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DEMOGRAPHICS' IMPACT ON ECONOMIC GROWTH IN CENTRAL EUROPE AND THE BALTIC STATES

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ABSTRACT

To ensure sustainable development and public welfare, the complex impact of demographic factors on macroeconomic dynamics should be investigated properly. Moreover, a few of the Sustainable Development Goals are interconnected robustly with demographic issues. There are some trends (e.g., substantial increase in longevity, rapidly lowered fertility, etc.) common for most advanced and emerging market economies. We examined the impact of selected socio-demographic factors on the real GDP per capita growth rates in a sample of the Baltic states and the Central European countries that have experienced economic transformations in the 1990s and either entered or declared their intentions to join the European Union in the future. We investigated general demographic dynamics in the region from 1960 to 2021. Due to the data availability, our special attention was focused primarily on the highlighted countries' socio-demographic and macroeconomic variables from 2000 to 2021. We suggested that there was a certain interdependence between the working age population stratum specific weight, the elderly demographic dependency ratio, public healthcare spending, gross capital formation, and the real GDP per capita growth rates. In addition, we propose the main priorities for social and demographic policy in the field of well-being improvement. The potential ways to enhance the model – regarding healthcare, education, and the general profile of fiscal policy – have been disclosed as well.

Keywords: *population structure, demographic ageing, human capital, public welfare, social and fiscal policy mix, economic growth, sustainable economic development*

1. INTRODUCTION

The economic growth issues form the core of modern scientific discourse in a plethora of social studies. The methods applied to achieve the aforementioned phenomenon vary significantly depending on the conceptual bases of the particular scholars' theory or the implemented economic policy's profile. To ensure sustainable development and public welfare, national governments and other public institutions should conduct prudent, growth-friendly, and consistent policy (Arslan, & Kekeç, 2023; Kuzmak, & Kuzmak, 2023; Oliinyk, 2023). Meanwhile, the self-confident economic agents' activities should be considered and judicious in addition. Therefore, the country's welfare level derives from both the complex measures provided by public authorities

and the respective agents' self-organization. Disregarding the ideological component, human recourses are considered traditionally as an essential economic development factor (Kuzu & Arslan, 2023). While the population inherently possesses the power to induce intellectual capital, the ways to accelerate the respective positive dynamics in advanced and emerging market economies are rather incomparable. Permanent shifts in the age structure of the population determine the peculiarities of public spending and final consumption (Vladymyr, 2023). An increased life expectancy at birth and low fertility form the common trend for most European economies, forcing respective authorities constantly reshape their social, demographic, and fiscal policy mix. In this study, we evaluated multi-level interdependencies between the population structure fluctuations and both direct and indirect investment in intellectual and physical capital, taking the concept of demographic sustainability into account. Moreover, considering the Wicksell / Cobb–Douglas function, we investigated mutual connections between investment dynamics in physical and intellectual capital. National governments should counteract the critical inequality and simultaneously soften the undesirable effects of macroeconomic cyclicality. Meanwhile, the excessive social protection might have unacceptable consequences for the national economies. Moreover, full-scaled paternalism slows economic development, reducing the respective agents' activity. It is necessary to find the exact socio-demographic and fiscal policy mix that could be synchronously growth-friendly and acceptable for different economic agents. In that 'ideal' model, the economically active agents ensure their own well-being, while public welfare depends on both government decisions and the complex of individual activities in addition.

2. LITERATURE REVIEW

Ahmad & Khan (2018) disclosed the interrelation between demographic transition, human capital accumulation and economic dynamics in 67 emerging markets, using 5-year interval data over 1960–2014. The authors pointed out that an essential increase in the labor force participation rate contributed to the investigated dynamics positively. The prerequisites needed to get the demographic transition's benefits were determined as: a) adaptive labor markets (capable to absorb different population strata); and b) sustainable investment in human capital. Meantime, special attention should be paid to the intellectual component of human capital formation. Using data for 132 countries from 1996 to 2011, Ali, Egbetokun, & Memon (2018) revisited the main human capital-related hypothesis and presented new results on a set of conditions under which the aforementioned phenomenon has been robustly and positively associated with economic development. The authors proved that economic opportunities reinforced the human capital impact on growth. Under a neoliberal economic doctrine, Lazutka, Juška, & Navickė (2018) examined the split of national income between labor and capital in Lithuania, considering its distributional implications and ongoing demographic crisis in the Baltic states. The authors proved that Lithuanian rapid economic growth phenomenon has been based on artificially suppressed wages, lowered taxes on capital and 'cheap' labor export to the core EU member-countries. Those facts contributed to socially corrosive high economic inequality and large-scale emigration as well. Thus, aiming to optimize public welfare, the government's human capital growth-friendly policy should be applied. Ogundari & Awokuse (2018) observed two alternative measures of human capital – investment in health and education – considering their effects on economic growth separately. Investment in the healthcare system positively contributed to economic development, while its overall effect appeared to be slightly larger than investment's in the education one. That fact could be explained by rather insufficient institutional development of the region under study (Sub-Saharan Africa).

