



Impact of the Shadow Economy on Tax Buoyancy in Central Java

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Abstract

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Taxation plays a strategic role as the primary source of government revenue, supporting fiscal stability and sustainable economic growth. In this context, tax buoyancy serves as an important indicator for evaluating the responsiveness of tax revenues to economic growth. Despite its substantial contribution to regional income, Central Java exhibits the lowest level of tax buoyancy among provinces on the island of Java, indicating the presence of unrealized fiscal potential. This study examines the effect of the shadow economy on tax buoyancy using a labor-based approach and panel data regression with a Fixed Effects Model. The analysis utilizes secondary data from the Directorate General of Fiscal Balance (Direktorat Jenderal Perimbangan Keuangan/DJPK) and Statistics Indonesia (BPS) for the period 2016–2022. The independent variables include population, investment, and the shadow economy. The results indicate that population has a negative effect on tax buoyancy, while investment shows no statistically significant effect. In contrast, the shadow economy exerts a significant positive influence on tax buoyancy. The novelty of this research lies in its application of a labor-based approach to capture the dynamics of the shadow economy within a tax buoyancy framework. These findings highlight the importance of policy strategies aimed at formalizing the informal sector through tax incentives, regulatory simplification, and improvements in business licensing systems in order to enhance the sustainability of tax revenues.

INTRODUCTION

Taxation represents one of the core instruments of an economy and serves as the primary source of state revenue (Maryantika & Wijaya, 2022). Tax revenues are allocated to support government operations and finance a wide range of national development programs (Rachdianti *et al.*, 2016). Higher levels of tax compliance among individuals and business entities contribute directly to increased state revenue, which subsequently supports economic growth, expands activities across economic sectors, and facilitates the development of infrastructure and public facilities (Roslita, 2022). Beyond its revenue-generating function, taxation also operates as a mechanism for income redistribution, reduction of socio-economic inequality, and enhancement of economic stability. These functions contribute to capital accumulation and stimulate higher levels of output in goods and services, thereby supporting overall growth

in Gross Domestic Product (GDP) (Oxford Policy Management (OPM), 2021).

Tax buoyancy constitutes a key indicator for assessing the relationship between taxation and economic growth, as it measures the responsiveness of tax revenue to changes in economic activity, particularly Gross Domestic Product (GDP) growth (Balqis & Miksalmina, 2022). The tax buoyancy rate reflects the effectiveness of a tax system in capturing economic expansion and translating it into increased tax revenue (Chakraborty *et al.*, 2020). In Indonesia, the average tax buoyancy during the 2010–2022 period was approximately two, although considerable fluctuations were observed, including a peak value of 3.37 in 2011 (Setyoningrum & Purwanti, 2020). Such volatility indicates persistent challenges in maintaining a stable and responsive tax system amid changing economic conditions. Figure X presents the trend of tax buoyancy in Indonesia from 2010 to 2022.



Figure 1. Average Tax Buoyancy in Indonesia for the Period 2013-2022 (Percent)

Source: Ministry of Finance of the Republic of Indonesia, 2024

Tax buoyancy data for the 2013–2022 period exhibit considerable fluctuations, reflecting variations in the responsiveness of tax revenue growth to changes in economic performance over the decade. During the 2013–2019 period, tax buoyancy remained predominantly positive, ranging from 0.72% to

1.72%, indicating a moderate yet relatively consistent responsiveness of tax revenue to economic growth. This phase represents a period of comparatively stable fiscal conditions, although the elasticity of tax revenue remained constrained.

A pronounced decline emerged in 2020, when tax buoyancy fell to -0.4% . This contraction is largely attributable to the severe economic disruption caused by the COVID-19 pandemic. The sharp decline in economic activity significantly weakened tax collection as production, consumption, and investment declined across multiple sectors. Government policy responses, including tax relief measures, payment deferrals, and fiscal incentives, further suppressed tax revenues by increasing tax expenditures. These interventions, while necessary to support households and businesses, temporarily reduced the government's capacity to generate revenue.

