



Article

Statistical Analysis of the Structure of Population Employment by Type of Economic Activity in the RT

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Abstract

Structural changes occurring within a country's economy are reflected in the composition of employment across economic sectors. Employment adapts to different stages of socio-economic development and can serve as an important indicator of economic growth or crisis, since changes in the level of employment accompany overall economic development. Therefore, analyzing the sectoral distribution of employment by type of economic activity is of both theoretical and practical importance under contemporary conditions. This article examines the methodological aspects of assessing structural changes in population employment based on an analysis of broader structural transformations, which allows for the estimation of the magnitude of changes across specific types of economic activity in the Republic of Tajikistan. The analysis is based on official employment statistics published by the Statistical Agency under the President of the Republic of Tajikistan for the period 2011–2022. The results indicate that agriculture, hunting, and forestry remained the dominant source of employment throughout the study period, although its share gradually declined, while employment increased in education, health and social services, and several service-related activities. Furthermore, this study investigates internal changes in the number of employed persons by type of activity within the overall sectoral employment composition, thereby reflecting the dynamics of changes in employment across other sectors of economic activity.

Keywords: sectoral employment composition in the Republic of Tajikistan; types of economic activity; structural changes; labor resources; state employment policy; workers' professional qualifications; standard of living



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1. Introduction

The analysis of employment within the broader framework of structural transformation is critically important because it extends beyond merely describing changes in the employment levels and reveals the fundamental economic mechanisms driving labor reallocation. Structural transformation, defined as the progressive shift of economic activity from agriculture to manufacturing and subsequently to the service sectors, is a fundamental characteristic of modern economic growth and development. Examining employment patterns within this broader framework enables researchers to distinguish between superficial changes, such as the reclassification of jobs when firms outsource service activities, and genuine structural shifts in the productive base of the economy. This

approach enables a more precise assessment of the magnitude of employment changes across specific types of economic activity, allowing researchers to quantify, for example, the extent to which observed shifts in employment, such as declines in manufacturing, are attributable to structural transformation rather than to alternative processes, including servitization or skill-biased technological change. Furthermore, an occupational perspective on structural transformation, classifying jobs according to whether they generate tangible or intangible output, provides a robust analytical framework that is largely unaffected by outsourcing and organizational restructuring. Consequently, this approach offers more reliable estimates of the fundamental reallocation of labor between goods-producing and service-producing sectors. As recent studies have demonstrated, understanding these dynamics is essential to the formulation of effective employment policies, as different forms of structural transformation have distinct implications for job polarization, wage inequality, and labor income shares across skill groups and regions [1–5].

Employment, as a socio-economic category, reflects the economic and social relationships arising from individuals' participation in productive and service activities aimed at satisfying both personal and societal needs and is regulated by the applicable legal framework [6,7]. In the RT (briefly RT hereafter) employment is defined as any lawful activity undertaken by able-bodied citizens that generates income in the form of wages, salaries, or other remuneration while contributing to both individual and societal well-being. A strategic objective of the Government of the RT is to promote suitable employment, which encompasses legal, social, and economic dimensions. Suitable employment should correspond to a citizen's gender, education, specialty, professional training, work experience, health status, and location (within no more than one hour's travel from the place of residence), while ensuring remuneration that is not lower than the officially established minimum wage. Failure to take these requirements into account may inevitably influence the sectoral employment composition by affecting labor allocation across different types of economic activity.

A key priority of state employment policy is the development of education through training courses that enhance the quality and efficiency of labor resources, alongside the implementation of state programs for training, retraining, and advanced skills development that consider the demands of the digital economy [7–9]. Adapting workers' qualifications to the requirements of the modern labor market and identifying current and future needs for specialists, based on the socio-economic development prospects of the RT, remain critical, as the effectiveness of the labor market can be assessed through employment status, working conditions, and sectoral employment composition. The effectiveness of the labor market can be evaluated using indicators such as working-age population, working hours, labor intensity, occupational safety, and production safety conditions. Importantly, the structure of employment largely reflects the broader economic structure, and changes in the economy exert a corresponding influence on the distribution of employment. Consequently, effective employment policy should be aligned with ongoing structural changes in the economy and the evolving distribution of employment by type of economic activity.