Lutz et al. (2019) assessed the significance of changing age structure and increase in human capital for economic growth for a panel of 165 countries over 1980–2015. They determined that the education's quality has been the main trigger for economic development, while investment in human capital could accelerate macroeconomic dynamics crucially. Hallett, Hougaard Jensen, Sveinsson, & Vieira (2019) investigated the features of fiscal policies applied in the OECD countries considering the particular financial rules aimed at maximizing economic growth under changing demographics. Public and private capital was identified as the labor productivity-enhancing factor. Moreover, properly handled demographic changes (e.g., prudent policy dealing with the population ageing) should not be necessarily considered as a conventional problem, in case if reliable fiscal rules and credible restraints were set up in advance. Regarding demographic and technological changes' macroeconomic implications, Jimeno (2019) proposed a new design for a growth-friendly fiscal policy. Meanwhile, due to the above model, an increase in productivity was associated with the risk of disruptive effects on employment and wages. Sanderson & Scherbov (2019) provided a new way to measure individual and population ageing. They proposed 'prospective age' concept, which should be regarded while preparing the respective social and financial policy mix. Yoshino, Kim, & Sirivunnabood (2019), investigated the ageing's impacts on fiscal sustainability in the Group of 20 from the 1950s up to the present time and proposed the demographic forecast for the subsequent three decades. Due to enormous and multi-faceted population ageing effects on public production (e.g., fiscal balances deteriorations, destructive changes in the patterns of saving and investment, shortages in the labor supply, and imperfect welfare systems in emerging market economies in addition), a possible decline in economic growth as well as the ineffectiveness of macroeconomic policy has been predicted. Investigating the data of 143 economies with 14 publicly available indicators, Baser & Gokten (2019) pointed out the new paths of economic growth, taking the mediating role of human intellectual capital into account. The scholars focused on the institutional quality phenomenon that determined the decisions for starting or supporting the development processes. Diebolt & Hippe (2019) highlighted the human capital's long-run impact on innovation and economic development regional disparities in Europe. The scientists proved that both central and local policy makers should prepare human capital strategy appropriately and adapt it to the regional peculiarities to boost economic development. Using the time series techniques for 1971–2013 in Spain, Marquez-Ramos & Mourelle (2019) disclosed the existence of nonlinearities in the interrelation between education (both secondary and tertiary) and economic growth at the country level. While preparing the programs for economic development, a government should consider the above nonlinearities. Introducing a new dataset measuring learning peculiarities in 164 countries and territories from 2000 to 2017, Angrist, Djankov, Goldberg, & Patrinos (2019) investigated the relationships between 'schooling' and 'learning' and the subsequent gap in human capital formation, taking the concept of sustainable development into account. The authors demonstrated that human capital had been accounted for up to a third of cross-country income differences.

Considering a sample of Asian countries, Aslam (2020) argued that human capital alone might not be a significant contributor to economic growth. Moreover, the high-quality institutional architectonics of public governance could provide all the necessary conditions to amplify the human capital's influence on the development processes. Terták & Kovács (2020) explored the changes that have occurred in the relations between economic agents and – on a broader scale – in public governance over the short-run as a response to the global COVID–19 pandemic. The authors pointed out that the banking system, apart from providing its traditional services, also has had to act in both complex and adaptable roles, indispensable for the maintenance and strengthening of social cohesion. Regarding the concept of an Empty Planet, Jones (2020)

examined how increased longevity and declined fertility have affected growth simultaneously in advanced and emerging market economies. Collin & Weil (2020) examined the income and poverty dynamic responses to induced investment in human capital of the new workers cohorts, using a quantitative macroeconomic model with realistic demography. The higher human capital impact on fertility and the follow-on effects on income have been investigated as well. The authors found out that investment in human intellectual capital was more cost-effective than investment in physical one as a means to achieve specified income or poverty goals.

In the series of studies (Kozlovskyi, Pasichnyi, Lavrov, Ivaniuta, & Nepytaliuk, 2020; Pasichnyi & Nepytaliuk, 2021) a concept of demographic sustainability has been proposed in order to achieve optimal parameters of public governance and sustainable development. Wijaya, Kasuma, & Darma (2021) highlighted the effects of demographic pressure, happiness, and a human development index on labor force and economic growth in Romania over the 2013–2019 period. A significant positive impact of a human development index on economic growth through the labor force has been proved statistically. Ding, Huang, Gao, & Min (2021) investigated panel data of 143 countries and regions over the 1990–2014 period, proving that the output elasticity concerning human capital has been greater compared to the physical one, while green GDP has been remarkably more sensitive to the shifts in human capital than the 'traditional' GDP. Zapata-Cantu & González (2021) highlighted the significance of institutions and human capital, regarding the challenges for innovation and sustainable development in Latin America, and proposed a roadmap for emerging markets basing on dynamic capabilities and mission-oriented policies. He & Yao (2022) employed panel data from 30 Chinese provinces from 2008 to 2019 and utilized the spatial Durbin model and quantile regression model to examine the interrelation between a business environment, human capital structure upgrading, and economic development quality. The authors proved that human capital compositional amelioration played a crucial intermediary role, through which improvement in the business environment affected economic growth. Marszowski & Lejwoda (2022) argued whether demographic changes and automation have threatened the labor market's development. They pointed out that the mental barriers to the above phenomena should be broken to strengthen their acceptance and accelerate the growth processes. Meanwhile, considering the sample of 181 economies, Ishfaq, Ghani, & Ngo-Hoang (2022) studied the effects of human capital accumulation and it's influencing variables (e.g., expenditure on education and quality of education, labor force, free trade, and investment) on economic growth and proved that all the investigated indicators have had a positive impact.

