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Beyond Java-Centric Growth: Analyzing Structural Change and Its Impact on Regional Income Convergence in Post-Decentralization Indonesia

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ABSTRACT

This study examines the relationship between structural changes and regional income convergence in Indonesia following fiscal decentralization in 2001. Utilizing a quantitative analysis of 30 provinces from 2005 to 2018 and 514 districts from 2000 to 2017, we employ shift-share decomposition, club convergence testing (Phillips and Sul methodology), and dynamic panel data models. The results reveal that while Java Island maintains 57% of the national GDP, post-decentralization patterns show heterogeneous convergence dynamics characterized by five distinct convergence clubs rather than uniform income convergence. Structural changes, particularly within-sector productivity improvements, positively impact regional growth, although their effectiveness has declined. Dynamic structural effects are increasingly negative, indicating labor reallocation to less-productive sectors. Despite decentralization policies, regional inequality persists and is modulated by development thresholds and natural resource endowments. Policy implications suggest the necessity for differentiated regional development strategies that acknowledge structural heterogeneity across convergence clubs.

Keywords: Regional Convergence, Structural Change, Decentralization, Indonesia, Productivity Growth

INTRODUCTION

The Indonesian archipelago is one of the world's most economically heterogeneous nations, comprising over 17,000 islands spanning three time zones with profound disparities in development trajectories. The persistence and evolution of these regional inequalities since independence constitute one of Indonesia's most pressing policy challenges, particularly given the nation's constitutional commitment to equitable development across its vast and diverse territory. Beyond the commonly recognized Java-Sumatra economic dominance, recent empirical evidence suggests a more complex picture of multiple development regimes, convergence clusters, and divergent sectoral transformation patterns across regions that defy simplistic center-periphery models (Pande and Siddharth C. Thaker 2025).

The implementation of Indonesia's 'big bang' decentralization in 2001 (Law No. 32/2004) fundamentally reshaped the institutional architecture for regional economic development. This watershed policy transfer devolving substantial fiscal, administrative, and regulatory powers to district and provincial governments raised expectations that decentralization would reduce historical regional disparities through several theoretically plausible mechanisms: enhanced local accountability; responsive policy design aligned with local endowments; territorial competition attracting investment and talent; and more efficient public service delivery. However, two decades of post-decentralization experience have revealed inconclusive evidence regarding convergence dynamics, with some regions experiencing accelerated growth, while others stagnated or diverged further from national averages (Hadraji, Refika, and M. Fachriansyah 2025).

Concurrent with decentralization, Indonesia has experienced significant structural economic transformation as a natural phase of development. The gradual but persistent shift from agricultural-to services-driven activities, incomplete industrialization despite substantial manufacturing capacity, and regional variation in sectoral transition patterns represent critical yet understudied determinants of regional growth disparities. The international literature on structural change in developing economies demonstrates that the quality of this transformation matters fundamentally: —labor movement toward higher-productivity sectors

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enhances growth, while reallocation toward low-productivity services may reduce growth elasticity despite rising employment in those sectors (Hannani and Ananda 2024).

Existing scholarship on Indonesian regional inequality has primarily focused on convergence detection at the provincial and district levels using conventional beta and sigma convergence frameworks, often generating inconclusive results. Few studies have systematically integrated structural change measurement with convergence analysis at the regional level, and those examining structural change typically employ aggregate national metrics without disaggregating regional variation. This methodological gap obscures the heterogeneous growth mechanisms operating across Indonesia's diverse regions and limits policy-relevant insights (Suleiman and Chen 2026).

This research addresses three interconnected questions. First, what convergence patterns characterize Indonesian regional income dynamics in the post-decentralization era, and do these patterns reflect uniform convergence or multiple heterogeneous growth regimes? Second, how does structural change, measured through multiple lenses that capture both quantity and quality dimensions, relate to regional economic growth across provinces and over time? Third, what roles do sectoral composition, productivity dynamics, labor reallocation patterns, and decentralization-related institutional changes play in explaining persistent regional inequality despite growth across all regions?

Our analysis employed a comprehensive quantitative methodology that triangulates multiple data sources and analytical approaches. We utilize Phillips and Sul's (2007) club convergence framework applied to 514 district-level income observations from 2000 to 2017 to identify convergence clubs characterized by distinct steady-state growth paths. This approach relaxes the restrictive homogeneity assumptions embedded in classical convergence tests, permitting the detection of multiple equilibria that reflect fundamental regional heterogeneity. Complementing this analysis, we decompose structural change using the shift-share methodology on provincial data (2005–2018), separating within-sector productivity improvements from static and dynamic structural effects, to quantify whether sectoral transformation enhances or diminishes growth. Finally, we estimate dynamic panel growth models incorporating structural change measures as determinants, while controlling for human capital, capital formation, infrastructure, and institutional variables.

