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Improving The Scientific And Methodological Foundations Of Statistical Research And Forecasting Of Demographic Processes In The Republic Of Uzbekistan

Siroj Zarina Rustambekovna¹

1. Doctoral Researcher at Tashkent State University of Economics Associate Professor of the Department of "Banking and Finance" at Tashkent University of Applied Sciences, PhD

* Correspondence : zarina36.84@gmail.com

Abstract: This article examines the scientific and methodological foundations for the statistical study and forecasting of demographic processes in the Republic of Uzbekistan. The study focuses on the statistical assessment of population dynamics, fertility, mortality, migration, age and age structure, as well as other key demographic indicators. Particular attention is paid to improving methodological approaches to the formation of a system of demographic indicators, identifying trends and interrelationships, and forecasting future demographic changes. Statistical analysis, comparative analysis, dynamic series analysis, correlation-regression methods and forecasting approaches are used in the research. The proposed methodological approaches can contribute to improving the quality of demographic statistics, strengthening analytical and forecasting capabilities, and providing a more reliable information basis for socio-economic planning and management decisions.

Keywords: demographic processes, population statistics, statistical research, demographic indicators, fertility, mortality, migration, population forecasting, statistical methodology, demographic analysis.

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1. Introduction

In recent years, the increasing intensity of demographic processes, changes in population size and structure, fluctuations in fertility and mortality rates, growing migration flows, and accelerating urbanization have become important factors influencing the socio-economic development of countries. In this context, the systematic statistical observation of demographic processes, identification of their development trends, and scientifically grounded forecasting of future demographic changes are becoming increasingly important for public administration and strategic planning.

In the Republic of Uzbekistan, demographic processes related to population growth, territorial distribution, age-age structure, natural population movement, and migration play a significant role in shaping the demand for labor resources, education, healthcare, housing, social protection, and infrastructure. Assessing these processes solely through absolute statistical indicators does not provide a comprehensive understanding of their dynamics and structural characteristics. Therefore, the application of relative, average, intensity, and structural indicators, together with comparative analysis across regions and the analysis of time series, is essential for obtaining a more comprehensive statistical assessment of demographic development.

The modern development of demographic statistics requires not only the collection, processing, and dissemination of statistical information but also improvements in data quality, integration, comparability, and analytical capacity.

In particular, the integration of population census data, administrative registers, and sample survey results into unified statistical information systems can significantly improve the accuracy and completeness of demographic assessments. At the same time, the adaptation of international statistical standards and methodological recommendations to national conditions remains an important methodological task.

Statistical forecasting of demographic processes makes it possible to estimate potential changes in population size, structure, fertility, mortality, and migration based on historical and current statistical trends. The reliability of demographic forecasts depends on the quality of initial data, the length and consistency of observation periods, the characteristics of the demographic indicators being analyzed, and the methodological approaches applied. Therefore, combining traditional methods of time-series analysis and extrapolation with econometric modeling and modern forecasting techniques is particularly relevant for improving the scientific and methodological foundations of demographic forecasting.

The methodological literature frames the present study in several respects. The established measurement framework treats population change as the joint outcome of fertility, mortality and international migration, while the existing age structure generates an additional momentum effect, so that forecasting cannot rest on aggregate growth rates alone [1], [2]. This decomposition underlies the cohort-component method that remains the standard apparatus of population projection [3], and the associated body of formal demographic measurement specifies the rates and life-table quantities through which the components are estimated [4]. Recent revisions of the international framework extend it in two directions. The first concerns resolution: the transition from conventional five-year age groups and projection intervals toward annual estimates and projections by single year of age broadens the scope for detecting structural change within populations [5]. The second concerns uncertainty: probabilistic projection methods, now applied by the United Nations to fertility, mortality and international migration, yield prediction intervals rather than a single deterministic trajectory, and are particularly informative for countries undergoing rapid demographic transformation [6], [7], [8].

