining remain the province's leading resource-based sectors, they differ substantially in terms of output, labour characteristics, wage structures, and investment, providing initial evidence that the socioeconomic determinants of sectoral growth may also differ and therefore warrant further econometric investigation.

### Model Selection and Diagnostic Tests

To ensure that the estimated panel regression models are statistically appropriate, a series of model specification and diagnostic tests were conducted prior to estimating the final regression models. The model selection procedure consisted of the Chow test, the Breusch–Pagan Lagrange Multiplier (LM) test, and the Hausman specification test. Subsequently, diagnostic tests were performed to evaluate multicollinearity, heteroskedasticity, serial correlation, and cross-sectional dependence. These procedures provide the statistical basis for selecting the most appropriate panel data specification and ensuring the reliability of the estimated coefficients.

**Table 3.** Panel Model Selection Tests

| Test | Agriculture | Mining | Decision |
|---|---|---|---|
| Chow Test | F = 876.77*** | F = 239.50*** | FEM preferred |
| Breusch–Pagan LM Test | $\chi^2$ = 0.00 (p = 1.000) | $\chi^2$ = 0.00 (p = 1.000) | REM not supported |
| Hausman Test | $\chi^2$ = 25.90*** | $\chi^2$ = 20.72*** | FEM selected |

**Source:** Processed by the Author (2025)

Table 3 presents the results of the panel model specification tests. The Chow test strongly rejects the Common Effect Model for both the agricultural and mining sectors, indicating the presence of significant individual effects across districts and municipalities. Furthermore, the Breusch–Pagan Lagrange Multiplier (LM) test does not provide evidence supporting the Random Effect Model over the Common Effect Model. The Hausman specification test

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further rejects the null hypothesis for both sectoral models, indicating that the Fixed Effect Model (FEM) is the most appropriate estimator. Accordingly, the subsequent analysis primarily relies on the Fixed Effect Model with heteroskedasticity-robust standard errors.

**Table 4.** Variance Inflation Factor (VIF) Test

| Variable | Agriculture | Mining |
|---|---|---|
| Employment | 2.92 | 5.11 |
| Education | 7.44 | 1.48 |
| Working hours | 1.93 | 1.94 |
| Gender composition | 1.48 | 1.94 |
| Formal wage | 2.11 | 2.45 |
| Informal wage | 1.63 | 2.35 |
| Health conditions | 3.22 | 1.76 |
| Gross Fixed Capital Formation | 3.85 | 5.23 |
| Mean VIF | 3.07 | 2.78 |

**Source:** Processed by the Author (2025)

Table 4 reports the multicollinearity test results based on the Variance Inflation Factor (VIF). All explanatory variables exhibit VIF values below the commonly accepted threshold of 10, indicating that multicollinearity is unlikely to distort the estimated regression coefficients. The highest VIF value is observed for the education variable in the agricultural model (7.44) and Gross Fixed Capital Formation in the mining model (5.23), both of which remain within acceptable limits. Moreover, the mean VIF values of 3.07 for the agricultural model and 2.78 for the mining model suggest that the explanatory variables do not exhibit excessive linear dependence. Therefore, all variables were retained for the subsequent panel regression analysis.

**Table 5.** Panel Diagnostic Tests

| Diagnostic Test | Agriculture | Mining | Conclusion |
|---|---|---|---|
| Modified Wald Test | $\chi^2 = 33.26$*** | $\chi^2 = 13.41$** | Heteroskedasticity detected |
| Wooldridge Test | F = 19.64*** | F = 42.64*** | Serial correlation detected |
| Pesaran CD Test | CD = –0.088 (p = 0.930) | CD = 0.065 (p = 0.948) | No cross-sectional dependence |

**Source:** Processed by the Author (2025)

Table 5 presents the diagnostic test results for the selected panel regression models. The Modified Wald test indicates the presence of heteroskedasticity in both sectoral models, while the Wooldridge test reveals first-order serial correlation. Conversely, Pesaran's CD test indicates no evidence of cross-sectional dependence in either model. Given the presence of heteroskedasticity and serial correlation, the final regression models are estimated using heteroskedasticity-robust standard errors to obtain consistent statistical inference.

