How did the full-scale invasion affect the aging process in Ukraine?

Basysta, Khrystyna

Kyiv School of Economics

25 November 2023

How did the full-scale invasion affect the aging process in Ukraine?

B A S Y S T A
K H R Y S T Y N A

2023

RESEARCH PAPER

This manuscript was part of the Social Science Research Project course at Kyiv School of Economics (September – November 2023), conducted under the curriculum designed for third-year students.

Abstract

The aging process in Ukraine has become increasingly significant due to several factors, including the country's shrinking workforce, rising pension expenditures, and reduced capacity for long-term social and economic investments. Moreover, the ongoing war in Ukraine exacerbates these challenges by displacing a significant portion of the population, contributing to an increased burden on social welfare systems, and hindering economic recovery. Furthermore, the absence of a large enough workforce could contribute to the labor shortage and the resulting reduction in Ukraine's global competitiveness. To address these issues and mitigate the economic impact, Ukraine needs comprehensive strategies encompassing healthcare, pension services, and long-term social and economic investments. By investing in such strategies and promoting sustained economic development, Ukraine can effectively manage the challenges posed by its aging population and enhance overall economic stability.

Keywords: *Population, aging process, Ukraine, war, life expectancy.*

How did the full-scale invasion affect the aging process in Ukraine?

Basysta Khrystyna

Introduction

Demographic aging has increasingly become one of the most pressing challenges that industrialized economies face in the 21st century. According to Eurostat's latest projections for the next 50 years, the workforce in European countries will keep getting older, although the extent, speed, and timing of this change will vary across nations. This demographic shift has raised concerns about how it might worsen existing differences between regions in a global economy that relies on knowledge and innovation. The age makeup of the local workforce is likely to affect a region's ability to innovate and grow.

Whereas the aging process was studied in many countries, Ukraine remained beyond the scope of analysis. This is a considerable shortcoming considering that even before the war Ukraine envisaged an increased pace of aging. The recent full-scale invasion further intensified this process, requiring the deep and rigorous investigation of changes that war brought about for the population shrining and structure.

This study focuses on Ukraine and aims to compare the aging process before and after the full--scale invasion. In doing so, we intend to estimate the impact of war on the aging process in this country. The analysis will include the examination of the change in Ukraine's population size, and composition by age, gender, and education.

This research is expected to make a considerable contribution to current policy-making in Ukraine. On the one hand, my results can provide the foundation for policy formulation aimed at tackling population shrinking. On the other hand, my findings can help to assess the impact of aging on Ukraine's potential to rebuild its economy and society in the aftermath of this war.

Literature review

The issue of aging has been addressed from various angles. The article written by Anne Goujon explores the fundamental factors driving the phenomenon of aging populations. First of all, aging is analyzed from the perspective of why aging is happening. The author points out that one of the critical aspects is the increase in life expectancy over the last century. As the health system advanced over time, this provided a potential impetus for the next generation to live longer than the previous one. Furthermore, as women were allowed to enter the labor market, the fertility rate experienced a decline which further enhanced population aging.

Secondly, the research identifies strengthened international migration and internal mobility as the main underlying forces of age-related structural change locally within Europe. It is said to be more influential than natural increase (births and deaths), which are considered to be presumed less differentiated across territories. Additionally, migration has also been analyzed within one country by focusing on population displacement across regions such as urban and rural for example. Younger individuals and working-age populations are drawn to dynamic urban areas, while older individuals tend to retire to regions offering natural and cultural amenities. Also, the availability of essential services like healthcare and infrastructure is mentioned as a critical factor because for some regions they are simply not accessible. All this resulted in the aging process being more intense in rural regions while remaining moderate in urban ones.

Despite a large number of studies on migration and its determinants, the impact of some shock events like war, for instance, has not been analyzed before and, therefore, can also have a significant effect on the aging process. Ukraine can be considered a perfect case to fill this gap. I choose this country as the subject of analysis and I will proceed by comparing the process of aging before and after the full-scale invasion. Hence, the research question toward this issue is: How did the full-scale invasion affect the aging process in Ukraine?