Tax buoyancy recovered substantially in the post-pandemic period, reaching 1.94% in 2021 and remaining relatively stable at 1.92% in 2022. This rebound signals a restoration of fiscal

responsiveness alongside the gradual recovery of economic activity. Improvements in tax performance can be attributed to several factors, including the implementation of targeted fiscal stimulus and tax incentive programs that revitalized business operations, the recovery of household consumption and investment, and the easing of mobility restrictions following the expansion of vaccination coverage. Enhancements in digital tax administration and increased institutional adaptability in fiscal policy implementation also contributed to improved tax collection efficiency. Overall, these developments indicate that the economic contraction was the primary driver of weak tax buoyancy in 2020, while the subsequent recovery reflects both strengthening macroeconomic fundamentals and the adaptive resilience of Indonesia's tax system.

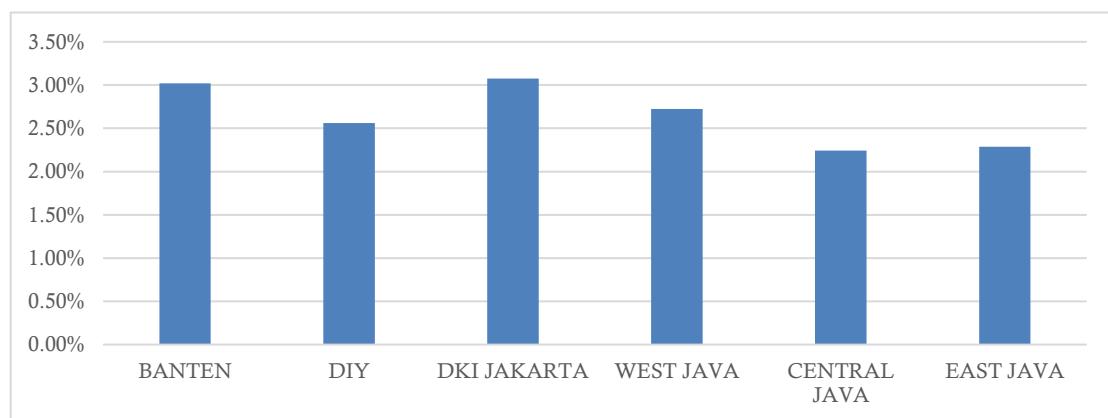


Figure 2. Average Tax Buoyancy of Provinces in Java Island for the Period 2016-2022 (Percent)
Source: BPS-Statistics Indonesia, 2024

Figure 2 indicates that the Province of DKI Jakarta recorded the highest tax buoyancy on the island of Java, reaching 3.08% percent, followed by Banten at 3.02% percent and West Java at 2.72% percent. The Special Region of Yogyakarta (DIY) registered a tax buoyancy rate of 2.56% percent, while East Java recorded 2.29% percent. Central Java ranked lowest, with a tax buoyancy value of 2.24% percent.

Elevated tax buoyancy levels in provinces such as DKI Jakarta and West Java reflect the relative effectiveness of their taxation systems in capturing existing economic potential, thereby generating stable and increasing regional tax revenues. In contrast, the comparatively low

tax buoyancy observed in Central Java underscores the need for further optimization of its taxation framework to enhance regional revenue performance.

Tax buoyancy refers to the responsiveness of tax revenues to changes in economic growth and is widely recognized as a key indicator of fiscal sustainability and the efficiency of taxation systems (Dudine & Jalles, 2018). A clear distinction must be made between tax buoyancy and tax elasticity. Tax elasticity measures the responsiveness of tax revenue to changes in the tax base, such as income or Gross Domestic Product (GDP), after controlling for discretionary policy interventions, including tax

rate changes or the introduction of new tax regulations. This measure reflects how tax revenues respond to economic growth in the absence of policy-driven effects. A tax system is considered elastic when a one percent increase in GDP generates more than a one percent increase in tax revenue, while inelasticity occurs when revenue growth is less than proportional to economic expansion.

