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Modelling the impact of demographic changes on labour productivity and economic activity in Ukraine during wartime and post-war recovery

Abstract. The aim of the study was to analyse the impact of demographic changes on Ukraine's labour force and economic development during wartime and post-war recovery. The study was theoretical and empirical in nature and covered the period 2021-2025, whilst data from 2026 were used for certain indicators. The methodology was based on the application of statistical, comparative and scenario-based analysis of demographic and macroeconomic indicators, the calculation of an approximate labour productivity index based on real gross domestic product and the number of employees, as well as the use of a production function and a scenario-based model for decomposing economic output into labour and productivity components. The results showed that Ukraine's population fell from 40.998 million in 2021 to a projected 32.283 million in 2026, whilst the number of births decreased from 273.8 thousand to 168.8 thousand in 2025. At the same time, the current decline in the labour force was primarily driven by external migration, war-related losses and other factors reducing the labour supply, whilst the falling birth rate poses predominantly long-term demographic risks. Following a 28.8% fall in real gross domestic product in 2022, the economy began a gradual recovery, although the pace of economic growth remained volatile. The estimated real GDP index per officially employed worker, having fallen from 100 in 2021 to 80.9 in 2022, gradually rose to 87 in 2025, though it remained 13% below the pre-war level. Scenario modelling showed that, under conditions of active technological modernisation, the real output index could rise to 118.7% of the 2025 level by 2030, whilst under a pessimistic scenario it would fall to 90.3%. The practical significance of the study lies in the possibility of using the results obtained when formulating state demographic, social and economic policies aimed at restoring the labour force, increasing labour productivity and ensuring Ukraine's sustainable economic development

Keywords: migration; human capital; population; gross domestic product; labour force

INTRODUCTION

Full-scale war has brought about changes in Ukraine's demographic structure, accompanied by a decline in population, large-scale migration processes, a reduction in the number of people of working age, and a transformation in the regional distribution of the labour force. These processes have affected the functioning of the labour market, the level of employment, the availability of labour for enterprises, and economic performance. At the same time, the country's post-war recovery will require significant labour resources for the reconstruction of infrastructure, the development of production, and the achievement of sustainable economic growth.

Population decline, intensified migration, an ageing population and a shrinking proportion of economically active citizens pose long-term risks to Ukraine's economic development amidst the challenges of war and post-war recovery. N. Petrukha *et al*. (2024) investigated the impact of demographic transformations on economic processes. The authors analysed trends in population decline, changes in fertility rates, migration flows and the impact on the labour market, the investment climate, the budgetary system and the country's economic development. The authors concluded that population decline, rising migration and a shrinking economically active population were holding

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back economic growth, reducing tax revenues and diminishing the country's investment attractiveness. The study also justified the need to adapt state policy to the new demographic conditions and identified areas for supporting Ukraine's recovery processes. Demographic trends and the impact on social and labour relations were analysed in a study by N. Dehtiar (2025), which found a sustained decline in population size, an increase in the proportion of older people, a gender imbalance in older age groups, and the negative impact of internal migration and mobilisation processes on the supply of labour to the economy. The author also identified the main challenges for employment and justified the need to develop mechanisms for adapting the labour market to new socio-economic conditions.

Demographic losses caused by the war have a significant impact on the formation of the labour force and the prospects for Ukraine's economic development. I. Shubala (2022) conducted research into the impact of demographic and migration factors on economic processes. The author analysed the consequences of war-induced migration flows, changes in the population structure and the impact on the labour market and the prospects for economic recovery. The study revealed that the loss of human capital, a decline in the economically active population, an increase in the demographic burden and the outflow of working-age citizens abroad may hinder the country's post-war recovery. The main demographic transformations in Ukraine in the context of the state's economic security, analysed by A.M. Shtangret & B.M. Vityk (2026), made it possible to compare demographic trends with those of European Union countries and to develop scenarios for future changes depending on the duration of hostilities. The study found that population decline, falling birth rates, an ageing population, migration losses and labour shortages have a negative impact on the tax base, economic productivity, innovation, competitiveness, and the country's prospects for post-war recovery.

Military hostilities are accompanied by an intensification of depopulation processes, increased population migration and a transformation of the age structure of society. The impact of demographic factors on economic processes was examined in the "Comprehensive Analysis of the Demographic Situation in Ukraine" conducted by D. Naporchuk (2024), which covered indicators of fertility, mortality, the age structure of the population, migration processes and trends in the size of the working-age population. The study found that demographic ageing, depopulation and mass migration lead to a reduction in the labour force, an increase in the demographic burden, a decline in labour productivity and a rise in the state's social expenditure. V. Veklych (2024) analysed the sex-age structure of Ukraine's population, trends in demographic ageing, fertility dynamics, migration processes and the impact on the economy's supply of labour resources. The study found that the decline in the working-age population, the rise in the proportion of older people, the outflow of labour abroad and the mismatch between labour supply and demand are exacerbating labour shortages and hampering economic growth.

The deterioration in demographic indicators in the context of war leads to a reduction in the labour force and places a greater strain on the socio-economic system. An analysis of the demographic situation in Ukraine during the war, carried out by I.V. Yaremina *et al.* (2023), involved assessing the scale of population migration, trends in birth and death rates, and identifying the main factors influencing population replacement. The results showed that military operations contributed to an intensification of depopulation processes, an increase in the outflow of the working-age population, a deterioration in the age structure of the population, and a heightened risk of labour shortages in the future. M.I. Khoroshev (2024) analysed changes in the demographic situation in Ukraine during the war by examining the dynamics of birth rates, mortality rates, migration processes and changes in the age and sex structure of the population. The analysis revealed a sustained decline in the birth rate, a deterioration in natural population growth indicators, significant migration losses and a reduction in the size of the working-age population. It was also established that the mass exodus of young people and economically active citizens, population ageing and changes in the demographic structure may have a negative impact on the labour market, the country's economic potential and the prospects for post-war recovery.

At the same time, there remains insufficient research into the quantitative assessment of the impact of demographic changes on labour productivity, as well as the development of economic and mathematical models to forecast the consequences for Ukraine's economic development during the war and in the post-war recovery period. The aim of this study was to conduct a comprehensive assessment of the impact of demographic changes on Ukraine's labour force and economic development in the context of full-scale war and post-war recovery. To achieve this aim, the following objectives were set: to analyse Ukraine's demographic and economic indicators during the war; to assess the impact of demographic changes on the labour force, labour productivity and economic activity; and to develop a scenario-based economic-mathematical model for assessing the possible consequences of demographic transformations for Ukraine's economic development.