Given the unique circumstances such as war, there is a need to investigate and comprehend consequences within the country's population getting older. This study seeks to bridge this gap by offering valuable insights into a critical aspect of demographic change that has been underexplored.

The research objectives can be summarized as follows:

- to investigate the changes in Ukraine's aging population before and after the full-scale invasion and estimate the impact of war on the aging process in the country;
- to examine the changes in Ukraine's population size and age distribution before and after the full-scale invasion;
- to contribute to current policy-making in Ukraine by providing insights that can aid in addressing population shrinking and assessing the impact of aging on Ukraine's ability to rebuild its economy and society post-war period.

As a result, my main hypotheses based on the presented literature review can be formulated as follows:

Hypothesis 1: The ongoing war in Ukraine could bring about substantial changes in both the overall population size and the distribution of age groups, possibly resulting in a hastened aging of the population.
Hypothesis 2: The aging process in Ukraine following the war is anticipated to result in a reduction in the labor force, potentially leading to shifts in employment patterns.
Hypothesis 3: The rise in life expectancy in Ukraine, driven by increased mortality from conflict-related casualties among the younger population, might result in the acceleration of an aging population.
Hypothesis 4: An increase in the out-migration of individuals may result in a higher population of individuals aged 65 and above, thereby expediting the aging process in Ukraine.

Data and Method Description

The study design for the research project investigating the impact of the full-scale invasion on the aging process in Ukraine is primarily based on longitudinal panel data. It focuses on the dynamics of demographic change in the post-invasion context. The advantages of the longitudinal observational design include capturing changes over time, assessing cause-and-effect

relationships, investigating the impact of shock events like war on changes in demographics, and providing insights into the long-term consequences and their implications for the aging process in Ukraine. Nonetheless, there are also some limitations to this type of design. The conclusions may be specific to Ukraine and could not apply to other countries with different socio-economic, political, and cultural contexts. Also, data availability could be a constraint as the collection of statistical information can be challenging, particularly in temporarily occupied regions.

The core aim of this research is to comprehensively understand how the full-scale invasion has influenced the aging process in Ukraine. I collected data from the State Statistics Service of Ukraine. The data used in this study is primarily demographic and focuses on the population trends in Ukraine both before and after the full-scale invasion. The specific datasets used in this research include population statistics related to age, gender, number of immigrants and emigrants, and other relevant demographic variables. The data covers multiple years from 1990 to 2023, allowing for a comprehensive comparison of aging trends before and after the war. My study relies on extensive data from official sources and makes it clear in the research methodology that the analysis is population-based.

The choice of variables in data collection is based on the provided literature review section. The dependent variables include the population size, the number of working-age population, and the share of the old-aged population in the country. The population size is measured in the number of people in the country, the working-age population has been selected from 16-64 years old. The share of the old-aged population is measured by dividing the number of the population aged 65 and more by the number of the total population. For independent variables, I decided to include fertility rates, mortality rates, migration, life expectancy, and war dummy the value of zero assigned to all years before 2022 and the value of one for later periods, 2023 and 2024.

The models that will be guiding my analysis are the following:

1. Total population size = b0 + b1*Fertility + b2* Mortality + b3*Emigration+ Life expectancy + b4*War

2. Working age population size = b0 + b1*Fertility + b2* Mortality + b3*Emigration + Life expectancy + b4*War
3. Share of old age population = b0 + b1*Fertility + b2* Mortality + b3*Emigration + Life expectancy + b4*War

The chosen analytical technique is regression analysis. It is appropriate for my study as it allows the simultaneous examination of multiple independent variables and their relationships with dependent demographic factors. I will use an OLS method for estimating my models' parameters since the dependent variables are measured on a numeric continuous scale. It provides a quantitative approach, controls for potential confounding factors, facilitates hypothesis testing, and generates interpretable results, making it a universal and reliable method for understanding the complex dynamics of aging in Ukraine.

Empirical Analysis and Results

My analysis differentiates three primary dependent variables: population size, labor force size, and the share of the population aged 65 and older. Within my analysis, I will assess the key factors contributing to changes in these variables over the specified period. Furthermore, I will also examine how the aging process has been affected by the russian full-scale invasion.

