

## 2 The economic impact of population ageing and pension reforms

Prepared by Carolin Nerlich and Joachim Schroth

*This article examines the macroeconomic and fiscal implications of population ageing in the euro area and looks at how pension reforms can help to address these challenges. According to Eurostat's latest projections, population ageing is set to continue and even intensify in the euro area over the next few decades. This ongoing process, which stems from increases in life expectancy and low fertility rates, is widely expected to lead to a decline in the labour supply and productivity losses, as well as behavioural changes, and is likely to have an adverse effect on potential growth. Moreover, by causing increases in precautionary savings, ageing can be expected to have a dampening impact on interest rates over an extended period of time. Population ageing also entails changes in relative prices, mainly owing to shifts in demand, with demand for services rising. Furthermore, euro area countries are also projected to experience further upward pressure on public spending on pensions, health care and long-term care as their populations age.*

*Although many euro area countries implemented pension reforms following the sovereign debt crisis, further reforms appear to be necessary in order to ensure fiscal sustainability in the long run. In this respect, measures that increase the retirement age can be expected to dampen the adverse macroeconomic effects of ageing, as they will have a favourable impact on the labour supply and domestic consumption. In contrast, increasing the contribution rate or reducing the benefit ratio could have less favourable macroeconomic implications.*

### 1 Introduction

#### **Population ageing in the euro area poses a number of economic challenges.**

This ongoing process is widely expected to exert downward pressure on potential growth, the labour supply and the equilibrium interest rate. At the same time, ageing economies are expected to face higher age-related fiscal costs, which could pose risks to fiscal sustainability. Since consumption patterns are likely to change as populations age, this could also affect relative prices – which could, in turn, have implications for the transmission of monetary policy. The combination of all of these various effects adds to the challenges for monetary policy.

#### **This article analyses a number of important macroeconomic implications of population ageing and looks at how pension reforms could help to cushion that impact.**

It starts by looking at Eurostat's latest demographic projections and their main drivers, before going on to discuss the macroeconomic implications of ageing for potential growth, looking specifically at the labour supply, capital formation and total factor productivity. The adverse impact on growth is also examined using a highly stylised model framework. The article also discusses the effect on fiscal balances and debt sustainability, while the impact on relative prices via changes in consumption patterns is discussed in a dedicated box. The final section looks at the

role of pension reforms and their macroeconomic effects and includes a box featuring model simulations. The implications for monetary policy, particularly via changes to the equilibrium real interest rate, are also discussed in a separate box.

## 2 Demographic developments in the euro area

**Euro area countries are facing significant demographic challenges, which are expected to have major economic implications.** The total population of the euro area is projected to rise from 340 million in 2016 to around 352 million in 2040, before falling to 345 million in 2070, according to Eurostat's 2015 population projections.<sup>83</sup> In addition, the age structure of the euro area's population is also set to change, with population ageing expected to continue and intensify further. Those developments will be driven mainly by low birth rates, as well as further increases in life expectancy, while net migration flows will, on average, only partially mitigate the impact of ageing populations. There will also be major cohort effects, with the whole of the "baby boomer generation" (i.e. the significant numbers of people who were born in the 1950s and 1960s) entering retirement over the next 20 years. It should be noted, however, that population ageing is not restricted to the euro area. Indeed, it is a worldwide phenomenon affecting advanced economies (and some emerging market economies) around the globe. Population ageing is most advanced in Japan.<sup>84</sup>

**Population ageing is being driven by a number of demographic trends.** The average fertility rate in the euro area currently stands at 1.6, which is significantly below the natural replacement level (i.e. the level that is thought to be necessary in order to keep the total population constant), which is around 2.1. Although Eurostat expects birth rates to increase slightly, they are forecast to remain well below the replacement level on average. Consequently, young people are set to account for a smaller percentage of the total population in the future (see Chart 1). Life expectancy is expected to continue rising, albeit more slowly than in the last few decades.<sup>85</sup> By 2070, remaining life expectancy at the age of 65 will average 23.6 years for men and 26.9 years for women – i.e. around 5 years more than today. Increases in life expectancy, combined with cohort effects due to the ageing of the baby boomer generation, will contribute to a strong increase in the size of the old-age cohort (i.e. the number of people aged 65 or over), as shown in Chart 1. The size of that old-age cohort is expected to peak in absolute terms in around 2050. At the level of the euro area as a whole, net migration flows are projected to only partially offset the decline in the working-age population. Their impact is expected to diminish further

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<sup>83</sup> See [Eurostat's 2015 population projections](#). Eurostat's projections for the euro area are comparable to the latest UN population projections, although the UN's forecasts are slightly more adverse in terms of the degree of population ageing.

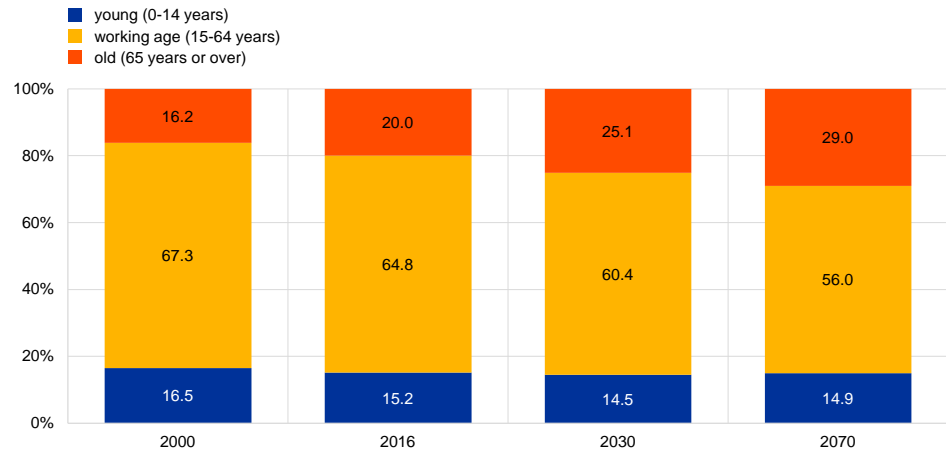
<sup>84</sup> See OECD, *Pensions at a Glance 2017*, 2017. In the case of Japan, the fiscal adjustment that is needed to stabilise government debt is estimated at 30-40% of total consumption. See also Hansen, G. and Imrohorglu, S., "Fiscal reform and government debt in Japan: A neoclassical perspective", *Review of Economic Dynamics*, Vol. 21, 2016.

<sup>85</sup> For more detailed information on these demographic projections, see European Commission, "The 2018 Ageing Report – Underlying Assumptions & Projection Methodologies", Institutional Paper 65, November 2017.

over time, reflecting a decline in net migration relative to the total population, as well as the ageing of current migrants.

**Chart 1**  
Age cohorts in the euro area

(as a percentage of the total population)



Sources: Eurostat and ECB calculations.

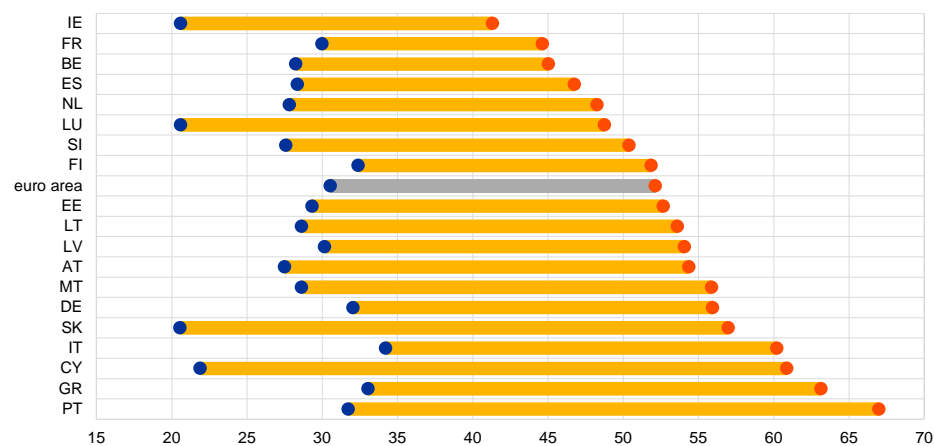
**The euro area's old-age dependency ratio, which is defined as the number of people aged 65 or over as a percentage of the working-age population (i.e. people aged 15 to 64), is projected to be significantly higher by 2070.** On the basis of Eurostat's 2015 projections, the average old-age dependency ratio in the euro area is expected to increase strongly, rising from slightly above 30% in 2016 to around 52% by 2070 (see Chart 2). An increase in this ratio means a decline in the number of workers that are potentially available to take care of each pensioner, in the absence of any changes to the statutory retirement age.<sup>86</sup> This will entail a significant fiscal burden for the countries concerned in terms of their public pension systems.

<sup>86</sup> The old-age dependency ratio that is used in this article relates to demographic dependency. This is different from the concept of economic dependency, which also takes account of other factors, such as the employment of older workers and differences in income patterns across age cohorts. When interpreting this old-age dependency ratio, it is important to bear in mind that a country's effective retirement age may be higher or lower than 65.

**Chart 2**

**Old-age dependency ratios in 2016 and 2070**

(percentages)



Sources: Eurostat and ECB calculations.

Note: This chart shows old-age dependency ratios – defined as the number of people aged 65 or over as a percentage of the working-age population (i.e. people aged 15 to 64) – for 2016 (blue dots) and 2070 (orange dots).