The experience of transition economies demonstrates that structural transformation is one of the most challenging aspects of economic development [8–11]. In this context, analyzing changes in the sectoral composition of employment by economic activity is essential to addressing several interrelated issues: first, it contributes to a deeper theoretical foundation of structural processes and to identifying the regularities underlying the uneven distribution of employment across sectors of activity; second, it addresses the limitations of existing methodological approaches for the study of structural changes in employment; and third, it helps bridge the gap created by the lack of a clear conceptual framework

and mechanism for the development of employment policy at both the national and regional levels.

Accordingly, analyzing employment within the context of overall structural transformation is so important because it extends beyond a descriptive assessment of employment trends and enables a more precise evaluation of changes in the sectoral composition of employment. As demonstrated in recent studies [4,7,9–11], structural transformation, characterized by the progressive reallocation of labor from agriculture to manufacturing and subsequently to services, represents a core feature of modern economic growth. Furthermore, an occupational perspective provides a robust analytical framework that is largely unaffected by outsourcing and firm-level organizational restructuring, thereby allowing for a more reliable assessment of the underlying reallocation of labor between goods-producing and service-producing sectors [1–3]. Understanding these dynamics is essential to developing evidence-based employment policies tailored to the specific structural conditions of RT.

Recent studies have emphasized that structural transformation in developing and transition economies is characterized by a gradual reallocation of labor from agriculture to industry and services, accompanied by urbanization, technological change, and shifts in labor productivity. In the countries of Central Asia and the post-Soviet region, the pace and direction of these transformations have been strongly influenced by labor migration, demographic dynamics, institutional reforms, and government employment policies. International organizations, including the World Bank, the International Labor Organization (ILO), and the Asian Development Bank (ADB), have highlighted the importance of expanding productive employment opportunities and strengthening human capital to support sustainable economic diversification in the region. Despite these contributions, empirical evidence on long-term structural changes in employment in Tajikistan remains limited. Therefore, the present study contributes to the literature by examining changes in the sectoral employment composition of the RT over the period 2011–2022 [12–14]. The process of structural transformation has been widely examined in developing and transition economies, where economic development is typically accompanied by a gradual reallocation of labor from agriculture to manufacturing and service activities. Previous studies have shown that the pace and outcomes of this transformation are strongly influenced by institutional reforms, labor migration, demographic change, productivity growth, and the sectoral composition of national economies [15–18]. In the post-Soviet and Central Asian context, researchers have highlighted the persistent importance of agriculture, the role of international labor migration, and the uneven development of service sectors as key factors shaping labor market restructuring [14–16]. These findings provide an important framework for interpreting employment changes in Tajikistan and underscore the need for country-specific analyses of long-term structural transformation.

The objective of this paper is to assess structural changes in employment in the RT through an analysis of broader economic transformations, specifically the reallocation of labor across different types of economic activity. This approach enables a more comprehensive assessment of the magnitude of employment shifts across economic sectors, moving beyond a purely descriptive analysis of employment trends to reveal the underlying dynamics of labor reallocation. The findings provide an evidence-based foundation for understanding structural changes in the labor market and for supporting the formulation of effective employment policies.

2. Materials and Methods

This article employs statistical classification methods, indicators of structural differences, time-series analysis, and relative structural indicators to examine employment

patterns by type of economic activity in the RT for the period 2011–2022. To quantify the magnitude of structural changes in employment, three complementary indicators were calculated for each group of economic activities. The linear coefficient of absolute structural change (L) measures the average absolute deviation of sectoral employment shares between the base period (2011) and the current period (2022) and is computed as:

$$L = \frac{1}{2} \sum_{i=1}^n |d_{i1} - d_{i0}| \quad (1)$$

where d_{i0} is the share of employment in sector i in the base year (2011), d_{i1} is the share in the current year (2022) and n is the number of sectors within the group. The squared coefficient of absolute structural change (S), which gives greater weight to larger deviations, is calculated as:

$$S = \sqrt{\sum_{i=1}^n (d_{i1} - d_{i0})^2} \quad (2)$$

The structural diversity index (I), expressed as a percentage, is derived as

$$I = S \times 100\%, \quad (3)$$

providing an intuitive measure of the overall intensity of structural change within each group. The four groups of economic activities were formed based on the directional consistency of employment share changes over the 2011–2022 period. Specifically, Group I includes activities with a consistently increasing employment share over the study period; Group II comprises activities with no stable trend or unchanged employment share; Group III consists of activities with a steadily declining employment share; and Group IV includes activities that were reclassified or newly introduced under GCTEA-2 and for which comparable time-series data are unavailable prior to 2019. This classification approach enables a systematic assessment of divergent employment dynamics across sectors, distinguishing between activities experiencing sustained growth, persistent decline, and those with irregular or non-comparable trajectories.