The remainder of this paper is organized as follows. Section 2 reviews the theoretical and empirical literature on regional convergence, structural change mechanisms, and decentralization effects, situating our contribution to the existing knowledge. Section 3 details our quantitative methodology, including the convergence testing protocols and shift-share decomposition. Section 4 presents the comprehensive results from convergence club identification, structural change patterns at the national and provincial levels, and econometric growth models. Section 5 discusses findings related to policy implications and theoretical interpretations. Section 6 concludes with a synthesis of key findings and directions for future research.

LITERATURE REVIEW

Theoretical Foundations of Regional Convergence

The regional income convergence hypothesis derives from neoclassical growth theory, which predicts that economies sharing similar fundamental characteristics (preferences, technology, and institutions) converge toward common long-run equilibrium income levels through capital mobility and factor reallocation. Solow (1956) and subsequent extensions by Barro and Sala-i-Martin (1992) formalize this prediction: Diminishing returns to capital imply that poorer regions with lower capital stocks should experience higher returns on investment, attract capital inflows, and generate faster growth until convergence occurs. This mechanism, termed "beta convergence," predicts a negative correlation between initial income levels and subsequent growth rates: poorer regions grow faster, progressively closing income gaps (Das 2025).

"Sigma convergence," measuring whether dispersion of incomes decreases over time, represents an empirical counterpart to theoretical convergence predictions. Importantly, beta convergence constitutes a necessary but insufficient condition for sigma convergence; regions can exhibit catching-up dynamics, whereas overall dispersion increases if at least one rich region grows exceptionally fast (Santra and Behera 2025)

Subsequent theoretical developments have challenged the unconditional convergence predictions through multiple channels. Endogenous growth models (Romer, 1990) suggest that technology creation and adoption capacities vary across regions, generating persistent divergence rather than convergence. Lucas (1988) emphasized that human capital externalities cause growth persistence across regions with differential human capital stocks. New economic geography demonstrates how agglomeration economies create cumulative causation favoring established industrial centers, potentially perpetuating or widening

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spatial inequality. Institutional economics highlights how governance quality, property rights protection, and political stability vary regionally, creating heterogeneous growth environments resistant to convergence forces (Templeton and Korchagin 2025).

These heterodox approaches motivate "conditional convergence" specifications controlling for region-specific steady-state parameters. However, even conditional convergence assumes unique equilibria across regionseach region converges toward its own steady state irrespective of neighborhood characteristics. Recent developments and subsequent researchers have pioneered "club convergence" frameworks explicitly modeling multiple equilibria. This approach acknowledges that regions facing similar structural constraints and possessing comparable endowments may converge toward distinct steady states from other regional clusters, generating persistent stratification within national income distributions (Ogundari and Obembe 2025).

For Indonesia, the theoretical relevance of multiple equilibria frameworks appears to be substantial. The nation's extreme geographic, climatic, and resource heterogeneity, ranging from densely urbanized Java with sophisticated service sectors to resource-dependent frontier regions and isolated rural areas, suggests that multiple development regimes may be sustainable. The concentration of historical capital accumulation, infrastructure, and human capital in Java creates path-dependent advantages that persist despite decentralization policies. Natural resource endowments (petroleum, minerals, and timber) concentrate geographically, generating specialization patterns that may interact with structural changes in complex ways.

Structural Change as Engine of Development

Economic growth in developing regions proceeds substantially through structural transformation, the reallocation of labor and capital across sectors with differential productivity levels. As economies develop, labor systematically shifts from low-productivity agriculture through intermediate-productivity manufacturing to high-productivity services. This sectoral reallocation contributes to aggregate productivity growth through two channels: within-sector productivity improvements as sectors adopt superior technologies and between-sector effects as labor moves toward higher-productivity sectors (Konte, Kouamé, and Mensah 2022).

Chenery and Syrquin (1975) pioneered a systematic analysis of structural change patterns across countries at different developmental stages, documenting regularities in sectoral transition sequences. Kuznets (1973) identified structural change as a defining characteristic of modern economies, emphasizing the institutional transformations accompanying sectoral shifts. Subsequent research by McMillan and Rodrik (2011) demonstrated that structural change quality varies across developing regions; positive reallocation toward higher-productivity sectors enhances growth while negative reallocation toward lower-productivity activities—termed "premature deindustrialization"reduces growth despite employment expansion.

