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Economic and sectoral studies department

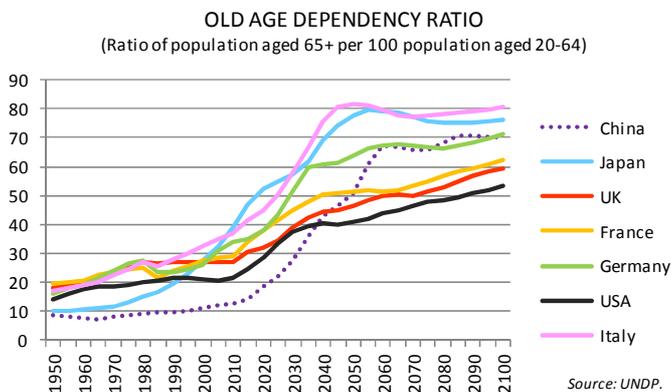
POPULATION AGING: RISK OF DEFLATION OR INFLATION?

— The world is going through an unprecedented phenomenon in terms of aging as a result of two forces: falling fertility and rising longevity. All countries are experiencing this shift, albeit to different extents and with different timings. Japan is at the forefront of the demographic changes, but the rest of the advanced world is now following in its footsteps as a lower birthrate in the past and continuing reductions in mortality begin to bite.

— Demographics in the advanced world are now at a turning point. According to the UN, the combined working-age population of the world's advanced economies has probably peaked and is expected to fall by more than 5% in the next five decades. In China, the working-age population is expected to collapse by a third by 2065. At the same time, the share of these countries' population aged 65 and over will skyrocket.

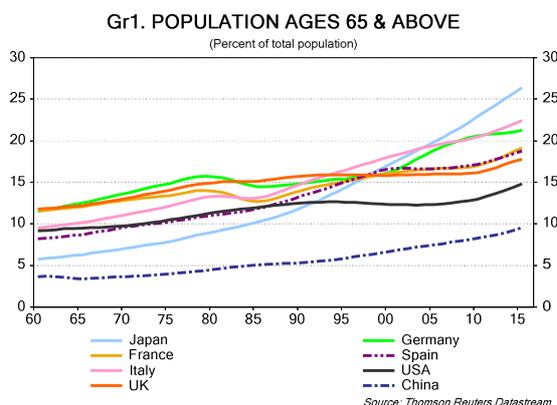
— This paper aims at reviewing the consequences of aging for price dynamics. There has been scant theoretical and empirical work to date on the potential relationship between aging and inflation, and the limited research on this topic is not conclusive. Recent work suggests that fast-aging countries could confront rising inflation pressures, which challenges the more common view that an aging population is inherently deflationary.

— Over the past twenty years, Japan has endured essentially the same demographic experience most developed countries are set to face over the next fifty years, and the country has long been mired in deflation. Currently, several aging countries are also experiencing historically low inflation or even deflation. While it is possible that population aging could lead to sustained inflationary pressures in the future, Japan's experience suggests, though, that the opposite could be more likely. Assessing whether Japan's experience could provide a predictive model for other economies is clearly an issue worthy of further research.

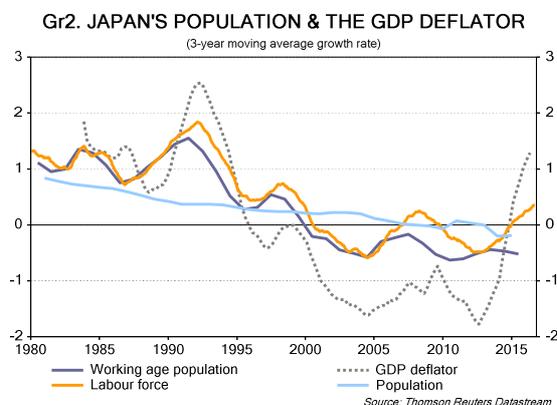


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Seven years after the global financial crisis, growth in the advanced world has repeatedly disappointed while inflation has remained stubbornly below main central banks' target. Economists have come up with a variety of explanations to account for this weak macroeconomic performance, such as excessively high indebtedness, a gradual drop in potential growth and the progressive loss of policy room for maneuver, both fiscal and monetary. But commentators have also increasingly pinpointed the potential role of demographic trends in recent macroeconomic underperformance. Recently, a number of central bankers and researchers have suggested that there could be a link between low inflation and population aging.

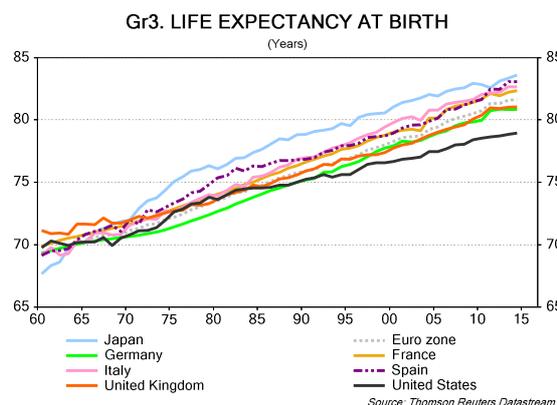


With a declining population that is aging faster than any other country on the planet, Japan is at the forefront of the demographic shift (see Box 1), and it has long been mired in deflation. There are good reasons to believe that a rapidly declining and aging population has played a substantial role in Japan's decades-long growth slowdown and deflation trap. Several European nations are now following in Japan's demographic footsteps, having experienced earlier and relatively larger declines in fertility rates than developed countries such as the United States. This has led some commentators to believe that, barring a big rise in immigration, these countries could slide into a Japanese-like regime.



While economists generally agree that the aging of populations creates fiscal strains and reduces output

growth¹, there has been scant theoretical and empirical work on the potential relationship between aging and inflation. The impact of aging on inflation dynamics is ambiguous in theory owing to various conflicting channels. In this paper, we start by briefly describing the main elements of the demographic transition the world is currently experiencing. Next we review the main theoretical channels through which changes in demographics can possibly affect inflation dynamics. We emphasize that the graying of the population could potentially influence price dynamics through a wide-ranging set of key macroeconomic variables. We conclude that it is hard to tell from the theoretical perspective how changes in demographics can shape inflation rate behavior.



The unprecedented aging phenomenon² the world is now experiencing has emerged as a key medium- to long-term policy concern given the potentially important implications for central banks, governments, and the investment banking world at large. Against this backdrop, the question of the impact of aging on inflation is bound to become a high-profile topic for debate on academic and policy research agendas in years ahead.

RAPIDLY AGING POPULATIONS...

