

Population Review

Volume 65, Number 1, 2026

Type: Article pp. 1-26

Demographic Prospects of Armenia in the Context of Global Demographic Transformations: Structural Risks and Economic Security Challenges (2025–2100)

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Abstract

This paper assesses Armenia's demographic outlook through 2100 in the context of global demographic structural transformations and the redistribution of regional power. The analysis is based on the United Nations Population Division's World Population Prospects 2024 data (medium variant) and long-term comparable projections from INED, applying comparative-analytical and descriptive-quantitative approaches. The results indicate that global population growth in the 21st century will be concentrated primarily in Africa, whose share in the world population will increase from 18.8% (2025) to 37.5% (2100), while Asia's share will decline from 58.7% to 45.3%, and Europe's from 9.0% to 5.8% over the period 2025–2100. For Armenia, a sustained demographic decline is projected: the population is expected to decrease from approximately 2.95 million (2025) to 1.692 million (2100), representing a total change of about –42.7% and an average annual growth rate of CAGR $\approx -0.74\%$. This trend suggests that Armenia is positioned within the “negative pole” of global demographic polarization, characterized by persistently low fertility rates, deepening population ageing, and a narrowing base of the working-age population. In addition to long-term projections, the study examines Armenia's short-to-medium-term demographic-economic patterns using descriptive trend analysis (2000–2024) based on WDI and UN data, focusing on the co-movement of real GDP, working-age population, and dependency indicators. The evidence suggests that Armenia's growth has occurred alongside a stagnating or declining demographic base, implying that demographic change acts primarily as a structural constraint relevant to economic security rather than as a short-run growth driver.

Keywords: Demographic Transition, Population Projections, Global Demographic Polarization, Population Ageing, Working-Age Population, Migration, Economic Growth.

JEL Classification: J11, J14, O11, O15, F22.

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Introduction

Global development processes in the 21st century are characterized not only by rapid economic and technological change, but also by profound demographic transformations that fundamentally reshape countries' development opportunities and constraints. Demographic factors are gradually becoming one of the key determinants of economic growth, labor market stability, social protection systems, and national economic security. The latest United Nations projections indicate that by 2100 the world will face not a universal increase or decrease in population, but rather a structural demographic polarization, in which population growth will be concentrated in a limited number of regions, while a number of countries and regions will enter a prolonged phase of demographic decline.

At the global level, this process is manifested in the geographical redistribution of population growth from Asia to Sub-Saharan Africa. While during the first half of the 21st century the majority of the world's population will remain concentrated in Asia, in the second half of the century Africa will become the main driver of global population growth. At the same time, Europe, East Asia, and several post-Soviet countries are characterized by persistent trends of population decline, ageing, and shrinking working-age populations. These opposing processes are shaping a new global demographic equilibrium with profound economic, social, and political implications, affecting productivity, migration flows, and international competitiveness.

In this context, Armenia's demographic position is of particular interest. Armenia belongs to the group of countries that are in the late stage of demographic transition and are simultaneously exposed to the pressures of emigration, persistently declining fertility, and rapid population ageing. Despite its relatively small population, Armenia's demographic dynamics have a disproportionately large impact on the country's economic development, labor market formation, fiscal stability, and the sustainability of social systems. Under the conditions of a small and open economy, adverse demographic trends may deepen structural vulnerabilities and constrain long-term development potential.

Under conditions of global demographic polarization, Armenia's challenges cannot be considered in isolation. Rapid population growth in a number of African and South Asian countries is creating new centers of future labor force accumulation, while countries such as Armenia face the risks of labor shortages, human capital outflows, and rising dependency ratios. This contrast is important not only from a demographic perspective, but also from the standpoint of economic security, as the contraction of the working-age population and the deepening of ageing may exert long-term pressure on economic growth, public finances, and social protection systems.

Despite the extensive scientific literature on global demographic processes, Armenia's position within the framework of global demographic polarization has not yet received comprehensive and systematic analysis. Most existing studies focus on individual demographic indicators or their social consequences, without linking them to global structural demographic shifts and long-term economic security challenges. Moreover, in empirical studies on Armenia, demographic factors are often treated as background exogenous variables rather than as structural constraints on economic dynamics.

This paper aims to fill this gap by assessing Armenia's demographic outlook through 2100 in the context of global structural demographic transformations. The study seeks to answer the following key questions: (1) what position Armenia occupies under conditions of global demographic redistribution; (2) how Armenia's long-term demographic trends compare with those of the world's fastest-growing

and fastest-declining populations; and (3) whether demographic variables manifest themselves as drivers of economic growth in Armenia in the short term.

The scientific contribution of the paper lies in interpreting Armenia's demographic dynamics not as a secondary social process, but as a strategic determinant of economic security. The combination of long-term demographic projections and short-term empirical assessment makes it possible to demonstrate that, in Armenia's case, demographic factors exert a structural and non-automatic influence on economic growth. This approach allows Armenia to be positioned within the broader framework of global demographic polarization and to be conceptualized as a key issue of long-term development and policy strategy.

Literature Review

The relationship between demographic processes and economic development has long been one of the central research areas in socio-economic sciences. The classical demographic transition theory interprets population dynamics primarily as an outcome of socio-economic development, identifying gradual declines in fertility and mortality as consequences of economic growth, urbanization, improvements in healthcare, and the expansion of education (Kirk, 1996, Notestein, 1945). Within this framework, demographic change was historically viewed mainly as a derivative result of economic development rather than as an independent constraint or driver of growth.

However, beginning in the second half of the twentieth century, an alternative perspective emerged emphasizing the structural role of demographic factors in shaping economic development. Coale and Hoover (1958) and Easterlin (1967) demonstrated that population growth rates and age structure can directly influence capital accumulation, savings behavior, and long-term economic growth. Their findings suggested that demographic dynamics are not merely passive outcomes but active determinants of economic performance.

This perspective was further developed through the concept of the demographic dividend. Bloom and Williamson (1998) showed that an increase in the relative share of the working-age population can generate favorable conditions for rapid economic growth. Similarly, Bloom et al. (2003) argued that demographic changes can create a window of opportunity for accelerated development, provided that appropriate institutional frameworks, educational investments, and macroeconomic stability are in place. In this context, demographic structure becomes a powerful, although temporary, driver of economic growth.

Nevertheless, later empirical research emphasized that the demographic dividend is not automatic. Bloom et al. (2003) and Canning et al. (2015) demonstrated that its realization depends critically on human capital accumulation, labor market flexibility, and effective economic policies. Without these supporting conditions, demographic advantages may fail to translate into economic growth.

At the same time, demographic transition also involves structural constraints. Lee and Mason (2010) showed that periods of working-age population expansion are inevitably followed by population ageing, rising dependency ratios, and declining labor supply. In such conditions, demographic change becomes a limiting factor for economic growth. Similar conclusions were reached by Fogel (2004) and Prettnner

(2013), who described demographic transition as a dual process with initially positive and subsequently constraining effects.

