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INSTITUTIONAL INERTIA AND LABOR MARKET ADJUSTMENT IN A LATE-REFORMING EMERGING ECONOMY

Behzod Tagaev
National University of Uzbekistan named after Mirzo Ulugbek, Tashkent, Uzbekistan
Email: btagaev@nuu.uz
ORCID 0000-0002-4065-9817

Liudmyla Akimova
National University of Water and Environmental Engineering, Rivne, Ukraine;
Cyprus University of Technology, Limassol, Cyprus;
Email: l_akimova@ukr.net
ORCID 0000-0002-2747-2775

Desislava Serafimova
University of Economics, Varna, Bulgaria
ORCID 0000-0001-8096-9396
Email: serafimova_d@ue-varna.bg

Tamás Fülöp
John von Neumann University, Hungary
ORCID 0009-0001-0628-1451
Email: fulop.tamas@nje.hu

ABSTRACT. Structural transformation in emerging economies often proceeds without a clear movement of labor into high-productivity sectors. This paper examines that pattern through Uzbekistan, a late-reforming economy in Central Asia, and reads its labor market trajectory against the wider post-socialist experience, drawing on Kazakhstan and Poland as contextual benchmarks. Using shift-share decomposition together with matched domain-specific and pooled panel regressions, we identify the sectors that drove employment change and assess how the supply of graduates relates to sectoral labor absorption. Employment change has followed a mainly service-led path, with manufacturing playing only a limited role in net job creation. The link between education and employment is uneven across sectors. Absorption is stronger in a few knowledge-intensive and highly skilled activities and weaker across several broader training areas. This pattern raises the question of whether labor reallocation is productivity-enhancing and underscores the need to align the expansion of higher education with the changing structure of labor demand.

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Introduction

The reallocation of labor between sectors during economic development is considered one of the most important processes in economic science. The shift of labor from the low-productivity agricultural sector to more productive industrial and service sectors not only improves living standards by reducing poverty but also develops the country's overall productive potential (Kuznets, 1973; Lewis, 1954). Lewis's (1954) classic two-sector model and its modern multi-sector modifications view this structural transformation (Ngai & Pissarides, 2007) as a completely natural consequence of economic progress. Yet more recent work shows that the redistribution of labor resources never happens in isolation. This process is almost always accompanied by significant economic costs (Gollin & Kaboski, 2023; Donovan & Schoellman, 2023).

This problem appears particularly acute for post-socialist countries. After the collapse of the centrally planned system, the states of Eastern Europe and Central Asia faced massive changes. They were forced to simultaneously alter their ownership structure, seek a new balance in industry, reform education, and essentially create labor market institutions from scratch. However, labor force movement did not always follow the classic path from agriculture to industry and then to the high-productivity service sector. In some cases, employment shifted toward construction, trade, the public sector, and low-productivity household services, while the manufacturing sector remained too weak to absorb a large-scale labor force. This makes post-socialist economies a valuable case for studying structural transformation in the absence of a pronounced, productivity-enhancing redistribution of resources.

Uzbekistan presents an instructive case within the wider story of post-socialist development. Like many transition economies, the country inherited a labor market with strong public-sector influence, a high share of employment in agriculture, a centralized education system, and weak wage differentiation. Unlike several Eastern European countries, which integrated into the European Union and global value chains much earlier, Uzbekistan chose an evolutionary path of reform and intensified liberalization processes only after 2017. This chronology makes the country a unique case for studying a delayed model of post-socialist adaptation, in which sectoral redistribution of the labor force, large-scale expansion of the higher education system, and profound institutional transformations occur simultaneously.

To better understand the situation, the authors consider Uzbekistan not in isolation, but as an example of a country that embarked on reforms later than others within the overall development path of post-socialist labor markets. The closest benchmark for comparison in Central Asia is Kazakhstan, which shares a similar Soviet institutional legacy, dependence on natural resources, and uneven regional development. Poland and some Eastern European countries serve as a contrasting example. Earlier European integration and deep involvement in production value chains there have shaped a completely different trajectory of labor redistribution. The purpose of this comparison is not to evaluate a cross-national pattern, but to position the empirical data on Uzbekistan within the broader discussion of why post-socialist labor redistribution in some cases contributes to productivity gains, while in others it is constrained by low-productivity labor absorption. Complementary evidence from Eastern European labor markets shows that shocks can generate persistent Beveridge-curve shifts, with unemployment and vacancies rising simultaneously, while institutional integration capacity mitigates matching frictions and structural mismatches (Tutar et al., 2025).

Against this backdrop, two forces operated simultaneously in the labor market. On the demand side, economic liberalization and rising incomes shifted consumption patterns toward the service sector and spurred activity in construction and trade. However, the redistribution of workers between these growing sectors was largely dependent on labor market barriers, which

continue to limit the transition from agriculture to the formal sector (Donovan et al., 2023). On the supply side, the dramatic expansion of higher education led to a threefold increase in the annual influx of graduates, from 76,400 in 2010 to 236,300 in 2025, significantly altering the skill structure of new entrants to the labor market. Whether the sectoral composition of graduate training corresponds to the sectors in which employment has grown is the central empirical question of this paper.

The existing literature has paid considerable attention to structural transformation in developing economies and to labor-market adjustment in Eastern Europe. However, less is known about cases in which post-socialist transformation occurred later and with weaker industrial absorption. This gap matters because the Uzbek case reflects a wider problem faced by transition economies outside the early European integration path. Labor can move out of agriculture and education systems can expand rapidly, but these changes do not necessarily produce productivity-enhancing employment if sectoral demand remains concentrated in low-absorption or low-productivity activities.

This paper addresses this gap by combining shift-share decomposition with panel data analysis to link graduate output by field of study to sectoral employment outcomes over a 15-year period. This research focus is also motivated by recent evidence showing that mismatches between education and employment lead to significant earnings penalties in graduate labor markets in developing countries. This suggests that the balance between educational expansion and actual labor absorption is an economically significant outcome, not simply a descriptive characteristic (Jones, 2024). School-to-work transition analysis shows that completing the move to stable employment can take more than five years even where the first job is found quickly, and that transition duration falls with education level but remains heterogeneous across gender and regions (Kriaa & Bouhari, 2018). Related micro-level evidence confirms that education reduces unemployment duration, particularly for women, yet regional labor-market conditions continue to shape young graduates' job-search outcomes independently of their qualifications (Kriaa et al., 2020). Panel evidence further indicates that the employment returns to education are non-uniform across qualification levels and demographic groups, with vocational and technical skills exhibiting the strongest labor-market demand relative to higher education attainment (Jarząbek & Stolarska-Szeląg, 2024). Thus, this paper provides new empirical evidence on the extent to which the rapid expansion of higher education in Uzbekistan has been consistent with structural changes in labor demand and contributes to the broader debate about service-led growth and premature deindustrialization in transition economies.

This paper makes three main contributions to the literature. First, it presents new sectoral data on labor reallocation in a late-reform postsocialist economy for the period 2010–2025. Second, it links structural transformation to the expansion of higher education, examining whether the supply of graduates shifted toward sectors with higher labor absorption. Third, this approach allows the Central Asian case to be included in the general discussion of post-socialist development. It shows that labor outflow from agriculture can easily occur alongside weak recruitment into industry and a significant mismatch between graduates' skills and market demands. This allows the authors to draw conclusions applicable not only to Uzbekistan but also to broader issues of institutional inertia, service-based transformation, and the distribution of human capital in transition economies.

