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Research Paper

Identification of Leading Sectors in Aceh Province Based on Dynamics and Shifts in Workforce Structure during the Period of National Policy Changes (1978–2025)

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Abstract

Long-run evidence on how employment in Aceh has shifted between sectors across national policy regimes is limited. This study decomposed changes in employment in Aceh Province into national share, industry mix and competitive share components and identified leading sectors over five periods between 1978 and 2025. Employment of persons aged 15 years and over in nine main industries, compiled from Statistics Indonesia publications, was analysed with classical shift-share analysis using Indonesia as the reference economy. Employment in Aceh increased by 1,671,747 persons in 1978–2025 and declined only in 1998–2002 (−184,480). The national share was the largest component in four periods, the industry mix was negative in every period, and the competitive share was positive except in 1998–2002. The tertiary sector accounted for 62.3% of the long-run employment change, the secondary sector for 20.9% and the primary sector for 16.7%. Community services, trade, manufacturing, construction, agriculture and mining had positive cumulative competitive shares and were classified as leading sectors; electricity and finance were potential sectors and transport was non-leading. Employment in Aceh has moved towards services without a sustained expansion of manufacturing.

Keywords: Competitive share; Leading sector; Shift-share analysis; Structural transformation; Aceh Province.

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1. Introduction

Structural transformation reallocates labour from agriculture towards manufacturing and services, and the speed and direction of this reallocation determine how far employment growth raises productivity and income. Many developing economies have reached their peak manufacturing employment shares earlier and at lower income levels than early industrialisers, a pattern described as premature deindustrialisation [1]. In Indonesia, the transformation of the economic structure and its effect on labour absorption have been examined for 2002–2019 [2]. For

regional governments, identifying the sectors that combine employment growth with competitiveness is a basis for setting development priorities [3], [4].

Shift-share analysis is a standard tool for this purpose. The method decomposes regional growth into a component attributable to national growth, a component attributable to the regional industry mix and a residual competitive component [5]. Later work reinterpreted the competitive component to separate competitiveness from specialisation [6], developed a taxonomy that adds spatial interaction to the decomposition [7] and extended the decomposition to unbalanced employment growth at the industry level [8].

In Indonesia, employment-based shift-share studies have documented workforce transformation in Riau in 2010–2019 [9], the labour-based economic structure of North Sulawesi in 2013–2022 [10], the role of leading sectors in labour absorption in Tulungagung [11] and changes in employment in Kampar during the COVID-19 outbreak [12]. A national study of five provinces found a negative national growth effect during the pandemic [13], and studies based on gross regional domestic product (GRDP) have identified leading sectors in DKI Jakarta [14]. Most of these studies cover five to ten years.

In Aceh, shift-share analyses of GRDP found a structural transformation from the primary sector towards the tertiary and secondary sectors in 2008–2012 but not in 2000–2008 [15], and identified leading sectors in Aceh Besar Regency [16], [17]. These studies measure output rather than employment and do not span the successive national policy regimes that have shaped the Acehnese labour market: New Order industrialisation and its end in the 1997–1998 crisis [18], fiscal decentralisation from 2001, and the 2004 tsunami and subsequent reconstruction, which changed the livelihoods of coastal households [19]. A long-run, employment-based decomposition for Aceh that covers these regimes has not been reported.

This study addresses three questions: (1) which shift-share components drove employment change in Aceh in each period between 1978 and 2025; (2) how did the employment structure shift between the primary, secondary and tertiary sectors; and (3) which sectors can be classified as leading, potential or non-leading on the basis of their competitive share?

2. Method

Data and Periods

The study used a quantitative descriptive design with secondary data. The variable was the number of employed persons aged 15 years and over by main industry in Aceh Province and in Indonesia, compiled from the 1980–1981, 1988, 1998, 2002 and 2012 editions of *Statistik Indonesia* [20] and the 2026 edition [21]. Employment was grouped into nine sectors: (1) agriculture, plantations, forestry, hunting and fisheries; (2) mining and quarrying; (3) manufacturing; (4) electricity, gas and water; (5) construction; (6) trade, restaurants and accommodation; (7) transport, warehousing and communication; (8) financial institutions, real estate, rental and business services; and (9) community, social and personal services. Sectors 1–2 were treated as primary, 3–5 as secondary and 6–9 as tertiary. The analysis covered five periods (1978–1988, 1988–1998, 1998–2002, 2002–2012 and 2012–2025) and the full period 1978–2025. The period endpoints follow the available editions and approximate changes in national policy regimes.