A parallel strand emphasises disaggregation and data quality. The State of World Population 2024 argues that demographic indicators should be examined not only in aggregate but in relation to differences between population groups and their socio-economic conditions [9], while the international recommendations for population censuses and for vital statistics systems specify the definitions, coverage and classification standards on which comparable demographic measurement depends [10], [11]. For Uzbekistan, official statistics supply the empirical foundation for such analysis: the permanent population rose from approximately 33.9 million in 2020 to 37.5 million at the beginning of 2025 and reached 38.24 million as of 1 January 2026 [12], [13], and is published with disaggregation by age, urban and rural residence, region, marriages, divorces and external migration [14], while the Demographic Yearbook provides the detailed series required for constructing time-series models, calculating demographic coefficients and analysing regional disparities [15]. Taken together, these sources show demographic research moving toward integrated statistical systems that combine component analysis, regional disaggregation, modelling and probabilistic forecasting. What remains underdeveloped is the adaptation of these approaches to Uzbekistan's statistical information system in the form of a single methodological framework linking statistical assessment to forecasting at both national and regional levels; this methodological gap provides the basis for the present study.

Despite the availability of extensive demographic statistics, methodological challenges remain in the comprehensive assessment and forecasting of demographic processes at the national and regional levels. These challenges include differences in demographic development across regions, the interaction between natural and migration components of population change, structural shifts in the population, and the need to improve the comparability and analytical usefulness of demographic indicators. Addressing these issues requires the development of an integrated methodological framework that combines statistical assessment, comparative analysis, modeling, and forecasting.

The purpose of this study is to examine the existing methodological approaches to the statistical study of demographic processes in the Republic of Uzbekistan, identify opportunities for their improvement, and develop scientifically grounded approaches to the statistical assessment and forecasting of key demographic indicators.

The scientific and practical significance of the study lies in the systematization and improvement of methodological approaches to the comprehensive statistical assessment of demographic processes, identification of regional differences, and forecasting of future demographic changes. The proposed approaches can be applied to improve demographic information systems, support socio-economic planning, strengthen analytical and forecasting capacities, and provide a more reliable statistical basis for management decisions related to population development.

2. Research Methodology

The study applies a comprehensive statistical approach to examine demographic processes in the Republic of Uzbekistan and to develop scientifically grounded forecasting methods. The research is based on official demographic statistics, including data on population size and dynamics, fertility, mortality, migration, age-age structure, and regional distribution of the population.

To assess the dynamics and structural changes in demographic processes, statistical grouping, relative and average indicators, structural analysis, comparative analysis, and time-series analysis are applied. Particular attention is given to identifying changes in demographic indicators over time and determining differences between regions.

For forecasting purposes, trend analysis, extrapolation, correlation-regression analysis, and econometric forecasting methods are used. The selection of forecasting methods is based on the characteristics of the analyzed indicators, the availability and consistency of statistical data, and the stability of observed demographic trends. Forecast accuracy is assessed by comparing predicted and actual values using appropriate statistical error measures [16].

The study also applies a regional comparative approach to identify territorial differences in demographic development. Population growth, natural increase, fertility, mortality, and migration indicators are analyzed both at the national level and across administrative regions. This makes it possible to identify areas with different demographic development patterns and to establish their statistical characteristics.

An integrated methodological framework is proposed in which statistical observation → data processing → descriptive assessment → comparative analysis → modeling → forecasting are considered as interconnected stages. This approach allows demographic processes to be studied systematically rather than through individual indicators.

The empirical analysis is based primarily on official statistical data from the National Statistics Committee of the Republic of Uzbekistan [12]–[15], supplemented by methodological materials and demographic databases of international organizations, particularly the United Nations [1], [5]. The methodological principles are aligned with internationally recognized approaches to demographic statistics and population forecasting.

Overall, the methodology is aimed at improving the reliability of statistical assessment, identifying the main patterns of demographic change, and developing a methodological basis for more accurate forecasting of population dynamics in Uzbekistan.

3. Analysis And Results

The analysis of demographic processes in the Republic of Uzbekistan shows that population development is characterized by sustained population growth, a relatively high level of natural increase, changes in the age and age structure, urbanization, migration processes, and considerable regional differences. These factors are closely interconnected and collectively determine the current and future demographic structure of the country. Therefore, the statistical assessment of demographic processes requires a comprehensive approach that considers both the quantitative dynamics of the population and changes in its structural characteristics.

Population Dynamics in Uzbekistan

One of the most important indicators characterizing demographic development is the dynamics of the permanent population. Official statistical data indicate that Uzbekistan's population has demonstrated a long-term upward trend. The permanent population increased from approximately 20.6 million people in 1991 to 38.24 million people as of January 1, 2026. Thus, over the period of independence, the population increased by approximately 17.6 million people.

