

A MULTI-METRIC ENTROPY-BASED ANALYSIS OF GDP DIVERSIFICATION IN NIGERIA (1990–2024)

Elijah Babatunde Sunday

*Department of Statistics, Federal University Lokoja, Lokoja, Kogi State, Nigeria
elisbabs499@gmail.com*

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ABSTRACT

This study examines the structural transformation and sectoral diversification of Nigeria's economy from 1990 to 2024. Four complementary measures are applied to annual GDP data across agriculture, industry, and services: Shannon entropy, the Herfindahl–Hirschman Index (HHI), Theil's Index, and Shift–Share Analysis. The results reveal a diversification paradox. Although Nigeria's overall diversification remained moderate throughout the period, the economy experienced a sharp industrial contraction alongside rapid service-sector expansion, producing increasing sectoral imbalance. Diversification peaked in 2002–2003 and has declined steadily since, with entropy decomposition confirming that service-led growth has reinforced concentration rather than balance. These findings point to the need for a second-generation diversification strategy that targets within-sector development, productive linkages, and export orientation.

Keywords: Economic Diversification, Shannon Entropy, Structural Transformation, Nigerian Economy, Premature De-industrialization, GDP Structure

1. Introduction

Economic diversification is a central policy objective for resource-dependent developing economies. In Africa, commodity price volatility and external shocks continue to undermine development prospects, making structural transformation an urgent priority (Bahar & Santos, 2018; IMF, 2022). Nigeria, as Africa's largest economy and most populous nation, presents a compelling case study of both the challenges and the limits of diversification. Despite decades of policy rhetoric emphasising a shift away from oil dependence, Nigeria's economic structure remains highly vulnerable to external shocks and internal imbalances (World Bank, 2023).

The academic literature identifies several critical dimensions of this challenge. Alaba and Oluwatobi (2020) show that African economies, including Nigeria, have transitioned to service-dominated structures without first achieving manufacturing maturity—a phenomenon known as premature de-industrialisation. Rodrik (2016) contrasts this with the historical path of now-developed economies, which maintained substantial industrial sectors throughout their middle-income transitions. Akinlo and Oyeleke (2021) note that despite multiple policy interventions since the Structural Adjustment Programme of the 1980s, Nigeria has not developed competitive manufacturing, leaving the country dependent on imports and limited in export variety.

Beyond the sectoral level, recent scholarship stresses the importance of within-sector diversification. Hidalgo et al. (2022) argue that meaningful diversification requires developing productive capabilities within sectors, not merely reallocating activity between them. A shift from industry to low-productivity services, without accompanying capability development, may constitute structural change without economic deepening. The resource curse literature reinforces this concern: Cust and Mihalyi (2023) document how resource windfalls distort economic structures through Dutch disease and by weakening the institutional environment needed for productive investment. In Nigeria, oil revenues have created a rentier dynamic that reduces the urgency of diversification and complicates policy implementation (Eberechi, 2022).

On the methodological side, recent studies have moved beyond single concentration indices. Diop and Asongu (2023) apply entropy-based measures across multiple African economies, finding that sectoral diversification has often come at the cost of reduced export sophistication. Ogbuabor et al. (2021) use Shift–Share Analysis on Nigerian sub-national data, revealing regional disparities that national aggregates conceal. The COVID-19 pandemic added further urgency: the African Development Bank (2023) reports that more diversified African economies showed greater resilience during the crisis, while Nigeria's service-concentrated structure exposed deep fragilities (Nwokike, 2022).

Despite this growing body of work, three gaps remain. First, most studies focus on export diversification or employment, with limited attention to GDP structural transformation over extended time horizons. Second, most rely on a single index, which captures only one dimension of diversification. Third, the possibility that sectoral growth can simultaneously reduce overall diversification—a diversification paradox—has received little systematic treatment.

This study addresses all three gaps. A multi-metric framework is applied to Nigeria's annual GDP data from 1990 to 2024, combining Shannon entropy, the HHI, Theil's Index, and Shift–Share Analysis. Entropy changes are decomposed by sector to attribute diversification gains and losses precisely. Three research questions guide the analysis:

1. How has Nigeria's economic diversification evolved across agriculture, industry, and services from 1990 to 2024?
2. What do Shift–Share results show about the changing sectoral drivers of GDP growth, and how do these relate to diversification outcomes?

3. What structural reforms does Nigeria's diversification experience suggest for achieving sustainable and balanced economic transformation?

2. Methodology

2.1 Data Source

The analysis uses annual GDP data for Nigeria from 1990 to 2024. Data are obtained from the Central Bank of Nigeria official website. The economy is disaggregated into three broad sectors:

- Agriculture (A)
- Industry (I): encompassing manufacturing, mining, construction, and utilities
- Services (S): including trade, finance, telecommunications, and public administration

All values are reported in nominal Naira billions.

2.2 Sectoral Share Dynamics

Let E_{it} denote the nominal GDP of sector i at time t , where $i \in \{A, I, S\}$. Total GDP at time t is:

$$E_t = \sum_{i=1}^3 E_{it}$$

The sectoral share vector is defined as:

$$\mathbf{p}_t = (p_{At}, p_{It}, p_{St}) = \left(\frac{E_{At}}{E_t}, \frac{E_{It}}{E_t}, \frac{E_{St}}{E_t} \right)$$

subject to the constraints:

$$\sum_{i=1}^3 p_{it} = 1, \quad p_{it} \geq 0 \quad \forall i, t$$

The growth rate of total GDP between periods t and $t+1$ is:

$$g_t = \frac{E_{t+1} - E_t}{E_t}$$

Similarly, sectoral growth rates are defined as:

$$g_{it} = \frac{E_{i,t+1} - E_{it}}{E_{it}}$$

Total GDP growth can be expressed as a weighted average of sectoral growth rates:

$$g_t = \sum_{i=1}^3 p_{it} g_{it}$$

This identity shows that aggregate growth is determined by sectoral performance weighted by initial shares.