Shift-Share Decomposition

Classical shift-share analysis was applied with Indonesia as the reference economy [5]. The change in employment in sector i of Aceh (j) between the initial year ($t-1$) and the final year (t) is the sum of three components:

$$D_{ij} = E_{ij,t} - E_{ij,t-1} = N_{ij} + M_{ij} + C_{ij} \quad (1)$$

$$N_{ij} = E_{ij,t-1} \times r_n \quad (2)$$

$$M_{ij} = E_{ij,t-1} \times (r_{in} - r_n) \quad (3)$$

$$C_{ij} = E_{ij,t-1} \times (r_{ij} - r_{in}) \quad (4)$$

where N_{ij} is the national share, M_{ij} the industry mix and C_{ij} the competitive share. The growth rates are defined as:

$$r_n = (E_{n,t} - E_{n,t-1}) / E_{n,t-1};\ \ r_{in} = (E_{in,t} - E_{in,t-1}) / E_{in,t-1};\ \ r_{ij} = (E_{ij,t} - E_{ij,t-1}) / E_{ij,t-1} \quad (5)$$

where E_{ij} is employment in sector i in Aceh, E_{in} is employment in sector i in Indonesia and E_n is total employment in Indonesia. The aggregate components are the sums over the nine sectors; the industry mix therefore does not sum to zero when the regional structure differs from the national one.

A positive C_{ij} indicates that employment in a sector grew faster in Aceh than in the same sector nationally. Sectors were classified by the sum of C_{ij} over the five periods and by the number of periods with positive C_{ij}: leading sectors had a positive cumulative competitive share; potential sectors had a negative cumulative value but positive values in at least three periods; and non-leading sectors had a negative cumulative value and positive values in fewer than three periods.

3. Results and Discussion

Components of Employment Change

Table 1 summarises the aggregate components in each period. The national share was positive in every period and accounted for 76.0–95.6% of the change in the four periods with employment growth. The industry mix was negative in every period because Aceh's employment was concentrated in agriculture, whose national employment grew more slowly than total national employment. The competitive share offset this structural disadvantage in four of the five periods.

Table 1. Aggregate shift-share components of employment change in Aceh (persons; % of D_{ij} in brackets)

Period	N_{ij}	M_{ij}	C_{ij}	D_{ij}
1978–1988	361,237 (78.7)	−58,375 (−12.7)	156,301 (34.0)	459,163
1988–1998	275,380 (95.6)	−94,017 (−32.6)	106,630 (37.0)	287,993
1998–2002	74,203 (-40.2)	−21,425 (11.6)	−237,258 (128.6)	−184,480
2002–2012	303,629 (87.7)	−66,695 (−19.3)	109,356 (31.6)	346,289
2012–2025	580,007 (76.0)	−72,362 (−9.5)	255,137 (33.4)	762,782
1978–2025	1,628,001 (97.4)	−793,487 (−47.5)	837,233 (50.1)	1,671,747

Source: Calculated from Statistics Indonesia data [20], [21].

Employment declined by 184,480 persons in 1998–2002 although national growth implied an increase of 74,203. The competitive share of −237,258 indicates that the decline was specific to Aceh, and agriculture alone accounted for −176,977 of it. The period followed the 1997–1998 crisis that ended the New Order [18] and coincided with an escalation of armed conflict in Aceh, which may have disrupted rural employment. In 2002–2012, the competitive share recovered to 109,356, and in 2012–2025 it reached its highest value (255,137), equal to one third of the employment change in that period.

Shifts in Employment Structure

Table 2 presents the change in employment by sector, and Figure 1 aggregates it into the primary, secondary and tertiary sectors. Agriculture contributed the largest increase in 1978–1988 (181,968 persons), trade in 1988–1998 and 2012–2025, and community services in 2002–2012.

Table 2. Change in employment (D_{ij}) by sector in Aceh (persons)

Sector	1978–1988	1988–1998	1998–2002	2002–2012	2012–2025	1978–2025
Agriculture	181,968	63,137	−146,590	6,824	144,705	250,044
Mining	6,396	6,396	291	755	15,920	29,757
Manufacturing	65,847	11,516	−30,807	18,278	109,545	174,379
Electricity, gas & water	2,055	2,055	3,059	−4,165	8,099	11,103
Construction	18,788	18,788	−5,433	91,562	40,680	164,385
Trade, restaurants & accommodation	71,843	110,230	34,402	18,565	242,648	477,688
Transport & communication	18,070	18,070	2,118	18,207	14,876	71,341
Finance & business services	6,962	6,962	−5,028	15,701	−13,102	11,494
Community, social & personal services	87,235	50,840	−36,492	180,562	199,411	481,556
Total	459,163	287,993	−184,480	346,289	762,782	1,671,747

Source: Calculated from Statistics Indonesia data [20], [21].

