



# Age-Structure and Economic Growth: Analysing Third Demographic Dividend in Europe and Central Asian Region

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**Abstract:** The region under study is worth exploring as the long-run socio-economic development and demographic changes are significant to probe into to get insights about fundamental sources of growth trajectory for a longer period. Using POLS and GMM estimations for 34 countries of Central Asia and Europe as a region from 1990-91 to 2019-20 based on data collected from the World Bank and Penn World Table, the study finds that a decreasing young dependency ratio in Central Asian countries can improve job market inclusion, potentially increasing economic production while European nations' increasing old-age dependency ratio exerts pressure on welfare programs and employment opportunities, often hindering growth. Additionally, nations with healthy dependency ratios, where the working-age population is sufficiently utilised, generally experience stronger economic growth historically. The study regards the Action Programmes as an essential roadmap for policy approaches that capitalise on the potential of individuals and strengthen societies amid new demographic realities since demographic proportions substantially affect economic development in this region, shaping labour markets, consumer trends, and investment approaches.

**Keywords:** Age Structure, Economic Growth, Population Ageing, Demographic Dividend, GMM

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## 1. INTRODUCTION

Population ageing is exerting, and will persist in exercising, a diverse array of impacts on society, authorities, and markets. The primary emphasis is on how age-related adjustments in people's choices and demands change production and consumption patterns. The channels of production and consumption regulated by the government result in age-related adjustments in government expenditure being experienced differently and with varying rates across regional, provincial, and federal administrations. For example, health and education constitute the majority of state and local government expenditures globally, representing around one-fifth of total government expenditure, public utilities and social security (OECD, 2019). Compared to the other regions, Central Asia and Europe are worth exploring as the long-run socio-economic development and demographic changes seem to be significant to understanding the region's fundamental sources of growth trajectory considering a relatively longer period. The demographic dividend, characterised by the increase in the working-age population during the change in demographics, has been theorised as crucial for the rapid expansion of nations in the East Asian region (Bloom & Williamson, 1998). Several countries undergo demographic transition and experience population ageing, a deceleration or shrinkage of the workforce, and diminished economic development is obvious (Park & Shin, 2012; Mason & Lee, 2006, 2011). Nonetheless, there exists a degree of confidence that population ageing may produce a silver dividend capable of counterbalancing the decline of the demographic dividend (Ogawa *et al.*, 2021; ADB, 2024). A similar phenomenon is now being witnessed by several nations in Central Asia and Europe. The demographic dividend pertains to the rise in the working-age population, whereas the third dividend highlights longevity and extended working life as possible growth drivers in a nation with an elderly population. Specifically, motivating older individuals to pursue ongoing education might incentivise their engagement in the labour market.

Studies estimate both the first and third demographic dividends based on the assumption that population ageing primarily influences economic growth by intertwining with the labour force participation rate, along with its adverse growth impacts functioning through additional mechanisms. An ageing population diminishes the rate of savings (Park *et al.*, 2021; Horioka & Niimi, 2017), hindering the formation of capital and thereby reducing

economic growth. The reduction in the population below 15 years of age also impacts human capital formation by influencing incentives for investing in it (Lutz, 2019). Ageing adversely impacts the growing total factor productivity as older individuals are often less creative, resulting in diminished technological advancement (Jones, 2010). Empirical research on the diverse mechanisms by which ageing influences economic growth indicates that diminished total factor productivity growth is the predominant determinant for the same. Maestas *et al.* (2022) demonstrated that the adverse impact of ageing is considerably attributed to diminished total factor productivity. Further, there were six avenues found responsible for examining the impact of population ageing on GDP per capita in a study on OECD nations (Lee & Shin, 2019) which encompassed shifts in infrastructure, human resources, average hourly earnings, labour force participation, the share of working-age population (15 years and more) and total factor productivity. These avenues determine that population ageing adversely affects economic growth mainly by decelerating total factor productivity growth if not channelised to realise the third dividend. Therefore, to incorporate the nations of Central Asia and the European region and investigate the effects of population ageing on GDP growth requires accounting for the specific attributes of each nation while traversing these six avenues.