2.3 Diversification Metrics

2.3.1 Shannon Entropy

The Shannon entropy function measures the evenness of the sectoral distribution. It is defined as:

$$H_t = -\sum_{i=1}^3 p_{it} \ln p_{it}$$

- $H_t = 0$ when one sector dominates completely
- $H_t = \ln 3 \approx 1.0986$ when all three sectors have equal shares

For easier interpretation, entropy is normalized to range between 0 and 1:

$$\hat{H}_t = \frac{H_t}{\ln 3}$$

A value of $\hat{H}_t = 1$ indicates perfect balance; lower values indicate concentration.

2.3.2 Herfindahl–Hirschman Index

The Herfindahl–Hirschman Index (HHI) measures concentration as the sum of squared shares:

$$HHI_t = \sum_{i=1}^3 p_{it}^2$$

- $HHI_t = \frac{1}{3} \approx 0.333$ when shares are equal
- $HHI_t = 1$ when one sector dominates completely

For consistency with entropy, a diversification index is also computed

$$D_t = \frac{1-HHI_t}{1-\frac{1}{3}} = \frac{3}{2}(1-HHI_t)$$

This index also ranges from 0 (concentration) to 1 (perfect balance)

2.3.3 Theil Index

The Theil T-index measures the deviation from perfect diversification:

$$T_t = \sum_{i=1}^3 p_{it} \ln\left(\frac{p_{it}}{\frac{1}{3}}\right) = \ln 3 - H_t$$

- $T_t = 0$ indicates perfect diversification
- Higher values indicate greater concentration

2.4 Shift–Share Analysis

Shift–Share Analysis reveals which sectors drive GDP growth. For any period from t_0 to t_n , we compute each sector's contribution to total growth:

$$Contribution_t = \frac{E_{i,t_n} - E_{i,t_0}}{E_{t_n} - E_{t_0}} \times 100\%$$

A sector gains share if it grows faster than the overall economy:

$$\Delta p_i = p_{i,t_n} - p_{i,t_0} > 0 \text{ if } \frac{E_{i,t_n}}{E_{i,t_0}} > \frac{E_{t_n}}{E_{t_0}}$$

This analysis helps identify whether growth is broad-based or concentrated in specific sectors.

2.5 Decomposing Changes in Diversification

To understand why diversification changes, entropy is decomposed into sectoral contributions. Using a linear approximation:

$$\Delta H \approx \sum_{i=1}^3 \bar{w}_i \Delta p_i,$$

where

$$\bar{w}_i = -\left(\ln\left(\frac{p_{i,t_0} + p_{i,t_n}}{2}\right) + 1\right)$$
 is an average weight for each sector

This decomposition allocates the change in overall entropy to each sector. A positive contribution indicates that the sector's share change increased diversification; a negative contribution indicates that it increased concentration. The near-zero approximation errors reported in the results confirm the accuracy of this discrete approximation.

2.6 Statistical Analysis

The long-run trend in diversification is estimated using linear regression:

$$\hat{H}_t = \alpha + \beta t + \varepsilon_t$$

where β measures the annual change in normalized entropy. Additionally, correlation analysis examines the relationship between diversification levels, changes in diversification, and GDP growth rates:

$$g_t = \alpha + \beta_1 \hat{H}_t + \beta_2 \Delta \hat{H}_t + \varepsilon_t$$

3. Results and Interpretation

3.1 Trends in Economic Diversification Indicators

Table 1 reports the evolution of diversification indicators alongside sectoral GDP shares from 1990 to 2024. Figure 1 illustrates the joint evolution of these measures over time.

In 1990, normalized entropy stood at 0.909, indicating a moderately diversified economy despite the industrial sector accounting for 51.9% of GDP. Between 1990 and 2002, entropy rose steadily, peaking at a normalized value of 0.986 in 2002. This improvement reflects a convergence of sectoral shares, driven by rising contributions from agriculture and services alongside a declining industrial share.

After 2002, diversification declined persistently. By 2024, normalized entropy had fallen to 0.890, while the HHI increased from 0.343 in 2002 to 0.418 in 2024. These two measures moved in opposite directions, confirming progressive re-concentration. The Theil index rose from 0.015 to 0.121 over the same period, indicating an increasing deviation from the equal-shares benchmark. Table 2 summarizes the net outcome: a decline in normalized entropy of 0.019 over the full 35-year period.



Figure 1: Diversification Indicators, Nigeria, 1990–2024

Table 1: Sectoral Diversification Results, 1990–2024

Year	Entropy	Norm. Entropy	HHI	Div. Index	Theil	Agric (%)	Industry (%)	Services (%)
1990	0.9991	0.9095	0.3977	0.9034	0.0995	16.14	51.94	31.92
1991	1.0087	0.9181	0.3911	0.9133	0.0899	16.67	50.65	32.68
1992	1.0029	0.9129	0.3950	0.9075	0.0957	16.31	51.38	32.32
1993	1.0177	0.9264	0.3844	0.9234	0.0809	16.96	48.87	34.17
1994	1.0295	0.9371	0.3764	0.9354	0.0691	17.71	46.83	35.45
1995	1.0374	0.9443	0.3713	0.9431	0.0612	18.36	45.46	36.18
1996	1.0356	0.9426	0.3727	0.9410	0.0630	18.32	46.09	35.59
1997	1.0382	0.9450	0.3710	0.9435	0.0604	18.53	45.63	35.84
1998	1.0420	0.9484	0.3684	0.9474	0.0567	18.78	44.66	36.56
1999	1.0509	0.9565	0.3627	0.9560	0.0477	19.63	42.57	37.81
2000	1.0469	0.9530	0.3652	0.9522	0.0517	19.23	43.56	37.21
2001	1.0445	0.9508	0.3664	0.9504	0.0541	18.85	43.42	37.73
2002	1.0837	0.9864	0.3429	0.9857	0.0149	25.43	38.14	36.44
2003	1.0819	0.9848	0.3442	0.9837	0.0168	25.34	39.85	34.81
2004	1.0807	0.9837	0.3447	0.9829	0.0179	24.65	37.12	38.23
2005	1.0801	0.9832	0.3452	0.9822	0.0185	24.80	35.46	39.74
2006	1.0768	0.9802	0.3478	0.9783	0.0218	25.11	32.78	42.11
2007	1.0692	0.9732	0.3535	0.9697	0.0294	25.26	30.16	44.58
2008	1.0570	0.9622	0.3624	0.9563	0.0416	25.14	27.67	47.19
2009	1.0455	0.9517	0.3708	0.9438	0.0531	24.64	26.26	49.10
2010	1.0339	0.9411	0.3791	0.9313	0.0647	23.89	25.32	50.79
2011	1.0348	0.9419	0.3784	0.9324	0.0638	23.35	26.06	50.59
2012	1.0361	0.9431	0.3776	0.9337	0.0625	23.91	25.61	50.48
2013	1.0259	0.9338	0.3849	0.9226	0.0727	23.33	24.81	51.86
2014	1.0233	0.9315	0.3867	0.9199	0.0753	22.90	24.93	52.16
2015	1.0156	0.9245	0.3924	0.9114	0.0830	23.11	23.71	53.18
2016	1.0116	0.9208	0.3952	0.9072	0.0870	24.45	21.96	53.59
2017	1.0190	0.9275	0.3898	0.9153	0.0797	25.08	22.25	52.67
2018	1.0193	0.9278	0.3896	0.9156	0.0794	25.13	22.24	52.63