THE DEMOGRAPHIC TRANSITION

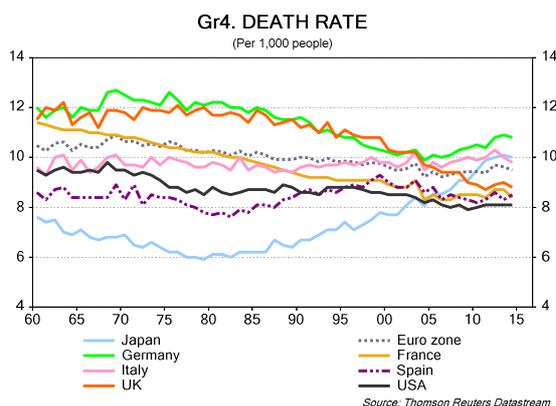
The demographic transition refers to the modernization process of societies from a pre-modern regime of high birth and death rates to a post-modern one in which both birth and death rates are low³. Before the

¹ See, for example, International Monetary Fund (2004), *The Global Demographic Transition*, *World Economic Outlook*, Washington D.C., September. See Chap. III, "How will Demographic Change Affect the Global Economy", pp. 137-180.

² The United Nations (UN) definition for "aging" is populations with more than 7% elderly at age 65 and above. When populations have more than 14% and 20% elderly, the UN defines them as respectively "aged" and "super-aged".

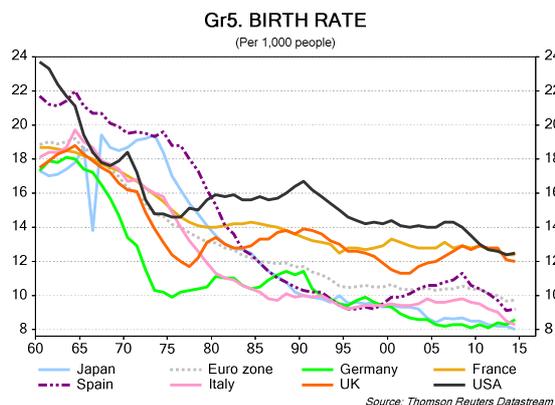
³ See notably Frank Notestein (1945), "Population: The long view", in T. Schultz (ed.), *Food for the World* (Chicago) pp. 36-57; W.S. Thompson (1929), "Population", *American Journal of Sociology*, 34, pp. 959-975.

transition's onset, high birth and mortality rates cause the population to grow only slowly. The demographic transition begins when the mortality rate declines (mainly because of increased infant and child survival), so that the country's population growth accelerates and the share of youth (children and young adults) in the population increases (the "boom" generation). But of course, the youth "bulge" associated with declining mortality during the early phase of the demographic transition is temporary as the "boom" generation gradually works its way through the age structure.



Later, at an intermediate stage, fertility begins to decline (partly as a result of educational progress and the increased use of contraception), reducing the number of children, and the share of the working-age population (generally taken to be 15-64) increases. As the working-age cohort produces the lion's share of a country's economic output, per capita income then grows more rapidly, which is often referred to as the "sweet spot" or the "demographic dividend". Eventually, though, the "boom" generation reaches the older ages. This secular "age wave", combined with lower fertility and continuing

improvements in old-age mortality, then reduces the growth rate of the working-age share and speeds growth of the elderly population, causing the sweet spot to disappear and ultimately to reverse. During the late stage of the demographic transition, low mortality and fertility increase the share of the older population, a process known as population aging, which raises dependency and puts pressure on family support systems and public transfer programs (pensions and health care).



An unprecedented aging phenomenon is what is happening now in most developed countries. The demographic sweet spot the advanced world has been living through since around 1970, when those born in the post-war baby boom entered the workforce, is now coming to an end, as the retirement of the huge baby boom generation (born from 1946 through 1964), combined with the effect of a lower birth rate in the past causes the share of the population of working age to go into reverse. Simultaneously, the older populations in the advanced world continue to grow at an unprecedented rate.

BOX 1. JAPAN'S DEMOGRAPHIC UPHEAVAL

With a population that is declining and aging faster than any country on the planet, Japan is at the forefront of the demographic transition, and so may provide a laboratory for studying the demographic challenges awaiting the world.

Japan's fertility has been below replacement level (that is, 2.1 births per woman) for the past 40 years. The country's fertility rate started to decline as early as the 1920s, and then rebounded in the 1940s, before showing a sharp drop from 1949 onwards, corresponding to the end of the (first) baby boom in Japan. The birth rate was then roughly flat at around 2 until the mid-1970s, when it began to fall dramatically.

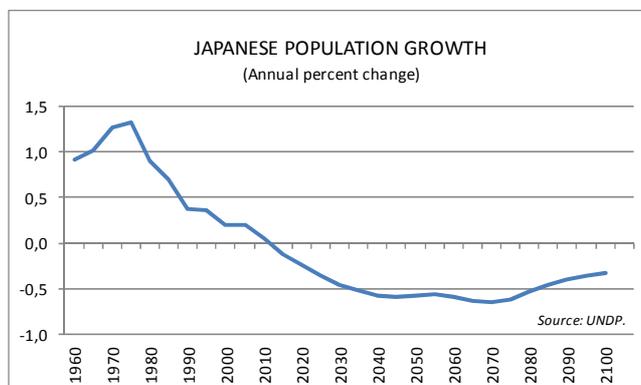
By 2005, Japan's total fertility rate (TFR) – the average number of children born to each woman in her childbearing lifespan (15–49 years old) – had dropped to 1.26 births per woman. It then rose slowly, but steadily, to reach 1.43 in 2013. The fall in the Japanese birth rate can be traced back to many factors including the spread of contraception, the higher educational level of women, a declining rate of marriage, a rising age at marriage, the expanding participation of women in the workforce, a lack of childcare facilities, a non family-friendly work environment, economic stagnation, and the rising cost of child-raising.

Japan's fertility rate is not, though, the lowest in the OECD. In 2013, with its 1.43 TFR, Japan was doing better than South Korea and Singapore (both 1.19), Hong Kong (1.12) and Germany (1.38)⁴. But the fact that Japan has had a low fertility rate for a long time has meant that the pace of decrease in the growth rate of its population has virtually been globally unprecedented.

⁴ Source: the World DataBank.

Sustained immigration could have possibly delayed the population decline, but Japan has long been characterized by a very low level of immigration, mainly owing to very restrictive policies for unskilled migration. Immigrants accounted for only 1.61% of Japan's total population in 2015, twice as much as that of a decade ago, but still very low when compared with many other countries, especially Canada (22%), North America (14%⁵), and even the UK (13%), Germany (15%), France (12%) or Italy (10%).

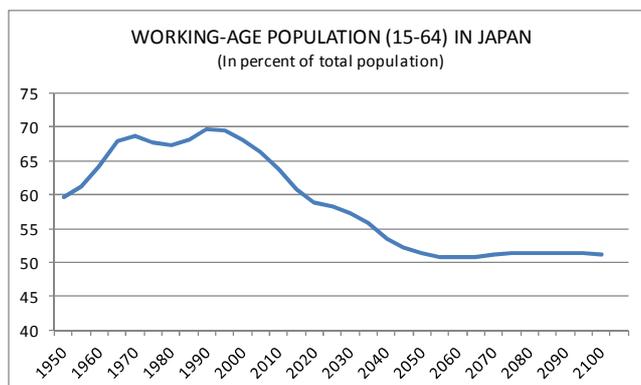
Falling fertility, combined with very low levels of immigration has been reflected in a continuous decline of Japan's population growth since 1975. Japan's population growth hit zero in 2011 and then moved into negative territory.



