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Is FDI a Driver of Regional Productivity? New Evidence from Post-Pandemic Indonesia

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Abstract:
This study explores the determinants of total factor productivity (TFP) across 34 Indonesian provinces from 2021 to 2023, focusing on the role of foreign direct investment (FDI), manufacturing value added (MVA), and non-oil and gas exports. Using a Cobb–Douglas production function and fixed-effects panel regression, the analysis shows that FDI and MVA have positive and significant impacts on regional productivity, while commodity-based exports are negatively associated with TFP. These findings highlight the limitations of a raw export-led growth model and the importance of industrial deepening. Spatial fixed-effects further reveal persistent productivity disparities, influenced by geography, infrastructure, and institutional quality. The results suggest that enhancing productivity requires tailored policy strategies that support industrial diversification, improve local absorptive capacity, and address structural constraints. This study contributes to understanding post-pandemic regional productivity trends and provides timely insights for inclusive economic policymaking in Indonesia.

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1. Introduction

Indonesia's ambition to achieve high-income status by 2045 relies heavily on its ability to boost long-term productivity. As one of the largest emerging economies, the country faces both structural opportunities and institutional challenges in ensuring sustained and inclusive growth. A key part of this agenda is total factor productivity (TFP), which measures how well labor and capital are turned into output.. However, Indonesia's TFP growth has slowed considerably since 2010, weakening one of the key engines of development. Dutu (2016) observed that post-2010 productivity growth was significantly lower than in the 2000s, while the World Bank (2020) notes that recent gains have come more from efficiency within sectors rather than a transformative shift toward higher-value activities.

Even though the government has focused on revitalizing industry, manufacturing in Indonesia has remained stagnant in terms of jobs and output. Between 2010 and 2020, manufacturing employment hovered around 14–15% of total employment—a level far below other middle-income countries (World Bank, 2020). This phenomenon, often described as "premature deindustrialization," limits Indonesia's ability to benefit from productivity gains typically associated with manufacturing, such as scale economies, technological learning, and higher formal employment rates (Rodrik, 2013; Szirmai, 2012).

Foreign direct investment (FDI) has long been viewed as a pathway to escape productivity stagnation. Theoretically, FDI brings in not only capital, but also access to advanced technologies, managerial expertise, and international best practices. Numerous empirical studies support this view: Rahmaddi and Ichihashi (2013) showed that FDI has a significant positive effect on Indonesia's while Fazaalloh (2024) demonstrated that FDI inflows are particularly effective in raising regional growth when absorptive capacity—such as infrastructure and skilled labor—is adequate. However, the relationship is not linear. Kataoka (2020) found that in many provinces, the impact of FDI is diluted due to weak institutional frameworks, fragmented supply chains, and the absence of meaningful linkages between foreign and local firms.

At the same time, the structure of industry helps explain why productivity levels vary from one region to another. Structural transformation—from agriculture to manufacturing and modern services—is a hallmark of development. Provinces with a larger share of manufacturing value added (MVA) tend to report better economic indicators, reflecting their greater exposure to innovation, export markets, and industrial policy incentives. According to Szirmai (2012), the manufacturing sector acts as an engine of growth by enabling scale-intensive production, technological upgrading, and the creation of productive jobs. In Indonesia, however, the industrial base is unevenly distributed, with Java enjoying a significant concentration of industrial clusters, while outer provinces lag behind.

Another key aspect of regional productivity is the structure and quality of exports. In theory, openness to international trade fosters efficiency through competition, benchmarking, and access to global markets. Firms that export are often more productive than their non-exporting peers, as they are pushed to meet international standards and innovate continually (Yang & Chen, 2012). Nevertheless, in Indonesia, non-oil and gas exports are still dominated by raw or semi-processed commodities, such as palm oil, coal, rubber, and copper. These commodities offer little scope for value addition or technology spillovers. Handoyo et al. (2024) found that technical efficiency and firm-level innovation are key predictors of export success—suggesting that simply increasing export volume does not guarantee productivity improvement.

