The macroeconomic impacts of demographic changes in Hungary in the context of the European Union*

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The article provides a review of Hungarian and international demographic trends and examines the macroeconomic impacts of demographic developments in Hungary in comparison with the European Union. Based on available population projections, it is expected that ageing will also characterise Hungarian demographic processes, but the extent of ageing in Hungary may be more moderate than the estimated impact in several regional and Western European countries. According to the population projections and estimations found in the literature, we came to the conclusion that in the long run population ageing is expected to substantially change labour supply, consumption, and savings ratios, dampen growth prospects and potentially exert a disinflationary impact in the upcoming decades. Demographic processes may affect developments in key variables relevant for the conduct of monetary policy and the effectiveness of transmission channels. In addition, population ageing may increase budgetary expenditures through the pension and the healthcare system. The adverse impacts may be mitigated by economic policy measures and adjustment by economic agents. At the same time, demographic processes may also represent an economic opportunity that can be exploited through the adequate reallocation of resources.

Journal of Economic Literature (JEL) Classification: E21, J10, J11, H50

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1. Introduction

One of the greatest challenges facing the global economy is population ageing caused by the declining birth rate, coupled with an expected rise in life expectancy. The expected rate and speed of ageing varies by geographic region and country,

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but Europe is expected to have the highest ratio of older persons in its population by 2050.

Similarly to the European trend, changes in the population structure in Hungary are also shaped by population ageing. If current demographic trends continue, the old-age dependency ratio may double by 2060. This process is driven by two fundamental factors. On the one hand, Hungary's fertility rate is exceptionally low even in a European comparison, while on the other hand, life expectancy is gradually increasing, albeit from a lower point and at a slower rate than the European average. Assuming a gradually increasing fertility rate and life expectancy remaining below the European Union average, the old-age dependency ratio may slightly exceed the average of the European Union by 2060.

One key question is how the changing age structure will impact the development of macroeconomic variables and how economic policy may help in preparing for these changes. Based on the current prognosis, population ageing is set to impact every facet of life, shaping the expected developments in macroeconomic indicators. It may have an adverse impact on growth prospects and the fiscal balance. In terms of the conduct of monetary policy, it may affect the degree of inflationary pressure, the equilibrium real interest rate and the effectiveness of transmission channels. Adverse impacts can be cushioned using economic policy tools, and negative impacts can also be mitigated through adjustments induced by demographic processes.

2. Demographic processes in Hungary in an international context

2.1. International demographic trends

Population ageing is a trend essentially prevailing in the entire world, but at diverging rates and speeds. The change in the population's age structure may be characterised by an increase in the proportion of older persons (aged 65 or older) in the coming decades *(Table 1)*. According to the World Bank's forecast, the proportion of elderly within the population may be the highest in high-income countries: in these countries, one out of four people will be over the age of 65 by 2050. The speed of ageing, which can be identified as the change in the proportion of elderly *(UN 2013b)* may be the most significant in middle-income countries. In these countries, the ratio of persons over the age of 65 may almost triple by 2050 compared to the level in 2000. The number of older persons may increase at a faster pace in less developed regions compared to developed ones, mainly due to the higher birth rates in earlier decades, with the result that 80% of the total older population may be concentrated in less developed regions *(UN 2013b)*. This could create an issue, because developing countries could age before their economies converge with developed countries *(Lee et al. 2010)*.

Table 1.
Expected rate of ageing across various country groups of the world based on the World Bank's forecast

Country/Country group[1]	Share of 65 years and older in the population			Old-age dependency ratio		
	2000	2050	Change	2000	2050	Change
High income countries	13.7	25.8	+88%	20.3	44.3	+118%
Middle income countries	5.5	15.4	+180%	8.7	24.0	+176%
Low income countries	3.5	7.3	+109%	6.3	11.5	+83%
European Union	15.7	28.9	+84%	23.4	51.4	+120%
Central Europe and Baltic countries	13.5	27.9	+107%	19.8	48.5	+145%
Hungary[2]	15.1	26.0	+72%	22.3	43.8	+96%
Hungary[3]	15.0	27.5	+84%	22.0	47.3	+115%

Note: 1. Country groups are defined based on the classification featured in the World Bank database, which categorises countries based on gross GDP per capita for 2013. 2. World Bank (2014). 3. Eurostat (2014).
Source: Eurostat (2014), World Bank (2014)

Population ageing refers to a relative rise in the proportion of older cohorts within the population compared to younger ones, which – ceteris paribus – could result in a significant rise in the burden of the economically active population. The proportion of older persons relative to persons of working age (*old-age dependency ratio)* may rise to the greatest extent in middle-income countries, driven by the increase in persons aged 65 or older, but the indicator may still fall significantly short of the value in high-income countries *(Table 1)*. In terms of global regions, the old-age dependency ratio may be the highest in the European Union in 2050, rising from 23% in the 2000s to 51% by 2050. This means that while in 2000 there were 23 older persons for every 100 persons of working age, by 2050 there will be more than double this amount, i.e. 51 older persons. The old-age dependency ratio may approach 60% by 2050 in several Western European countries, including Germany and Portugal. Alongside European countries, the number of older persons relative to persons of working age may also increase significantly in Japan: by 2050 this ratio may reach 72% according to the World Bank's population projection *(World Bank 2014)*. Hungary's old-age dependency ratio may double by 2050, but still remain slightly below the estimated average for Central European countries.

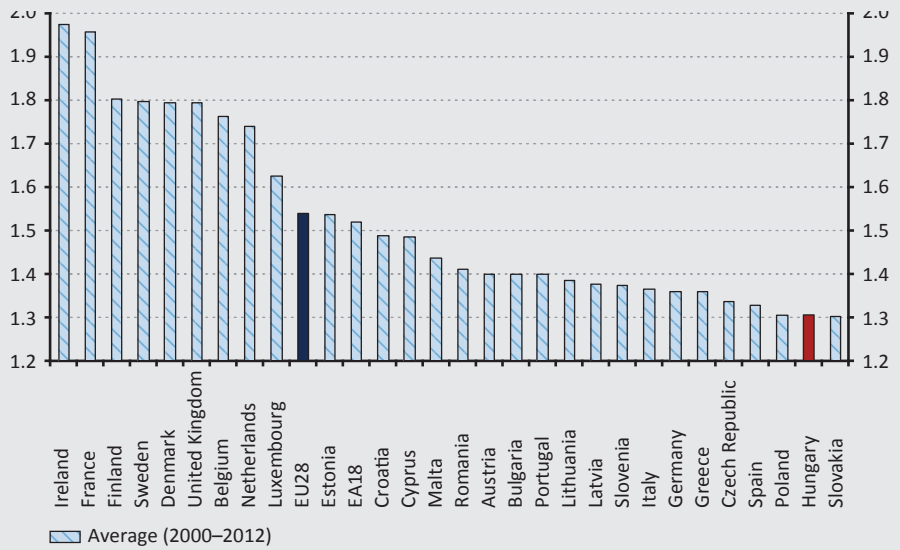
Population ageing can also be captured through other population statistics indicators than those mentioned above (ratio of persons aged 65 and older within the population, old-age dependency ratio). These include the ageing index, calculated as the number of older persons (aged 65 or older) per hundred children (persons aged between 0–14) *(CSO 2014a)*. Demographic ageing is also indicated by the population's rising median age *(Chawla et al. 2007)*. Demographic dependency

indicators with modified content also appear in the literature for the evaluation of economic and social impacts of ageing. These indicators compare the number of older persons or inactive persons to the number of persons actually employed rather than those of working age (for instance the total economy dependency ratio).

2.2. Hungarian demographic processes in a European comparison

Hungary's fertility rate is exceptionally low even by European standards, based on *Eurostat (2014)* data. In European countries, the total fertility rate[1] has declined gradually since the 1960s, but has exhibited a slightly increasing trend since the turn of the millennium, rising from 1.45 to 1.6. The fertility rate in European Union countries is set to fall short of the 2.1 figure necessary for a long-term reproduction,[2] in spite of the rising trend, and the European fertility rate will be the lowest among the world's regions *(UN 2013a)*. The fertility rate exhibits a significant deviation within the European Union: the rate stood at around 2 in Ireland and France and at 1.3–1.4 in the Visegrad group and Southern Europe *(Figure 1)*. The total fertility rate in Hungary has fluctuated between 1.25 and 1.34 since the turn of the millennium.

Figure 1.
Developments in the total fertility rate in European Union countries, 2000-2012



Source: Eurostat

[1] The total fertility rate is the "average number of children born alive that would be born to each woman during her lifetime if the prevailing age-specific fertility rates applied during her child-bearing years" *(CSO 2014b).*

[2] A total fertility rate of 2.1 children per women ensures broad stability of the population, on the assumptions of no migration flows and unchanged mortality rates *(OECD 2013).*

Life expectancy has increased slightly since the turn of the millennium, but its level and growth rate remain low by European standards. Life expectancy at the age of 60 averaged 23.6 years in 2012 in the European Union, and Hungary's value (20 years) is one of the lowest in the EU. Since the turn of the millennium, life expectancy at the age of 60 has increased by the same number of years for men and women in Hungary, and thus the gap in life expectancy between the genders has not narrowed.

The low fertility rate and the gradual increase in life expectancy result in the ageing of population in Hungary as well. The falling fertility rate results in smaller cohorts of younger age compared to older generations and also decreases the future number of women of childbearing age, while members of older generations are expected to live longer due to rising life expectancy. In Hungary, 17.5% of the total population is aged 65 and older *(Eurostat 2014)*, similarly to the average in other European Union countries (18.6%). The old-age dependency ratio stands at 25.8% in Hungary, which falls slightly short of the 28% of average value of European Union countries.