One of the central themes in recent demographic literature is population ageing and its macroeconomic implications. Ageing societies experience declining labor supply, increasing fiscal pressure on pension and healthcare systems, and rising risks to fiscal sustainability (Börsch-Supan, 2003, European Commission, 2021, Galasso and Profeta, 2018). These trends are particularly pronounced in Europe, East Asia, and post-Soviet countries, where fertility rates remain below replacement levels.

Global demographic projections published by the United Nations Population Division provide essential evidence on long-term demographic trends. These projections show that future population growth will be concentrated primarily in Sub-Saharan Africa, while Europe and much of Asia will experience population stagnation or decline (UN DESA, 2022, UN DESA, 2024). This phenomenon is widely described as global demographic polarization, reflecting increasing divergence between regions with rapidly growing populations and those experiencing demographic decline (Coleman, 2006, Goujon et al., 2018, Lutz et al., 2008, Vollset et al., 2020).

Rapid population growth in developing countries presents both opportunities and risks. Ashraf et al. (2013) and Cervellati and Sunde (2015) found that demographic expansion contributes to economic growth only when accompanied by investments in education and human capital. Otherwise, high population growth may increase unemployment, poverty, and institutional pressures. Kelley and Schmidt (2005) similarly concluded that in weak institutional environments, population growth often becomes an economic burden rather than a growth driver.

In contrast, declining demographic trends characterize many developed economies. Studies on Japan, South Korea, and European countries show that shrinking labor forces may significantly constrain long-term economic growth, even in technologically advanced economies (Acemoglu and Restrepo, 2017, Jones, 2022, Maestas et al., 2023). Migration is often considered a potential solution, but evidence suggests that it rarely fully compensates for natural population decline and may create new social and political challenges (OECD, 2023, UN DESA, 2019).

Demographic challenges are particularly critical for transition economies. Research on post-Soviet countries indicates that population decline and emigration are associated with human capital loss, economic instability, and institutional weakening (EBRD, 2021, Milanovic, 2016, World Bank, 2020). In this context, demographic change becomes a key component of economic security.

The literature on Armenia remains relatively limited and focuses mainly on fertility decline, migration, and population ageing (National Statistical Committee of the Republic of Armenia, 2023, UNDP Armenia, 2021). Although these studies provide important insights, Armenia's demographic position within the broader framework of global demographic polarization remains insufficiently explored. Moreover, limited research has examined demographic dynamics as structural risk factors for long-term economic development and economic security (UNDP, 2023, World Bank, 2023).

This paper addresses this gap by integrating global demographic analysis with Armenia's long-term demographic projections and short-term empirical evidence. This approach allows demographic change to be interpreted not as a secondary social factor, but as a structural determinant of economic growth and economic security, particularly in the context of a small and open economy.

Unlike previous studies, this paper explicitly integrates demographic projections with economic security interpretation, positioning demographic decline as a structural macroeconomic risk.

Methodology

This study applies an integrated methodological framework combining (a) descriptive–comparative analysis of long-term demographic projections and (b) short-term empirical assessment for Armenia, with the objective of identifying whether demographic factors operate as automatic drivers of economic growth or function primarily as structural constraints from the perspective of economic security. The research design is structured in two complementary stages.

Data Sources and Harmonization

The long-term demographic analysis is based on data from the United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects 2024 (medium variant), covering the period 2025–2100. The dataset includes total population size, regional population levels (Africa, Asia, Europe), and Armenia’s long-term demographic indicators.

To ensure cross-country comparability and to assess structural shifts among the world’s largest populations, projections from the French National Institute for Demographic Studies (INED) were also incorporated. Data harmonization was ensured through the following procedures:

- (1) All calculations were conducted using identical benchmark years (2025, 2050, 2075, and 2100);
- (2) Consistent definitions of total population (millions of persons) were applied;
- (3) Uniform rounding rules were used across datasets; and
- (4) When indicators were drawn from different sources, the respective source was explicitly identified to avoid inconsistencies.

For the short-term empirical analysis, an integrated annual dataset for Armenia covering the period 2000–2024 was constructed using the World Bank’s World Development Indicators (WDI) and the UN World Population Prospects database. The dataset includes real Gross Domestic Product (constant 2015 USD), working-age population (ages 15–64), population growth rate, labor force indicators, trade openness (% of GDP), gross fixed capital formation (% of GDP), and inflation (consumer price index).

Long-Term Demographic Analysis and Structural Redistribution

In the first stage, long-term demographic trends were evaluated using absolute population changes, relative shares, and compound annual growth rates (CAGR). The CAGR was calculated using the standard formula:

$$CAGR = \left(\frac{P_{2100}}{P_{2025}} \right)^{\frac{1}{75}} - 1 \quad (1)$$

where P_t represents population size in year t .

Regional structural changes were assessed using population share indicators:

$$Share_{r,t} = \frac{P_{r,t}}{P_{World,t}} \times 100 \quad (2)$$

This approach allows identification of the global redistribution of demographic weight across regions and provides the basis for positioning Armenia within the global structure of demographic polarization.

Short-Term Structural Relationship Analysis

In addition to long-term demographic projections, the study evaluates the structural relationship between Armenia's economic performance and demographic dynamics using descriptive and graphical analysis based on annual data for 2000–2024. Real GDP and working-age population trends are compared using logarithmic transformation and time-series visualization.

This approach allows identification of structural relationships, trend divergence, and potential demographic constraints on economic growth without imposing restrictive econometric assumptions. The descriptive-structural method is particularly appropriate in the case of small sample sizes and long-term demographic analysis, where the objective is to identify structural patterns rather than short-term statistical causality.

Methodological Limitations

Long-term demographic projections are subject to uncertainty, particularly regarding fertility, mortality, and migration assumptions. The medium-variant scenario was selected as the internationally accepted benchmark for comparative analysis.

The short-run component relies on descriptive and graphical evidence and therefore does not claim causal identification. The purpose is to document structural divergence and its economic-security implications rather than to estimate short-run elasticities.

Analysis

The analysis confirms that global demographic trends developments in the 21st century will be characterized not by uniform population growth or decline, but by pronounced structural transformation, centered on the geographical redistribution of population and increasing demographic polarization among countries. Calculations based on the United Nations *World Population Prospects 2024* medium variant scenario reveal key emerging trends at both regional and country levels.

At the regional level, the analysis shows that Africa represents the main driver of global demographic growth. In 2025, Africa's population is approximately 1.55 billion, accounting for 18.8 percent of the world's total population. By 2100, this figure is projected to reach around 3.81 billion, representing 37.5 percent of the global population. This change nearly doubles Africa's demographic weight and highlights the region's growing importance in the global distribution of human resources. Africa's population growth follows an almost linear and continuous trajectory throughout the observed period.

Asia exhibits a different demographic pattern. Although Asia remains the most populous region in 2025, with approximately 4.84 billion people and a 58.7 percent global share, a gradual decline begins after 2050. By 2100, Asia's population is projected to decline to approximately 4.61 billion, and its global share will fall to 45.3 percent. These results indicate that Asia is entering the late stage of demographic transition, where sustained fertility decline and population ageing begin to outweigh earlier population growth.