Year	Entropy	Norm. Entropy	HHI	Div. Index	Theil	Agric (%)	Industry (%)	Services (%)
2019	1.0195	0.9280	0.3894	0.9159	0.0791	25.16	22.25	52.60
2020	1.0192	0.9277	0.3892	0.9161	0.0794	26.21	21.36	52.44
2021	1.0095	0.9189	0.3961	0.9059	0.0891	25.88	20.56	53.56
2022	0.9916	0.9026	0.4085	0.8872	0.1070	25.58	19.02	55.40
2023	0.9844	0.8960	0.4137	0.8794	0.1143	25.18	18.65	56.18
2024	0.9780	0.8903	0.4185	0.8723	0.1206	24.64	18.47	56.89

Table 2: Overall Diversification Trend, 1990–2024

Starting Normalized Entropy (1990)	0.9095
Ending Normalized Entropy (2024)	0.8903
Net Change	−0.0192

3.2 Sectoral Composition and Structural Transformation

Figure 2 illustrates the changing sectoral composition of Nigeria's GDP over the study period, and Table 3 summarizes the shifts.

Three patterns stand out. First, the industrial sector contracted sharply, falling from 51.9% of GDP in 1990 to 18.5% in 2024—a loss of more than 33 percentage points. Second, services expanded substantially, rising from 31.9% to 56.9% and becoming the dominant sector. Third, agriculture grew modestly, from 16.1% to 24.6%, playing a stabilizing but secondary role. Although these changes signal significant structural transformation, the diversification indices show that the transformation was imbalanced. Service-sector dominance did not develop alongside industrial deepening; instead, it displaced industrial activity. As a result, sectoral shares diverged rather than converged, explaining why entropy declined even as the economy continued to grow.

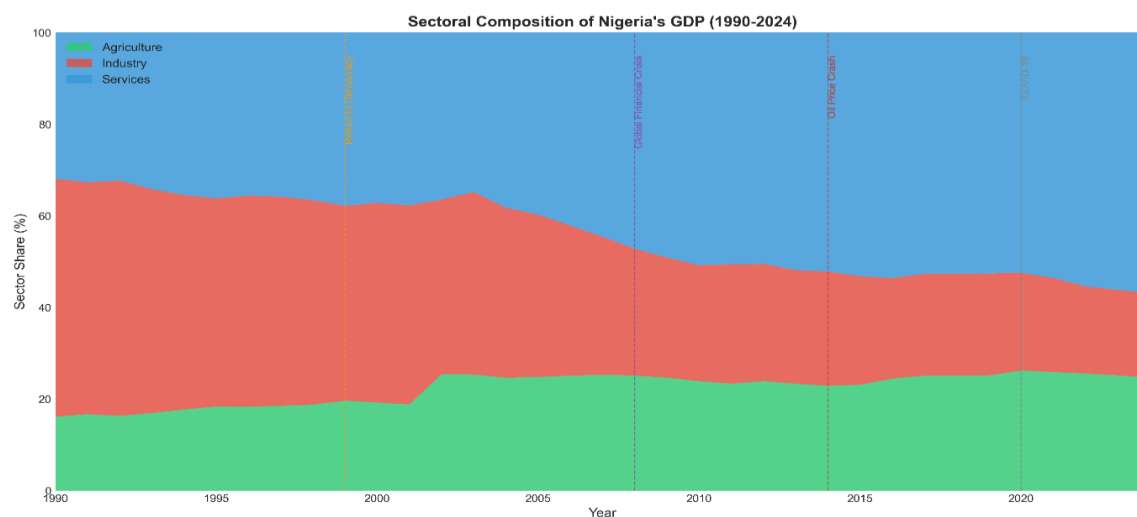


Figure 2: Sectoral Composition of Nigeria's GDP, 1990–2024

Table 3: Sectoral Transformation Summary

Sector	1990 Share (%)	2024 Share (%)	Change (percentage points)
Agriculture	16.1	24.6	+8.5
Industry	51.9	18.5	−33.5
Services	31.9	56.9	+25.0

3.3 Shift–Share Analysis of Sectoral Growth Contributions

Table 4 and Figures 3–6 report Shift–Share results across four sub-periods. The analysis reveals how the sources of growth changed and how those changes relate to diversification outcomes.

1990–2000 (Figure 3)

During this period diversification improved. Agriculture and services increased their GDP shares by 3.1 and 5.3 percentage points respectively, while industry's share declined by 8.4 points. Growth contributions were relatively balanced: services accounted for 67.9% of total growth, agriculture for 37.1%, and industry contributed negatively (−5.0%). This broad-based expansion reduced industrial dominance and explains the increase in entropy visible in Table 1.