Meanwhile, starting from the early 1950s, Japan has registered large gains in longevity, which have produced not only an older population but also an older workforce, relative to other advanced economies. With increasing longevity and falling fertility, Japan has experienced both a growing population of older workers and a shrinking population of younger ones.

At 85, the Japanese life expectancy is now the highest in the world, and the UN reckons that the country's life expectancy could be 94 by the year 2095. Since the early 1990s, the share of the population aged 65 years or older has risen sharply, from 12% in 1990 to 25% in 2013; it is set to keep increasing to a projected 40% in 2060. Meanwhile, the share of youth, below the age of 15, fell from 16% in 1995 to 13% in 2013. It is slated to fall further to a projected 10% in 2060, due to the drop in fertility.

In parallel, the drop in fertility has led, with roughly a 15- to 20-year lag, to a sharp fall in the share of the population in the working-age group (from 15 to 64 years of age), from a peak of 69.5% in 1995 to 60.8% in 2015.



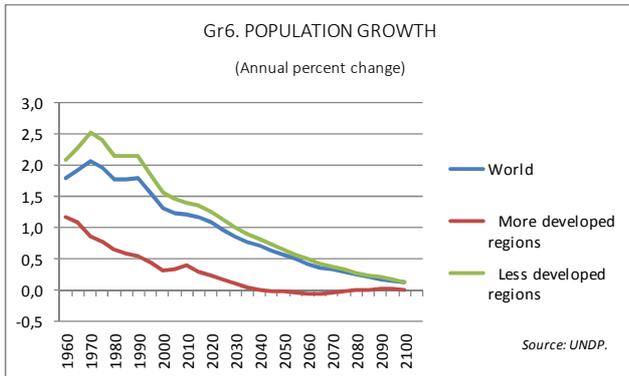
The share of the working-age population will continue to fall in coming decades to a projected 51% by 2060, which means that, by the year 2060, each Japanese person of working age will be supporting one person of non-working age, which is a huge "dependency ratio"⁶.

⁵ But 26% if one adds to the immigrants their US-born children.

⁶ The dependency ratio is a measure showing the number of dependents aged zero to 14 and over the age of 65, to the working-age population, aged 15 to 64.

SLOWING POPULATION GROWTH

Prior to the twentieth century, world population growth was slow⁷. It then rose to a peak of over 2% per annum in the mid-1960s as a result of unprecedented declines in mortality rates⁸. The longevity transition first started in more advanced countries and then spread to poorer areas over time. Increased life expectancy reflected many factors, such as improved life standards, better nutrition, advances in medical technology, improved education and, especially in low-income countries, better sanitation and water systems, along with important strides in the prevention and treatment of infectious diseases like HIV, malaria, and polio, among others.



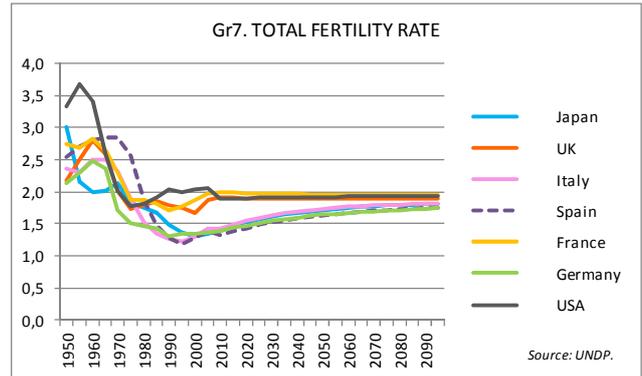
From the 1960s onwards, the world's population growth rate started to decline (from a high of 2.1% a year between 1965 and 1970 to 1.1% currently) as a result of a historically unprecedented fall in fertility in virtually all major areas of the world⁹. Throughout the late 1960s and early 1970s, the majority of industrialized countries went through a rapid fall in fertility that reflected such factors as contraceptive availability, changing attitudes about the status of women and the expansion of women's opportunities to work outside the home. In Japan, the UK, the US and all European countries, fertility is now below the level required for full replacement of the population in the long run (around 2.1 children per woman, on average)¹⁰.

⁷ World population grew at about 0.05% annually for 10,000 years. In the 17th and 18th centuries, the population growth rate increased to about 0.5% annually and reached 0.7% after 1900. In 1900, 1.6 billion people inhabited our planet; by 2000, this figure had risen to 6.1 billion. The United Nations projects that, by 2100, the world population will reach 11.5 billion people.

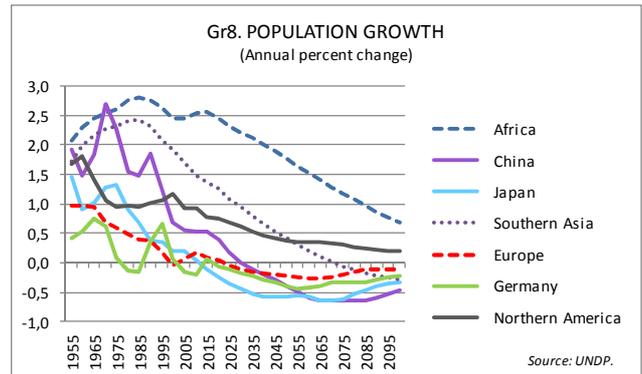
⁸ For the world as a whole, life expectancy more than doubled from around 30 years in 1900 to 71 years now, and is projected to rise to 78 years in 2050-55 and to around 83 years in 2095-2100. Life expectancy varies considerably across regions, from a low of 61 in Africa to a high of 80 in northern America.

⁹ The world fertility rate has dropped to 2.43 births per woman, down from 4.85 in 1970, with large differences across regions (1.6 in Europe, for example, vs. 4.6 in Africa) and countries (1.2 in Singapore, for example, vs. 7.6 in Niger).

¹⁰ In 2010-2015, fertility was 1.4 children per woman for Japan, 1.55 for China, 1.6 for Europe as a whole (1.28 for Portugal, 1.32



According to the UN's population projections, the standard source for demographic estimates, world population growth is set to continue to fall to a projected 1% in 2020 (the lowest rate since the 1950s) and to only ¼% by 2080 (which will bring the world back to 17th and 18th century figures). Of course, these global developments mask significant differences between countries and regions, especially between developed areas and less developed regions. For example, Africa (the fastest-growing major area), the Middle East and some parts of Asia are still growing at a robust rate, reflecting their higher fertility rates, while the population in Europe is hardly growing at all, and population growth in Japan has dipped into negative territory.