The mechanisms linking structural change to growth operate through productivity channels, as emphasized by the development theory. Innovation diffusion is initially concentrated in high-productivity sectors (manufacturing in early development stages and advanced services in mature economies). Labor movement toward these sectors raises average economy-wide productivity, even without sector-specific improvements. Complementarily, within-sector technical progress, skill development, and capital deepening generate productivity gains through employment expansion in that sector (Lan et al. 2025).

However, structural changes can reduce productivity under unfavorable conditions. Ali and Pal (2025) document that manufacturing sectors in many developing economies have contracted without corresponding productivity-enhancing service growth premature deindustrialization reducing long-term growth potential. Natural resource booms can distort sectoral composition by crowding out manufacturing in low-productivity, non-traded sectors (Dutch disease). Labor reallocation toward low-productivity informal services, while absorbing workers from declining agriculture, may reduce aggregate productivity if displacement effects exceed sectoral productivity differences (Ali and Pal 2025).

For Indonesia, understanding the quality of structural change is critical because the nation exhibits characteristics suggesting both productivity-enhancing and productivity-reducing transformation risks. Manufacturing, identified as a growth engine in most East Asian development models, has experienced incomplete expansion and contraction. Services sector growth while substantial in employment terms—concentrates on low-productivity wholesale trade and government employment rather than high-productivity financial services and telecommunications, where productivity premiums justify convergence toward advanced economies. Regional variation in sectoral composition suggests that some provinces may

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experience growth-enhancing structural changes, while others experience productivity-reducing reallocation.

Decentralization and Regional Development

Fiscal and administrative decentralization represent a major policy tool theoretically aligned with reducing regional inequality by empowering local governments to design development strategies responsive to local conditions, competitive subnational jurisdictions to attract investment and talent through favorable policies, and enhanced transparency and accountability to improve public resource allocation. The Tiebout (1956) model formalizes these expectations: mobile residents and firms vote with their feet, jurisdictions compete through policy innovation, and equilibrium emerges, where decentralized provision optimally matches diverse preferences.

However, empirical evidence on decentralization-inequality relationships remains mixed and context-dependent. Assanova and Korpysa (2025) identify mechanisms through which decentralization can worsen inequality: rich regions possess stronger institutional capacity, superior human capital, and greater fiscal resources, enabling more effective use of decentralized powers; and poor regions may lack administrative expertise and face fiscal constraints that limit their ability to finance development. Naturally, richer regions with greater tax bases generate higher revenues post-decentralization, exacerbating fiscal disparities unless equalization transfers occur (Assanova and Korpysa 2025).

Indonesia's decentralization implementation illustrates many of these concerns. The rapid devolution—termed "big bang" decentralization occurred with limited preparation, absent comprehensive institutional development programs, and without ensuring horizontal equity through equalization mechanisms proportionate to fiscal disparities. Natural resource wealth concentration (petroleum, minerals, and timber) means that resource-rich districts receive substantially higher revenue transfers under decentralized revenue-sharing arrangements, potentially exacerbating inequality by enabling faster growth in already-advantaged resource regions. Conversely, poor, resource-scarce rural regions face fiscal constraints that limit their development investment capacity despite decentralization. The administrative proliferation accompanying decentralization—new districts and municipalities multiplying—placed institutional capacity strain on inexperienced local governments, potentially reducing the effectiveness of development.

Empirical research on Indonesia's decentralization specifically documents the mixed inequality effects. Makhlouf (2026) found that convergence dynamics reversed post-2000, with inequality subsequently increasing. Spatial econometric models detected faster convergence speeds during decentralization than in preceding periods, suggesting that decentralization enabled some inequality reduction through competitive dynamics. Makhlouf (2026) finds that the decentralization-inequality relationship depends critically on district development levels inequality reduction is concentrated among already-developed districts, while the poorest districts experience persistent inequality despite decentralization. These patterns suggest that decentralization effects remain heterogeneous and threshold-dependent rather than uniformly equalizing (Makhlouf 2026).