Table 1. Dynamics of the Permanent Population of Uzbekistan

Year	Population, million persons
1991	20.6
2000	24.5
2010	28.0
2020	33.9
2023	36.0
2024	36.8
2025	37.5
2026	38.2

Source: compiled by the author based on data from the National Statistics Committee of the Republic of Uzbekistan.

The data presented in Table 1 demonstrate that population growth has remained positive throughout the analyzed period. At the same time, the intensity of population growth has varied between different periods. This indicates that population forecasting should not be based exclusively on the assumption of a constant growth rate. Instead, changes in fertility, mortality, migration, age structure, and regional demographic conditions should be considered.

The increase in population creates additional demand for social and economic infrastructure. Population growth affects the need for educational institutions, healthcare facilities, housing, employment opportunities, transport infrastructure, utilities, and social protection. Consequently, accurate demographic statistics are essential for medium- and long-term socio-economic planning.

Natural Population Increase

Natural population movement remains one of the most important components of Uzbekistan's demographic development. It is determined by the interaction between births and deaths. Official statistics indicate that during January–December 2025, approximately 879.6 thousand live births and 177.1 thousand deaths were registered. As a result, the natural increase amounted to approximately 702.5 thousand people.

Table 2. Main Indicators of Natural Population Movement in 2025

Indicator	Number, thousand persons
Live births	879.6
Deaths	177.1
Natural increase	702.5

Source: National Statistics Committee of the Republic of Uzbekistan.

The substantial difference between the number of births and deaths indicates that natural increase continues to play a major role in overall population growth. However, the analysis of natural increase should not be limited to absolute values. For regional comparisons, it is necessary to consider demographic intensity indicators, because regions differ significantly in terms of population size.

The high level of natural increase also has implications for the age structure of the population. A relatively large number of births contributes to the expansion of younger age groups and subsequently affects the future size of the working-age population. Therefore, current fertility patterns can have demographic consequences extending over

several decades.

Fertility Dynamics

Fertility is one of the principal determinants of population reproduction. The analysis of fertility should consider both the absolute number of births and the intensity of childbearing among women of reproductive age.

An important methodological issue is that changes in the number of births may result from changes in both fertility behavior and the number of women in reproductive age groups. Therefore, a comprehensive demographic analysis requires the use of general and age-specific fertility indicators.

The age distribution of fertility is particularly important for population forecasting. If births become increasingly concentrated in particular age groups, changes in the age structure of the female population may significantly influence future birth numbers even when fertility rates remain relatively stable.

For this reason, the proposed methodological approach emphasizes the analysis of fertility by age, region, urban and rural residence, and changes over time. Such disaggregation makes it possible to distinguish structural demographic changes from temporary fluctuations.

Mortality and Population Survival

Mortality represents the second major component of natural population change. The statistical assessment of mortality requires consideration of the number of deaths, mortality rates, age-specific mortality, age differences, and changes in life expectancy.

A simple comparison of the total number of deaths between different years may not accurately reflect changes in mortality conditions because the size and age structure of the population may change simultaneously. Therefore, mortality should be evaluated using standardized and age-specific indicators whenever sufficient data are available.

The improvement of mortality statistics is also important for forecasting. Declining mortality and increasing life expectancy can gradually increase the proportion of older people in the population; established stochastic approaches model this component as an extrapolative process in its own right rather than as a by-product of aggregate trends [17]. This process can influence the demand for healthcare, social protection, pensions, and long-term care services.

Consequently, mortality analysis should be incorporated into demographic forecasting models as an independent component rather than being treated only as a secondary indicator.

Age and Age Structure

The age and age structure of the population represents a fundamental component of demographic analysis. As of January 1, 2026, men accounted for approximately 50.4% of Uzbekistan's permanent population, while women accounted for 49.6%.

Table 3. Urban and Rural Population Distribution

Type of residence	Population, million persons
Urban population	19.47
Rural population	18.77
Total	38.24

Source: National Statistics Committee of the Republic of Uzbekistan.

The relatively close distribution between urban and rural populations does not mean that demographic behavior is identical in the two settlement types. Differences may exist in fertility, migration, employment, access to healthcare and education, housing conditions, and household composition.

Urbanization may also influence internal migration and the redistribution of population between regions. Therefore, demographic forecasting should incorporate the changing relationship between urban and rural populations.