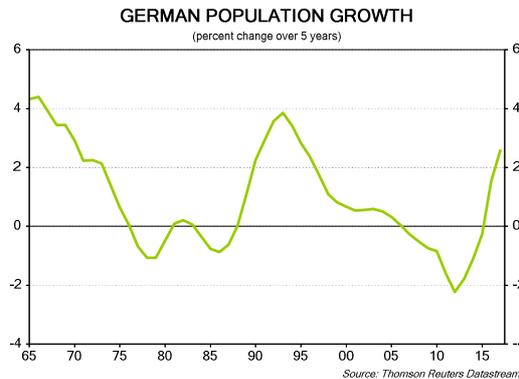


In the US, population growth is robust in comparison with that of most other advanced nations, largely thanks to recent immigrants, who tend to have more children than residents whose families have been in the country for several generations. However, in coming decades, population in America will grow at barely a third of the annual 1% rate that prevailed from 2000 to 2013. Between 2020 and 2045, the EU-27's population is expected to shrink by around 0.2% per year, with the decline being particularly pronounced in Italy and Germany. By 2050, Japan's population should have fallen by more than 15%. For the OECD area as a whole, total population growth is projected to enter negative territory around 2050.

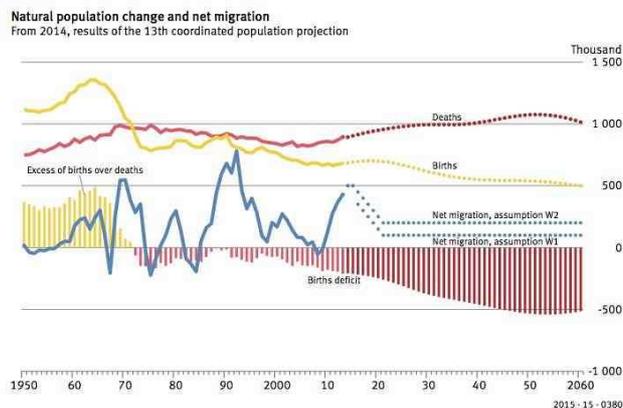
for Spain, 1.39 for Germany, 2 for France), 1.89 for the USA and 1.92 for the UK.

BOX 2. CAN IMMIGRATION CHANGE GERMANY'S DESTINY?

Germany has succeeded in reversing a decade-long decline in population thanks to four consecutive years of increasingly high net migration. Net migration to Germany has, in every year since 2011, exceeded 300,000, with a record high figure of 1,139,000 reached in 2015. Offsetting the decline in Germany's birth rate, rising immigration has taken the German population to nearly 82 million people – a level last seen in 2009. In 2015, Germany registered its biggest annual increase in population (+1.2%) in more than 20 years. The population growth has been particularly concentrated among those of working age.



Long-term trends, however, continue to point to a demographic decline. The German Federal Statistics Office warns that not even a million migrants can reverse Germany's long-term population decline, owing to a growing birth deficit after 2020 at a time when the large Baby-Boom generation will start to die off. Even if the birth rate were to rise from 1.4 to 1.6 children per woman, the Statistics Office calculates, overall births would still decline in the long term. To offset the demographic decline, Germany would need 470,000 immigrants each year between now and 2040, a flow of migrants which, according to the Statistics Office, is unlikely to be sustained year after year. The German population is expected to begin to shrink from around the year 2020, as described by the variant "continuity amid weaker immigration" of the 13th coordinated population projection of the Federal Statistics Office (see the graph below).

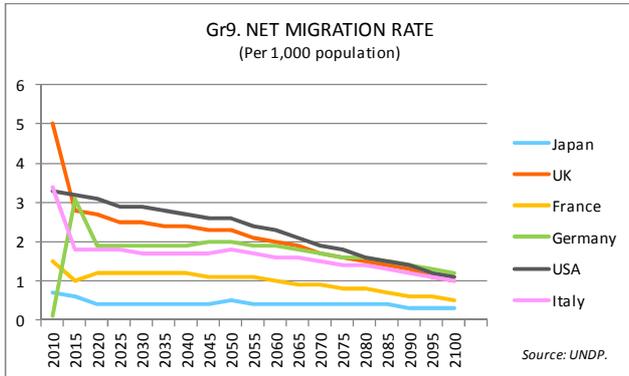


Immigration could theoretically slow the developed world's decline in population growth. Given migrants' relatively younger age and higher fertility, immigration could have a potentially strong and long-lasting effect on population growth and composition. However, immigration policy tends to be restrictive in most advanced countries, partly because of fears that migration may bring social pressures with it. At present, only 3.3% of the world's population lives in countries

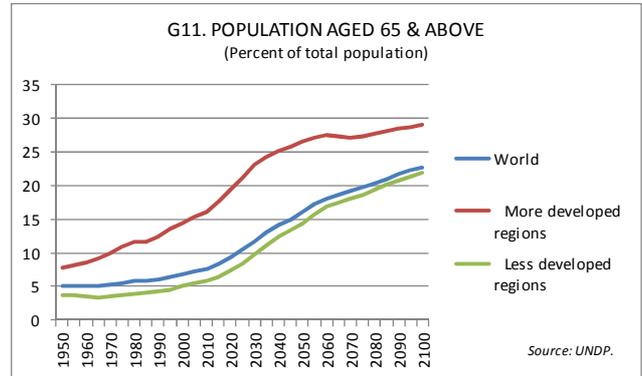
other than the one in which people were born¹¹. To maintain a constant total population, Japan and European countries would need to raise their immigration levels multiple times beyond current levels, which hardly looks feasible. As net immigration into developed countries will likely remain small overall

¹¹ Nearly 20% of the world's international migrants are in the United States, followed by Germany and Russia.

compared to the size of populations¹² and fertility in the advanced world is unlikely to rise for the foreseeable future, the current trend of declining populations in the advanced world appears irreversible.



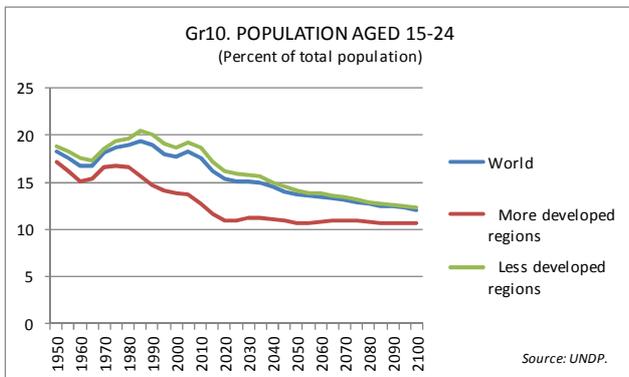
projected to rise to 4.5% by 2050 and to 8.4% by 2100. Not only is the world's population becoming older, the older are living longer. However, here again, there are wide differences between countries and regions.