Europe demonstrates an even more pronounced negative demographic trend. Europe's population is estimated at approximately 744 million in 2025, representing about 9 percent of the global population, but is projected to decline to around 592 million by 2100, reducing its global share to 5.8 percent. The persistent and nearly continuous population decline throughout the entire period reflects deep and long-term demographic challenges.

At the country level, the analysis reveals significant restructuring among the world's most populous countries. India is projected to maintain its position as the world's most populous country through 2100, with moderate but positive population growth. In contrast, China's population is projected to decline sharply, falling from approximately 1.42 billion in 2025 to around 0.63 billion in 2100. This represents one of the most significant demographic shifts globally and has major implications for global demographic balance.

The role of African countries increases substantially at the global level. The populations of Pakistan, Nigeria, the Democratic Republic of the Congo, Ethiopia, and Tanzania are projected to more than double, indicating that most global population growth during the second half of the 21st century will be concentrated in low- and middle-income countries. Graphical analysis shows that population growth rates in these countries significantly exceed the global average, further reinforcing demographic polarization.

The analysis of the fastest-growing countries confirms that high fertility rates, young age structures, and early stages of demographic transition represent the main drivers of population growth. Conversely, the fastest-declining countries—primarily located in Europe and East Asia—demonstrate that low fertility, emigration, and ageing contribute to sustained long-term population decline.

Within this global context, Armenia’s demographic position can be characterized as structurally vulnerable. Although Armenia is neither among the most populous nor the fastest-declining countries globally, its demographic trajectory is comparable to countries experiencing population contraction and rapid ageing. Comparative analysis of regional and country-level trends indicates that Armenia is positioned within the negative pole of global demographic polarization, without the institutional and migration-related adjustment mechanisms present in some developed economies.

The analysis confirms that global demographic trends are shaping a new structural environment in which countries’ economic and social prospects increasingly depend on their demographic profiles. For Armenia, these findings highlight the importance of demographic policy as a fundamental component of economic security and long-term development strategy.

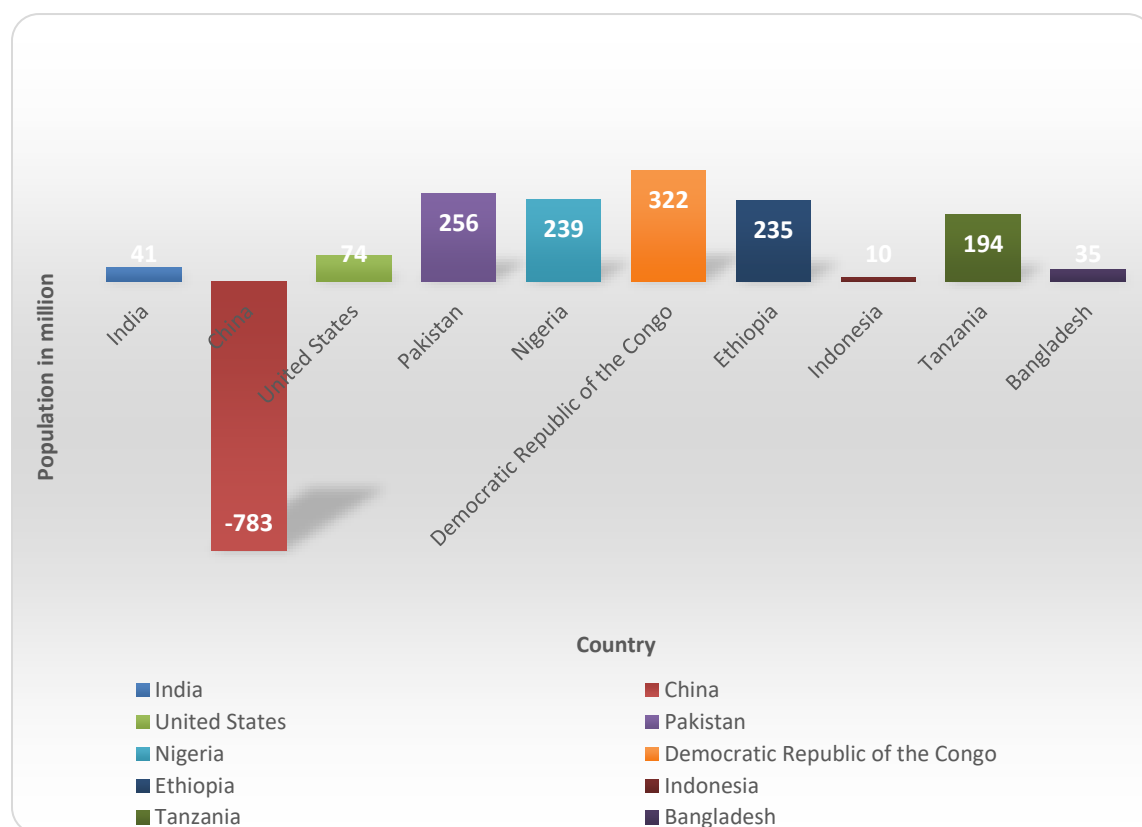
Overall, the data indicate that global demographic dynamics during the 21st century will undergo profound structural transformation, driven primarily by the geographical redistribution of population growth from Asia to Africa and the relative demographic weakening of developed economies.

Table 1. Long-Term Population Dynamics of Selected Major Countries, 2025–2100: Structural Shifts in the Global Demographic Balance

Country	Population in 2025 (million)	Population, 2100 (projection, million)	Change (million)
India	1464	1505	41
China	1416	633	-783
United States	347	421	74
Pakistan	255	511	256
Nigeria	238	477	239
Democratic Republic of the Congo	109	431	322
Ethiopia	132	367	235
Indonesia	286	296	10
Tanzania	69	263	194
Bangladesh	174	209	35

Source. Compiled and calculated based on data from the (UN DESA, 2024) and (INED, 2025)

India's population growth, although limited in absolute numerical terms, has strategic significance, as it confirms that the country, despite entering the late stage of demographic transition, will retain its position as the world's most populous nation through 2100. The moderate growth observed under conditions of declining fertility is driven by a large initial population base and a relatively young age structure, allowing India to avoid rapid demographic decline.



Source: Author's calculations based on (UN DESA, 2024) and World Bank WDI.

Figure 1. Structural Polarization of Population Increase and Decrease Across Major Countries of the World (2025–2100)

China's projected sharp population decline represents one of the most profound and symbolic demographic shocks of the 21st century. The loss of nearly half of its population by 2100 is driven by persistently low fertility rates, rapid population ageing, and structural changes in reproductive behavior. This trend implies a contraction of the labor force, an increase in dependency ratios, and constraints on long-term economic growth potential, which may further accelerate the global redistribution of economic power.

In contrast, the steady population growth of the United States stands out among developed countries and reflects the institutional distinctiveness of its demographic model. The combined effects of natural increase and immigration allow the United States to maintain and even expand its demographic mass, unlike much of Europe and East Asia, where population decline is becoming a systemic phenomenon.