The grouping of economic activities was based on the direction and stability of changes in their employment shares during the study period (2011–2022) (see Table S1). Group I (“activities with a stable growth trend”) includes education; health and social services; professional, scientific and technical activities; arts, entertainment and recreation; and the supply of electricity, gas, steam and air conditioning. These all demonstrated a generally increasing employment share over time. Group II (“activities without a stable growth trend”) comprises agriculture, hunting and forestry; mining and ore processing; manufacturing; construction; wholesale and retail trade; hotels and restaurants; information and communications; financial and insurance activities; management and support activities; public administration and defense; and other service activities whose employment shares either fluctuated during the study period or remained relatively stable without a clear long-term trend. Group III (“activities with a stable declining trend”) includes transport and warehousing, real estate activities, and water collection, treatment, and supply, which exhibited a general reduction in their employment shares over the analyzed period.

To facilitate the replication of the calculations, the structural change indicators were computed separately for each group of economic activities using the employment shares reported in Tables S2 and S3. For each activity included in a given group, the difference between its employment share in 2011 and 2022 was first calculated. The linear coefficient was then obtained as the arithmetic mean of the absolute values of these differences, while the squared coefficient was calculated as the square root of the average squared differences. Finally, the structural diversity index was derived by multiplying the squared coefficient by 100 and expressing the result as a percentage. For example, Group I includes

education; health and social services; professional, scientific and technical activities; arts, entertainment and recreation; and the supply of electricity, gas, steam and air conditioning. Analogous calculations were performed for all activities within the group, after which the resulting changes were substituted into Equations (1) and (2) to obtain the linear and squared coefficients reported in the next Section. The transition from GCTEA-1 to GCTEA-2 introduced several economic activities that were reported as separate statistical categories only from 2019 onward. For these activities, the absence of a separate value in 2011 should not be interpreted as indicating zero employment but rather reflects their inclusion within broader categories under GCTEA-1.

The methodological procedure consisted of three consecutive steps. First, the employment data were harmonized to ensure comparability between the GCTEA-1 and GCTEA-2 classifications, with corresponding economic activities matched according to their functional characteristics and aggregated where necessary (the complete concordance is provided in Supplementary Table S4). Second, all economic activities were classified into three groups according to the predominant long-term direction of changes in their employment shares (stable increase, no stable trend, or stable decrease). Finally, the harmonized employment shares for 2011 and 2022 were used to calculate the linear coefficient, quadratic coefficient, and structural diversity index according to Equations (1)–(3), while Supplementary Table S6 provides the complete intermediate calculations supporting the values.

3. Results and Discussion

The selection of the time series is justified by the fact that in 2011, a new classification, General Classification of Types of Economic Activity (GCTEA-1), was introduced, which is not directly comparable with the previously used classification, the General Classification of Industries of the National Economy (GCINE). The adoption of GCTEA-1 was driven by the need to align the accounting and statistical system with international practice. It should be noted that data on types of economic activity for the period 2019–2022 are classified according to GCTEA-2. To ensure methodological transparency and reproducibility, the analytical procedure was designed to follow three sequential steps: (i) harmonization of employment data between the GCTEA-1 and GCTEA-2 classifications; (ii) classification of economic activities according to their predominant long-term employment trends over the period 2011–2022; and (iii) calculation of the structural change indicators using the harmonized employment shares. In this context, the nomenclature of economic activity categories, as reflected in Figure 1, differs partially from the previous classification. For example, under GCTEA-2, included categories are other service activities; arts, entertainment, and recreation; administrative and support service activities; professional, scientific, and technical activities; information and communications; water supply and sanitation; and the distribution and collection of secondary goods. These categories were either absent from the previous classification or were presented in a different form. The transition from GCTEA-1 to GCTEA-2 in 2019 introduced several new categories of economic activity and modified the classification of existing activities. To maintain data comparability, activities were harmonized into broader sectoral groups based on their economic functions. Categories that existed only under GCTEA-2 were reported separately for the period 2019–2022, whereas activities that were merged, renamed, or redistributed between classifications were aggregated to the nearest comparable category. Therefore, the reported structural changes should be interpreted as reflecting broad sectoral shifts in employment rather than exact changes in individual activity categories.