The conceptual framework links three elements. The first is demand-side restructuring, which changes the sectoral composition of employment. The second is the expansion of graduate supply, which changes the skill composition of new labor-market entrants. The third is institutional inertia, which affects whether workers and graduates move into sectors with stronger productivity potential. The framework therefore treats structural transformation not

simply as a decline in agriculture, but as a question of where labor is absorbed after leaving traditional sectors.

Uzbekistan's labor market inherited a Soviet structure characterized by universal employment, high reliance on agriculture and industry, and artificially flattened wage differentials. After independence in 1991, the government chose a path of gradual reform. The authorities maintained state ownership of strategic enterprises and shielded the labor market from intense competitive pressures. By 2010, agriculture still employed nearly 27 percent of all workers. This figure was closer to the level of lower-middle-income countries in South Asia than to the ambitious goals of achieving developed upper-middle-income economy status set in national development strategies (McMillan et al., 2014).

The post-2017 reform period changed the Uzbek labor market on both the demand and supply sides. On the demand side, exchange-rate liberalization and broader market opening were accompanied by stronger activity in construction, tourism, and selected manufacturing segments. On the supply side, the higher education system has seen rapid expansion. As a result of the reforms initiated in Uzbekistan, the enrollment rate in higher education among those aged 18 to 23 has increased from 6.8% in 2014 to 47.7% at the beginning of the 2024–2025 academic year, with the goal of reaching 50% by 2026 (National Statistics Committee of the Republic of Uzbekistan, 2025). Because this acceleration became especially pronounced after 2018, the reform period created a setting in which sectoral labor absorption and graduate expansion evolved simultaneously. This makes Uzbekistan a useful case for examining whether employment reallocation toward expanding sectors was sufficiently strong and sufficiently skill-intensive to absorb the growing pool of graduates.

1. Literature review

Structural transformation is typically understood as the shift of workers from low-productivity sectors of the economy to more productive ones, with manufacturing long treated as the central engine of that process (Lewis, 1954; Kuznets, 1973; Herrendorf et al., 2014; Petrukha et al., 2026). However, recent research shows that the paths of structural change in developing and transition economies are becoming increasingly diverse. The service sector is absorbing an increasing share of the labor force even where incomes stay low (Autor & Dorn, 2013; Eichengreen & Gupta, 2013; Gollin & Kaboski, 2023).

Modern multi-sector models make one point clear. Labor mobility rests not only on gaps in productivity between sectors but also on the overall structure of demand and on systemic barriers to movement (Ngai & Pissarides, 2007; Duarte & Restuccia, 2010). At the same time, micro-level studies confirm that labor market imperfections, the informal sector, and people's low willingness to relocate significantly hinder these processes. As a result, workers lack the opportunity to transition successfully to more efficient sectors (Donovan et al., 2023; Chakrabarti et al., 2025). All this suggests that without targeted government support, structural modernization will not take off on its own and is unlikely to yield the expected economic benefits. Cross-country evidence from the European Union confirms that the modernization of employment structures toward knowledge-intensive services is uneven across member states, supporting the view that sectoral reallocation alone does not guarantee productivity-enhancing transformation (Cyrek, 2017).

Demand-driven structural changes, on the other hand, are driven by rapid growth in labor productivity in the service sector, leading to higher incomes and are often associated with consumption. There are also concerns that the shift in the economy, driven primarily by the service sector, may pose certain risks in the long run (Erumban & de Vries, 2024).

In his work, Rodrik (2016) clearly demonstrates an important development trend. Many developing countries are experiencing a decline in the share of manufacturing at a much earlier stage than in the past. In economics, this phenomenon is commonly referred to as premature deindustrialization. Industry is crucial to a country's economic development, and manufacturing is a major source of technological learning, productivity growth, and export potential (McCullough, 2025; Ravindran & Babu, 2023). Recent studies suggest that the shift to a service economy can also provide sustainable employment growth. However, the ultimate impact on a country's long-term development depends critically on the internal structure of the expanding service sector. The absorption of labor into high-productivity exported services can become a powerful stimulus for the modernization of the entire economic system. At the same time, a massive influx of workers into the informal sector or low-tech domestic services can almost completely offset the productivity gains expected from structural changes.

The relationship between the expansion of higher education and the structural transformation of the economy appears to be quite complex. On the one hand, an influx of qualified personnel can significantly accelerate the adoption of new technologies and support the growth of highly productive sectors (Acemoglu & Restrepo, 2019; Tutar & Bilan, 2026; Yarovenko et al., 2025). On the other hand, if the supply of specialists begins to exceed actual demand in the labor market, this often leads to the devaluation of degrees and a chronic mismatch between worker skills and business needs (Abdulla, 2025).

Recent research suggests that the contribution of human capital to economic innovation depends on the interplay of individual skills, government institutions, and the broader business environment (Karácsony et al., 2023). Survey evidence from a wartime post-socialist context shows that digital competences are formed primarily during university education and are strongly associated with subsequent career success, indicating that the quality – not only the quantity – of graduate training shapes employment outcomes (Mishchuk et al., 2025). Technological advances simultaneously create new jobs and eliminate old ones, changing the relationship between education and employment, and increasing the value of lifelong learning (Acemoglu & Restrepo, 2018; Autor et al., 2024; Jarząbek & Stolarska-Szeląg, 2024; Kuzior et al.,2025; Tagaev & Bilan, 2026). Remote-working technologies can substantially improve the professional integration of skilled workers, although excessive reliance on remote arrangements carries the risk of digital isolation, a nuance relevant for evaluating service-led employment growth in digitalizing transition economies (Tutar & Bilan, 2026). Global panel evidence suggests that AI-related vibrancy does not significantly reshape employment structures in the short run, implying that labor dynamics in the 2010–2025 window were driven more by reforms, demographics, and shocks than by automation pressures (Kuzior et al., 2025). Artificial barriers to job search and information gaps have been shown to hinder the efficient allocation of skilled labor, a problem that is particularly acute in developing countries and countries with economies in transition (Akimova et al., 2025; Donovan & Schoellman, 2023; Esposito & Scicchitano, 2022; Vidyakin et al., 2026).

This confirms that obtaining higher education does not automatically lead to the creation of new productive jobs. The real effectiveness of large-scale economic reforms depends on the inclusion of a skilled workforce in the growing sectors of production in the labor market. The experience of former Soviet Union countries shows that initial conditions and the institutional environment are crucial to the effective and successful implementation of reforms. In most transition economies, the inherited industrial base was too narrowly specialized and proved uncompetitive in the new conditions. This led to a disorderly redistribution of labor and the expansion of inefficient service industries (Hamilton & de Vries, 2025).

Examples from the history of reforms demonstrate that labor market barriers and long-standing structural imbalances can significantly weaken industry and deprive it of its role as the

main driver of employment. This occurs because labor outflow does not always automatically translate into a shift to more efficient sectors (Donovan & Schoellman, 2023; Hamilton & de Vries, 2025). As a result, structural transformations become protracted and require fundamentally new approaches to human resource management. Recent evidence from post-Soviet public administrations supports this interpretation. Formal modernization can proceed more rapidly than the processes of retraining personnel and organizational restructuring required to transform the actual structure of labor. This is particularly true in systems where rigid, centralized control over personnel and institutions, focused on formal compliance with regulatory requirements, hinders workforce adaptation (Tagaev & Bilan, 2026).