The rapid population growth projected in Pakistan, Nigeria, the Democratic Republic of the Congo, and Ethiopia indicates that the global demographic future will be largely shaped by low- and middle-income countries, particularly in Sub-Saharan Africa. In these countries, population more than doubles due to high fertility rates, declining mortality resulting from healthcare improvements, and their position in the early stages of demographic transition. At the same time, the limited adaptability of economic and institutional systems creates serious development challenges related to education, labor markets, food security, and urban infrastructure.

The near-stagnant population dynamics of Indonesia and Bangladesh reflect an intermediate stage of demographic transition, where declining fertility begins to offset natural population growth. These countries face a dual challenge: they must capitalize on the remaining demographic dividend while simultaneously preparing for rapid population ageing.

Tanzania's multiple-fold population increase further reinforces the African demographic trajectory, highlighting that even countries with relatively small initial populations can become major global demographic centers. This development has important implications for regional economic integration, migration flows, and natural resource management.

Overall, the analysis of the presented data indicates that by 2100 the world will not face a uniform pattern of population growth or decline, but rather a process of demographic polarization. While countries in Africa and South Asia will accumulate the majority of global human resources, East Asia and several advanced economies will face deepening challenges related to labor shortages, population ageing, and the financial sustainability of social protection systems. In this context, demographic factors become not only socio-economic variables but also key determinants of global economic security and geopolitical balance.

Presented below are the ten countries projected to experience the fastest population growth through 2100, based on the United Nations Department of Economic and Social Affairs, Population Division's *World Population Prospects 2024* (medium/median variant), as well as long-term

comparable projections provided by INED. These estimates cover the period 2025–2100 and reflect both the population multiplication factor and the compound annual growth rate.

It should be noted that the precise identification of the “world’s ten fastest-growing countries” would require comparison across the full set of all countries globally. However, the INED dataset provides long-term projections for the fifty most populous countries in 2025. Therefore, the countries presented below should be interpreted as the fastest-growing within this group, rather than as the absolute fastest-growing globally. Nevertheless, given that the majority of the world’s population is concentrated within this group, the sample provides a representative basis for assessing global demographic dynamics.

Table 2. Fastest-Growing Countries by Population Worldwide (2025–2100): Comparative Evaluation of Growth Intensity and Average Annual Growth Rates

Country	Population, 2025 (million)	Population, 2100 (million)	Growth Factor (×)	CAGR (% per year)
Angola	39	150	3.85	1.81
Democratic Republic of the Congo	113	431	3.81	1.8
Tanzania	71	263	3.7	1.76
Côte d’Ivoire	33	104	3.15	1.54
Afghanistan	44	130	2.95	1.45
Mozambique	36	104	2.89	1.42
Ethiopia	135	367	2.72	1.34
Sudan	52	137	2.63	1.3
Yemen	42	110	2.62	1.29
Madagascar	33	85	2.58	1.27

Note. The table was compiled based on data from the United Nations, Department of Economic and Social Affairs, Population Division, *World Population Prospects 2024* (medium scenario), using comparable long-term projection indicators provided by INED. The countries presented were selected from among the 50 most populous countries in the world in 2025 and are ranked according to the population growth multiplication factor for the period 2025–2100. The average annual growth rate (CAGR) was calculated for the respective period.

The data presented in Table 2 indicate that the world’s fastest-growing populations are almost entirely concentrated in Sub-Saharan Africa, with the exception of Afghanistan and Yemen. High population multiplication factors (×2.5–×3.9) and average annual growth rates of approximately 1.3–1.8 percent are characteristic of countries that are in the early stages of demographic transition and exhibit high fertility rates and young age structures.

In these countries, rapid population growth is driven not only by high natural increase but also by improvements in healthcare and reductions in child mortality, while educational and economic transition processes often lag behind demographic dynamics. As a result, a situation emerges in which

quantitative population growth is not accompanied by proportional human capital accumulation, which may limit the real potential for economic growth.

From a global demographic perspective, this group of countries is becoming the primary center of human resource accumulation during the second half of the 21st century, thereby intensifying demographic polarization across world regions. This trend stands in sharp contrast to countries such as Armenia, which face the challenges of population decline and ageing, and highlights that the restructuring of global demographic balance has not only quantitative but also profound socio-economic implications.

Table 3. Comparative Analysis of Demographic Dynamics in Armenia and the Fastest-Growing Countries Worldwide (2025–2100, Medium Scenario)

Country	Population, 2025 (million)	Population, 2100 (million)	Total Change (%)	CAGR (% per year)
Armenia	2.95	1.69	-42.7	-0.74
Angola	39	150	285	1.81
Democratic Republic of the Congo	113	431	281	1.8
Tanzania	71	263	270	1.76
Ethiopia	135	367	172	1.34
Madagascar	33	85	158	1.27

The comparison presented in Table 3 clearly demonstrates that Armenia is positioned at the structurally opposite pole of global demographic polarization. While in several Sub-Saharan African countries the average annual population growth rate ranges between approximately +1.3 and +1.8 percent, the corresponding figure for Armenia is −0.74 percent. This difference is not merely quantitative but deeply structural, reflecting the countries’ positions at different stages of demographic transition.

The high CAGR values observed in African countries are driven by high fertility rates, young age structures, and gradual declines in mortality, resulting in rapid population accumulation. In contrast, Armenia’s negative CAGR reflects persistent fertility decline, population ageing, and the relative contraction of working-age population groups. Although Armenia’s annual population decline appears moderate in numerical terms, its cumulative effect over a 75-year period results in the loss of nearly half of the country’s population.

This comparison highlights that, at the global level, a unified demographic trend is not emerging, but rather a bipolar system. On the one hand, there are countries accumulating human resources and becoming the primary sources of the future labor force; on the other hand, there are

countries facing labor shortages and rising dependency ratios. Armenia belongs to the latter group but lacks the institutional and migration-based compensatory mechanisms that partially mitigate demographic decline in several developed countries.

From the perspective of economic security, this implies that Armenia’s demographic challenges cannot be viewed solely as the outcome of social or biological processes. The negative CAGR directly constrains economic growth potential, the fiscal base, and the long-term sustainability of social systems. In this context, Armenia’s demographic dynamics should be interpreted as a structural risk emerging within the broader process of global demographic polarization, requiring targeted and long-term policy responses.

Table 4. Fastest-Declining Countries by Population Worldwide (2025–2100): A Comparative Long-Term Assessment

Country	Population in 2025 (million)	Population in 2100 (million)	Population Decline (%)	Average Annual Change	Key Demographic Drivers
Bulgaria	6.4	3.8	–41%	–0.7%	Emigration, population aging
Latvia	1.9	1.1	–42%	–0.8%	Decline in the working-age population
Lithuania	2.8	1.7	–39%	–0.7%	Emigration, low fertility
Ukraine	36	24	–33%	–0.5%	Long-term consequences of war, migration
Japan	122	75	–38%	–0.6%	Extreme population aging, lowest fertility levels
South Korea	51	31	–39%	–0.7%	Among the lowest fertility rates in the world
Italy	59	45	–24%	–0.4%	Population aging, low fertility
Spain	48	40	–17%	–0.3%	Migration mitigates the decline
Greece	10.3	8.1	–21%	–0.35%	Fertility decline, emigration
Armenia	2.95	1.69	–42.7%	–0.74%	Fertility decline, migration pressures

Source. The data and calculations presented in the table are based on the United Nations Population Division, *World Population Prospects 2024* (Medium variant). The decline rate was calculated as the relative percentage change in population over the period 2025–2100, while the average annual trend reflects the proportionality of long-term demographic decline.