Furthermore, Indonesia exhibits stark regional disparities in productivity performance. Provinces like Jakarta, East Java, and West Java consistently outperform others due to their access to infrastructure, human capital, and investment. In contrast, provinces in eastern Indonesia face constraints ranging from logistical isolation and poor internet penetration to underdeveloped industrial capacity. While previous studies (e.g., Purwono et al., 2021) have noted some convergence in TFP across provinces between 2011 and 2017, they fall short in explaining what structural factors drive this variation. Most research has focused on aggregate national trends or firm-level data, leaving a significant gap in our understanding of regional-level productivity determinants in the post-2015 era.

Additionally, recent economic shocks—such as the COVID-19 pandemic and global supply chain disruptions—have reshaped investment flows, labor mobility, and trade patterns. Yet, few studies have examined how these changes influence subnational productivity, particularly using updated panel data. Given the shifting economic landscape, a timely re-investigation of productivity drivers is not only academically necessary but also policy-relevant.

To fill in this knowledge gap, the present study investigates the determinants of total factor productivity (TFP) across 34 Indonesian provinces from 2021 to 2023. It focuses on three main explanatory variables: foreign direct investment, manufacturing value added, and non-oil and gas

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exports. By employing a fixed-effects panel data model, this study accounts for unobserved heterogeneity across provinces and isolates the net effects of these structural variables on productivity performance.

This study contributes to the literature by offering an updated, spatially disaggregated analysis of productivity drivers in Indonesia—something that is rarely done using recent provincial data. Theoretically, it advances our understanding of how openness (through FDI and exports) and industrial structure interact to shape productivity. Practically, it provides evidence-based insights for regional policymakers seeking to boost economic competitiveness. For lagging provinces, the findings highlight the importance of enhancing local absorptive capacity, investing in value-added industries, and rethinking commodity-driven export strategies. In sum, this paper bridges the gap between macro-level growth theory and regional development practice, providing new perspectives on how Indonesia can foster inclusive productivity growth in the years ahead.

2. Literature Review

2.1. The Foreign Direct Investment and Regional Productivity

Foreign direct investment (FDI) has long been positioned as a key driver of productivity enhancement, particularly in developing economies. Through capital inflows, access to frontier technologies, and exposure to international management standards, FDI can stimulate efficiency gains across sectors. Empirical evidence supports this proposition. For example, Blomström and Kokko (2001) emphasize that FDI often leads to positive spillover effects—especially when domestic firms are able to absorb and adapt the incoming knowledge and technologies.

However, the magnitude of FDI's impact is far from uniform. A growing body of literature highlights that the effectiveness of FDI is highly dependent on the host region's absorptive capacity. According to Borensztein, De Gregorio, and Lee (1998), countries with a minimum threshold of human capital are better positioned to benefit from FDI. In the Indonesian context, this argument is reinforced by Fazaalloh (2024), who finds that infrastructure quality, workforce skills, and institutional readiness are crucial in enabling regions to capture the full benefits of foreign investment.

Yet, structural barriers persist in many regions. Kataoka (2020) notes that several Indonesian provinces fail to convert FDI into productivity gains due to weak institutional frameworks, poor inter-firm linkages, and underdeveloped supply chains. This is consistent with the findings of Alfaro et al. (2004), who caution that the productivity-enhancing effects of FDI are conditional—not automatic—and are often constrained by local economic fragilities. Thus, while FDI remains a promising lever for regional growth, its potential depends heavily on the quality of supporting institutions and the strength of domestic absorptive mechanisms.

2.2. Manufacturing Value Added (MVA) and Structural Transformation

Industrialization has long been acknowledged as a cornerstone of sustained economic growth. As noted by Szirmai (2012), the manufacturing sector plays a pivotal role in driving productivity through scale economies, technological spillovers, and the creation of more formal and higher-quality employment. In this view, manufacturing does not merely contribute to output—it transforms the structure of economies by embedding innovation and diversifying production capacities.

However, Indonesia's industrial landscape reveals a stark geographical imbalance. The manufacturing base is disproportionately concentrated in Java, while many provinces outside the island remain reliant on agriculture and extractive industries. Tambunan (2019) argues that this uneven distribution of industrial activity explains a large part of the regional disparities in productivity levels, with Java's agglomeration effects and infrastructure advantages giving it a structural head start over lagging regions.

