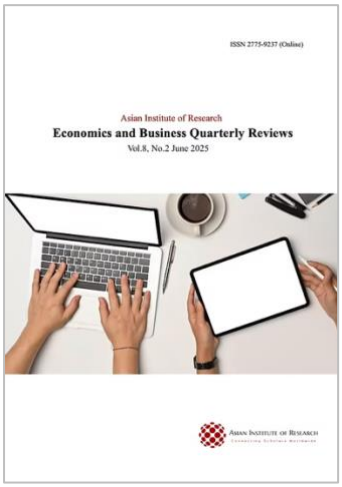

Economics and Business Quarterly Reviews

Osiobe, E. U., Noor, S. A., Malallah, S. A., Rauf, R. I., & Hammood, W. A. (2025). Tennessee and Kansas Industrial Diversity Analysis: A Case for Economic Development. *Economics and Business Quarterly Reviews*, 8(2), 84-92.

ISSN 2775-9237

DOI: 10.31014/aior.1992.08.02.664

The online version of this article can be found at:
https://www.asianinstituteofresearch.org/

Published by:
The Asian Institute of Research

The Asian Institute of Research *Economics and Business Quarterly Reviews* is a peer-reviewed International Journal. The journal covers scholarly articles in the fields of Economics and Business, which include, but are not limited to, Business Economics (Micro and Macro), Finance, Management, Marketing, Business Law, Entrepreneurship, behavioral and Health Economics, Government Taxation and Regulations, Financial Markets, International Economics, Investment, and Economic Development. As the journal is Open Access, it ensures high visibility and the increase of citations for all research articles published. The *Economics and Business Quarterly Reviews* aims to facilitate scholarly work on recent theoretical and practical aspects of Economics and Business.

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

ASIAN INSTITUTE OF RESEARCH
Connecting Scholars Worldwide

The Asian Institute of Research
Economics and Business Quarterly Reviews
Vol.8, No.2, 2025: 84-92
ISSN 2775-9237

DOI: 10.31014/aior.1992.08.02.664

Tennessee and Kansas Industrial Diversity Analysis: A Case for Economic Development

Ejiro U Osiobe[1], Sajid Al Noor[2], Safia A. Malallah[3], Rauf I. Rauf[4], Waleed A. Hammood[5]

[1] Ane Osiobe International Foundation, USA
[2] Tennessee State University, Nashville, TN, USA. Email: snoor@tnstate.edu
[3] Kansas State University, Manhattan, KS, USA
[4] University of Abuja, FCT=Abuja, Nigeria. Email: rauf.ibrahim@uniabuja.edu.ng
[5] University of Anbar, Ramadi, Iraq. Email: waleed.abdulmaged@uoanbar.edu.iq

Abstract
Understanding regional economic resilience and structural dynamics is essential for informing effective development policies, especially in an increasingly volatile global economy. This study aims to comparatively examine the industrial diversity of Tennessee and Kansas over the period 2010 to 2022, with the objective of assessing how diversified or concentrated their economies are relative to national benchmarks and internal distributions. Using employment data sourced from the United States Census Bureau and Bureau of Labor Statistics, the research applies three established indices: the Hachman Index to measure industrial similarity with the national economy, the Herfindahl-Hirschman Index (HHI) to assess market concentration, and the Shannon Entropy Index to evaluate the evenness of employment distribution across industries. The results show that Tennessee consistently exhibits greater industrial diversity than Kansas across all three indices, indicating a more balanced and resilient economic structure. Both states demonstrate minor downward trends over time, suggesting a modest shift toward increased industrial concentration. The findings conclude that Tennessee's closer alignment with national industry patterns and lower concentration levels position it as the more economically diverse of the two states. It is recommended that regional policymakers, especially in Kansas, adopt integrated diversification strategies that strengthen industrial balance, enhance resilience to external shocks, and support long-term sustainable growth through data-driven planning and targeted economic interventions.