MATERIALS AND METHODS

The study was of a theoretical and empirical nature and covered the period 2021-2025, during which large-scale demographic and socio-economic changes took place, caused by the full-scale war in Ukraine. The chosen time frame made it possible to compare pre-war indicators from 2021 with trends from 2022 to 2025 and to analyse changes in population size, the labour force, the state of the labour market, labour productivity and macroeconomic dynamics. Statistical analysis of the data was carried out using descriptive statistical methods, in particular by determining absolute and relative changes in indicators, conducting index analysis and comparing the values across individual years. For certain indicators relating to population size, external migration and labour shortages, data and estimates for 2026 were also used, as these reflected the current state of demographic processes and the labour market. The medium-term consequences of the decline in the labour force were assessed using scenario modelling of the dynamics of Ukraine's real output for the period 2026-2030.

The theoretical and methodological basis of the study was formed by the principles of economic theory concerning the interrelationship between demographic processes,

labour supply, human capital, labour productivity and economic development. For the theoretical interpretation of the impact of demographic changes on economic development, the Cobb-Douglas production function of the form (1):

$$Y = A \times K^{\alpha} \times (hL)^{\beta}, \quad (1)$$

where Y – output or real GDP; K – physical capital; L – the index of the number of officially employed workers; h – the level of human capital per worker; A – the technological and organisational factor; α and β – the parameters of output elasticity with respect to the respective factors.

The production function was used as a theoretical basis for interpreting the potential to offset the reduction in the labour component through the accumulation of human and physical capital, automation, and technological and organisational changes. No empirical estimation of the parameters α and β was carried out due to the lack of complete official statistical data on the individual components of the production function.

Demographic transformations were examined using methods of statistical and comparative analysis. The dynamics of Ukraine's population in 2021-2026 were analysed on the basis of data from the International Monetary Fund (2026). A comparison of annual indicators was used to determine the overall scale of population decline and to assess the associated narrowing of the potential labour force base. Natural population decline was defined as the difference between the number of births and deaths in the relevant year and was used to characterise the intensity of depopulation processes.

Changes in formal wage employment were analysed using data from the Pension Fund of Ukraine's Register of Insured Persons (2025a) on the total number of insured persons and the number of officially registered wage earners in 2021-2025. These indicators were used as a data source for assessing trends in formal wage employment. However, the indicators do not cover the self-employed, those in informal employment, the unemployed or other participants in the labour market; therefore, these indicators are not regarded as a measure of the total labour force or aggregate labour supply in Ukraine. Regional shifts in the distribution of the labour force, linked to internal population movements, the outflow of workers from frontline regions and the uneven distribution of economic activity, were analysed on the basis of M. Trachuk (2024). Structural changes in the labour market and the worsening labour shortage were examined taking into account analytical assessments by the National Institute for Strategic Studies (2025).

External migration processes were examined using a comparative analysis of the dynamics of decisions to grant temporary protection to Ukrainian citizens in European Union countries between 2023 and 2025, based on data from Eurostat (2026). These indicators were used to assess the intensity of new migration flows and to characterise the long-term impact of forced external migration on Ukraine's labour force. Ukraine's economic dynamics were analysed using indicators of changes in real GDP and GDP at current prices in the national currency and US dollars for the period 2021-2025. The analysis was based on data from the State Statistics Service of Ukraine (n.d.) and the International Monetary Fund (2026). The dynamic comparison method was used to analyse economic trends.

Following the outbreak of full-scale war, the State Statistics Service of Ukraine temporarily suspended the publication of the Labour Force Survey results, making it impossible to use comparable official indicators of the labour force size, labour force participation rate, employment rate, unemployment rate (according to ILO methodology) and potential labour force. In view of this, the study utilised available administrative indicators of official wage-earning employment, registered unemployment and labour shortages, which, whilst not a complete substitute for labour market statistics, do allow for the characterisation of certain trends in the functioning of the labour market under wartime conditions. The trends in the number of registered unemployed in 2021-2025 were analysed based on data from the Ministry of Finance, whilst the number of employees in 2021-2025 was analysed using data from the Pension Fund of Ukraine (2025a). Absolute and relative changes were determined for each indicator over the available period. The reduction in the number of registered unemployed was interpreted in the context of demographic losses, outward migration, mobilisation processes and a reduction in labour supply, rather than as direct evidence of an improvement in labour market conditions.

An index-based method was used to estimate labour productivity. Due to the lack of complete comparable data on the total number of employed persons, the productivity indicator was defined as the real GDP index per employed person registered in the Pension Fund of Ukraine system. The year 2021 was taken as the base year, for which the value of all indices was set at 100. The index of the number of employees was calculated using formula (2):

$$I_{L,t} = \frac{L_t}{L_{2022}} \times 100, \quad (2)$$

where $I_{L,t}$ – the index of the number of employees in year t; L_t – the number of employees in the relevant year; L_{2022} – the number of employees in the base year.

The real GDP index, with a base of 2021 = 100, was derived by successively applying the official annual rates of change in real GDP. The real GDP index per employee was calculated using formula (3):

$$I_{LP,t} = \frac{I_{Y,t}}{I_{L,t}} \times 100, \quad (3)$$

where $I_{LP,t}$ – the index of real GDP per employee; $I_{Y,t}$ – the index of real GDP; $I_{L,t}$ – the index of the number of employees.

The calculations were based on data from the State Statistics Service of Ukraine (n.d.), the International Monetary Fund (2026) and the Pension Fund of Ukraine (2025a). The resulting indicator was regarded as an approximate macroeconomic estimate of labour productivity, as it did not cover the self-employed, those in informal employment and other categories of the working population that were not represented in the administrative data used.

To assess labour shortages and structural mismatches between labour supply and demand, a descriptive analysis was carried out of current indicators relating to the number of vacancies, jobseekers, registered unemployed and the occupations experiencing the greatest labour shortages. Figures as at 1 June 2026 were used to characterise the

current balance between employers' demand and the available labour supply. To characterise the functioning of enterprises, recruitment policies and hiring plans, the findings of the "Labour Market Barometer 2025" study (GRC, 2026) were also summarised.

To investigate the relationship between demographic processes and economic development, scenario-based economic and mathematical modelling was applied, which made it possible to assess possible trajectories of change in real output under various combinations of labour force dynamics and labour productivity. The economic-mathematical modelling was carried out using a scenario-based decomposition of the real output index into labour and productivity components. Since the labour productivity index was defined in the study as the ratio of the real GDP index to the index of the number of employees (Formula 3), this ratio was algebraically transformed into the form shown in (4) for the construction of the scenario model:

$$Y_t = L_t \times LP_t, \quad (4)$$

where Y_t – the real output index; L_t – the index of the number of employees; LP_t – the labour productivity index.