**While all euro area countries will experience population ageing, the size of that demographic challenge will vary considerably across countries.** The countries

with the highest old-age dependency ratios are currently Germany, Greece, Italy, Portugal and Finland (see Chart 2). Old-age dependency ratios are projected to increase by more than 35 percentage points by 2070 in Cyprus, Portugal and Slovakia, with Portugal ending up with a ratio of 67% – the highest in the euro area. Ratios of 60% or more are also projected for Greece, Italy and Cyprus. In contrast, Ireland is forecast to have the lowest ratio in the euro area by 2070, while Belgium, Spain and France are projected to experience the smallest increases.

**The projected drivers of population ageing also differ across countries.** The question of whether – and to what extent – ageing is driven by low fertility rates and/or increases in life expectancy has important consequences for the dynamics of population ageing and its economic and fiscal implications. According to Eurostat, life expectancy is forecast to increase in all euro area countries. However, the expected increases tend to be larger in those countries where life expectancy is currently lower, with the largest increases expected in Latvia and Slovakia. Moreover, Eurostat expects the fertility rate to improve slightly in all countries except France (which will, however, continue to have the highest rate in the euro area). Projections regarding net migration show a high degree of cross-country heterogeneity. For a few countries, those projections even show net migration outflows, which can be expected to further amplify the ageing problem.

**That being said, caution is required when assessing long-term demographic trends.** Population projections are strongly dependent on the underlying assumptions regarding fertility rates, life expectancy and migration flows. While all three components are surrounded by a certain degree of uncertainty, the uncertainty relating to migration flows is by far the highest. Consequently, population projections

have historically been subject to large forecasting errors and frequent revision.<sup>87</sup> Methodological changes have also contributed to the revision of such forecasts. In order to at least partly address the problem of uncertainty, population projections are often complemented by sensitivity analysis.<sup>88</sup>

## 3 The economic impact of ageing

### 3.1 Implications for potential growth

**Population ageing stemming from increases in life expectancy and low fertility rates has the potential to exert downward pressure on all components of potential growth.** However, behavioural changes and public choices in relation to ageing could serve to counteract those effects to some extent.

**Ageing can be expected to reduce the labour supply over time, since fewer young workers will be entering the labour force and older workers will tend to have lower participation rates.** Low fertility rates reduce the size of younger cohorts, which can ultimately be expected to reduce the labour supply and GDP per capita.<sup>89</sup> Having fewer dependent children initially leads, in relative terms, to an increase in the working-age population as a percentage of the total population. However, once those smaller cohorts reach working age, there will be a downward impact on the working-age population, both in absolute terms and as a percentage of the total population. An increase in life expectancy will lead to larger numbers of people reaching retirement age, which will increase the old-age dependency ratio.<sup>90</sup> Ageing-related changes in the population structure also affect the labour component of potential output via differences in age-specific participation rates. Indeed, in 2016 the participation rate for “prime-agers” in the euro area (defined as people between the ages of 25 and 54) stood at around 85%, significantly higher than the equivalent rates for older people between the ages of 55 and 64 (around 60%) and younger people under the age of 25 (around 40%). The impact that these factors have on the aggregate labour supply is expected to vary over time and be strongly dependent on the population structure. In the euro area, large cohorts of prime-agers are set to become older people over the next ten years and reduce their participation, while small cohorts of young people will become prime-agers (see Chart 3). Consequently,

<sup>87</sup> See Maddaloni, A. et al., “Macroeconomic implications of demographic developments in the euro area”, *Occasional Paper Series*, No 51, ECB, August 2006, as well as Clements, B. et al., “The fiscal consequences of shrinking populations”, *Staff Discussion Notes*, No 15/21, IMF, October 2015.

<sup>88</sup> See, for example, European Commission, “[The 2018 Ageing Report – Underlying Assumptions & Projection Methodologies](#)”, op. cit., which includes sensitivity analysis for all three components (fertility rates, life expectancy and migration flows) when projecting long-term potential growth.

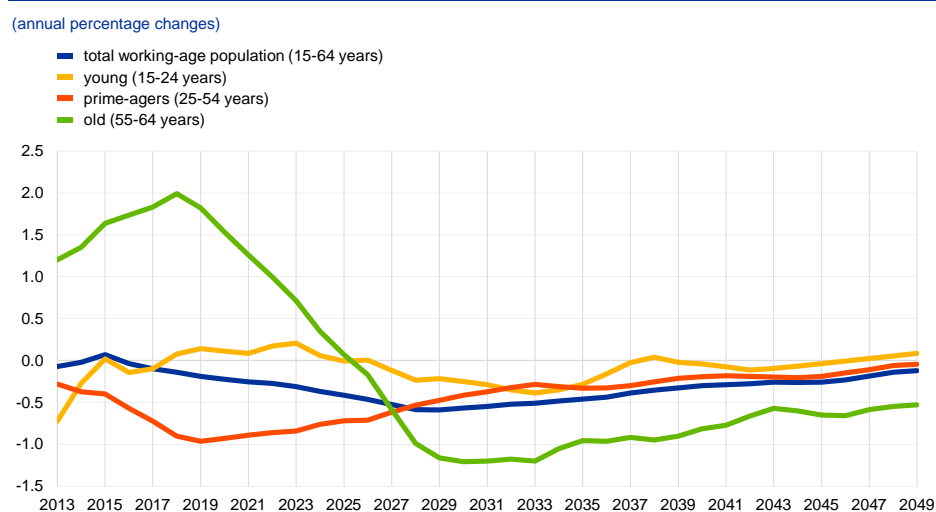
<sup>89</sup> In contrast, the strength of young cohorts entering the labour market was one of the factors that contributed to the “growth miracle” in emerging Asia over the period 1965-1990. See Bloom, D. and Williamson, J., “Demographic Transitions and Economic Miracles in Emerging Asia”, *The World Bank Economic Review*, Vol. 12, Issue 3, September 1998.

<sup>90</sup> Strictly speaking, declining mortality rates for working-age cohorts have, ceteris paribus, an upward impact on the working-age population. However, in the euro area, mortality rates for working-age cohorts are already at very low levels, so positive effects on the working-age population will be very limited going forward.

prime-agers will account for a significantly smaller percentage of the working-age population, while older people will make up a larger percentage. In the absence of changes to age-specific participation rates, this will exert downward pressure on the labour supply. This is also broadly in line with the results set out in Box 1, which uses a stylised model framework to show the impact that population ageing has on various macroeconomic variables (such as employment). Net migration, which has in the past consisted mainly of people of working age, can be expected to mitigate that downward impact to some extent.

### Chart 3

#### Projected changes to working-age population by age group



Sources: European Commission and ECB calculations.

### Box 1

#### Stylised macroeconomic implications of ageing based on an overlapping generations model

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**This box illustrates a number of stylised macroeconomic implications of ageing on the basis of the overlapping generations (OLG) model developed by Baksa and Munkacsi, which has been parameterised for the euro area.**<sup>91</sup> This model explicitly takes account of the compositional effects of ageing – i.e. changes in the population structure owing to declining fertility rates and increases in life expectancy, which have important implications for the labour supply, private consumption and public debt. The advantage of this model is that it allows an evaluation of the impact that population ageing will have on a large set of macroeconomic variables in a general equilibrium framework, as well as an assessment of the implications of various kinds of pension reform (which will be discussed in Section 4).

<sup>91</sup> OLG models are well suited to capturing demographic developments and interaction between generations. For a detailed description of Baksa and Munkacsi's model, see Baksa, D. and Munkacsi, Z., "A detailed description of OGRE, the OLG model", *Working Paper Series*, No 31/2016, Lietuvos bankas, 2016. "OGRE" stands for "overlapping generations and retirement". That original model took account of informality, which is not included in this analysis in the interests of simplicity. The data used in this box cover the period 2009-16.

**The main characteristics of Baksa and Munkacsi’s model can be summarised as follows:** The model is a dynamic general equilibrium OLG model with an infinite time horizon. It is a closed-economy model with price and labour market rigidities, and monetary policy is characterised by a Taylor rule.

**Demography and nature of the ageing shock:** The total population in each period is the sum of the working-age cohort (i.e. people between the age of 20 and the retirement age) and the pensioner cohort (i.e. people who have reached the retirement age).<sup>92</sup> The total population changes over time, with workers being born and pensioners passing away on the basis of certain probabilities, which follow a predetermined path. Ageing is introduced in the form of a permanent 10 percentage point increase in the old-age dependency ratio, phased in over a 30-year period, after which fertility and mortality rates are assumed to remain constant. The increase in the old-age dependency ratio is modelled in such a way that the relative importance of the fertility and mortality rates as driving factors resembles Eurostat’s 2015 population projections for the euro area (see Section 2). The “long-term” steady state values discussed below relate to a 50-year period.

**Household sector:** Households’ economic activity is divided into two phases: the working phase and the retirement phase. During the working phase, households either work (in which case, they receive income and pay income tax) or are unemployed (in which case, they receive unemployment benefits). They use their net incomes and benefits for consumption and precautionary saving. During the retirement phase, households do not work and instead receive pension benefits. Depending on the probability of dying in the next period of the model, they will also spend some or all of their savings on consumption.

**Production sector and labour market rigidities:** The model includes two types of firm, producing physical capital goods and consumption goods respectively. Those goods-producing firms hire workers and use physical capital, subject to an exogenous technological process (assuming a Cobb-Douglas production function). Firms take account of price adjustment costs when setting prices. Moreover, the model assumes labour market rigidities owing to hiring costs and wage bargaining, which influence the level of unemployment.