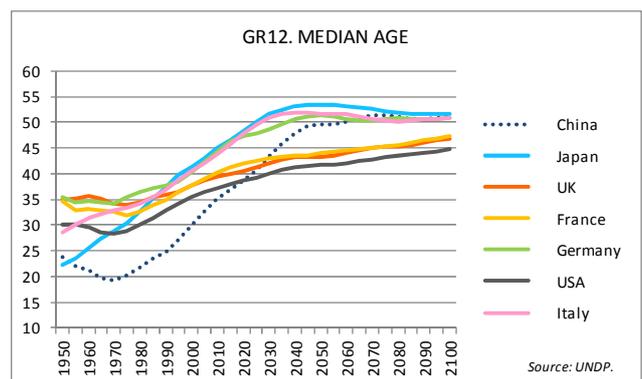
RAPIDLY AGING POPULATION

But slowing or declining population growth is not the only result of the transition from high to low rates of mortality and fertility. Changes also occur in the age structure of the population: the world is now experiencing an unprecedented phenomenon in terms of aging. The decline in fertility combined with the rise in life expectancy is causing a dramatic change in the population age distribution with an increasing share of old people and a decreasing share of children. The share of adolescents and young adults is falling in every region of the world, and in some countries, even the absolute number of 15- to 24-year-olds is shrinking.

In the advanced world, the cohort of old (65 and over) and very old (80 and over)¹³ is growing much stronger than the cohort of young, with the population of old people also aging. Population aging is most rapid in Japan, Western Europe and the United States. Currently, Japan and Europe have the greatest proportion of their population aged 60 or over (respectively 33% and 24%). Between now and 2030, Japan will age by five years, with the median age projected to increase to 51.5 years from the current level of 46.5. Germany, now the second-oldest population in the world after Japan, will see its median age increase from 46.2 years today to 48.6 years by 2030. Several other European countries, as well as key emerging countries such as China, will experience similar trends¹⁴. China is set to face dramatic changes in the next half-century—a legacy of the one-child policy—, with a projected tripling of the number of Chinese people aged 65 and over (from 131 million currently to about 406 million).



Meanwhile, the world's population aged 60 and over is rising at an annual rate of 3.26% per year. The share of people aged 60 and over has risen from 8% of the global population in 1950 to 12% currently, and is projected to increase to about 22% by 2050 and to 28% by 2100. By 2050, all major regions of the world except Africa will have nearly 25% or more of their populations aged 60 or over. And the population aged 80 and over, now accounting for 1.7% of the world's population, is



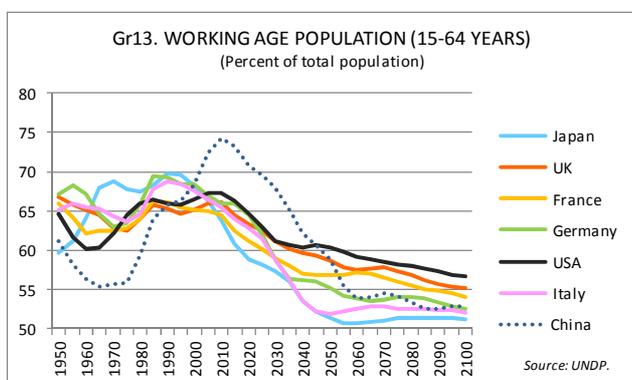
¹² Net migration should, however, contribute to the expansion or mitigate the decline of the populations of such countries as the United States, Germany, Canada, the UK, Australia, Russia and Italy, which are expected to be the top net receivers of migrants (with more than 100,000 annually) in the coming decades.

¹³ Those aged 80 and older are in the most rapidly growing age group worldwide. By 2050, the population of centenarians will be 16 times larger than in 2000 (2.2 million compared with 135,000).

¹⁴ In Spain, for example, the median age will rise from 43.2 years currently to 50.1 by 2030; in Italy, from 45.9 years to 50.8; in Portugal, from 44 years to 50.2; in China, from 43.2 to 48.6 during the same time period.

DECLINING WORKING-AGE POPULATION

Population aging combined with lower fertility is having a profound effect on the growth of the working-age population. Between now and 2030, all countries, except a few in the Sub-Saharan African region, will face either a slower-growing or declining working-age population¹⁵. Japan and Germany, whose working-age population has been shrinking over the past 15 years, will continue to exhibit the same trend in the next 15 years. In France, the number of people in the working-age category has grown over the last 15 years, but will be more or less flat in the next 15 years. Among rich countries, the UK and the US remain demographically more fortunate, as the number of working-age people will continue to grow in 2015-30, but at much slower rates. In China, the growth rate of the working-age population has slowed since the late 1980s and it turned negative in 2015. By 2065, the Chinese working-age population is expected to collapse by a third.



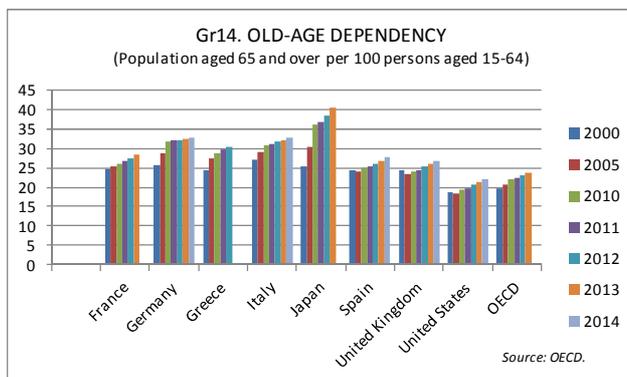
The demographics of the world's advanced countries are now at a turning point. According to the UN, the combined working-age population of the world's advanced economies has probably peaked and should shrink by more than 5% in the next 50 years while the share of their population over 65 is expected to grow by 80%. By 2050, the working-age population will have contracted by 28% in Japan, 23% in both Germany and Italy and 21% in China; in the US, it will have grown by 10% (yet it will be down as a share of total population from 66% to 60%).

RISING OLD-AGE DEPENDENCY RATIOS

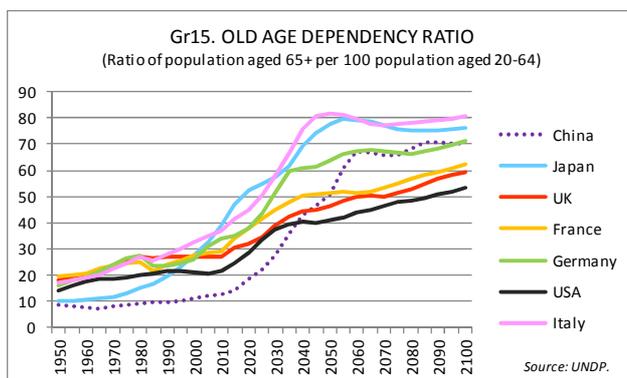
The falling working-age cohort, combined with the surge of older persons as a share of total populations, is reflected in a sharp deterioration in the "old-age

¹⁵ See Moody's (2014), "Population Aging will Dampen Economic Growth over the Next Two Decades", Special Comment, August 6. UN projections used for Moody's analysis are based on the assumption of 'medium fertility', 'normal mortality' and 'normal immigration' (i.e. the future path of international migration is set on the basis of past international migration estimates and consideration of the policy stance of each country with regard to future international migration flows). See http://data.un.org/Resources/Methodology/PopDiv.htm#_A_Fertility_assumptions.

dependency ratio" (the ratio of old people to those of working age)¹⁶. In 2014, Japan had 42 people aged 65 and over for every 100 adults between the ages of 25 and 64. The UN expects that by 2035 this number will have risen to 69 in Japan. Germany will have 66 old people for every 100 of working age by 2035 (up from 32 in 2014) and America 44 (up from 22). In China, the old-age dependency ratio will triple from 12 in 2014 to 36 by 2035.