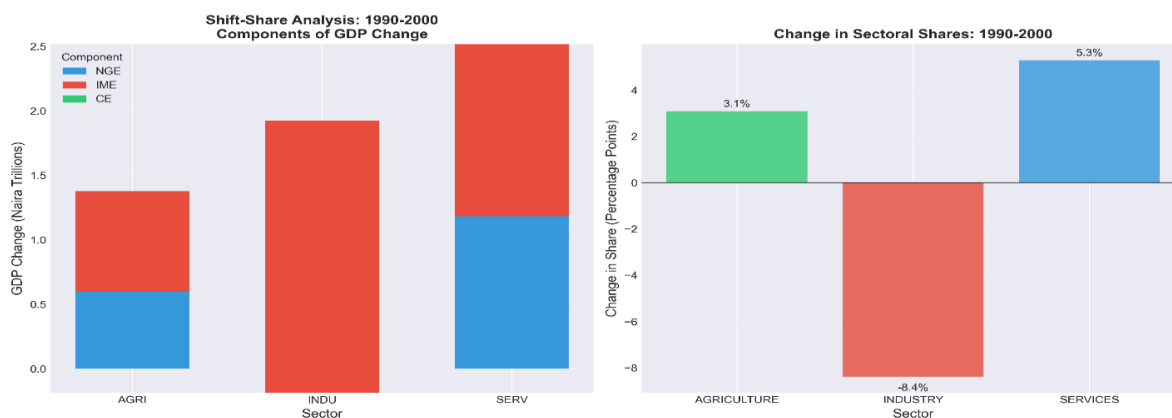


Figure 3: Shift–Share Analysis, 1990–2000

2000–2010 (Figure 4)

Although overall growth accelerated, diversification began to deteriorate. Services expanded rapidly, increasing their share by 13.6 percentage points and contributing 62.4% of total growth. Industry's share fell sharply by 18.2 points. This period marks the transition from broad-based diversification to service-led concentration, consistent with the decline in entropy after 2002.

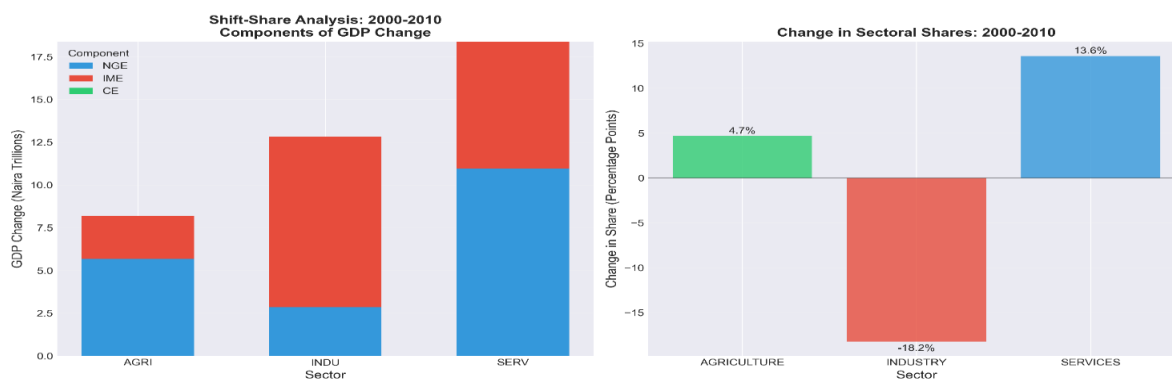


Figure 4: Shift-Share Analysis, 2000-2010

2010-2020 (Figure 5)

Structural imbalance persisted. Services remained dominant, contributing 58.3% of growth, while industry stagnated. Agriculture contributed 34.4%, which was insufficient to restore balance. The modest but sustained decline in entropy during this decade reflects structural inertia rather than cyclical fluctuation.

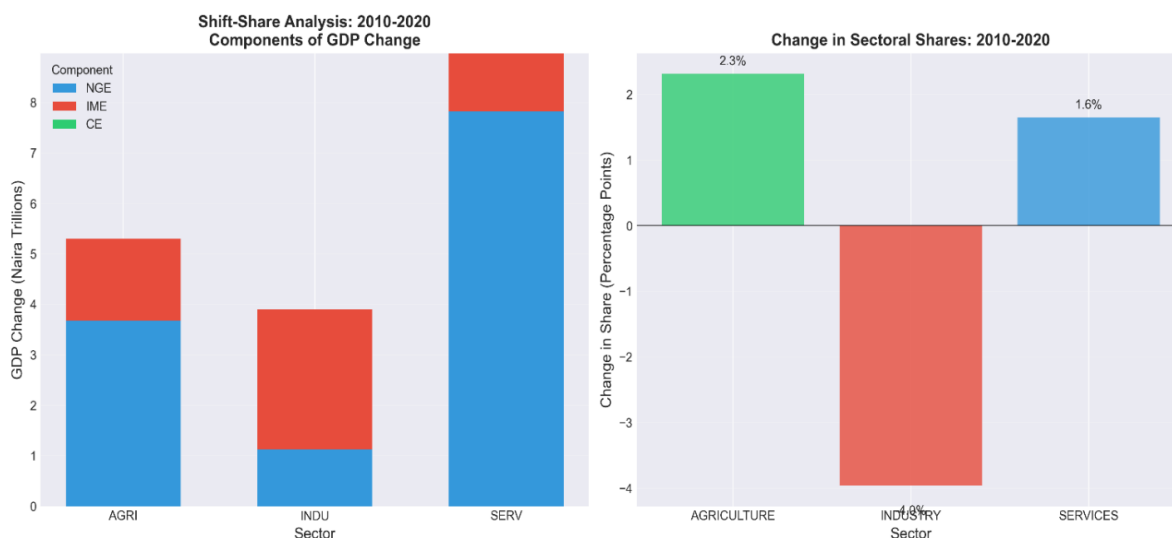


Figure 5: Shift-Share Analysis, 2010-2020

2020-2024 (Figure 6)

This sub-period exhibits the strongest concentration dynamics. Services accounted for 90.5% of total growth, while industry recorded negative growth and agriculture's contribution fell sharply. This extreme asymmetry coincides with the steepest entropy decline in the full sample and highlights growing structural fragility.