Eastern European experience is important for interpreting this pattern. In the more successful cases, European integration, foreign investment, and industrial upgrading helped connect labor reallocation to export-oriented manufacturing and modern services. In weaker cases, however, post-socialist restructuring produced employment losses in inherited industries, expansion of domestic services, and persistent regional differences in labor absorption. This comparison suggests that the key distinction is not simply between agriculture and non-agriculture. The more important distinction is between reallocation into sectors with productivity potential and reallocation into activities that absorb labor without generating strong upgrading.

An important factor shaping structural transformation and labour market adjustment in Eastern European countries is the institutional environment (Petrov & Serafimova 2026). Comparative panel analysis of CEE and EU-16 countries confirms that institutional quality supports growth more strongly in Western Europe than in post-communist economies, where catching-up processes dominate, consistent with the role of institutional inertia emphasized for late-reform transition economies (Ciołek et al., 2025). Conceptual work on institutions as a factor of sustainable development emphasizes that institutional capacity coordinates investment, infrastructure, and human-capital formation, providing the enabling environment in which structural transformation becomes productivity-enhancing (Staniek, 2023). In particular, the countries that joined the European Union have progressively aligned their legislation, higher education systems and industrial policies with the EU acquis. At the same time, policy frameworks such as the European Green Deal, the twin green and digital transition, social inclusion policies, and the Corporate Sustainability Reporting Directive (CSRD) have created additional regulatory incentives affecting sectoral development and labour demand. These differences in institutional environments may therefore partly explain why labour market adjustment and sectoral transformation have evolved differently across post-socialist economies.

Despite growing interest in these interconnected processes, there is very little empirical research on the relationship between the expansion of the education system and labor demand across sectors amid structural changes in the economies of Central Asia in transition. This gap is especially evident in Uzbekistan, where the rapid expansion of higher education coincides with rapid structural changes in the economy, particularly amid fundamental reforms that began in 2017.

2. Methodology

The shift-share framework decomposes the change in employment in sector i over the study period into additive components. Following the formulation applied in regional development and structural transformation studies (McMillan et al., 2014; Timmer & de Vries, 2009) the total employment change in sector i is expressed as:

$$\Delta E_i = E_{i0} \cdot g + E_{i0} \cdot (g_i - g)$$

where ΔEi is the total change in employment in sector i, Ei0 is employment in the base period, g is the economy-wide employment growth rate, and gi is the sector-specific growth rate. The first term in the equation, the national growth effect (NGE), reflects the change in employment that would have occurred if the sector had grown at the national rate. The second term, the differential shift, indicates whether the sector has grown faster or slower than the national economy on average. A positive differential shift indicates a real structural advantage beyond aggregate demand growth (Broadberry & Wallis, 2025).

The employment data originate from the National Statistics Committee of the Republic of Uzbekistan, which publishes annual estimates of employment by economic activity according to the International Standard Industrial Classification (ISIC Rev. 4). The dataset covers 19 sectors (codes A through S) from 2010 to 2025. Employment is measured as average annual employment in thousands. Breaks in the ISIC concordance occur at two points in the series, specifically the reclassification of certain service activities in 2017 and the redefinition of administrative services in 2022. Both breaks were addressed through backward extrapolation using growth rates from overlapping years, a standard procedure in handling non-stationary and structurally evolving time series (Sibeijn & Pequito, 2022).

The graduate data originate from the annual reports of the National Statistics Committee of the Republic of Uzbekistan. They record the number of graduates by broad field of education for each calendar year, classified into 11 categories according to the International Standard Classification of Education (ISCED 2013). The concordance between graduate fields and employment sectors is constructed following the methodology applied in comparable studies of education-employment alignment in developing economies (Wen, 2022). For example, engineering graduates are associated with manufacturing and construction, while natural sciences graduates are associated with professional and scientific activities (Appendix Table A1).

Robustness checks using alternative mappings, including multi-sector assignments, yield qualitatively similar results, indicating that the findings are not sensitive to the specification of concordance. This emphasis on concordance robustness is consistent with recent research on mismatches, which shows that measured labor-market outcomes are sensitive to how education-to-job linkages are operationalized and interpreted across institutional settings.

This decomposition strategy proves particularly useful in cases where overall employment growth conceals uneven labor redistribution across sectors. This applies to situations in which labor is shifting to the service sector without a corresponding increase in labor productivity (de Vries et al., 2015; McMillan et al., 2014).

The national employment growth rate over the full 2010 to 2025 window equals 28.4 percent, rising from 11.6 million to 14.9 million employed persons. Positive differential shifts, therefore, require sector-specific growth rates exceeding 28.4 percent over fifteen years. Negative differential shifts identify sectors that grew at below-average rates or contracted in absolute terms, regardless of whether they gained employment in absolute numbers.

Sectoral diversification is measured using the normalized Herfindahl-Hirschman Index (HHI), defined as the sum of squared employment shares across all nineteen sectors. Higher values indicate greater concentration in a small number of sectors. The index is computed from the nineteen-sector employment shares at the start and end of the period, so that the change in concentration can be set beside the shift-share results. Changes in the HHI complement the shift-share results by indicating whether structural change moved the economy toward greater or lesser productive diversification.

To examine whether the association between graduate supply and labor absorption differs across sectors, the paper uses a restricted matched field-sector panel constructed from the baseline concordance reported in Appendix Table A1. The core panel includes seven areas and industries significant for public policy, monitored annually from 2010 to 2025. The resulting panel is a small, balanced one designed for comparative analysis within specific areas, rather than for assessing the employment outcomes of all graduates nationwide. The matched domains are education–education, ICT–ICT, healthcare–healthcare, agriculture–agriculture, natural sciences–professional and scientific activities, engineering–manufacturing and construction, and business and law–trade, finance, and administrative services. Arts and humanities, social sciences, and residual services are not used as core matched observations because their labor-market destinations are broader and conceptually less specific, which would substantially weaken the interpretation of pair-level coefficients.

The baseline estimating equation for each matched domain is written as

$$Edt = \alpha d + \beta Gd,t-1 + \lambda Xt + \tau t + \varepsilon dt$$

where Edt denotes employment in the corresponding field (domain) d in year t, Gd,t−1 is the lagged supply of graduates in the corresponding field of study, Xt includes macroeconomic control variables, and τt denotes a linear time trend. In the field-specific specifications presented in Table 4, the model is estimated separately for each field-of-sector pair. For this reason, the estimates do not include year fixed effects. Instead, a linear time trend is used because each field contains one-year observations, and year fixed effects would absorb the relevant time variation. The coefficient β is interpreted as a structured relationship between the supply of graduates and subsequent labor absorption within the corresponding field, rather than as a causal effect.

The baseline specification allows for a comparison of the degree of correspondence between education and employment across related fields within a single model that includes a linear time trend and macroeconomic control variables. This approach is appropriate when detailed data on each individual worker are unavailable, but the key substantive question is whether certain policy-relevant fields exhibit higher absorption rates than others (Corradini et al., 2025). In this model, the coefficient on the lagged graduate supply indicator indicates whether a greater influx of graduates led to increased subsequent employment in the relevant sector. Thus, the model is comparative across specific fields rather than establishing direct causal relationships.