By 2050, it is expected that in many advanced countries there will be fewer than 2 working-age adults supporting the burden of one 65+ adult. This will impose huge demands on the working-age population, if a stable intergenerational flow of benefits to the elderly population is to be maintained. It is worth noting, though, that current measures of dependency which assume that no one will work after the age of 65 in coming decades likely overestimate the future financial burden given the strong assumption that individuals' behavior and the policy framework will adapt to the demographic shift. As older workers remain healthy they will likely want to delay retirement in order to provide for an adequate standard of living in retirement, while policymakers will likely extend working lives given the extra fiscal burden associated with population aging.



¹⁶ The total age dependency ratio is an index that gives a rough indication of the level of support burden placed on the working-age group (15-64 years), through comparison of the relative size of the young-age population and old-age population groups with that of the working-age group. It is presented as number of dependents per 100 persons of working age.

...SHOULD HAVE AN IMPACT ON PRICE DYNAMICS

According to conventional economic wisdom, demography does not affect inflation because inflation is always a monetary phenomenon that can be controlled by monetary policy. However, controlling inflation has often proven to be challenging, especially since the financial crisis of 2008, when most advanced economies have faced less-than-desired inflation rates despite ultra-easy monetary policies. This may suggest that something other than monetary policy is influencing inflation. Until recently, there had been little research into how changes in demographics affect inflation – with most work on aging focusing on the effects on growth and fiscal sustainability¹⁷. But a growing body of research is now investigating the link between aging and prices. However, there is no agreement among economists on whether population aging is inherently inflationary or deflationary.

This is because declining and aging populations can potentially influence price dynamics through a multiplicity of channels, both on the demand side and on the supply side of the economy, with some transmission mechanisms being inflationary, others deflationary, and some having an ambiguous effect, so that the net effect on prices is by no means straightforward. A secular change in demographics leads to an entire transition path that alters saving and investment behaviors, consumption patterns, the size of the workforce and, consequently, potential employment and output growth, the rate of productivity growth, the returns to factors of production (such as capital and land) and other key macroeconomic variables in a way which is not clear a priori. Moreover, the magnitudes of these various effects depend on many factors, such as the relative speeds of adjustment of aggregate supply and aggregate demand, the characteristics of the labor market, the extent of behavioural responses and the policy response of governments. At this stage in the research, the question as to whether population aging has a deflationary or an inflationary impact does not have a definitive answer. This is an issue which is clearly worthy of further academic research.

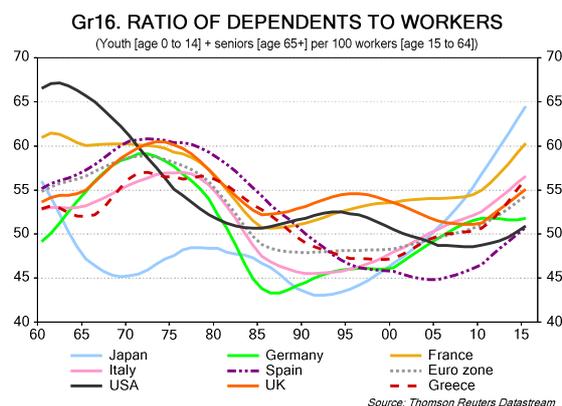
FOR SOME, AGING WILL CREATE A CHALLENGING INFLATIONARY ENVIRONMENT IN THE COMING YEARS

Rising ratio of dependents to workers

Juselius and Takats, in a recent paper for the Bank for International Settlements, argue that the sharp rise in the dependency ratio will likely foster faster rates of

¹⁷ See, for example, Bloom, David E., David Canning, and Gunther Fink (2011), "Implications of Population Aging for Economic Growth", PGDA Working Paper N°64, January.

inflation in the foreseeable future¹⁸. Based on a panel of 22 advanced countries between 1955 and 2010, these authors find a statistically robust correlation between an economy's age structure and inflation: the larger the proportion of dependents – both young and old – the higher inflation goes, whereas lower inflation is associated with a larger share of people of working age¹⁹. Juselius and Takats reckon that demography explains about a third of the variation in inflation and the bulk of the slowdown in inflation that occurred between the late 1970s and early 1990s.



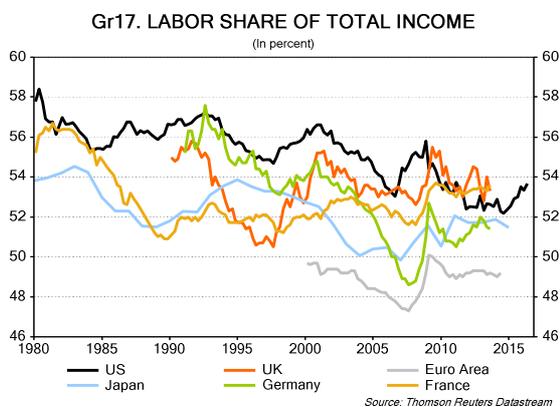
Their explanation, albeit tentative, is straightforward. People's economic needs and contributions vary over the various stages of life. Specifically, the ratio of consumption to production tends to be high for youth and the elderly and low for working-age adults. As children and the elderly consume more goods and services than they produce, a higher share of dependent people, young and old, should be expected to lead to excess demand and thus to inflationary tendencies. By contrast, working people tend to consume less than they produce, both through their work and through their savings (which support capital accumulation), so a higher share of the working-age population will supposedly increase the supply of goods and services relative to demand, leading to excess supply and thus to a deflationary bias. Accordingly, Juselius and Takats expect that rising old-age dependency ratios will lead to significant inflationary pressures in coming decades.

¹⁸ See Mikael Juselius and Elod Takats (2016), "The age-structure-inflation puzzle", Bank of Finland Research Discussion Paper, March 1, and Mikael Juselius and Elod Takats (2015), "Can demography affect inflation and monetary policy?", BIS Working Papers, N°485, February. Also see Mikael Juselius and Elod Takats (2016), "Age and inflation", Finance & Development, Vol.53, N°1, March.

¹⁹ For instance, these authors find that in the USA the baby boomers boosted inflation by 6 percentage points between 1955 and 1975 and lowered it by 5 percentage points between 1975 and 1990, when they entered working age.