Utilising the panel dataset of selected economies in Central Asia and the European region, the study examines the variations in the significance of various avenues based on the elderly as well as the youth dependency ratio. The labour shortfall resulting from an ageing population is primarily mitigated by increased labour force participation rates among different age groups since the shortfall appears to significantly boost the labour force participation rate in the elderly. The labour shortage resulting from an older population does not appear to be an issue in most nations, owing to the increased labour force participation rate. Moreover, increased longevity, human resources, and total factor productivity enhance the moderating impact of the rising labour force participation rate in the elderly. The impact of population ageing assumes heterogeneity while being considered detrimental for nations with modest levels of some attributes. Furthermore, the ameliorative impact of an increased labour force participation rate is insufficient to counterbalance the adverse growth effects of population ageing. The labour force deficit can

be entirely mitigated by increased labour force participation; however, the principal mechanism for the adverse growth impact of ageing is diminished total factor productivity growth, which is challenging to counteract. This is particularly applicable to nations possessing high-value attributes, predominantly developed nations. The remainder of the work is structured this way: Section 2 presents the existing literature, Section 3 outlines the data and methodological specification, Section 3 discusses the key findings from the study, and Section 4 provides the conclusion.

## **2. LITERATURE REVIEW**

The ageing population raises dependency ratios and may affect the shift from employment to retirement (Coile, 2015). Since 2015, the overall fertility rates have decreased by more than 10% in some of the populated nations in the region, including Russia, Turkey, Ukraine, the UK, and the USA. The levels of fertility are at their minimum in South and Southeastern Europe in nations like Andorra, San Marino, Portugal, Italy, Malta, Albania, Spain, Cyprus, Greece, Bosnia and Herzegovina, and North Macedonia. The five Central Asian nations, together with Monaco, Georgia, and Israel, are the countries in the region exhibiting a TFR that exceeds or equals the replacement level. Life expectancy at birth is projected to be 76.2 years for males and 82 years for females, reflecting a rise from 74.7 and 80.9 years, respectively, since 2015. The ageing population persists, with individuals aged 65 and over constituting 17.6% of the total population, surpassing 20% in 24 of the 56 nations in the region; yet, individuals are living longer and healthier lives (UNECE). In light of this scenario, numerous countries globally are advocating for policies aimed at extending the working lifespan; however, significant inquiries and ramifications arise concerning these modifications to address potential effects stemming from shifts in population age demographics (Temple et al., 2017; Coile, 2018; Gal & Rado, 2019). Adjustments in the demographic age composition exert significant economic ramifications, potentially beneficial regarding productivity and economic expansion, particularly when evaluating the contributions of a better educated and more efficient older workforce (Kotschy et al., 2020; Marois et al., 2022). Studies on the effects of an evolving population composition on economic growth predominantly emphasised the total population while neglecting structural implications, such as education,

which also become evident (Kotschy & Sunde, 2018; Baerlocher *et al.*, 2019; Lutz *et al.*, 2019; Kotschy *et al.*, 2020; Marois *et al.*, 2022). This pertains to the phenomenon of the “demographic dividend” and its potential to mitigate the adverse effects of ageing, provided that appropriate institutional circumstances are in place. An ageing population structure signifies the expiration of the initial demographic dividend, a phase marked by a beneficial age distribution for economic advancement. Demographic changes facilitate the establishment of a secondary dividend determined by the accumulation of capital and a higher saving rate. The subsequent and significant aspect of population variations arises from changes in the age-structure. An increasingly educated population may produce an educational dividend, marked by the development of human capital as a catalyst for productivity (Rentería *et al.*, 2016; Baerlocher *et al.*, 2019; Lutz *et al.*, 2019). The impact of health and education can be examined from various viewpoints including overall productivity, job creation, psychological health, and income disparity. One may also contemplate an augmented support capacity (the relationship between production and consumption) resulting from an expanding labour supply of ageing people, referred to as the silver dividend (Matsukura *et al.*, 2018), or, in more significant terms (educational attainment, better health and nutrition, and labour market stability for elderly), a longevity dividend (Scott, 2023).