Given the limited number of related areas analyzed, the robustness of the findings is supported by conservative standard error calculations, checks of the stability of coefficient signs across different specifications, and robustness tests using alternative data comparisons.

The results obtained require the most balanced and careful interpretation. The actual processes in the labor market and their outcomes largely depend on internal barriers, information asymmetries, and job seekers' personal preferences (Banerjee & Chiplunkar, 2024). These hidden structural factors continue to exert a powerful influence on labor force distribution even during periods when key macroeconomic indicators and aggregate demand appear entirely favorable.

The matched panel consists of seven field-sector domains observed annually from 2010 to 2025, yielding 112 observations. The baseline analysis is implemented as a set of separate domain-specific time-series regressions, each estimated independently for one matched field-sector link with a linear time trend and controls for real GDP growth and the working-age population. Identification in Table 4, therefore, comes from within-domain variation in lagged graduate supply and subsequent employment in the corresponding matched sector. This design

is adopted because the objective of the baseline analysis is comparative, namely to assess whether the strength of graduate-employment alignment differs across policy-relevant matched domains. The data of Table 5 indicate pooled matched-panel specifications with domain and year fixed effects to assess whether the overall positive matched association remains visible when all seven domains are combined in a common panel. Because the pooled model has only seven clusters, we do not rely on the clustered standard errors alone. We also compute wild cluster bootstrap p-values with Webb six-point weights, a restricted null, and 9,999 replications, which give more reliable inference when the number of clusters is small (Canay et al., 2021). We report these bootstrap p-values alongside the clustered errors in Table 5 and lean on them when judging statistical significance.

A robustness analysis examines whether the positive relationship within the identified domains holds true under alternative definitions of the dependent variable and under the post-2017 reform context. This analysis aims to assess the stability of the obtained estimates rather than to propose an independent identification strategy. Three robustness checks are implemented. First, the pooled specification is re-estimated in first differences to examine whether year-over-year changes in the supply of graduates are associated with year-over-year changes in employment. Second, the employment growth rate is used as the dependent variable to examine whether the identified relationship holds true when the outcome is expressed in relative (proportional) rather than absolute terms. Third, the pooled specification is supplemented with an interaction term between the lagged supply of graduates and a post-2017 indicator to assess whether the balance between education and employment has improved since the onset of liberalization.

Formally, the first-difference specification is written as

$$\Delta Eit = \delta t + \theta \Delta Gi, t - 1 + \lambda' \Delta Xt + uit$$

where ΔE_{it} denotes the year-to-year change in employment in matched domain i, δ_t captures year fixed effects, and ΔX_t includes changes in macroeconomic controls. This specification removes domain-specific level effects and examines whether changes in graduate supply are associated with changes in employment within domains over time.

The interaction specification is written as

$$Eit = \alpha i + \gamma t + \beta 1 Git - 1 + \beta 2(Git - 1 \times Post2017t) + \lambda' Xt + \varepsilon it$$

where $Post2017_t$ is an indicator variable equal to 1 for years after 2017. The coefficient β_2 captures whether the association between graduate supply and employment strengthened in the post-liberalization period. These specifications are estimated as pooled matched-panel models across all seven domains and are reported as robustness checks to assess whether the overall matched association remains stable under alternative formulations.

The analysis has three limitations. First, graduate supply is not instrumented, so the matched-panel estimates should be interpreted as structured associations rather than causal effects. Second, the matched design focuses on the most policy-relevant field-sector links and does not capture the full general-equilibrium adjustment of the labor market. Third, sector-level data do not allow the analysis to distinguish between employment expansion, job quality, and within-sector productivity change. These limitations do not alter the paper's central contribution, which is to combine evidence on labor reallocation from decomposition with matched evidence on the alignment between skill formation and sectoral absorption.

3. Results

The employed population in Uzbekistan increased from 11.6 million in 2010 to 14.9 million in 2025, representing a cumulative increase of 28.4 percent over the entire period. However, employment expansion was extremely uneven. Between 2010 and 2015, the pace remained moderate, but it accelerated significantly after the launch of large-scale reforms in 2017. Later, in 2020, amid the pandemic shock, there was a sharp slowdown, followed by a robust recovery in the years that followed. The overall trend shows that labor market capacity has grown steadily, but the dynamics and nature of these changes were determined by profound structural shifts rather than a smooth long-term trend.

The more important change concerns the sectoral composition of employment. Agriculture remained the largest employer throughout the period, yet its share fell from 26.8 percent to 21.0 percent. In absolute terms, agricultural employment was nearly unchanged, rising by only 14.5 thousand workers over fifteen years. This implies that virtually all net job creation occurred outside agriculture, consistent with a structural shift away from the traditional primary sector. At the same time, the destination of labor released from agriculture was highly uneven across sectors.

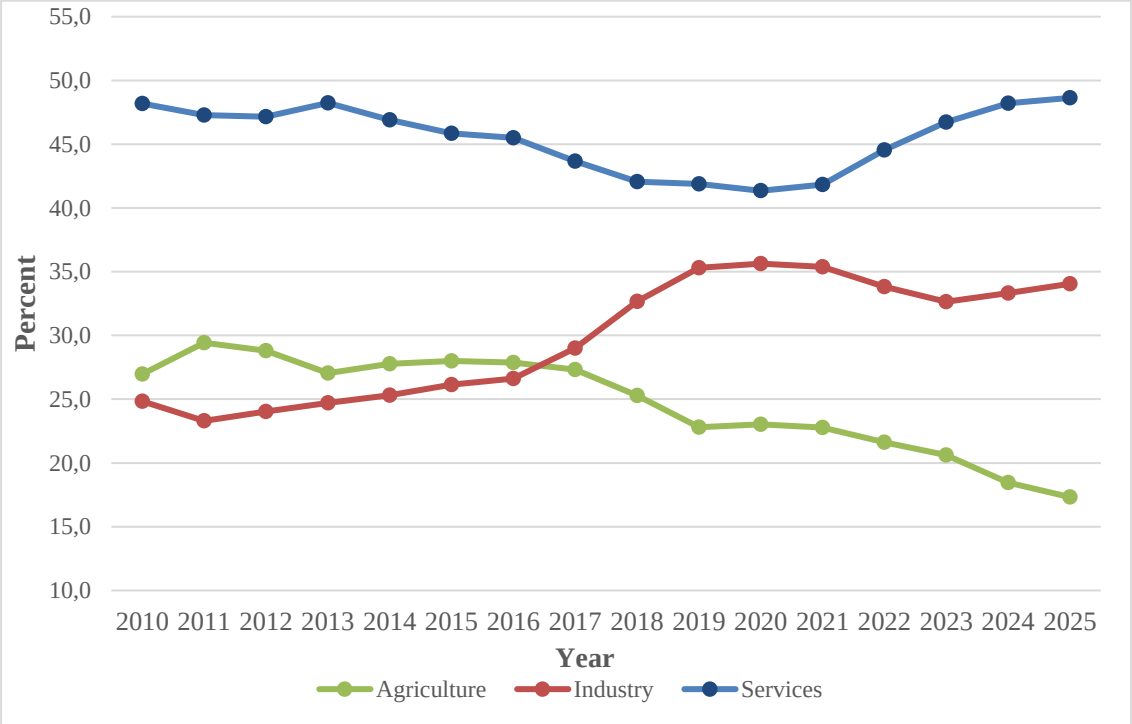

Figure 1. Structural changes in employment, 2010–2025

Figure 1 shows the decline in employment in agriculture and the persistent dominance of the service sector over the period 2010–2025. Employment in industry increased after 2017, but remains secondary. The overall trend points to a service-led transformation, with limited absorption of labor by the industrial sector.