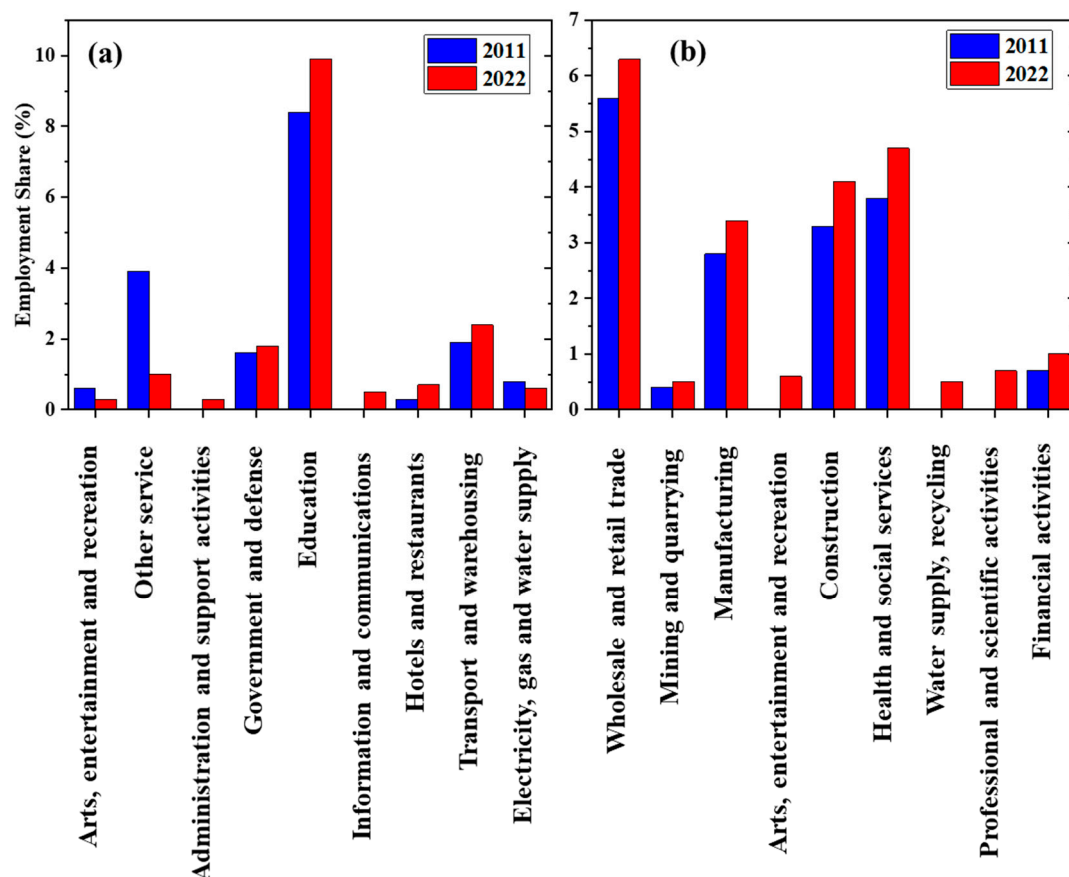


Figure 1. Distribution of the share of the employed population in the economy of the Republic by the share of the employment in first nine (a) and second nine (b) economic activities, 2011–2022 in % (Statistical Agency under the President of the RT [19,20]).