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## Empirical Results

This section presents the panel regression results for the agriculture, forestry and fisheries sector and the mining and quarrying sector in Bangka Belitung Province. The estimation results obtained from the Fixed Effect Model (FEM) and the Random Effect Model (REM) are reported in Tables 6 and 7. Based on the model selection procedure presented in Table 3, the Fixed Effect Model is identified as the preferred specification and therefore serves as the primary basis for interpreting the empirical results. The Random Effect estimates are presented only to provide a comparison across alternative panel data specifications.

**Table 6.** Estimation Results for the Agriculture, Forestry, and Fisheries Sector Growth

| Variable | Dependent: ln_pdrb_agriculture | |
|---|---|---|
| | FEM | REM |
| ln_JTK_agriculture | -0.037091 | 0.52442*** |
| | (0.0237044) | (0.102065) |
| | [-1.56] | [5.14] |
| TPA_agriculture | 0.0130696 | 0.176214 |
| | (0.0086657) | (0.2371452) |
| | [1.51] | [0.74] |
| JJK_agriculture | -0.0038094 | -0.02342 |
| | (0.0020598) | (0.0415079) |
| | [-1.85] | [-0.56] |
| GENDER_agriculture | -0.00000721 | 0.001893 |
| | (0.0001483) | (0.0027299) |
| | [-0.05] | [0.69] |
| ln_formal_UPAH_agriculture | 0.0022418 | 0.09851 |
| | (0.0147511) | (0.0975689) |
| | [0.15] | [1.01] |
| ln_nonformal_UPAH_agriculture | 0.0061093 | 0.278829 |
| | (0.0372627) | (0.1793568) |
| | [0.16] | [1.55] |
| UHH | 0.0753625** | -0.12224 |
| | (0.0223278) | (0.0973703) |
| | [3.38] | [-1.26] |
| ln_PMTB | 0.106962 | -0.50866 |
| | (0.0885106) | (0.8121142) |
| | [1.21] | [-0.63] |
| Constant | 1.329381 | 7.809533 |
| | (1.125128) | (5.961881) |
| | [1.18] | [1.31] |
| R-squared | 0.87 | 0.83 |

Note: Significance levels are denoted as follows: 1% ***, 5% **, and 10% *. Values in parentheses represent robust standard errors, while values in square brackets indicate the t-statistic for the FEM and the z-statistic for the REM.
**Source:** Processed by the Authors (2025)

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Table 6 reports the estimation results for the agriculture, forestry and fisheries sector. Under the preferred Fixed Effect specification, life expectancy (UHH) is the only variable that exhibits a positive and statistically significant relationship with agricultural sector growth ($\beta = 0.075$, $p < 0.05$). The estimated coefficient indicates that a one-unit increase in life expectancy is associated with an increase of approximately 0.075 percent in agricultural sector output, holding other variables constant. The model achieves an R-squared of 0.87, indicating that the explanatory variables jointly account for a substantial proportion of the variation in agricultural sector growth.

The remaining explanatory variables, including employment, education, working hours, gender composition, formal wages, informal wages, and Gross Fixed Capital Formation, do not exhibit statistically significant effects under the preferred specification. Although the Random Effect Model indicates that employment has a positive and statistically significant coefficient ($\beta = 0.524$, $p < 0.01$), this relationship is not supported by the preferred Fixed Effect specification identified through the Hausman test. Consequently, the Fixed Effect estimates are regarded as the principal empirical evidence for the agricultural sector.

**Table 7.** Estimation Results for the Mining and Quarrying Sector Growth

| **Variable** | **Dependent: ln_pdrb_mining** | |
|---|---|---|
| | **FEM** | **REM** |
| ln_JTK_mining | 0.084599 | 0.877967** |
| | (0.0794542) | (0.3745854) |
| | [1.06] | [2.34] |
| TPA_mining | -0.003396 | 0.224551*** |
| | (0.0133271) | (0.0782007) |
| | [-0.25] | [2.87] |
| JJK_mining | -0.00169 | 0.042127 |
| | (0.0052103) | (0.0346618) |
| | [-0.32] | [1.22] |
| GENDER_mining | 0.000000109 | 0.000109 |
| | (0.0000148) | (0.0000787) |
| | [0.01] | [1.39] |
| ln_formal_UPAH_mining | 0.030001 | -0.79426*** |
| | (0.0625918) | (0.2488893) |
| | [0.48] | [-3.19] |
| ln_nonformal_UPAH_mining | 0.084344 | -0.17172 |
| | (0.0558004) | (0.1251882) |
| | [1.51] | [-1.37] |
| UHH | -0.0792 | 0.121317*** |
| | (0.0587528) | (0.0467093) |
| | [-1.35] | [2.6] |
| ln_PMTB | 0.370259 | -0.56653 |
| | (0.4072503) | (0.6825029) |