The main limitation of the study is the lack of up-to-date and comparable official data on the labour force, employment, labour force participation and unemployment, calculated according to ILO methodology, following the start of the Russian Federation's full-scale armed invasion of Ukraine on 24 February 2022. The use of alternative estimates and expert assessments was limited due to differences in methodology, population coverage and the temporal comparability of such data. Consequently, these indicators could not be included in the scenario model, which reflects only that part of the relationship that can be quantified on the basis of available official information.

Demographic losses were reflected through changes in the labour component, whilst technological modernisation, automation, the accumulation of human capital and organisational adaptation of enterprises were reflected through changes in the productivity component. The scenario calculations were performed sequentially using formula (5):

$$Y_t = Y_{t-1} \times (1 + g_L) \times (1 + g_{LP}), \quad (5)$$

where Y_{t-1} – the index of real output in the previous year; g_L – the average annual rate of change in the number of officially employed workers; g_{LP} – the average annual rate of change in labour productivity. The base value of the index in 2025 was set at 100.

Three scenarios for Ukraine's economic development in 2026-2030 were formulated. The optimistic scenario envisaged an annual reduction in the number of officially employed workers by 0.5% and a 4% increase in labour productivity, subject to the partial return of migrants, active automation and investment in human and physical capital. The baseline scenario was based on a 1.5% annual reduction in the number of officially employed workers and a 2.5% annual increase in productivity, which corresponded to the persistence of labour shortages and gradual organisational and technological adaptation. The pessimistic scenario envisaged an annual reduction in the number of officially employed workers by 3% and a productivity increase of only 1%, assuming continued emigration, weak investment activity and limited technological modernisation. Assumptions regarding changes in the number of employees were formulated taking into account long-term estimates of the decline in the total population and the working-age population (Tverdostup, 2023; Order of the Cabinet of Ministers of Ukraine No. 922-r, 2024). Therefore, a figure of -1.5% is taken as the baseline, -0.5% as a more favourable scenario assuming a partial return of the population, and -3% as a stress scenario in the event of worsening migration and demographic losses. The baseline productivity growth rate of 2.5% was determined taking into account its estimated average annual growth rate for 2022-2025, which stood at approximately 2.4%. The values of 4% and 1% were used, respectively, to reflect accelerated and limited technological adaptation. The parameters of the scenarios are conditional estimates and are not regarded as statistically assessed forecasts or established cause-and-effect relationships.

RESULTS

Demographic transformations and the impact on Ukraine's labour force

Full-scale war has brought about significant changes to the demographic situation in Ukraine, manifested in a decline in population size, a fall in the birth rate and large-scale migration (Strelchenko *et al.*, 2024). These trends have directly influenced the formation of the country's labour force, the level of economic activity among the population and the prospects for post-war economic recovery. To assess demographic changes in Ukraine, population trends for 2021-2026 have been analysed (Fig. 1).

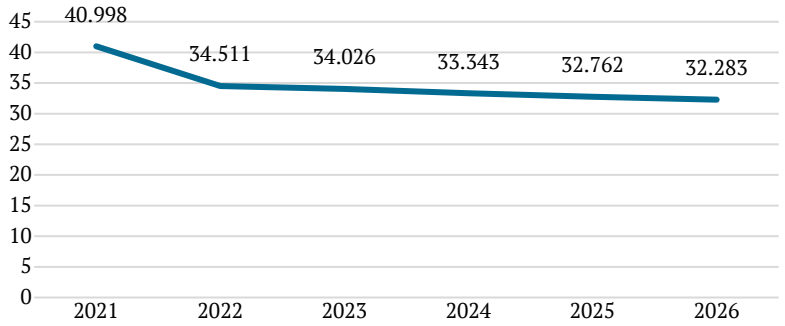


Figure 1. Population trends in Ukraine for 2021-2026, in millions

Source: compiled by the author based on data from the International Monetary Fund (2026)

According to Figure 1, Ukraine's population fell from 40.998 million to a projected 32.283 million between 2021 and 2026 – a decrease of almost 8.7 million people, or 21.3%. The sharpest decline occurred in 2022 following the outbreak of full-scale war, whilst in 2023-2026 the rate of population decline remained lower but steady. These trends indicate the persistence of long-term demographic losses, which are leading to a contraction in the country's labour force, exacerbating labour shortages and creating additional constraints on economic development and post-war recovery. Birth and mortality rates characterise population replacement processes and reflect demographic trends that influence the formation of the country's labour force (Park *et al.*, 2022). Against the backdrop of full-scale war, these indicators have undergone changes, which have affected the dynamics of natural population decline. To assess these changes, Table 1 presents the trends in birth rates, death rates and natural population decline in Ukraine for 2021-2025.

Table 1. Trends in birth rates and death rates in Ukraine for 2021-2025, in thousands

Year	Birth rate	Mortality	Natural population decline
2021	273.8	714.3	-440.5
2022	206	541.7	-335.7
2023	187.4	496.2	-308.8
2024	176.7	495.1	-318.4
2025	168.8	485.3	-316.5

Source: compiled by the author based on data from the Ministry of Justice of Ukraine (n.d.)

The data in Table 1 indicate a sustained decline in Ukraine's natural population growth rates between 2021 and 2025. The number of births fell from 273,800 in 2021 to 168,800 in 2025, a decrease of 38.3%. The sharpest decline was recorded in 2022 following the outbreak of full-scale war, when the birth rate fell by 24.8 % compared with the previous year. At the same time, the death rate remained higher than the birth rate throughout the entire period under review. Despite a reduction in the number of deaths from 714,300 in 2021 to 485,300 in 2025, the natural population decline in 2025 stood at 316,500.

These findings confirm the deepening of depopulation processes and a further decline in the country's demographic potential. At the same time, the decline in the birth rate between 2021 and 2025 cannot be regarded as the direct cause of the current labour shortage, as those born during this period will not yet have reached working age within the forecast horizon of the study. The current labour shortage is largely linked to external migration, mobilisation processes, war-related losses, internal population displacement and occupational-territorial imbalances, whilst the decline in the birth rate poses long-term risks to the replenishment of Ukraine's labour force.