Total population size

Modeling population size through the primary predictors (as shown in Table 1) yields compelling evidence that the aging process in Ukraine is predominantly influenced by life expectancy. Furthermore, the analysis reveals a notable adverse impact of both migration and mortality rates on population size. Collectively, these key predictors account for approximately 88% of the variability in population size in Ukraine. Interestingly, the analysis does not reveal a significant difference in the aging process before and during the war period. This suggests that the presence of war does not appear to have a statistically significant impact on the aging process in Ukraine. However, when interactions are considered, the influence of armed conflict on the aging process becomes more evident. As demonstrated in Table 1, a full-scale invasion intensifies the population decline, consequently accelerating the aging process. The findings imply that the war

diminishes the positive impact of fertility rates on population size, likely as a result of discouraging childbirth. Similarly, the war amplifies the negative effect of emigration on population size by encouraging people to leave the country in search of safety. Intriguingly, the results reveal a positive effect on life expectancy, driven by the fact that those who emigrated were predominantly young and middle-aged individuals, ultimately elevating the average life expectancy within the country.

Working age population size

An examination of the working-age population reveals a substantial influence on life expectancy and the total number of individuals leaving the country. The negative life expectancy coefficient signifies that a one-unit increase in life expectancy is associated with an expected decrease of 1.4 million people in the working-age population. In terms of emigration, for each additional emigrant, the number of people aged 15-64 is projected to decrease by nearly 1450 individuals (as seen in Table 2). These factors collectively explain about 91% of the variation in Ukraine's working-age population. Similar to the total population, the inclusion of a dummy variable for war did not demonstrate statistical significance for this predictor.

Nonetheless, introducing an interaction term between fertility rate, number of emigrants, life expectancy, and war in the regression model provides a more nuanced insight into the relationship between these variables and the working-age population. While the fertility rate positively impacts the working-age population, the interaction term during wartime indicates a decline. This indicates that war-associated factors, like displacement, financial difficulties, and uncertainty may be the reason why people do not plan to have children, thereby playing a role in the diminishing working-age population. From the beginning and during full-scale warfare in Ukraine, life expectancy also displayed significance in the interaction, indicating an impact on the overall age distribution and implying that the Ukrainian population is aging. Furthermore, it is evident that the announced state of war in Ukraine motivated people to leave the country, and the interaction term confirmed a significant negative effect on the size of the working-age population due to emigration during wartime.

The share of the old age population

The linear regression model uncovers meaningful connections between various demographic factors and the percentage of older adults (aged 65 and above) within the population. The analysis highlights that mortality rate and life expectancy exert the most significant impact on the proportion of older individuals, whereas fertility rate and the total number of emigrants have comparatively weaker effects, as presented in Table 3. A higher mortality rate is associated with an increased proportion of older adults in the population. This is because a higher mortality rate implies a shorter average lifespan, particularly during times of conflict, leading to a larger segment of the population reaching the age of 65 and beyond. Conversely, a higher life expectancy contributes to a greater share of older adults in the population. Notably, the presence of war does not exhibit a statistically significant influence on the share of older adults within the population. It's worth noting that the overall aging of the Ukrainian population was ongoing throughout the country's independence, but significant events like war accelerated this process. With these key predictors, the model can account for approximately 85% of the variation in the data. However, it is important to highlight that attempts to introduce interaction terms in the model turned out to have insignificant results concerning the share of the older population in Ukraine. This suggests that the primary effects of demographic factors, such as mortality rate and life expectancy, have a more substantial impact on the proportion of older adults in the population compared to their interactions with other demographic variables.

Interpreting the results

The analysis reveals that the aging process in Ukraine is primarily influenced by life expectancy, with migration and mortality rates also playing significant roles. Surprisingly, the presence of war did not exhibit a significant impact on the aging process in Ukraine when considering the main effects. However, when interactions were introduced, it became apparent that the war intensified population decline and accelerated the aging process. These findings strongly support Hypothesis 1, indicating that the war has indeed hastened the aging of the population in Ukraine. Graph 1 and Graph 2 demonstrate these changes.