Extended working hours are influenced by exogenous and institutional variables. Modifications in pension system regulations affect retirement patterns and career prolongation (Coile *et al.*, 2017; Coile, 2018; Gal & Rado, 2019; Lee & Sanchez-Romero, 2019). Nonetheless, it also stems from household choices and labour market factors: education, health status, inequality, and the nature of occupations together with their technical prerequisites (Berkman & Truesdale, 2023). Bloom *et al.* (2021) contended that prolonged careers are influenced, among other aspects, by educational attainment, increased life expectancy, and employment attributes. Loichinger (2015), Loichinger & Prskawets (2017), Kotschy & Sunde (2018), and Marois *et al.* (2019) asserted that such factors lead to increased productivity thereby postponing retirement. Studies found that the engagement of older persons in the workforce diminished across different countries as life expectancy improved over time and that economic prosperity in the region was linked to early retirement (De Souza *et al.*, 2019; Queiroz, 2017). Berkman and Truesdale (2023) emphasised that

the allocation of resources, skills, and opportunities influenced LFPR in older people in the USA. The findings suggested that disparities and discrimination in education, race, sex, vocational training, and health among others must not be overlooked, and policies should address the multifaceted dimensions of the ageing process, recognising it as a life-cycle concern. Such policies should be linked to pension reforms which would also help in increased female labour force participation, the improvement of occupational mobility and security for elderly workers (Wallenius, 2022; Aitken & Singh, 2023), and an expansion of suitable jobs for older people (Acemoglu *et al.*, 2022). In developing nations, it is essential to recognise that socioeconomic inequities and the political-institutional framework are inextricably linked to discussions regarding education and the labour market (Bloom *et al.*, 2021; Fernandes & Queiroz, 2022). Literature indicates that the existing policy framework has been unreliable, resulting in minimal improvements in utilising silver dividends to accelerate economic growth rate via important channels, which may adversely affect workforce efficiency and GDP growth; however, the improvement in channels determining this relationship can prolong the duration of a favourable economic support ratio for a long time (Marteleto *et al.*, 2016; Melo & Rios-Neto, 2020).

### 3. METHODOLOGICAL SPECIFICATION AND DATA

The methodological framework hypothesised that capital-output ratio, human capital, average hours worked, labour force participation rate, working-age population, population 15 years+, total factor productivity, and life expectancy at birth are the channels translating the impact of an ageing population on economic growth rate. It modelled the effect of these channels on economic growth rate through a multivariate framework:

$$\ln GDPPC_{it} = \alpha_0 + \beta_1 \ln ODR_{it} + \beta_2 \ln YDR_{it} + \beta_3 \ln GDPPC_{it-1} + \beta_j X_{it} + \omega_t \quad (\text{Eq.1})$$

$$\ln GDPPC_{it} = \alpha_0 + \beta_1 \ln OPS_{it} + \beta_2 \ln YPS_{it} + \beta_3 \ln GDPPC_{it-1} + \beta_j X_{it} + \omega_t \quad (\text{Eq.2})$$

where GDPPC is gross domestic per capita, ODR is old-age dependency ratio, YDR is youth dependency ratio, OPS is old-age population share, YPS is youth population share, and  $\omega$  is the stochastic error term while  $X_{it}$

represents control variables as a capital-output ratio, human capital, labour force participation rate, average hours worked, the share of the working-age population to the total population, the share of 15 years+ population to the total population, total factor productivity and life expectancy. It is to be noted that the dependency ratio was replaced by population shares of the elderly and young population in Eq. (2). Based on the literature, this study used POLS and GMM estimations to conclude. These econometric specifications were chosen to deal with the issues of serial correlation and endogeneity. Further, the Generalised Method of Moments (GMM) was used because the number of time observations was smaller than the number of cross-section units to ensure that there was likely to be limited variation in the values of parameters to be estimated after collecting initial estimations using Pooled Ordinary Least Square method (POLS). The dummies for the selected years were included in the model to control for fixed effects. Previously, studies with smaller samples had used GMM estimations to analyse the long-term relationship between the regressors and regressed variables (Chakraborty & Mazzanti, 2020; Ozturk & Al-Mulali, 2015). Moreover, there were 34 countries selected from Central Asia and Europe as a region based on the availability of data for the time period of 1990-91 to 2019-20. The data sources for all the selected variables included the World Bank and Penn World Table. The descriptive statistics for all the selected variables are shown in Table 1.