Billari (2022) compared the 'slow' demography with the 'fast' one in order to adjust demographic forecasts. Considering constantly rising longevity, Albertini, Tur-Sinai, Lewin-Epstein, & Silverstein (2022) investigated the phenomenon of sandwich generations and gave special attention to the differences between welfare and transfer regimes. Taking the concept of the Sustainable Development Goals into account, Niaz (2022) pointed out a roadmap from vulnerability to sustainability through financial inclusion and proved that individual socio-economic status and its development have been dependent on demographic factors. Duszczyk & Kaczmarczyk (2022) profoundly examined the challenges associated with war in Ukraine and migration to Poland and their complex impact on the structure of population. Kiniorska, Brambert, Kamińska, & Kopacz-Wyrwał (2023) disclosed demographic ageing in Europe during the period of 2008–2021 and presented a new typological approach to the areas of unbalanced age structure. They concluded that most of the countries under study have already reached the stage of 'very old' population in the 1990s. Regarding demographic change, Devriendt, Heylen, & Jacobs (2023) evaluated alternative options for the reforms in the public pension system in an

overlapping generations' model for an open economy. The scholars argued that a reform combining an increase in the retirement age with an intelligent linkage between the pension benefit and the earlier labor earnings could be the best choice for the aged societies. Sulisnaningrum, Widarni, & Bawono (2022) applied vector analysis to investigate causality relationship between human capital, technical advancement, and economic growth in Indonesia from 1995 to 2020. According to the aforementioned scholars, human capital and technology were reinforcing each other mutually because of progress processes; economic growth should be bolstered by monetary expansion to foster innovation.

The demographic factors' effect on economic development has been the subject on numerous studies. However, the regional and institutional peculiarities of macroeconomic and sociodemographic dynamics interrelation in Central Europe and the Baltic states requires additional investigation.

The purpose of this article is to evaluate the demographic factors' impact on the economic growth dynamics and to propose the main priorities for the social and demographic policy mix in the field of well-being improvement.

3. METHODS AND DATA

The theoretical and methodological bases of this study were the scientific works addressing the issues of the socio-demographic and fiscal policy mix compositional structure and the features of population dynamics in advanced and emerging market economies.

We used the statistics of the World Bank open database. Taking the inertia of demographic changes and the data availability into account, we investigated the time interval from 1960 to 2021. The sample represented the Baltic states and the Central European countries that have experienced radical economic transformations in the 1990s and later joined the European Union (hereinafter – EU) or declared their course for entering it. The sample included Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Moldova, Poland, Romania, Slovakia, Slovenia, and Ukraine. For the period from 1960 to 1992, we analyzed the population dynamics and macroeconomic indicators of the respective republics of the Union of Soviet Socialist Republics (hereinafter – USSR), the Czechoslovak Socialist Republic (from 1990 to1992 – the Czech and Slovak Federative Republic), and the Federal People's Republic of Yugoslavia (from 1963 to 1992 – the Socialist Federal Republic of Yugoslavia). The population aged 15 to 64 was identified as economically active. The working possibilities for the persons aged 65 and older has been noted.

We used the theoretical generalization to systematize the factors influencing the socio-demographic and economic development of the sampled countries. We applied the methods of statistical analysis (grouping, study of dynamic series, and stochastic modeling, etc.) to investigate the population dynamics' peculiarities.

We made a methodological assumption that certain architectonics of public administration rationally combined with the economic agents' self-organization could ensure sustainability, optimal demographic and income dependency ratios. While studying the factors' impact on economic growth, we considered the concept of demographic sustainability. It could be partially described by *the model (1)*. We disclosed general changes in the population age composition of the sampled countries and analyzed the respective dynamics in terms of working age and non-working age strata. The main attention has been paid to an increase in the elderly population age stratum and to the government policy measures aimed to optimize both social and

economic consequences of the aforementioned phenomenon.

$$\begin{cases} \frac{IAP}{EAP} = Ddr \rightarrow opt\,(min); \\ \frac{AIEpc}{AIpc} = Idr \rightarrow opt\,(min); \end{cases} \quad (1)$$

where Ddr – demographic dependency ratio;

IAP – economically inactive population;

EAP – economically active population;

Idr – income dependency ratio;

AIEpc – average amount of per capita income spent on economically inactive population;

AIpc – average per capita income.

The initial hypothesis of the study was that the real GDP per capita annual growth rate (GDPpc_gr) has been stochastically interrelated with: a) working age population's share as a percentage of total population (WAP); b) the elderly demographic dependency ratio (EDdr); and c) domestic general government healthcare expenditures as a percentage of GDP (GHE). We imposed a control – gross capital formation (GCF) as a percentage of GDP. Consisting of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories, GCF combined all kind of investments in physical capital. Hence, we have built *the next stochastic model (2)*:

$$GDPpc\_gr = A + \alpha 1 \times WAP + \alpha 2 \times EDdr + \alpha 3 \times GHE + \alpha 4 \times GCF + \varepsilon, \quad (2)$$

where A – a constant;

α1, α2, α3, α4 – respective regression coefficients;

ε – statistical error.

Obtained and verified stochastic interdependence could be used to prepare the socio-demographic and macroeconomic policy mix.