Tax buoyancy incorporates both automatic responses and discretionary policy effects in tax revenue growth. While tax buoyancy captures the overall performance of tax revenues relative to economic growth, tax elasticity provides a more precise assessment of the inherent responsiveness of the tax system. A tax buoyancy coefficient exceeding one indicates that tax revenue growth outpaces economic growth, reflecting strong fiscal performance. A buoyancy value below one or a negative coefficient suggests weaker tax revenue growth relative to economic expansion, signaling limited fiscal responsiveness. Understanding the distinction between tax buoyancy and tax elasticity is essential for evaluating the efficiency, adaptability, and structural robustness of a national tax system.

Extensive empirical literature has examined the determinants of tax buoyancy, with particular emphasis on demographic factors and investment dynamics. Population growth is frequently associated with an expansion of the tax base, as it increases demand for goods and services and raises aggregate taxable income. The fiscal impact of population growth remains highly context-dependent, consistent with findings by Brasington (2024) and Nur Alfaish et al. (2023), which show that population growth concentrated among low-income groups does not necessarily result in higher tax revenues. Investment also contributes to economic activity and potential tax revenue generation (Salebu, 2018). The fiscal gains from investment are often mitigated by tax incentives, exemptions, and revenue leakages into the informal economy, as documented by (Musah et al., 2024).

The shadow economy constitutes a particularly critical challenge for fiscal systems. Informal trade, undeclared labor, and unreported

economic transactions directly erode the tax base and weaken the responsiveness of tax revenues to economic growth. Recent international evidence reinforces this argument. Gnangnon (2023) presents cross-country findings from developing economies demonstrating that a larger shadow economy significantly constrains the effectiveness of structural tax reforms. An increase of one percentage point in the size of the informal sector substantially reduces the probability of successful domestic revenue mobilization, as governments tend to rely more heavily on volatile trade taxes rather than stable sources of domestic taxation.

Empirical evidence from Sub-Saharan Africa further confirms the adverse fiscal implications of the shadow economy. The extensive scale of informal economic activity significantly reduces government tax revenues, as a large share of transactions remains unregistered and untaxed, thereby limiting fiscal capacity for development expenditure and public service provision. Additional structural factors, including unemployment, trade openness, and the quality of corruption control, also influence tax revenue performance in the region. These findings emphasize the necessity of policy frameworks that prioritize economic formalization as a means of improving tax compliance and strengthening the national tax base.

Comparable patterns are observed across other developing and emerging economies. A substantial body of empirical research, including studies by Ajide & Dada (2024), Futselaar & Ying-Hui (2021), Medina & Schneider (2020), and Schneider & Buehn (2021), indicates that the shadow economy accounts for a significant share of Gross Domestic Product (GDP), distorts fiscal balances, and weakens the effectiveness of tax systems. Beyond direct revenue losses, the persistence of informal economic activity undermines institutional trust and constrains governments' capacity to mobilize sustainable fiscal resources.

According to the *Global Shadow Economy Report* by Ernst & Young (2025), Indonesia's shadow economy is estimated to be approximately USD 326 billion (around IDR 5,304 trillion), equivalent to 23.8% of the

national GDP. This places Indonesia among the top five countries with the largest shadow economies worldwide. The vast scale of unrecorded activities has contributed to a widening tax gap, as a considerable share of potential tax revenues remains untapped outside the formal fiscal framework. Despite the magnitude of this issue, empirical evidence explicitly linking the shadow economy to tax buoyancy remains limited. This study seeks to address this gap by analyzing the case of Central Java through a labor-based estimation approach, thereby providing new insights into how shadow economic activities undermine fiscal responsiveness and overall tax performance.

RESEARCH METHODS

This study adopts a quantitative research design and relies on secondary data, with detailed descriptions of the variables presented in Table 1. The dataset consists of 245 panel observations covering 35 regencies and municipalities in Central Java over the 2016–2021 period. Both dependent and independent variables were obtained from the Direktorat Jenderal Perimbangan Keuangan (DJPK) and Statistics Indonesia (Badan Pusat Statistik, BPS), which provide reliable, consistent, and publicly available regional economic data suitable for panel data analysis.