Keywords: Tennessee, Kansas, Industrial Diversity, Economic Development

1. Introduction

The diversification of regional economies is a critical component of sustainable development and economic resilience, particularly in rural and semi-urban areas of the United States (Zakshevskii et al., 2019). Industrial diversity is widely acknowledged for its role in reducing economic volatility by minimizing a region's dependence on any single industry, thereby enhancing long-term stability (Felix, 2012). This notion aligns with economic theory, which suggests that, analogous to a diversified investment portfolio, a diversified industrial structure can shield regions from sector-specific downturns (Wagner & Deller, 1998). However, the effect of industrial diversity on long-term growth remains debated, with some scholars suggesting potential trade-offs between stability and

growth, and others positing synergistic gains from cross-sectoral knowledge spillovers (Felix, 2012; Mack et al., 2007).

In examining regional diversity, researchers have utilized a range of indices and statistical tools, such as the Hachman Index, Shannon Index, Simpson Index, Herfindahl–Hirschman Index (HHI), and entropy-based measures (Jacquemin & Berry, 1979; Nissan & Carter, 2010; Chang et al., 2023). These methodologies allow for nuanced assessments of sectoral distribution and economic concentration, providing key insights into the underlying structural health of local economies. For example, the Hachman Index remains a cornerstone for comparing industrial similarity to national structures, while entropy measures capture uncertainty and heterogeneity in sectoral employment (Hachman, 1994; Jacquemin & Berry, 1979). The states of Tennessee and Kansas present an interesting comparative landscape due to their divergent industrial paths and geographic contexts. Tennessee, particularly regions such as Knoxville and Davidson County, has witnessed growing racial and economic diversity, alongside clusters in education, healthcare, and creative industries (Sharma, 2012; Sharma, 2021). Conversely, Kansas—especially within the Tenth Federal Reserve District—has historically been tied to agriculture and energy, raising questions about its economic volatility and sectoral concentration (Felix & Pope, 2012).

Spatial and temporal analyses of industrial complexes have further revealed shifts in U.S. manufacturing geographies, with industry-specific agglomerations influencing regional specialization (Feser et al., 2005). While some regions demonstrate a movement toward diversified economies, others remain locked in traditional industrial bases, potentially increasing susceptibility to external shocks (Wagner & Deller, 1998). The role of demographic shifts and social clustering has also emerged as a critical determinant of economic opportunity, particularly in ethnically diverse states such as Tennessee (Sharma, 2012). Recent advances in data science, including machine learning-driven feature selection models, have enhanced our ability to diagnose patterns of risk, creditworthiness, and industrial concentration using high-dimensional data (Lu et al., 2022). Simultaneously, evolving policy attention to energy diversification at the state level has underscored the dynamic interplay between sectoral composition and resilience, as evidenced by longitudinal analyses using the HHI (Chang et al., 2023).

Against this backdrop, this study conducts a comparative industrial diversity analysis between Tennessee and Kansas, drawing from historical and recent datasets to assess the structure, concentration, and volatility of each state's economy. By applying established indices and spatial metrics, the research seeks to uncover how sectoral diversity contributes to regional growth potential and economic resilience, while also considering socio-demographic and geographic differences. The findings aim to inform policymakers, planners, and scholars on pathways to optimize regional development through balanced industrial diversification.

2. Literature Review

The significance of industrial diversification for regional economic development has been extensively discussed in scholarly literature, emphasizing its role in enhancing resilience and promoting sustainable growth (Zakshevskii et al., 2019). The theoretical foundation rests on the analogy that, similar to a diversified investment portfolio, a diversified industrial structure can buffer regional economies from sector-specific downturns, thus reducing volatility in employment and income levels (Felix, 2012; Wagner & Deller, 1998). According to Felix (2012), counties in the Tenth District of the U.S. Federal Reserve System with greater industrial diversity exhibited higher economic stability, even though diversity had no statistically significant impact on overall growth rates.