The largest employment growth occurred in the service sector, with employment in the S sector increasing from 1.1 million employees in 2010 to 2.7 million in 2025. The number of employees in the ICT sector also doubled, from 53.1 thousand to 108.8 thousand.

The construction sector also demonstrated significant growth, increasing its labor force absorption from 1,034,000 to 1,451,000 workers. By contrast, manufacturing employment grew only from 1,339 thousand to 1,700 thousand workers, a positive change in absolute terms but a

weak one relative to the overall rise in employment, which echoes the broader difficulty that transition and developing economies face in building a strong manufacturing base (Diao et al., 2025). Table 1 reports the full distribution of employment levels and sectoral shares in 2010 and 2025.

Table 1. Employment levels and shares by sector, 2010 and 2025

Sector	Employment 2010 (000s)	Employment 2025 (000s)	Share 2010 (%)	Share 2025 (%)
A - Agriculture	3,118.1	3,132.6	26.81	20.98
B - Mining	121.4	66.7	1.04	0.45
C - Manufacturing	1,339.1	1,699.6	11.52	11.38
D - Energy supply	86.9	70.7	0.75	0.47
E - Water supply	58.3	52.8	0.50	0.35
F - Construction	1,033.7	1,450.5	8.89	9.71
G - Wholesale & retail trade	1,235.6	1,507.9	10.63	10.10
H - Transport & storage	509.9	584.6	4.38	3.91
I - Accommodation & food	249.2	389.5	2.14	2.61
J - ICT	53.1	108.8	0.46	0.73
K - Finance & insurance	69.9	82.9	0.60	0.56
L - Real estate	62.1	67.8	0.53	0.45
M - Professional & scientific	135.8	152.6	1.17	1.02
N - Administrative services	64.0	114.2	0.55	0.76
O - Public administration	584.6	637.0	5.03	4.27
P - Education	1,102.0	1,367.6	9.48	9.16
Q - Healthcare	596.2	719.3	5.13	4.82
R - Arts & recreation	64.4	66.9	0.55	0.45
S - Other services	1,144.1	2,661.8	9.84	17.82
Total	**11,628.4**	**14,933.8**	**100.0**	**100.0**

Note. Source: National Statistics Committee of the Republic of Uzbekistan. All figures in thousands of persons.

The shift-share decomposition clarifies whether sectoral employment growth merely followed the national trend or whether particular sectors disproportionately absorbed labor. Table 2 shows that Uzbekistan's employment transformation was highly concentrated in a small number of sectors rather than broadly distributed across the economy.

The largest single result is the size of the positive differential shift in sector S. With a differential shift of +1,192.5 thousand workers, this sector alone accounted for the dominant share of employment growth above the national benchmark. Positive structural contributions were also observed in construction, accommodation and food services, ICT, and administrative services, but their magnitudes were far smaller. Construction recorded a positive differential shift of +123.0 thousand workers, accommodation and food services +69.5 thousand, ICT +40.6 thousand, and administrative services +32.0 thousand. These results indicate that the sectors outperforming the national average were concentrated primarily in non-tradable or domestically oriented services, not in a broad set of high-productivity tradable activities. This trend is consistent with recent comparative studies, which show that labor absorption by the service sector does not always translate into an economic transformation toward increased productivity. This is particularly noticeable in cases where modern tradable sectors remain too weak to absorb new workers en masse.

Because sector S carries so much of the story, it is worth asking what sits inside it. Under ISIC Rev. 4, this heading includes other personal and household services, such as repair of household goods, hairdressing and beauty work, laundry, funeral services, and the activities of membership organizations. In the Uzbek administrative data, it also includes a large share of self-employment and small-scale informal service work that does not fit the other headings. Growth of this kind marks a service-led shift in employment, but on its own it does not signal a move into higher-productivity work, since much of it is low-paid and weakly capitalized. The rise of sector S is therefore best read as evidence that labor leaving the land has been absorbed mainly by low-productivity services rather than by tradable industry.

The negative shifts are also informative. Agriculture recorded the largest decline, with a decrease of 871.8 thousand workers, confirming that employment there lagged well behind the national growth rate. Public administration, trade, and transportation also performed below the baseline. Industry, however, occupied an intermediate position. Although the absolute number of people employed in industrial production increased, the differential shift was slightly negative, at minus 20.1 thousand workers. This means that industry as a whole kept pace with the country's overall employment growth but did not become the main driver of labor attraction, outpacing the overall trend.

Overall concentration barely moved. The Herfindahl-Hirschman Index across the nineteen sectors fell from about 1,310 in 2010 to about 1,234 in 2025, and the normalised index eased from 0.083 to 0.075. The economy became only a little less concentrated, and even that small change hides a reallocation from one large sector, agriculture, into another, other services, rather than a broad spreading of work across many activities.

Table 2. Shift-share decomposition, 2010-2025 (thousands of workers)

Sector	Base employment (000s)	National growth effect (000s)	Actual change (000s)	Differential shift (000s)
A - Agriculture	3,118.1	+886.3	+14.5	-871.8
B - Mining	121.4	+34.5	-54.7	-89.2
C - Manufacturing	1,339.1	+380.6	+360.5	-20.1
D - Energy supply	86.9	+24.7	-16.2	-40.9
E - Water supply	58.3	+16.6	-5.5	-22.1
F - Construction	1,033.7	+293.8	+416.8	+123.0
G - Trade	1,235.6	+351.2	+272.3	-78.9
H - Transport	509.9	+144.9	+74.7	-70.2
I - Accommodation	249.2	+70.8	+140.3	+69.5
J - ICT	53.1	+15.1	+55.7	+40.6
K - Finance	69.9	+19.9	+13.0	-6.9
L - Real estate	62.1	+17.7	+5.7	-12.0
M - Professional	135.8	+38.6	+16.8	-21.8
N - Admin services	64.0	+18.2	+50.2	+32.0
O - Public admin	584.6	+166.2	+52.4	-113.8
P - Education	1,102.0	+313.2	+265.6	-47.6
Q - Healthcare	596.2	+169.5	+123.1	-46.4
R - Arts	64.4	+18.3	+2.5	-15.8
S - Other services	1,144.1	+325.2	+1,517.7	+1,192.5

Note. National growth effect = base employment multiplied by the economy-wide growth rate of 28.4 percent. Differential shift = actual change minus national growth effect.

Graduate output expanded much faster than total employment. The annual number of graduates rose from 76.4 thousand in 2010 to 236.3 thousand in 2025, corresponding to a compound annual growth rate of 7.8 percent. This expansion was not linear. Graduate output remained relatively subdued through much of the 2010s, fell sharply in 2015, and then accelerated dramatically after 2022 as the earlier expansion of higher education enrollment translated into completed degrees. The resulting pattern points to a major policy-induced break in the supply of new graduates.

The structure of graduate graduation rates also changed significantly. Education remained the largest field in absolute terms, but its share of total graduates declined from 59.8 percent in 2010 to 32.9 percent in 2025. In contrast, arts and humanities, business and law, and some other non-educational fields expanded rapidly. Graduation rates in arts and humanities increased from 800 in 2010 to 27,500 in 2025, representing the fastest growth of any field. Business and law increased their rates from 6,900 to 36,600. Natural sciences, information technology, engineering, agriculture, healthcare, and services also recorded significant growth, albeit at different rates. Table 3 summarizes these changes for individual years and provides the corresponding compound annual growth rates.