The transition from GCTEA-1 to GCTEA-2 in 2019 introduced changes in the classification of several economic activities, creating potential challenges for longitudinal comparisons. To improve data comparability, all economic activities were reviewed and harmonized according to their functional and economic characteristics, and a concordance table was prepared to document the correspondence between classifications (Table S4). Activities that were directly comparable across the two classifications were analyzed continuously over the entire study period, whereas newly introduced categories were reported separately from 2019 onward. Consequently, the results should be interpreted as reflecting both actual changes in sectoral employment composition and, where relevant, the effects of modifications in statistical classification. Although harmonization procedures were applied to maximize comparability between GCTEA-1 and GCTEA-2, some differences in employment shares may partly reflect changes in statistical classification rather than exclusively real economic transformations. This limitation is particularly relevant for activities that were subdivided into multiple categories or introduced as separate sectors under GCTEA-2. Nevertheless, the dominant trends identified in major sectors such as agriculture, manufacturing, education, healthcare, and trade remain sufficiently robust to support the conclusions of the study. This methodological limitation primarily affects economic activities that were introduced or disaggregated following the implementation of GCTEA-2. While the harmonization procedure minimized inconsistencies between the two classifications, it cannot completely eliminate the influence of changes in statistical reporting. Nevertheless, the principal findings of the study, particularly those concerning the dominant sectors, such as agriculture, manufacturing, education, health and social

services, and trade, remain robust because these activities were consistently classified throughout the study period.

In GCTEA-1, categories of economic activity such as other public, social, and personal services, as well as other service-sector organizations, were included. As the country's economy develops within the context of the digital economy, changes in the types of economic activity are accelerating in both the real and service sectors. In this context, categories of economic activity that correspond to the evolving conditions of the country's digital economy may be incorporated into future versions of the GCTEA, and, in this regard, no undue restrictions should be imposed. The statistical survey revealed that significant changes have occurred in the sectoral employment composition of the population of the RT according to the GCTEA classification.

The classification of economic activities was based on the predominant long-term pattern of changes in employment shares observed over the entire study period (2011–2022), rather than solely on the difference between the initial and final years. Consequently, the assignment of an activity to the “growth,” “no stable trend,” or “declining” group considered the overall direction and stability of its employment trajectory across all available annual observations, while allowing for temporary year-to-year fluctuations. Therefore, some activities whose employment share in 2022 was similar to or slightly lower than that in 2011 were classified as growth activities if they exhibited a generally increasing trend during most of the study period, whereas activities assigned to the declining group were characterized by an overall downward trajectory despite occasional short-term increases.

To improve readability, the presentation of employment shares is supplemented with a separate table highlighting the largest sectors and their contribution to total employment (see Table S5). Particular emphasis was placed on education, health and social services, trade, and agriculture, hunting and forestry, as these activities account for the majority of employment and therefore provide the clearest picture of structural changes in the labor market.

This study is based on official employment statistics published by the Statistical Agency under the President of the RT for the period 2011–2022. These data are compiled from national statistical reporting systems and labor force accounting procedures that cover the economically active population of the country and are reported annually by economic activity. The analysis uses aggregated national-level data rather than a sample survey; therefore, no separate sample size was determined for the present study. Employment figures refer primarily to persons employed within the territory of the RT, whereas Tajik citizens working abroad, including labor migrants in the Russian Federation, are not fully represented in the sectoral employment statistics and should therefore be considered a limitation of this study.

It should be noted that the share of the employed population in agriculture, hunting, and forestry is higher than that in other sectors, accounting for 67% of total employment in 2011 and 63.2% in 2022. However, this information is not included in the diagram, as sectors with a relatively low share of the employed population are not reflected in the figure.

Given the dominant role of agriculture, hunting, and forestry in the sectoral employment composition of the RT, this sector is presented separately in Table 1. Although its share of total employment declined from 67.0% in 2011 to 63.2% in 2022, it remained by far the largest source of employment throughout the study period. The observed decrease of 3.8 percentage points indicates a gradual reallocation of labor toward industrial and service-sector activities, reflecting the early stages of structural transformation in the national economy.

Table 1. Employment share of agriculture, hunting, and forestry in the RT (2011–2022).

Year	Employment Share (%)
2011	67.0
2017	60.9
2018	61.1
2019	61.2
2020	60.9
2021	60.6
2022	63.2

Despite the observed decline in its employment share, agriculture, hunting, and forestry remained the dominant sector throughout the study period, accounting for more than 60% of total employment in 2022. This finding indicates that the labor market of the RT continues to be strongly dependent on agricultural activities, and that the ongoing structural transformation should be interpreted as gradual rather than as a fundamental shift away from an agrarian sectoral employment composition.