4. RESULTS

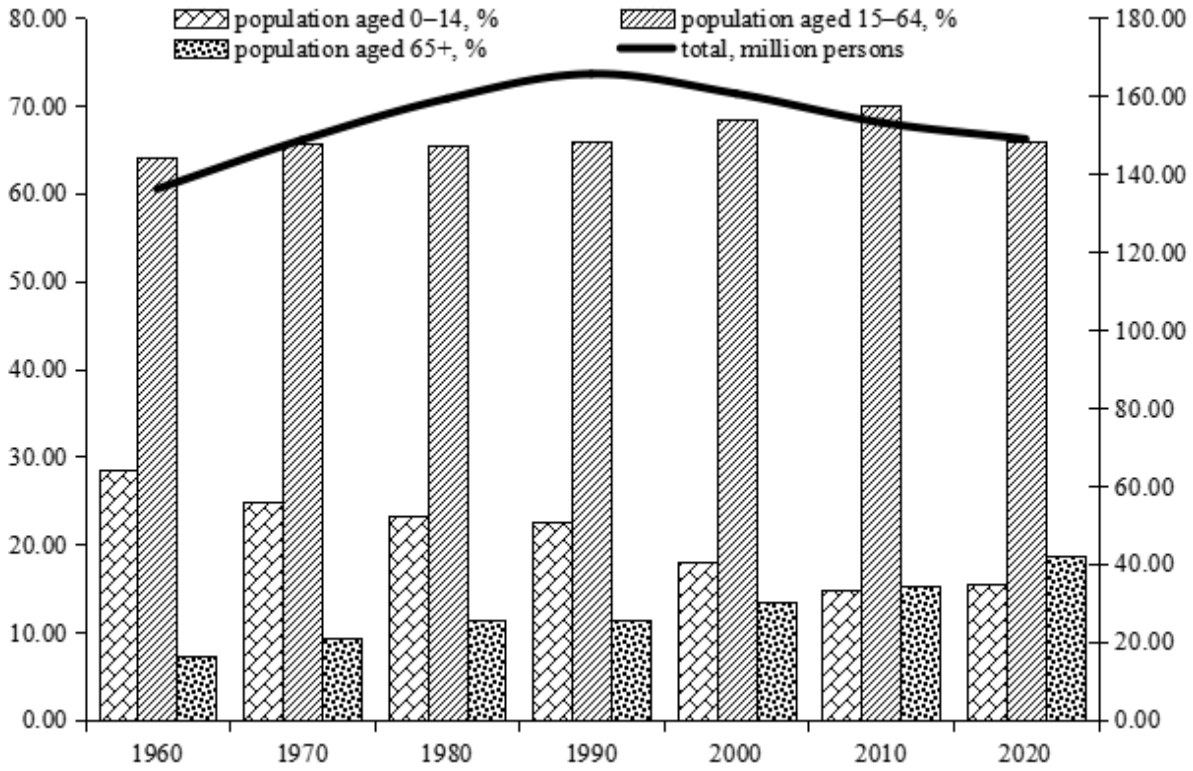
4. 1. SOCIAL AND DEMOGRAPHIC DYNAMICS IN CENTRAL EUROPE AND THE BALTIC STATES IN 1960–2021: AN EXPERIENCE OF COMPARATIVE ANALYSIS

From 2015, the United Nations established 17 Sustainable Development Goals (hereinafter – SDGs) aimed to maintain international peace and security, to set friendly relations among the nations, to achieve international co-operation, and to serve as a harmonizing center for the nations' actions. Several of the SDGs are directly (SDG 1–SDG 5) or indirectly (SDG 8, SDG 10, SDG 16–17) interconnected with demographics. To counteract poverty efficiently as well as to ensure zero hunger, good health and well-being, high quality of education, and gender equality, the specific public regulation measures should be undertaken (Moraliyska, 2023). Prudent social and demographic policy mix could ensure decent work and economic growth, reducing the inequalities simultaneously. In this study, we consider the SDGs as an undertaken public poli-

cy's strategic markers. To investigate demographic dynamics of the sampled countries properly, we split the entire time interval under study in two sub-intervals: a) from 1960 to 1990; and b) from 1991 to 2020. During the first sub-interval, all the sampled economies belonged to the so-called 'socialist camp' under conditions of the aggravation and finalization of the first Cold War. Thus, the dominant ideology and centralized processes of public production determined most aspects of their social, economic, and even demographic ontology. Resource-oriented type of the USSR development model affected demographic dynamics as well.

The total population of the countries under study increased by 1.22 times from 136.11 million in 1960 to 165.60 million in 1990 (Fig. 1). In 2020, the sampled countries population equaled to 148.92 million. In 2021, the population of the countries under study decreased rapidly and equaled to 148.06 million. That fact could be due to the global COVID–19 pandemic. The share of the working age stratum in the structure grew slightly up (by 1.73 percentage points) from 64.21% in 1960 to 65.94% in 2020. The above dynamics corresponded with a reduction (equaled to 13.13 percentage points) in the specific weight of the youngest population stratum from 28.61% at the beginning of the period to 15.48% at its end. Over the entire period, gradually declining fertility formed a general trend for the advanced economies. Regarding that fact, an essential increase in life expectancy at birth has been observed. Automatically, the specific weight of the elderly population age stratum in the total structure raised from 7.17% in 1960 to 11.31% in 1990 (with an increase equaled to 4.14 percentage points) and to 18.58% in 2020 (with an increase equaled to 11.41 percentage points).

Figure 1. The number and age structure of the Baltic states and the Central European countries' population over the 1960–2020 period



Source: the authors' own calculation based on World Bank data

The overall demographic dependency ratio changed slightly. In 1960, there were 0.56 incapacitated persons of any age stratum for the one working aged person. In 1990 and 2020, the

indicator equaled to 0.51 and to 0.52, respectively. In 2010, the minimum overall demographic dependency ratio for the period – equaled to 0.43 – has been recorded. At the same time, the specific demographic dependency ratios (focused on the youngest and the eldest population strata) changed essentially. The share of the elderly population stratum increased from 7.17% in 1960 to 18.58% in 2020. Meanwhile, the specific weight of the persons under the age of 14 decreased from 28.61% to 15.48%, respectively.

The elder population financial resources' distribution peculiarities, considering savings and consumption as well as the cost of healthcare for the different age strata, should be regarded in the social policy preparation processes. The sample's total population reached its own peak in 1990. Principally, its subsequent reduction was due to the next socio-political phenomena: a) the collapse of the USSR and the historically determined migration of the part of its existing population; and b) European integration, decentralization trends, and foot voting. Tiebout (1956) argued that the concept of foot voting was primarily associated with the fiscal jurisdictions' specific profiles.