Data from the Pension Fund of Ukraine's Register of Insured Persons (2025a) make it possible to track changes in the number of officially registered employees. According to available data, in December 2024 the total number of insured persons stood at 10.618 million, of whom 8.839 million were employees. By way of comparison, in December 2023 the number of employees stood at 8.906 million, and in December 2022 at 8.634 million. Consequently, following an increase in 2023, there was a slight decline throughout 2024, which, against a backdrop of a worsening labour shortage, points to limited scope for further expansion of formal employment. The mass exodus of citizens abroad, mobilisation processes, war-related losses and the internal displacement of the population have altered the age and geographical structure of Ukraine's labour force. This has resulted in an uneven distribution of labour resources across regions and an exacerbation of geographical imbalances in the labour market. Regions that have taken in a significant number of internally displaced persons have faced increased pressure on local infrastructure and labour markets, whilst frontline regions have been characterised by a decline in economic activity, an outflow of labour and a loss of productive capacity (Trachuk, 2024).

The scale of external migration among the Ukrainian population remains significant, although the intensity of new migration flows is gradually declining. According to the data, the number of decisions granting temporary protection to Ukrainian citizens in EU countries fell from 1.056 million in 2023 to 794,800 in 2024 and 683,500 in 2025 (Eurostat, 2026). At the same time, as of early 2026, there were around 5.9 million citizens outside Ukraine, indicating that forced external migration remains on a significant scale and continues to have a long-term impact on the country's labour force.

The decline in the working-age population has gradually transformed the structure of the Ukrainian labour market. According to estimates by the National Institute for Strategic Studies (2025), against the backdrop of structural changes in the labour market, the problem of labour shortages is becoming increasingly acute, exacerbated by demographic losses, large-scale external migration and mobilisation processes. At the same time, educational and vocational mismatches between the labour supply and employers' needs are becoming more pronounced, making it difficult for businesses to secure skilled workers and hindering the recovery of economic activity.

These processes have resulted in a worsening of the structural labour shortage in sectors that underpin the functioning of the economy and critical infrastructure. The greatest labour shortages are observed among skilled industrial workers, construction workers, drivers, electricians, welders and healthcare workers, whilst the available labour supply does not fully meet employers' needs. Consequently, demographic changes are affecting not only the size of the labour force but also its occupational and skills structure, which limits the potential for increasing labour productivity, complicates the provision of labour to enterprises and hampers Ukraine's post-war economic recovery.

Analysis of labour productivity and the functioning of the labour market in Ukraine

In addition to changes in population size and the structure of the labour force, demographic processes affect macroeconomic indicators, business activity and the functioning

of the labour market. In the context of the war, population decline, emigration, and a reduction in the labour force pose additional constraints on the country's economic development. To assess Ukraine's economic dynamics during the war, the trends in gross domestic product for 2021-2025 have been analysed (Table 2).

Table 2. Trends in Ukraine's real GDP and GDP volume for 2021-2025

Year	Real GDP, change, %	GDP at current prices, billion UAH	GDP at current prices, billion USD
2021	3.4	5,459.6	199.8
2022	-28.8	5,239.1	162
2023	5.5	6,628	181.2
2024	2.9	7,662.4	190.8
2025	1.8	8,876.7	212.9

Source: compiled by the author based on data from the State Statistics Service of Ukraine (n.d.) and the International Monetary Fund (2026)

The data in Table 2 show that Ukraine's economy experienced its deepest recession in 2022, after which a phase of gradual recovery began. At the same time, the trend in real GDP indicates a slowdown in economic growth, suggesting that structural constraints on economic development persist even after the most acute phase of the crisis has ended. One of the structural constraints on further recovery may be the reduction in the labour force due to demographic losses, large-scale emigration and labour shortages. Following the outbreak of full-scale war, the State Statistics Service of Ukraine temporarily suspended the publication of labour force survey results, which limited access to official data on the size of the economically active population, employment, and unemployment. Consequently, data on the number of registered unemployed persons were used to assess changes in the labour market. The relevant indicators are presented in Table 3.

Table 3. Selected administrative indicators of the Ukrainian labour market for 2021-2025

Year	Number of people with registered unemployed status at the end of the year, in thousands	Officially registered employees, in millions
2021	295	9.807
2022	186.5	8.634
2023	96.1	8.906
2024	94.2	8.839
2025	88.3	8.875
Absolute and relative change over the period	-206.7 people (-70.1%; 2025/2021)	-0.932 million people (-9.5%; 2025/2021)

Note: the number of registered unemployed covers only those who officially applied to the State Employment Service of Ukraine and had unemployed status as at the end of the relevant year; therefore, it does not reflect overall unemployment according to ILO methodology; this figure is not the same as the number of people who received unemployment benefits during December, as recorded in the Pension Fund of Ukraine's Register of Insured Persons; the number of employees, according to the Pension Fund of Ukraine, reflects official wage-earning employment, including those who received financial support, but does not include the self-employed or those in informal employment; it also differs from the broader category of persons who received wages, income, financial support, benefits, or compensation; the data presented are used solely to characterise specific administrative aspects of the labour market's functioning and are not subject to direct quantitative comparison

Source: compiled by the author based on data from the State Employment Service of Ukraine (2026) and the Pension Fund of Ukraine (2022; 2023; 2024; 2025b; 2026)

The data in Table 3 show that between 2021 and 2025, the number of registered unemployed fell significantly. At the same time, this indicator reflects only administratively registered unemployment and cannot be regarded as a measure of the overall level of unemployment in the country. This change occurred against a backdrop of large-scale external migration, mobilisation processes, demographic losses and a reduction in labour supply; therefore, it does not in itself indicate an improvement in the labour market situation. According to data from the Pension Fund of Ukraine's Register of Insured Persons, the number of officially registered employees fell from 9.807 to 8.875 million between 2021 and 2025, a decrease of 9.5%. The sharpest decline occurred in 2022, after which the figure remained relatively stable at between 8.8 and 8.9 million people. The continued high demand for workers from employers, coupled with reports of labour shortages, points to the existence of structural imbalances in the labour market, whereby administrative indicators of official employment do not fully reflect the true scale of the labour shortage (Han & Lee, 2020).

The administrative indicators provided do not allow for a direct assessment of labour productivity. To provide a rough macroeconomic assessment of the relationship between economic dynamics and the utilisation of labour resources, an index of real GDP per employee was calculated for the period 2021-2025. The year 2021 was chosen as the base year, as it was the last full pre-war year, enabling an assessment not only of the pace of recovery following the 2022 downturn, but also of the extent to which the economy is approaching its pre-war level of productivity. Due to the lack of complete comparable labour force survey data after 2022, the real GDP index per employed person

registered in the Pension Fund of Ukraine system has been used as a proxy indicator of labour productivity. To ensure comparability, the number of employees in December of the relevant year was used, taking into account those in receipt of monetary allowances. The results of the calculation are presented in Table 4.