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| Variable | Dependent: ln_pdrb_mining | |
|---|---|---|
| | FEM | REM |
| | [0.91] | [-0.83] |
| Constant | 7.333691** | 4.208292 |
| | (1.933355) | (5.737435) |
| | [3.79] | [0.73] |
| R-squared | 0.75 | 0.85 |

Note: Significance levels are denoted as follows: 1% ***, 5% **, and 10% *. Values in parentheses represent robust standard errors, while values in square brackets indicate the t-statistic for the FEM and the z-statistic for the REM.
**Source:** Processed by the Authors (2025)

Table 7 presents the estimation results for the mining and quarrying sector. Under the preferred Fixed Effect specification, none of the explanatory variables are statistically significant at conventional significance levels. The estimated coefficients indicate that changes in employment, education, working hours, gender composition, wages, health conditions, and Gross Fixed Capital Formation are not significantly associated with mining sector growth during the observation period. The estimated model reports an R-squared of 0.75, indicating that the explanatory variables jointly capture a considerable proportion of the variation in mining sector growth, although none of the individual coefficients are statistically distinguishable from zero.

The Random Effect Model produces several statistically significant coefficients, including positive effects of employment ($\beta = 0.878$, $p < 0.05$), education ($\beta = 0.225$, $p < 0.01$), and life expectancy ($\beta = 0.121$, $p < 0.01$), together with a negative effect of formal wages ($\beta = -0.794$, $p < 0.01$). However, because the Hausman specification test identifies the Fixed Effect Model as the preferred estimator, these coefficients are interpreted only as supplementary results and are not used as the primary basis for inference.

Overall, the empirical results reveal heterogeneous relationships between socioeconomic factors and sectoral economic growth. Under the preferred Fixed Effect specification, health conditions emerge as the only statistically significant determinant of agricultural sector growth, whereas none of the examined socioeconomic variables significantly explain mining sector growth. These findings indicate that the socioeconomic determinants of economic performance vary across resource-based sectors, thereby supporting the use of a sector-disaggregated analytical framework in examining regional economic growth.

**Discussion**

The The empirical findings reveal substantial differences in the socioeconomic determinants of growth between the agriculture and mining sectors in Bangka Belitung Province. More importantly, the results demonstrate that these determinants do not operate uniformly across resource-based industries. Based on the preferred Fixed Effect Model, health conditions, represented by life expectancy, emerge as the only robust determinant of agricultural sector growth, whereas none of the examined socioeconomic variables significantly explain mining sector growth. These findings support the argument that analysing resource-based sectors in aggregate may conceal important structural differences, as each sector responds differently to socioeconomic conditions according to its production characteristics and resource dependency (Richiardi & Valenzuela, 2024; Tran & Vo, 2020).

The positive effect of life expectancy on agricultural sector growth highlights the importance of health as a component of human capital in labour-intensive production systems. Human Capital Theory argues that healthier individuals are more productive because they possess greater physical capacity, lower absenteeism, and higher work efficiency (Bloom & Canning, 2008). In Bangka Belitung, agricultural activities continue to depend predominantly on manual labour, particularly in food crops, plantations, and fisheries. Consequently, improvements in public health are likely to enhance labour productivity and contribute directly to agricultural output. This finding is also consistent with previous studies emphasising the importance of health in improving productivity within resource-based and rural economies (Bloom & Canning, 2008; Epo & Nochi Faha, 2020; Jahanger et al., 2022).