The sample's average life expectancy at birth increased significantly from 67.87 years in 1960 to 75.80 years in 2020. Its maximum – 76.60 years – has been recorded in 2019. The variable's annual reduction equaled to 0.80 years in 2020 could have been caused by the global COVID–19 pandemic, which affected many elderly people.

4. 2. POPULATION AGEING IN THE SAMPLED COUNTRIES: EXPECTATIONS AND EMPIRICAL EVIDENCE

The shifts in the average life expectancy in the sampled countries in 1990–2020 (in five-year increments) are presented in the Table 1. A gradual indicator's increase was observed in most countries under study; and throughout the sample, except for Moldova and Ukraine, the average life expectancy exceeded 70 years. Regarding the entire period, the most impressive expansion of the indicator (from 69.48 to 78.35 years, an increase equaled to 8.87 years or 12.77 percentage points) was observed in Estonia. That country was characterized by a significant reduction in adult mortality and moderate fertility as well.

Table 1. Average life expectancy at birth in the Baltic states' and the Central European countries in 1990–2020, years

Country	1990	1995	2000	2005	2010	2015	2020	*1990–2020*
Bulgaria	71.64	71.05	71.66	72.56	73.51	74.61	73.61	*72.66*
Croatia	72.17	72.08	72.81	75.24	76.48	77.28	77.72	*74.83*
Czech Republic	71.38	73.07	74.97	75.92	77.42	78.58	78.23	*75.65*
Estonia	69.48	67.54	70.42	72.57	75.43	77.59	78.35	*73.05*
Hungary	69.32	69.79	71.25	72.65	74.21	75.57	75.62	72.63
Latvia	69.27	66.39	70.31	71.36	73.48	74.48	75.39	*71.53*
Lithuania	71.16	69.01	72.02	71.25	73.27	74.32	74.93	*72.28*
Moldova	67.64	66.87	67.01	67.82	69.62	71.48	72.01	*68.92*
Poland	70.89	71.89	73.75	75.00	76.25	77.45	76.60	*74.55*
Romania	69.74	69.46	71.16	71.91	73.46	74.91	74.35	*72.14*
Slovakia	70.93	72.25	73.05	73.90	75.11	76.56	76.87	*74.10*
Slovenia	73.20	73.96	75.41	77.61	79.42	80.78	80.53	*77.27*
Ukraine	70.10	66.74	67.68	67.96	70.27	71.19	71.19	*69.30*
Average	70.53	70.01	71.65	72.75	74.46	75.75	75.80	72.99

Source: the authors' own calculation based on World Bank data

Over 1960–2020, the lowest life expectancy at birth was observed in Moldova – 62.00 years in 1960; over 1990–2020, in the same country the average indicator equaled to 68.92 years, which was 4.07 years less than the sample mean. The highest growth of the indicator was recorded in Slovenia. In 1960, it equaled to 68.98 years and could be compared to the indices of Ukraine and Bulgaria (68.30 and 69.25 years, respectively). However, in 2019, just before the global COVID–19 pandemic, life expectancy at birth in Slovenia equaled to 81.53 years, which corresponded to the similar indicators in the most developed economies. Meanwhile, Slovenia (along with Greece, Italy, and Luxembourg in addition) had one of the lowest effective retirement ages in the EU – approximately 62 years. Thus, the average life expectancy after the retirement equaled to 20 years. That indicates an increase in the quality of life, but the appropriate implicit compensators – counteracting destructive changes in redistributive proportions – should supplement it. Thus, public administration measures regarding social inclusion of the elderly population and prolonging the individuals' economic activity have become vital.

The dynamics of the youngest and the eldest age strata (traditionally excluded from the working age population according to the methodology of the International Labor Organization) is represented in the Table 2. Over the 1990–2020 period, the population compositional structure and demographic dependency ratios changed crucially. While the sampled countries maintained an almost constant average share of the working age population, a shift towards an increase in the elderly demographic dependency ratio has been occurred.

Table 2. Changes in the age structure of the Baltic states and the Central European countries' population in 1990–2020, percentage

Country	Growth rate of particular age strata compared with 1990											
	Population aged 0–14						Population aged 65+					
	1995	2000	2005	2010	2015	2020	1995	2000	2005	2010	2015	2020
Bulgaria	–15,13	–27,88	–41,21	–43,73	–42,24	–42,62	10,80	18,30	15,95	16,66	25,38	29,88
Croatia	–9,87	–18,13	–28,28	–29,84	–35,35	–37,74	14,33	25,77	34,43	36,40	46,29	55,55
Czech Republic	–13,54	–24,39	–32,46	–33,03	–28,44	–24,33	4,18	8,03	9,44	23,43	44,84	64,46
Estonia	–14,91	–29,44	–41,01	–42,12	–39,04	–36,99	6,78	14,65	24,04	27,51	35,30	48,01
Hungary	–11,79	–18,86	–26,09	–29,83	–32,84	–33,66	5,51	10,42	12,85	15,27	23,17	40,82
Latvia	–9,81	–26,02	–42,49	–48,28	–47,76	–45,35	7,82	12,21	19,34	20,57	22,05	24,31
Lithuania	–5,36	–15,95	–33,21	–45,19	–49,19	–48,16	10,87	21,00	32,03	32,98	34,93	43,25
Moldova	–5,25	–17,26	–35,48	–42,98	–45,99	–49,77	8,04	11,89	16,44	17,93	15,70	32,98
Poland	–7,09	–21,84	–33,78	–39,53	–41,10	–39,76	11,41	21,31	31,61	35,16	57,58	87,28
Romania	–14,42	–24,29	–39,10	–42,03	–44,16	–45,76	13,22	26,51	34,49	31,40	39,25	53,40
Slovakia	–9,19	–21,04	–32,82	–38,55	–38,49	–36,89	6,03	12,17	15,27	23,76	40,45	68,05
Slovenia	–12,50	–24,26	–32,53	–30,80	–26,91	–23,17	15,05	32,00	45,87	60,80	74,83	105,07
Ukraine	–7,12	–23,60	–37,48	–41,19	–37,45	–35,95	12,07	9,10	20,31	15,83	13,74	20,25
Average	–10,46	–22,53	–35,07	–39,01	–39,15	–38,47	9,70	17,18	24,01	27,51	36,42	51,79