Table 4. Estimated trends in labour productivity in Ukraine for 2021-2025

Year	Real GDP index, 2021 = 100	Number of employees, million	Index of the number of employees, 2021 = 100	Real GDP index per employee, 2021 = 100
2021	100	9.807	100	100
2022	71.2	8.634	88	80.9
2023	75.1	8.906	90.8	82.7
2024	77.3	8.839	90.1	85.8
2025	78.7	8.875	90.5	87

Note: the number of employees is given as at December of the relevant year; the real GDP per employee index is calculated as the ratio of the real GDP index to the number of employees' index; this indicator is an approximate macroeconomic estimate, as it does not cover the self-employed, those in informal employment and other categories of the working population

Source: calculated by the author based on data from the State Statistics Service of Ukraine (n.d.), the International Monetary Fund (2026) and the Pension Fund of Ukraine (2022; 2023; 2024; 2025a; 2025b; 2026)

The results of the calculations show that in 2022, the real GDP per employee index fell to 80.9% of the 2021 level, as the decline in real GDP was significantly greater than the reduction in the number of officially employed workers. Between 2023 and 2025, the indicator rose gradually: to 82.7% in 2023, 85.8% in 2024 and 87% in 2025. Consequently, compared with the low point in 2022, estimated labour productivity rose by approximately 7.5%; however, in 2025 it still remained 13% below the pre-war level of 2021. This trend indicates a gradual recovery in output per worker, but does not provide grounds for claiming a full return to pre-war productivity levels.

At the same time, the growth in estimated productivity should not be interpreted unambiguously as a sustained technological improvement in the economy's efficiency. Under wartime conditions, it may have been partly driven by a reduction in the workforce, an increase in the workload on existing staff, and the uneven recovery of individual sectors. Consequently, the growth in output per employee was accompanied by a worsening labour shortage and the risk of excessive labour intensification. In the long term, offsetting demographic losses requires not only a more intensive use of the existing labour force, but also the accumulation of human capital, the renewal of fixed capital and the acceleration of technological development.

From the perspective of the production function, output is determined by the interaction of physical capital, human capital and the technological-organisational factor. A reduction in the number of workers diminishes the available labour supply; however, its negative impact can be partially offset by capital accumulation, the upskilling of workers, automation, and growth in total factor productivity. In formal terms, this relationship can be represented by a production function:

$$Y = A \times K^{\alpha} \times (hL)^{\beta},$$

where Y – output or real GDP; K – physical capital; L – the labour force; h – the level of human capital per worker; A – the technological and organisational factor; α and β – the elasticity parameters of output with respect to the respective factors.

In the Ukrainian context, demographic losses primarily reduce the L component, whilst the migration of skilled workers, disruptions to educational pathways and limitations on vocational training may have a negative impact on the h component. The economy's ability to sustain output depends on the extent to which the reduction in the labour force is offset by the accumulation of human and physical capital, automation, and technological and organisational changes.

Further evidence of the decline in Ukraine's labour potential is the deepening labour shortage in the labour market. It is estimated that, to ensure long-term economic growth and post-war recovery, the country's economy will require around 4.5 million additional workers in the long term. As at 1 June 2026, there were 241,000 job vacancies listed on the Unified Job Portal, whilst only 141,000 people were seeking work through the State Employment Service of Ukraine (2026), of whom 94,000 had the status of registered unemployed. On average across the country, there were 17 vacancies for every 10 jobseekers, indicating that demand for labour exceeded supply. The most acute shortage was observed among skilled workers, in particular seamstresses, drivers, electricians, fitters, track fitters, turners, welders, and car mechanics. Such trends confirm the emergence of structural imbalances in the labour market, whereby the occupational and skills profile of the available workforce is increasingly out of step with the needs of the economy.

The results of the "Labour Market Barometer 2025" survey provided further evidence of sustained economic activity in Ukraine in 2025. According to the survey, 91% of companies continued to operate at full capacity – 5 percentage points more than in the previous year – whilst a further 8% of enterprises were operating at reduced capacity and planned to resume full operations. Revenue growth was reported by 33% of companies, which is 5 percentage points higher than in 2024, whilst 28% of enterprises reported stable revenues, which was 6 percentage points higher than the previous year's figure. At the same time, 95% of employers were recruiting staff, compared with 88% of companies in 2024. Almost half of the enterprises were recruiting staff across all areas of the operations, and 99% of organisations reported the intention to continue recruiting staff in 2026. At the same time, labour shortages remained one of the main challenges for businesses: 37% of companies noted a shortage of candidates for blue-collar roles, whilst 58% of employers reported a shortage of

staff across all categories. Among the main priorities for businesses in 2025 were retaining the workforce (65% of companies), maintaining competitive pay levels (61.6%) and retaining existing sales markets (47.7%). These figures indicate a gradual recovery in business activity, which occurred alongside a worsening labour shortage and increased competition for workers (GRC, 2026).

The findings suggest that, in the context of the war, Ukraine's economic activity is increasingly determined not so much by the quantitative parameters of the labour force as by the ability of enterprises to adapt to its shortage. The reduction in the labour force is accompanied by a structural transformation of the labour market, whilst maintaining production volumes requires a more efficient use of human capital, the modernisation of the production base and the introduction of technological solutions. This confirms the validity of applying economic-mathematical approaches to assess the impact of demographic changes on labour productivity and Ukraine's economic development.

A scenario-based model for assessing economic dynamics in the context of changes to the labour component of the economy

The analysis carried out has shown that, given the existing statistical limitations, the quantitative assessment of the impact of individual demographic indicators on economic development was conducted in the form of a hypothetical scenario-based assessment of economic dynamics under different rates of change in the number of officially employed workers. Therefore, including population size, fertility, natural decline, migration, and the labour force in a single regression model is methodologically inappropriate, as these indicators partly reflect the same demographic processes. To avoid conceptual duplication of explanatory variables and the problem of multicollinearity, the study employs a scenario-based model decomposing economic output into labour and productivity components:

$$Y_t = L_t \times LP_t,$$

where Y_t – the real output index; L_t – the index of the number of employees; LP_t – the labour productivity index. Within the model, demographic losses are reflected through changes in the labour component L_t, whilst technological modernisation, automation, staff upskilling and organisational adaptation of enterprises shape the dynamics of the component LP_t.