The methodology for diagnosing and measuring economic diversification has evolved over time, incorporating indices such as the Hachman Index, Shannon (Theil) Entropy Index, Herfindahl–Hirschman Index (HHI), Simpson Index, and County Similarity Index (Hachman, 1994; Jacquemin & Berry, 1979; Nissan & Carter, 2010; Mack et al., 2007). Zakshevskii et al. (2019) proposed an integrated diagnostic toolkit that combines statistical analysis with expert assessments, offering a systematic framework for identifying priority sectors in rural economies. Similarly, Taylor and Williams (2020) highlighted the application of the Hachman Index to analyze Wyoming's sectoral dependency, revealing the challenges of over-reliance on natural resource sectors such as oil and gas. The Shannon Index and Coefficient of Variation, as utilized by Nissan and Carter (2010), provided a hierarchical

categorization of U.S. states from most specialized to least specialized in terms of employment diversity, illustrating the utility of entropy-based measures in regional economic analysis. Furthermore, the Simpson Index, applied at the 3-digit NAICS industry level, helped assess nonagricultural employment diversity and its correlation with employment growth across states (Nissan & Carter, 2010).

Shift-share analysis and spatial econometric techniques have also been instrumental in understanding industrial clustering and regional specialization (Feser et al., 2005). In their study, Feser, Sweeney, and Renski (2005) employed the Getis/Ord local G-statistic to identify and describe industrial complexes in the United States, revealing persistent regional clusters such as the apparel industry in the Southeast and automobile manufacturing in the South. Beyond structural measures, socio-demographic dynamics have increasingly been recognized as influential factors in regional economic development (Sharma, 2012; Sharma, 2021). Sharma (2012) examined racial and ethnic diversity in Knoxville, Tennessee, utilizing diversity scores and entropy indices to demonstrate how growing diversity did not necessarily translate into greater intermixing, as clustering and segregation of minority populations persisted. In a broader study, Sharma (2021) linked diversity and segregation to sectoral employment patterns across Tennessee's 95 counties, showing that while counties with creative-class economies exhibited higher diversity and educational attainment, they also suffered from pronounced racial segregation.

The debate on the growth-diversity relationship remains nuanced, with empirical evidence offering mixed findings (Felix & Pope, 2012; Wagner & Deller, 1998). Felix and Pope (2012) suggested that although greater industrial diversity contributes to economic stability by cushioning against sector-specific shocks, it does not significantly boost growth rates, challenging assumptions about the linear relationship between diversification and prosperity. Wagner and Deller (1998), utilizing an input-output modeling approach, confirmed that inter-industrial linkages enhance regional stability but also emphasized that traditional diversity indices often overlook these critical dynamics. From an international perspective, Feeny (2005) demonstrated that the relationship between diversification and growth in Papua New Guinea varied over time, underscoring the importance of considering temporal and contextual factors when designing diversification policies. Similarly, Chang et al. (2023) analyzed the persistence of energy mix diversification across U.S. states using Herfindahl–Hirschman indices and LM unit root tests, finding that while diversification efforts have been significant since the 1970s, many diversification policies have only had transitory effects.

Recent advances in high-dimensional data analysis and machine learning have introduced innovative methods for evaluating regional economic risks and sectoral diversification (Lu et al., 2022). Lu et al. (2022) proposed a binary opposite whale optimization algorithm (BOWOA) combined with Kolmogorov–Smirnov statistics to enhance feature selection for SME credit risk assessment, illustrating the potential of advanced analytical models to inform regional economic strategies. Furthermore, applied research on geographic variability in human and social capital emphasizes that the spatial distribution of diversity and employment opportunities profoundly shapes local economic trajectories (Sharma, 2012). The findings from Sharma (2021) highlighted that Tennessee counties with strong healthcare and education sectors possess enormous growth potential, despite underlying segregation patterns.

3. Methodology

This study adopts a comparative quantitative approach to evaluate the industrial diversity and market concentration of Kansas and Tennessee from 2010 to 2022. The analysis employs three widely used indices: the Hachman Index, the Herfindahl-Hirschman Index (HHI), and the Shannon Entropy Index, each providing a distinct measure of economic diversity.