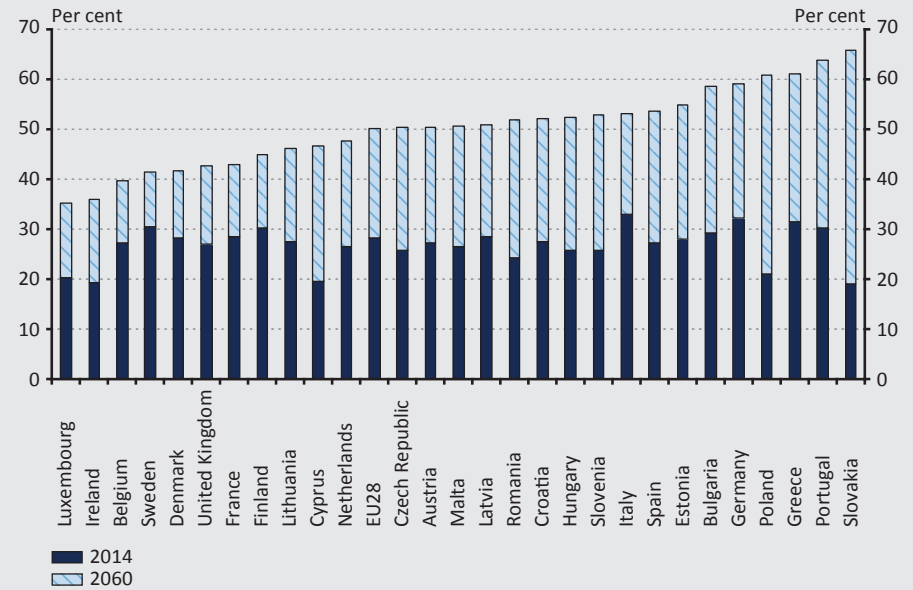
2.3. Expected developments in demographic processes by 2060

In the coming decades, the ageing of the Hungarian and European population is expected to continue based on the population projections, and the speed of ageing may accelerate.[3] We use the *Eurostat (2014)* forecast as the baseline scenario for presenting demographic processes, which contains data comparable at the European Union level. In the European Union, the proportion of persons aged 65 and older within the total population could rise from the current 18.6% to 28.4% by 2060 while the overall population of the European Union may increase slightly by 2050. The proportion of older persons within the population may be the highest by 2060 in Slovakia, Portugal, and Greece, and the rate of ageing may be most significant in Slovakia and Poland. In these countries, the old-age dependency ratio may rise above 60% by 2060 *(Figure 2)*. The old-age dependency ratio may reach 52% in Hungary by 2060, with ageing thus exerting a slightly higher impact compared to the European average (50%). The speed of ageing may also accelerate in the coming decades, as the proportion of older persons is expected to rise at a faster pace than at present. While the proportion of persons aged 65 and older increased by 72% between 1960 in 2010, a rate of increase of 92% is expected in the European Union between 2010 and 2060 *(Eurostat 2014)*.

In Hungary, population ageing may be accompanied by a decreasing population in the coming decades according to available population projections. The *Eurostat (2014)* forecast assumes that the fertility rate and life expectancy may converge from their current low level to the higher European average *(Table 2)*. According to

[3] The population projections of Eurostat and *CSO HDRI (2013)* show a very similar picture regarding the expected development of Hungarian population. Hungarian population projections are compared in Annex.

Figure 2.
Expected developments in the old-age dependency ratio in European Union countries



Source: Eurostat (2014)

the population projection, Hungary will remain a net destination country in terms of migration, although the rate of migration will be lower in the second half of the projection horizon. As a result of all these factors, the total Hungarian population may shrink to 9.2 million by 2060 from 9.9 million in 2014, according to Eurostat's projection. The ratio of the working age group (between 15 and 64) within the total population could fall to 56% by 2060 from 68% in 2014; in other words, the cohort of persons of working age may decrease by 1.6 million over the 2014–2060 period. The ratio of persons aged 65 and older within the total population could rise to close to 30% by 2060, from 18% in 2014.

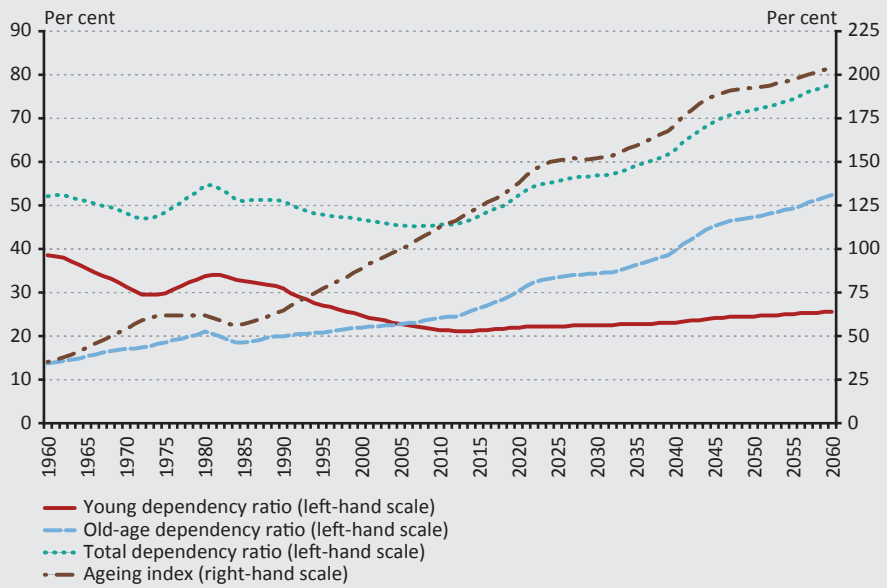
Table 2.
Hypotheses of Hungarian population projection

Indicator	2012 data	2020	2040	2060
Fertility rate	1.34	1.50	1.68	1.74
Life expectancy at birth (years), men	71.6	73.6	78.1	82.0
Life expectancy at birth (years), women	78.7	80.2	83.8	87
Net migration (thousand persons)	8.1	24.3	24.2	14.0

Source: EC (2014).

Population ageing results in a rise in the old-age dependency ratio. Based on population projections, the ratio in Hungary may double between 2014 and 2060, rising from 26% in 2014 to 52% in 2060 *(Figure 3)*. This means that while in 2014 there were 26 older persons for every 100 persons of working age, by 2060 there will be more than double that amount, i.e. 52 older persons to be supported. The total dependency ratio may increase at a lower pace, as the decline in the number of children can partly offset the rise in the ratio of elderly.[4] The young dependency ratio may rise only slightly, from 21% to 26% between 2014 and 2060.[5] Despite the shrinking proportion of children, the young dependency ratio may nevertheless rise as the number of persons of working age could shrink even faster than the number of children according to population projections. Based on the *ageing index,* the number of older persons equalled the number of children by 2006, and the index may rise to 240% by 2060, meaning that by this date there will be twice as many older persons (204) for every 100 children. As a result of population ageing, the median age of the Hungarian population could rise from 41 in 2014 to 48 by 2060.

Figure 3.
Dependency ratios and the ageing index in Hungary



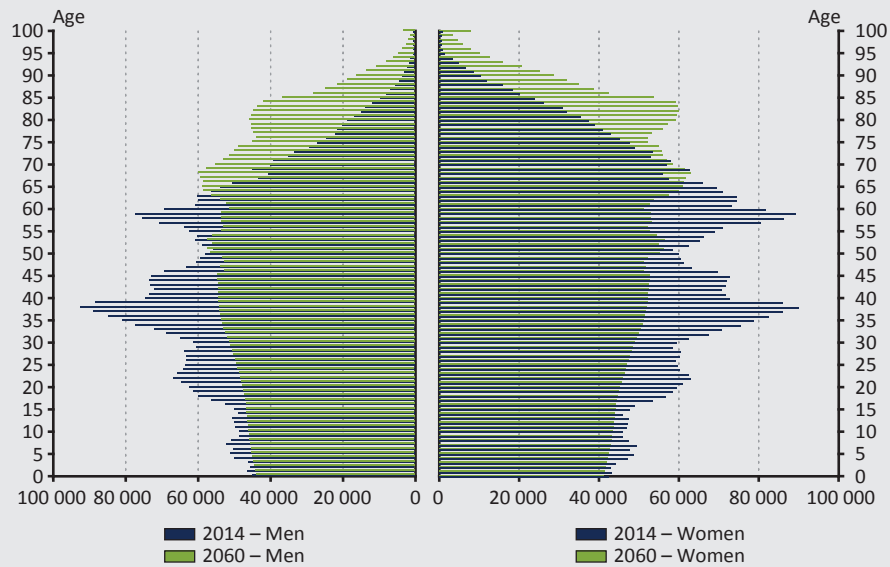
Source: Eurostat (2014).

[4] The total dependency ratio is the proportion of older persons and children relative to the number of persons of working age.

[5] The young dependency ratio is the proportion of children (age 0–14) the number of persons of working age (age 15–64).

The expected population ageing and the decline in the population is also reflected in the shifting of the population pyramid *(Figure 4).* The rise in the proportion of older persons (aged 65 and older) within the total population will be affected by the large age cohorts reaching age 65 during certain periods (members of the Ratkó generation, i.e. Hungary's baby-boomers, and their children), which could affect the macroeconomic and fiscal impacts of ageing.

Figure 4.
Composition of the Hungarian population by age and gender, 2014-2060



Source: Eurostat (2014).

3. Macroeconomic impacts

The following section quantifies the impact of demographic changes on the labour market, the consumption and savings ratio, asset prices, economic growth, the budget deficit and the presumed inflationary trend. For this exercise, we use the estimates found in the literature alongside the *Eurostat (2014)* population projection as our baseline scenario.

The estimates presented in the reviewed literature explain developments in macroeconomic variables with demographic variables (amongst other things). Using the coefficients associated with demographic variables used in the estimates, and using the Eurostat's population projection *(Eurostat 2014)*, we calculate the expected impacts of demographic processes on macroeconomic variables for

each European Union member state. For the sake of comparability, we apply two additional transformations to our results. As a first step, we took the average of the impacts for each decade and country. Then as a second step, we deducted the quantified average impact for the decade of the 2000s for the macroeconomic variable at issue for Hungary from the decade averages each country. This renders the calculated impacts comparable across both time and space. For Hungary, as the result of demographic processes, the expected changes in the macroeconomic variable at issue are presented. We therefore present the change induced by demographic processes compared to the average of the 2000–2009 period. The interpretation of impacts among the other European Union countries is similar; the consequences of demographic processes can be assessed compared to the decade of 2000–2009, and the demographic processes of specific countries on the macroeconomic indicator under review can be compared to the degree expected in Hungary. For the sake of transparency, we represent the impacts relevant to Hungary and – interpreted as the arithmetic average of the impacts affecting individual member states – the European Union. We also represent the band covering the minimum and maximum impact estimated for European Union member states.

Before presenting the results of our calculations, we must stress the uncertainty of the calculations. While the estimates found in the literature are generally crafted using observations of several countries and/or longer periods, their future projectability is limited because they are usually not based on deep parameters derived from theory, but on the historic covariance of data. Covariance observed in the past may change and the measured covariance may not necessarily signify causality, thus the customary "ceteris paribus" analysis could be misleading.[6] Demographic processes project changes on a scale never seen before, and that may question the calculations based on the projection of correlations measured in the past. First, impacts measured in the past (typically linear) were measured in a model framework that was suitable for adequately measuring the impacts in the context of the demographic variable values prevailing at the time. Second, significant demographic changes may also trigger adjustment processes that did not exist in the past, and so their impact could not be quantified. Third, in many cases our calculations are based on earlier estimates that analysed the impact of demographic processes on a specific macroeconomic indicator. For instance, there are separate estimates for developments in consumption, savings and investment ratios in function of demography, although these do not necessarily exhibit trends that are numerically comparable even though these macroeconomic indicators

[6] Applying the "ceteris paribus" assumption, that is, other things being equal, to projections spanning several decades could be particularly contentious. The expected substantial future change in demographic processes may compel changes, including the macroeconomic impacts addressed in the following section or potential modifications to social welfare systems, which may in and of themselves shape demographic processes and may also generate a knock-on effect on macroeconomic developments, which may invalidate calculations assuming all other things being equal.