**Fiscal sector:** The fiscal sector includes various kinds of public revenue (personal income tax, social security contributions, VAT, etc.) and public expenditure (pension benefits, unemployment benefits and government consumption). In order to account for the diversity in euro area countries’ pension systems, it is assumed that three-quarters of pension benefits are based on the pay-as-you-go principle and one-quarter is based on a fully funded scheme. In the initial steady state without population ageing, the pension system is assumed to be in balance. The government is able to issue bonds to balance the government budget.

**The long-term results for the euro area suggest that ageing mainly affects the economy via the labour market and changes to consumption and savings.** Table A presents the stylised long-term steady state results of an ageing shock under the assumption that no consolidation measures are adopted to counteract that shock’s impact on public debt (reference scenario with no consolidation). Following that ageing shock (i.e. the 10 percentage point rise in the old-age

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<sup>92</sup> This model does not take account of people below the age of 20. The demographic part of the model is based on Gertler, M., “Government debt and social security in a life-cycle economy”, *Carnegie-Rochester Conference Series on Public Policy*, 1999, pp. 61-110. It combines the perpetual youth model with life-cycle elements, such as the probability of retiring and dying, which can be aggregated.

dependency ratio), the ratio of workers to pensioners declines. As comparatively fewer people are in work, the labour supply and employment decline. Moreover, private consumption per capita also declines, as workers in particular reduce their consumption. Instead, workers increase their precautionary savings by investing in government bonds, in order to smooth their consumption over a longer period in retirement. Pensioners dissave more gradually in view of their rising life expectancy. Private investment declines only marginally. Overall, the ageing shock results in GDP per capita declining by 4.7%. The real interest rate falls as the ratio of capital to labour increases on account of the shortage of labour supply. Total pension costs rise owing to an increase in the number of pensioners, while revenue from VAT declines on account of a fall in consumption. In the reference scenario, fiscal instruments are kept constant, so the additional spending on pensions is financed entirely via debt. Thus, the ageing shock results in the government debt-to-GDP ratio rising almost 60 percentage points in the long run (reaching unsustainable levels in the absence of policy adjustments). Variations of this scenario will be discussed in Section 4.

**Nonetheless, when interpreting these results, one has to remember that the model is based on a number of simplifying assumptions.** It assumes, for example, that the economy is closed, that there are only two types of cohort and that only two types of good are produced. Moreover, this model looks at the euro area as a whole and does not, therefore, account for any cross-country heterogeneity. Thus, these results are not a suitable basis on which to make concrete recommendations at country level.

**Table A**

Stylised long-term economic effects of ageing (reference scenario)

(percentage changes or percentage point changes)	
Indicator	Change due to ageing shock
GDP per capita (%)	-4.7
Total consumption per capita (%)	-5.6
Ratio of workers' consumption to total consumption (pp)	-3.6
Employment (%)	-5.1
Ratio of workers' savings to GDP (pp)	41.7
Ratio of private investment to GDP (pp)	-0.3
Ratio of capital to labour (pp)	2.3
Ratio of public debt to GDP (pp)	59.3
Ratio of pension expenditure to GDP (pp)	2.3

Source: ECB calculations.

Note: Based on the model developed by Baksa and Munkacsi, calibrated for the euro area.

**Ageing may also have an adverse effect on aggregate total factor productivity, and thus on output per worker.** Several studies have found significant negative effects on aggregate labour productivity as a result of an ageing workforce.<sup>93</sup> One

<sup>93</sup> See, for example, Nagarajan, R. et al., "The Impact of Population Ageing on Economic Growth: An In-depth Bibliometric Analysis", *FEP Working Papers*, No 505, University of Porto, 2013, as well as Maestas, N. et al., "The Effect of Population Aging on Economic Growth, the Labor Force and Productivity", *NBER Working Papers*, No 22452, 2016, which estimates for the United States that two-thirds of the age-related slowdown in growth is accounted for by lower productivity, with one-third stemming from a reduction in the labour supply.



effect of ageing could materialise via weaker growth in total factor productivity, which captures underlying productivity growth derived from more efficient production processes and technological progress. This may be explained by the hump-shaped distribution of average productivity across cohorts that has been found by some studies, which may be related to a slowdown in the adoption of the latest technology as age increases (with statistics showing, for example, a reduction in workers' participation in training with increasing age) or a deterioration in the health of some older workers.<sup>94</sup>

**However, there may also be countervailing forces mitigating any adverse effects on productivity.** Low fertility rates may, for example, allow for stronger investment in human capital per child. Furthermore, the scarcity of labour could increase the return to investment in human capital and thus incentivise training in the course of a person's working life (i.e. "lifelong learning"), particularly when accompanied by increases in the retirement age. Finally, for white-collar occupations, the benefits of accumulated experience and expertise may continue to develop throughout a person's working life. Thus, structural shifts towards knowledge-based sectors, in which high productivity levels can be maintained throughout people's working lives, could limit the downward impact that ageing has on future productivity.

**The impact that ageing has on private savings can be expected to vary over time in line with the population structure, but it will also be dependent on how households and firms react to an ageing society.** The life-cycle hypothesis of savings states that people will smooth consumption over their lifetimes by accumulating savings during their working lives and then running those savings down during their retirement. Changes to the population structure will thus have a mechanical impact on aggregate savings via differences in age-specific savings ratios. In the euro area, the expected increase in the number of pensioners as a percentage of the total population between now and 2070 implies a shift from savers to dissavers, which suggests that this will have a downward impact on aggregate savings in the long run. Over the next ten years, however, this effect on savings might not be visible as a result of the sizeable baby boomer generation becoming elderly workers. Since this age group is the one with the highest savings rate, per capita savings are likely to increase in the short term. In addition to these shifts in age cohorts, ageing may also cause households to change their saving behaviour. As life expectancy increases, households may save more during their working lives, anticipating that those savings will have to see them through a longer period in retirement. This is also supported by the model results in Box 1. Low fertility rates may also have a positive effect on the savings of the working-age population by

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<sup>94</sup> See, for example, European Commission, *Population Ageing in Europe – Facts, Implications and Policies*, 2014. See also Aiyar, S. and Ebeke, C., "The Impact of Workforce Aging on European Productivity", *IMF Working Papers*, No 16/238, 2016, which takes some of these factors into account and estimates that ageing may reduce aggregate total factor productivity growth in the EU by 0.2 percentage point per year over the next 20 years. The estimated drag on GDP growth varies across countries depending on the population structure. For example, it is small in Germany, where a series of large cohorts are about to retire, and it is large in Spain, where the number of prime-age workers is set to decline strongly over the next 20 years as a percentage of the total working-age population.

reducing consumption needs relating to the raising of children.<sup>95</sup> Fiscal policies and the type of underlying pension system may also have a role to play by encouraging people to save more during their working lives.

**The impact on investment and capital accumulation will depend, inter alia, on the responsiveness of return rates, the openness of the economy and the relative ageing profiles of the various countries.** The downward pressure that ageing exerts on the labour force can be expected to reduce the price of capital relative to labour. Assuming that capital and labour are substitutes (at least to some extent), this will lead to capital deepening and result in investment being affected less negatively than the labour force (as can also be seen from the simulation in Box 1). This could, for example, be a result of declines in the size of households as a consequence of ageing, which will see the number of households and the need for housing investment remaining broadly unchanged.<sup>96</sup> Such capital deepening will exert downward pressure on returns to capital. However, in open economies with no capital controls, savings do not have to be invested domestically and can be absorbed by capital exports, which will reduce the pressure on domestic returns to capital.<sup>97</sup> Indeed, several studies have found evidence of capital flows from “older” countries to countries with more favourable demographics.<sup>98</sup> Box 4 provides a more detailed model-based discussion looking at the amount of downward pressure on the euro area’s equilibrium real interest rate that can probably be attributed to demographic factors and pension reforms for the period up to 2030.

### 3.2 Fiscal balances and sustainability

**Population ageing will place further upward pressure on the already elevated levels of age-related public spending.** The European Commission’s 2015 Ageing Report anticipates public expenditure on pensions, health care and long-term care rising from 21% of GDP in 2013 to 23% of GDP in 2060 (see Chart 4).<sup>99</sup> These projections take account of the future impact of past reforms in the areas of pensions, health care and long-term care, so they are not directly comparable with the results of the stylised model presented in Box 1.

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<sup>95</sup> See, for example, Prskawetz, A. and Lindh, T. (eds.), “The Relationship between Demographic Change and Economic Growth in the EU”, Research Report 32, Vienna Institute of Demography, 2007.

<sup>96</sup> See, for example, Goodhart, C. and Pradhan, M., “Demographics will reverse three multi-decade global trends”, *BIS Working Papers*, No 656, August 2017.

<sup>97</sup> See Leibfritz, W. and Röger, W., “The Effects of Aging on Labor Markets and Economic Growth”, in Hamm, I. et al. (eds.), *Demographic Change in Germany*, 2008.

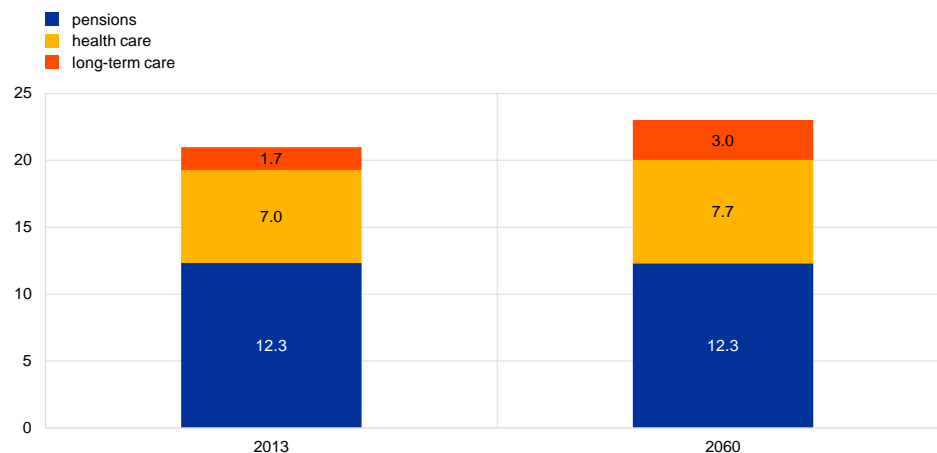
<sup>98</sup> See, for example, Börsch-Supan, A., Ludwig, A. and Winter, J., “Aging, Pension Reform, and Capital Flows: A Multi-country Simulation Model”, *NBER Working Papers*, No 11850, December 2005.