When examining the working-age population size, the analysis highlights the substantial influences of life expectancy and the total number of emigrants. A negative coefficient for life expectancy suggests that an increase in life expectancy is associated with a decrease in the

working-age population. Additionally, emigration decreases the number of people aged 15-64 (as shown in Graph 3). Therefore, Graph 4 shows a significant drop in the share of the labor force. Interestingly, the war dummy variable does not exhibit statistical significance for this predictor, but interaction terms reveal a more nuanced relationship. During wartime, fertility rates have a negative effect on the working-age population, likely due to war-related factors like displacement and financial difficulties, as suggested by Hypothesis 2. Furthermore, the interaction confirms that the state of war led to a significant surge in emigration.

The analysis of the share of the older population (aged 65 and above) underscores the significant influence of mortality rate and life expectancy. A higher mortality rate increases the proportion of older adults, while a higher life expectancy also contributes to a greater share of older individuals. Importantly, the presence of war does not have a statistically significant impact on the share of older adults, suggesting that the aging process in Ukraine was ongoing before the war. This alignment with Hypothesis 3 indicates that the rise in life expectancy can be attributed to factors other than war-related casualties. Additionally, the results indicate that the introduction of interaction terms did not yield statistically significant results, which supports Hypothesis 4 – the increase in out-migration did not significantly expedite the aging process in Ukraine.

In summary, the results of the analysis generally support the formulated hypotheses and provide valuable insights for policymakers in Ukraine. The war has indeed accelerated the aging of the population, which has implications for labor force dynamics and policy planning in a post-war period. These findings underscore the importance of addressing factors such as life expectancy and mortality rates in understanding the aging process in Ukraine.

Conclusions

In conclusion, this investigation sheds light on the complex dynamics influencing the aging process in Ukraine, emphasizing the profound impact of key factors such as life expectancy, migration, and mortality rates. While the initial analysis did not reveal an isolated and substantial effect of the full-scale invasion on aging, the incorporation of interaction terms within the regression models provided a more nuanced perspective. Notably, the war emerged as a catalyst, magnifying population decline and accelerating the aging process. The implications of these

findings are crucial for post-war policy development in Ukraine, stressing the importance of targeted strategies addressing healthcare, migration patterns, and mortality rates.

However, it is essential to acknowledge certain limitations in this study. Data constraints, particularly the unavailability of information from temporarily occupied territories and the exclusion of Crimea from statistical data collection since 2014 limit the comprehensive analysis of the entire country. These limitations may impact the generalizability of the findings. Moreover, the specificity of the conclusions to the Ukrainian context suggests caution in directly applying them to countries with different socio-economic, political, and cultural contexts.

In light of these results and recognizing the accelerated aging process, several recommendations can be made for policymakers. Firstly, there is a pressing need to invest in the improvement of healthcare services, addressing both immediate post-war health concerns and the long-term well-being of the population. Secondly, effective measures should be implemented to manage emigration, considering policies that encourage retention of the working-age population and discourage a significant outflow. Additionally, introducing family support programs can play a vital role in mitigating the potential negative impact of war on fertility rates and the working-age population. Post-war economic planning should prioritize initiatives that stimulate economic growth and provide opportunities for the labor force.

Moreover, recognizing the accelerated aging process, policymakers should focus on improving and providing enhanced social services for the elderly population. This includes the development of comprehensive support systems, healthcare access, and community engagement programs tailored to the needs of the aging demographic. By integrating these suggestions into post-war policies, Ukraine can strategically address the demographic challenges revealed by this study, fostering a resilient and sustainable society in the aftermath of conflict.

References

Goujon, Anne. "The Demographic Landscape of EU Territories: Challenges and Opportunities in Diversely Ageing Regions." 2021, pp. 13-16.