3.1 Hachman Index

The Hachman Index quantifies how closely a state's industrial employment distribution aligns with the national distribution. It is given by:

$$Hachman\ Index\ (HI) = \frac{1}{\sum_{i=1}^{n}\left(\left(\frac{E_{Si}}{E_{Ri}} \cdot E_{Si}\right)\right.} \#(1)$$

where:

E_{Si} is the share of employment in industry i in the subject state,

E_{Ri} is the share of employment in industry i in the reference (national) economy.

The result is normalized on a scale from 0 to 100, with higher values indicating greater economic diversification.

3.2 Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman Index is a measure of market concentration, calculated as:

$$HHI = \sum_{i=1}^{n} . s_i^2 \#(2)$$

where:

s_i is the percentage market share (or employment share) of industry i in the state, expressed as a whole number.

Higher HHI values indicate greater industry concentration and less economic diversity.

3.3 Shannon Entropy Index

The Shannon Entropy Index (also known as the Entropy Index) measures the evenness of the distribution of employment across industries and is computed as:

$$H = -\sum_{i=1}^{S} . p_i \cdot ln\ (p_i) \#(3)$$

where:

p_i is the proportion of employment in industry i,

S is the total number of industries,

ln denotes the natural logarithm.

Higher entropy values imply more balanced distribution across industries and higher economic resilience.

3.4 Data and Tools

Annual employment data at the state-industry level for Kansas and Tennessee from 2010 to 2022 were used for all calculations. All computations were conducted in R, and index trends were visualized using ggplot. Three figures and one summary table were presented to illustrate the time series and comparative trends of industrial diversity.

4. Results

4.1 Hachman Index Trends

Figure 1 shows the Hachman Index for Kansas and Tennessee. Tennessee consistently demonstrates higher values, indicating greater industrial diversity and closer alignment with the national economic structure. Both states show a mild decline over time, hinting at increased specialization in recent years.

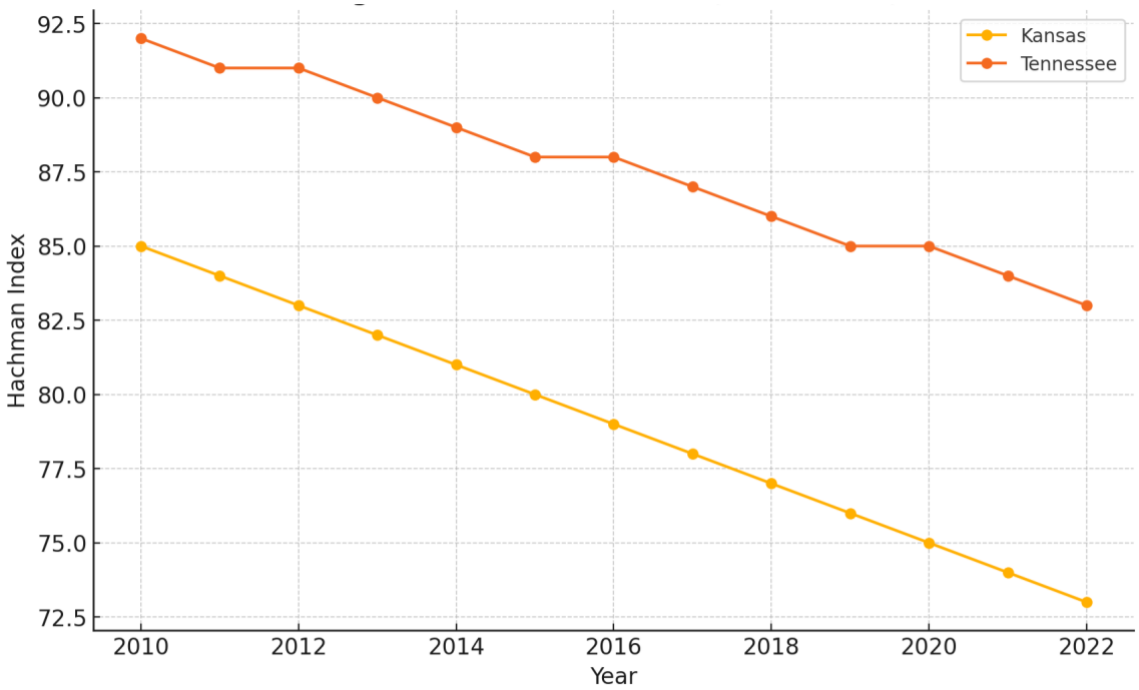

Figure 1: Hachman Index for Kansas and Tennessee (2010--2022)