The countries presented in Table 4 are characterized by persistent negative demographic dynamics typical of the final stage of demographic transition, where fertility levels remain significantly below the replacement threshold over the long term (TFR < 2.1, and in many cases < 1.5). This trend is accompanied by increasing life expectancy, resulting in accelerated population ageing and rising dependency ratios.

In the case of Eastern European and Baltic countries (Bulgaria, Latvia, Lithuania), demographic decline is further intensified by long-term emigration of working-age population groups, which disrupts the internal mechanisms of natural population reproduction and reduces domestic labor supply. In Ukraine, demographic decline is additionally driven by the long-term consequences of military conflict, forced population displacement, and changes in reproductive behavior.

In advanced East Asian economies (Japan, South Korea), the primary driver of population decline is extremely low fertility, associated with the high economic cost of family formation, intense labor market competition, and changing social norms. In Southern Europe (Italy, Spain, Greece), migration flows partially mitigate population decline but do not reverse the long-term negative trend.

For small and medium-sized economies, including Armenia, population decline acquires not only socio-demographic but also economic security significance. It constrains economic growth potential, reduces domestic market size, and increases pressure on social security and pension systems. In this context, the effectiveness of demographic policy becomes a structural factor in ensuring long-term development and sustainability.

Table 5. Global Polarization of Long-Term Population Growth and Decline (2025–2100): A Comparative Assessment Based on United Nations Demographic Projections

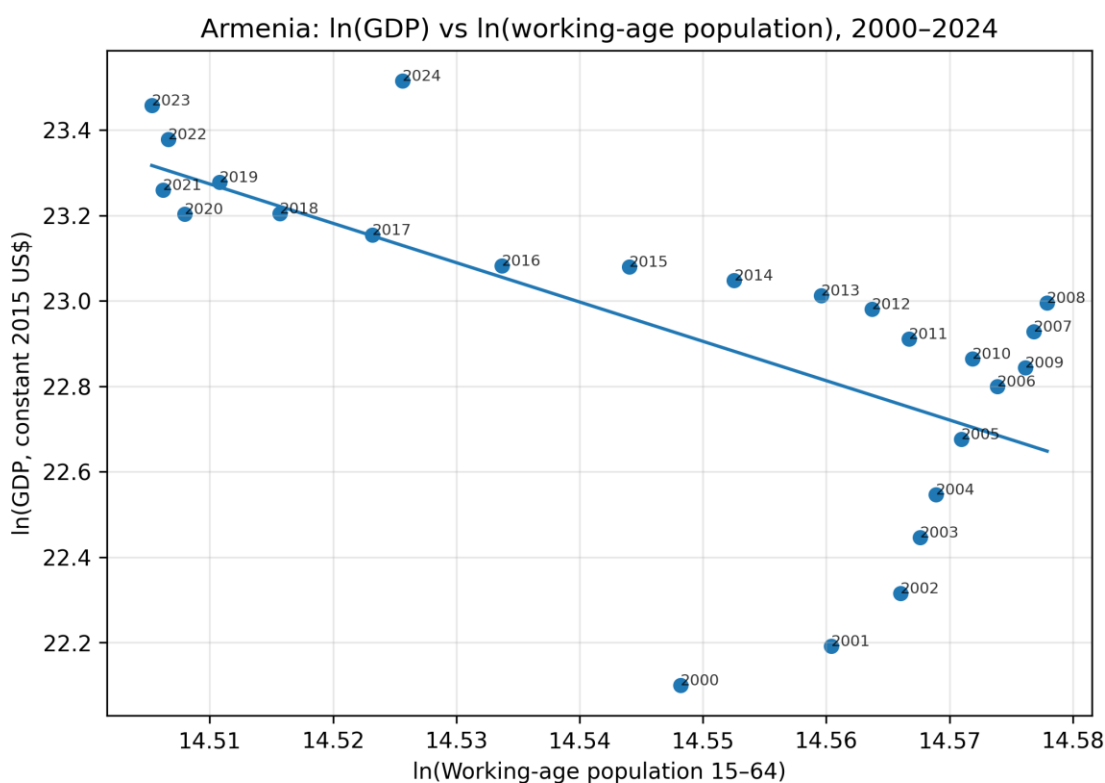
Group	Country	Population in 2025 (million)	Population in 2100 (million)	Total Change (%)	Average Annual Growth Rate (%)	Key Demographic Drivers
Growing	Niger	27	190	×7.0	+2.6%	High fertility and very young age structure
Growing	Democratic Republic of the Congo	113	431	×3.8	+1.8%	High fertility and declining mortality
Growing	Tanzania	71	263	×3.7	+1.75%	Late urbanization stage
Growing	Ethiopia	135	367	×2.7	+1.3%	Young population age structure
Growing	Mali	23	83	×3.6	+1.7%	Large family size and slow educational transition
Declining	Bulgaria	6.4	3.8	−41%	−0.7%	Emigration and population ageing
Declining	Latvia	1.9	1.1	−42%	−0.8%	Working-age population emigration
Declining	Japan	122	75	−38%	−0.6%	Extreme ageing and ultra-low fertility
Declining	Republic of Korea	51	31	−39%	−0.7%	Ultra-low fertility rates
Declining	Armenia	2.95	1.69	−42.7%	−0.74%	Fertility decline and migration pressures

Source: Calculations are based on the United Nations Population Division's *World Population Prospects 2024* (Medium variant) projections for the period 2025–2100. For growing countries, a combination of total population multiplication factor and compound annual growth rate (CAGR) was used, while for declining countries, relative percentage population decline was applied.

The table illustrates the global demographic polarization of the 21st century. Countries experiencing rapid population growth are primarily located in the early stages of demographic transition, where high fertility is combined with young age structures and declining mortality, without a corresponding transition in education and productivity. Under these conditions, population growth represents a potential resource but simultaneously creates pressures on labor markets, infrastructure, and food security.

In contrast, countries with declining populations are typically in the final stage of demographic transition. In these countries, persistently low fertility, rapid population ageing, and the emigration of working-age population groups lead to labor shortages, rising dependency ratios, and increasing financial pressure on social protection systems. In small and medium-sized economies (e.g., Armenia, the Baltic states), this process evolves into not only a demographic issue but also a matter of economic security.

The comparative analysis confirms that future global population growth and decline do not occur uniformly; rather, they represent spatially and institutionally differentiated processes that require distinct development strategies and socio-economic policy responses.