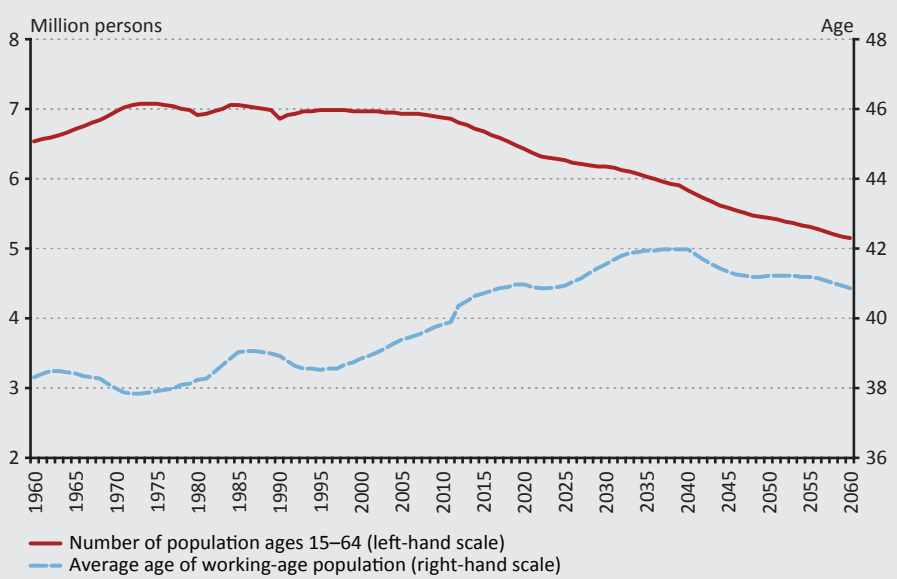
are linked by similarities. The potential consistency issue mentioned above does not affect the calculations using the outcomes of the general equilibrium model.

3.1. Labour market

Demographic processes have a direct impact on the supply side of the labour market. The Hungarian population aged 15 to 64 may shrink gradually from 6.7 million in 2014 to 5 million by 2060 *(Figure 5)* based on Eurostat's population projection *(Eurostat 2014)*. The ratio of persons of working age within the total population may fall to 56% by 2060 from 68% in 2014. The impact may be less pronounced within the European Union as a whole, where the proportion of working age may shrink by 11% by 2060 compared to a 23% decline in Hungary. The ratio of persons of working age within the total population in EU member states may decrease at a slower rate, from 66% in 2014 to 57% by 2060. Meanwhile, the gradual ageing of persons of working age is also expected in Hungary. The average age of the active population has gradually been rising since the 1990s, a trend that may be broken after 2040 due to the age composition of immigrants and the grandchildren of the Ratkó generation reaching the inactive age.

The labour force participation rate – the ratio of economically active persons relative to persons of working age – *may fundamentally shape developments in labour supply, alongside demographic processes.* In the 15–64 age cohort, the labour

Figure 5.
Size and average age of the working-age (aged 15-64) population in Hungary



Source: Eurostat (2014).

force participation rate is low in international comparison, despite the increased seen in recent years. Especially the labour force participation rates of career starters, persons before retirement age, unskilled workers and mothers with small children fall short of international averages. The adverse labour market impact of demographic processes may be partially offset by measures boosting the labour force participation rate and steps aimed at raising the effective retirement age in line with life expectancy.

3.2. Consumption

Population ageing can also affect developments in the aggregate consumption and savings ratios, due to changes in life expectancy and age cohort proportions. According to the life-cycle theory, individuals' average and marginal propensity to consume and save depends on their age. The consumption rate is higher and the savings ratio lower at younger and older ages compared to middle age. With the shift in age structure, the determinants of economic growth, including aggregate consumption and savings may change depending on the life cycle that the largest number of individuals find themselves in *(Bloom at al. 2010).*

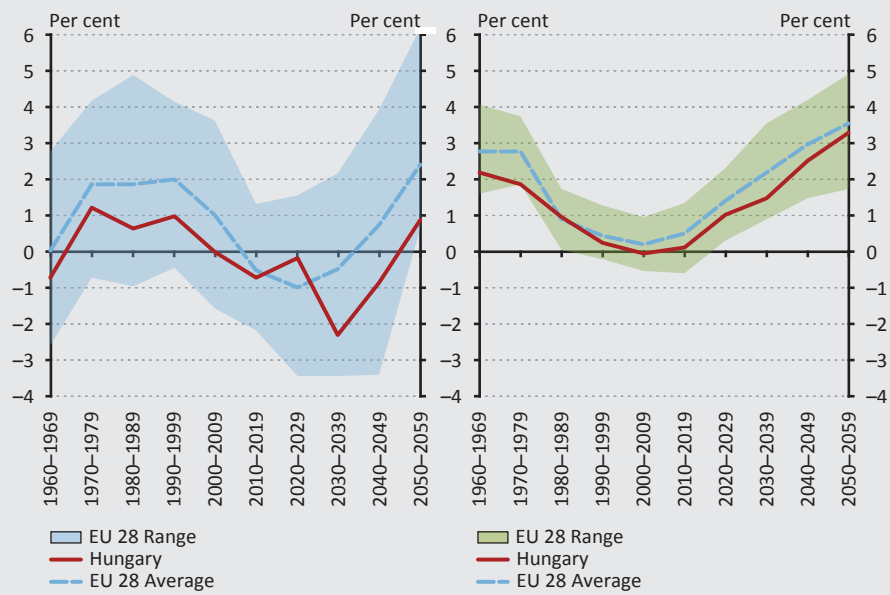
The empirical findings of *Erlandsen and Nymoen (2004)* also corroborate *the significant impact of the population's age structure on aggregate consumption.* In their regression model, the authors explain developments in the consumption rate with the proportion of the 50–66 age cohort within the total population, alongside macro variables (income, real interest rate). The 50–66 age cohort is highlighted in the study because they are on the cusp of retirement, therefore their propensity to save is much higher, while their propensity to consume is much lower compared to younger age cohorts, while their income is higher relative to other middle-aged cohorts.

The impact of demographic changes on consumption can also be estimated using the total dependency ratio according to the findings of *Masson and Tryon (1990)*. The consumption rate of dependents relative to their income is characteristically higher compared to actively employed persons, therefore an increase in the total dependency ratio boosts consumption. In their study, *Masson and Tryon (1990)* apply a regression to model the logarithm of total consumption expenditure, in which the logarithm for real disposable income for the previous period, propensity to consume, the long-term real interest rate and changes in the logarithm of net GDP after taxes are also included as explanatory variables alongside the total dependency ratio. Estimates have confirmed the positive correlation between the total dependency ratio and consumption: a 1% increase in the total dependency ratio generates a 0.1 percentage point increase in the consumption rate *(Masson and Tryon 1990).*

According to the above methods, using the Hungarian population projection as our basis, Hungary's consumption rate could rise gradually in the decades following 2030. Over a shorter horizon, the two calculations yield opposing impacts in terms of their sign, the difference in absolute terms only amounts to a few percentage points, meaning that neither version reflects a material change in the consumption rate in the upcoming decade and a half. The estimates of *Erlandsen and Nymoen (2004)* reveal that all other things being equal, the consumption rate could decline gradually compared to 2000–2009, by 3 percentage points up until the 2030s *(Figure 6, left-hand panel)*. Hungary's slightly more unfavourable population projection presages a more pronounced decline relative to the European Union average. The reason for the discrepancy is that the grandchildren of the Ratkó generation will reach the 60s in the 2030s, which could go hand-in-hand with their gradual preparation for retirement. According to the model, consumption could return to the level prevailing before the 2000s starting from the 2040s following a 4 percentage point slump.

Adapting the estimate of *Masson and Tryon (1990)* to Hungarian data, a progressive rise in the consumption rate can be observed *(Figure 6, right-hand panel)*. This

Figure 6.
Estimated developments in the consumption rate in Hungary and the European Union compared to 2000–2009 according to *Erlandsen and Nymoen (2004)* (left-hand figure) and *Masson and Tryon (1990)* (right-hand figure)



Source: Authors' calculations.

stems from the gradual increase in the total dependency ratio, resulting in a rise in the propensity to consume based on the life-cycle theory. The discrepancy between the two outcomes may be due to the fact that the proportion of persons aged between 50 and 66 could increase less dynamically compared to the total dependency ratio during the period under review.

According to our projections based on the estimates of *Masson and Tyron (1990)*, demographic processes in Hungary presage a lower consumption rate compared to European Union standards, but the changes in the Hungarian consumption rate may be on par with the European Union average. Looking ahead, demographic processes could exert the greatest impact on the consumption rate in the Mediterranean countries (GR, ES, PT) and the smallest impact in Luxembourg, Denmark and Sweden. According to the estimates of *Erlandsen and Nymoen (2004)*, the smallest impact on the consumption rate is expected in Slovakia and Hungary, while the greatest impact is expected in the Baltic States (LV, LT) and Ireland.

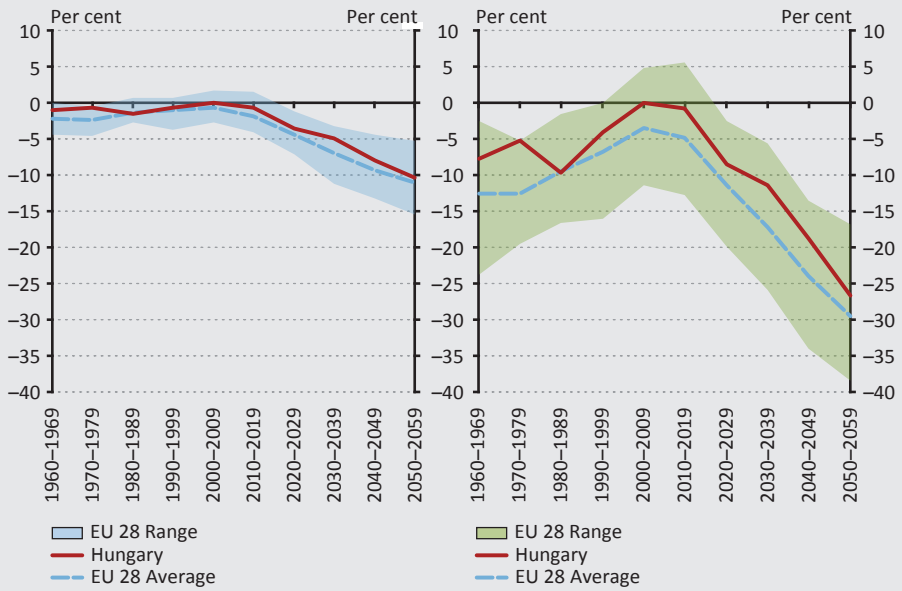
3.3. Savings

Similar driving forces are at play in the relationship between the savings ratio and the composition of the population as between the consumption rate and the composition of the population. Beyond the fact that the savings and consumption rate are mutually complementary, the savings ratio and demographic processes can also be linked through the life-cycle theory: the consumption rate is higher and the savings ratio lower at younger and older ages compared to middle age.