Declining workforce growth

All things being equal, population aging ought to lead to declining labor force supply²⁰, which, in turn, should be expected to pave the way for an improvement in the bargaining power of labor that could drive wages up relative to the remuneration of other factors of production, such as capital and land. This is the mechanism emphasized by Goodhart, Pradhan and Pardeshi (2015)²¹. Goodhart et al. argue forcefully that the demographic "sweet spot" (or the high share of working-age people relative to the total population) that has shaped the framework of the global economy over the past four decades, and which was made even sweeter by the entry of China and the former Soviet bloc into the global trading system, is now reversing, spelling the end of a multi-decade period of cheap labor and downward pressure on inflation.



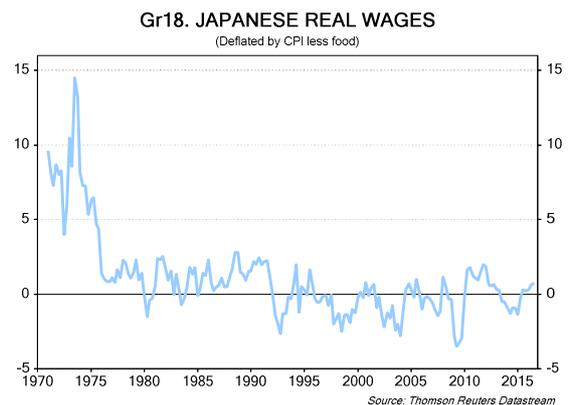
Over the past four decades, globalization has led to an unusually ample global labor supply, which has caused labor power to collapse in the west, pushing wages down and creating substantial disinflationary pressures. But this oversupply of labor is now going into reverse, Goodhart et al. argue, given that the share of the working-age population is starting to fall while the entry of China into the world economy was a one-off supply

²⁰ Labor force growth is driven by a combination of changes in the overall labor force participation rate (the proportion of the population in the labor force) and changes in population. The labor force participation rate is typically lower for 16-to-19-year-olds in comparison to other age groups; it increases during the prime working years and then declines sharply after age 55 as workers leave the labor force. In most advanced countries, the labor market is now experiencing a negative demographic effect in which a large segment of the population is moving from an age group with higher participation rates to an older age group with lower participation rates, hence, a decline in labor force participation rates which causes the growth of the labor force to slow down.

²¹ See Goodhart, Charles, Manoj Pradhan and Pratyancha Pardeshi (2015), "Could Demographics Reverse Three Multi-Decade Trends?", *Global Issues*, Morgan Stanley, September 15. Also see Charles Goodhart, Philipp Erfurth (2014), "Demography and economics: Look past the past", *Vox*, 4 November, and Alan Greenspan (2007), *The Age of Turbulence: Adventures in a New World*, Penguin Press.

shock. As the positive labor supply shock of the last decades turns into a negative shock, they argue, the bargaining power of labor is bound to improve, pushing up real wages and causing the disinflationary trend of the three past decades to end and ultimately reverse.

Goodhart et al.'s predictions may prove correct, but they stand in contrast to the experience of Japan which has faced many years of falling prices despite its rapidly aging population and declining workforce. For Goodhart et al., the lack of inflation in Japan is related to very specific circumstances. When Japan's demographics turned in the early 1970s, they explain, its neighbors in Asia were still benefitting from a population "sweet spot", with a marked expansion in their workforce. This ample labor supply abroad, they believe, led Japanese companies to offshore their productions, preventing local wages from rising. But today, they argue, the picture is very different, as most of the world is now at the point where workforce growth is slowing, which suggests that labor will become increasingly scarce worldwide, which should inevitably lead to a bidding war for workers and, thereby, to wage-generated inflation across the developed world.



What happens next to the bargaining power of labor is clearly very important for price dynamics. Yet it is worth remembering a couple of points. First, there probably remains a reserve army of global workers, as there is still a large dormant segment of the labor force in China (where millions of rural and urban residents are unemployed or underemployed) and a vast supply of cheap, non-Chinese labor. Second, it might be the case that the integration of China and other emerging countries such as India into the world economy has led to a fundamental change in the bargaining power of labor in the west. In particular, the waning power of trade unions across much of the developed world and the trend towards rising labor market flexibility are unlikely to go into reverse, which should not be conducive to sustained wage increases in coming years. What is more, the future decline in the size of the labor force may not be as sharp as currently anticipated, as current projections of the future labor force neglect behavioral change and institutional

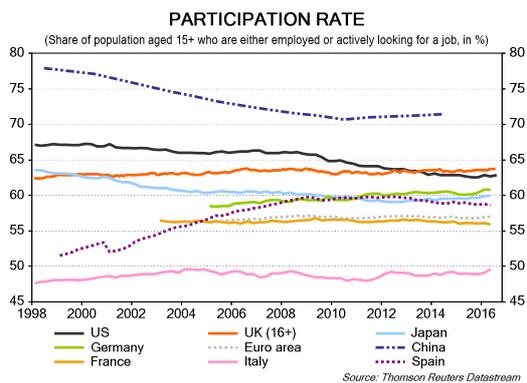
response to changing age structures and life expectancies (see Box 3).

BOX 3. DEMOGRAPHY IS (NOT QUITE) DESTINY

As labor supply is higher among working-age adults than among the elderly or youth, a country with large and rising cohorts of elderly should expect a slowdown in the growth rate of its future workforce or an outright contraction of its workforce. Actual labor force growth is, in effect, falling off throughout the developed world, with labor force shrinkage already under way in Japan and in parts of Europe.

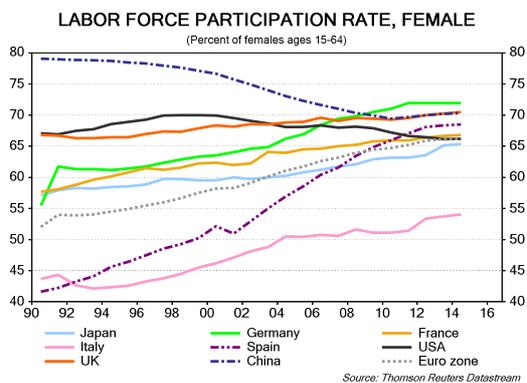
There are nevertheless a number of potential antidotes to labor-market tightening stemming from population aging²². Specifically, policymakers can mitigate the impact of aging by:

- Lifting the participation rate²³ of more economically-inactive persons, notably women and older people
- Lengthening working life
- Raising net immigration
- Increasing investment in education and health.



Female labor-force participation

Greater female labor-force participation could contribute to expanding the effective size of the labor force. Bloom et al. (2009), for instance, find that average female labor force participation tends to rise when the number of children per woman declines²⁴. As current population projections predict substantial declines in total fertility rates over the next decades, sizeable increases in female labor force participation can be expected.



At present, in the OECD area as a whole, 63% of women aged 15 to 64 are in the labor force (67% in France, Japan and the USA and 73% in Germany), and the OECD average for 65 to 69-year-olds is just 20% (5% in France, 11% in Germany, 28% in the USA and 32% in Japan), compared with 32% for men (7% in France, 19% in Germany, 37% in the USA and 54% in Japan). Women remain a substantial reservoir of potential

²² See, for example, Börsch-Supan, Axel, Klaus Härtl and Alexander Ludwig. 2014. "Aging in Europe: Reforms, International Diversification, and Behavioral Reactions." *American Economic Review*, 104(5): 224-29.