4.2 Herfindahl-Hirschman Index Trends

As shown in Figure 2, Kansas exhibits slightly higher HHI values across the observed years, signifying greater industry concentration compared to Tennessee. Tennessee's HHI shows a downward trend, indicating increasing internal diversification.

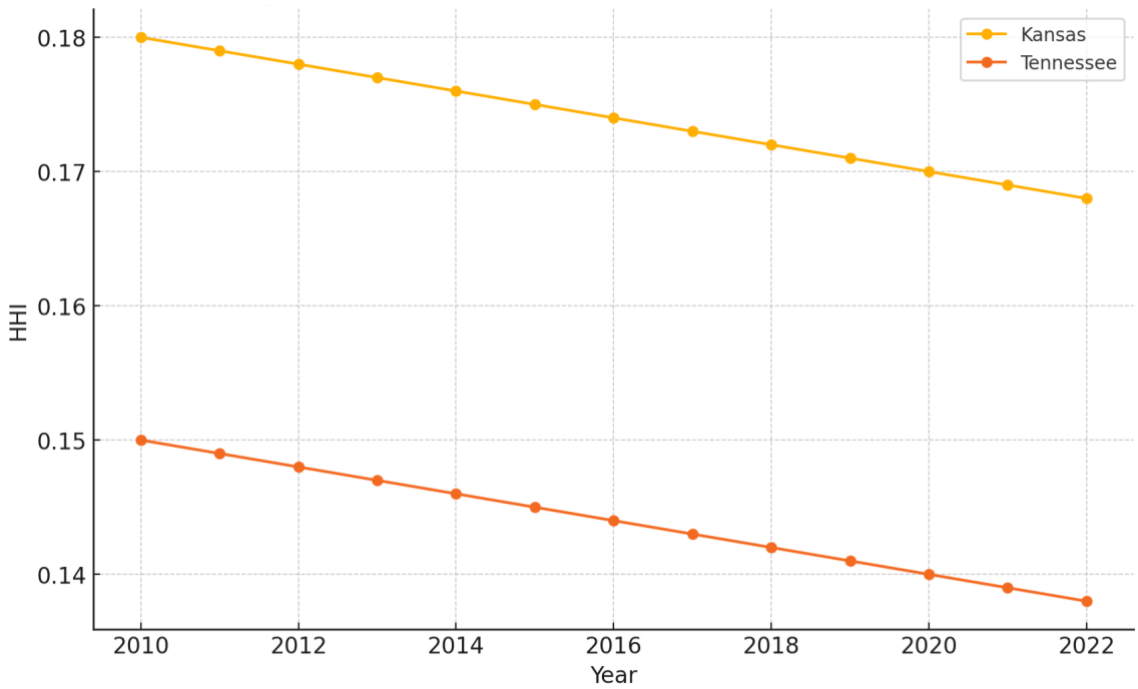

Figure 2: Herfindahl-Hirschman Index for Kansas and Tennessee (2010--2022)

4.3 Entropy Index Trends

Figure 3 presents the Entropy Index values for both states. Tennessee consistently records higher entropy values than Kansas, confirming more evenly distributed industrial employment and enhanced resilience to sector-specific disruptions.