<sup>99</sup> See European Commission, “[The 2015 Ageing Report – Economic and budgetary projections for the 28 EU Member States \(2013-2060\)](#)”, *European Economy*, No 3, 2015. Although the 2018 Ageing Report will become available in the next few months, those updated projections are unlikely to substantially alter the assessment of fiscal sustainability risks for the euro area as a whole.

## Chart 4

### Ageing-related public spending in the euro area

(percentages of GDP)



Sources: 2015 Ageing Report and ECB calculations.

**Pay-as-you-go pension schemes will be particularly affected.** As populations age, the number of beneficiaries of public pension schemes will increase, while the number of contributors is expected to decline, resulting in deficits unless parameters are adjusted. In fact, demographic effects alone are projected to raise pension expenditure by an average of 7.6% of GDP in the euro area over the period 2013-60 (see Chart 5). This effect is, however, expected to be almost entirely offset by changes to other important drivers of pension expenditure, such as declines in the coverage ratio or the benefit ratio.<sup>100</sup> While these changes reflect reform measures in a number of euro area countries, they are also driven by favourable underlying macroeconomic assumptions.<sup>101</sup> At euro area level, pension expenditure is projected to remain at its current high level of more than 12% of GDP in the long run, notwithstanding considerable cross-country heterogeneity.<sup>102</sup>

<sup>100</sup> The coverage ratio is defined as the number of pensioners relative to the number of people aged 65 or over. The coverage ratio could, for example, be reduced by restricting eligibility for early retirement. The benefit ratio, meanwhile, is defined as the average pension relative to the average wage. The benefit ratio declines as pension entitlements become less generous.

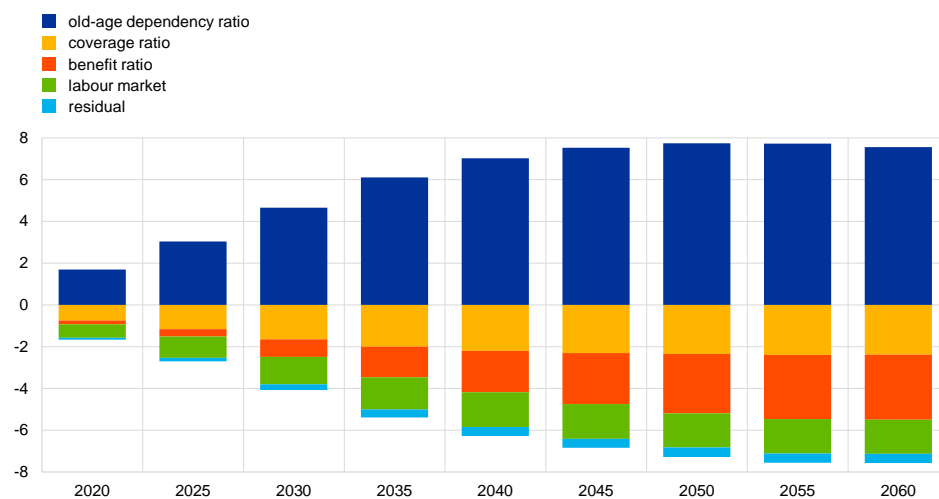
<sup>101</sup> The projections in the 2015 Ageing Report are based on fairly optimistic underlying macroeconomic assumptions. For example, they assume that countries' structural unemployment rates will converge with the EU average, which implies huge declines in some cases. Moreover, they also assume that annual growth in total factor productivity will rise to 1% of GDP in all EU countries. For a critical assessment of those underlying assumptions, see the box entitled "The 2015 Ageing Report: How costly will ageing in Europe be?", *Economic Bulletin*, Issue 4, ECB, 2015. The macroeconomic assumptions underlying the 2015 Ageing Report are very different from those contained in the model that was presented in Box 1.

<sup>102</sup> According to the 2015 Ageing Report, some countries, such as Germany, Luxembourg, Malta, Slovenia and Slovakia, are projected to experience significant pressure on pension spending, while pressures are projected to weaken considerably in France, Italy and Latvia.

## Chart 5

### Drivers of changes in pension expenditure

(percentage points of GDP; changes relative to 2013)



Sources: 2015 Ageing Report and ECB calculations.

### Population ageing will also increase spending on health care and long-term care.

According to the projections in the 2015 Ageing Report, spending on health care and long-term care as a percentage of GDP is projected to rise by an average of 0.7 and 1.3 percentage points respectively over the period 2013-60 (see Chart 6). Indeed, older people are more likely to make use of healthcare services, which in Europe are predominantly provided by the public sector. It should be noted, however, that population ageing is only one factor driving healthcare costs – and not necessarily the most important.<sup>103</sup> Meanwhile, spending on long-term care is also expected to rise, as such care is increasingly being provided by professional suppliers, rather than via intra-family support, partly as a result of increases in female labour market participation. Finally, public spending on education is expected to decline as the number of young people gradually falls as a percentage of the total population, partially offsetting the rising expenditure discussed above.<sup>104</sup>

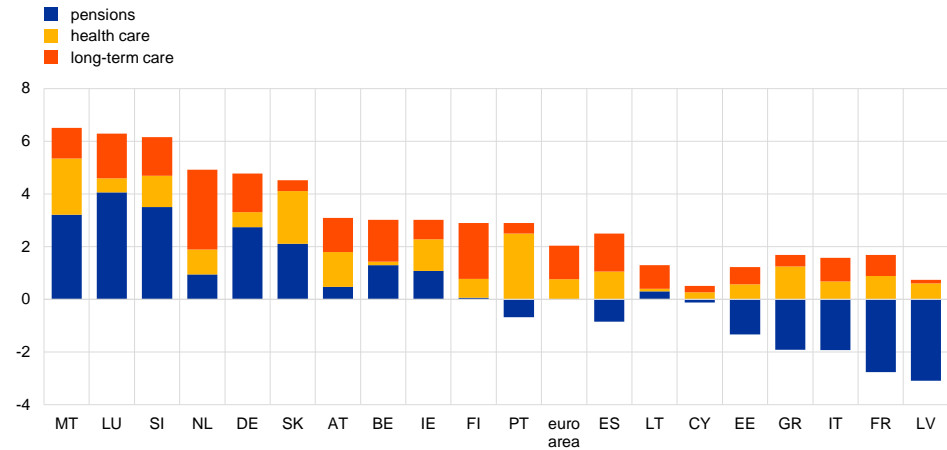
<sup>103</sup> Healthcare costs are driven, inter alia, by technological progress, demand for higher-quality healthcare services and growth in GDP per capita (assuming that the income elasticity of demand for healthcare services is higher than one). See also European Commission, “The 2015 Ageing Report – Economic and budgetary projections for the 28 EU Member States (2013-2060)”, op. cit.

<sup>104</sup> At the same time, in the presence of a limited labour force, governments could conceivably come under pressure to invest more in education and lifelong learning. See Maddaloni, A. et al., “Macroeconomic implications of demographic developments in the euro area”, op. cit. In this case, spending on education might not decline.

## Chart 6

### Changes in ageing-related public spending

(percentage points of GDP; changes over the period 2013-60)



Sources: 2015 Ageing Report and ECB calculations.

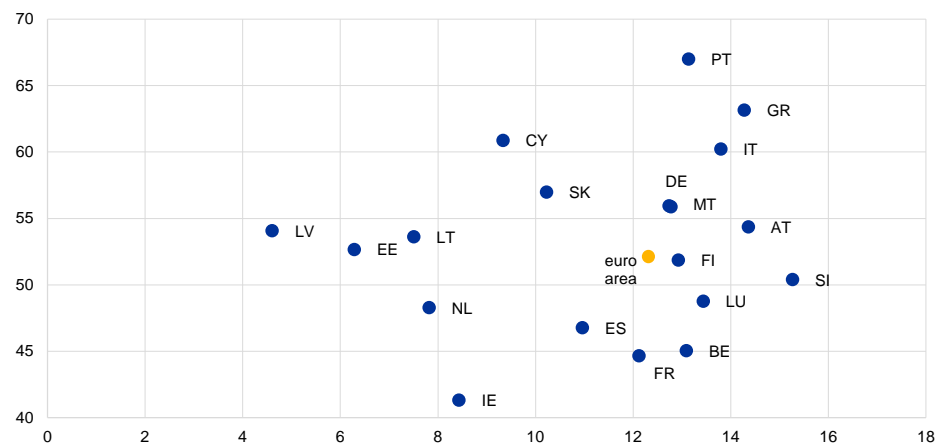
Note: The data in this chart contain updated information for Belgium that became available after the publication of the 2015 Ageing Report.