The data presented in Figure 1 clearly indicate that the past decade has brought about significant changes in the structure of employment by type of economic activity, with the share of employment increasing in several sectors. In 2022, compared with 2011, the changes in the share of employment by type of activity, expressed in percentage points, are as follows:

- (a) Increase: education (+1.5 p.p.); other service activities (+0.8 p.p.); health and social services (+0.9 p.p.); construction (+0.6 p.p.); professional, scientific, and technical activities (+0.9 p.p.); manufacturing (+0.7 p.p.); mining and quarrying (+0.1 p.p.); arts, entertainment, and recreation (+0.5 p.p.); water supply, sanitation, and distribution of secondary materials (+0.5 p.p.); information and communications (+0.5 p.p.); transport and warehousing (+0.1 p.p.); hotels and restaurants (+0.4 p.p.); financial activities (+0.1 p.p.); administrative and support activities (+0.3 p.p.); and public administration and defense (+0.4 p.p.).
- (b) Decrease: agriculture, hunting, and forestry (−3.8 p.p.); electricity, gas, and water supply (−0.1 p.p.); real estate activities (−0.4 p.p.); other utility, social, and personal services (−2.9 p.p.); and other service-sector organizations (−1.0 p.p.).

The observed employment changes are broadly consistent with patterns reported in developing and transition economies, where labor reallocation is often associated with urbanization, migration, productivity growth, and policy interventions. However, the available data do not allow these mechanisms to be tested directly; therefore the present analysis cannot establish causal relationships between these factors and the observed changes in employment shares. Consequently, the proposed explanations should be interpreted as contextual factors that may have influenced the evolution of the sectoral employment composition rather than as confirmed drivers of change.

The annual analysis of changes in the share of the employed population by type of economic activity made it possible to distinguish four groups of economic activities. The first group (I) includes activities in which the share of the employed population demonstrates a steady growth trend. The second group (II) comprises activities that do not exhibit a stable growth trend or in which the share of employment remains unchanged. The third group (III) includes activities that show a steady decline, while the fourth group (IV) consists of activities for which information is collected within other categories under

GCTEA-2. The results of the analysis of changes in the share of the employed population by type of economic activity are presented in Table S2.

The dynamics of changes in the share of the employed population by type of economic activity, determined as the difference between the value of the structural indicator in the current and base periods, were identified and classified into four groups of economic activities. This study showed that the share of the employed population exhibits a steady growth trend, particularly in the service sector. Although the share of employment in the service, industrial, and construction sectors in the RT remains lower than that observed in a number of CIS countries, employment in agriculture, forestry, and fisheries accounts for 63.2% of total employment. By comparison, the mining and quarrying sector accounts for 4.0%, construction for 3.9%, and the service sector for 27.7% of total employment.

The share of the employed population in the hotels and restaurants, education, and health and social services sectors was 12.5% in 2011, increasing by 2.8 percentage points by 2022, as summarized in Tables S1–S3. Although the share of the employed population in some sectors (i.e., education; the supply of electricity, gas, steam, and air conditioning; professional, scientific, and technical activities; health and social services; and arts, entertainment, and recreation) slightly declined in 2022 compared with 2021, these sectors were classified within the first group, as the share of employment in these activities exhibited a steady growth trend over the study period. Overall, the combined share of the types of economic activity included in the first group decreased by 0.26 percentage points in 2022 compared with 2021, but increased by 3.74 percentage points relative to 2011.

The opposite trend is observed in the second group of economic activities. In 2022, there was an increase of 0.6 percentage points compared with 2021 and a decrease of 0.4 percentage points relative to 2011. Overall, in the third group of economic activities, 2022 recorded a decrease of 0.4 percentage points in the chain comparison and an increase of 0.2 percentage points in the base comparison.

Within the analyzed period, there was a steady growth trend in the share of the population employed in social sectors such as education; healthcare and social services; professional, scientific and technical activities; and arts, entertainment, and recreation. This is largely due to the fact that the education and science sectors are among the key priorities of the domestic policy of the Government of the RT, while the social sector as a whole accounts for approximately half of total state budget expenditures. The structural shifts observed during 2011–2022 appear to reflect broader economic transformation processes in the RT. Growth in the employment shares of education, healthcare, professional and technical services, and other service-related activities is consistent with ongoing economic modernization, urbanization, and government investment in social infrastructure and human capital development. Conversely, the declining relative importance of agriculture and several traditional activities may be explained by labor migration, sectoral productivity changes, and the reallocation of labor toward higher-value service activities, while some differences may also be influenced by revisions to the national classification system of economic activities.