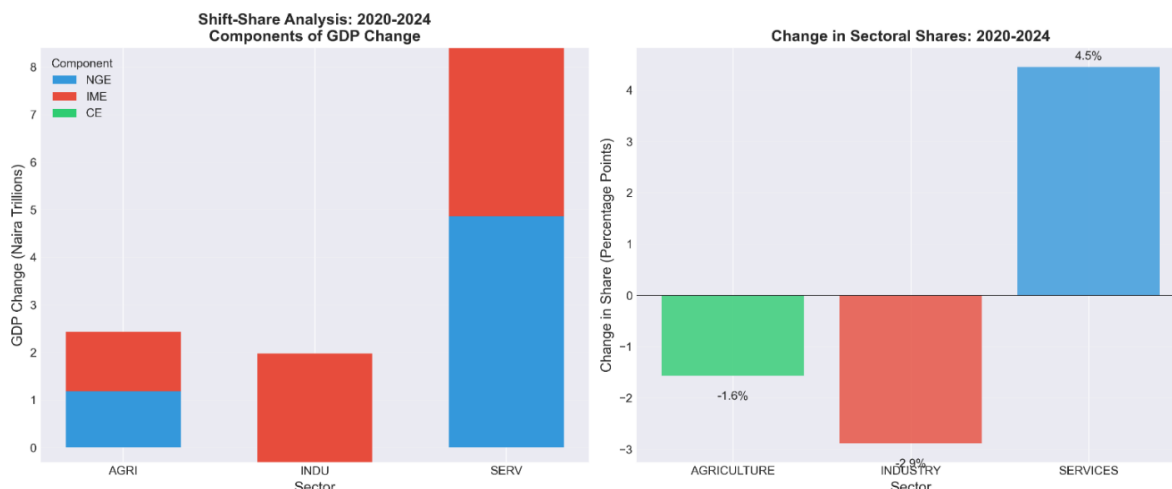


Figure 6: Shift-Share Analysis, 2020-2024

Table 4: Shift-Share Analysis Results

Sector	Share Change	Growth Rate (%)	Growth Contribution (%)
Period: 1990-2000			
Agriculture	16.1% → 19.2% (+3.1)	39.7	37.1
Industry	51.9% → 43.6% (-8.4)	-1.7	-5.0
Services	31.9% → 37.2% (+5.3)	36.7	67.9
Period: 2000-2010			
Agriculture	19.2% → 23.9% (+4.7)	169.6	27.9
Industry	43.6% → 25.3% (-18.2)	26.1	9.7
Services	37.2% → 50.8% (+13.6)	196.2	62.4
Period: 2010-2020			
Agriculture	23.9% → 26.2% (+2.3)	40.6	34.4
Industry	25.3% → 21.4% (-4.0)	8.2	7.3
Services	50.8% → 52.4% (+1.6)	32.4	58.3
Period: 2020-2024			
Agriculture	26.2% → 24.6% (-1.6)	6.5	12.8
Industry	21.4% → 18.5% (-2.9)	-2.0	-3.3
Services	52.4% → 56.9% (+4.5)	22.9	90.5

3.4 Entropy Change Decomposition

Figures 7–11 and Tables 5–9 decompose changes in entropy into sectoral contributions, enabling precise attribution of diversification dynamics across each sub-period.

1990–2000 (Figure 7; Tables 5a–5b)

Entropy increased by $\Delta H = 0.0478$. Agriculture and industry contributed almost equally to this improvement, despite industry's declining share. Services made a smaller positive contribution. The near-zero approximation error confirms the accuracy of the decomposition.

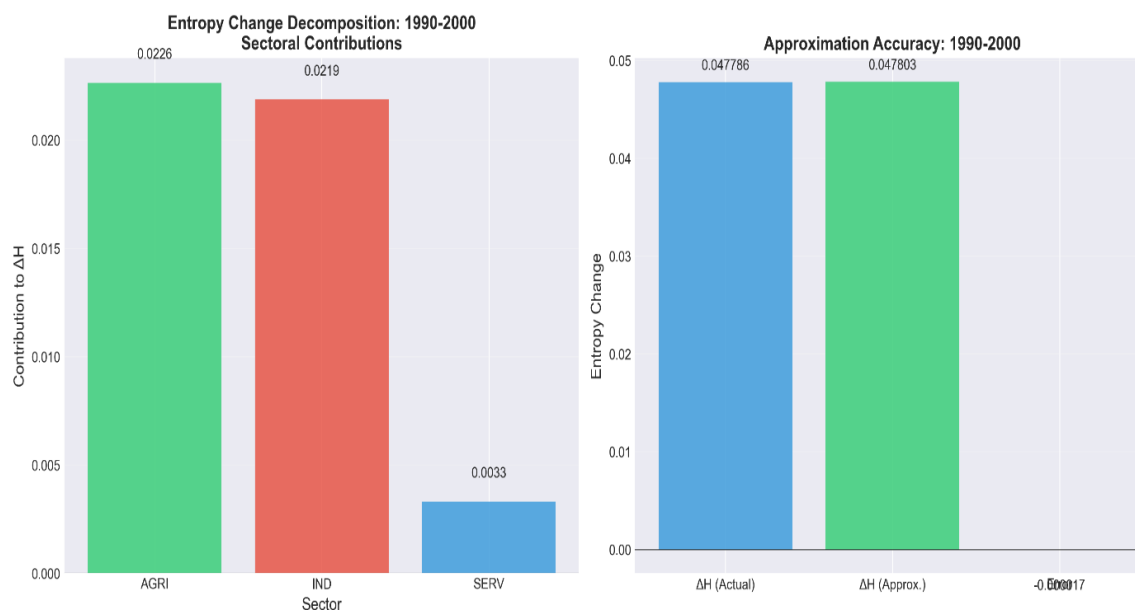


Figure 7: Entropy Change Decomposition, 1990–2000

Table 5a: Entropy Change Summary, 1990–2000

ΔH (Actual)	0.047786
ΔH (Approximation)	0.047803
Approximation Error	–0.000017

Table 5b: Sectoral Contributions, 1990–2000

	Δp	Weight	Contribution
Agriculture	+0.0309	0.7323	+0.0226
Industry	–0.0839	–0.2608	+0.0219
Services	+0.0530	0.0624	+0.0033

2000–2010 (Figure 8; Tables 6a–6b)

Entropy declined by $\Delta H = -0.0130$. Agriculture contributed positively, but both industry and services contributed negatively. Services' expansion reduced diversification because it increased dominance rather than restored balance—a pattern that persists in later periods.