**The projected increase in age-related public spending varies across countries and is subject to considerable uncertainty.** The projected changes to the various age-related public expenditure items vary depending on the underlying generosity of the public systems in question and the relevant coverage ratios. For public pension expenditure, the effective retirement age is a decisive parameter. Chart 7 provides a rough illustration of the relative generosity of the various countries' pension systems by comparing their pension costs and old-age dependency ratios. Taking the euro area average as a benchmark, the countries in the bottom right-hand corner can be considered to have fairly generous pension systems, given their relatively small old-age populations.

## Chart 7

### Projected old-age dependency ratios and public pension costs in 2060

(x-axis: pension costs as a percentage of GDP; y-axis: old-age dependency ratio)



Sources: Eurostat, 2015 Ageing Report and ECB calculations.

**The impact of ageing on public revenues is inconclusive, owing to the different time profiles and the fact that the effects on the various tax bases partially offset one another.** On the one hand, revenue from personal income tax is likely to decline as the labour force shrinks, assuming that tax rates remain unchanged. Revenue from VAT is also expected to decline, as population ageing is likely to have an adverse impact on private consumption.<sup>105</sup> Moreover, as is pointed out in Box 2 on relative prices, ageing may result in a shift towards higher demand for specific services. If these services benefit from tax exemptions, as is currently the case for healthcare services in several countries, revenue from VAT is likely to fall even further as a result of ageing. On the other hand, an increased propensity to save owing to increases in life expectancy (or in the case of a shift towards fully funded pension systems) can be expected to boost revenue from capital taxes. The economic relevance of changes to tax revenues caused by dissaving after retirement is, however, more difficult to predict and requires closer examination of country-specific tax provisions.

**Overall, population ageing is expected to place a burden on fiscal sustainability.** Higher age-related primary deficits are expected to contribute to higher government debt-to-GDP ratios. Converting the projected additional age-related spending into a net present value provides an indication of the implicit liability that is caused by ageing and the fiscal adjustment that is needed in order to fulfil the intertemporal adjustment constraint.<sup>106</sup> In other words, additional public savings are needed in order to prevent government debt levels from increasing on account of ageing. Moreover, debt dynamics hinge crucially on the interest-rate-growth differential. To the extent that ageing has an unfavourable impact on real GDP growth, as was suggested in the previous section, public debt levels will become harder to sustain. If, however, ageing also contributes to a decline in the equilibrium real interest rate, as is suggested in Box 4, this will, instead, help to support debt sustainability. Thus, the overall impact of ageing depends on which of these opposing effects prevails. Ageing could make it more difficult to ensure debt sustainability if interest rates decline by less than real economic growth.

## Box 2

### Population ageing and relative prices

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Prepared by Eliza Lis

**There is evidence that the consumption patterns of the elderly differ from those of younger cohorts.** Thus, population ageing has the potential to affect the relative prices of goods and services, particularly if changes in relative consumption demand do not result in corresponding changes in relative supply. Changes in relative prices are typically regarded as steering the allocation of resources and may therefore play a key role in structural changes in the different sectors of the economy.

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<sup>105</sup> See also Table A in Box 1.

<sup>106</sup> According to the European Commission's [Debt Sustainability Monitor 2017](#), euro area countries require a structural adjustment totalling 0.4% of GDP per annum on account of population ageing in order to achieve a debt-to-GDP ratio of 60% in the medium term (the "S1 indicator") and an adjustment totalling 1.3% of GDP in order to ensure that public debt stabilises permanently at the current level (the "S2 indicator").

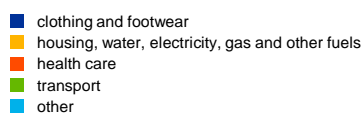
**Empirical evidence suggests that the elderly spend more, in relative terms, on services (particularly non-tradable services) than younger cohorts.**<sup>107</sup> Chart A shows how the structure of household consumption expenditure differs across age groups in the euro area, showing that the elderly spend more on housing and healthcare services and less on clothing and transport.<sup>108 109</sup>

Such changes in consumption patterns can reflect both passive consumption behaviour (for instance, if housing-related expenditure remains unchanged post-retirement and accounts for a larger share of consumption on account of a decline in disposable income) and active changes in consumption demand (for instance, if transport costs fall because a person is no longer commuting to work or if more health care is needed as a result of the ageing process itself). More generally, changes in the composition of consumption demand will depend on items' income-elasticities, which may well change as consumers get older. For instance, health care may become more of a necessity as people get older (reduction in elasticity), while transport may become more of a luxury (increase in elasticity).

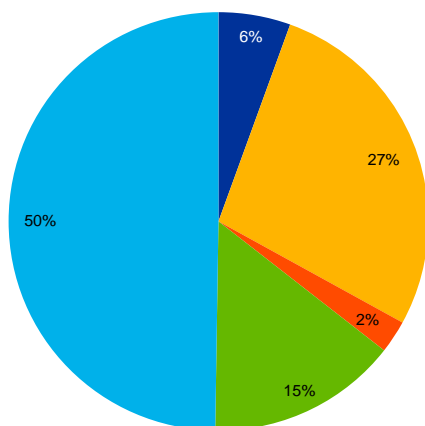
### Chart A

#### Structure of consumption expenditure by age group

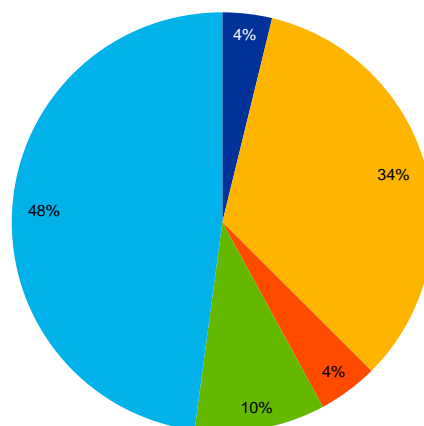
(percentages)



a) People below the age of 60



b) People aged 60 or over



Sources: Eurostat and ECB calculations.

Notes: Data are based on Eurostat's 2010 household budget survey (the latest available) and represent weighted euro area averages. The figures in the left-hand chart are simple averages of the data reported for the various age categories below the age of 60. "Other" comprises items where there is no marked difference between the two age groups.

<sup>107</sup> See, for example: Lührmann, M., "Population aging and the demand for goods & services", *MEA Discussion Papers*, No 95-2005, University of Mannheim, 2005; Börsch-Supan, A., "Labor market effects of population aging", *Labour*, Vol. 17, Supplement S1, 2003, pp. 5-44; and van Ewijk, C. and Volkerink, M., "Will ageing lead to a higher real exchange rate for the Netherlands?", *De Economist*, Vol. 160, 2012, pp. 59-80.

<sup>108</sup> This chart may vary across individual euro area countries, depending on cultural preferences, economic performance, and policy and institutional frameworks. It is noticeable that, in contrast with the findings in the literature, expenditure on household furnishings and equipment does not vary much across age groups in the euro area.

<sup>109</sup> Aggregate household data may not cover all changes to consumption patterns, as they do not account for the substantial public spending on health care and long-term care. See Groneck, M. and Kaufmann, C., "Determinants of Relative Sectoral Prices: The Role of Demographic Change", *Oxford Bulletin of Economics and Statistics*, Vol. 79, 2017, pp. 319-347.

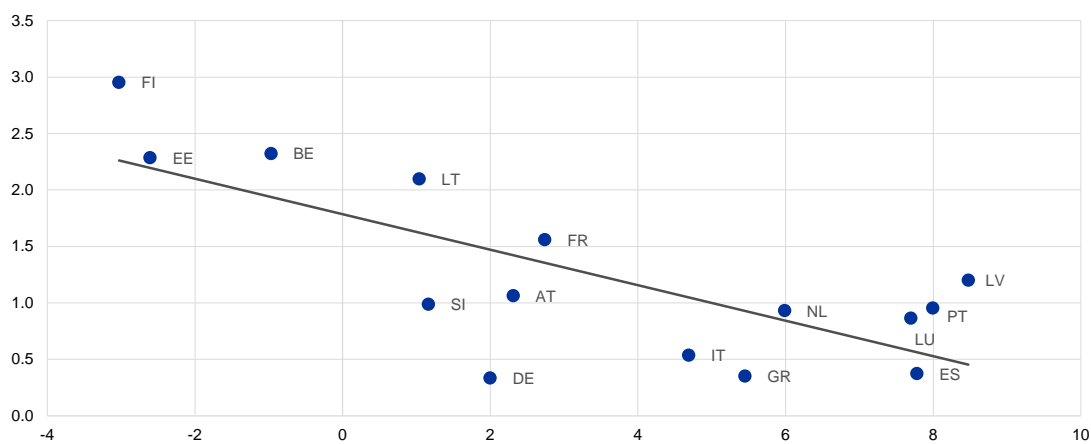
If ageing entails an increase in the overall consumption of services relative to goods, this could have an impact on the output prices of services sectors relative to industry. Indeed, the relative price of services will increase if supply does not rise in line with demand. This, in turn, will depend on how elastic supply is in reacting to price changes, which will be determined, inter alia, by how readily available or mobile the necessary factors of production are. Ultimately, therefore, it will be the interaction between the age-elasticity of demand and the price-elasticity of supply that determines where relative prices end up.

Looking purely at observed data, Chart B shows that the price of services relative to industry has increased on average since 1995 in most euro area countries, following an increase in the share of services in total value added in those economies.<sup>110</sup> Chart C shows that increases in the output prices of the services sector relative to industry have coincided with increases in the old-age dependency ratio in some euro area countries. These simple correlations do not control for other factors, such as differential impacts on services and industry prices as a result of secular change and international competition, but they are in line with recent findings in the literature. Groneck and Kaufmann,<sup>111</sup> for example, control for various explanatory variables in their estimations and show that an increase in the old-age dependency ratio leads to an increase in the relative price of non-tradables.