Furthermore, provinces with higher manufacturing value added (MVA) tend to benefit not only from economic scale, but also from greater exposure to export markets, government industrial policy, and the diffusion of innovation. As the ASEAN Development Outlook (2021) highlights, such provinces are often better integrated into regional and global production networks, making them more resilient and competitive in the face of economic shocks.

2.3. Non-Oil and Gas Exports and Their Limitations

The promise of export-led development has shaped Indonesia's economic strategy for decades, but the composition of exports remains a critical—and often underappreciated—determinant of productivity. In theory, openness to international trade should incentivize efficiency, innovation, and competitiveness. Yet in practice, Indonesia's export portfolio remains dominated by unprocessed or minimally processed commodities such as palm oil, coal, and rubber. These products, while valuable in terms of volume, contribute relatively little to technological advancement or industrial upgrading.

This pattern reflects what Basri and Patunru (2021) describe as a "productivity trap," in which reliance on raw commodity exports perpetuates a low-value growth model. The absence of downstream processing means that Indonesia exports natural wealth without capturing the full economic benefits. Firms are less incentivized to innovate, and spillovers into other sectors are limited.

Supporting this concern, Handoyo et al. (2024) demonstrate that it is not the quantity of exports that matters most for productivity, but rather the quality and technological intensity of export activities. Their research finds that firm-level innovation and technical efficiency are far more predictive of productivity gains than sheer export volume. In other words, growth rooted in raw exports may yield foreign exchange, but it does little to lift the overall efficiency of the economy.

UNIDO (2022) echoes this perspective, urging economies like Indonesia to move up the value chain. Without strategic efforts to deepen industrial capacity—through investments in processing, technology, and skill development—export-led growth risks becoming shallow and short-lived. Therefore, the country's current export structure, while beneficial in the short term, may undermine its long-term productivity aspirations unless it shifts toward value-added sectors.

2.4. Regional Disparities and Structural Constraints

Even with improvements in investment and trade, productivity outcomes vary significantly across Indonesia's provinces—revealing a deeper layer of structural inequality. Regions such as Jakarta, East Java, and East Kalimantan consistently outperform their peers, not only because of their industrial or financial base, but due to institutional and infrastructural advantages. These provinces benefit from better roads, logistics networks, access to skilled labor, and more responsive local governance—factors that enable them to attract and absorb investment more effectively (McCulloch & Sjahrir, 2020).

In stark contrast, provinces like Papua and East Nusa Tenggara (NTT) continue to face systemic barriers. Geographical isolation, limited digital infrastructure, under-resourced educational systems, and weak institutional frameworks constrain their ability to engage in high-productivity activities. As noted in the World Bank's 2023 report, these challenges are not simply developmental lag but represent structural bottlenecks that persist even when economic inputs—such as capital and trade—are accounted for.

Resosudarmo et al. (2021) highlight that Indonesia's spatial inequality is rooted in historical patterns of investment and state capacity. Addressing these entrenched disparities requires more than just market reforms or fiscal transfers. It demands a deliberate policy agenda focused on capability-building: strengthening regional governance, expanding basic infrastructure, and improving public service delivery.

Ultimately, fostering inclusive productivity growth in Indonesia depends on whether lagging regions are empowered with the tools they need to compete. Without this, the national economy risks

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fragmenting—where only a handful of provinces capture the benefits of globalization and structural change, while others are left behind.

3. Data and Methodology

This study adopts a quantitative approach using panel data from 34 Indonesian provinces over the period 2021 to 2023. This time frame was deliberately chosen to capture the immediate post-COVID-19 recovery and associated structural adjustments. According to the World Bank (2023), after a strong rebound in 2021–22—when growth rose to 5.3%—Indonesia's economic growth was expected to moderate to around 4.9% in 2023 as domestic demand normalized (World Bank, 2023a). Although output returned to pre-pandemic levels, productivity growth remained weak, with Indonesia continuing to face "declining productivity growth like other emerging market economies" (World Bank, 2023b). This context underlines the relevance of investigating recent regional productivity trends.