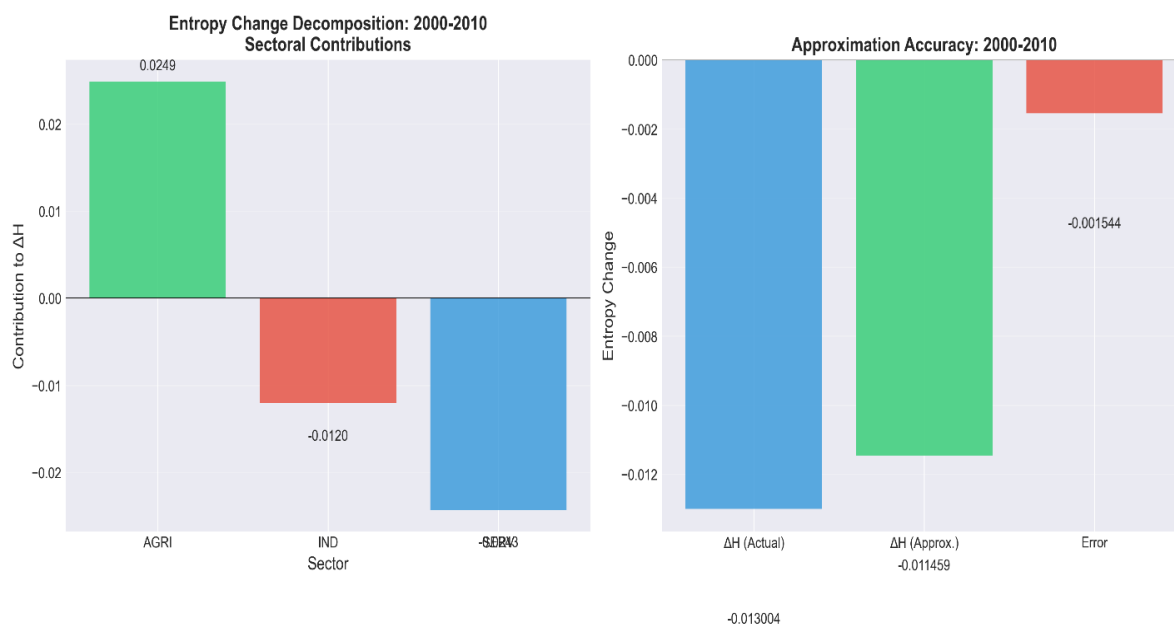


Figure 8: Entropy Change Decomposition, 2000–2010

Table 6a: Entropy Change Summary, 2000–2010

ΔH (Actual)	-0.013004
ΔH (Approximation)	-0.011459
Approximation Error	-0.001544

Table 6b: Sectoral Contributions, 2000–2010

	Δp	Weight	Contribution
Agriculture	+0.0466	0.5342	+0.0249
Industry	-0.1824	0.0660	-0.0120
Services	+0.1358	-0.1790	-0.0243

2010–2020 (Figure 9; Tables 7a–7b)

The entropy decline of $\Delta H = -0.0147$ was driven mainly by industry's contraction and the negative entropy effect of service expansion. Agriculture played a limited stabilizing role.

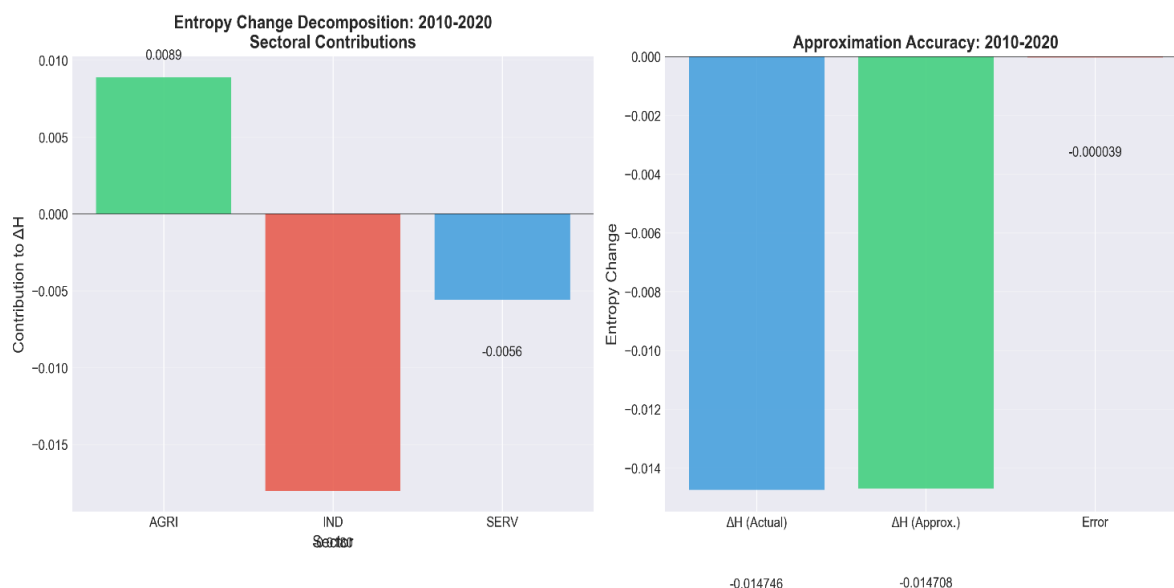


Figure 9: Entropy Change Decomposition, 2010–2020

Table 7a: Entropy Change Summary, 2010–2020

ΔH (Actual)	-0.014746
ΔH (Approximation)	-0.014708
Approximation Error	-0.000039

Table 7b: Sectoral Contributions, 2010–2020

	Δp	Weight	Contribution
Agriculture	+0.0231	0.3843	+0.0089
Industry	-0.0396	0.4551	-0.0180
Services	+0.0165	-0.3386	-0.0056

2020–2024 (Figure 10; Tables 8a–8b)

All three sectors contributed negatively to entropy change during this sub-period. Services, despite increasing their GDP share, had the largest negative entropy contribution, reflecting extreme concentration. This explains the steep diversification decline observed after 2020.