Table 3. Graduate supply by field, selected years (thousands) with compound annual growth rates

Field	2010	2015	2020	2025	CAGR 2010-2025 (%)
Total	**76.4**	**33.6**	**77.7**	**236.3**	**7.8**
Education	45.7	19.0	37.8	77.7	3.6
Arts & humanities	0.8	1.2	2.5	27.5	26.6
Social sciences	0.8	0.7	0.7	6.4	14.9
Business & law	6.9	3.8	7.0	36.6	11.8
Natural sciences	3.5	1.7	6.2	17.9	11.5
ICT	2.2	0.8	2.8	8.4	9.3
Engineering	11.9	6.3	21.0	34.7	7.4
Agriculture	3.5	1.8	5.0	9.4	6.8
Healthcare	3.9	0.1	3.3	10.9	7.1
Services	1.2	0.7	2.7	6.9	12.4

Note. CAGR = compound annual growth rate. Source: National Statistics Committee of the Republic of Uzbekistan, 2010–2025. Totals are official published figures. Field-level values are harmonized across three classification regimes (2010–2014, 2015–2021, 2022–2025), and totals for 2019 to 2022 were adjusted to official statistics, so component fields need not sum exactly to the reported totals.

The timing and composition of graduate growth are important for interpreting the subsequent matching results. Engineering and ICT, which are directly relevant to technologically dynamic sectors, expanded strongly over the period. Engineering rose from 11.9 thousand to 34.7 thousand graduates, while ICT increased from 2.2 thousand to 8.4 thousand. Healthcare also expanded, despite temporary volatility. At the same time, some broader academic fields increased much faster than the likely absorptive capacity of their corresponding sectors. The most obvious case is the arts and humanities, where the increase in graduate output was exceptionally large relative to the near-stagnation of employment in arts and recreation.

Table 4 presents estimates for specific fields, reflecting the relationships between fields of study and the economic sectors defined in Table A1 in the Appendix. Each coefficient is obtained from a separate regression analysis for each matched field of study, covering the

period from 2010 to 2025. The models include a linear time trend and macroeconomic control variables. Year-specific fixed effects were not included, as only one annual observation is available for each field of study. Therefore, the resulting coefficients should be interpreted as comparative indicators of the correspondence between the field of study and employment, rather than as direct causal estimates. Evidence from youth graduate cohorts indicates that the effectiveness of labor-market integration varies with the scarcity of qualifications and participation in active labor market policies, underscoring that alignment between graduate supply and sectoral demand cannot be assumed from educational expansion alone (Zrelli Ben Hamida et al., 2017).

The results reveal clear differences between the fields of study. The most pronounced positive relationship is found in the ICT sector and in the engineering block, which combines manufacturing and construction. Positive values are also demonstrated for healthcare, natural sciences, education, and business specialties, while the estimates for agriculture remain weak and statistically insignificant. This architecture indicates that the absorption of graduates was more intense in technological and modernizing industries than in traditional sectors. Appendix Table A3 reports semi-standardized effects, showing that the largest one-standard-deviation associations are observed for business and law, education, engineering, and ICT.

Table 4. Domain-specific regression estimates: graduate supply and matched sectoral employment, 2010-2025

Graduate field	Target sector(s)	Coefficient (beta_1)	Std. error	R-squared (within)
Engineering	Manufacturing + Construction	1.38***	0.29	0.84
Education	Education (P)	0.62**	0.21	0.79
ICT	ICT (J)	2.14***	0.47	0.89
Healthcare	Healthcare (Q)	0.85***	0.18	0.83
Business & law	Finance + Trade + Admin	1.20***	0.31	0.71
Agriculture	Agriculture (A)	0.34	0.58	0.61
Natural sciences	Professional & scientific (M)	0.91**	0.33	0.68

Note. Each coefficient is obtained from a separate domain-specific regression estimated for one matched field-sector link over 2010 to 2025. Models include a linear time trend and controls for real GDP growth and the working-age population. Year fixed effects are not included in these domain-specific models because each domain has only one annual observation. Standard errors are reported cautiously given the small time dimension. *** $p < 0.01$, ** $p < 0.05$.

Table 5 reports complementary robustness checks to assess whether the positive relationship between graduate employment and the outcome persists across alternative specifications. The purpose of these models is to verify the stability of the main empirical pattern when employment is expressed in levels, differences, growth terms, and in interaction with the post-2017 period.

The robustness checks align with the main findings, with one caveat we state plainly. The relationship remains positive in the baseline fixed-effects model and the first-difference version, so it is not driven solely by fixed size gaps between sectors. It weakens sharply, however, once the outcome is expressed in growth terms. In the growth rate specification, the coefficient is smaller, suggesting that this relationship is more pronounced for absolute labor absorption than for proportional sector expansion. The interaction term for the post-2017 period also has a positive sign, consistent with stronger indicator consistency during economic

liberalization, although its magnitude is less precisely determined than in the baseline models. Taken together, the tests support the stability of the main results presented in Table 5.

The small number of clusters deserves a closer look. With only seven domains, clustered standard errors can overstate precision, so we recompute the significance of each specification with a wild cluster bootstrap. The bootstrap p-values are 0.21 for the baseline model, 0.18 for the first-difference model (both above the usual thresholds), and 0.36 for the growth-rate model. The post-2017 interaction is the exception, at 0.06. Read through this more conservative lens, the graduate-employment link in levels is best treated as suggestive, and the clearest signal is that the alignment grew stronger after the 2017 reforms.

In the pooled baseline model with fixed effects, the lagged value of graduate supply remains positively related to the employment rate. The same positive sign is also retained in the first-differences specification, indicating that the main result is not strictly dependent on persistent differences in employment levels between related sectors. However, when the employment growth rate is used as the dependent variable, the coefficient is small and not statistically significant. The link works through the absolute size of sector-level employment rather than through faster proportional growth, and part of the level result reflects the shared upward trend in graduate output and employment. Substantively, a higher graduate supply is more strongly associated with the absolute magnitude of sector-level employment growth than with faster percentage growth rates, controlling for the initial size of a particular sector.

Table 5. Robustness checks

Model	Baseline FE	First difference	Growth	Post-2017
Graduate supply (t−1)	9.544* (5.042)	2.361* (1.233)	0.046 (0.056)	6.112 (3.932)
Graduate × Post-2017	—	—	—	4.317 (3.364)
Wild-cluster bootstrap p-value	0.21	0.18	0.36	0.06
R^2	0.995	0.228	0.334	0.995

Note: Standard errors are given in parentheses. All models are estimated using matched panel data for seven industry sectors over the period 2010–2025 and include control variables for real GDP growth and working-age population. The baseline model and the model for the period after 2017 include fixed effects for industry sectors and time periods by year. Wild-cluster bootstrap p-values were calculated separately using Webb weights and 9999 replications. Significance levels (asterisks) are determined based on clustered standard errors: * $p < 0.10$, $p < 0.05$, *** $p < 0.01$.

The interaction with the post-2017 period is positive but imprecisely estimated. This result is consistent with, but does not conclusively establish, stronger alignment after the reform turn. The direction of the coefficient suggests that the post-liberalization environment may have improved some sectors' capacity to absorb graduates, yet the available evidence remains insufficient to treat this as a definitive structural break in the matching process.