The structural analysis revealed that in 2021, the first group of economic activities included hotels and restaurants, financial intermediation and insurance activities, and other service activities; however, in 2022, these sectors changed classification and were reassigned to the second group of economic activities.

The aggregate indicator for the second group of economic activities shows a decline in employment. Over the period 2011–2022, the employment indicator in this group decreased by 0.4 percentage points. In contrast, in the third group of economic activities, the aggregate indicator shows an increase in employment. However, between 2018 and 2022, the indicator for this group decreased by 1.2 percentage points, which indicates an unfavorable trend.

To accurately assess the degree of structural change, structural difference indicators are calculated for the groups of economic activities for the period 2011–2022 [19,20], the results are summarized in Table 2. The calculations were performed using employment shares rather than absolute employment numbers. For each group, the employment shares of all constituent activities in 2011 and 2022 were extracted from Table S3, the intertemporal differences were calculated, and the resulting values were used to compute the structural change indicators. Therefore, the indicators presented in Table 2 quantify the magnitude of changes in the internal composition of each group over the study period.

Table 2. Structural analysis of economic activity types.

Group	Linear Coefficient	Squared Coefficient	Structural Diversity Index (%)
Group 1	0.35	2.05	17.5
Group 2	0.85	1.29	42.5
Group 3	0.09	0.2	4.5

To illustrate the calculation procedure, Group I was used as an example. The employment share of education increased from 8.40% in 2011 to 9.90% in 2022, corresponding to a change of +1.50 percentage points, while the share of health and social services increased from 3.80% to 4.74%, corresponding to a change of +0.94 percentage points. Similar calculations were performed for all economic activities included in Group I, after which the absolute and squared differences were substituted into Equations (1) and (2) to calculate the linear coefficient of structural change, the quadratic coefficient, and the structural diversity index. The complete intermediate calculations for all groups of economic activities are provided in Supplementary Table S6, enabling independent verification and replication of the reported results. For example, the change in the employment share of the education sector was calculated as $\Delta = 9.90 - 8.40 = 1.50$ percentage points, giving $|\Delta| = 1.50$ and $\Delta^2 = 2.25$. These values were combined with the corresponding values for the remaining activities in Group I, and their averages were calculated according to Equations (1)–(3) to obtain the structural change indicators reported in Table 2. The same procedure was applied to Groups II and III. For calculation purposes, their 2011 share was assumed to be zero because no separate category existed under GCTEA-1, a point further emphasized in Note S1.

The linear coefficient of absolute structural change reflects the average magnitude of changes in employment shares across the economic activities included in a given group, whereas the squared coefficient assigns greater weight to larger shifts and is therefore more sensitive to substantial structural adjustments. The structural diversity index characterizes the overall intensity of changes within the sectoral employment composition, with higher values indicating a greater degree of redistribution of labor among economic activities. The relatively high values obtained for Group II indicate that this group experienced the most pronounced structural changes during 2011–2022, as it includes the largest and most economically significant sectors, such as agriculture, manufacturing, construction, trade, and public administration, where both increases and decreases in employment shares contributed to a substantial reallocation of labor within the group.

The analysis revealed that significant changes have occurred in the structure of groups of economic activities. Within the second group of economic activities, the structural indicators indicate more pronounced changes. For example, while the linear coefficient of absolute structural change was 0.85 percentage points, the squared coefficient of absolute

structural change reached 1.29 percentage points. In addition, the structural divergence index was 0.425 (or 42.5%), indicating a substantial degree of structural change.

Table S6 presents the intermediate calculations used to derive the structural change indicators reported in Table 2. For each economic activity, the employment share observed in 2022 was compared with the corresponding share in 2011, and the resulting difference (Δ) was used to calculate both the absolute and squared deviations. The group-level indicators were subsequently obtained by averaging these deviations across all activities within each group according to Equations which are given in the Materials and Methods Section. This procedure ensures full transparency and enables independent replication of the reported results.