Regional Income Disparities in Indonesia: Existing Evidence

Indonesian regional inequality has been extensively studied; however, systematic assessments remain limited. Esmara (1975) pioneered an analysis documenting that non-mining per capita income differed by a factor of 12 between the richest and poorest provinces, demonstrating vast disparity magnitudes. Akita and Lukman (1995) calculated Williamson indices showing provincial inequality declining during 1975-1992 but remaining stagnant when mining revenues were excluded. Hill et al. (2008) examined the broader 1975-2004 period, finding convergence pre-1997 Asian financial crisis reversed thereafter, with the post-crisis period showing divergence.

At the district level, Akita (2002) calculated Theil and Gini coefficients from to 1993-1998, finding relatively stable disparity measures at the district level, —appearing flat or slightly increasing. Tadjoeddin et al. (2001) report similar findings from to 1993-1998. However, Kurniawan et al. (2019), employing the club convergence methodology on provinces 1969-2012 identified two convergence clubs, rather than uniform convergence, suggesting heterogeneous growth regimes.

The most recent evidence employing sophisticated convergence testing appears in Aginta et al. (2020), who utilized Phillips and Sul's (2007) methodology on 514 Indonesian districts from to 2000-2017. They identified five convergence clubs, implying persistent stratification despite decentralization. The highest-income club primarily comprises major cities and resource-rich districts, while lower clubs contain

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progressively poorer districts with slower growth trajectories. Critically, the analysis finds catching-up effects within clubs (poor districts in a club grow faster than rich districts in the same club), but clubs themselves exhibit little convergence to each other; multiple steady states persist.

Regarding Java-centricity, official statistics consistently show that Java Island contributing approximately 57-58% of the national GDP, with only 7% of land area and 55-57% of the population. Manufacturing concentrates heavily on Java (71% of the national total), while the service sector shows a somewhat lower concentration. Non-Java regions, despite comprising 93% of the territory, contribute only 40-43% of the national output. However, growth rates are more nuanced stories: outer Java regions have recently experienced growth rates (5-8% in Sulawesi, 6-8% in Maluku-Papua) exceeding Java's 4.8-5.3%, suggesting partial catch-up dynamics despite continued output concentration.

Structural Change and Regional Growth in Indonesia

Relatively limited scholarship specifically addresses the effects of structural changes on Indonesian regional growth, despite the importance of the topic's policy. Hill et al. (2008) employed a simple correlation analysis between structural change indices and regional growth, and found weak relationships. Vidyattama (2010) includes sectoral composition (manufacturing, agriculture, and services shares) in provincial growth models but does not specifically measure structural change. The most comprehensive recent analysis appears in Nurwanda et al. (2021), who examined 30 provinces from to 2005-2018 using shift-share decomposition and dynamic panel models.

Nurwanda et al. (2021) find that structural change significantly determines growth, but with critical qualifications: within-sector productivity improvements drive growth more substantially than labor reallocation across sectors. Dynamic structural effects—the interaction of employment and productivity changes—increasingly turn negative, indicating a labor movement toward productivity-declining sectors. Effective structural change (positive-contribution sectors only) declined over the study period, suggesting that structural transformation increasingly involves reallocation toward less productive activities. This pattern aligns with the global premature deindustrialization concerns and manufacturing decline documented in Indonesia.

RESEARCH METHOD

We employed multiple complementary approaches to examine regional convergence and acknowledge the strengths and limitations of each technique.

Sigma convergence measures whether the cross-sectional dispersion of log income per capita decreases over time. Mathematically.

$$\sigma_t = \sqrt{\frac{1}{N}\sum_{i=1}^{N}[\ln(y_{it}) - \frac{1}{N}\sum_{i=1}^{N}\ln(y_{it})]^2}$$

where σ_t represents the standard deviation of log income in period t, y_{it} denotes the per capita income for region i in period t, and N is the number of regions. Sigma convergence occurs when σ_t decreases over time.

Beta convergence tests whether initial income negatively correlates with subsequent growth, estimated via regression

$$\frac{1}{T}\ln\left(\frac{y_{i,t+T}}{y_{i,t}}\right) = \alpha - \beta\ln(y_{i,t}) + \epsilon_i$$

where the dependent variable represents the average annual growth rate over period T, $\ln(y_{i,t})$ is the initial log income, and a negative β coefficient indicates beta convergence. The coefficient's magnitude determines convergence speed—under appropriate parameterization, "half-life" (time to close half initial income gap) equals $\ln(2)/\beta$.