4. Discussion

The study's results highlight a trend characteristic of post-socialist countries, whereby labor is shifting away from agriculture but not being absorbed on a large scale by industry or high-productivity tradable services. Uzbekistan has become a clear example of this dynamic amid the late reforms in Central Asia. Since 2010, employment growth in the country has been quite significant, but the most noticeable positive shift has occurred in a wide range of services,

not in industrial production. This suggests that the main problem lies not in the lack of labor market adaptation per se, but in the quality and direction of this adaptation. The case of Uzbekistan reflects a general problem of transition economies, also observed in parts of Eastern Europe and the post-Soviet space, where structural changes occur without a pronounced redistribution of resources to stimulate productivity growth.

The subdued role of industry is key to understanding the results. Employment in the industrial sector has grown in absolute terms, but it has not yet become the primary consumer of surplus labor. This distinction is crucial because growth in non-agricultural employment alone does not guarantee a structural transformation that improves the economy's overall efficiency.

The small role of the industrial sector indicates that structural modernization in Uzbekistan is limited not by a decline in production volumes but by industry's low capacity to absorb displaced workers. This factor is crucial in the broader context of the country's post-transition development, where pronounced dependence on migration flows and remittances can seriously disrupt internal labor market adaptation mechanisms and weaken aggregate labor demand (Peković, 2025). More broadly, recent work links migration dynamics, financial conditions, and wider restructuring, which together shape the direction of employment and the paths that transforming economies follow (Bilan et al., 2025; Berde & Remsei, 2025; Lyeonov et al., 2025; Mishchuk et al., 2024; Samoliuk et al., 2024).

Unlike classic models of structural transformation, in which the industrial sector is the main driver of productivity growth, Uzbekistan's case reflects a different pattern: industry employment grows but does not generate an outstripping demand for new workers. This result is consistent with the experience of other transition economies, where the inherited production structure and ongoing resource misallocation reduce the elasticity of employment with respect to economic growth (Hsieh & Klenow, 2009). As a result, the redistribution of labor does not fully lead to an increase in the efficiency of the entire system, which once again highlights the difference between a simple increase in the number of jobs and the real development of the country's productive potential.

This interpretation also allows us to connect the empirical data from Central Asia with the experience of Eastern European countries. Where post-socialist economies were able to attract industrial investment, integrate into European value chains, and modernize firm capabilities, labor reallocation was more likely to contribute to productivity growth. In cases where these channels remained weaker, labor market adjustment occurred primarily through the absorption of labor into domestic services, construction, the public sector, or migration. Uzbekistan belongs to the second trajectory type. Its experience is useful not because it is representative of all post-socialist economies, but because it reveals a mechanism specific to countries where institutional inertia limits the developmental impact of labor reallocation. The case of Uzbekistan shows that countries embarking on late post-socialist reforms may face de-agrarianization without a developmental redistribution of labor if industrial modernization, labor market mediation, and mechanisms linking the education system to the sphere of employment remain institutionally weak.

From an institutional perspective, these differences cannot be explained solely by market forces or differences in the timing of economic reforms. Regulatory harmonisation, industrial policy coordination, access to European structural funds, and the gradual diffusion of sustainability-related standards have strengthened the adaptive capacity of firms, higher education institutions and labor market organizations in many EU Member States. Consequently, labour reallocation has been supported not only by economic growth itself but also by institutional mechanisms facilitating structural adaptation and improving the responsiveness of labour market institutions to emerging economic priorities.

Poland's experience reveals a very different development path after socialism. Thanks to its early accession to the European Union, strong industrial ties, and well-established labor market mechanisms, Poland serves more as a useful benchmark for comparison than as a direct example of cause and effect. This contrast helps better understand why Uzbekistan's situation is considered a late-reform trajectory. In the Uzbek scenario, labor redistribution occurred without a comparable level of industrial development or support from state institutions.

Placing the three countries side by side helps locate Uzbekistan on this map. Table 6 sets out their employment structure in the most recent year available for each. Poland follows the industrial-upgrading path. Manufacturing still holds close to a fifth of employment, agriculture has fallen below eight percent, and higher incomes rest on deep ties to European production networks. Kazakhstan follows a resource-based path. Agriculture has dropped to about a tenth of employment, and services already employ seven workers out of ten, yet the industry runs on mining rather than manufacturing, and its labor market leans on commodity earnings rather than on money sent home from abroad. Uzbekistan sits apart from both. This situation still leaves approximately one in five workers in the agricultural sector. The share of manufacturing is very modest, and recent employment growth has come primarily from low-productivity services. Remittances play a much more significant role than in Kazakhstan, accounting for approximately fourteen percent of output, compared to almost zero in its neighbors. For this reason, Uzbekistan is perceived as an example of a late service-based transformation, where the labor force has already left agriculture but has not yet migrated to the tradable industrial sector or high-tech services.

Table 6. Comparative structural position of Uzbekistan, Kazakhstan and Poland

Indicator	Uzbekistan (2025)	Kazakhstan (2025)	Poland (2024)
Agriculture, share of employment (%)	21.0	10.2	7.8
Industry, share of employment (%)	12.6	12.6	21.0
of which manufacturing (%)	11.4	6.7	18.3
Construction, share of employment (%)	9.7	6.9	7.0
Services, share of employment (%)	56.7	70.3	64.2
GDP per capita (current US$, 2024)	about 3,160	about 14,150	about 24,000
Tertiary education	rapid, 6.8 to 47.7% (2014 to 2025)	high	high, EU level
Structural role	late reformer, service-led, remittance-linked	resource-based, commodity-dependent	EU and GVC integrated, industrial upgrading

Note. Employment shares are computed from the following sources. Uzbekistan, National Statistics Committee of the Republic of Uzbekistan, 2025, as in Table 1. Kazakhstan, Bureau of National Statistics, Labor Force Survey, first quarter of 2026. Poland, Statistics Poland, 2024. GDP per capita, World Bank, World Development Indicators, 2024. Industry covers mining, manufacturing, energy and water supply.

The results also indicate significant heterogeneity in absorptive capacity across industries. Information technology and engineering demonstrate the highest rates, followed by healthcare and the natural sciences, while agriculture shows virtually no comparable level of new talent absorption. This suggests that the absorption of specialists by a given sector depends

not only on the number of graduates but also on the ability of companies and institutions to match specialized skills with the needs of industries with real potential for productivity growth. From an economic policy perspective, the expansion of higher education should be complemented by stronger practice-oriented training, active employer engagement, and the development of labor market intermediation institutions.

More broadly, the findings suggest that successful structural transformation depends not only on the pace of reforms or the availability of skilled labor, but also on the adaptive capacity of national institutions responsible for education, industrial development and labor market governance. Similar reform measures may therefore produce substantially different outcomes depending on how effectively governments, universities and employers coordinate their responses to changing technological, demographic and regulatory conditions. Institutional adaptation thus complements institutional reform by emphasizing the capability of organizations and public systems to continuously adjust to evolving economic environments rather than merely implementing formal policy changes.