The values presented in Table 2 were calculated using the shares of employment by economic activity and reflect the magnitude of structural changes between 2011 and 2022. Group 1 includes economic activities characterized by a stable increase in employment share (education; health and social services; professional, scientific and technical activities; arts, entertainment and recreation; and the supply of electricity, gas, steam, and air conditioning), whereas Group 2 comprises activities without a stable growth trend, and Group 3 includes activities exhibiting a sustained decline in employment share. The relatively high values of the structural change indicators for Group 2 reflect the fact that this group contains the largest number of economic activities and accounts for the majority of total employment, including agriculture, manufacturing, trade, construction, and public administration, where both increases and decreases in employment shares occurred during the study period. Consequently, Group 2 experienced the most pronounced redistribution of employment and therefore exhibits the highest level of structural change among the analyzed groups.

The factors discussed above should therefore be regarded as plausible contextual explanations rather than empirically verified determinants of the observed structural changes. Although economic modernization, urbanization, labor migration, productivity growth, and government policy are widely recognized in the literature as important drivers of employment transformation, the present study is based exclusively on sectoral employment statistics and does not include the additional socio-economic variables required to evaluate their individual effects. Consequently, no direct causal relationships between these factors and the observed changes in employment shares can be established within the scope of this analysis. The proposed explanations are intended to provide an interpretative framework for understanding the observed trends and are consistent with previous studies on structural transformation in developing and transition economies. Future research integrating employment data with indicators of productivity, wages, value added, demographic change, migration, and regional development would allow for a more comprehensive assessment of the mechanisms underlying structural transformation in the Republic of Tajikistan.

4. Conclusions

The structural analysis of population employment in the RT for the period 2011–2022 reveals a gradual yet uneven transformation of labor allocation across types of economic activity. While agriculture, hunting, and forestry remain the dominant sectors, their share of total employment declined over the studied period. In contrast, employment in the service sector, particularly in education, health and social services, professional and scientific activities, and arts and entertainment, demonstrated a steady growth trend. The results indicate the beginning of a transition toward a post-industrial economy. The calculated structural difference indicators, including a structural diversity index of 42.5% for the second group of economic activities, confirm the presence of significant changes in employment composition. The results indicate gradual changes in the sectoral composition of employment and

provide evidence of an ongoing process of structural transformation in the RT. Although employment shares increased in several service-related sectors, agriculture, hunting, and forestry remained the dominant source of employment, accounting for more than 60% of total employment in 2022. These findings indicate that the country is experiencing an early and gradual process of structural transformation and economic diversification rather than a transition toward a post-industrial economy. The persistently high concentration of employment in agriculture suggests that the labor market continues to retain a predominantly agrarian character despite emerging changes in the composition of employment. Further research incorporating indicators such as labor productivity, sectoral value added, wages, employment quality, and regional disparities would provide a more comprehensive assessment of the country's long-term structural transformation.

These findings underscore the need for a targeted state employment policy that aligns professional training and skills development with the evolving demands of the digital economy and the service sector. Given the steady growth in service-sector employment and the relative decline in agricultural employment, the education system must proactively adapt its curricula and vocational training programmers to equip graduates with the competencies demanded by these expanding sectors. Without such alignment, skill mismatches are likely to persist, constraining both individual employability and the economy's capacity to benefit from structural transformation. Therefore, policymakers should establish regular mechanisms for labor market needs assessment and foster stronger partnerships between educational institutions and employers to ensure that human capital development keeps pace with the evolving sectoral employment composition. Although employment in several service-related activities has increased over time, the persistently high share of employment in agriculture demonstrates that this sector remains the foundation of the national labor market. Further research should focus on the qualitative aspects of employment, including wage differentiation and labor productivity, to better inform policy decisions.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/rsee3030012/s1>, Table S1: Classification of economic activities according to the direction of changes in employment shares, 2011–2022; Table S2: Changes in the number of employed people by type of economic activity in 2011–2022 (Source: Statistical Agency under the President of the RT [19,20]); Table S3: Classification of the share of the employed population by type of economic activity in 2011–2022 in % [19,20]; Table S4: Correspondence between GCTEA-1 and GCTEA-2 classifications and treatment of economic activities in the analysis; Table S5: Employment shares of the five largest economic sectors in the Republic of Tajikistan, 2011–2022; Table S6: Intermediate calculations used for the estimation of structural change indicators by group of economic activities in the Republic of Tajikistan, 2011–2022; Note S1: Information on the transition from GCTEA-1 to GCTEA-2 by economic activity.

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