Воронцова, Оксана. “Скільки Українців Виїхали За Кордон І Не Повернулися Через Війну: Шокуючі Цифри.” Главком | Glavcom, 17 Aug. 2023, glavcom.ua/country/society/skilki-ukrajintsiv-vijikhali-za-kordon-i-ne-povernulisja-cherez-vijnu-shokujuchi-tsifri-949777.html

Opendatabot. Блекаути Не Вигнали Українців З Батьківщини. 28 Dec. 2022, opendatabot.ua/analytics/blackouts-and-refugees

Opendatabot. На 335 Тисяч Зменшилось Населення Країни За 2022 Рік. 3 Feb. 2023, opendatabot.ua/analytics/death-2022

“Birthrates in Ukraine Could Drop to World’s Lowest Level — Report.” The New Voice of Ukraine, 23 Sept. 2023, english.nv.ua/nation/birth-rates-in-ukraine-could-drop-to-world-s-lowest-level-news-50356055.html

State Statistics Service of Ukraine. www.ukrstat.gov.ua

Table 1

Regression Models for the Population Size

Regression Models for the Population Size

	Dependent variable:			
	`Total numbernresident population n`			
	(1)	(2)	(3)	(4)
`Fertility rate`	2,594,979.000	2,601,564.000	2,601,564.000	2,601,564.000
	(2,134,121.000)	(1,597,392.000)	(1,597,392.000)	(1,597,392.000)
`Mortality rate`	-891,260.500*	-573,878.000	-573,878.000	-573,878.000
	(439,182.000)	(339,241.800)	(339,241.800)	(339,241.800)
`Total numbernof emmigrants`	-0.435*	7.930***	7.930***	7.930***
	(0.240)	(2.216)	(2.216)	(2.216)
`Life expactancy`	-1,777,042.000***	-1,002,376.000***	-1,002,376.000***	-1,002,376.000***
	(290,600.300)	(298,581.900)	(298,581.900)	(298,581.900)
War1.0	2,104,985.000	165,466,316.000***	3,109,890.000	-2,383,858,276.000***
	(3,143,436.000)	(43,198,447.000)	(2,367,778.000)	(629,999,946.000)
`Fertility rate`:War1.0		-267,848,094.000***		
		(70,723,263.000)		
`Total numbernof emmigrants`:War1.0			-8.218***	
			(2.170)	
`Life expactancy`:War1.0				32,623,898.000***
				(8,614,093.000)
Constant	179,908,307.000***	115,649,341.000***	115,649,341.000***	115,649,341.000***
	(27,074,649.000)	(26,430,447.000)	(26,430,447.000)	(26,430,447.000)
Observations	23	23	23	23
R^2	0.911	0.953	0.953	0.953
Adjusted R^2	0.884	0.935	0.935	0.935
Residual Std. Error	1,241,352.000 (df = 17)	929,153.000 (df = 16)	929,153.000 (df = 16)	929,153.000 (df = 16)
F Statistic	34.690*** (df = 5; 17)	53.989*** (df = 6; 16)	53.989*** (df = 6; 16)	53.989*** (df = 6; 16)
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 2

Regression Models for the Working-Age Population

Regression Models for the Working-Age Population (15-64 Years Old)

	Dependent variable:			
	`Number ofn15-64 years old`			
	(1)	(2)	(3)	(4)
`Fertility rate`	3,970,807.000*	3,977,486.000**	3,977,486.000**	3,977,486.000**
	(2,030,911.000)	(1,424,522.000)	(1,424,522.000)	(1,424,522.000)
`Mortality rate`	-610,535.500	-288,630.500	-288,630.500	-288,630.500
	(417,942.200)	(302,529.000)	(302,529.000)	(302,529.000)
`Total numbernof emmigrants`	-1.447***	7.037***	7.037***	7.037***
	(0.228)	(1.976)	(1.976)	(1.976)
`Life expactancy`	-1,422,418.000***	-636,712.800**	-636,712.800**	-636,712.800**
	(276,546.200)	(266,269.300)	(266,269.300)	(266,269.300)
War1.0	3,309,732.000	168,998,862.000***	4,328,956.000*	-2,416,652,048.000***
	(2,991,412.000)	(38,523,500.000)	(2,111,537.000)	(561,821,191.000)
`Fertility rate`:War1.0		-271,664,766.000***		
		(63,069,574.000)		
`Total numbernof emmigrants`:War1.0			-8.335***	
			(1.935)	
`Life expactancy`:War1.0				33,088,768.000***
				(7,681,874.000)
Constant	135,575,579.000***	70,400,961.000***	70,400,961.000***	70,400,961.000***
	(25,765,259.000)	(23,570,137.000)	(23,570,137.000)	(23,570,137.000)
Observations	23	23	23	23
R^2	0.930	0.968	0.968	0.968
Adjusted R^2	0.909	0.955	0.955	0.955
Residual Std. Error	1,181,318.000 (df = 17)	828,599.800 (df = 16)	828,599.800 (df = 16)	828,599.800 (df = 16)
F Statistic	45.149*** (df = 5; 17)	79.566*** (df = 6; 16)	79.566*** (df = 6; 16)	79.566*** (df = 6; 16)
Note:				*p<0.1; **p<0.05; ***p<0.01