Table 1. Variables and Data Sources

| Variables | Descriptions | Measurements | Sources |
|-----------------------------|--|-----------------|---------|
| Dependent Variable | | | |
| Tax Buoyancy (LNTB) | Tax buoyancy in this study is defined as the responsiveness of tax revenue, calculated by comparing regional tax receipts to the GRDP at the regency/municipality level in Central Java. | Percent | BPS |
| Independent Variable | | | |
| Total Population (LNJP) | Population in this study refers to the total number of individuals permanently residing at the regency/municipality level in Central Java. | A million souls | BPS |
| Investment (LNI) | Investment in this study refers to the realized investment receipts recorded at the regency/municipality level in Central Java. | Million IDR | BPS |
| Shadow Economy (SE) | The shadow economy in this study refers to economic activities that are not reported for taxation purposes. This variable is measured using the labor-force approach, calculated by comparing the total population to the labor force at the regency/municipality level in Central Java. | Index | BPS |

Source: Processed Data, 2024

Regency-level data in Central Java are employed because this administrative unit captures variations in fiscal capacity, labor market structures, and local economic conditions that are relevant for explaining differences in tax buoyancy. The 2016–2021 period is selected based on consistent data availability and its relevance to major fiscal developments, including the implementation of the 2016 Tax Amnesty

program and the economic disruption caused by the COVID-19 pandemic.

The shadow economy is proxied by the proportion of informal employment relative to total employment. This labor-based indicator offers a more direct representation of unrecorded economic activity than alternative approaches, such as the currency demand method or the Multiple Indicators Multiple Causes (MIMIC) model. Informal workers, who typically operate

without formal contracts and outside the tax system, reflect economic activities that lie beyond the formal fiscal framework. Changes in the composition of formal and informal employment therefore serve as an effective proxy for shadow economy dynamics at the regional level, enabling an assessment of how informal activity influences the responsiveness of tax revenue to economic.

The empirical analysis applies panel data multiple linear regression. Several diagnostic tests are conducted to ensure model reliability, including tests for multicollinearity, heteroskedasticity, and autocorrelation. The normality test is not performed, consistent with the Central Limit Theorem, given the relatively large sample size of 245 observations (Wooldridge, 2020). Three alternative panel specifications—the Common Effects Model, Fixed Effects Model, and Random Effects Model—are estimated, with the most appropriate model selected using the Chow test, Hausman test, and Lagrange Multiplier test. The results indicate that the Fixed Effects Model (FEM) is the most suitable specification.

This model selection is further supported by theoretical considerations. Significant heterogeneity exists across regencies and cities in Central Java, reflecting differences in fiscal administrative capacity, industrial composition, labor market characteristics, and geographic conditions. These factors are largely time-invariant and may be correlated with the explanatory variables. Ignoring such heterogeneity would risk biased parameter estimates. By controlling for unobserved, unit-specific effects, the FEM produces more consistent and robust estimates and allows identification of within-region variations in tax buoyancy over time.

The panel data regression equation used in this study is as follows:

$$\text{LnTB}_{it} = \alpha_{it} + \beta_1 \text{LnJP}_{it} + \beta_2 \text{LnI}_{it} + \beta_3 \text{SE}_{it} + \mu_{it} \quad \dots \quad (1)$$

Where LnTB is Tax buoyancy; α is Constant; β is Regression coefficients (1–3); LnJP is Population size (log-transformed); LnI is

Investment (log-transformed); SE is Shadow economy; and μ is Error term

The study also employs statistical tests, including the coefficient of determination (R^2), F-statistic, and t-statistic, to evaluate the performance of the regression model concisely. The coefficient of determination (R^2) measures the proportion of variation in the dependent variable that is explained by the independent variables. The F-statistic test examines the joint significance of all independent variables, while the t-statistic test assesses the significance of each coefficient (Basuki, 2018; Ghazali, 2022).