Note: GDP is expressed in constant 2015 U.S. dollars. Data sources: World Bank *World Development Indicators (WDI)* and United Nations *World Population Prospects 2024*.

Source: Author's calculations based on UN DESA (2024) and World Bank WDI.

**Figure 2. Relationship between Armenia's Real GDP and Working-Age Population
(Ages 15–64), 2000–2024 (Natural Logarithms)**

Figure 2 presents the relationship between Armenia's real Gross Domestic Product ($\ln\text{GDP}$) and the working-age population ($\ln\text{WAP}$, ages 15–64) over the period 2000–2024. The logarithmic specification of the data allows for the assessment not only of the direct co-movement between the variables but also of their structural relationship, approximating an elasticity-type interpretation.

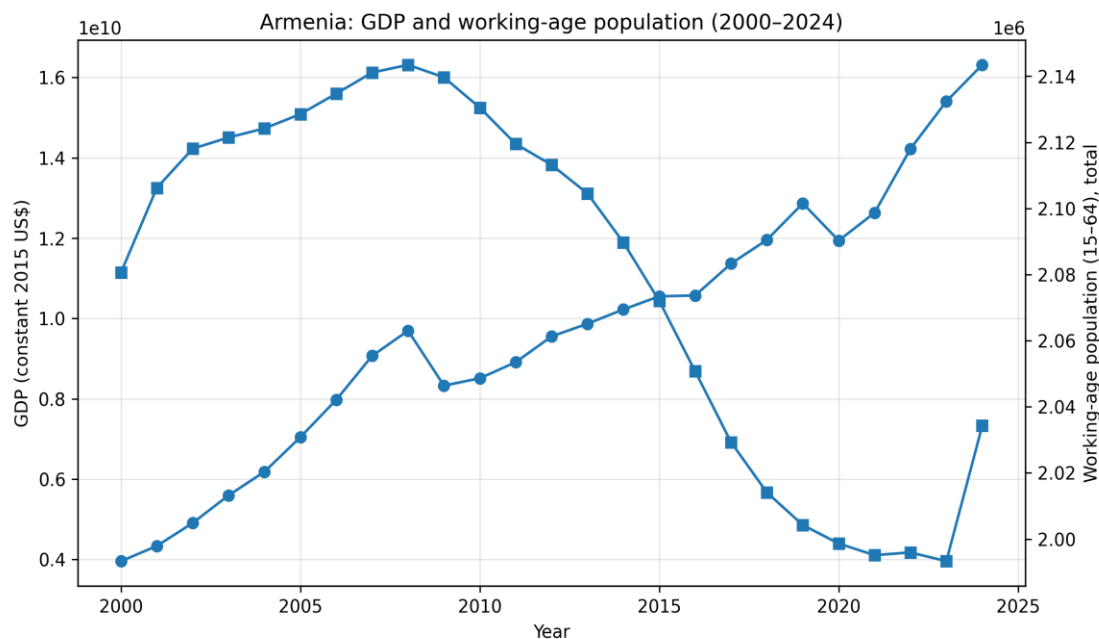
The figure shows that during the observed period, the size of the working-age population generally exhibits a declining or stagnant trend, while real GDP demonstrates sustained long-term growth, particularly after the second half of the 2010s. As a result, a visibly negative-sloped relationship emerges, indicating that Armenia's economic growth during this period was not driven by quantitative expansion of the working-age population. On the contrary, growth occurred under conditions of a relatively narrowing labor force base.

The distribution of observations over time clearly reveals structural phases. During 2000–2008, higher levels of $\ln\text{WAP}$ are associated with relatively lower levels of $\ln\text{GDP}$, reflecting low-productivity growth characteristic of the transition period. In the period 2009–2014, some structural disruption is observed due to the global financial crisis and subsequent recovery; however, the overall structural pattern remains intact. During 2015–2024, significant growth in $\ln\text{GDP}$ occurs alongside a continued decline or near stagnation of the working-age population, indicating the increasing role of productivity gains, capital intensity, and external factors such as trade and investment.

This finding has important structural and policy implications. On the one hand, it demonstrates that in the short and medium term, economic growth can be sustained even under conditions of a shrinking working-age population, provided that compensatory mechanisms such as capital accumulation, technological progress, or external economic openness are present. On the other hand, the negative relationship highlights a long-term risk, as the continued decline in the working-age population may constrain growth potential if productivity improvements fail to fully offset quantitative labor losses.

Thus, the figure visually confirms one of the central arguments of this paper: Armenia's demographic dynamics represent not merely a social background factor, but a structural constraint on economic growth. The contraction of the working-age population constitutes a long-term economic

security challenge, requiring targeted policy responses aimed at enhancing productivity, stimulating investment activity, and mitigating adverse demographic trends.



Note: GDP is expressed in constant 2015 U.S. dollars. Data sources: World Bank *World Development Indicators (WDI)* and United Nations *World Population Prospects 2024*.

Source: Author's calculations based on UN DESA (2024) and World Bank WDI.

Figure 3. Dynamics of Armenia's Real Gross Domestic Product and Working-Age Population (Ages 15–64), 2000–2024

Figure 3 presents the time-series comparison between Armenia's real Gross Domestic Product (GDP) and its working-age population (ages 15–64) over the period 2000–2024. The use of dual axes allows simultaneous observation of economic output and the demographic base, revealing structural imbalances between them.

The data show that Armenia's economy has gone through several distinct phases during the observed period. Between 2000 and 2008, real GDP experienced rapid and sustained growth, accompanied by a relatively stable level of working-age population. This phase is characterized by recovery-driven and expansionary growth, in which economic output increased partly in parallel with the quantitative labor force base.

During 2009–2014, economic growth slowed and short-term instability emerged, reflecting the impact of the global financial crisis and its aftermath. During this period, the working-age population began to decline gradually, while GDP maintained relatively stable but more moderate growth rates.

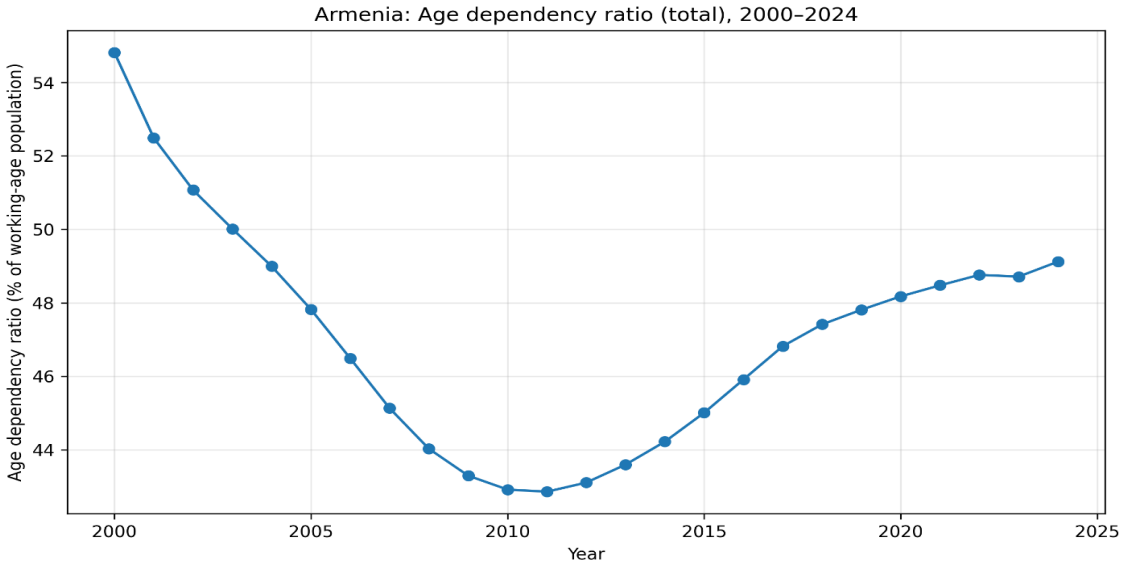
This indicates that economic activity increasingly depended not on labor force expansion but on other factors, such as capital accumulation, productivity improvements, and external economic conditions.