Regional Differences in Demographic Development

The analysis demonstrates substantial differences in population size between regions of Uzbekistan. As of January 1, 2026, Samarkand, Fergana, Kashkadarya, and Andijan regions had some of the largest populations in the country, while Syrdarya and Navoi

regions had substantially smaller populations.

Table 4. Population by Selected Regions, 2026

Region	Population, million persons
Samarkand	4.38
Fergana	4.22
Kashkadarya	3.72
Andijan	3.52
Navoi	1.11
Syrdarya	0.95

Source: National Statistics Committee of the Republic of Uzbekistan.

The differences presented in Table 5 demonstrate that national demographic indicators can conceal considerable territorial variation. The demographic situation of a densely populated region may differ substantially from that of a region with a smaller population and different economic and settlement characteristics.

For this reason, regional statistical analysis should include population growth, fertility, mortality, natural increase, migration, urbanization, population density, and age-age structure.

Regional differentiation is particularly important for forecasting because demographic trends do not develop uniformly throughout the country. A forecasting methodology that applies identical assumptions to all regions may therefore produce less informative results.

Migration Processes

Migration is another important component of demographic change. In addition to natural population increase, migration can influence both the total population and its spatial distribution.

During 2025, official statistics recorded international arrivals and departures involving Uzbekistan. Although the scale of net international migration is considerably smaller than the natural increase, migration remains an important factor for demographic analysis, particularly at the regional level.

Internal migration is also important because population redistribution between regions and settlements can substantially affect regional population structures. The movement of young and working-age people, in particular, may influence the labor supply, fertility patterns, urbanization, and age structure of both origin and destination areas.

Therefore, the proposed statistical framework considers migration as an independent component of demographic analysis. This makes it possible to distinguish population changes resulting from natural reproduction from changes associated with population mobility.

Statistical Assessment of Demographic Trends

The analysis indicates that demographic processes should be evaluated through a system of interconnected indicators rather than through a single population measure.

The proposed indicator system includes:

- total permanent population;
- annual population growth;
- number of live births;
- fertility indicators;
- number of deaths;
- mortality indicators;
- natural population increase;
- migration inflows and outflows;
- net migration;
- age structure;
- urban and rural population;
- population density;
- regional demographic indicators;
- dependency-related indicators.

The simultaneous analysis of these indicators provides a more complete picture of demographic development.

For example, an increase in the total population may be associated with a high natural increase, positive migration, or a combination of both. Similarly, a decline in population growth may occur because of declining fertility, increasing mortality, negative migration, or changes in the age structure.

This demonstrates the importance of component-based statistical analysis.

Demographic Forecasting

The analysis of historical demographic trends provides the empirical basis for forecasting future population development. However, demographic forecasting requires a methodology that takes into account the different components of population change.

Short-term forecasting can make greater use of recent demographic trends, while medium- and long-term forecasting requires consideration of structural changes in fertility, mortality, migration, and age composition.

A key methodological improvement is therefore the transition from simple trend extrapolation toward an integrated forecasting framework. Such a framework should combine historical statistical trends with demographic component analysis and scenario assumptions [3], [8].

Table 5. Three broad types of demographic scenarios can be considered:

Scenario	Main methodological assumption
Baseline	Recent demographic trends continue with moderate changes
Alternative demographic growth	Fertility and natural increase remain relatively higher
Lower-growth scenario	Fertility declines more rapidly and/or migration balance becomes less favorable

Scenario analysis does not imply that one particular scenario will necessarily occur. Its purpose is to demonstrate the sensitivity of future population development to changes in major demographic determinants.

Forecasting at the Regional Level

Regional forecasting represents an important direction for improving the methodology of demographic research in Uzbekistan.

The use of regional forecasts makes it possible to identify differences in expected population growth and to estimate future changes in population distribution. Such information is relevant for determining future requirements for schools, hospitals, housing, employment, transport, and other infrastructure.

Regional forecasting should therefore be based on region-specific demographic characteristics rather than simply distributing the national forecast proportionally among regions.

In particular, fertility, mortality, migration, urbanization, and age structure should be analyzed separately for each region. This approach can improve the analytical value of forecasts and make them more useful for regional planning.

Monitoring of Demographic Processes

Forecasting alone is insufficient to ensure the effective statistical monitoring of demographic processes. Forecast results should be regularly compared with actual statistical observations, and forecasting assumptions should be revised when significant deviations occur.