To measure total factor productivity (TFP), we apply the Solow residual method under a Cobb–Douglas production function framework. Specifically, output (Y) is assumed to result from capital (K), labor (L), and a residual productivity term (A), expressed as:

$$Y = A \times K^{\alpha} \times L^{\beta} \quad (1)$$

To isolate productivity, the equation is log-linearized:

$$\ln A = \ln Y - \alpha \ln K - \beta \ln L \quad (2)$$

This approach is widely used in macroeconomic growth accounting and attributes unexplained output growth to productivity (Hall & Jones, 1999; Szirmai, 2012; World Bank, 2023c). The elasticities are set at and , assuming constant returns to scale. While the Cobb–Douglas model is parsimonious and allows comparability, it imposes constant output elasticities across provinces. More flexible functional forms such as translog production functions allow for varying elasticities but require large datasets and complex estimation procedures (World Bank, 2023c). Given our panel's size and focus, the Cobb–Douglas model remains an appropriate and transparent choice.

The dependent variable is the log-transformed TFP at the provincial level. Three key explanatory variables are used: foreign direct investment (FDI), manufacturing value added (MVA), and non-oil and gas exports. FDI is measured in constant million Rupiah. MVA is the share of manufacturing in GRDP for each province, treated as time-invariant due to data constraints. Non-oil and gas exports are annual provincial values reported by the Ministry of Trade.

To estimate the relationship between TFP and its determinants, we use a fixed-effects panel regression model:

$$\ln(TFP_{\mathrm{it}}) = \alpha_{\mathrm{i}} + \beta_1 FDI_{\mathrm{it}} + \beta_2 MVA_{\mathrm{i}} + \beta_3 \ln(Exports_{\mathrm{it}}) + \varepsilon_{\mathrm{it}} \quad (4)$$

Here, captures unobserved province-specific effects, and is the error term. This model accounts for time-invariant heterogeneity such as geography, infrastructure, and institutional capacity. The Hausman test confirmed fixed-effects as the more consistent estimator over random-effects (χ^2 = 95.846, $p < 0.00001$), supporting the assumption that province-specific characteristics correlate with the regressors.

Standard panel diagnostics were applied to ensure model robustness. The Breusch–Godfrey/Wooldridge test detected autocorrelation (χ^2 = 18.533, p = 0.00034), addressed using clustered standard errors. Variance inflation factor (VIF) tests confirmed no multicollinearity, with all VIF values below 2.

An important modeling note concerns the treatment of MVA. Because consistent annual MVA data were unavailable, the study uses each province's 2023 MVA as a fixed indicator of its industrial base. This limits our ability to observe dynamic manufacturing shifts over time. In a fixed-effects model, including a time-invariant variable like MVA requires caution; its coefficient reflects cross-sectional rather than within-province variation. As such, it captures the baseline industrial strength of each province, not short-term changes.

Overall, this methodological design is consistent with studies such as Fazaalloh et al. (2024) and Rahmaddi & Ichihashi (2013), who used similar fixed-effects strategies to analyze provincial economic performance. The use of updated post-pandemic data and careful modeling adjustments ensures that this analysis is both timely and empirically robust.

Data were collected from Statistics Indonesia (Badan Pusat Statistik), the Ministry of Investment, and the Ministry of Trade. Because the research relies entirely on aggregated and publicly available data, ethical approval was not required

4. Result and Discussion

The spatial distribution and evolution of total factor productivity (TFP) across Indonesian provinces between 2021 and 2023 are presented in Figure 1. The horizontal bar chart allows for a clear comparison of TFP levels across regions and over time, highlighting provincial disparities and temporal changes. Provinces such as Kalimantan Timur, Kalimantan Utara, and DKI Jakarta consistently recorded the highest productivity levels, a trend that reflects their stronger industrial bases, greater inflows of foreign direct investment (FDI), and better infrastructure (Kuncoro, 2012; Hill, 2022).

In contrast, provinces such as Nusa Tenggara Timur, Maluku, and Bengkulu remained at the lower end of the TFP distribution throughout the period. These regions typically rely on traditional agriculture and extractive industries with limited downstream processing capacity, which has been shown to constrain productivity growth (Suriadi & Mustikawati, 2021; BPS, 2023). This pattern is consistent with literature emphasizing the productivity challenges of primary-sector-dominated economies (McMillan & Rodrik, 2011).