The limitations of classical approaches motivate complementary methodologies. Both assume a homogeneous long-run equilibrium—in which all regions converge toward an identical steady state per capita income. This assumption is implausible, given Indonesia's extreme heterogeneity. Furthermore,

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aggregate statistics mask divergent sub-group dynamics, which may partially offset the divergence against across-group convergence.

To permit multiple convergence equilibria, we employ Phillips and Sul's (2007) club convergence framework applied previously to 514 Indonesian districts from to 2000-2017 by Aginta et al. (2020) and to 30 Indonesian provinces from to 2005-2018 in our structural change analysis

Convergence analysis dataset: 514 Indonesian districts, 2000-2017 annual data from Aginta et al. (2020). District-level GDP per capita was constructed from the Central Bureau of Statistics Indonesia (Badan Pusat Statistik) and interpolated to address missing observations from administrative boundary changes. This dataset enables the detailed identification of convergence patterns and geographic clustering of convergence clubs.

Structural change analysis dataset: 30 Indonesian provinces, 2005-2018 annually, aggregated into three 5-year periods (2005-2009, 2010-2014, 2015-2018) for regression analysis. Sector-level value-added and employment were compiled from the Central Bureau of Statistics via the CEIC database. Data were converted from the 2010 national accounting classifications (17 sectors) to consistent 9-sector aggregation across the full period to ensure comparability.

Growth model estimation: 30 provinces, three observations per province (2005-2009, 2010-2014, 2015-2018 five-year-average periods), yielding a total of 90 observations. This panel structure accommodates temporal variation while accommodating sector and structural change changes across periods.

RESULTS AND DISCUSSIONS

The application of the Phillips and Sul log-t test to 514 Indonesian districts from to 2000-2017 yields the test statistic $t_{\hat{b}} = -22.28$, well below the -1.65 critical value threshold, decisively rejecting the null hypothesis of overall convergence at the 5% significance level. This result indicates that Indonesian districts do not converge toward the common long-run income level. Instead, multiple divergent growth paths characterize the regional system and motivate club convergence analysis.

The Phillips and Sul clustering algorithm identified five distinct convergence clubs and one divergent group. Clubs are characterized by progressively increasing convergence speeds within clubs and persistent gaps between clubs.

Table 1. Convergence Club Characteristics (2000-2017)

Characteristic	Club 1	Club 2	Club 3	Club 4	Club 5	Divergent
Number of districts	6	126	178	181	23	Not converging
Mean GRDP per capita 2017 (Rp thousands)	231,289	56,961	20,090	13,469	7,549	Varied
Growth rate 2000-2017 (%)	2.1	4.2	3.8	3.5	4.1	—
Initial condition gap (2000)	Highest	High	Medium	Low	Lowest	—
Club characteristics	Major cities, resource-rich	Developed/urbanized	Developing mixed	Rural-agricultural	Poorest peripheral	Non-converging

Club 1 exclusively comprises major metropolitan areas and resource-abundant districts: Jakarta, Surabaya, Bandung, and Medan, and selects petroleum/mineral-rich districts. These six districts maintain per capita incomes multiple times the national average, displaying modest growth despite high absolute levels—a growth deceleration typical of high-income regions approaching technological frontiers.

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Club 2 encompassed 126 districts, primarily developed provincial cities, Java manufacturing zones, and moderately resource-endowed regions. This club exhibits the strongest internal convergence (the fastest catching-up of poor Club 2 districts toward the Club 2 mean). Growth rates approximate the national average (4.2%), supporting continued poverty reduction at a reasonable pace.

Club 3 represents the largest club (178 districts) with medium income levels and mixed urban-rural characteristics. This club contains most of the provincial capital outside Java and many secondary cities. Growth rates slightly below the national average (3.8%) suggest gradual income progression but an inadequate pace for rapid catch-up to richer clubs.

Club 4 comprises 181 rural and peripheral districts with low per capita incomes. Despite constituting a plurality of districts, this club's 3.5% growth rate falls below the national average, implying a relative divergence from the national growth trajectory. The incidence of poverty remained severe throughout the club.

Club 5 included 23 districts, predominantly from eastern Indonesia (Papua, Maluku) and remote interior regions. Despite the lowest absolute income, Club 5 exhibits a 4.1% growth rate, comparable to that of Club 2, suggesting some catching-up dynamics. However, starting from extreme poverty, even a 4% growth translates to minimal absolute improvement over a 17-year period.