RESULTS AND DISCUSSION

Before performing panel data regression analysis, the initial step involves testing whether the classical assumptions are fulfilled. The first test conducted is the multicollinearity test using the Variance Inflation Factor (VIF) to identify the presence of multicollinearity in the data. The results of the multicollinearity test are presented below:

Table 2. Multicollinearity Test Results

| Variable | VIF |
|----------|----------|
| SE | 1.056233 |
| LNJP | 1.158109 |
| LNI | 1.124985 |

Source: Processed Data, 2024

Table 2 indicates that all independent variables exhibit Variance Inflation Factor (VIF) values below the threshold of 10, suggesting the absence of multicollinearity among the explanatory variables.

The heteroskedasticity test assesses whether the variance of the regression residuals remains constant or varies across observations. In this study, heteroskedasticity is examined using the White test. The results of the White heteroskedasticity test are presented as follows:

Table 3. Heteroscedasticity Test Results

| | | | |
|---------------|----------|---------------------|--------|
| F-statistic | 0.499026 | Prob. F(4,233) | 0.8744 |
| Obs*R-squared | 4.594545 | Prob. Chi-Square(4) | 0.8681 |

Source: Processed Data, 2024

Referring to Table 3, the probability value is 0.8681, exceeding the significance level of $\alpha = 0.05$. This result indicates the absence of heteroskedasticity in the estimated model.

Autocorrelation is subsequently examined using the Durbin–Watson (DW) statistic. The calculated DW value is 1.973978, while the lower and upper critical bounds are $d_L = 1.76325$ and $d_U = 1.81384$, respectively. Since the DW statistic falls between d_U (1.81384) and $4 - d_U$ (2.18616), the null hypothesis of no autocorrelation cannot be rejected, indicating that the model's residuals are free from autocorrelation.

Table 4. Chow and Hausman Test

| Statistical Tests | Chi-Sq Statistic | Probability Value | Decision |
|-------------------|------------------|-------------------|----------|
| Chow | 630.287608 | 0.0000 | FEM |
| Hausman | 24.712449 | 0.0000 | FEM |

Source: Processed Data, 2024

Based on the results of these tests, the Chow test produces a probability value of 0.0000, indicating a firm rejection of the null hypothesis. This result suggests that the Fixed Effect Model (FEM) provides a significantly better fit compared to the Common Effect Model. Subsequently, the Hausman test yields a probability value of 0.0000, leading to the rejection of the null hypothesis that the Random Effect Model (REM) is appropriate. This implies that the individual effects are correlated with the explanatory variables; thus, the Fixed Effects Model (FEM) is the most suitable specification for this study.

Table 5. Fixed Effect Model Results

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|------------|-------------------|----------|
| C | 404.4192 | 101.5991 | 3.980539 | 0.0001 |
| SE | 56.29880 | 14.53214 | 3.874090 | 0.0001 |
| LNJP | -31.68197 | 7.152500 | -4.429496 | 0.0000 |
| LNI | 0.110708 | 0.188492 | 0.587335 | 0.5576 |
| R-squared | 0.322596 | | F-statistic | 2.664286 |
| Adjusted R-squared | 0.201515 | | Prob(F-statistic) | 0.000006 |

Source: Processed Data, 2024

Based on the estimation results using the Fixed Effect Model (FEM), the panel data The regression equation is:

$$TB = 404_{it} - 31.68 \ln JP_{it} + 0.11 \ln I_{it} + 56.29 SE_{it} \dots \dots \dots (2)$$

Based on the Fixed Effect Model estimation results shown in Table 3, the coefficient of determination (R^2) in the regression equation for tax buoyancy is 0.3226. This indicates that population size, investment, and shadow economy variables collectively explain 32.26% of the variation in tax

buoyancy. In comparison, the remaining 67.74% is influenced by other variables not included in the model. The computed F-statistic for the regression equation is 2.6643. To calculate the F-table value, the formula $F(\alpha; df_1; df_2) = F(\alpha; k-1; n-k)$ is used, where kkk is the total number of independent and dependent variables, and nnn is the sample size. According to the F-table, the critical F value for the tax buoyancy regression equation is 2.641. Since the computed F-statistic exceeds the critical F-value and the p-value is less than 0.05, it can be concluded that the population size,

investment, and shadow economy variables collectively influence tax buoyancy.