Source: the authors' own calculation based on World Bank data

The number of the elderly population significantly increased even in the countries with relatively low per capita incomes, in particular, in Ukraine and Moldova. In 2020, in Ukraine, Latvia, and Bulgaria, the number of the elderly population increased by less than 30.00% compared with 1990. The lowest indicator – equaled to 20.25% – was observed in Ukraine. In 2020, in Slovenia, along with a phenomenal increase in the average life expectancy at birth, the investigated indicator raised more than twice. Over the 1990–2020 period, on average, the elderly

population stratum induced by 51.79%, while the youngest stratum decreased by 38.47%. That fact affected both productive and consumption capacities of the respective national economies.

In 2020, in Slovenia and the Czech Republic, the number of population aged 0–14 decreased by less than 25.00%. Over the entire period under investigation, the above age stratum reduced rapidly in Moldova (–49.77%) and Lithuania (–48.16%). Among the sub-group of the Baltic countries, an essential range of variation has occurred: along with the excessive reduction in the above age stratum in Lithuania, the indicator for Estonia equaled to 36.99%. While examining the above variable, one should consider both natural population change and migration. In the latter case, institutional traditions play a key role, in particular, in terms of national informal rules regarding the composition and the size of the family as well as the system of migrants' professional competences.

Samuelson (1954) formulated an ambiguous *Serendipity Theorem*, according to which sustainable economic growth was determined exclusively by a combination of optimal fiscal decentralization and corresponding rate of natural increase. However, in the commentary, Deardorff (1976) convincingly proved that such statement was debatable, since it had been often impossible to estimate the optimal natural population change that could be able to maximize the economic agent's (fully representing the society) individual utility.

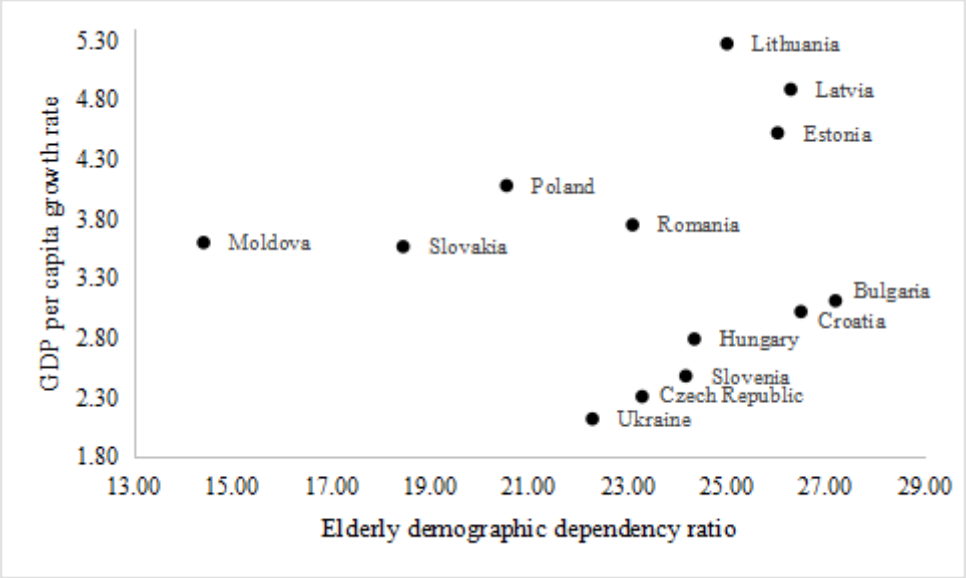
The structural changes in the population of the sampled countries partly confirm the aforementioned theorem. Population ageing appeared to be the factor that determined the design of the social production's distributive and redistributive phases. Hence, it had been appropriate to study the relationship between demographic ageing, social spending, and macroeconomic dynamics.

4. 3. MACROECONOMIC DYNAMICS OF THE SAMPLED COUNTRIES VS. POPULATION AGEING

In the context of the population ageing phenomenon, we investigated the 'post-colonial' period, when the sampled countries have restored their independence or ceased to be satellites of the USSR and participated in European integration. We analyzed the period of 1996–2021 since there were no earlier indicators for the individual countries. That interval has been heterogeneous in terms of macroeconomic dynamics. The Great Recession has divided it in half. We considered the sub-periods of 1996–2008 and 2009–2021 separately.

Regarding the 1996–2021 period, the Baltic countries were the sample's leaders in terms of economic growth rates (the average GDP per capita growth rates varied from 4.53% in Estonia to 5.28% in Lithuania). Meanwhile, all the Baltic states were characterized by comparatively high elderly demographic dependency ratios: from 25.01% in Lithuania to 26.30% in Latvia. The larger average elderly demographic dependency ratio was recorded only in Croatia (26.51%) and Bulgaria (27.21%) (Fig. 2).