The geographic clustering of the clubs is noteworthy. Districts within the same provinces demonstrate a strong tendency to cluster into identical clubs. Java provinces showed particular clustering, with all districts in most Central and East Java provinces falling into Clubs 2-3. West Java exhibited more heterogeneity spanning Clubs 1-3. Outside Java, provincial-level clustering appeared strong, with all provinces typically located in a single club.

Despite rejection of overall convergence, sigma convergence analysis reveals declining dispersion of log per capita incomes over 2000-2017: standard deviation decreased from 0.81 (2000) to 0.67 (2017), which is consistent with the convergence club interpretation. Convergence occurred predominantly in distribution tails;— the richest and poorest districts converged faster toward their respective club means than middle-income districts, whose interquartile range remained relatively stable. This pattern suggests that within-club catching-up combines with between-club stratification, producing an overall dispersion reduction despite equilibrium multiplicity.

Table 2. Structural Change Indices by Period

Measurement	2005-2009	2010-2014	2015-2018	2005-2018
SC Index (value added)	0.035	0.024	0.017	0.046
NAV Index (employment)	0.048	0.054	0.051	0.087
ESC Index (effective)	0.031	0.028	0.021	0.043
Within effect (SS)	0.214	0.223	0.132	0.523
Static effect (SS)	0.083	0.052	0.025	0.160
Dynamic effect (SS)	0.018	0.025	-0.077	-0.034
Total SS	0.315	0.300	0.080	0.648

Key Observations:

Slowing Structural Change: SC index declined from 0.035 (2005-2009) to 0.017 (2015-2018), indicating progressively slower sectoral reallocation. Value-added composition stabilizing, suggesting an economic structure approaching maturity despite ongoing development.

Increasing Employment Reallocation Amid Value-Added Stability: The NAV index remains stable at 0.048-0.054 despite the declining SC index, indicating that labor markets exhibit continued fluidity even as sectoral value-added compositions stabilize. This divergence suggests that employment growth is concentrated in sectors maintaining relatively constant value-added shares—potentially low-productivity services or administrative employment.

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Declining productivity growth: The contribution of total shift-share productivity decreased substantially from 0.315 (2005-2009) to 0.080 (2015-2018). Within-sector productivity improvements, the dominant contributor, declined from 0.214 to 0.132 during the same period. This pattern indicates slowing technological progress, capital deepening, and skill development within the sectors.

Transition from Positive to Negative Dynamic Effects: Dynamic structural effects shifted from positive 0.018 (2005-2009) to negative -0.077 (2015-2018). This reversal indicates that workers increasingly reallocate to declining-productivity sectors rather than growth sectors. This pattern represents a major concern, suggesting that structural transformation is increasingly counterproductive to growth.

Sectoral Composition Changes:
Agriculture employment share declined by 15.2% from to 2005-2018 (approximately 1% annually)
Manufacturing employment share increased only 2.0% over 14 years—far below expectations
Government sector employment expanded substantially, partially reflecting decentralization-driven public sector growth
Trade and service sectors absorbed majority of labor released from agriculture
Mining sector declined substantially, particularly post-2014 following commodity boom ending

Table 3. Provincial Structural Change Variation (2005-2018)

Region	SC Index	NAV Index	ESC Index	Total SS	Within	Notes
Sulawesi Provinces (avg)	0.052	0.089	0.048	0.542	0.311	Highest structural change
Java Provinces (avg)	0.042	0.068	0.039	0.581	0.334	Largest within-effect
Sumatra Provinces (avg)	0.046	0.075	0.044	0.521	0.298	Moderate
Kalimantan Prov. (avg)	0.043	0.076	0.038	0.492	0.289	Variable, resource-dependent
Maluku-Papua (avg)	0.049	0.082	0.042	0.461	0.268	High employment reallocation
Fastest: Papua, Aceh	0.068, 0.063	—	—	—	—	—
Slowest: DKI Jakarta	0.038	0.041	0.035	0.621	0.412	Already structured

Sulawesi Island provinces demonstrate the highest structural change magnitudes, particularly in employment reallocation (NAV), indicating that the ongoing sectoral transition is more pronounced than Java. Java provinces, despite having lower nominal structural change indices, exhibit the highest within-sector productivity improvements, suggesting that technological progress and capital deepening dominate Java's growth mechanism. This regional variation implies that Java and outer Java have experienced structurally distinct growth processes.

Interestingly, the manufacturing employment share increased by more than 5 % % in only two provinces (Maluku, North Sulawesi). Most provinces showed stagnant or declining manufacturing employment, consistent with global premature deindustrialization trends, but concerning long-term development prospects.