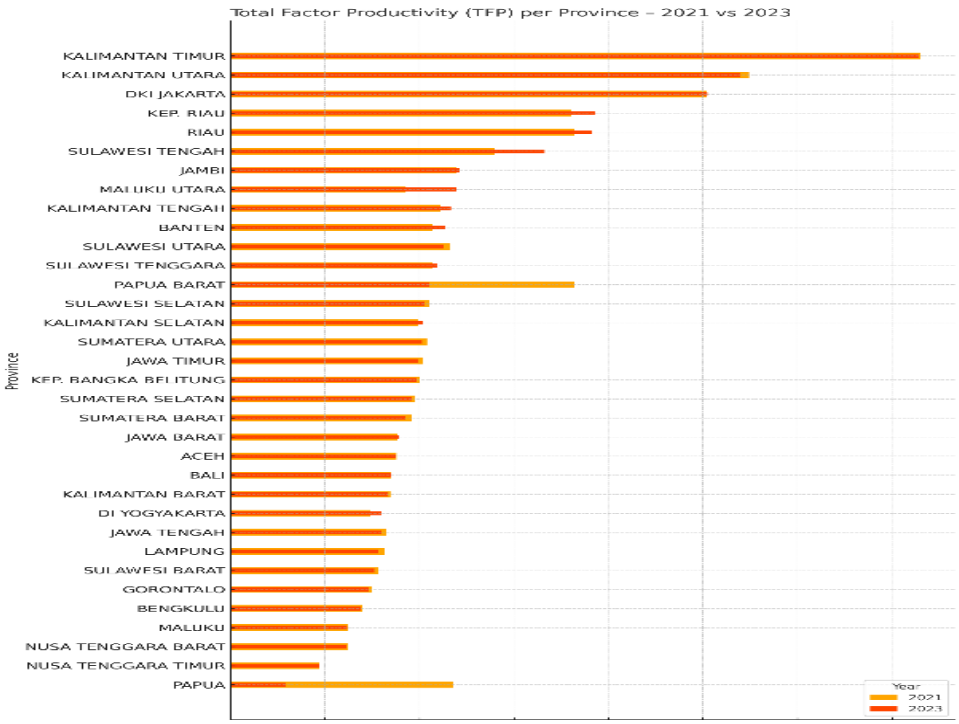

Figure 1 Total Factor Productivity (TFP) across Indonesian Provinces in 2021 and 2023.

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Several provinces—including Sulawesi Tengah and Papua Barat—demonstrated moderate gains in TFP, potentially as a result of recent infrastructure investment and policy-driven incentives such as decentralization and special economic zones (Syafrizal et al., 2023; Ardiansyah, 2022). However, other regions, notably Maluku Utara and Gorontalo, exhibited signs of stagnation or decline, which may be attributed to continued dependence on volatile, low-value commodity exports without sufficient industrial upgrading (Novita et al., 2023).

These spatial dynamics are broadly consistent with the regression results presented earlier in the paper. Provinces with a higher share of manufacturing value added and greater exposure to FDI tend to experience stronger productivity performance, while those reliant on undiversified resource exports appear to face structural barriers to efficiency gains. This visual evidence reinforces the importance of targeted regional policies aimed at promoting industrial diversification and enhancing local absorptive capacity (Szirmai, 2012; OECD, 2021).

Table 1. Fixed-Effects Regression Results on TFP Determinants, 2021–2023

Variable	Coefficient	t-stat	p-value
FDI(Foreign Direct Investment)	0.000036	.315	0.0238**
MVA(Manufacturing Value Added)	0.1166	.073	0.0421**
Non-Oil & Gas Exports	-0.7522	.169	0.0000***
Observations	: 102		
R^2	: 0.8268		
Adjusted R^2	: 0.7308		

The fixed-effects panel regression analysis presented in Table 1 reveals that all three explanatory variables—FDI, Manufacturing Value Added (MVA), and Non-Oil and Gas Exports—have statistically significant impacts on provincial Total Factor Productivity (TFP) in Indonesia. FDI has a small but positive and significant coefficient, suggesting that beyond capital infusion, foreign investment plays a vital role in enhancing productivity through knowledge spillovers, improved management, and technology transfer. This aligns with recent findings in the Southeast Asian context, including Widodo et al. (2020), which underscore the importance of regional absorptive capacity in maximizing the benefits of FDI.