Meredith (1995) captures the impact of demographic processes on savings using demographic dependency ratios. After reviewing the findings in the literature, the author concludes that the increase in both the young and old-age dependency ratio lowers the savings ratio. The life-cycle theory therefore prevails: there is no available income to set aside during the younger age, while the savings accumulated are used up during the older years, and thus the rise in the total dependency ratio has an adverse impact on the savings ratio. Although estimates deviate across a broad range, it can be determined that a rise in the old-age dependency ratio lowers the savings ratio to greater degree.

Also partly referencing the life-cycle theory, *Lindh (1999)* gives an estimate of the impact of changes in age cohort proportions on inflation, GDP growth, the savings ratio, and the investment ratio. In his model, the author divides the population into six groups (persons aged 0–14, 15–29, 30–49, 50–64, 65–74 and 75 and over) and uses this classification to explain, amongst other things, developments in the savings ratio. According to the findings, the size of the youngest age cohort and the cohort of persons aged 65 and over has a significant negative impact on the savings ratio.

Figure 7.
Developments in the savings ratio in Hungary and the European Union compared to 2000–2009, according to *Meredith (1995)* (left-hand figure) and *Masson and Lindh (1999)* (right-hand figure)



Source: Authors' calculations.

Applying the models of *Meredith (1995)* and *Lindh (1999)* to Hungary, the savings ratio could fall significantly as a result of demographic processes *(Figure 7)*. In the case of the former, a ten percentage point decline can be forecast, all other things being equal *(Figure 7, left-hand panel)*, while in the case of the latter, and even more drastic decline is observed *(Figure 7, right-hand panel)*. The large discrepancy between the findings stems from the fact that in the case of *Meredith (1995)*, we use the unweighted average of earlier estimates, which cushions our estimated result. In relation to the findings, it should be noted that the savings ratio in Hungary remains above the European Union average practically throughout the entire period based on both projections. This is due to the fact that demographic processes are unfolding somewhat differently in Western European countries, where population ageing is not accompanied by a significant decline in the population (due to higher immigration and fertility rates), and the young dependency ratio is higher across the forecast horizon compared to the Hungarian ratio, which exerts a more adverse impact on the savings ratio compared to Hungary.

Although our calculations for Hungary based on the estimates of *Meredith (1995)* are higher compared to the European Union average, they exhibit the same degree

of change in the savings ratio. Mediterranean countries (GR, ES, PT) may exhibit the lowest savings ratios, while Denmark, Belgium and Luxembourg may exhibit the highest ratios, even after a significant drop. Our calculations based on the estimates of *Lindh (1999)* show a similar path: the savings ratio in Hungary could exceed the European Union average, but may decline significantly following a parallel trajectory. The sharpest decline in the savings ratio could materialise in the Mediterranean countries (GR, ES, PT) and the Baltic states (LT, LV, EE), while the smallest decline is expected in Belgium, Denmark and Luxembourg, in line with the calculations based on the estimates of *Meredith (1995)*.

A comparison of calculations of consumption and savings ratios shows that although they are in line with theoretical considerations in terms of their overall direction (rising consumption and falling savings ratios), their rate of change differs. With regard to the fact that the extent of decrease in the savings ratio linked to demographic processes seems excessive, we consider calculations related to changes in the consumption rate to be more reliable.

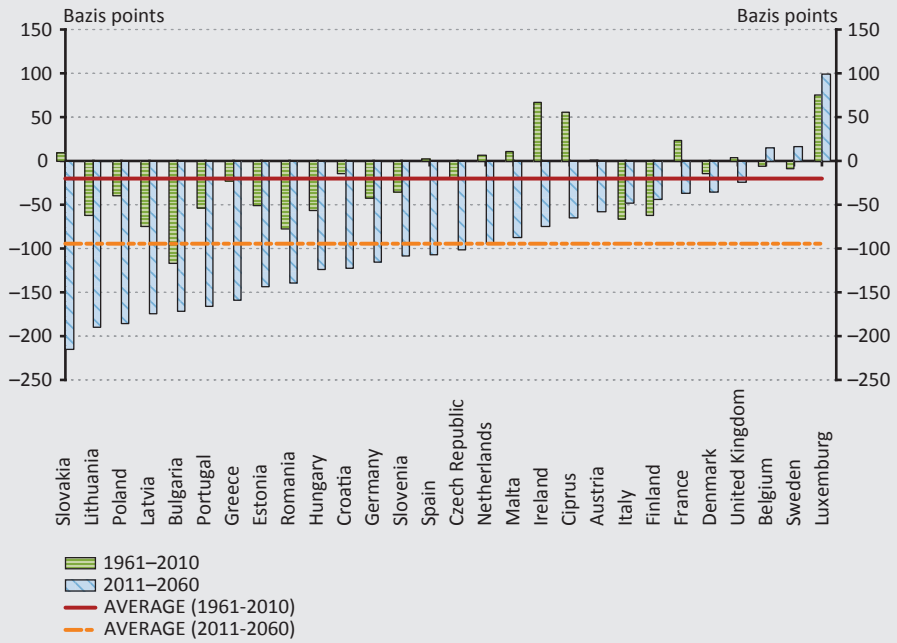
In the literature, the link between ageing and investments attracts less scrutiny than the link between ageing and savings. According to the available findings, ageing could potentially have a greater impact on investments than on savings. *Kim (2014)* used the data of OECD countries to determine that a rising proportion of older persons within the population leads to a slowing in the capital stock growth rate, while the capital stock growth rate correlates positively with the potential GDP growth rate. In addition, there is a positive link between the proportion of the population of working age and the investment ratio, and a negative link between the investment ratio and dependency ratios. According to *Kim's regression outcomes (2014)*, demographic variables are more closely correlated with the investment ratio than with the savings ratio in OECD countries, and thus ageing could exert a greater impact on investments than on savings.

3.4. Impact on asset prices

According to the life-cycle theory and the asset price meltdown hypothesis, demographic changes impact equilibrium real asset prices (in particular property prices), and households completely shed (deplete) their assets during their economically inactive life phases as consumption and savings behaviour changes *(Börsch-Supan 2006)*. However, empirical observations somewhat contradict this theory, as research shows that while wealth shrinks substantially, accumulated assets are not entirely depleted thanks to the impacts of inheritance and prudence *(Mosolygó 2009)*. According to the life-cycle theory, the rising old-age dependency ratio and continuously declining population exert a demand-side impact on asset prices. According to the theory, in terms of the impact on property prices, the population's age distribution is the most decisive factor, with significant differences in property ownership among age groups. In his study, *Takáts (2012)* uses a panel

regression (22 countries, sample between 1970 and 2009) to investigate the impact of demographic processes on inflation and finds that the outcomes show a significant negative impact of the old-age dependency ratio and the change in the overall population on property prices.

Figure 8.
Average annual impact of demographic processes on property prices in Hungary and the European Union between 1961–2060 according to *Takáts (2012)* (in basis points)



Note: AT=Austria, BE=Belgium, BG=Bulgaria, CY=Cyprus, CZ=Czech Republic, DE=Germany, DK=Denmark, EE=Estonia, ES=Spain, FI=Finland FR=France, GR=Greece, HR=Croatia, HU=Hungary, IE=Ireland, IT=Italy, LT=Lithuania, LU=Luxembourg, LV=Latvia, MT=Malta, NL=Netherlands, PL=Poland, PT=Portugal, RO=Romania, SE=Sweden, SK=Slovakia, SL=Slovenia, UK=United Kingdom.
Source: Authors' calculations.

Figure 8 illustrates that the historical average remained in the negative range for the European Union; therefore, with the exception of a few individual cases, demographic processes lowered property prices in the majority of member states. This tendency is set to gain momentum between 2011 and 2060, which could exert significant downward pressure on property prices, particularly in South-Eastern Europe. This is due to the fact that in these countries, the drastic ageing of the population is expected to be coupled with a greater population decrease than in Western Europe. Hungary may witness a sharp drop in property prices in the upcoming decades compared to the European Union average.

There is no broad consensus among researchers regarding the impact of demographic processes on financial asset prices. According to *Mosolygó (2009)*, the underlying cause of the moderate impact identified in empirical studies is mainly the fact that demographic processes unfold slowly, and the mechanisms of globalised money and capital markets may cushion their impact (flows of money and capital from low-yield markets to higher yield ones) and international migration flows may mitigate the fundamental issue.

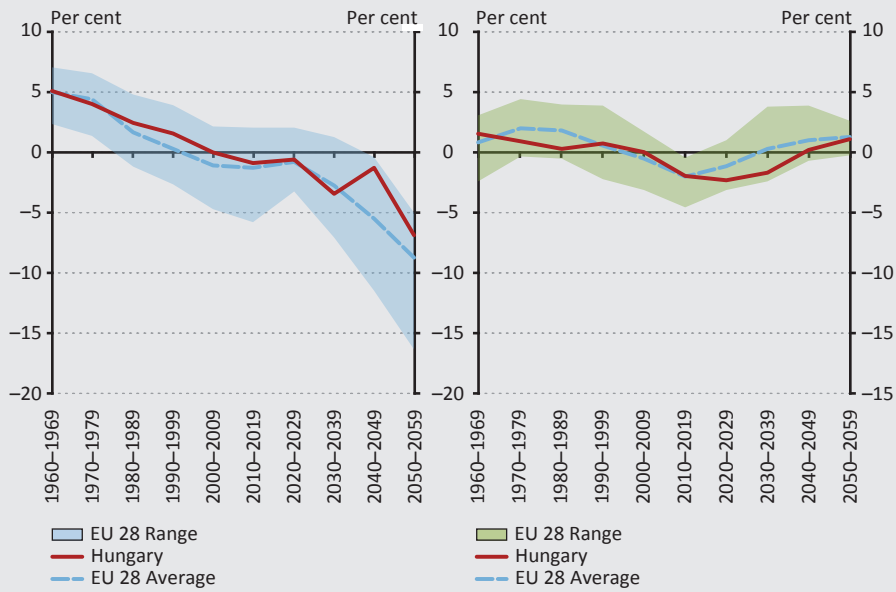
The literature broadly examines the changes in the allocation of savings by various age cohorts. Empirical observations show that the preponderance of equities within the portfolio is characteristic of younger and economically active age cohorts, while the emphasis shifts to bonds and deposit-type assets among older cohorts, as risk appetite varies by age *(Bergantino 1998)*. The increase in the weight of older generations could therefore alter the relative price of financial assets: demand for higher risk assets may fall while demand for safer assets may rise, which could entail a rise in the relative price of safer assets compared to riskier ones.