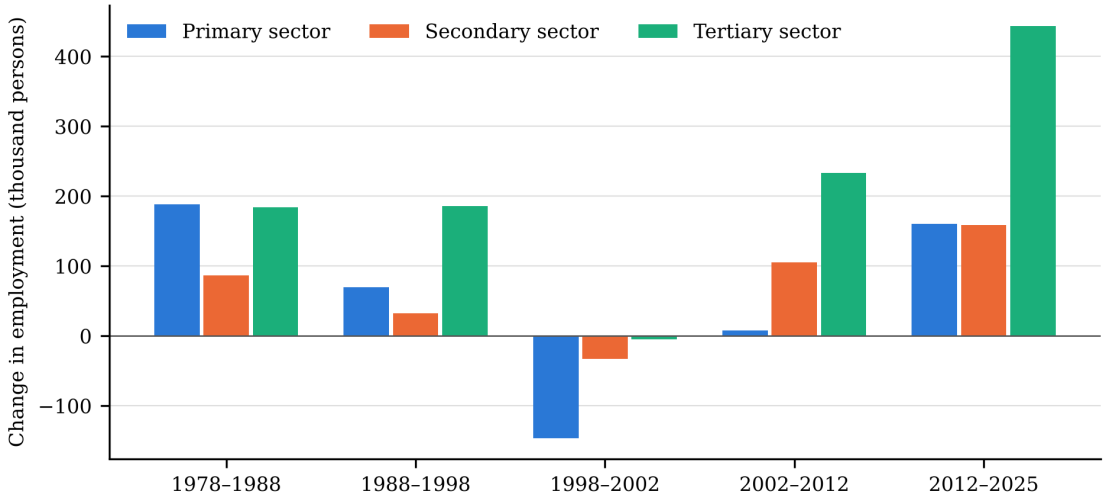


Figure 1. Change in employment in the primary, secondary and tertiary sectors of Aceh by period

Source: Calculated from Statistics Indonesia data [20], [21].

Over 1978–2025, the tertiary sector accounted for 1,042,079 persons (62.3%) of the employment change, the secondary sector for 349,867 (20.9%) and the primary sector for 279,801 (16.7%). The tertiary sector had the largest increase in every period with employment growth except 1978–1988, when the primary sector led by a small margin, and all three groups declined in 1998–2002. The secondary sector exceeded 100,000 persons only in 2002–2012 and 2012–2025; in 2002–2012 construction accounted for 91,562 of its 105,675 persons, which is consistent with the reconstruction that followed the 2004 tsunami. Manufacturing added 174,379 persons over 47 years, 10.4% of the total change, and lost 30,807 workers in 1998–2002. Agriculture added almost no employment in 2002–2012 (6,824 persons), a period in which tsunami-affected households shifted from aquaculture and fishing to trading and other non-farm work [19].

The findings agree with the GRDP-based evidence of a shift in Aceh's economy from the primary sector towards the tertiary and secondary sectors in 2008–2012 [15] and with the shift from primary to secondary and tertiary employment in Riau [9]. They differ in that the tertiary sector in Aceh absorbed about three times as many workers as the secondary sector, and most of the secondary increase came from construction rather than manufacturing. Employment moving

to services before manufacturing has become a major employer is the pattern associated with premature deindustrialisation [1].

Leading Sectors

Table 3 presents the competitive share of each sector by period, and Table 4 the long-run decomposition for 1978–2025.

Table 3. Competitive share (C_{ij}) by sector in Aceh (persons)

Sector	1978–1988	1988–1998	1998–2002	2002–2012	2012–2025	Sum	n+
Community, social & personal services	51,564	4,229	−2,086	67,902	54,356	175,965	4
Trade, restaurants & accommodation	50,514	50,067	21,016	−60,932	47,605	108,269	4
Manufacturing	61,073	−39,692	−49,731	3,332	85,800	60,783	3
Construction	6,925	2,579	−14,963	68,479	−12,291	50,729	3
Agriculture	−26,363	86,804	−176,977	42,861	93,438	19,764	3
Mining	5,644	1,738	757	−18,841	14,789	4,087	4
Electricity, gas & water	1,214	201	2,724	−8,284	−966	−5,111	3
Finance & business services	5,837	755	−13,559	437	−8,423	−14,954	3
Transport & communication	−107	−51	−4,439	14,401	−19,170	−9,365	1

Source: Calculated from Statistics Indonesia data [20], [21]. n+ = number of periods with positive C_{ij}.