Figure 2. The average GDP per capita growth and the average elderly demographic dependency ratios in the Baltic states and the Central European countries in 1996–2021, percentage



Source: the authors' own calculation based on World Bank data

In Moldova, the lowest average life expectancy at birth has been a compliment to the lowest average elderly demographic dependency ratio. Over the entire time interval, it equaled to 14.42%. Over the 1996–2008 period, the Baltic states were characterized by relatively high average economic growth (ranged from 6.82% in Estonia to 7.68% in Latvia) and rather low elderly demographic dependency ratio (ranged from 21.99% in Lithuania to 23.32% in Latvia).

Over the 2009–2021 period, considering the above sub-sample of the countries, the real GDP per capita growth rates slowed down (ranging from 2.10% in Latvia to 3.14% in Lithuania), while the average elderly demographic dependency ratios raised crucially (ranging from 28.03% in Lithuania to 29.29% in Latvia). In 1996–2008, an essential gap – equaled to 3.44 percentage points – occurred between the average elderly demographic dependency ratios in Slovakia and in the Czech Republic.

Considering the next sub-interval, the above gap deepened and equaled to 6.23 percentage points. Over the 2009–2021 period, Slovakia turned out to be almost the 'youngest' country of the sample with the ratio that equaled to 18.46%. Meanwhile, in Moldova, the average elderly demographic dependency ratio equaled to 14.42%. In 2009–2021, due to the beginning of Russian hybrid aggression and insufficient institutional development of public administration, Ukraine was the only sampled country with the negative average GDP per capita growth rates.

4. 4. STOCHASTIC MODELING OF THE INTERRELATIONS BETWEEN THE CERTAIN SOCIO-DEMOGRAPHIC VARIABLES AND ECONOMIC GROWTH IN CENTRAL EUROPE AND THE BALTIC STATES

Aiming to verify *the proposed above model 2*, we applied the ordinary least squares (hereinafter – OLS). Regarding the data availability, we investigated the entire period from 2000 to 2021 (OLS1) and two sub-intervals from 2000 to 2010 (OLS2) and from 2011 to 2021 (OLS3). The summary statistics for the sample is given in Table 3.

In the course of the study, we made 286 observations for the entire time interval. It should be noted specifically that the retirement age in the sampled countries varied significantly. The oth-

er crucial fact was that in the countries with a higher level of well-being, due to the peculiarities of healthcare and social insurance systems' composition, a plethora of the elder people retained the ability to work for a long time and, despite reaching the retirement age, continued their professional activities.

The obtained regressive analysis' results were quite controversial. Over the entire period, an increase in the working age stratum negatively affected the real GDP per capita growth rates. Nonetheless, considering the 2011–2021 sub-interval, the specially mentioned stochastic interdependence between the above variables has been positive, yet statistically insignificant. The above facts could be due to the methodology's peculiarities: only the specific weight of the working age stratum had been considered, while the human intellectual capital's quality mattered enormously.

Table 3. Summary statistics

Variables	Period	Observations	Mean	Standard deviation	Max	Min
GDPpc_gr	OLS1	286	3.72	4.53	17.99	–14.76
	OLS2	143	4.43	5.15	13.00	–14.76
	OLS3	143	3.01	3.69	17.99	–9.44
WAP	OLS1	286	68.16	2.39	74.20	62.18
	OLS2	143	69.10	1.58	73.34	66.05
	OLS3	143	67.23	2.69	74.20	62.18
EDdr	OLS1	286	23.85	4.79	33.89	13.44
	OLS2	143	21.56	3.39	26.19	13.87
	OLS3	143	26.13	4.90	33.89	13.44
GHE	OLS1	286	4.63	0.97	8.08	2.51
	OLS2	143	4.50	0.97	6.72	2.51
	OLS3	143	4.76	0.96	8.08	3.18
GCF	OLS1	286	24.49	4.96	41.56	8.93
	OLS2	143	26.44	5.37	41.56	12.66
	OLS3	143	22.55	3.58	31.33	8.93

Source: The authors' own calculation based on World Bank data

The Table 4 represents the results of the regressive analyses performed for the specifically mentioned sample.

Table 4. Regressions of economic growth on demographic variables and control, the sample of 13 countries, 2000–2021, panel data analysis

Variables	Period		
	OLS1	OLS2	OLS3
WAP	–0.676*	–0.652	0.120
	(0.237)	(0.346)	(0.652)
EDdr	–0.312*	–0.429*	0.125
	(0.119)	(0.153)	(0.359)
GHE	–1.370*	–1.676*	–1.195*
	(0.248)	(0.406)	(0.319)
GCF	0.335*	0.381*	0.319*
	(0.048)	(0.072)	(0.084)
R^2	0.236	0.267	0.128
N	286	143	143

Notes: The numbers in parentheses are the standard errors of the estimated parameters. '*' denotes significance at a 1% level. R^2 is the adjusted coefficient of determination.

Source: the authors' own calculation based on World Bank data

Prudent educational and social programs (co-financed by the respective central governments, local authorities, and private investors in addition) should ensure an essential improvement in economic development. To ameliorate the working age stratum's participation in public production, the fundamental changes in fiscal policy should be made. The taxes on labor and on capital rates optimal composition could accelerate economic growth instead of inducing negative foot voting.

The elderly demographic dependency ratio's slightly positive impact on the sampled economies' development rates – observed over the 2011–2021 period – had been statistically insignificant. Meanwhile, the elder population strata should be effectively involved in public production. The latter requires a mix of certain medical, educational, and cultural programs.