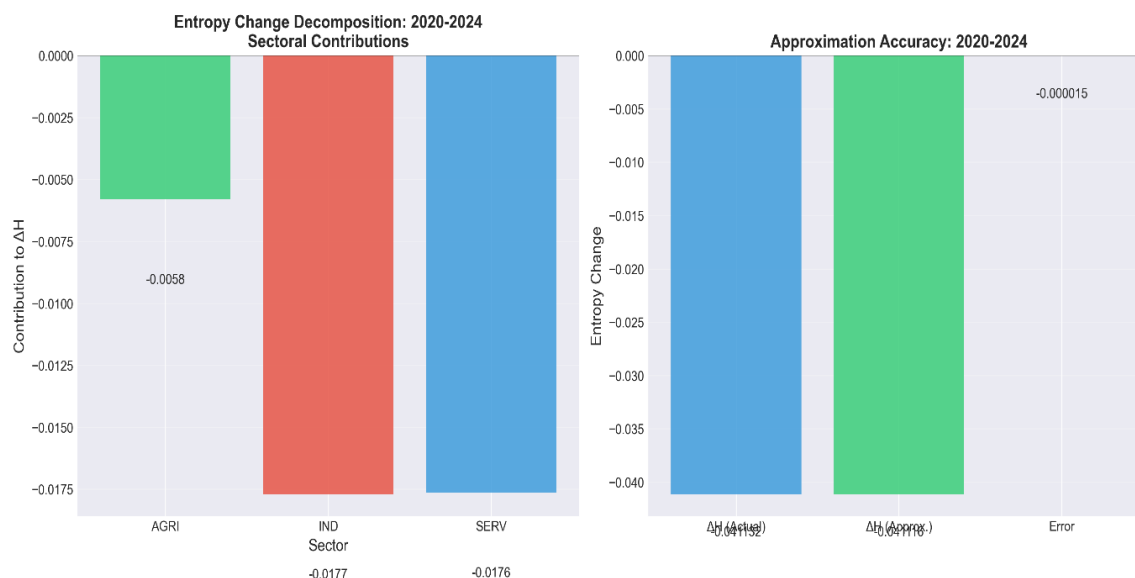


Figure 10: Entropy Change Decomposition, 2020–2024

Table 8a: Entropy Change Summary, 2020–2024

ΔH (Actual)	–0.041132
ΔH (Approximation)	–0.041116
Approximation Error	–0.000015

Table 8b: Sectoral Contributions, 2020–2024

	Δp	Weight	Contribution
Agriculture	–0.0157	0.3695	–0.0058
Industry	–0.0288	0.6136	–0.0177
Services	+0.0445	–0.3960	–0.0176

Long-Run Decomposition, 1990–2024 (Figure 11; Tables 9a–9b)

Over the full 35-year period, entropy declined by $\Delta H = -0.0211$. Agriculture made a positive contribution, but this was more than offset by negative contributions from both industry and services. The long-run diversification failure is therefore attributable to industrial collapse and service-sector dominance, not to agricultural underperformance.

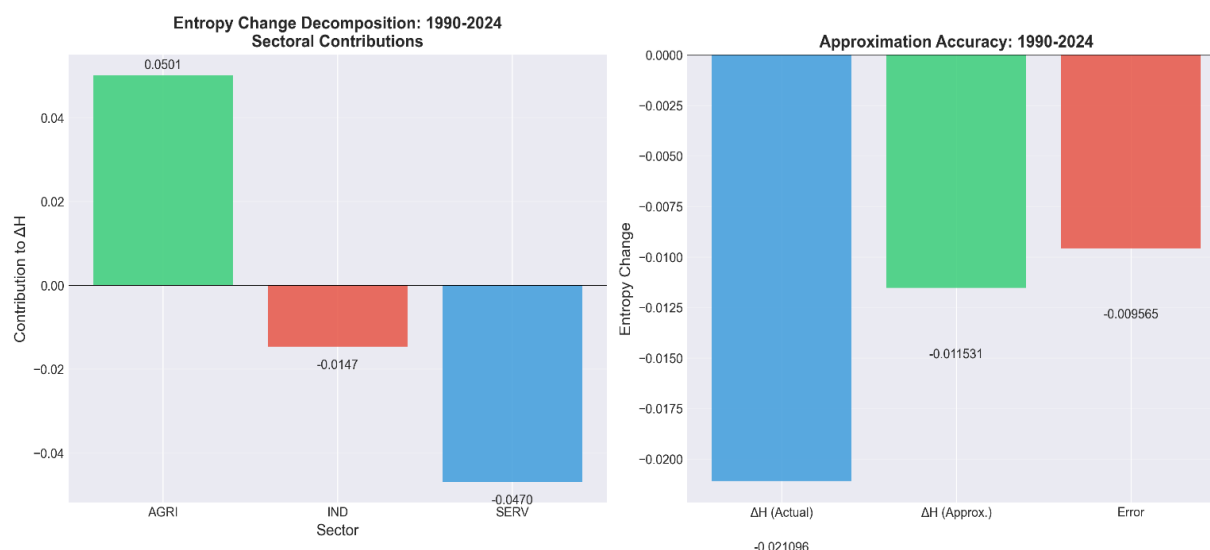


Figure 11: Entropy Change Decomposition, 1990–2024

Table 9a: Entropy Change Summary, 1990–2024

ΔH (Actual)	−0.021096
ΔH (Approximation)	−0.011531
Approximation Error	−0.009565

Table 9b: Sectoral Contributions, 1990–2024

	Δp	Weight	Contribution
Agriculture	+0.0850	0.5901	+0.0501
Industry	−0.3347	0.0439	−0.0147
Services	+0.2497	−0.1881	−0.0470

3.5 Diversification, Growth, and Trend Analysis

Table 10 reports a moderate positive correlation ($r = 0.582$) between entropy levels and GDP growth. More diversified economies are associated with higher long-run growth. However, the correlation between changes in entropy and contemporaneous growth is negligible ($r = 0.010$), suggesting that diversification operates as a structural condition for growth rather than an immediate driver.

Trend analysis in Table 11 confirms a statistically significant downward trend in entropy ($\beta = -0.00107$, $p = 0.013$). The structural turning point was 2002, after which diversification declined consistently.