3.5. Inflation

According to the life-cycle theory, net consuming cohorts (persons of non-working age, the elderly) may exert an inflationary impact on the economy, while net savers (persons of working age) may exert an opposite impact. Considering similar demographic processes are expected all over the developed economies, the above mentioned effect can occur in several countries among others in Hungary as well. The economically active population, besides creating assets for the entire population, consumes less income on the demand side due to its greater marginal propensity to save. By contrast, the economically inactive population is by definition not present on the supply side: its income originates from earlier periods or other transfers and it generally consumes its income, thereby creating demand and indirectly, inflationary pressure. In addition, the declining population may lower the relative price level through property prices *(Anderson et al. 2014)*. According to Juselius and *Takáts (2014)*, the inflationary impact of demographic processes is expressed through the equilibrium real interest rate. In their study, the authors establish that during periods of demographic expansion, less savings are available in the economy, which raises the real interest rate, and vice versa. The study of the causality link between demography and inflation is even less advanced than for growth impacts. Based on the studies by Juselius and *Takáts (2014)* and *Lindh and Malmberg (1998)*, demographic processes may have a significant impact on inflationary developments. On a closer horizon, both estimates show a weaker inflationary impact compared to the current level. The estimate of *Lindh and Malmberg (1998)* forecasts extraordinary disinflationary pressure for the period following 2030, especially in Mediterranean countries (ES, PT, GR, IT). The order of magnitude of this disinflationary impact, however, can be called into question

in this case as well. Granted, the projection based on the estimates of *Juselius and Takáts (2014)* presages impacts of more plausible degree over longer horizons as well *(Figure 9).*

Figure 9.
Estimated impact of demographic changes on inflation in the European Union and in Hungary based on *Lindh and Malmberg (1998)* (left-hand figure) and *Juselius and Takáts (2014)* (right-hand figure)



Source: Authors' calculations.

3.6. Economic growth

The population's changing age composition also affects economic performance. Demographic change exerts an impact on both demand and supply side: the demand side is affected through consumption and savings as discussed above, as well as the fiscal channel, while the supply side affects economic performance through the labour market, capital accumulation, and productivity channels.

At the same time, demographic changes raise the broader issue of measuring economic performance. In the case of rapidly ageing populations, real GDP as an economic indicator is not the best gauge, and a temporal comparison of GDP growth could be misleading. While the impacts of ageing may be mitigated by increasing productivity, real GDP, GDP per capita or GDP growth calculated for economically active cohorts could yield a different picture. As a result, growth in GDP per capita

could be a more accurate reflection of the rise in living standards, and GDP per working-age person could be a better indicator of sustainable development.

In the following section, we examine the impacts of demographic processes on economic performance using four different approaches. Firstly, we determine the expected impacts based on what is referred to as growth accounting. This approach deducts expected growth effects from the potentially available labour supply, i.e. developments in the size of the working age population and the number of dependents. The production function used as the second method follows a similar approach, linking growth effects to developments in labour supply and the total population. Thirdly, we use the findings of general equilibrium model. The advantage of the general equilibrium approach is that it takes into consideration the series of adjustments induced by demographic processes when quantifying impacts. Finally, we give an estimate of the expected growth impacts on the basis of earlier empirical work scrutinising the correlations between growth and demography.

3.6.1. Growth accounting approach

The per capita GDP growth rate can be broken down into output growth per worker and developments in the ratio of active workers within the population. Population ageing – assuming unchanged age-specific behaviour – could lower the labour supply and the savings ratio by decreasing the proportion of persons of working age within the population, thus yielding lower economic growth. Using this subdivision, *Bloom et al. (2010)* found that OECD country economies would have only grown by 2.1% instead of 2.8% between 1960 in 2005 if demographic processes would have followed the trajectory estimated for the upcoming decades.

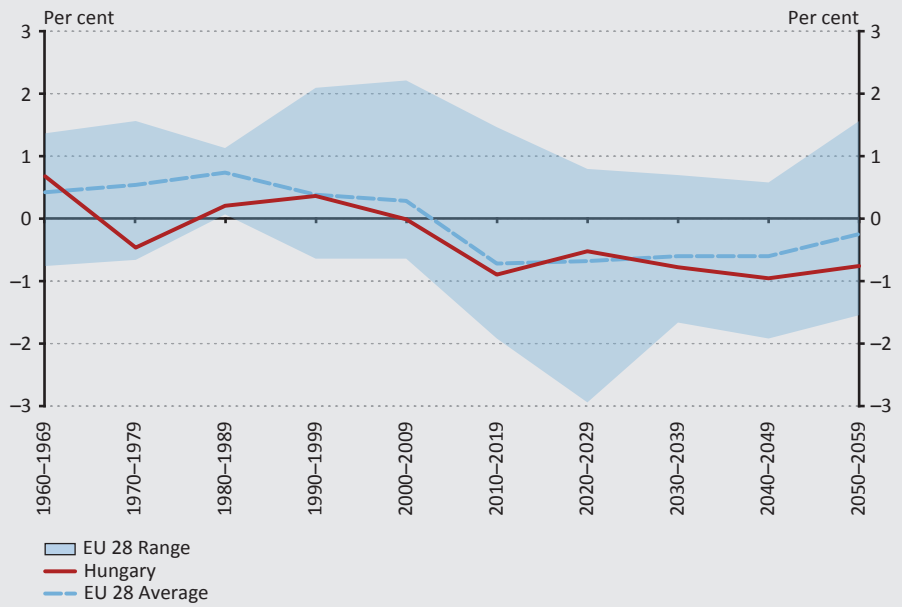
This subdivision of output implicitly assumes that value added can only be created through labour. *Ludwig (2005)* expresses output as a function of aggregate productivity, labour supply and capital stock, based on which a reduction in the size of the working age population results, ceteris paribus, in a decrease in GDP. Economic downturn can be avoided by increasing productivity, the employment rate or capital stock *(Ludwig 2005)*. The author argues that it is warranted to examine per capita variables, as falling output is distributed between increasingly fewer individuals.

3.6.2. Production function-based approach

Demographic forecasts point to an accelerating decline in the population and a decreasing proportion of working age population. The increasing rate of decrease of the working age population – alongside an unchanged labour force participation rate, technological progress and capital accumulation – suggests slowing growth, all other things being equal. Assuming the Cobb–Douglas production function and the customary two-thirds work ratio, it is evident that demographic processes made a positive growth contribution between 1980 and 1999, while a nearly 0.5

percentage point slowdown in growth can be demonstrated after 2000 due to the declining number of persons of working age. The per capita slowdown in growth could be even greater (0.6–0.7 percentage points), due to the continuous rise in the inactivity rate. As the grandchildren of the Ratkó generation become economically inactive, the slowdown in growth in the 2040s could be even greater than the European Union average *(Figure 10)*. The slowdown in growth is expected to exceed Hungary's figure in three countries, Slovakia, Poland and Bulgaria.

Figure 10.
Growth impact of the change in working-age population
(production function)



Source: Authors' calculations.

The adverse growth impacts presented above assume an unchanged labour force participation rate. The rise in life expectancy – alongside an unchanged activity rate – could mitigate the growth losses if the number of years for which an individual is economically active increases at the same rate. The calculations of the European Commission's working group responsible for analysing population ageing (AWG-Ageing Working Group) attribute a growth effect of a similar degree to demographic processes *(EC 2012)*. According to the AWG's calculations, total hours worked could decrease each year by 0.1% between 2010-2020, by 0.2% between 2021 and2040 and by 0.9% between 2041 and 2060. Due mainly to the lower total hours worked and the increasing proportion of economically inactive persons, the potential

growth per person could be 0.7 percentage points lower between 2041 and 2060 than in 2021–2030 (1.3% compared to 2.0%).

The limitations of calculations based on the production function reside in their inability to factor in the other economic impact of restructuring among generations. In addition, demographic processes may also affect capital accumulation and productivity (technological progress). Earlier findings reveal that demographic processes are expected to lower the savings and the investment ratio, eroding the contribution of capital accumulation to growth. Population ageing may erode innovation potential, as this is a characteristic of younger generations and younger cohorts also have greater risk appetite. These factors may lower the rate of improvement in productivity. At the same time, the rising average age of the economically active population and greater accumulated professional experience may boost productivity until 2040.

3.6.3. Model-based approach

A more differentiated view of the growth effect of demographic processes can be obtained nuanced using the correct general equilibrium approach. The overlapping generations model (OLG) proposed by Fougere and *Merette (1998)* also factors in generational transfers. According to basic simulations performed for OECD countries, with the results from Japan and Italy also applicable to Hungary, based on their similar demographic processes, demographic processes are expected to lower per capita growth by 0.4 percentage points between 2010–2050. As a result, GDP per capita could be nearly 30% lower around 2050 than in the absence of population ageing. The authors also scrutinise the impact of demographic effects in the context of a model framework expanded to include human capital. In this case, due to life expectancy, increasing human capital over a longer life phase generates higher income, and therefore the growth sacrifice of demographic processes may be smaller, thanks to the improving productivity stemming from higher human capital, which may even fully offset the growth losses defined in the basic simulation *(Fougere and Merette 1998)*.

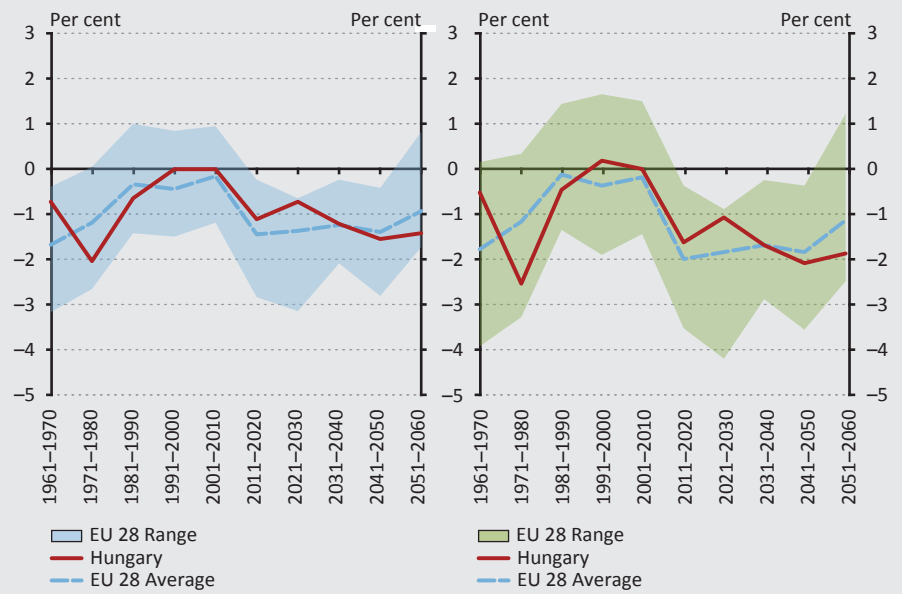
According to the life-cycle model-based calculations of *McMorrow and Roeger (1999)* for the European Union, the USA, and Japan, population ageing may lower per capita growth by 0.4 percentage points between 2000 and 2050 in the European Union, by 0.5 percentage points in Japan and by 0.2 percentage points in the USA. Given that Hungarian demographic processes are expected to be similar to those of the EU and Japan, a 0.4–0.5 percentage point decline in per capita GDP growth could also hold true for Hungary.