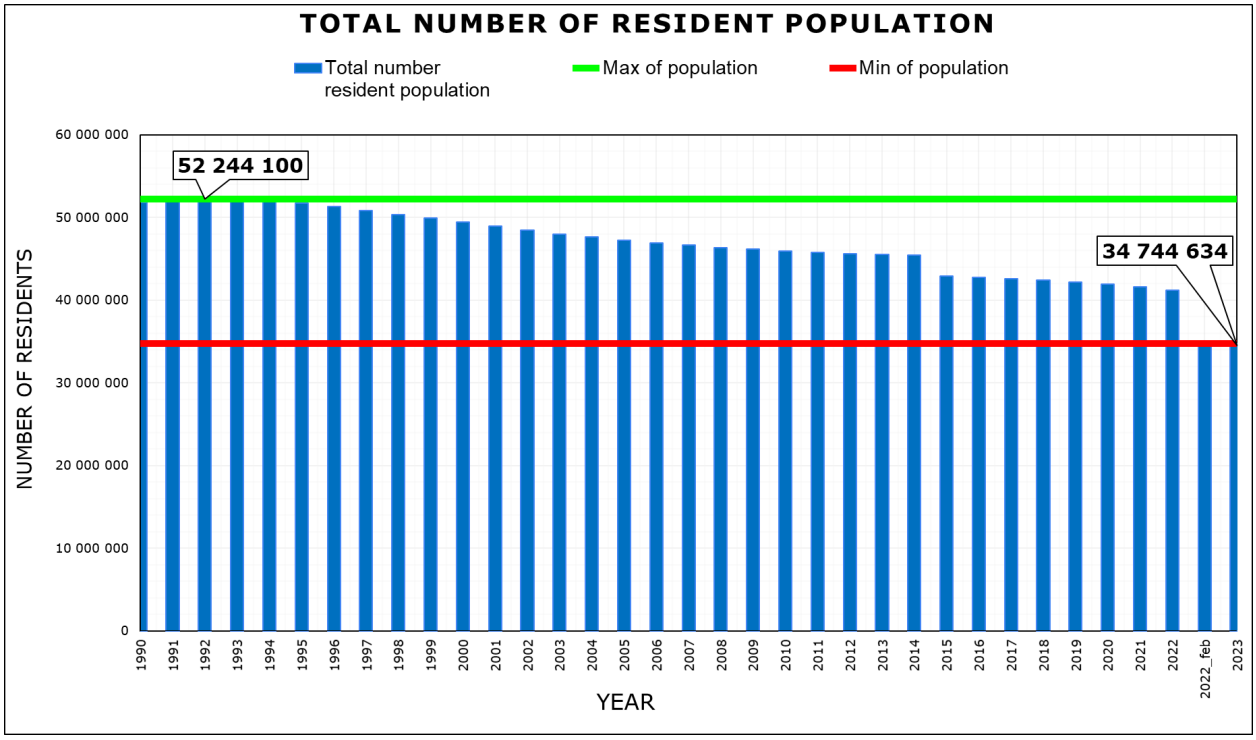
Table 3

Regression Models for the Share of Old-Aged Population

Regression Models for the The Share of 65+ Years Old				
	Dependent variable:			
	`The share of old npeople 65+`			
	(1)	(2)	(3)	(4)
`Fertility rate`	-0.752	-0.754	-0.754	-0.754
	(1.029)	(0.954)	(0.954)	(0.954)
`Mortality rate`	0.573**	0.475**	0.475**	0.475**
	(0.212)	(0.203)	(0.203)	(0.203)
`Total numbernof emmigrants`	-0.00000	-0.00000*	-0.00000*	-0.00000*
	(0.00000)	(0.00000)	(0.00000)	(0.00000)
`Life expactancy`	0.450***	0.211	0.211	0.211
	(0.140)	(0.178)	(0.178)	(0.178)
War1.0	0.110	-50.093*	-0.199	733.354*
	(1.516)	(25.793)	(1.414)	(376.166)
`Fertility rate`:War1.0		82.314*		
		(42.228)		
`Total numbernof emmigrants`:War1.0			0.00000*	
			(0.00000)	
`Life expactancy`:War1.0				-10.026*
				(5.143)
Constant	-23.241*	-3.493	-3.493	-3.493
	(13.059)	(15.781)	(15.781)	(15.781)
Observations	23	23	23	23
R^2	0.882	0.905	0.905	0.905
Adjusted R^2	0.847	0.869	0.869	0.869
Residual Std. Error	0.599 (df = 17)	0.555 (df = 16)	0.555 (df = 16)	0.555 (df = 16)
F Statistic	25.384*** (df = 5; 17)	25.270*** (df = 6; 16)	25.270*** (df = 6; 16)	25.270*** (df = 6; 16)
Note:				*p<0.1; **p<0.05; ***p<0.01