In the proposed model, demographic processes are not introduced as separate independent variables. The impact is realised indirectly through changes in the number of employees (the component L_t). This approach is consistent with the logic of the production function, since a decline in population size, a deterioration in the age structure, outward migration and a reduction in labour force participation primarily affect labour supply, which is partly reflected in the model by the index of the number of officially employed workers. Consequently, the scenarios reflect not the direct impact of individual demographic indicators, but the cumulative effect, realised through changes in the labour component of economic output.

The proposed approach is consistent with the production function, according to which a reduction in labour resources can only be offset by growth in human capital, the renewal of physical capital and improvements in technological efficiency. Unlike regression analysis based on a limited number of annual observations, the scenario model does not involve establishing cause-and-effect coefficients, but is used to identify possible trajectories of economic development under different combinations of employment and labour productivity trends. To implement the scenario-based approach, three variants of changes in the number of people in employment and labour productivity for the period 2026-2030 were formulated. The parameter values were defined as conditional estimates reflecting varying intensities of demographic losses, the return of the working-age population, investment activity and the technological adaptation of enterprises. The parameters of the optimistic, baseline and pessimistic scenarios are set out in Table 5.

Table 5. Parameters for scenario-based modelling of Ukraine's economic development in 2026-2030

Scenario	Average annual change in the number of employees, %	Average annual change in labour productivity, %	Economic rationale
Optimistic	-0.5	+4	Partial return of migrants, active automation, investment in human and physical capital
Base case	-1.5	+2.5	Persistence of labour shortages and gradual organisational and technological adaptation
Pessimistic	-3	+1	Continued labour outflow, weak investment and limited technological modernisation

Source: compiled by the author based on M. Tverdostup (2023), Order of the Cabinet of Ministers of Ukraine No. 922-r (2024) and the results of the calculations set out in Table 4

The values of the scenario parameters are not statistical forecasts of the number of officially employed workers or labour productivity, but rather define the boundaries of a hypothetical scenario range. The demographic component has been calibrated on the basis of official and analytical estimates of long-term changes in Ukraine's population. In accordance with Order of the Cabinet of Ministers of Ukraine No. 922-r (2024), the population may decline from 35.8 million in July 2024 to 28.9 million by the start of 2041, corresponding to an average annual rate of decline of approximately 1.3%. According to the results of scenario modelling by M. Tverdostup (2023), the decline in the working-age population between 2021 and 2040 could amount to 22.6-25.2%, or approximately 1.3-1.5% on an annual average basis. Therefore, the figure of -1.5% has been adopted as the baseline parameter for changes in the number of officially employed workers. The optimistic figure of -0.5% reflects a possible slowdown in this process due to the partial return of forced migrants, the mobilisation of internal labour market reserves and the expansion

of formal employment. The pessimistic figure of -3% has been used as a stress scenario, assuming a continued outflow of migrants, a limited return of the working-age population and a deepening of age-related imbalances. The demographic estimates were not equated with the forecast for officially employed labour, but were used to determine the direction and limits of its possible changes. The baseline labour productivity growth rate of 2.5% was determined taking into account the actual trend in the estimated index of real GDP per officially employed worker: in 2022-2025, its average annual growth rate was approximately 2.4%. The figure has been rounded to 2.5% and used as a benchmark for maintaining the established recovery trajectory. The optimistic figure of +4% assumes an acceleration in automation, technological modernisation and investment in human and physical capital, whilst the pessimistic figure of +1% reflects weak investment activity and limited scope for technological adaptation. The upper and lower limits have been set for the purpose of analysing the sensitivity of the model's results, rather than as the boundaries of a statistical confidence interval.

The scenario parameters reflect different relationships between the reduction in the labour component and the increase in labour productivity. The optimistic scenario assumes that active technological modernisation and investment in human capital will ensure a productivity gain sufficient to offset a slight reduction in the number of employees. The baseline scenario characterises a moderate adaptation of the economy whilst labour shortages persist, whereas the pessimistic scenario envisages labour losses outweighing the productivity gains. Based on the defined parameters, scenario-based calculations of the dynamics of the real output index were carried out, the results of which are presented in Table 6.

Table 6. Scenario-based trends in the real output index for 2026-2030, 2025 = 100

Year	Optimistic	Base	Pessimistic
2025	100	100	100
2026	103.5	10	98
2027	107.1	101.9	96
2028	110.8	102.9	94
2029	114.7	103.9	92.1
2030	118.7	104.9	90.3

Source: calculated by the author based on the scenario parameters given in Table 5

The results of the scenario modelling show that the impact of a reduction in the labour force on economic dynamics depends on the economy's ability to ensure sustained growth in labour productivity. Under the optimistic scenario, a 0.5% annual reduction in the number of employees is offset by a 4% increase in labour productivity, resulting in the real output index rising to 118.7% of the 2025 level by 2030. Such a trajectory is possible provided there is active technological modernisation, the return of part of the working-age population, the expansion of vocational training and a revival of investment activity.

Under the baseline scenario, an annual 1.5% decline in the number of employees is combined with a 2.5% increase in labour productivity. In this case, the compensatory effect remains limited, and the real output index rises to only 104.9% by 2030. This result indicates that a moderate increase in productivity makes it possible to sustain economic growth, but does not create a sufficient buffer for rapid post-war recovery. Under the pessimistic scenario, a 3% annual decline in the number of people in employment is not offset by a 1% increase in labour productivity. As a result, the real output index falls to 90.3% of the 2025 level. This points to the risk of labour shortages evolving from a local constraint on business activity into a systemic factor reducing potential output.

Consequently, it is not the decline in population itself that determines economic dynamics, but the relationship between the rate of decline in the labour force and the growth in labour productivity. If productivity growth exceeds the loss of the labour component, the economy can maintain positive output growth even under unfavourable demographic conditions. If technological and organisational adaptation proceeds more slowly than the rate at which the number of people in employment is falling, demographic losses will become a long-term constraint on economic development.

DISCUSSION

Demographic processes are among the factors that directly influence the formation of the labour force, labour productivity and opportunities for economic development. The results of this study have shown that demographic changes have influenced economic activity and the potential for economic development. A similar relationship between demographic processes and economic growth was noted by N. Jain *et al.* (2025), who viewed the demographic transition as a source of the demographic dividend through changes in the age structure of the population. In contrast, this study has shown that, for Ukraine, population decline, outward migration and a reduction in the labour force have become factors contributing to labour shortages and additional constraints on economic recovery.