This suggests the development of a continuous demographic monitoring mechanism consisting of several interconnected stages:

data collection → data validation → statistical assessment → identification of trends → regional comparison → forecasting → comparison of forecasts with actual results → methodological adjustment.

Such an approach makes demographic forecasting a continuous process rather than a one-time analytical exercise.

The integration of population census results, administrative data, civil registration information, migration statistics, and sample surveys can further strengthen this

monitoring system, provided that definitions and coverage remain consistent with international recommendations [10], [11]. The availability of more detailed and timely data would improve the ability to identify demographic changes at an early stage.

Methodological Results

The analysis confirms several methodological findings.

First, the demographic development of Uzbekistan should be studied as an interconnected system of fertility, mortality, migration, and population structure.

Second, population growth should be analyzed together with changes in age and age composition because the same rate of population growth can correspond to substantially different demographic structures.

Third, regional differentiation should be incorporated into statistical assessment and forecasting because demographic trends vary considerably between administrative territories.

Fourth, migration should be considered alongside natural population increase when assessing changes in population size and territorial distribution.

Fifth, long-term demographic forecasting should incorporate different scenarios because future demographic development depends on changes in fertility, mortality, migration, and population structure.

Sixth, forecast results should be regularly evaluated against actual statistical data. This makes it possible to identify forecast deviations and improve the methodological assumptions used in subsequent forecasting cycles.

Integrated Approach to Demographic Statistical Research

Based on the results obtained, an integrated methodological approach to statistical research of demographic processes in Uzbekistan can be proposed.

The first stage is the formation of a reliable statistical information base. The second stage involves checking the completeness, consistency, and comparability of demographic data. The third stage focuses on calculating and analyzing the main demographic indicators. The fourth stage involves identifying temporal and regional differences. The fifth stage consists of analyzing the contribution of fertility, mortality, and migration to population change. The sixth stage involves demographic modeling and forecasting. The final stage is continuous monitoring and methodological adjustment.

This approach allows demographic statistics to perform not only a descriptive function but also an analytical and forecasting function.

The results demonstrate that improving the scientific and methodological foundations of demographic statistics requires the integration of statistical observation, modern analytical methods, regional analysis, forecasting, and continuous monitoring. Such integration can increase the reliability of demographic assessments and strengthen the statistical information base required for long-term socio-economic planning.

Overall, the demographic development of Uzbekistan is characterized by sustained population growth, a significant natural increase, a relatively balanced age structure, substantial regional differences, and ongoing changes in population distribution. These characteristics confirm the need for a comprehensive statistical methodology that can simultaneously assess current demographic conditions and provide scientifically grounded forecasts of future population development.

4. Conclusion And Recommendations

The study establishes that demographic development in Uzbekistan is characterised by sustained population growth — from approximately 20.6 million in 1991 to 38.24 million at the beginning of 2026 — driven by a natural increase of some 702.5 thousand persons in 2025, accompanied by a near-balanced urban and rural distribution, a male share of about 50.4 per cent, and pronounced differences between regions that national aggregates conceal. These findings support the central methodological result: demographic processes should be assessed as an interconnected system of fertility, mortality, migration and population structure rather than through individual indicators, and forecasting should accordingly combine historical trends with component analysis, regional differentiation and alternative scenarios instead of extrapolating past growth rates. The practical implication is an integrated framework running from statistical

observation through data validation, descriptive assessment, comparative and component analysis, modelling and forecasting to continuous monitoring, in which forecasts are routinely compared against realised outcomes and methodological assumptions revised when deviations emerge; realising it requires a unified system of demographic indicators, closer integration of census, civil registration, administrative and survey sources, wider application of time-series, regression and scenario methods, and more detailed regional and structural disaggregation in statistical publications. The study is nonetheless methodological in character, and its conclusions are subject to limitations: the empirical analysis rests on published aggregate statistics rather than micro-level data, the proposed forecasting framework is specified but not estimated, and its accuracy has therefore not been tested against realised outcomes. Future research should estimate and validate the framework empirically — constructing regional forecasts from region-specific fertility, mortality and migration assumptions, evaluating forecast error against subsequent observations, and extending the analysis to the interaction between demographic change and the demand for labour, education, healthcare and social protection — so that the methodological system proposed here can be judged on the reliability of the forecasts it produces.

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