Additionally, the t-statistic and probability values for each variable are calculated and compared with the critical t-table value derived from $t(\alpha; df) = t(\alpha; n-k)$. The t-test results indicate that the variables population size and shadow economy have a significant influence on tax buoyancy in the districts/cities of Central Java during the 2016-2022 period. This is supported by t-statistic values exceeding the critical t-table value and significance levels of less than 0.05. This study reveals that rapid population growth in Indonesia does not proportionally enhance tax revenues. Instead, it fuels informal economic activities and constrains the taxable base, thereby weakening fiscal capacity (Gómez & Handeland, 2021). The evidence suggests that demographic expansion, when not accompanied by institutional strengthening, results in a mismatch between potential and realized fiscal returns (Awasthi & Engelschalk, 2018). Comparable dynamics have been documented in other regions. For example, in South Asia, despite sustained economic growth, tax-to-GDP ratios remain stagnant as much of the population is absorbed into agriculture and informal services that are difficult to tax effectively (Chettri *et al.*, 2023). These parallels reinforce the conclusion that population growth alone is insufficient to secure fiscal gains unless supported by robust institutional and policy frameworks.

Economic disparities further compound this problem. In regions dominated by low-income households, most workers engage in subsistence or informal labor, contributing minimally to direct taxation (Gerber *et al.*, 2021). Meanwhile, reliance on regressive consumption taxes, such as VAT, disproportionately burdens low-income groups without substantially enhancing tax buoyancy. Evidence from Latin America illustrates similar outcomes, where VAT expansion increased revenue stability but also widened inequality (Bird & Zolt, 2015). These findings highlight

the need for inclusive tax policies that can convert demographic pressures into sustainable fiscal resources.

Institutional weaknesses in tax administration further constrain the responsiveness of tax revenues to demographic changes. Beyond the expansion of the tax base, factors such as enforcement capacity, compliance incentives, and the adaptability of fiscal policy frameworks play a decisive role in shaping revenue outcomes. Weak administrative structures, limited digital integration, and persistent tax evasion diminish the effectiveness of tax collection systems (Bird, 2015). Empirical evidence from Indonesia (Putra & Anis, 2021) and Nigeria (Augustine *et al.*, 2021) indicates that in densely populated regions, revenue growth frequently fails to keep pace with population expansion due to substantial compliance gaps. These findings emphasize the pivotal role of governance quality in converting demographic dynamics into sustainable fiscal gains.

Within this context, the empirical results demonstrate that the shadow economy in Central Java exerts a paradoxically positive effect on tax buoyancy. Conventional economic theory generally posits that informality weakens fiscal performance by eroding the tax base. However, the findings of this study suggest that, under specific institutional and economic conditions, the shadow economy may instead enhance the responsiveness of tax revenues to economic growth. This result is particularly relevant for developing regions, where informal economic activities account for a substantial share of overall economic output.

The paradoxical positive effect observed in Central Java is consistent with earlier evidence from Turkey, where Erdinç & Suhail (2017) demonstrated that informal earnings enhanced household purchasing power and subsequently increased value-added tax revenues through higher levels of formal consumption. Similarly, Loayza (2016) emphasized the stabilizing role of informality in developing economies, arguing that the

informal sector functions as a labor market buffer and helps sustain aggregate demand during periods of economic stress.

By contrast, empirical findings from advanced economies present a markedly different pattern. Schneider & Buehn (2021) reported that in European countries, the shadow economy generally weakens fiscal performance, as spillover effects into formal consumption are insufficient to compensate for the erosion of the formal tax base. These cross-country variations highlight the critical role of institutional capacity, economic structure, and the degree of interaction between formal and informal sectors in shaping the relationship between the shadow economy and tax buoyancy.