Börsch-Supan et al. (2014) examine the impact of ageing on growth by applying the overlapping generations model to three Western European countries.[7] Assuming unchanged age-specific and gender-specific labour force participation rates, the authors conclude that an expected 20% decline in the proportion of active workers within the population could lower GDP per capita by 15% and consumption per capita by 10% by 2050, relative to 2005. The decline in consumption falls short of the decline in the proportion of economically active persons, as declining labour could be partially replaced by supplementary capital.

3.6.4. Regression results

In addition to the production function and model simulation-based approaches, growth effects can also be estimated using regression results. Bloom and Canning (2004) examine the data of 75 countries between 1960 and 1995 and conclude that demographic variables (life expectancy, proportion of working-age persons within the population) exert a significant and positive impact on the per capita GDP growth rate. Longer life expectancy is presumably coupled with better health, which could

Figure 11.
Estimated change in Hungarian economic growth compared to 2000–2009, based on *Prskawetz et al. (2007)* for output per working-age person (left-hand figure) and output per capita (right-hand figure)



Source: Authors' calculations.

[7] France, Germany, Italy.

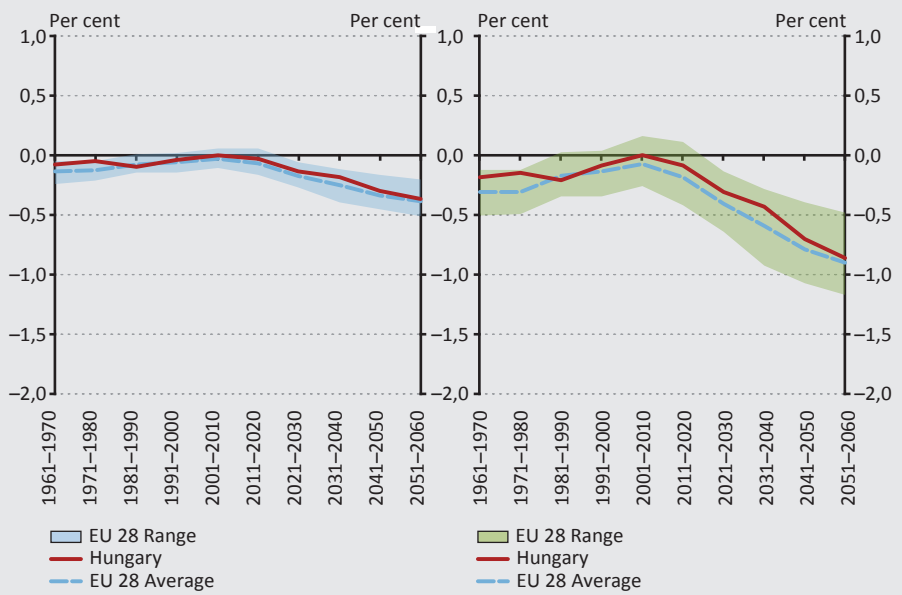
boost GDP per capita through higher labour productivity. The proportion of working-age persons within labour supply could drive potential output from the supply side.

Using the estimates of *Lindh and Malmberg (2007)* for Norway, which are based on a detailed breakdown by age group, developments in the composition of the Hungarian population will not significantly influence per capita growth. It is important to note that the estimate uses the proportion of age groups as the explanatory variable, rather than their absolute size. Consequently, it is unable to factor in the general decline in the size of age groups.

The estimates of *Prskawetz et al. (2007)* for India control for developments in the young and old-age dependency ratio and the size of the population. Based on their parameters, the growth rate per working-age person compared to the 2000s could decline by more than 1 percentage point, while per capita growth could decline by two percentage points in 2000–2060.

Using the estimates of *Bloom et al. (2007)*, in the coming decades the GDP growth rate could gradually decline by 0.2 or 0.3 percentage points compared to 2000-2009. No growth loss is expected at the beginning of the period until 2020, after

Figure 12.
Estimated change in GDP growth in the European Union and in Hungary (left-hand figure) and per capita growth (right-hand figure) compared to 2000–2009, based on *Bloom et al. (2007 and 2010)*



Source: Authors' calculations.

which point a gradual decline in GDP growth is expected. The estimate of *Bloom et al. (2010)* factors in the proportion of the working-age population and the developments in its size. Based on these findings, the per capita growth rate in the European Union gradually declines by approximately 0.8–1 percentage points compared to 2000-2009.

Based on a review of growth impacts, the majority of estimates point to deceleration in per capita GDP growth. The extent of the impact tends to increase over longer horizons. Compared to the 2000–2009 period, *per capita GDP growth may decrease by 0.5–1 percentage point in the coming decades as a result demographic effects.* The estimate of *Bloom et al. (2010)* projects a larger decline, as the model incorporates the impact of life expectancy. At the same time, the estimates yielding a stronger slowdown typically ignore the larger capital accumulation stemming from life expectancy and the ensuing extension in the years spent working. Accordingly, the expected degree of impact will probably be in the upper half of the range.

3.7. Fiscal impacts

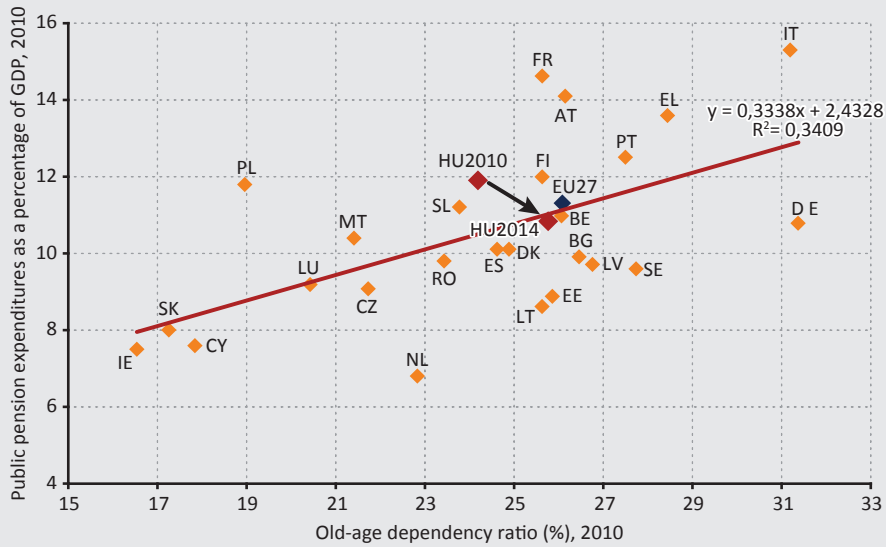
Changes in the population's age composition could have direct and indirect impacts on the fiscal balance. As a direct expenditure side impact, pension expenditures and healthcare expenditures in Hungary may jointly exceed their 2010 value by 2.8% of GDP in 2060, based on the AWG forecast *(EC 2012)*. On the revenue side, assuming an unchanged regulatory environment and labour force participation rate, the shrinking working-age population could result in declining revenues related to wages. A dual pressure on the social security system may emerge, as shrinking social contribution revenues resulting from demographic processes will have to fund social security benefits payable to an increasing number of beneficiaries.

3.7.1. Pension expenditures

Pension expenditures are one of the major expenditure items for Hungary's central budget. In Hungary's pay-as-you-go pension system, the current social contributions of economically active persons fund retirement provisions for the elderly.[8] The rate of public pension expenditures simultaneously depends on several factors, including pension system parameters (retirement age, service period, replacement ratio of new pensions, indexation of pension benefits) and the development of demographic trends. In European countries featuring higher old-age dependency ratios, public pension expenditures relative to GDP are generally higher *(Figure 13)*. This statically shows that, if no measures are taken, adverse demographic trends (shrinking proportion of working-age persons and growing proportion of persons aged 65 and older) could result in a rise in the pension budget deficit.

[8] This applies to the old-age type pension benefits paid from the Pension Insurance Fund as of 2012. Early-retirement benefits funded from the central budget are covered by the general budgetary tax revenues. A significant share of disability and rehabilitation benefits reclassified to the Health Insurance Fund was funded from central budget subsidies in 2012–2014.

Figure 13.
Public pension expenditures relative to GDP and the old-age dependency ratio in EU countries in 2010



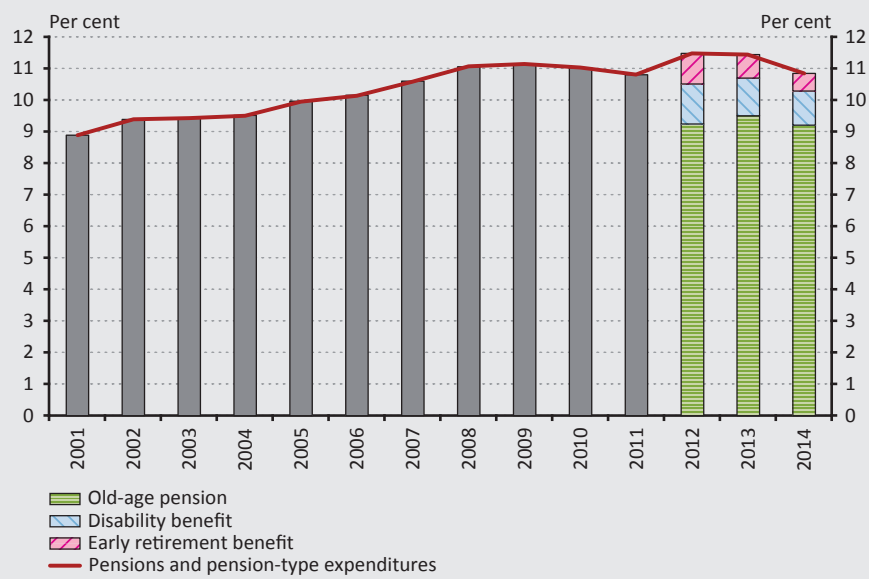
Note: Hungarian data on pension expenditures in 2014 as a percentage of GDP, MNB forecast.
Source: Eurostat, EC (2012), MNB.

Population ageing points toward an increase in spending in the long run, based on the decomposition of pension expenditures. According to the forecast in the AWG report, pension expenditures relative to GDP could rise from 11.9% in 2010 to 13.6% by 2060 in Hungary *(EC 2012)*, with this increase in expenditures slightly exceeding the average figure estimated for European Union countries (1.2 percentage points). The change in the old-age dependency ratio contributes the most to rising expenditures. The strongest demographic impact could occur in the 2010s and 2040s as the Ratkó generations enter retirement.