Table 10: Correlation Analysis

Measure	Correlation with GDP Growth
Entropy (level)	0.5824
Change in Entropy (ΔH)	0.0098

Table 11: Entropy Trend Analysis, 1990–2024

Slope (β)	−0.001066 per year
R^2	0.1777
p-value	0.0130

3.6 Synthesis of Empirical Evidence

The results consistently show that Nigeria's structural transformation has been characterized by sectoral substitution rather than balanced diversification. The collapse of industry and the unchecked dominance of services explain why diversification indices deteriorated even as overall GDP continued to expand. The entropy decomposition is particularly revealing: in every sub-period from 2000 onwards, service-sector growth reduced rather than increased overall entropy, because it reinforced concentration rather than restoring balance.

4. Discussion of Findings

The empirical results speak directly to the three research questions and carry important theoretical and policy implications.

4.1 Addressing Research Question 1

The entropy decomposition shows unambiguously that service-sector expansion is the proximate cause of Nigeria's declining diversification. Although services have grown rapidly and now account for nearly 57% of GDP, their very dominance reduces entropy. When a single sector increasingly crowds out others, the information content of the sectoral distribution falls. This is the diversification paradox: GDP growth and diversification are moving in opposite directions. Agriculture, by contrast, has made consistent positive contributions to entropy throughout the period, underscoring its stabilizing role in Nigeria's economic structure.

The trend analysis confirms a statistically significant decline in diversification since 2002, with the most rapid deterioration occurring after 2020. This pattern challenges the narrative that Nigeria's growth represents successful structural transformation. Instead, it suggests a process of unbalanced sectoral substitution where industrial capacity has been displaced rather than upgraded.

The Shift–Share analysis documents a clear structural break around 2002–2003. Before that point, growth contributions were relatively distributed across sectors. After 2002, services captured an ever-growing share of total growth—reaching 90.5% in 2020–2024—while industry contracted. This finding aligns with Rodrik's (2016) diagnosis of premature de-industrialisation but adds a new dimension: in Nigeria's case, the displacement of industry by services has been accompanied by a collapse in manufacturing capability rather than a transition to high-value, knowledge-intensive services. The result is an economy that is both concentrated and technologically shallow. Industry's decline also resonates with Cust and Mihalyi's (2023) resource curse framework: oil revenues appear to have crowded out manufacturing investment and reduced policy incentives for productive diversification. The growth contributions of agriculture, while

positive, have been insufficient to counterbalance the combined effects of industrial collapse and service concentration.

Three policy directions emerge from the evidence. First, Nigeria needs a second-generation diversification strategy that goes beyond sectoral rebalancing to target within-sector capability development. The current approach—assuming that any shift away from oil constitutes diversification—is inadequate. Hidalgo et al. (2022) argue that meaningful diversification requires developing productive capabilities within sectors. For Nigeria, this means prioritizing agro-processing and value-added manufacturing. The positive entropy contribution of agriculture throughout the period suggests that this sector could serve as a foundation for industrial development if linkages are strengthened. Second, the agriculture–industry linkage must be strengthened. Agriculture has been the only consistent positive contributor to entropy, yet its share remains modest. Investments in agro-industrial corridors and food-processing clusters could convert this stabilizing role into a driver of balanced growth. Yusuf and Mohamed (2023) document that value chain development in agriculture has significant employment and output multipliers, particularly when linked to domestic manufacturing. Third, the service sector requires upgrading, not merely expansion. Diop and Asongu (2023) note that service-led growth in Africa has often come at the cost of export sophistication. Nigeria’s policy challenge is to shift services toward high-productivity, export-oriented activities—technology, finance, and logistics—that generate sectoral linkages rather than reinforcing a services monoculture. Nwokike (2022) shows that digital transformation during the COVID-19 period created opportunities for service upgrading, but these have not been systematically exploited.

4.4 Theoretical Implications

Premature de-industrialization: Rodrik (2016) identified that developing countries are de-industrializing at lower income levels than historical precedents. Nigeria exemplifies this pattern, but with an additional dimension: the collapse of industry has not been compensated by the emergence of high-productivity services. This suggests a need to distinguish between “service-led growth” that reflects genuine structural upgrading and “service-dominated growth” that reflects industrial atrophy.

Resource curse mechanisms: Cust and Mihalyi (2023) emphasize political economy channels through which resource wealth distorts economic structure. Nigeria’s experience confirms that oil revenues reduce the urgency of diversification and create institutional incentives that favor rent-seeking over productive investment. The persistence of industrial decline despite multiple policy interventions illustrates how these dynamics operate.

Diversification paradox: The finding that service-sector growth reduces overall diversification when it reinforces existing concentration contributes a new concept to the literature. This paradox suggests that the standard narrative—more services equals more diversification—is misleading. The type of services and their relationship to other sectors matter more than the aggregate service share.

5. Conclusion

This study applied four complementary metrics to analyse Nigeria’s sectoral diversification from 1990 to 2024. The central finding is a diversification paradox: Nigeria’s GDP expanded substantially over the period, yet its economic structure became less balanced. Normalized entropy peaked at 0.986 in 2002 and declined to 0.890 by 2024, with the downward trend statistically significant ($p = 0.013$). The entropy decomposition identifies service-sector concentration and industrial collapse as the twin drivers of this outcome. The Shift–Share analysis reveals that services captured an increasing share of growth over time, reaching 90.5% of total growth in 2020–

2024, while industry contracted and agriculture's contribution diminished. The entropy decomposition shows that in every sub-period from 2000 onwards, service-sector growth reduced overall diversification because it reinforced existing concentration rather than restoring balance. Three policy implications follow. First, reviving industry—particularly agro-processing and light manufacturing—is essential to restoring structural balance. Second, within-sector capability development must accompany any sectoral rebalancing. Third, service-sector growth should be redirected toward high-productivity, export-oriented activities that generate cross-sectoral linkages. Diversification without these elements is diversification in name only.

These conclusions are subject to data limitations. The analysis uses three broad sectors; sub-sectoral disaggregation would sharpen the diagnosis. Future research should examine state-level diversification patterns, incorporate employment and export data, and assess the impact of specific policy interventions on sectoral entropy.

Nigeria's diversification challenge is well documented; translating that documentation into effective policy remains the urgent task. The metrics tell a clear story: an economy that has become increasingly service-concentrated while experiencing industrial collapse and agricultural stagnation. Corrective action is urgently needed to build a more balanced, resilient, and inclusive economy capable of delivering sustainable development for Nigeria's growing population.

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