Table 4. Shift-share decomposition of employment change in Aceh, 1978–2025 (persons)

Sector	N_{ij}	M_{ij}	C_{ij}	D_{ij}	Share of D_{ij} (%)
Agriculture	1,349,729	−1,122,904	23,219	250,044	14.96
Mining	611	3,760	25,386	29,757	1.78
Manufacturing	16,489	21,960	135,930	174,379	10.43
Electricity, gas & water	306	11,545	−748	11,103	0.66
Construction	12,886	63,449	88,050	164,385	9.83
Trade, restaurants & accommodation	86,773	106,595	284,320	477,688	28.57
Transport & communication	29,922	46,801	−5,382	71,341	4.27
Finance & business services	306	7,973	3,215	11,494	0.69
Community, social & personal services	130,980	67,334	283,242	481,556	28.81
Total	1,628,001	−793,487	837,233	1,671,747	100.00

Source: Calculated from Statistics Indonesia data [20], [21].

Six sectors had a positive cumulative competitive share and were classified as leading: community, social and personal services (175,965 persons; positive in four periods), trade (108,269; four), manufacturing (60,783; three), construction (50,729; three), agriculture (19,764; three) and mining (4,087; four). Electricity, gas and water (−5,111) and finance and business services (−14,954) were potential sectors because their competitive share was positive in three periods. Transport and communication was non-leading, with a positive competitive share in one period and a cumulative value of −9,365 (Table 5).

Table 5. Classification of sectors by competitive share, 1978–2025

Sector	Category
Community, social & personal services	Leading
Trade, restaurants & accommodation	Leading

Sector	Category
Manufacturing	Leading
Construction	Leading
Agriculture	Leading
Mining	Leading
Electricity, gas & water	Potential
Finance & business services	Potential
Transport & communication	Non-leading

Source: Calculated from Table 3.

The long-run decomposition in Table 4 confirms the leading position of trade (284,320) and community services (283,242), and shows that the industry mix of agriculture (−1,122,904) offset most of its national share. Agriculture remained a leading sector by a narrow margin, and its competitive share was positive in 1988–1998, 2002–2012 and 2012–2025. In the single-step 1978–2025 calculation, finance and business services had a positive competitive share (3,215), whereas the sum over the five periods was negative, so its classification as a potential sector depends on the period structure.

The results are consistent with the leading position of trade, transport and storage in Aceh Besar [17] for trade but not for transport, and with the finding that most sectors in Aceh Besar were leading except electricity and gas [16]. They differ from Tulungagung, where communication and transport were the leading sectors [11], and from Sleman, where construction, transport, real estate and business services led [3]. In Kampar, trade, manufacturing and construction had a negative industry mix that local factors offset [12], the same combination of a negative industry mix and a positive competitive share observed for these sectors in Aceh.

Implications and Limitations

The Aceh Provincial Government can prioritise trade, community services, manufacturing and construction, which combined employment growth with positive competitive shares, and can treat electricity and finance as sectors whose competitiveness has been unstable. The weak position of transport and the small contribution of manufacturing indicate that labour absorption depends on services and construction, which are sensitive to public spending and reconstruction cycles. The study has four limitations. First, the periods differ in length (4–13 years), so the components are not comparable on an annual basis. Second, sector definitions and survey methods changed across the Statistics Indonesia editions, and harmonisation into nine sectors may introduce measurement error. Third, classical shift-share analysis does not separate competitiveness from specialisation [6], [8] and does not account for spatial interaction [7]. Fourth, the decomposition is descriptive and does not identify the causal effect of specific policies. Further studies should use annual data, the Esteban-Marquillas or spatial extensions and productivity measures.

4. Conclusion

Employment in Aceh increased by 1,671,747 persons in 1978–2025. National growth was the largest source of employment change in the four periods with growth, the industry mix was negative in every period, and the competitive share was positive in all periods except 1998–2002, when employment declined by 184,480 persons. The tertiary sector accounted for 62.3% of the long-run employment change, and the secondary sector expanded mainly through construction rather than manufacturing. Community services, trade, manufacturing, construction, agriculture and mining are leading sectors; electricity, gas and water and finance and business services are potential sectors; and transport and communication is a non-leading sector. Regional

employment policy in Aceh should strengthen manufacturing linkages with the leading primary and trade sectors to widen labour absorption beyond services and construction.

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Authors' contributions and responsibilities

Huwaida designed the study, compiled the employment data, carried out the shift-share calculations and wrote the manuscript. Irwan Safwadi and Yuliana supervised the research, checked the methodology and revised the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

The employment data are published by Statistics Indonesia in the editions of Statistik Indonesia cited in the references. The harmonised dataset and calculation sheets can be obtained from the corresponding author.

Competing interests

The authors declare that no competing interests are associated with this article.

Ethical approval

Not applicable; the study analysed aggregate published statistics and did not involve human or animal subjects.

Declaration of generative AI use

Claude (Anthropic) was used to improve the English language, restructure the manuscript, recompute the aggregate shift-share components and prepare Figure 1. The authors checked the calculations and references and take full responsibility for the article.

Additional information

Questions about this article should be sent to Huwaida (huwaida304@gmail.com).

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