Table 4. Dynamic Panel Growth Model Estimates (5-Year Periods, 2005-2018)

Variable	Model 1: SC	Model 2: NAV	Model 3: ESC	Model 4: Within-Static-Dynamic
Lagged PRGDP	-0.082**	-0.091**	-0.088**	-0.085**

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Variable	Model 1: SC	Model 2: NAV	Model 3: ESC	Model 4: Within-Static-Dynamic
(Convergence coefficient)	(0.034)	(0.036)	(0.035)	(0.037)
INVT (investment share)	0.142*	0.148*	0.145*	0.151*
	(0.073)	(0.076)	(0.074)	(0.078)
SCHOOL (human capital)	0.341**	0.356**	0.349**	0.358**
	(0.142)	(0.147)	(0.144)	(0.150)
SC Index	-0.023	—	—	—
	(0.031)			
NAV Index	—	0.067*	—	—
		(0.035)		
ESC Index	—	—	0.058*	—
			(0.030)	
Within effect	—	—	—	0.312**
				(0.127)
Static effect	—	—	—	0.084
				(0.065)
Dynamic effect	—	—	—	0.241**
				(0.098)
Observations	90	90	90	90
Provinces	30	30	30	30
Hansen test p-value	0.142	0.156	0.148	0.151
AR(2) test p-value	0.234	0.241	0.238	0.246

Hansen test p-values (0.142-0.156) exceed the conventional threshold of 0.05, supporting the null hypothesis of instrument validity. The AR(2) test p-values (0.234-0.246) fail to reject the null hypothesis, confirming the appropriate lag structure specification. These diagnostics support the model specifications and estimation validity.

Discussion

The identification of five convergence clubs represents the most significant finding regarding Indonesia's post-decentralization inequality dynamics. This result decisively rejects neoclassical convergence predictions, demonstrating that Indonesian regional income distribution cannot be characterized as a single

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convergence process. Rather, districts are stratified into distinct development tiers, each approaching a different equilibrium income level.

The club structure reveals geographical clustering—districts within provinces tend to cluster in identical clubs, suggesting that provincial-level policies, institutions, and endowments exert a powerful influence on convergence dynamics. This clustering indicates that decentralization policies to date have insufficient strength to overcome the deep provincial-level structural differences. Java provinces predominantly occupy Clubs 1-2, reflecting historical capital concentration and superior infrastructure. Outside-Java provinces concentrate on Clubs 3-5, notwithstanding decentralization policies that theoretically enable leapfrogging development.

The persistence of within-club inequality (multiple clubs exist despite 17 years of decentralization) raises fundamental questions regarding the effectiveness of decentralization. If decentralization has an equalization objective, then the observed club structure suggests limited success. Two interpretations merit consideration: (1) fundamental structural constraints—geography, human capital, and infrastructure deficits—prove too powerful for decentralization policies to overcome absent targeted interventions in those areas; or (2) decentralization implementation itself may have exacerbated inequality by advantaging resource-rich districts receiving higher revenues while disadvantaging poor, resource-scarce districts with limited fiscal capacity for development investment.

Structural change exhibits a complex relationship with regional growth, with important qualifications based on optimistic conventional wisdom. While within-sector productivity improvements strongly predict growth, employment reallocation to lower-productivity sectors increasingly characterizes the transformation, yielding negative dynamic structural effects in recent years.

The declining effectiveness of structural change, —evidenced by declining ESC indices and increasingly negative dynamic effects, —suggests that Indonesia increasingly experiences premature deindustrialization or low-productivity service expansion without corresponding high-productivity sector development. This pattern mirrors concerns documented in Latin America and Sub-Saharan Africa, where service sector expansion absorbs labor released from agriculture without corresponding manufacturing or high-productivity sector growth. Indonesia's manufacturing employment growth (only 2% over 2005-2018) substantially lagged the decline in agricultural employment (15.2%), indicating labor absorption primarily in services.

The strong positive coefficient of within-sector productivity in growth regressions provides a more promising interpretation: improvements in sectoral technology and productivity remain powerful growth drivers. The challenge lies in implementing policies fostering within-sector productivity acceleration in all sectors, but particularly in services, where the majority of labor is increasingly concentrated. This may require accelerated human capital investment in service workers, capital deepening in the service sectors, and technology adoption acceleration.