The results of the analysis of the relationship between education and employment point to uneven matching rather than a uniform pattern of skill imbalance across the economy. High-tech and knowledge-intensive fields such as information technology, engineering, and healthcare show higher graduate employment rates. This supports the assumption that the influx of qualified young professionals is directly and effectively absorbed by the labor market in these industries. This interpretation fits within the framework of approaches based on the analysis of specific challenges in technological change, in which specialized competencies can facilitate sector expansion. However, the current structure of the study does not allow the authors to separate this mechanism from larger-scale structural changes within these industries themselves (Acemoglu & Restrepo, 2018; Autor et al., 2024).

Conversely, in mass-market fields such as business education or teaching, the relationship between the number of graduates and the number of people employed in the relevant sector is much weaker. In these fields, the growth in the number of specialists often outpaces job openings, indicating not a talent shortage but rather the market's inability to absorb such a large number of people (Abdulla, 2025). Compared to IT, engineering, or medicine, the return on investment in higher education remains extremely uneven. This is especially noticeable in areas where various barriers and a lack of information prevent graduates from finding jobs that match their competencies.

The situation in which some high-tech industries are experiencing a severe shortage of specialists while others are experiencing a clear surplus of graduates indicates a highly segmented labor market. This is not simply a “skills mismatch”, but a systemic problem. A number of studies show that such an imbalance can persist even when vacancies are plentiful. This is explained by the fact that the actual situation is determined less by overall demand for personnel than by the effectiveness of institutional mechanisms for finding, selecting, and distributing labor (Banerjee & Chiplunkar, 2024). In such a reality, relying on a simple increase in the number of university graduates is unlikely to ensure a significant increase in productive employment. A real economic impact will only emerge when specialized institutions can accurately match specialists' skills to the needs of sectors of the economy with real growth potential and that are ready to absorb qualified personnel.

Read together, these results indicate a clear mismatch between the direction of labor reallocation and the conditions for sustainable productivity growth in Uzbekistan. The outflow of resources from agriculture is considered an important, but far from sufficient, condition for development. Its real significance for economic modernization depends on the specific sectors that absorb the labor force that becomes available. If the labor force migrates predominantly to the low-productivity service sector, the long-term consequences will be radically different from

those of a scenario relying on industry or on developing a highly productive tradable services sector. For this reason, the key task of public policy is not to mechanically increase scale, but to establish a close relationship between industrial development, higher education, and labor market institutions.

Conclusion

This article analyzes structural transformation in Uzbekistan for the period 2010–2025 using a combination of sectoral structural analysis (the shift-share method) and balanced estimates of university graduate supply and sectoral labor absorption. The study's contribution lies in demonstrating how the economy-wide redistribution of labor resources and sector-specific patterns of graduate absorption developed in parallel during the period of liberalization, expansion of the service sector, and growth of the higher education system.

The analysis reveals several key patterns. First and foremost, labor force movement in Uzbekistan was driven primarily by the expansion of the service sector, while the industrial sector, despite positive absolute growth, failed to become the primary driver of labor absorption. Furthermore, the strongest correlation between the influx of graduates and their actual employment is observed only in a narrow segment of knowledge-intensive specialties, among which information technology and engineering, along with healthcare, are the leading ones. Read as a whole, the evidence points not to a broad skills shortage across all fields of study, but to a deeper structural mismatch between what the young workforce can offer and what the market actually demands.

These results have important implications for a broader range of studies of post-socialist economies. They show that structural transformation cannot be assessed solely by the decline in the share of agriculture or the scale of expansion of the higher education system. The development impact depends on whether workers and graduates are absorbed into sectors with sufficient potential for productivity growth. In Uzbekistan, labor redistribution and the expansion of the higher education system occurred simultaneously, yet the balance between them remained uneven. This points to institutional inertia, rather than a simple labor shortage or an oversupply of graduates.

The policy recommendation is to ensure coordination rather than simply expand. Higher education policy should be more closely linked to sectoral development, industrial policy, and labor market mediation. For transition economies, the main challenge is not simply to produce more specialists or to ensure the outflow of workers from agriculture. A far more important task is to create sectors and institutions capable of absorbing skilled labor and providing productive employment. Future research should expand the scope of this analysis to include comparative post-socialist datasets, in particular by comparing Central Asian countries with Eastern European economies, which have followed different trajectories of industrial modernization, migration, and education system expansion.

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Appendix

Appendix Table A0. Comparative data sources and empirical role

Country	Data source	Period	Main indicators	Role in the paper
Uzbekistan	National Statistics Committee	2010–2025	Sectoral employment, graduate output by field	Main empirical case
Kazakhstan	Main labor-market indicators	2001–2025	Labor force, employment, wage employment, self-employment, unemployment, inactivity by region	External post-Soviet benchmark
Kazakhstan	Labor market bulletin	2025	Employment, self-employment, unemployment, education and sectoral structure	Recent contextual benchmark
Poland	Labour market chapter	2024	Employment by sector, vacancies, registered unemployment by voivodeship	Eastern European benchmark

Note. Kazakhstan and Poland are used as comparative benchmarks rather than as part of the main econometric model. The main matched field-sector analysis remains based on Uzbekistan because comparable graduate-output and sectoral employment data are not consistently available for all comparator countries over the full 2010–2025 period.

Appendix Table A1. Concordance between graduate fields and employment sectors

Graduate field	ISCED	Matched sector(s) (ISIC Rev.4)	Mapping logic
Education	01	P – Education	Direct occupational match
Arts & humanities	02	R – Arts & recreation; S – Other services	Cultural, creative, and personal-service destinations
Social sciences	03	O – Public administration; M – Professional, scientific and technical activities	Administrative and analytical roles
Business & law	04	G – Trade; K – Finance and insurance; N – Administrative services	Core business-related employment
Natural sciences	05	M – Professional, scientific and technical activities	Scientific and technical activities
ICT	06	J – Information and communication	Direct sectoral alignment
Engineering	07	C – Manufacturing; F – Construction	Industrial and infrastructure-related employment
Agriculture	08	A – Agriculture, forestry, and fishing	Sector-specific employment
Healthcare	09	Q – Human health and social work	Direct occupational match
Services	10	S – Other services	Residual personal and household services

Note. Table A1 is a baseline concordance used in the main text. It follows dominant labor-market destinations and is consistent with the sectoral structure observed in the employment data and the field classification in the graduate series.

Appendix Table A2. Alternative multi-sector concordance with employment-based weights, 2010–2025

Graduate field	Sector 1	Weight	Sector 2	Weight	Sector 3	Weight
Arts & humanities	R	0.042	S	0.958	–	–
Social sciences	O	0.816	M	0.184	–	–
Business & law	G	0.900	K	0.046	N	0.054
Engineering	C	0.549	F	0.451	–	–

Note. Weights are based on average sectoral employment for 2010–2025, as shown in the uploaded employment spreadsheet. They are intended for robustness checks using weighted multi-sector mapping rather than for the baseline specification.

Appendix Table A3. Semi-standardized effects of graduate supply, 2010–2025

Graduate field	Baseline coefficient β	SD of graduate supply	Effect of a 1-SD increase in graduate supply
ICT	2.14	3.608	7.722
Engineering	1.38	7.241	9.992
Healthcare	0.85	3.423	2.909
Education	0.62	16.482	10.219
Business & law	1.20	9.138	10.966
Natural sciences	0.91	5.177	4.711
Agriculture	0.34	2.036	0.692

Note. SD values are sample standard deviations of annual graduate output over 2010–2025, calculated from the uploaded graduate series. The final column is computed as β × SD (G).