By contrast, employment, education, working hours, wages, gender composition, and Gross Fixed Capital Formation do not exhibit statistically significant effects in the preferred specification. These findings suggest that short-term changes in these socioeconomic variables are insufficient to generate measurable changes in agricultural output during the observation period. One possible explanation is that agricultural production in Bangka Belitung remains characterised by relatively traditional production practices, where productivity improvements occur gradually and are influenced by broader structural factors such as land quality, climate variability, and production systems rather than short-term changes in labour market conditions or investment. Although the Random Effect Model identifies employment as a significant determinant, this relationship is not supported by the preferred Fixed Effect specification and therefore should be interpreted with caution.

A contrasting pattern is observed in the mining sector. Under the preferred Fixed Effect Model, none of the socioeconomic variables significantly affect mining sector growth. This result suggests that fluctuations in mining output are not primarily driven by short-term changes in employment, education, wages, health conditions, or capital formation across districts. Instead, mining performance is likely to be determined by factors that are not explicitly included in the present model, including geological resource endowments, global commodity prices, production technology, firm-level investment decisions, and regulatory conditions. These characteristics distinguish mining from agriculture and reflect the capital-intensive and externally driven nature of extractive industries.

Although the Random Effect Model identifies significant relationships for employment, education, formal wages, and life expectancy, these effects are not confirmed by the preferred

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Fixed Effect specification. This discrepancy indicates that the estimated relationships are sensitive to model assumptions and that cross-sectional differences between districts may partly explain the significance observed under the Random Effect Model. Consequently, these findings should be interpreted as complementary evidence rather than as the principal empirical conclusions of this study.

Taken together, the findings provide important evidence that the socioeconomic determinants of economic growth differ substantially between the two leading resource-based sectors in Bangka Belitung Province. While agricultural growth appears to benefit primarily from improvements in human health, mining sector growth is not significantly explained by the socioeconomic variables examined in this study. These results reinforce the importance of sector-disaggregated analysis in regional economic research and support the argument that aggregate growth models may overlook important structural differences across industries. Consequently, development policies should be designed according to the specific characteristics of each sector rather than adopting a uniform strategy for all resource-based activities. For the agricultural sector, policies aimed at improving public health and maintaining labour productivity are likely to generate greater economic benefits. In contrast, strengthening the mining sector may require policies that promote technological upgrading, investment efficiency, workforce capability, and economic diversification beyond dependence on extractive activities.

## 5. Conclusion and Suggestion

This study examined the socioeconomic determinants of economic growth in the agriculture, forestry and fisheries sector and the mining and quarrying sector in Bangka Belitung Province using a balanced panel data approach. The empirical findings indicate that the determinants of sectoral growth are not uniform across resource-based industries. Based on the preferred Fixed Effect Model, life expectancy is the only socioeconomic variable that exerts a positive and statistically significant effect on agricultural sector growth, highlighting the importance of health as a component of human capital in labour-intensive production activities. In contrast, none of the examined socioeconomic variables significantly explain mining sector growth, suggesting that the performance of the mining sector is likely to be influenced by broader structural factors beyond the socioeconomic variables included in this study.

This study contributes to the regional economic growth literature by demonstrating that socioeconomic determinants operate differently across labour-intensive and capital-intensive resource-based sectors. By estimating separate models for the agricultural and mining sectors, the study provides sector-disaggregated evidence that extends the application of Human Capital Theory and the Resource Curse perspective to an island resource-dependent economy. These findings indicate that aggregate regional analyses may obscure important differences in sectoral growth mechanisms and therefore support the adoption of sector-specific approaches in both empirical research and regional development policy.

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Accordingly, improving public health and labour productivity should remain a priority for agricultural development, whereas policies for the mining sector should place greater emphasis on technological upgrading, investment quality, institutional capacity, and economic diversification.

Despite these contributions, this study has several limitations. The analysis is based on a relatively small balanced panel covering seven districts and municipalities over the period 2020–2024 and is limited to socioeconomic variables available from official statistics. Future research should extend the observation period, incorporate additional structural determinants such as institutional quality, technological innovation, commodity price fluctuations, and environmental factors, and undertake comparative analyses across other resource-dependent regions. Such efforts would provide a more comprehensive understanding of the heterogeneous determinants of sectoral economic growth and further strengthen the evidence base for designing sustainable regional development strategies.

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