I.T. Jumaniyazov & S.B. Abdulazizov (2025) analysed a completely different demographic situation. Whilst the findings of this study indicated a decline in Ukraine's population, a reduction in the labour force and an increase in emigration, in Uzbekistan the authors observed steady growth in population, the labour force and GDP between 2013 and 2023. Despite these differences, both studies confirmed that demographic processes had a direct impact on economic dynamics and the labour market. At the same time, this study focused on assessing the scale of demographic losses and conducting a scenario-based evaluation of the potential economic consequences. Both this study and the work by X. Hao *et al.* (2025) established the impact of the working-age population on economic development. However, the authors demonstrated that an increase in the proportion of the working-age population in China

contributed to economic growth, whilst the modernisation of the economy amplified this effect. In this study, the opposite trend was observed: a decline in Ukraine's population from 41 million in 2021 to 32.3 million in 2026, a reduction in the labour force, and migration losses had a negative impact on economic activity and the prospects for post-war recovery. Thus, whilst X. Hao *et al*. investigated positive demographic potential, the present study focused on the consequences of demographic losses.

A comparison with H. Gu *et al*. (2026) showed that similar demographic challenges can have different consequences. The authors found that the negative impact of population ageing in China was partly offset by the development of human capital and the upskilling of the workforce. In this study, the main problem was not only population ageing, but above all its rapid decline and the shrinking labour force, which led to labour shortages and hampered economic recovery. The study most closely related to this one in terms of subject was that by S. Yao *et al*. (2026), which also analysed the consequences of a shrinking labour force. The authors found that population ageing in China reduced corporate employment due to rising labour costs and the substitution of labour with capital. In that study, the negative impact on the labour market was linked to war-induced depopulation, migration, and a decline in the working-age population. Despite the different causes, both studies showed that a reduction in the labour force posed risks to economic development.

H. Al Naqbi *et al*. (2024) examined labour productivity from a technological perspective and demonstrated that generative artificial intelligence facilitated the automation of tasks and improved work efficiency. The findings of this study did not contradict this approach, but explained changes in labour productivity through a different mechanism. It was established that population decline, migration losses and a reduction in the labour force were weakening Ukraine's labour potential and limiting the scope for economic recovery. Thus, whilst H. Al Naqbi *et al*. analysed the technological factors driving productivity growth, this study demonstrated that demographic processes can constrain it regardless of the level of technological development. Another approach was proposed by W. Lai *et al.* (2023), who linked changes in labour productivity to climatic factors. The authors found that extreme temperatures had a negative impact on workers' physical and cognitive productivity. The results of this study were consistent with these findings regarding the negative impact of external factors on labour productivity; however, in the case of Ukraine, these factors were population decline, emigration and labour shortages, rather than climatic conditions. The findings of this study also partially aligned with the conclusions of F. Dell'Acqua *et al*. (2026), who found that generative artificial intelligence improved the speed and quality of task performance. At the same time, this study examined labour productivity through the lens of demographic changes, which were accompanied by population decline, migration losses and a reduction in the labour force. Thus, whilst F. Dell'Acqua *et al*. focused on factors driving productivity growth, this study demonstrated that demographic losses can constrain productivity even in the presence of potential for technological modernisation.

In this study, demographic changes were considered as a factor limiting Ukraine's economic activity due to population decline, migration losses and labour shortages. This was partly consistent with the findings of J.-D. Guénette & L. Shao (2025), who investigated the impact of demographic structure on labour productivity. At the same time, the work by J.-D. Guénette & L. Shao focused on age groups within the population, whereas this study showed that, for Ukraine, the decisive factors were war-induced depopulation, a decline in the population from 41 million in 2021 to 32.3 million in 2026, and a reduction in the labour force. Statistical analysis and scenario-based economic and mathematical modelling were used to assess these processes.

In the study by M. Dotsey *et al*. (2025), demographic processes were considered as a factor in China's economic growth through the accumulation of human capital and interaction with industrial policy. This study revealed a different nature of the impact of demographic processes on the economy. The decline in population and the labour force did not create an additional resource for development, but rather exacerbated labour shortages and hampered Ukraine's post-war recovery. The findings of C. Li & X. Li (2025) differed from those of this study in that population ageing in the Yangtze River Delta conurbation had a non-linear positive impact on economic growth through increased labour productivity and spatial spillover effects between regions. In contrast, in this study, population decline, migration losses and a reduction in the labour force led to labour shortages and constrained economic recovery. Therefore, the study focused on the consequences of war-induced depopulation rather than on the positive effects of demographic changes. Similar differences were also observed in comparison with the work by C. Wu *et al*. (2025). The authors found that population ageing in China may have increased labour productivity through automation and rising capital-labour ratios. In this study, the labour shortage was also a result of demographic changes; however, it was accompanied by increasing imbalances in the labour market. Ukraine's population decline and the reduction in its labour force were regarded as factors limiting economic activity and recovery prospects.

A broader macroeconomic context for interpreting the results is provided by the study by W. Liu & W. McKibbin (2020). The authors examined the global implications of demographic changes and demonstrated that young economies could benefit from the demographic dividend, whilst population ageing slowed economic growth and affected international capital flows. This study confirmed that demographic trends had long-term economic consequences, but applied this analysis to the Ukrainian wartime context. Here, the decisive factors were not global differences between young and ageing economies, but rather a sharp decline in population, migration losses and labour shortages. Unlike W. Liu & W. McKibbin, this study had an applied national focus and included scenario modelling of the potential economic consequences of demographic changes up to 2030.

In the paper by I. Calvo-Sotomayor & E. Atutxa (2025), the ageing of the workforce was viewed as a process whose impact depended on digitalisation, the sectoral structure of the economy and the transition to more knowledge- and

capital-intensive activities. This was partly consistent with the findings of this study regarding human capital and the adaptation of economic policy to demographic changes. At the same time, the key challenge for Ukraine was not the ageing of the population, but its rapid decline and the large-scale outflow of working-age citizens abroad. É. Berde *et al*. (2025) analysed the consequences of the exhaustion of the first demographic dividend in several countries and found that investment in human capital could partially mitigate the negative impact of population ageing on economic growth. This study also examined the role of human capital, but the main focus was on the consequences of war-induced depopulation. It was found that the decline in population and the labour force created additional risks to economic activity and economic development.