**Table 1: Descriptive Statistics**

<i>Variables</i>	<i>Mean</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
GDPPDC	8.9541	5.2438	5.6384	11.0015
ODR	0.17	0.13	0.22	0.59
YDR	0.43	0.19	0.13	1.07
OPS	0.11	0.09	0.14	0.30
YPS	0.23	0.08	0.07	0.32
Capital-Output Ratio	1.98	1.89	15.02	21.21
Human Capital	1.40	1.17	1.57	2.90
LFPR	2.32	2.16	3.36	4.88
Average Hours Worked	3.47	3.25	5.61	5.85
Share of Working-age Population	0.87	0.63	1.52	2.17
Share of Population 15 years+	0.76	0.52	1.29	2.03
TFP	1.65	1.13	2.58	4.93
Life Expectancy at Birth	2.71	1.06	3.74	5.91

Source: Author's Calculation

#### **4. RESULTS AND DISCUSSION**

The relationship between population ageing and economic growth through various channels is shown in Table 2 for dependency ratios and in Table 3 for population shares. The coefficients in both cases suggest similar relationships among variables except for the capital-output ratio and average hours worked in the case of GMM estimates. A decreasing young dependency ratio in Central Asian countries can improve job market inclusion, potentially increasing economic production. Conversely, European nations' increasing old-age dependency ratio exerts pressure on welfare programs and employment opportunities, often hindering growth. Recent studies indicate that nations with healthy dependency ratios, where the working-age population is sufficiently utilised, generally experience stronger economic growth. In addition, the Central Asian nations with a greater share of the working-age population could drive prosperity if appropriately utilised; nonetheless, obstacles persist in the job market and professional development, however, the European nations encounter stagnation attributed to ageing populations, wherein a diminished share of working-age adults constrains growth potential. In countries with a decreasing dependency ratio, the workforce increases, facilitating enhanced economic productivity. Conversely, greater dependency ratios might burden resources, hindering expenditure on education and healthcare. Recent studies suggest that Central Asian countries, confronting demographic changes, must emphasise the growth of human assets to capitalise on potential revenue and alleviate the effects of ageing populations prevalent in Europe. In Central Asian countries, increasing labour force participation, particularly among females, can alleviate the economic difficulties associated with elevated youth dependency ratios. In European nations, ageing populations lead to increased dependency ratios, requiring programs to enhance engagement among older workers. Recent studies highlight the importance of improving workforce participation while regulating dependency ratios for sustainable economic expansion in the region. Boosting educational attainment and technological penetration in Central Asian nations can augment total factor productivity, thereby stimulating economic growth within a young population. In European nations, the rising elderly dependency ratio resulting from ageing populations presents issues that impede total factor productivity growth. Increased life expectancy typically signifies enhanced healthcare and living conditions, fostering a healthier, more



efficient workforce. In Central Asian nations, rising life expectancy positively impacts the dependence ratio by increasing the proportion of the working-age population, thereby promoting economic growth. In European nations, increasing life expectancy has resulted in heightened old-age dependence ratios, posing challenges to economic equilibrium.

**Table 2: Regression Results for Dependency Ratios**

<i>Variables</i>	<i>POLS</i>	<i>GMM</i>
L1.GDPPDC	-0.280***	-0.277***
ODR	1.569**	-1.442**
YDR	-2.052	-2.033**
Capital-Output Ratio	-1.003*	-0.989***
Human Capital	-0.159	-0.134***
LFPR	1.682***	1.548**
Average Hours Worked	-2.041***	-1.927**
Share of Working-age Population	-1.983***	-1.831***
Share of Population 15 years+	1.423*	1.212**
TFP	-0.774**	-0.652***
Life Expectancy at Birth	1.012**	1.001**
Observations	680	522
Sargan-Hansen test (p-value)		0.2155
R-squared	0.7963	

Source: Author's Calculation (\*p < 10%, \*\*p < 5%, \*\*\*p < 1%)

**Table 3: Regression Results for Population Shares**

<i>Variables</i>	<i>POLS</i>	<i>GMM</i>
L1.GDPPDC	-0.594***	-0.421***
OPS	-2.233*	-1.889**
YPS	-3.294**	-2.975*
Capital-Output Ratio	-1.921***	1.571***
Human Capital	-0.457**	-0.343**
LFPR	2.107***	2.001***
Average Hours Worked	-3.002	2.867**
Share of Working-age Population	-2.862***	-2.492***
Share of Population 15 years+	2.105*	2.013*
TFP	1.385***	-1.129***
Life Expectancy at Birth	1.998**	1.683***
Observations	680	522
Sargan-Hansen test (p-value)		0.2511
R-squared	0.8145	