After 2015, a more pronounced structural divergence became evident. The decline in the working-age population became more visible and persistent, while real GDP resumed its upward trajectory, particularly during 2017–2019 and 2021–2024. This opposing movement suggests that Armenia’s economic growth during this period occurred under conditions of a shrinking labor force base, highlighting the growing importance of productivity gains and capital intensity.

The temporary GDP decline observed in 2020, followed by subsequent recovery, reflects the impact of the pandemic shock and post-crisis adjustment processes. Despite this disruption, the overall downward trend in the working-age population remained uninterrupted, underscoring the inertial and long-term nature of demographic dynamics.

Over time, Armenia’s economic growth and working-age population trends have become increasingly decoupled. In the short and medium term, economic growth may continue despite a shrinking labor force. However, in the long term, such a structure poses economic security risks. Continued decline in the working-age population may constrain productive capacity, increase dependency ratios, and intensify pressure on social protection and fiscal systems.

Thus, the presented figure visually confirms the central premise of this study: Armenia’s demographic dynamics constitute a structural constraint on economic growth, and their impact must be considered not only in social terms but also within the broader strategic framework of economic security.



Note: The age dependency ratio is calculated as the ratio of non-working-age population groups (ages 0–14 and 65+) to the working-age population (ages 15–64), expressed as a percentage. Data sources: World Bank *World Development Indicators (WDI)* and United Nations *World Population Prospects 2024*.

Source: Author’s calculations based on UN DESA (2024) and World Bank WDI.

Figure 4. Dynamics of Armenia’s Total Age Dependency Ratio, 2000–2024

Figure 4 presents the dynamics of Armenia’s total age dependency ratio over the period 2000–2024, which represents an important indicator of demographic structure and economic burden. This indicator reflects the ratio at which the working-age population must support the socio-economic needs of non-working-age groups and therefore has direct relevance for assessing economic security and the sustainability of social systems.

The data indicate that between 2000 and 2010, Armenia experienced a continuous and significant decline in the age dependency ratio, falling from approximately 55 percent to around 43 percent. This trend was driven by several factors simultaneously, including a sharp decline in fertility, which reduced child dependency, as well as a relatively high share of working-age population. This period can be characterized as a relative “demographic window of opportunity,” when the dependency burden was at its lowest and the relative weight of the labor force was at its highest.

After 2010, a reversal of this trend becomes evident. The age dependency ratio began to increase gradually, reaching approximately 49 percent by 2024. This increase is primarily driven by accelerated population ageing, rising life expectancy, and a decline in the number of working-age individuals. While in the earlier period the dependency burden was largely determined by child dependency, in the past decade its growth has been mainly driven by the expanding share of the elderly population, which carries significantly different economic and fiscal implications.

The rising trend in the age dependency ratio implies an increasing social and economic burden on the working-age population. This may manifest through higher expenditures on social protection and pension systems, increased demand for healthcare services, and growing fiscal pressure. At the same time, in the context of a shrinking working-age population, rising dependency ratios may constrain economic growth potential, particularly if productivity gains fail to fully compensate for quantitative labor force losses.

Thus, the figure shows that Armenia has transitioned from a phase of declining dependency ratios to a phase of sustained increase, reflecting its progression into the later stage of demographic transition. This dynamic confirms one of the key conclusions of the paper: Armenia's demographic challenges increasingly represent not only social concerns but also issues of economic security. The rising age dependency ratio should be interpreted as a structural risk requiring long-term and systemic policy responses aimed at increasing labor force participation, improving productivity, and ensuring the financial sustainability of social protection systems.

Table 6. Long-Term Dynamics of Regional Distribution and Structural Changes in the World Population (Africa, Asia, Europe, 2025–2100)

Year	Africa, Population (million)	Asia, Population (million)	Europe, Population (million)	World, Population (million)	Africa, Share (%)	Asia, Share (%)	Europe, Share (%)
2025	1550	4835	744	8232	18.8	58.7	9
2050	2467	5280	703	9664	25.5	54.6	7.3
2075	3291	5105	637	10250	32.1	49.8	6.2
2100	3814	4613	592	10180	37.5	45.3	5.8

The data presented in Table 6 indicate that the regional distribution of the world's population will undergo profound and long-term structural transformation during the 21st century. Over the period 2025–2100, population growth will be concentrated almost entirely in Africa, whose population is projected to increase by approximately 2.3 billion people, more than doubling its total size. As a result, Africa's share of the global population will rise from 18.8 percent to 37.5 percent, nearly doubling over the observed period.

In contrast, Asia exhibits an opposing demographic trend. Although Asia will remain the world's most populous region, its population will enter a gradual phase of decline after 2050. The region's share of the global population will decrease from 58.7 percent to 45.3 percent, reflecting the late stage of demographic transition and the increasing impact of population ageing.

Europe's demographic trajectory is even more negative. The region's population is projected to decline continuously throughout the entire period, falling from 744 million to 592 million, while its global share will decrease from 9 percent to 5.8 percent. This indicates that Europe is moving into the declining pole of global demographic polarization, characterized by sustained ageing and contraction of the working-age population.

Table 7. Long-Term Dynamics of Armenia's Population by Key Benchmark Years (1990–2100): Absolute and Relative Changes, and CAGR Estimates for 2025–2100 (Medium Scenario)

Benchmark Year	Population (million)	Absolute Change from Previous Period (million)	Percentage Change from Previous Period (%)
1990	3.552		
2000	3.126	-0.426	-12.01
2010	2.931	-0.195	-6.22
2020	2.891	-0.040	-1.37
2025	2.952	0.061	2.13
2030	2.851	-0.101	-3.42
2050	2.495	-0.356	-12.49
2075	2.054	-0.441	-17.68
2100	1.692	-0.362	-17.62

Note. Population data are presented in millions of persons and are based on the United Nations Department of Economic and Social Affairs, Population Division, World Population Prospects 2024 (medium scenario). The columns titled “Change relative to the previous period” were calculated based on the absolute (million persons) and relative (%) differences in population between the respective periods. The CAGR indicator reflects the average annual rate of population change during 2025–2100. The “total change” for 2025→2100 was calculated as the projected population in 2100 minus the population in 2025, while the CAGR was calculated as $(P_{2100} / P_{2025})^{(1/75)} - 1$.