The impact of ageing may be partly offset by measures affecting the pension system. The official retirement age will increase gradually from 62 to 65 between 2014 and 2022. Alongside the increase in the retirement age, stricter rules for early retirement and disability pension benefits will also result in a rise in the effective retirement age. These factors could result in a decline in the ratio of recipients of pension and pension-like benefits to the number of people over the age of 65 from 176% in 2010 to 122% by 2060 *(EC 2012).* The decreasing proportion of beneficiaries could reduce pension expenditures to the greatest extent in the 2010s. Changes in the rules of indexation also support the sustainability of the pension system. A purely inflation-indexed pension increase rule has been in effect since 2012, on the basis of which at the start of the year the usual indexation of benefits

already determined follows the rate of inflation planned in the Budget Act. The rule ensures the preservation of the real value of pensions, while in case of economic growth, the indexation falling short of the rate of nominal GDP enables expenditure savings in the budget relative to GDP from one fiscal year to the next. On the whole, pension expenditures may have decreased by 0.6% of GDP from 2013 to 2014, as the joint impact of measures affecting the number of beneficiaries (for instance the increase in retirement age effective from 2014) and the rules of indexation (Figure 14). According to the pension projection of AWG, GDP-proportionate pension expenditures can further decrease (by 2030 to 10.4 % of GDP), therefore in the next 20–25 years, no imbalances are expected to occur in the Hungarian pension system. The impact of population ageing on the pension system may accelerate during the 2040s in particular, as the Ratkó grandchildren enter retirement.

Figure 14.
Developments in pension and pension-type benefit expenditures between 2001 in 2014 in Hungary
(as a percentage of GDP)

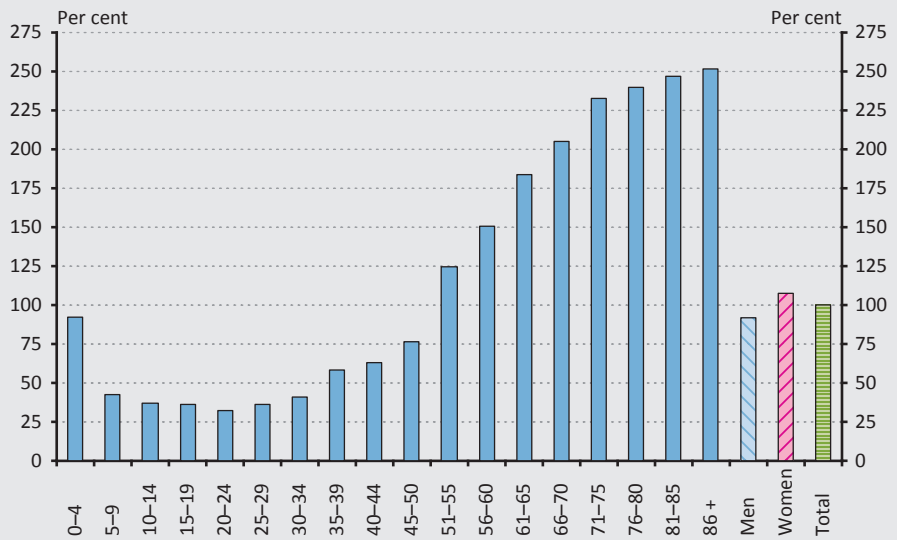


Note: The data for 2001-2011 present the pension-type benefit expenditures on the basis of the bills on the execution of the budget of Hungary, which do not correspond to the accounting system categories introduced from January 2012. Since 2012, the "old-age benefits" category includes old-age type benefits above the retirement age, disability benefits above the retirement age, service-dependent pension benefits available to women with 40 years of service time and survivors' benefits. The data for 2012 and 2013 present the data from the bills on budget execution for the years 2012 and 2013. The figures for 2014 present our current forecast. The nominal GDP time series is based on the ESA-2010 methodology.
Source: MNB calculation, bills on the execution of the budget of Hungary.

3.7.2. Healthcare expenditures

The rise in life expectancy and the proportion of older persons within the population may also entail a gradual increase in healthcare expenditures based on the age profile of per capita healthcare expenditure. According to the forecast in the AWG report, public healthcare expenditures could rise from 5% of GDP in 2010 to 6.1% by 2060 in Hungary *(EC 2012)*. In the version quantifying the impact of demographic changes,[9] a 1.5 percentage point increase in spending is expected between 2010 and 2060, based on the AWG report. The expenditure increase in Hungary stemming from ageing may slightly exceed the 1.3 percentage point average increase estimated for the European Union member states, but the overall level of expenditures could remain well below the European Union average. Longer life expectancy will presumably increase demand for healthcare services, which are concentrated for the most part among the older segments of the population. Based on the age profile of per capita expenditures, healthcare expenditures over the age of 50 already exceed the unit value valid for the total Hungarian population, and per capita expenditure over the age of 65 is more than twice the population average *(Figure 15).* The level

Figure 15.
Age profile of in-kind health insurance services per capita in Hungary
2012



Note: Average expenditure per capita in 2012, as a percentage.
Source: MNB (2013).

[9] The version quantifying the impact of demographic changes assumes that rising life expectancy will not increase the number of years spent in good health. In the reference version of the AWG report, public healthcare expenditures rise by 1.1 percentage point to 6.1% of GDP, as the version assumes that the half of the increased life expectancy will be spent in good health.

of public healthcare spending could be more favourable than estimated if increasing life expectancy coincides with a rise in the number of years spent in good health. At the same time, the majority of risks points towards a higher expenditure level: lower healthcare professional wages compared to the European average, convergence to the standard of care prevailing in more developed countries, and technological progress may require higher expenditures *(EC 2012)*.

Several studies in the international literature[10] argue that *higher life expectancy and population ageing only contributed slightly to the rise in healthcare expenditures observed over the past decades,* and therefore future changes in the population's age composition will not entail a significant rise in healthcare costs. The past rise in public healthcare expenditures was driven by technological progress, higher income levels and the expansion of health insurance *(Breyer et al. 2010; Felder 2013)*. As healthcare expenditures are characteristically concentrated over the last years of a person's life, population ageing does not necessarily increase expenditures, but could even delay them if it coincides with an increase in the number of years spent in good health.

3.8. Monetary policy implications

As opposed to the customary economic shocks, demographic processes typically exert their impact over the longer run. Therefore demographic processes are primarily not shocks that need to be accommodated on the horizon of monetary policy. Nonetheless, demographic processes may gradually impact the value of key variables relevant for the conduct of monetary policy, as well as the effectiveness of transmission channels. For instance, they may affect the equilibrium interest rate by changing the consumption and savings ratio. As discussed above, demographic processes presumably lower both the savings and the investment ratio. At the same time, the sign of their effect is not straightforward, although there is a greater chance of a more pronounced decline in the investment ratio, resulting in a lower equilibrium interest rate in the longer run. We also discussed the potential impact of demographic processes on the degree of inflationary pressure. According to our calculations, disinflationary impacts may be predominant in the upcoming one to two decades. The lower equilibrium interest rate and the disinflationary pressure may erode the effectiveness of traditional interest rate policy, as monetary policy is more likely to meet the zero lower bound in this context. As a result, the value of new monetary policy instruments may increase compared to less effective traditional monetary policy instruments.

In terms of transmission channels, the wealth effect may increase as a result of demographic changes. Cohorts may accumulate greater wealth by old-age as a result of longer life expectancy, rendering consumption more sensitive to changes

[10] *For instance Breyer et al. (2010).*

in interest rates. The role of stable inflation may gain value, especially if savings are channelled into long-term assets (pension savings), as inflation diverging from the expected rate could erode the purchasing power of savings. Preparing for retirement may be facilitated by a development in the securities market for long-term savings. The monetary authority can ensure the smooth functioning of this market by expanding its competence, applying adequate regulation, and fulfilling its supervisory functions.

In light of the foregoing, it is necessary to continuously monitor the macroeconomic impacts of demographic processes and to assess how the induced changes shape monetary transmission, in order to adequately conduct monetary policy.

4. Ageing societies: challenges and opportunities

4.1. Economic policy challenges

The expected change in the population's size and age composition will create significant challenges for society and economic policy. Population ageing may already accelerate in Hungary in the upcoming years as the Ratkó generation enters retirement, and thus the shrinking size of the working-age population, the slowing growth rate, and decreasing savings ratio may already create a challenge for economic policy-making in the near term. In addition, maintaining fiscal stability could also prove challenging as population ageing may result in a rise in the proportion of expenditure items sensitive to demographic change (such as pension expenditures, healthcare expenditures, social care).

Economic policy may spur economically active persons to remain actively employed throughout a longer career path through the tax and pension system, which could offset the adverse impact of demographic processes on labour supply and the fiscal balance. One possible tool for achieving this is to approach the effective and the statutory retirement age, or to gradually raise the statutory old-age retirement age in line with the increase in life expectancy, as already adopted by several western European countries (including Denmark and Italy).[11] Another solution could be to introduce more flexible retirement rules, which act as an incentive for continuing work beyond retirement age. Longer career paths simultaneously improve both the sustainability and adequacy of pension systems *(Schwan–Sail 2013)*. Measures aiming to increase the number of economically active years could achieve success if they go hand-in-hand with increased demand for those remaining on the labour market.

[11] It should be noted that the declared objective of the second, capital coverage pillar introduced in 1998 was to mitigate the long-term fiscal burden arising from demographic processes, but the contribution revenues thus removed from the pay-as-you-go state pension system were so substantial that the reform was undone in 2011.

Further increasing the labour force participation rate could help mitigate the adverse impacts of population ageing. As a result of economic policy responses to demographic changes (raising the statutory retirement age, measures affecting the number of pension beneficiaries), the decline in the economically active population could fall short of the rate determined by demographic processes. At the same time, a further rise in the labour force participation rate, which remains low by international standards, could drive a further increase in the number of employed persons.[12] Fostering labour market participation in the long run may call for increasing certain budgetary expenditures: for instance, increasing healthcare expenditures could foster the continued employment of individuals beyond retirement age, and spending on education could also boost the probability of labour market activity. The employment rate of persons with higher education levels is characteristically higher in older age *(IMF 2014)*; thus, (further) education of unskilled workers could improve their employment. Promoting lifelong learning may also boost employment within older age groups. In addition, economic policy can also foster preparation for old-age by incentivising savings and supporting early-start savings.

The migration trends observed in recent years could have a negative impact on the demographic situation, especially since emigration from Hungary is concentred in more educated groups aged between 20 and 45 *(Bodnár–Szabó 2014; SEEMIG 2014)*. Moreover, emigration may erode productivity and induce inflationary pressure through increasing labour market tightness. In the absence of accurate data on the emigrated Hungarian population, their potential return is difficult to forecast, and so it is important to prevent and reverse excessive migration. When emigrants return home, they may contribute to economic development with their experience acquired abroad (what is referred to as the 'brain gain'). The various population projections assume that international net migration in Hungary will remain positive across the entire projection horizon, in other words that Hungary will be destination country in terms of migration.

Finally, economic policy can also foster an improvement in demographic trends by promoting the birth rate, albeit this can only yield a result over a horizon of several decades, and may thus temporarily increase the younger and the total dependency ratio. It is essential that as a result of economic policy measures the birth rate increase over the long term, instead of in the form of one-off demographic booms, such as the Ratkó generation, as such developments could put pressure on the educational and pension system.

[12] The expansion of the public employment scheme contributed to the rise in the labour force participation rate, alongside the reform of the labour market contributions system. Over the long run, it is important to ensure the greatest possible opportunities for public employment scheme participants to find work on the primary labour market. Developing the skills and increasing the mobility of these participants may help in attaining this objective.