MVA is also positively associated with TFP. This reinforces contemporary development arguments that industrialization remains a cornerstone of structural transformation. Recent studies by Tambunan (2019) and ASEAN Development Outlook (2021) highlight how provinces with diversified manufacturing bases—especially those involved in electronics, food processing, or textiles—benefit from higher productivity growth. These outcomes are visible in provinces like East Java and Riau, where industrial infrastructure and firm clustering contribute to efficiency gains.

Conversely, the negative association between non-oil and gas exports and TFP reflects the persistent limitations of a commodity-based growth model. As shown in Basri & Patunru (2021) and McKinsey Indonesia (2023), export reliance on raw materials such as palm oil, coal, or rubber contributes little to technological upgrading or innovation. This finding affirms the notion that export-led growth without industrial deepening may limit long-run productivity gains.

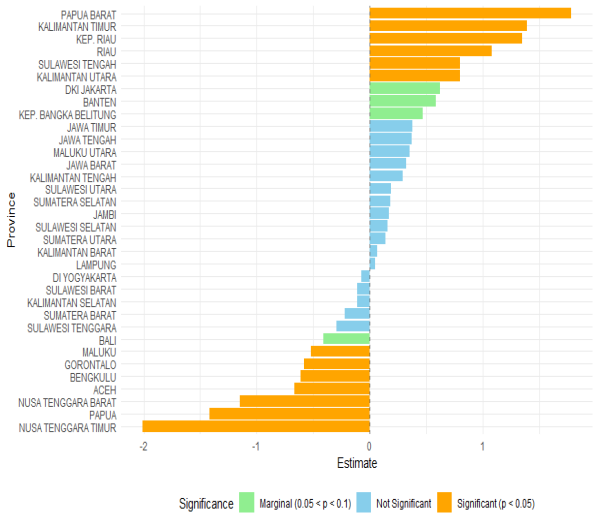

Figure 2. Spatial Variation in Fixed Effects (α_i) across Indonesian Provinces, 2021–2023

These structural patterns are further illuminated by the spatial distribution of provincial fixed effects. Even after accounting for differences in FDI, industrial structure, and trade, stark disparities in productivity persist across Indonesian provinces. At the upper end of the spectrum, resource-rich areas like Papua Barat and Kalimantan Timur exhibit notably positive fixed effects (α_i), reflecting their dominance in capital-intensive sectors such as mining, oil, and gas. According to the World Bank (2023a), provinces like Riau and East Kalimantan boast per capita GDP levels up to 20 times higher than their counterparts in underdeveloped regions like Maluku or Nusa Tenggara Timur. Moreover, Papua and Papua Barat benefit from substantial fiscal transfers, second only to Jakarta, alongside relatively advanced infrastructure for resource logistics (World Bank, 2023b). These advantages enable productivity levels that surpass what would typically be expected based on investment and trade variables alone.

In contrast, provinces such as Papua and Nusa Tenggara Timur exhibit significantly negative fixed effects—an indication of persistent structural challenges. Despite Papua's mineral wealth, its economic and social development remains severely constrained by inadequate infrastructure, limited access to education and healthcare, and governance gaps (World Bank, 2023c). Similarly, NTT struggles with chronic drought, low industrial capacity, and insufficient connectivity, all of which stifle economic diversification. The OECD/ADB (2020) underscores that regional inequality in Indonesia is largely shaped by disparities in human capital and basic public services. Our findings are aligned with this view: regions that score poorly on institutional readiness, electrification, and road networks consistently show lower productivity levels. As noted by McCulloch and Sjahrir (2020) and Resosudarmo et al. (2021), Indonesia's spatial inequality reflects a deeper divide in local capacities, where well-endowed and better-governed provinces pull ahead while remote and under-invested ones fall behind. This evidence affirms the central role of time-invariant geographic and institutional factors in shaping Indonesia's productivity map.