## Chart B

### Relative prices and shares of services, 1995-2016

(x-axis: percentage point change in share of services; y-axis: average annual percentage change in price of services relative to industry)



Sources: Eurostat and ECB calculations.

Notes: The price of services relative to industry is the ratio of the deflator for services to the deflator for industry excluding construction. Those deflators are calculated as the ratio of value added in current prices to value added in constant prices. The share of services relates to the share of services in total value added.

<sup>110</sup> Ideally, consumer prices should be used, rather than output prices. However, in order to be able to use longer time series, output prices are used here. The same approach is adopted in other literature on this topic.

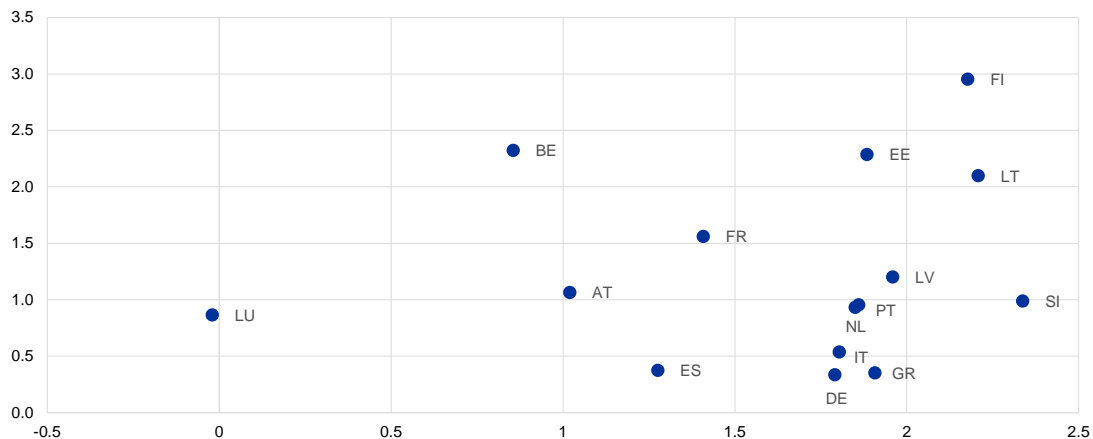
<sup>111</sup> See Groneck, M. and Kaufmann, C., "Determinants of Relative Sectoral Prices: The Role of Demographic Change", op. cit.



## Chart C

### Relative prices and old-age dependency ratios, 1995-2016

(x-axis: average annual percentage change in old-age dependency ratio; y-axis: average annual percentage change in price of services relative to industry)



Sources: Eurostat and ECB calculations.

Notes: The price of services relative to industry is the ratio of the deflator for services to the deflator for industry excluding construction. Those deflators are calculated as the ratio of value added in current prices to value added in constant prices.

**The euro area has generally seen services prices in the HICP rise more rapidly than non-energy industrial goods prices over the last few decades.** At the same time, services also account for a growing share of the economy. While there may be a number of reasons for these developments, such as differentials in terms of sectoral productivity trends or the impact of global competition, they may also reflect an increase in relative demand owing to population ageing.<sup>112</sup> With population ageing expected to intensify, these trends may strengthen in the years to come.

## 4 The role of pension reforms

### 4.1 Pension reforms in the euro area

#### **Many euro area countries have implemented pension reforms in recent years.**

The sovereign debt crisis and rises in public debt levels have increased the need to reform public pension systems.<sup>113</sup> Pension reforms have been particularly substantial in countries that have been subject to adjustment programmes, such as Greece, Spain, Cyprus and Portugal. Those reforms have involved a wide range of measures, affecting pension system rules as well as pension parameters. In general, recent parametric pension reforms have sought mainly to lift the effective retirement age, while several countries have also reduced the generosity of their pension systems. For example, countries have introduced less generous valuation rules for

<sup>112</sup> See the box entitled "Why is services inflation higher than goods inflation in the euro area?", *Monthly Bulletin*, ECB, January 2009.

<sup>113</sup> Public pension systems comprise all schemes that are statutory in nature and administered by the general government sector, in line with the definition used in the Ageing Reports. Accordingly, public pension expenditure affects the national accounts.

transforming pensionable earnings into pension entitlements, increased the required number of working years when calculating pensionable earnings, or shifted from wage to price indexation of pensions.<sup>114</sup> Some countries have also implemented automatic adjustment mechanisms linking key pension parameters to increases in life expectancy in order to make their public pension systems more sustainable. However, systemic pension reforms foreseeing a full or partial shift from pay-as-you-go schemes to fully funded schemes have been fairly limited among euro area countries over the last decade.<sup>115</sup>

**Despite recent progress, there is a risk of complacency.** Those recent reforms to public pension systems may not be sufficient to fully address euro area countries' ageing-related challenges. While they have certainly been helpful in terms of improving the financial sustainability of public pension systems, further efforts are indispensable in order to contain or further reduce the relatively high levels of pension expenditure in GDP terms. However, the pace of reform seems to have slowed of late. One possible explanation for this is the fact that, with an economic recovery under way and the impact of the sovereign debt crisis subsiding, governments are now under less pressure to implement pension reforms.<sup>116</sup> Indeed, there is empirical evidence supporting the view that business cycle developments, rather than concerns about the financial sustainability of pension systems, are the most important drivers of pension reforms.<sup>117</sup> Because of the considerable political costs in the short term, governments seem to have less appetite for implementing pension reforms during economic good times. Against this background, countries would be well advised to give themselves a buffer. There is no room for complacency in this regard, as pension pressures could turn out to be stronger than expected – e.g. if economic developments turn out to be less favourable than pension cost projections assume (see also Section 3.2). Thus, euro area countries should use today's improved economic environment to implement better long-term policies in order to address the challenges posed by population ageing.<sup>118</sup>

**The reform needs in the euro area vary considerably across countries.**

Differences relate both to the size of those reform needs and to the specific type of adjustment that is needed in each country. Identifying the reform measures that would be most appropriate for the various countries would involve taking account of the variety and complexity of countries' pension arrangements and lies outside the scope of this article. Euro area averages could serve as a rough benchmark for

<sup>114</sup> For a detailed overview of recent pension reforms in the EU, see Carone, G. et al., "Pension Reforms in the EU since the Early 2000's: Achievements and Challenges Ahead", *European Commission Discussion Papers*, No 42, 2016. For details of pension reforms in OECD countries, see OECD, *Pensions at a Glance 2017*, op. cit.

<sup>115</sup> In the early 2000s, several eastern European countries introduced mandatory private pension schemes, most of which have been abandoned in the meantime.

<sup>116</sup> See also OECD, *Pensions at a Glance 2017*, op. cit.

<sup>117</sup> See Beetsma, R., Romp, W. and van Maurik, R., "What drives pension reform measures in the OECD? Evidence based on a new comprehensive dataset and theory", *CEPR Discussion Papers*, No 12313, September 2017.

<sup>118</sup> The ECB has stressed the importance of pension reforms on several occasions. See, for example: the article entitled "Population ageing and fiscal policy in the euro area", *Monthly Bulletin*, ECB, July 2000; the article entitled "The need for comprehensive reforms to cope with population ageing", *Monthly Bulletin*, ECB, April 2003; and the article entitled "Challenges to fiscal sustainability in the euro area", *Monthly Bulletin*, ECB, February 2007.

individual measures. However, as the various pension parameters are strongly interlinked, it is important to adopt a much broader perspective when it comes to designing specific reforms. For example, reducing pension entitlements via cuts in pension valuation or indexation rules could be advisable in the case of a very generous pension system relative to the euro area average. However, such a policy could be less relevant if there are already other provisions seeking to ensure fiscal sustainability (e.g. a high effective retirement age). It is clear, therefore, that the decision as to which type of pension reform is best is highly country-specific. This also limits the usefulness of ranking such measures in terms of their potential impact on public finances when making country-specific recommendations.

**Political economy considerations highlight the role of social acceptance of pension reforms and the timing of their adoption.** While the benefits of pension reforms will only become visible with a lag, their political costs have to be borne immediately. Thus, in order to ensure broad support for those reforms, countries are advised not to place the full adjustment burden on a single feature, but to carry out the necessary adjustment by combining several reform elements. If, for example, adjustment needs were met solely by means of abrupt cuts to pension entitlements, this could, in extreme cases, potentially endanger pension adequacy. By adopting a more balanced approach, adjustment costs can be spread more widely across society, allowing older and younger generations to share that burden more equally. Moreover, the political costs of pension reforms tend to increase the later they are implemented. As the median voter is ageing, the political cost of adopting pension reforms is likely to increase over time<sup>119</sup> – as will the adjustment burden for the younger generation.

## 4.2 The macroeconomic effects of pension reforms

**Pension reforms are not only necessary for long-term fiscal sustainability, they can generally also help to dampen the adverse macroeconomic effects of ageing.** The concrete impact that public pension reforms have on macroeconomic variables such as the labour force, employment or public debt is strongly dependent on the reform measures adopted. Consequently, it is possible to compare the various reform options on the basis of their respective macroeconomic implications, while ignoring country-specific structural differences.<sup>120</sup> Box 3 presents the main results of

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<sup>119</sup> See, for example, Sinn, H.-W. and Uebelmesser, S., "Pensions and the path to gerontocracy in Germany", *European Journal of Political Economy*, Vol. 19, Issue 1, 2003. For a review of key literature, see Tepe, M. and Vanhuyse, P., "Are aging OECD welfare states on the path to gerontocracy?: evidence from 18 democracies, 1980-2002", *Journal of Public Policy*, Vol. 29, Issue 1, 2009.