4.2. Behavioural impacts

Besides the pivotal role of economic policy, a change in the behaviour of economic agents, i.e. adjustment, may also play a role in cushioning the negative macroeconomic impacts of ageing. The macroeconomics, fiscal and monetary impacts of ageing may be overstated if we do not factor in the autonomous response of individuals to the changed demographic environment.

Labour market

Better health and longer life expectancy could increase labour productivity and result in individuals working longer than earlier generations. A longer active career path enables higher consumption and yields a higher income level alongside the same savings ratio. Furthermore, the falling fertility rate could boost women's labour force participation rate, which is low by international standards, and thus result in higher labour supply. Certain economies may respond to labour shortages stemming from ageing by gradually increasing their capital/labour ratio: corporations may invest in assets that boost labour productivity.

Savings and consumption

A behavioural impact to counter the decline in savings due to ageing may consist of higher savings by individuals during their economically active years to prepare for longer life expectancy (retirement plans) in an effort to maintain their living standards. Accordingly, *Bloom et al. (2003)* argue that the increase in life expectancy is usually coupled with a higher savings ratio. There is consensus that consumption is on the rise as a result of ageing *(Erlandsen–Nymoen 2004; Masson–Tryon 1990)*. Increased productivity on the one hand and the promotion of savings on the other hand could help cushion the slowdown in GDP growth.

Economic growth

The change in age structure may also impact economic growth through human capital investment. The decline in the fertility rate observed in past decades has improved education levels: parents are presumably able to spend more per child with fewer children. According to *Lee and Mason (2010)*, the productivity of the various age groups is also relevant in addition to the population's age distribution. If large, less productive cohorts are replaced by fewer, but more productive workers, standards of living may even increase *(Lee–Mason 2010)*.

Another aspect is that the rising proportion of older persons within the population does not necessarily represent a burden for the economy and society. As the years spent in good health increase, individuals can continue working in a more productive manner. In terms of the fiscal balance, if the rise in life expectancy is paired with a rise in the number of years spent in good health, the higher ratio of

elderly within the population does not necessarily incur higher expenditures for the healthcare system. In addition, older persons often help out around the house and in childcare, and also provide financial support to younger generations.

At the same time, behavioural impacts may be substantively shaped by incentives such as the labour market and the institutional environment (e.g. the pension system). These could interact with demographic changes and yield diverging results from one country to the next *(Bloom et al. 2010)*.

4.3. Opportunities

Population ageing may also spur demand for certain goods and services, or create new demand. Areas include demand for health preservation and healing. Demand for health preservation can take on various forms: healthy nutrition (across the entire food industry fruit and vegetable production, milk and meat industry, artisan and organic goods), healthy lifestyle (exercise, sports, health tourism, recreation), healthy living environments (construction, environmental protection, green energy industries). Greater demand for healing services could, over and above the direct impacts, also spur demand for healthcare training and medical technology. Health preservation and healing services and goods could also create a market with export capacity given the fact that European demographic processes will also bolster external demand for them. In addition, ageing generations may also increase demand for in-home services (home care, maintenance and repair services) or even create new demand for smart homes.

Rising life expectancy also increases demand for education. During a long lifespan, acquiring high value added know-how is even more profitable. This could boost demand for higher education courses and put greater emphasis on knowledge-intensive industries and R&D. For older persons, demand could grow for training courses aimed at spending time usefully or enabling activities generating supplementary income.

5. Conclusion

Hungary's population has been continuously shrinking since the 1990s. In addition to the decreasing population, the demographic processes are also characterised by population ageing. Declining birth rates and the gradual rise in life expectancy, although they fall short of the European Union average, will result in the proportion of persons aged 65 and older accounting for an increasingly large portion of the total population. In the upcoming decades, the ageing of the Hungarian and European population is expected to continue based on population projections, and the speed of ageing may accelerate. Population ageing results in a rise in the old-age dependency ratio, which could create a host of challenges for economic policy due to its fiscal impacts and its macroeconomic impacts. Population ageing may already

accelerate in Hungary in the coming years, mainly during the 2040s as the so-called Ratkó's grandchildren generation enters retirement. Thus, preparing for these demographic changes may already create a challenge for economic policy-making in the near future. Further fostering the birth rate will be the other key challenge. The population projections capturing expected developments in demographic processes assume a continuously rising fertility rate. If this does not materialise, the demographic and partly macroeconomic impacts discussed above may follow a more unfavourable path.

Based on the available projections, demographic processes may significantly decrease labour market supply in the coming decades. The Hungarian population aged 15 to 64 may shrink gradually from 6.7 million in 2014 to 5 million by 2060 based on the *Eurostats'a population projection (2014)*. The labour supply of the shrinking working-age population may be boosted by the rising labour force participation rate, which nonetheless is relatively low in international comparison.

We quantified the impacts of demographic processes on the main macroeconomic variables using the estimates found in the literature. Although the estimates used are based on the data of decades shaped by more favourable demographic processes than the ones forecast for the future, the calculations do serve as a warning. According to our current knowledge, demographic processes are expected to significantly shape the development of key macroeconomic variables.

Based on these calculations, the consumption rate may rise and the savings ratio may decline in the coming decades, driven by the demographic processes. *Per capita growth could gradually decline by 0.5 to 1 percentage point.* Changes in the population's age composition could result in lower inflationary pressure compared to the past decade. Changes in the population's age composition could exert impact on the fiscal balance. Population ageing points towards rising pension expenditures and healthcare expenditures due to the higher life expectancy and the rising proportion of older persons within the population.

Population ageing may gradually change the value of key variables relevant to the conduct of monetary policy and may also influence the effectiveness of transmission channels. Looking forward, the equilibrium interest rate may decrease and inflationary pressure may become subdued. These two factors may erode the effectiveness of traditional interest rate policy, as monetary policy is more likely to meet the zero lower bound in this context. As a result, new instruments may become more valuable as compared to less effective traditional monetary policy instruments. Demographic processes may also affect the functioning of transmission channels. The market for long-term securities may increase as a result of higher life expectancy. The monetary authority can ensure the smooth functioning of this market by expanding its competence, applying adequate regulation and fulfilling its supervisory functions.

The adverse economic impacts of demographic processes can be cushioned with economic policy measures. For instance, economic policy may spur economically active persons to remain actively employed throughout a longer career path through the tax and pension system, and raising the effective retirement age could mitigate the increase in pension expenditures. Preserving and increasing Hungary's human capital will be an important task, which involves reversing the current unfavourable migration trends and attracting returning migrant workers, coupled with providing high standard education. Over the longer run, fostering the birth rate could also help improve demographic trends.

Besides the pivotal role of economic policy, adjustments in the behaviour of economic agents may also play a role in cushioning the macroeconomic impacts of ageing. Better health and longer life expectancy may increase labour productivity and extend the number of years spent on the labour market. Preparing for a longer retirement may foster higher savings, which could fuel the market for long-term securities. Longer life expectancy renders human capital investments even more profitable, which could boost productivity and innovative capacity.

Population ageing also represents economic opportunities which can be taken advantage of. Demand for certain goods and services may increase, and completely new demand might emerge. Areas include demand for health preservation and healing, a market with export capacity. Demand for education may also rise, fostering a shift in economic structure towards knowledge-intensive industries and R&D.

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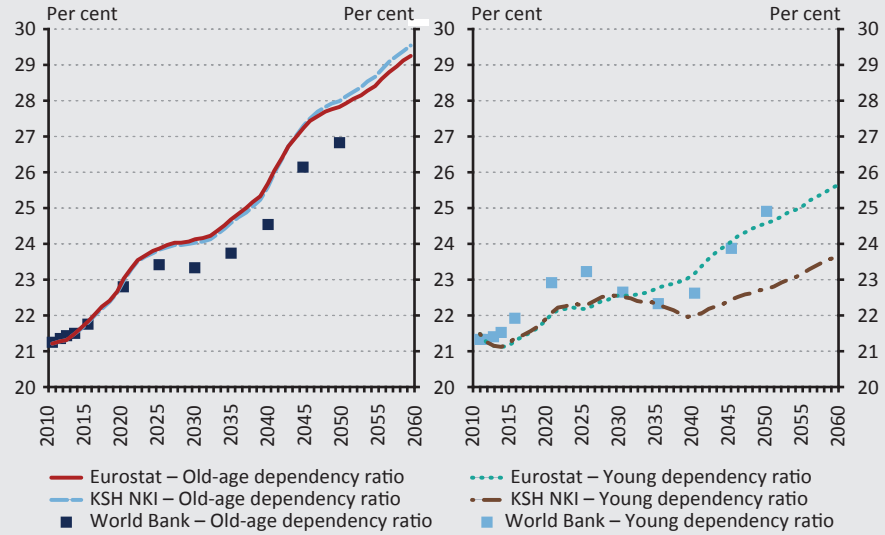
Appendix: A comparison of Hungarian population projections

The population projections prepared by various institutions exhibit slight discrepancies, but presage similar demographic processes. Each projection assumes population ageing and thus a further rise in the old-age dependency ratio *(Figure 16)*. When presenting demographic processes and quantifying macroeconomic impacts, we consider the *Eurostat (2014)* population projection, comparable on the European Union level, as the baseline scenario. In addition, two additional projections are available with respect to Hungary: the projection prepared by the Hungarian Demographic Research Institute of the Hungarian Central Statistical Office (CSO HDRI) and the World Bank.

The CSO HDRI's population projection presents the expected future developments in the size and composition of the Hungarian population. The projection baseline refers to the population structure prevailing at the time of preparation of the projection, and the future developments in the population are shaped by the assumptions on fertility rates, mortality rates and international net migration figures. The population projection presents three alternative scenarios (low, main and high variant). The main scenario assumes that in 2060, the fertility rate may stand at 1.6 alongside higher life expectancy and the net international net migration figure may stand at 10,000 individuals. As a result, the Hungarian population could shrink to 8 million by 2060, which is 1 million less than the population figure presented by the *Eurostat (2014)* as the baseline. The discrepancy may stem from a combination of lower life expectancy (80 years for men in 2060), lower fertility and the smaller immigration inflows. The slower increase in the young dependency ratio may be linked to the lower fertility rate *(Figure 16).*

The World Bank's population projection presages slightly more favourable demographic processes compared to the findings of the *CSO HDRI (2013) and Eurostat (2014)*. The World Bank projects developments in the populations of nearly 200 countries until 2050 for 5-year periods across the projection horizon, and uses 2010 census data as the projection baseline. The assumptions made in the World Bank's projection with respect to Hungary differ from the above to projections mainly in the area of net migration, as the total horizon assumes substantial net migration of 75,000 individuals per year. The old-age dependency ratio resulting from the projection is also lower compared to the other two projections.

Figure 16.
Dependency ratio projections for Hungary
2010-2060



Source: Eurostat (2014), CSO HDRI (2013), World Bank (2014)