Regional variation in structural change intensity—with Sulawesi provinces exhibiting greater employment reallocation than Java, despite Java's superior absolute productivity—merits attention. Two hypotheses are proposed: (1) Sulawesi experiences earlier-stage development where agricultural employment remains substantial, hence a greater reallocation room; or (2) Sulawesi experiences lower-quality structural change with labor movement toward lower-productivity sectors, which would be concerning from a growth perspective. A disaggregated sectoral analysis is required to distinguish between these hypotheses.

The impact of the decentralization policy remains ambiguous, based on the evidence presented. On the one hand, convergence club analysis shows no overall convergence since decentralization implementation (2001-onward), suggesting that decentralization failed to create equalizing dynamics. On the other hand, conditional convergence estimates yield an 8-9% annual convergence rate within clubs, and recent growth rates in outer-Java regions (6-8%) exceed Java rates (4.8-5.3%), suggesting that partial catch-up dynamics may accelerate post-decentralization despite club stratification persistence.

The growth model results indicate that human capital and investment are positively correlated with growth across specifications, suggesting that decentralization-enabled human capital expansion and investment acceleration may function as growth mechanisms. However, the inability to disentangle decentralization effects, specifically from other concurrent influences (globalization, commodity cycles, and technology), limits attribution.

The natural resource curse appears salient in the decentralization context: resource-rich districts received higher fiscal allocations under decentralization's revenue-sharing, enabling faster growth through commodity booms (particularly 2010-2014 period). However, commodity decline thereafter contributed to divergence, suggesting that resource-rich districts' decentralization benefits are transitory. Aceh, Riau, and

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East Kalimantan's negative dynamic structural effects during 2010-2014 substantiate this interpretation—natural resource sector productivity declines following extraction peaks, contributing to overall productivity decline despite fiscal windfalls.

Despite decentralization and growth elsewhere, Java Island maintains 57% of its national output with modest 4.8-5.3% growth rates, sustaining its share. This persistence reflects deep structural advantages: superior infrastructure (concentration of transport, telecommunications, and power networks), accumulated industrial clusters generating agglomeration economies, highest human capital concentration, largest domestic market, and preferential treatment in the pre-decentralization era, creating durable comparative advantages.

The fact that Java provinces demonstrate the highest within-sector productivity improvements (0.334 average versus 0.268-0.311 for other regions) indicates that technological adoption and capital deepening are most concentrated in Java. This agglomeration of productivity-enhancing innovation perpetuates Java's development trajectory and limits outer-region catch-up, despite comparable employment reallocation. Addressing this inequality would require substantial targeted technology transfer, infrastructure investment, and human capital development in the outer regions, which — require political commitment, as demonstrated by post-decentralization policies.

CONCLUSION

Regional income inequality and convergence dynamics in post-decentralization Indonesia exhibit complex patterns that defy simple characterization. This research demonstrates that, rather than converging toward uniform equilibrium, Indonesian districts stratify into five convergence clubs with persistent between-club inequality despite within-club catching-up dynamics. Java Island maintains a dominant economic position through concentrated infrastructure, human capital, and agglomeration economies, while the outer regions experience heterogeneous growth trajectories reflecting varied structural characteristics and decentralization policy impacts. Structural change, —the sectoral transformation accompanying economic development, —exhibits an ambiguous relationship with regional growth. Within-sector productivity improvements represent powerful growth drivers, yet increasingly negative dynamic structural effects indicate growing labor absorption in low-productivity sectors. Employment reallocation and effective structural change measures (directing labor to productivity-enhancing sectors) positively correlate with regional growth; however, their contribution declines as structural transformation progressively orients toward service sectors with weaker productivity levels. Decentralization policy impacts remain indeterminate from available evidence, with convergence club identification suggesting a limited overall effect, yet regional growth variations potentially indicate accelerating catch-up dynamics. The natural resource curse appears salient: —resource-rich regions benefited from decentralization revenue-sharing during commodity booms yet declined thereafter, suggesting decentralization benefits vulnerable to commodity cycles without economic diversification. This study contributes to understanding post-decentralization of Indonesia through three mechanisms. First, it demonstrates that multiple convergence equilibria characterize the regional system, providing methodological advances over classical convergence frameworks imposing unrealistic homogeneity assumptions. Second, it integrates structural change measurement into convergence analysis, demonstrating that sectoral composition and transformation quality fundamentally influence regional growth, beyond what traditional models capture. Third, it provides an empirical quantification of the impact of decentralization on regional inequality, suggesting that autonomous decentralization produces insufficient equalizing force without complementary central policies.

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