A comparison with E. Kokkinopoulou *et al*. (2026) revealed another aspect of labour potential. The authors demonstrated that education contributed to increased labour productivity, innovation, and competitiveness. In this study, human capital was also considered as a prerequisite for economic recovery; however, the main focus was on the decline in the number of people possessing it. The reduction in the population from 41 million to 32.3 million and the contraction of the labour force indicated a narrowing of the country's labour potential. In the study by P. Cuadrado *et al*. (2023), population ageing in Spain was linked to a decline in labour force participation. This study also revealed the negative impact of demographic processes on economic activity; however, in Ukraine, the reduction in labour supply was driven not only by ageing but also by the war, emigration, mobilisation and depopulation. Whilst in Spain immigration partially offset labour force losses, in this study migration was identified as one of the factors contributing to the decline in the labour force.

A study by V. Šipilova *et al*. (2025), which examined the decline in the working-age population in Latvia, was thematically similar. Both studies showed that demographic decline led to labour shortages and imbalances in the labour market. At the same time, V. Šipilova *et al*. analysed the long-term factors behind these processes, whilst this study assessed the consequences of the war-induced depopulation of Ukraine in 2021-2026 and used scenario analysis to evaluate the potential implications of demographic changes for economic development up to 2030. Another aspect of economic development was examined by A. Gómez-Tello *et al*. (2025), who investigated regional differences in labour productivity across Europe. The authors identified the influence of agglomeration effects, capital-intensity and knowledge generation. This study overlapped with that work only in terms of the analysis of labour productivity and human capital. However, whilst A. Gómez-Tello *et al*. explained productivity by the spatial concentration of resources and knowledge, in this study its limitations were linked primarily to demographic losses, a shrinking labour force and a skills' shortage.

The analysis showed that demographic changes influenced economic activity, labour productivity and the long-term prospects for economic development. Regardless of differences across countries, time periods and methodological approaches, most studies demonstrated a close interrelationship between demographic processes and the functioning of the labour market. At the same time, the nature of this impact proved to be varied. In a number of countries, the growth in the proportion of the working-age population, the development of human capital, the modernisation of the economy, the automation of production and rising educational levels among the population created the conditions for sustaining labour productivity and economic growth. In contrast, the findings of this study indicate that, for Ukraine, the determining factors were war-induced depopulation, large-scale outward migration and a reduction in the size of the labour force.

CONCLUSIONS

This study has shown that demographic transformations have become one of the key factors in the decline of Ukraine's labour potential and the emergence of long-term constraints on economic development. Between 2021 and 2026, Ukraine's population fell from 40.998 to 32.283 million people, a decrease of 21.3%, whilst the number of births fell by almost 38%. These changes indicate a deepening of depopulation processes, a narrowing of the labour force reproduction base and increased risks to post-war economic recovery.

An analysis of the labour market has shown that the reduction in registered unemployment by more than 70% does not reflect an improvement in the employment situation. It occurred simultaneously with a reduction in labour supply, large-scale emigration and a worsening of professional and skills imbalances. As a result, labour shortages are becoming structural in nature and are increasingly hampering the resumption of production activities and the provision of skilled workers to enterprises.

Macroeconomic analysis has shown that, following a 28.8% fall in real GDP in 2022, the economy entered a phase of gradual recovery, although the pace of growth has been gradually slowing. The estimated real GDP index per employee, having fallen from 100 in 2021 to 80.9 in 2022, rose to 87 in 2025. Consequently, compared with the low point in 2022, the figure has risen by approximately 7.5%, but has not yet reached pre-war levels. This trend reflects the economy's gradual adaptation to labour shortages, but cannot be regarded as an unconditional result of sustained technological productivity growth.

Scenario modelling has confirmed that the decisive factor in future economic dynamics is the relationship between the rate of decline in the labour force and the growth in labour productivity. Under conditions of active technological modernisation, the real output index could rise to 118.7% of the 2025 level by 2030, whereas under a pessimistic scenario it would fall to 90.3%. This indicates that it is precisely the increase in labour productivity that is capable of partially offsetting the negative consequences of demographic losses, whilst insufficient technological and organisational adaptation turns these into a long-term constraint on economic development.

A limitation of the study is the restricted availability of official statistical data under martial law, which necessitated the use of approximate macroeconomic indicators of labour productivity and scenario modelling instead of a full-scale econometric assessment. Prospects for further research relate to the development of sectoral and regional economic-mathematical models and the assessment of the impact of human capital, technological change and

migration processes on labour productivity and economic growth in Ukraine.

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Моделювання впливу демографічних змін на продуктивність праці та економічну активність в Україні в умовах війни та післявоєнного відновлення

Анотація. Метою дослідження було проаналізувати вплив демографічних змін на трудовий потенціал та економічний розвиток України в умовах війни й післявоєнного відновлення. Дослідження мало теоретико-емпіричний характер і охоплювало період 2021-2025 рр., а для окремих показників використовувалися дані 2026 року. Методологія ґрунтувалася на застосуванні статистичного, порівняльного та сценарного аналізу демографічних і макроекономічних показників, розрахунку наближеного індексу продуктивності праці на основі реального валового внутрішнього продукту і чисельності найманих працівників, а також використанні виробничої функції та сценарної моделі декомпозиції економічного випуску на трудовий і продуктивнісний компоненти. Результати показали, що чисельність населення України скоротилася з 40,998 млн осіб у 2021 році до прогнозних 32,283 млн осіб у 2026 році, тоді як кількість народжених зменшилася з 273,8 тис. до 168,8 тис. осіб у 2025 році. Водночас поточне скорочення трудового потенціалу визначалося насамперед зовнішньою міграцією, воєнними втратами та іншими чинниками зменшення пропозиції праці, тоді як зниження народжуваності формує переважно довгострокові демографічні ризики. Після падіння показника реального валового внутрішнього продукту на 28,8 % у 2022 році економіка перейшла до поступового відновлення, однак темпи економічного зростання залишалися нестійкими. Розрахунковий індекс реального ВВП на одного офіційно найманого працівника після зниження зі 100 у 2021 році до 80,9 у 2022 році поступово зріс до 87 у 2025 році, однак залишався на 13 % нижчим за довоєнний рівень. Сценарне моделювання показало, що за умов активного технологічного оновлення індекс реального обсягу виробництва до 2030 року може зрости до 118,7 % від рівня 2025 року, тоді як за песимістичного сценарію він знижується до 90,3 %. Практичне значення дослідження полягає в можливості використання отриманих результатів під час формування державної демографічної, соціальної та економічної політики, спрямованої на відновлення трудового потенціалу, підвищення продуктивності праці та забезпечення стійкого економічного розвитку України

Ключові слова: міграція; людський капітал; чисельність населення; валовий внутрішній продукт; трудовий потенціал