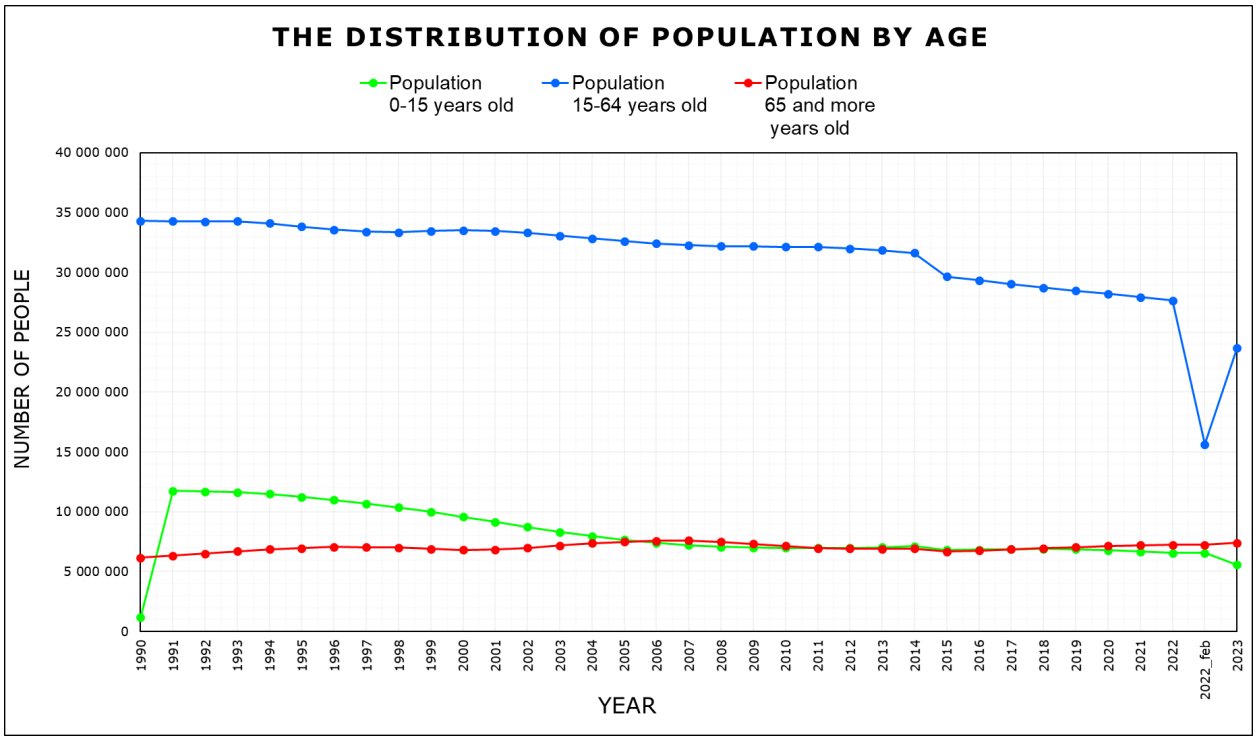
Graph 1

Total number of Ukrainian population through the years (1990-2023)



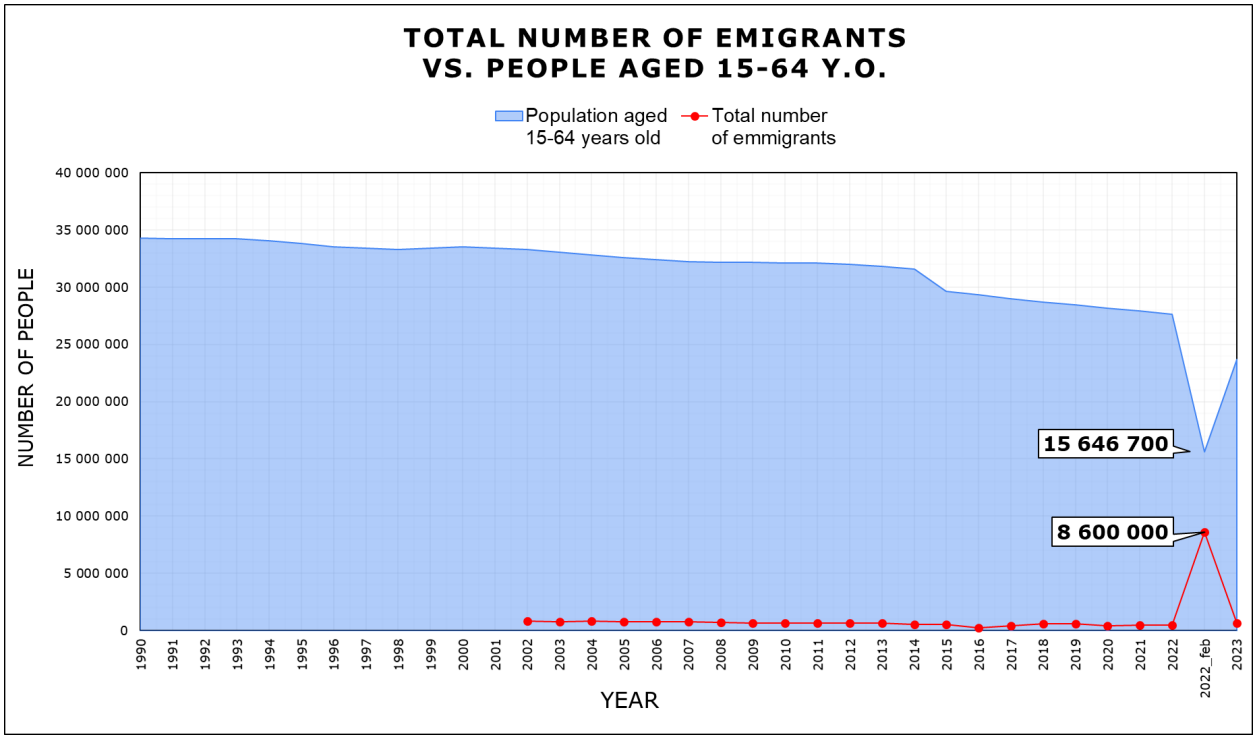
Graph 2

The distribution of population by age



Graph 3

Total number of emigrants compared to working-age population



Graph 4

The share of the labor force in Ukraine through the years (1995-2023)