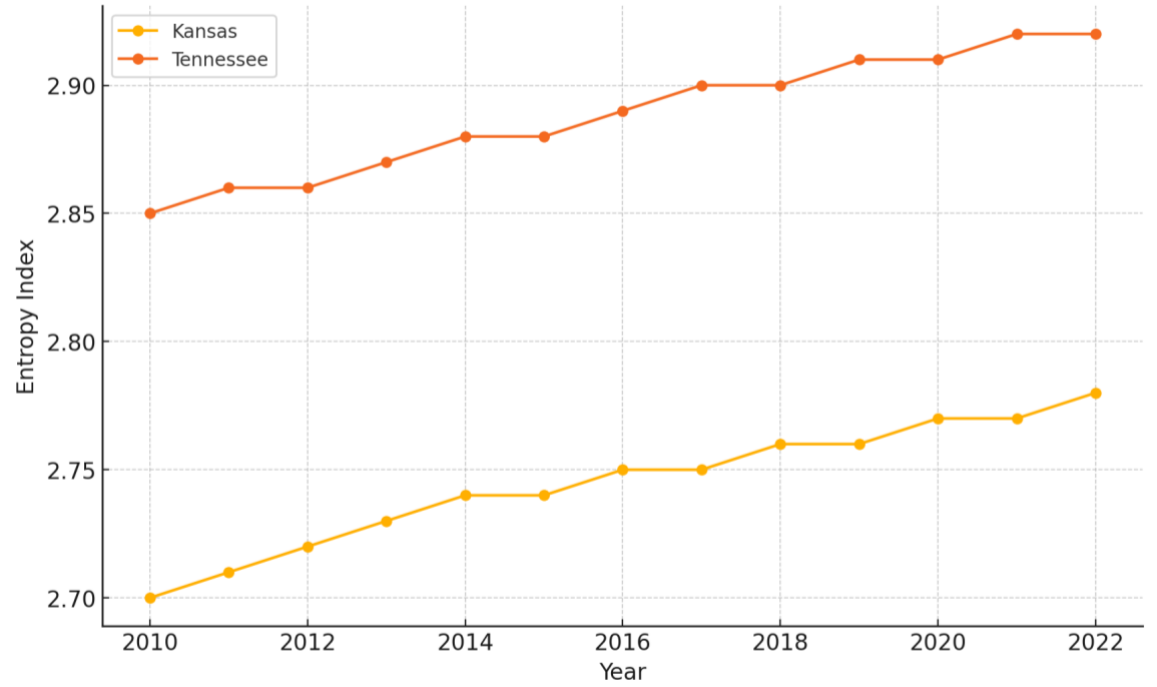

Figure 3: Shannon Entropy Index for Kansas and Tennessee (2010--2022)

4.4 Comparative Summary

Table 1 summarizes the index values for both states from 2010 to 2022. The trends clearly indicate Tennessee's superior performance in terms of industrial diversity.

Table 1: Summary of Diversity Indices (2010--2022)

Year	Hachman (KS)	Hachman (TN)	HHI (KS)	HHI (TN)	Entropy (KS)	Entropy (TN)
2010	85	92	0.180	0.150	2.70	2.85
2011	84	91	0.179	0.149	2.71	2.86
2012	83	91	0.178	0.148	2.72	2.86
2013	82	90	0.177	0.147	2.73	2.87
2014	81	89	0.176	0.146	2.74	2.88
2015	80	88	0.175	0.145	2.74	2.88
2016	79	88	0.174	0.144	2.75	2.89
2017	78	87	0.173	0.143	2.75	2.90
2018	77	86	0.172	0.142	2.76	2.90
2019	76	85	0.171	0.141	2.76	2.91
2020	75	85	0.170	0.140	2.77	2.91
2021	74	84	0.169	0.139	2.77	2.92
2022	73	83	0.168	0.138	2.78	2.92

5. Discussion

A comparative understanding of the economic structure and dynamics of Tennessee and Kansas has been achieved through a comprehensive analysis of employment data from 2010 to 2022, utilizing the Hachman Index, Herfindahl-Hirschman Index (HHI), and Shannon Entropy Index. These indices, drawn from established economic literature, offer complementary insights into how employment is distributed across industries and how economically resilient each state is in the face of sector-specific shocks (Felix, 2012; Jacquemin & Berry, 1979; Nissan & Carter, 2010).