Empirical evidence further indicates that the scale of informality plays a decisive role in determining the direction of its fiscal impact. Gnangnon (2023) argued that positive fiscal contributions from the shadow economy are only feasible when its size remains below a certain threshold—estimated at approximately 67 percent of GDP—beyond which negative effects tend to dominate. The findings of the present study are consistent with this perspective, as Indonesia's shadow economy, although substantial, has not yet reached a level that critically undermines fiscal performance.

More recent cross-country analyses reinforce this interpretation. Medina and Schneider (2024) showed that a positive association between the shadow economy and tax revenues is more likely to emerge in economies characterized by relatively low levels of financial development. In a similar vein, evidence from ASEAN countries suggests that informality may contribute positively to tax collection where domestic consumption demand remains strong (Song, 2025).

Taken together, these findings indicate that the shadow economy in Central Java should not be viewed solely as a fiscal liability. Rather, it represents a structural characteristic of the regional economy that, under certain conditions, may contribute to strengthening tax buoyancy. Nevertheless, this positive

contribution remains highly context-specific and inherently fragile. An excessive expansion of the informal sector or a weakening of its linkages with formal consumption channels may reverse the observed effect. Policymakers therefore face the challenge of formulating tax reforms that balance enforcement with inclusion. Measures such as simplified business registration procedures, lower compliance costs, targeted incentives for micro and small enterprises, and enhanced tax literacy programs may facilitate the gradual integration of informal activities into the formal economy, thereby transforming the short-term benefits of informality into more sustainable fiscal outcomes.

Contrary to the theoretical expectation that higher levels of investment should enhance regional fiscal capacity, the empirical results reveal that investment (LNI) does not exert a statistically significant effect on tax buoyancy in Central Java. This outcome suggests that investment-driven growth in the region has not been sufficiently broad-based or value-enhancing to generate measurable increases in tax revenue. A closer examination of the provincial economic structure indicates that investment flows are largely concentrated in labor-intensive manufacturing sectors, such as textiles, garments, and footwear, as well as in infrastructure projects characterized by long gestation periods. These sectors typically operate with narrow profit margins and rely heavily on tax incentives, which weakens their immediate contribution to fiscal revenues despite their role in employment creation and production expansion. According to the World Bank (2017), the fiscal impact of such industries remains limited, as substantial segments of their production networks involve informal or small-scale enterprises that operate partially or entirely outside the formal tax system.

This structural composition explains why investment-driven growth does not necessarily enhance tax revenue elasticity. In Central Java, supply chains linked to these industries depend heavily on subcontracting arrangements involving micro and small

enterprises, many of which operate informally or exhibit only partial tax compliance. Consequently, a substantial portion of investment-induced economic activity remains outside the formal tax net, thereby weakening the fiscal multiplier effects typically associated with capital accumulation. These outcomes are largely attributed to narrow profit margins, extensive tax incentive regimes, and weak integration of informal suppliers into the formal tax base (Musah *et al.*, 2024). Evidence from Vietnam and Bangladesh further supports this view, demonstrating that export-oriented, labor-intensive industries promote economic growth but generate modest fiscal contributions due to subcontracting structures and persistent compliance challenges (Peprah *et al.*, 2022).

Within the Central Java context, institutional and administrative constraints further attenuate the relationship between investment and tax buoyancy. Investment projects involving multinational enterprises, particularly those embedded in global production networks, are more susceptible to practices such as transfer pricing, under-invoicing, and profit shifting, all of which erode the effective domestic tax base. Export-oriented investment intensifies this challenge, as firms operating within global value chains often engage in tax planning strategies that reduce taxable profits in host regions (Gauß *et al.*, 2024). Local tax authorities frequently lack the enforcement capacity, digital surveillance infrastructure, and specialized audit expertise required to detect and address such practices. As a result, substantial investment inflows may coexist with stagnant tax performance. Empirical evidence from Southeast Asia and Sub-Saharan Africa reinforces this observation, showing that generous fiscal incentives combined with weak enforcement significantly diminish the fiscal returns of investment, even in periods of accelerated economic growth (Johnson & Toledano, 2023). Persistent informality and limited linkages between formal and informal sectors in labor-intensive regional economies further constrain the expansion of the taxable base, thereby

reinforcing structural barriers to fiscal capacity (Anwar & Wijaya, 2023).