<sup>120</sup> Empirical studies find evidence that the macroeconomic implications of pension reforms are more favourable if various types of feature are combined. This is supported by the results of OLG models for Luxembourg, Portugal and Finland, which are summarised in Dieppe, A. and Guarda, P. (eds.), "Public debt, population ageing and medium-term growth", *Occasional Paper Series*, No 165, ECB, 2015. See also Karam, P.D. et al., "Macroeconomic effects of public pension reforms", *IMF Working Papers*, No 10/297, 2010, which finds evidence of positive spillover effects for pension reforms. Thus, the positive impact on growth could increase significantly if several countries adopted such pension reforms in parallel.

a model simulation exercise with three different kinds of pension reform, which is based on the stylised model framework introduced in Box 1.

**Lifting the statutory and effective retirement ages, in line with increases in life expectancy, is expected to have a strongly positive impact on the labour supply and economic growth.** Lengthening people's working lives (for example, by reducing early retirement or increasing the statutory retirement age) effectively increases the size of the active labour force relative to the number of pensioners.<sup>121</sup> Moreover, if that increase in the retirement age is complemented by appropriate labour market measures, the additional older workers will be unlikely to crowd out younger workers.<sup>122</sup> Longer expected working lives will also increase incentives for lifelong learning and the accumulation of human capital, both of which are growth-enhancing. Moreover, longer working lives can also be expected to reduce the financing pressures on public pension systems through increases in pension contributions. While this will also imply increased pension entitlements for the next generation, it can be expected to contribute to improvements in pension adequacy.

**Increases in contribution rates are assumed to have less favourable economic implications.** Raising contribution rates may improve the financing of pay-as-you-go pension systems. However, such measures actually have the potential to exacerbate the macroeconomic effects of population ageing, rather than dampening them. In particular, the distortionary effects of higher contribution rates on the labour supply and employment can result in weaker economic growth.<sup>123</sup>

**Likewise, cutting the benefit ratio is, ceteris paribus, also potentially less favourable than lifting the retirement age.** Cutting pension entitlements can have detrimental macroeconomic effects via reductions in domestic demand. Pensioners are likely to respond to reduced pension transfers by cutting back on consumption. The working-age population may, in turn, increase precautionary savings in view of the reduction in future pension entitlements.

### Box 3

#### Stylised macroeconomic effects of public pension reforms

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Prepared by João Domingues Semeano and Carolin Nerlich

**The OLG model developed by Baksa and Munkacsi which was presented in Box 1 can be used to show the long-term macroeconomic effects of pension reforms.** To this end, Table A indicates the outcomes of a number of variations on the benchmark scenario (which involved an ageing shock and an absence of consolidation measures) in terms of the euro area average. The size of the various reform measures is, ceteris paribus, determined by the objective of preventing population ageing from having an adverse impact on public debt, as established in Box 1. This

<sup>121</sup> The positive economic impact of prolonging people's working lives is stronger if those additional working years are spent in good health.

<sup>122</sup> Carta, F., D'Amuri, F. and von Wachter, T., "Aging workforce, pension reform, and firm's dynamics", mimeo, 2017, finds that the recent pension reforms in Italy have not had a negative impact on youth employment.

<sup>123</sup> Increases in contribution rates have also been found to adversely affect external imbalances. See, for example, Castro, G. et al., "Aging and fiscal sustainability in a small euro area economy", *Macroeconomic Dynamics*, Vol. 21, Issue 7, October 2017.

exercise seeks to provide a general indication of the potential long-term macroeconomic effects of three different kinds of public pension reform, assessing them one at a time. It does not, however, address the question of which type of reform measure is most appropriate for which euro area country, given that this issue is highly country-specific. The three types of pension reform under assessment involve changes to the retirement age, the contribution rate and the benefit ratio. In addition, this exercise also considers an increase in personal income tax to compensate for the impact that ageing has on public debt.

**The results of this exercise point to considerable differences in terms of the macroeconomic effects of the three pension reforms.** These simulations suggest that raising the retirement age has the potential to considerably reduce the adverse impact that ageing has on growth. In concrete terms, this means that GDP per capita declines by 3.6% less than in the reference scenario (see Table A).<sup>124</sup> In contrast, simply increasing contribution rates or personal income taxes results in the adverse macroeconomic impact strengthening, rather than weakening, relative to the reference scenario. This is driven largely by stronger negative effects on consumption per capita and employment. Finally, reducing the benefit ratio such that the ageing-related adverse impact on debt is avoided results in GDP per capita falling only marginally less than in the reference scenario. Thus, on the basis of this stylised model framework, we can conclude that pension reforms that seek to prolong people’s working lives appear to be at least partly able to address the adverse macroeconomic effects of ageing.

**Table A**

Stylised long-term macroeconomic effects of different public pension reforms and other government measures

(percentage changes)

Consolidation measure	GDP per capita	Consumption per capita	Employment
	change relative to reference scenario		
Increase in retirement age	3.6	4.1	3.8
Reduction in benefit ratio	0.1	-0.1	0.0
Increase in employer’s contribution rate	-0.3	-0.3	-0.3
Increase in personal income tax	-0.6	-0.8	-0.8
Memo item: Reference scenario	-4.7	-5.6	-5.1

Source: ECB calculations.

Note: Based on the model developed by Baksa and Munkacsi, calibrated for the euro area.

**Moving from a pay-as-you-go pension system to a fully funded system can help to make pension arrangements more sustainable, but involves risks for household finances.** Fully funded systems still play only a limited role in the euro area, with the Netherlands being a notable exception in this regard. In fact, pension payments derived from private pension funds only account for around 6% of total

<sup>124</sup> In broad terms, this result is also supported by other empirical studies using different model specifications. See, for example, Karam, P.D. et al., “Macroeconomic effects of public pension reforms”, op. cit.; and Vogel, E. et al., “Aging and Pension Reform: Extending the Retirement Age and Human Capital Formation”, *MEA Discussion Papers*, No 06-2012, University of Mannheim, June 2012.

pension expenditure in the euro area.<sup>125</sup> Moving to a fully funded pension scheme would make pension shortfalls more transparent. This could encourage increases in domestic savings, which could also turn out to be beneficial for asset markets. However, a move towards higher levels of mandatory funding generally entails a double burden for those generations who are continuing to contribute to the pay-as-you-go system for existing pensioners while simultaneously having to build up their own pension savings. Moreover, fully funded pension schemes can pose risks to household finances in an environment of low or negative asset returns, for example in the presence of low equilibrium interest rates.<sup>126</sup> Administration costs and risky investment strategies can further erode the benefits of funded arrangements.

**Finally, forces relating to ageing and pension reforms can be expected to play a significant role in respect of monetary policy.** As was stressed in previous sections, these forces will influence the euro area's equilibrium real interest rate for the foreseeable future. Moreover, they may also affect central bank objectives. Box 4 discusses aspects that are relevant from a monetary policy perspective.

## Box 4

### Monetary policy implications of population ageing and pension reforms

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Prepared by Leopold von Thadden

**Forces relating to population ageing and the reform of pension systems matter for monetary policy from both a positive and a normative perspective, as they may affect the margin for interest rate changes, as well as the objectives of central banks.** This box provides an overview of the various aspects that are relevant in this regard.<sup>127</sup>

**Forces relating to population ageing and pension reforms are a slow-moving driver of the equilibrium real interest rate, a variable that is important when judging the monetary policy stance for any given inflation objective.**<sup>128</sup> As various studies have pointed out, past and projected future demographic forces place slow-moving downward pressure on the euro area's equilibrium real interest rate, in line with the developments observed in many other jurisdictions. On the basis of a small-scale New Keynesian model enriched with a demographic structure, Kara and Thadden offer model-based long-term simulations for the euro area (starting in 2008 and running until 2030) which allow likely effects to be broken down into those attributable to "pure" demographic forces and those related to various pension system designs.<sup>129</sup> That study confirms that two major demographic forces, namely the declining growth rate of the working-age population and increases in life expectancy, are contributing independently to declines in the equilibrium real

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<sup>125</sup> See OECD, *Pensions at a Glance 2017*, op. cit.

<sup>126</sup> See also Boeri, T. et al., *Dealing with the New Giants: Rethinking the Role of Pension Funds*, 2006.

<sup>127</sup> For an overview of relevant aspects, see Bean, C., "Global demographic change: some implications for central banks", FRB Kansas City Annual Symposium, Jackson Hole, Wyoming, 2004.

<sup>128</sup> For a detailed discussion of this concept, see the box entitled "Real interest rates in the euro area: a longer-term perspective", *Monthly Bulletin*, ECB, July 2014.