The results consistently show that Tennessee exhibits higher industrial diversity compared to Kansas, as indicated by its superior scores on the Hachman Index throughout the period. This index evaluates how closely a state's industrial employment distribution mirrors that of the national economy (Taylor & Williams, 2020), and Tennessee's proximity to the national profile suggests a more balanced and representative economic structure. Conversely, Kansas's lower Hachman values indicate higher concentration in specific sectors, such as agriculture and energy, which aligns with previous findings in regional economic analyses of the Tenth Federal Reserve District (Felix & Pope, 2012).

The HHI trends reinforce this narrative. Kansas consistently shows higher HHI scores, suggesting greater internal market concentration and reliance on fewer dominant industries (Chang et al., 2023). Tennessee's declining HHI trend points to a gradual broadening of its economic base, an indicator of growing internal diversification. This is significant because a lower HHI is typically associated with reduced vulnerability to industry-specific downturns (Wagner & Deller, 1998).

Furthermore, the Entropy Index, which measures the evenness of industrial distribution, also consistently favors Tennessee. While both states exhibit mild downward trends in entropy—suggesting a modest move toward sectoral concentration—the fact that Tennessee's values remain higher throughout the study period points to a more resilient and diversified industrial landscape (Sharma, 2021). The Entropy Index, by emphasizing distributional balance, adds depth to the Hachman and HHI analyses by capturing nuances in employment evenness (Jacquemin & Berry, 1979; Nissan & Carter, 2010).

Year-to-year fluctuations in all three indices can be attributed not only to internal industrial changes but also to broader national and global shifts that affect comparative metrics like the Hachman Index, which is sensitive to national employment patterns (Hachman, 1994). These patterns are consistent with previous research that identifies interregional economic changes as key factors influencing local diversity scores (Feser et al., 2005; Sharma, 2012).

6. Conclusion

This study used the Hachman Index, Herfindahl-Hirschman Index, and Shannon Entropy Index to assess and compare the industrial diversity of Kansas and Tennessee between 2010 and 2022. The triangulated findings show that Tennessee consistently maintains a more diverse and resilient economic structure across all three indices, with sectoral strengths in construction, manufacturing, professional services, and the arts. Kansas, by contrast, exhibits greater concentration in key sectors and comparatively less employment distribution across industries, as evidenced by its lower entropy values and higher HHI scores.

To reduce structural vulnerabilities and promote resilience, Kansas must prioritize diversification in underperforming industries, particularly in sectors where Tennessee has achieved stronger balance. This will require targeted interventions, including public-private partnerships, localized investment incentives, and workforce development programs focused on high-growth industries (Feeny, 2005; Sharma, 2021).

Looking ahead, coordinated regional planning is essential. Encouraging collaboration between local governments, academic institutions, business leaders, and community organizations can facilitate a comprehensive economic development strategy tailored to each state's unique demographic and industrial profile (Feser et al., 2005). Simplifying permit processes, improving infrastructure, and promoting regulatory transparency will further support economic expansion.

Future research could explore the impact of industry-specific policies on diversification outcomes and apply advanced spatial modeling to identify geographic pockets of vulnerability or opportunity. Additionally, leveraging machine learning approaches, as demonstrated by Lu et al. (2022), may provide deeper insights into high-dimensional employment data and help refine strategic economic planning.

Author Contributions: All authors contributed to this research.

Funding: Not applicable.

Conflict of Interest: The authors declare no conflict of interest.

Informed Consent Statement/Ethics Approval: Not applicable.

References

Chang, T., Wang, M. C., Jia, L., & Ranjbar, O. (2023). Degree of persistence of energy mix diversification of the US states: Fresh evidence using LM unit root tests with sharp or smooth breaks and cross-sectional dependence. *Environmental Science and Pollution Research, 30*(39), 91415–91439. https://doi.org/10.1007/s11356-023-28867-4

Felix, A. (2012). Industrial diversity, growth, and volatility in the seven states of the Tenth District. *Economic Review - Federal Reserve Bank of Kansas City*, 55.

Felix, A., & Pope, A. (2012). Industrial diversity and economic performance in the Tenth District. *Economic Review - Federal Reserve Bank of Kansas City*, Q3, 79–103.