Surprisingly, over all the intervals under investigation, the domestic general GHE share in total public spending negatively affected the real GDP per capita growth rates. The above fact could be caused by incomparable healthcare spending structure in the sampled countries. To disclose the exact economic growth prerequisites, both public and private healthcare expenditures should be investigated accurately.

Gross capital formation appeared to be the only model's variable that had positive impact on economic growth and simultaneously had been statistically significant. Over the entire period of 2000–2021, an increase in GCF by 1.00 % induced real GDP per capita by 0.335%. Due to the Wicksell / Cobb–Douglas production function, investment in physical capital should be rationally combined with cultivation of human intellectual capital.

5. DISCUSSION

Demographic changes have a certain impact on the national economies' growth trends. To ensure development, national governments, local authorities, and other economic agents as well should improve their performance towards macroeconomic sustainability (Villi, 2023). The explicitly mentioned sample represented primarily emerging markets and additionally some from advanced economies.

Even though the countries under study varied significantly in terms of economic growth (especially during the 2000s), there were some specific trends common for the entire sample. In 1990, the total population of the sample reached its peak and approached 165.60 million people. Regarding the 1991–2021 period, all the countries under study were characterized by indisputable decrease in fertility and unsustainable increase in the average life expectancy. The above phenomenon was observed in the most of developed countries as well. Meanwhile, the population age structure of the sample varied substantially. The impact of the population ageing and fluctuations in the working age stratum appeared to be rather ambiguous. Moreover, an increased elderly population dependency ratio affected both production and consumption processes, forcing the respective national governments to reshape their social and demographic policies in order to achieve a sustainable increase in public welfare.

The obtained results proved that the stochastic interdependence between certain socio-demographic and macroeconomic factors appeared to be valid (while its statistical density has been rather weak). The controversial fact that an increase in the working age population stratum negatively affected economic growth could be explained by the specifically mentioned group's aggregated knowledge's and working attitude's peculiarities. In addition, the macroeconomic variables associated with investment in human capital are considered as 'growth-friendly spending' *par excellence*. The interrelations between government healthcare expenditures ap-

peared to be positive in the numerous studies (e.g., Ogundari & Awokuse, 2018, Ding, Huang, Gao, & Min, 2021, etc.). Meanwhile, a few scholars (e.g., Baser & Gokten, 2019, Yoshino, Kim, & Sirivunnabood, 2019, Terták & Kovács, 2020, Štilić et al., 2023, etc.) pointed out that undeveloped institutional environment could eliminate the positive impact of public spending on social and economic development. Thus, in emerging market economies, an increase in public healthcare spending could have a negative effect on the growth processes. In this investigation, we obtained the similar results. Additionally, not only the dynamics but also the structure of healthcare spending and the respective institutional framework matter. Moreover, considering changing demographics, the main attention should be focused on the structure of public healthcare expenditures, regarding the population's actual distribution in terms of age strata.

The model could be improved by: a) a profound investigation of the human intellectual capital's quality impact on the proportions of public production; b) an examination of the actual public and private healthcare expenditures effect on demographic dynamics in terms of longevity; and c) a complex investigation of fiscal policy's impact on the working age population stratum's economic behavior (e.g., in terms of foot voting, etc.). Not only the influence of GCF, but also that part of gross accumulation that was aimed at improving the technological structure of capital investments should be analyzed additionally to refine the model.

Public and private educational expenses (regarding economically active and inactive population strata) could ameliorate the proposed model as well. The improved model could help to prepare an effective and growth-friendly public policy mix.

6. CONCLUSION

Over the second half of the XXth century, the substantial improvements in public production, healthcare and the entire social sphere formed the prerequisites for an induced average life expectancy at birth and consequently for the unprecedented shifts in demographic structure. From the last decade of the XXth century, all advanced and most of emerging market economies have been permanently experiencing an essential decrease in fertility combined with the longevity phenomenon. Regarding the above, the social and demographic policy mix should be reshaped to increase public welfare and efficiently counteract population ageing.

We considered the sample of the Baltic states and the Central European countries. Predominantly, due to the data availability, we investigated social, demographic, and macroeconomic dynamics of the explicitly mentioned sample over the 2000–2021 period. Even though the majority of the sampled economies were characterized by similar demographic characteristics at the beginning of the time interval under study, the applied socio-demographic and macroeconomic policy mix mattered vitally in terms of their resultative public welfare.

Over the period of 2000–2021, an increase in the working age stratum specific weight adversely affected economic growth. That fact could be due to the methodology peculiarities as we assessed the quantitative instead of qualitative parameters of human capital. Specific attention should be paid to the intellectual capital cultivation processes. Over 2011–2021, an increase in the working age stratum specific weight affected the real GDP per capita growth rates positively, yet statistically insignificant. The average elderly demographic dependency ratio was negatively interrelated with economic development indices. Regarding that, the social and demographic policy mix should be focused on the elimination of the population ageing negative impact on public welfare. Hence, the respective policy profile should be updated to ensure active and efficient elderly population strata participation in the production processes. Healthcare expenditures – both public and private – should be rationalized, regarding the respective

population's actual structure to ensure the elderly strata productive involvement.

Taking the Wicksell / Cobb–Douglas production function into account, an increase in human capital requires simultaneous proportional expansion in physical capital. Thus, the taxes on labor and on capital rates optimal composition should be found empirically. Regarding all the intervals under study, gross capital formation appeared to be the only model's variable that had a statistically positive impact on economic development. Over 2000–2021, if gross capital formation raised by 1.00% the real GDP per capita growth rates have induce by 0.335%. The obtained results could be considered while preparing a growth-friendly social and demographic policy mix.

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