The diagnostic tests further support the model's validity. The Wooldridge test detects the presence of serial correlation; however, this issue is addressed by clustering standard errors at the provincial level to ensure robust statistical inference.

Table 2. Diagnostic Tests for Model Specification, 2021–2023

Test	Statistic	df	p-value	Conclusion

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Serial Correlation (Wooldridge test)	18.533	3	0.00034	Evidence of serial correlation

The regression findings offer nuanced insights for Indonesia's long-term development strategy. Although FDI plays an important role in boosting productivity, its effectiveness largely depends on how well local ecosystems are equipped to absorb and benefit from the foreign expertise and practices that come with it. Investing in education, technical training, and digital infrastructure should be considered complementary priorities to attract and harness meaningful foreign investment. This resonates with the work of Widodo et al. (2020) and the ASEAN+3 Macroeconomic Research Office (2023), which emphasize that foreign capital alone is not enough to drive structural transformation.

Industrial policy must also evolve from a Java-centric orientation to a more inclusive national strategy. Provinces outside Java—especially those with untapped industrial potential—require targeted support in the form of industrial zones, SME upgrading schemes, and innovation financing. The experience of East Java and Riau shows that strategic clustering of industries and infrastructure development can unlock sustained TFP growth (Tambunan, 2019; OECD, 2021).

In terms of trade structure, the persistent drag of raw commodity exports on productivity suggests the urgency of moving up the value chain. Encouraging downstream processing, promoting agro-industrial exports, and supporting technological upgrades in export-oriented sectors are not just desirable—they are essential for escaping the middle-income trap (UNIDO, 2022; McKinsey Indonesia, 2023).

Future research should delve deeper into why certain provinces benefit more than others. Disaggregated indicators such as digital literacy, institutional capacity, and integration into global value chains could provide a more complete picture. Modeling interaction terms between FDI and such indicators may help identify the inflection points at which globalization becomes a force for inclusive productivity growth.

In essence, the findings underscore that enhancing TFP is not just a matter of increasing inputs or opening markets—it's about building resilient, adaptive, and capable regional economies equipped to thrive in an interconnected world.

5. Conclusion

Indonesia's aspiration to become a high-income country by 2045 hinges on its ability to strengthen productivity across all regions. This study shows that while foreign direct investment (FDI) and manufacturing value added contribute positively to total factor productivity (TFP), regions that rely heavily on non-oil and gas commodity exports tend to experience lower productivity. These patterns suggest that structural transformation—not just higher investment or export volumes—is essential for sustained growth.

Interestingly, even after accounting for these variables, some provinces consistently perform better or worse than the model predicts. Provinces like East Kalimantan and Papua Barat stand out with unusually high productivity, likely due to their capital-intensive extractive industries and better infrastructure. On the other hand, provinces such as Papua and Nusa Tenggara Timur continue to lag behind, reflecting longstanding challenges in education, connectivity, and public service quality. These findings suggest that productivity is influenced not only by economic inputs but also by deep-rooted geographic and institutional factors.

What emerges is a need for more tailored policies. For foreign investment to lift productivity, it must be matched by improvements in local capacity—better skills, stronger institutions, and efficient logistics. Similarly, industrial policy must extend beyond Java and prioritize emerging manufacturing hubs in less developed regions. Commodity exports, while valuable, need to be upgraded into higher-value products to generate real gains in efficiency.

The study is not without limitations. It uses fixed indicators for manufacturing due to data constraints, which prevents tracking dynamic shifts over time. It also doesn't capture how institutional quality or digital infrastructure might alter the impact of investment. Still, the results offer a strong starting point for further investigation.

Going forward, it would be valuable to examine how regional capabilities—like digital readiness or governance quality—interact with investment to shape productivity outcomes. A more granular approach using firm-level or sub-provincial data could provide even richer insights. For now, the message is clear: raising productivity in Indonesia will require more than simply opening markets or increasing capital flows. It's about building the right conditions—locally and nationally—for every region to thrive.

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