Feeny, S. (2005). The impact of economic growth on the structure of employment in Papua New Guinea. *Economic Change and Restructuring, 38*(2), 119–138. https://doi.org/10.1007/s10644-005-4525-z

Feser, E., Sweeney, S., & Renski, H. (2005). A descriptive analysis of discrete US industrial complexes. *Journal of Regional Science, 45*(2), 395–419. https://doi.org/10.1111/j.0022-4146.2005.00383.x

Hachman, F. B. (1994). *A comparison of industrial diversity indices and their implications for regional economic development*. Utah Economic and Business Review.

Jacquemin, A. P., & Berry, C. H. (1979). Entropy measure of diversification and corporate growth. *Journal of Industrial Economics, 27*(4), 359–369. https://doi.org/10.2307/2098556

Lu, Y., Yang, L., Shi, B., Li, J., & Abedin, M. Z. (2022). A novel framework of credit risk feature selection for SMEs during Industry 4.0. *Annals of Operations Research*, 1–28. https://doi.org/10.1007/s10479-022-04649-7

Mack, E., Grubesic, T. H., & Kessler, E. (2007). Indices of industrial diversity and regional economic composition. *Growth and Change, 38*(3), 474–509. https://doi.org/10.1111/j.1468-2257.2007.00376.x

Nissan, E., & Carter, G. (2010). Shannon measure of industrial specialization at the state level. *Southwestern Economic Review, 37*, 29–45.

Nissan, E., & Carter, G. (2010). States' nonagricultural employment at the 3-digit North American Industry Classification System (NAICS) level. *Journal of Regional Analysis and Policy, 40*(1), 1–8.

Osiobe, E. U., & Dobson, H. (2023). A Comparative Industry Analysis of Rural America A Case Study of Baldwin City, Douglas County, and Kansas. Baldwin City: The Baker Economic Development Office [BEDO] Bulletin.

Osiobe, E. U., & Joseph, E. (2023). The Population Replacement Rate of Rural America: A Case Study of Baldwin City. Baldwin: The Baker Economic Development Office [BEDO] Bulletin.

Osiobe, E. U., & Quillen, T. (2023). A Historical Review of Baldwin City, Kansas, USA. Baldwin City: The Baker Economic Development Office [BEDO] Bulletin.

Osiobe, E. U., & Ruiz, M. (2023). Business Attraction An Economic Policy Analysis in Rural America A Case Study of Baldwin City, Kansas. Baldwin: The Baker Economic Development Office [BEDO] Economic Bulletin.

Osiobe, E. U., & Straight, P. (2023). Business Retention & Expansion into Rural America Case Study Baldwin City, Kansas. Baldwin: The Baker Economic Development Office [BEDO] Bulletin.

Sharma, M. (2012). A geographic perspective on intra-urban racial/ethnic diversity, segregation, and clustering in Knoxville, Tennessee: 1990–2000. *Applied Geography, 32*(2), 310–323. https://doi.org/10.1016/j.apgeog.2011.05.003

Sharma, M. (2021). Economic growth potentials and race/ethnicity in Tennessee: Diversity and economy. In *Research Anthology on Empowering Marginalized Communities and Mitigating Racism and Discrimination* (pp. 1119–1142). IGI Global. https://doi.org/10.4018/978-1-7998-9023-2.ch054

Taylor, R. L., & Williams, J. D. (2020). Measuring economic diversity with the Hachman Index: An application to Wyoming counties. *Wyoming Economic Summary Report*, University of Wyoming.

Wagner, J. E., & Deller, S. C. (1998). Measuring the effects of economic diversity on growth and stability. *Land Economics, 74*(4), 541–556. https://doi.org/10.2307/3146907

Zakshevskii, S. V., Kalachikhin, V. A., & Dudarev, A. A. (2019). Diagnostic tools for analyzing the diversification of rural economy. *Scientific-Research Institute of Economics and Organization of Agro-Industrial Complex of the Central Black Earth Region*. Russian Federation.