Source: United Nations, Department of Economic and Social Affairs, Population Division. *World Population Prospects 2024* (online data portal).

The data presented in Table 7 indicate that Armenia's long-term demographic dynamics over the period 1990–2100 are characterized by structural decline, interrupted by short-term stabilization episodes. With a population of approximately 3.55 million in 1990, Armenia had already lost more than 12 percent of its demographic potential by 2000. This decline was driven by the economic shocks of the early independence period, high levels of emigration, and a sharp decrease in fertility. This phase can be characterized as an accelerated and unbalanced onset of demographic transition.

During 2000–2010, the population decline continued but slowed in relative terms, amounting to approximately –6.2 percent. This indicates that the effects of emigration and natural decrease were partially mitigated, although their structural foundations remained unchanged. In the period 2010–2020, population change became nearly stagnational (–1.37 percent), reflecting a temporary stabilization of demographic decline, associated with modest improvements in fertility and a relative balancing of migration flows.

The population increase recorded during 2020–2025 (+2.13 percent) has an exceptional and short-term character. It does not reflect a fundamental demographic reversal but is rather associated with temporary migration and statistical accounting factors. Therefore, this increase does not alter the overall long-term declining trend, which resumes beginning from 2025–2030.

By 2050, Armenia's population is projected to decline to approximately 2.50 million, representing a decrease of nearly –12.5 percent compared to 2025. At this stage, demographic dynamics become more structurally entrenched, driven by persistently low fertility, rapid population aging, and the continued contraction of working-age groups. By 2075 and 2100, the rates of population decline deepen further, reaching –17.7 percent and –17.6 percent, respectively, indicating a long-term inertial and difficult-to-reverse demographic decline.

Over the period 2025–2100, the total population decrease amounts to approximately –1.26 million people, or –42.7 percent, while the average annual rate of decline (CAGR) is estimated at –0.74 percent. Although the annual decline may appear moderate in numerical terms, its cumulative effect creates serious structural consequences, including labor force contraction, an increase in the dependency ratio, and intensified pressure on social systems.

Armenia's demographic trajectory through 2100 thus emerges as a stable and long-term process of decline, without clear signs of spontaneous recovery. This trend has profound implications not only for social development but also for economic security, limiting economic growth potential, fiscal sustainability, and institutional development capacity. Therefore, the results presented confirm that demographic policy should be considered a core component of economic and national security strategy, rather than a secondary social issue.

Policy Implications and Recommendations

The results of this study indicate that Armenia's demographic challenges cannot be effectively addressed through isolated or short-term policy measures. Demographic dynamics represent a structural and inertial process for the country, with direct implications for economic growth potential, labor market stability, and the long-term sustainability of social systems. Therefore, the demographic factor must be integrated into the core framework of Armenia's economic and institutional development strategy.

First, under conditions of a declining working-age population, the central direction of economic policy must be productivity enhancement. As the opportunities for quantitative expansion are limited,

the only sustainable path to maintaining growth is through improvements in human capital quality, technological modernization, and increased capital intensity. This implies the targeted development of the education system, vocational training, and lifelong learning programs, particularly in alignment with labor market demands.

Second, demographic policy should be transformed from a narrow social support instrument into a long-term economic security tool. Fertility promotion policies may have only limited effects unless accompanied by measures to reduce the economic cost of family formation, improve housing affordability, expand childcare infrastructure, and increase women's participation in the labor market. Without this comprehensive approach, fertility increases are unlikely to become sustainable in the long term.

Third, migration policy in Armenia should be viewed not merely as a response to demographic losses but as a structural governance issue. To mitigate the negative effects of emigration, it is necessary to transition toward a selective and targeted migration strategy that promotes the return and reintegration of highly qualified professionals, while also creating conditions for immigration in sectors where labor shortages are becoming structural.

Fourth, the increase in the old-age dependency ratio requires a long-term revision of social protection and pension systems. In an aging society, the financial sustainability of social systems cannot be ensured solely through increases in current revenues. It is necessary to promote extended labor market participation among older age groups, introduce flexible work arrangements, and revise pension system incentives in accordance with the new demographic reality.

Finally, Armenia's economic development strategy must take into account the consequences of global demographic polarization. The accumulation of human resources in growing regions and labor shortages in declining regions are reshaping the global competitive environment. For Armenia, this implies that external economic integration, technological cooperation, and stronger linkages with international labor markets can serve as additional mechanisms for mitigating demographic constraints.

In the case of Armenia, demographic policy should be viewed not as a secondary social policy domain but as a fundamental component of economic security and long-term development strategy. Without a systemic and integrated policy response, demographic constraints will continue to reinforce structural vulnerabilities and limit the country's development potential.

Conclusion

This study demonstrates that Armenia's demographic dynamics in the 21st century are emerging as a stable and structural constraint on economic growth rather than an automatic driver of it. The structural and graphical analysis indicates that Armenia's economic growth has increasingly occurred independently of demographic expansion. This finding supports theoretical approaches according to which the economic impact of demographic factors depends not on quantitative population growth but on structural characteristics such as age composition, labor force quality, and productivity dynamics.

These results should be interpreted in the context of Armenia's long-term demographic outlook. Demographic projections and graphical analysis show that by 2100 Armenia will be in a phase of population decline, contraction of working-age groups, and an increasing old-age dependency ratio. Under these conditions, quantitative changes in the labor force do not translate into productivity gains, and demographic developments function as a structural environment that constrains economic growth potential. Long-term emigration trends and the loss of young and middle-aged cohorts further deepen the limitations on human capital reproduction.

The structural and graphical analysis complements this picture by showing that Armenia's economic growth has increasingly relied on productivity gains, capital accumulation, and external economic integration rather than demographic expansion. The divergence between GDP growth and the declining working-age population indicates that demographic dynamics do not function as an automatic engine of economic growth. Instead, demographic decline represents a structural constraint that may increasingly limit economic potential if productivity improvements fail to compensate for labor force contraction.

The main scientific contribution of this article lies in interpreting Armenia's demographic developments not as a secondary social process but as a strategic variable of economic security. The study demonstrates that the demographic factor in Armenia has a structural rather than automatic effect on economic growth, and its impact manifests through the long-term stability of the labor market, fiscal base, and social systems. This approach makes it possible to position Armenia within the broader framework of global demographic polarization, revealing its place within the emerging structural divergence between demographic centers of growth and decline.

The findings confirm that Armenia's demographic challenges cannot be addressed solely through macroeconomic policy instruments. Without targeted demographic, migration, and human capital development strategies, the decline of the working-age population and population aging will

continue to constrain economic growth potential and intensify long-term economic security risks. Therefore, demographic policy should be considered a core component of Armenia's economic and institutional development strategy. Future research may extend this analysis by incorporating the structural effects of migration, productivity dynamics, and regional comparative modeling.

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