Source: Author's Calculation (\*p < 10%, \*\*p < 5%, \*\*\*p < 1%)

## 5. CONCLUSION

Shifts in the population composition present several challenges to the nation's economic performance, particularly if they catalyse behavioural and regulatory transformations. The ageing population diminishes the fraction of working-age adults relative to the elderly, hence raising population and economic dependency ratios (Kotschy & Sunde, 2018). Given the interrelationship of several life cycle features, one might assert that traits developed throughout initial years and schooling reverberate in later life stages, including labour market participation and retirement timing (Mason & Lee, 2006). Evidence indicated that improvements in healthcare and educational attainment correlate with extended working careers and delayed retirement; however, these patterns are not uniform among individuals within the community. Improved life expectancy and nutritional support would facilitate reduced dependency ratios. Studies indicated that the advantages of this situation are linked to labour market stability, marked by a significant reduction in inconsistency and welfare incentives encouraging individuals to extend their working years. Effective strategies encompass enhancing job quality, instituting comprehensive retirement and impairment policies (Berkman & Truesdale, 2023), fostering age-appropriate professions (Acemoglu *et al.*, 2022), and encouraging health along with incentives for job stability and migration among the elderly (Aitken & Singh, 2023). The United Nations Economic Commission for Europe (UNECE) states “The UNECE region remains at the forefront of global demographic transformation. Most countries are facing, or will soon face, declining fertility, ageing populations, and projected population decline. These changes present challenges, but they also present opportunities. The Action Programmes provide an essential roadmap for policy approaches that capitalise on the potential of individuals and strengthen societies amid new demographic realities.”

Demographic proportions substantially affect economic development in Central Asia and Europe as a region, shaping labour markets, consumer trends, and investment approaches. Increased levels of human capital—defined by educational attainment and skill acquisition—augment productivity, promoting economic development. An improved dependency ratio increases the labour force participation rate, enabling a greater number of individuals to engage in economic activities, hence stimulating growth. An advantageous dependency ratio, marked by a greater proportion of the working-age population

compared to dependents, improves total factor productivity by enabling a more effective distribution of man and materials. Berkman and Truesdale (2023) emphasised that effective policies must account for all population dispersion alongside typical trends from a life cycle viewpoint, as earning and ageing preferences are shaped by prior experiences. Socio-economic disparities hinder adequate human capital creation (Coile *et al.*, 2017; Lutz *et al.*, 2021) and may adversely affect economic development and productivity. This is especially apparent in nations with highly varied demographic composition, where the historical continuity of social inequities perpetuates the vulnerabilities of the unorganised job market and surviving-wage jobs encountered by elderly individuals in the labour market (Fernandes & Queiroz, 2022). The effective use of a third dividend is viable in emerging nations to take early steps and in advanced nations to execute initiatives with faster results considering this an immediate issue to be resolved in the short run. The notion is more plausible quantitatively due to the reported rise in educational diversity and adjustments in the pension system. Nonetheless, qualitatively, gains in factor productivity and GDP per capita should transpire in contexts where learning and social equity are prioritised. Consequently, acknowledging inequities as a consequence of wider factors is essential to rectify the discord between elderly people and the prolongation of working life. It is especially crucial in nations undergoing swift population transitions and encounter significant social inequalities, notably marked by an extensive pension system that incentivises affluent people to retire prematurely, while economically disadvantaged people encounter systemic challenges their entire lives, including an unorganised working environment, minimal social security aid, and uncertain job prospects. Additionally, the study can be further extended to account for gender dividend, rural-urban divide, disparities across social groups, and regional variations at deeper levels. At times, the female labour force participation rate, their tenure for job involvement, education composition, longevity, and of course productivity, or rather differential productivity in their life cycle is one of the significant determinants for tapping the third demographic dividend.

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- **Funding:** No funding has been received and there is no financial or non-financial interest associated.

- **Redundant or Duplicate Publication:** The manuscript titled above is free from any plagiarism to the best possible knowledge and has not been submitted elsewhere for publication. No submissions and previous papers have been made that might be regarded as redundant or duplicate publications of the same or very similar work.
- **Conflict of Interest:** I wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.
- **Ethical Issues:** I confirm that I have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, for intellectual property.

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