<sup>129</sup> See Kara, E. and von Thadden, L., "Interest rate effects of demographic changes in a New Keynesian life-cycle framework", *Macroeconomic Dynamics*, Vol. 20, Issue 1, 2016, pp. 120-164. That paper uses an OLG model that is similar in structure to the model used by Baksa and Munkacsi, with similar quantitative predictions. The model offers a tractable closed-economy extension of a New Keynesian monetary policy framework, enriched with a demographic structure allowing for a working-age population and retirement, similar to Gertler, M., "Government debt and social security in a life-cycle economy", op. cit.

interest rate.<sup>130</sup> The first force is consistent with long-term predictions by standard growth models,<sup>131</sup> while the second operates through life-cycle effects on savings and consumption, as typically addressed by OLG models.<sup>132</sup> The study shows that the strength of the second force depends critically on how pension systems respond to demographic changes, since pension arrangements – both existing and expected future arrangements – interact directly with life-cycle motives for savings. These insights are quantified in two polar scenarios.<sup>133</sup> First, the cumulative long-term effect on the equilibrium real interest rate will be most pronounced in a scenario in which the rise in the old-age dependency ratio encourages additional private savings by workers, assuming an unchanged retirement age and a ceiling on the amount of tax-financed redistribution from workers to pensioners. In this scenario (which strengthens privately funded elements), the cumulative decline in the period to 2030 totals around 110 basis points. In contrast, this effect would be significantly reduced in a second scenario where it was assumed that pensions would continue to be funded via a pay-as-you-go system, leading to an increase in tax-financed redistribution from workers to pensioners. In this alternative scenario (which reduces, *ceteris paribus*, incentives for workers to save), the cumulative decline totals around 50 basis points.<sup>134</sup>

**Besides forces relating to ageing and pension reforms, equilibrium interest rates are also affected by a wide range of other factors.** Recent literature points to a number of complementary structural channels which can explain the decline in equilibrium interest rates from a general equilibrium perspective. The evidence documented in the literature emphasises, *inter alia*, productivity-driven aspects of secular stagnation, slow balance sheet repair in the aftermath of the financial crisis, and the scarcity of safe assets. Moreover, the openness of an economy is relevant for the quantitative strength of all of these channels.<sup>135</sup>

<sup>130</sup> Given the focus on long-term developments, the equilibrium interest rate is driven by changes in the ratio of capital to labour.

<sup>131</sup> In the same vein, the Solow growth model predicts that, in a steady-state comparison, a decline in population growth will lead, *ceteris paribus*, to a decline in the equilibrium real interest rate.

<sup>132</sup> The second force tends to support a degree of recovery in the equilibrium interest rate when dissaving effects start to dominate, before fading away if demographic variables settle again at new stable long-term values. Adopting a global perspective, this reversal effect was emphasised, in particular, in Goodhart, C. and Pradhan, M., “Demographics will reverse three multi-decade global trends”, *op. cit.*

<sup>133</sup> The quantitative findings summarised in this box are similar in magnitude to those reported in: Miles, D., “Modelling the impact of demographic change upon the economy”, *The Economic Journal*, Vol. 109, 1999, pp. 1-36; Börsch-Supan, A. et al., “Ageing, pension reform and capital flows: a multi-country simulation model”, *Economica*, Vol. 73, 2006, pp. 625-658; and Krueger, D. and Ludwig, A., “On the consequences of demographic change for rates of returns to capital, and the distribution of wealth and welfare”, *Journal of Monetary Economics*, Vol. 54, 2007, pp. 49-87. All of these studies draw on OLG models in order to assess the combined effect of demographic changes and various pension reforms on equilibrium interest rates. For estimates from a dynamic panel model that are consistent with these findings, see Ferrero, G. et al., “On secular stagnation and low interest rates: demography matters”, *Working Paper Series*, No 2088, ECB, 2017. For broad-based analysis of demographic changes from a structural general equilibrium perspective with a focus on US developments, see, in particular, Gagnon, E. et al., “Understanding the New Normal: The Role of Demographics”, *Finance and Economics Discussion Series*, No 80, Board of Governors of the Federal Reserve System, 2016.

<sup>134</sup> The study also looks at intermediate policy options in terms of pension design. For example, in the first scenario, the effect would be mitigated if the retirement age were to increase, commensurate with the increase in life expectancy, offsetting the life-cycle effect supporting additional private savings.

<sup>135</sup> For representative discussions, see: Eggertsson, G. and Mehrotra, N., “A model of secular stagnation”, *NBER Working Papers*, No 20574, 2014; Rogoff, K., “Debt supercycle, not secular stagnation”, in *Progress and Confusion: The State of Macroeconomic Policy*, MIT Press, 2016, pp. 19-28; Summers, L., “Reflections on the new secular stagnation hypothesis”, in *Secular stagnation: facts, causes and cures*, Vox, 2014, pp. 27-40; and Caballero, R. and Farhi, E., “The Safety Trap”, *Review of Economic Studies*, forthcoming.

**The above-mentioned cumulative impact on equilibrium real interest rates will play out slowly over time, given the slow-moving nature of demographic changes.** Nevertheless, it is important that this impact is recognised by monetary policymakers. By way of illustration, Kara and Thadden consider an environment with sticky prices in which the reaction function of monetary policy is characterised by a Taylor rule. If that rule fails to incorporate the downward pressure on the equilibrium rate in a sufficiently timely manner, there is a risk of an overly tight monetary policy stance and downward pressure on inflation. However, in line with the long-term neutrality of money, the study also shows that such pressure disappears in the presence of flexible prices, an assumption that is typically used when characterising the long-term developments discussed in this box.<sup>136</sup>

**If equilibrium real interest rates were to stay at low levels for a protracted period of time, this would have implications for the conduct of monetary policy.** With an unchanged inflation objective, monetary policy would be likely to face challenges arising from the lower bound constraint on nominal interest rates more often. This would naturally mean that other monetary policy tools, such as forward guidance and non-standard measures, would have to complement the conventional interest rate channel more frequently than in the past.<sup>137</sup> Moreover, macro-prudential tools could gain in importance in the event that frequently used non-standard monetary policy tools were regarded as being conducive to risks to financial stability that needed to be contained.

**As regards normative aspects, a central bank's objectives can be shaped by the age structure of the economy and its interaction with pension system design.** It has traditionally been acknowledged that “older” societies attach more weight to price stability than to the stabilisation of output and employment – both in terms of the preferred long-term level of the price stability objective and in terms of the adjustment speed when returning to this level in response to shocks. This finding reflects the fact that cohorts may well express differing degrees of aversion to inflation over their lifetimes, for example because of age-specific exposure to labour market incomes. More nuanced findings emerge if one also considers the role of cohort-specific portfolio compositions and recognises that people typically rely more on returns from asset accumulation as they get older. Thus, ageing societies typically develop a more pronounced preference for financial

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<sup>136</sup> The study confirms that, consistent with the long-term neutrality of money, downward pressure on inflation can emerge in an environment characterised by sticky prices (as opposed to flexible prices). Moreover, it will disappear if the central bank can correctly identify the decline in the equilibrium rate in real time. The study shows numerically how, in the absence of such identification, that pressure can be addressed by responding more strongly to deviations of observed inflation from the central bank's inflation objective. For details of related work which identifies a downward bias in inflation if central banks learn about the impact that demographic processes have on the equilibrium interest rate over time, see Bielecki, M. et al., “The demographic transition and monetary policy in a small open economy”, mimeo, 2018. Moreover, a number of empirical studies have emerged more recently which, deviating from the long-term neutrality of money, suggest that there might be links between ageing and inflation in the long run. However, these studies point in opposing directions in terms of the impact on aggregate inflation, depending on the country and time period in question. For instance, both Yoon, J.-W. et al., “Impact of demographic changes on inflation and the macroeconomy”, *IMF Working Papers*, No 14/210, 2014, and Bobeica, E. et al., “Demographics and inflation”, *Working Paper Series*, No 2006, ECB, 2017, find a relationship between population ageing and deflationary pressures. Meanwhile, Juselius, M. and Takats, E., “Can demography affect inflation and monetary policy?”, *BIS Working Papers*, No 485, 2015, finds a link with inflationary pressures. Those differing results could, of course, stem from a variety of different factors, such as the samples, definitions or controls employed.

<sup>137</sup> See the article entitled “The ECB's forward guidance”, *Monthly Bulletin*, ECB, April 2014, and the article entitled “The transmission of the ECB's recent non-standard monetary policy measures”, *Economic Bulletin*, Issue 7, ECB, 2015.



stability, particularly where the ageing process has been accompanied by a strengthening of privately funded elements of pension systems.<sup>138</sup>

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## 5 Conclusions

**This article finds that population ageing will have major macroeconomic and fiscal implications for the euro area.** In particular, ageing will lead to a decline in the labour supply and is likely to have adverse effects on productivity, while the implications for savings and investment will vary over time, depending on the relative size of the various cohorts and behavioural changes. Model simulations broadly support these findings. Population ageing will also entail changes to relative prices, mainly owing to shifts in demand, with demand for services rising. There will also be additional upward pressure on public spending on pensions, health care and long-term care. This will make it challenging for euro area countries to reduce their sizeable debt burdens and ensure fiscal sustainability in the long run.

**Against this background, many countries implemented pension reforms following the sovereign debt crisis, although the pace of reform has slowed of late.** Further reforms in this area would seem to be essential and should not be delayed, also in view of political economy considerations.

**While pension reforms will help to contain the fiscal impact of population ageing, their precise macroeconomic implications may vary considerably depending on the specific nature of those reform measures.** In particular, increasing the retirement age can be expected to reduce the adverse macroeconomic effects of ageing, thanks to a favourable impact on the labour supply and domestic consumption. In contrast, reducing the benefit ratio will tend to do very little to tackle those macroeconomic effects, while increasing the contribution rate will actually tend to exacerbate them. These findings are supported by model simulations. That being said, these results are, by construction, merely a general assessment of the macroeconomic effects of pension reforms and do not allow conclusions to be drawn regarding the reform agendas of specific countries. At the same time, forces relating to population ageing and pension reforms are a slow-moving determinant of the equilibrium real interest rate and need to be taken into account by a price stability-oriented monetary policy.

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<sup>138</sup> For a more detailed discussion, see Miles, D., "Should monetary policy be different in a greyer world?", in Auerbach, A. and Herrmann, H. (eds.), *Ageing, financial markets and monetary policy*, Springer, 2002.