The non-significant effect of investment on tax buoyancy reflects a deeper misalignment among investment promotion strategies, the sectoral composition of the regional economy, and the effectiveness of tax administration. Investment inflows contribute to production expansion and employment generation; however, these gains do not automatically translate into a broader taxable base when economic activities are concentrated in sectors characterized by limited value added, extensive reliance on fiscal incentives, and high levels of informality. Persistent administrative inefficiencies, particularly in the monitoring of cross-border transactions and the evaluation of tax expenditures, further limit the capacity of local governments to capture the fiscal benefits associated with investment-led growth.

These findings highlight the necessity of a recalibrated policy framework that emphasizes investment in higher value-added industries, reinforces linkages between formal and informal sectors, and applies fiscal incentives that are more conditional and time-bound. Strengthening tax administration through digitalization, real-time reporting systems, and targeted audits of multinational enterprises is also essential in enhancing fiscal responsiveness. Empirical evidence indicates that advances in tax administration technologies, including integrated data systems and digital audit tools, substantially improve the detection of profit shifting and enhance overall enforcement capacity (Xi & Ling, 2025). By situating the Central Java case within broader international experiences, this analysis provides a deeper and more nuanced understanding of why investment does not exert the expected influence on tax buoyancy and highlights structural reforms needed to strengthen the fiscal payoff of future investment inflows.

CONCLUSION

This study was conducted against the backdrop of persistent fiscal pressures in Central Java, where rapid demographic expansion and the continued prominence of informal economic activities raise concerns about the region's ability to maintain responsive and sustainable revenue performance. To address this challenge, the research sought to examine the influence of the shadow economy, investment, and Population Size on tax buoyancy. This indicator reflects the responsiveness of tax revenues to economic growth and the overall capacity of the tax system to support regional development. The analysis employed a quantitative empirical approach using a Fixed-Effects panel regression model based on official regional data for the period 2016-2022.

The empirical results show that Population Size has a significant negative effect on tax buoyancy, indicating that demographic expansion not accompanied by proportional improvements in productive capacity weakens revenue-generating efficiency and may indirectly foster greater participation in informal economic activities. The shadow economy, in contrast, demonstrates a statistically significant positive relationship with tax buoyancy, reflecting its paradoxical role in sustaining consumption-driven indirect tax revenues despite simultaneously eroding the base for direct taxation. Meanwhile, investment exhibits a positive but statistically insignificant effect, suggesting that the prevailing investment structure, dominated by labor-intensive and lower value-added activities, has not substantially enhanced the responsiveness of regional tax revenues under current institutional conditions.

These findings carry several important policy implications. Strengthening fiscal capacity requires more robust compliance mechanisms, broader adoption of digital-based tax enforcement, and redistributive measures that reduce regressive tax burdens. The progressive formalization of the shadow economy through simplified administrative

procedures, targeted incentives, and greater access to financial services is also essential for improving the stability of the tax base. Furthermore, investment promotion should prioritize higher-value-added sectors and be supported by conditional fiscal incentives, alongside stronger oversight of multinational enterprises. Ultimately, enhancing tax buoyancy in Central Java depends not only on economic expansion but also on the adaptability and institutional resilience of the regional tax administration.

Despite its contributions, the study acknowledges several limitations. Measuring the shadow economy remains methodologically challenging due to variations in estimation techniques and behavioral differences among economic agents, which may result in inconsistencies across datasets. Future research would benefit from the application of alternative or mixed-method approaches to generate more precise and context-specific measurements. In addition, extending the analysis to sectoral or micro-level data could provide deeper insights into the mechanisms through which informal economic activities influence tax buoyancy across different regional and structural settings.

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