²³ The labor force participation rate is defined as the percentage of economically active persons (i.e. employed plus unemployed) in the working age population. It thus describes their general propensity to make themselves available to the labor market.

²⁴ See Bloom, D. E., D. Canning, G. Fink and J. E. Finlay (2009), "Fertility, Female Labor Force Participation, and the Demographic Dividend", *Journal of Economic Growth* 14(2): 79-101.

workers. Importantly, though, suitable work arrangements for women must be implemented to avoid that an increase in women's participation rate further depresses the birth rate.

Elder workforce participation

Other priority areas of focus for policymakers should be to encourage the participation rate of older people and to stretch working life. In the OECD area as a whole, only 50% of 60 to 64-year-olds (both men and women) are still employed (30% in France, 56% in Germany, 55% in the USA and 65% in Japan), while the figure for 65 to 69-year-olds is a mere 26% (6% in France, 15% in Germany, 32% in the USA and 42% in Japan).

Given rising life expectancy and improved health outcomes for the elderly, people may choose to remain in the workforce for longer²⁵. More flexible old-age pension arrangements combined with adjustments in tax and benefit policies could change incentives and encourage a higher participation rate among "young" seniors²⁶. And increasing the legal age of retirement would effectively force people to work longer before retiring.

With a 42% share of workers aged 65-69, Japan shows that there is plenty of potential for workers in Europe and in the USA to retire later. Projected declines in the ratio of the working-age to non-working-age populations are much less sharp if, instead of defining "working age" to be 15 to 64 years of age, one takes 70 years as the upper age limit for employment (a development that improved standards of living and medicine should facilitate) to reflect the prospect of later retirement.

Inward immigration

More inward migration could also mitigate labor-market tightening due to demographics in countries with "old" populations. In 2015, Europe, and most notably Germany, was the scene of one of the greatest cross-continent mass migrations in recent history, with an influx of more than 1 million Syrians. However, looking forward, social and political opposition to sustained mass immigration (because of fears of social tensions and political backlash) will likely prevent increased immigration on a scale large enough to counteract the potential economic effects of population aging in most advanced countries²⁷.

Investment in education and health

Finally, increasing investment in education and health could help to counter the declining labor supply that will come about because of demographics. Prettner et al. (2012), for example, find that declining fertility goes hand in hand with increasing human capital endowment per person in terms of education and health, which, in turn, could lead to a larger and more productive effective labor force in the future²⁸. This strand of research builds upon the idea that economic growth is not merely a function of the quantity of labor but also of its quality, which is increased by greater education and health investments.

All in all, changes in individual behavior and in the policy framework are set to mitigate the negative impact of aging on the future size of the workforce, but these anticipated changes are nevertheless unlikely to be able to completely reverse the overall declining labor force trend that current projections of population size and structure predict for the decades to come in the developed world.

²⁵ See, for example, Bloom, D. E., D. Canning, G. Fink and J.E. Finlay (2007), "Demographic Change, Institutional Settings, and Labor Supply", mimeo. These authors show that the theoretically optimal response to rising life expectancy is to increase working life proportionately, without increasing savings rates. However, this theoretical response has so far largely failed to materialize owing to various factors including difficult labor markets and social security systems. In many countries, the latter provide strong incentives to retire rather than to continue working. In practice today, penalties for working past the national retirement age, coupled with increases in uncertainty about the availability of benefits often lead individuals to save more to finance consumption in retirement.

²⁶ See, for example, Imrohoroğlu, Selahattin and Sagiri Kitao. 2012. "Social Security Reforms: Benefit Claiming, Labor Force Participation, and Long-Run Sustainability." *American Economic Journal: Macroeconomics*, 4(3):96-127; and Sánchez-Romero, Miguel, Jože Sambt, and Alexia Prskawetz (2013), "Quantifying the Role of Alternative Pension Reforms on the Austrian Economy", *Labor Economics*, Volume 22, June, pp. 94-114. Importantly, Sánchez-Romero and al. find that an increase in the educational distribution of the work force would increase the incentive for later retirement ages and thereby help counter the declining labor supply stemming from lower fertility.

²⁷ Stabilizing the share of elderly people in the populations of advanced countries would require an immediate eightfold increase in immigration from less-developed countries, according to the International Monetary Fund.

²⁸ See Prettner, Klaus, David E. Bloom, and Holger Strulik (2012), "Declining Fertility and Economic Well-Being: Do Education and Health Ride to the Rescue?", IZA Discussion Paper No. 6527, April. Based on a panel of 118 countries between 1980 and 2005, these authors show that more human capital investment can partly offset the negative impact of declining fertility on the effective size of the labor force. Also see e.g. Ahituv, A. (2001), "Be Fruitful or Multiply: On the Interplay between Fertility and Economic Development", *Journal of Population Economics*, Vol. 14:51-71; Bloom, D. E. and Canning, D. (2000), "The Health and Wealth of Nations", *Science*, Vol. 287:1207-1209; Lee, R. and A. Mason (2010), "Fertility, Human Capital and Economic Growth over the Demographic Transition", *European Journal of Population* 26: 159-182.

FOR OTHERS, A DECLINING AND AGING POPULATION IS INHERENTLY DEFLATIONARY

Loss of human capital

According to other authors, the impact of ongoing demographic shifts will be mostly deflationary. Fujita and Fujiwara (2014)²⁹ developed a model with demographic and skill transitions, and specialized knowledge (that is, skills and abilities in one particular area). In their model, the skill the worker possesses is firm specific, which means that if the worker loses his job, he also loses his skills. These authors examine the ebb and flow of productivity in the course of the demographic transition. Initially, the decline in fertility causes the share of older and, thus, more-experienced and more-productive workers in the labor force to increase, leading to increased output and real wages, and higher inflation.

Eventually, however, as labor force aging progresses, firm specificity (or specialized knowledge) renders the older workers increasingly vulnerable to human capital depreciation. This is because when older workers quit their jobs, they lose their human capital, and then become less productive³⁰. So it is held that in the late stage of labor force aging, a higher share of older workers implies a higher share of inexperienced workers (because of the skill depreciation at the time of job loss), hence, a fall in nation-wide labor productivity and in real wages. And lower real wages, in turn, put downward pressure on inflation. When the model is subject to a significant rise in the pace of job losses, such as the one experienced in Japan in the 1990s and

²⁹ See Fujita, Shigeru, and Ippei Fujiwara (2014), "Aging and Deflation: Japanese Experience", Unpublished manuscript, July. http://conference.nber.org/confer/2014/JPMs14/Fujita_Fujiwara.pdf.

³⁰ Several researchers argue that workforce aging has negative implications for labor productivity owing to factors such as the depreciation of knowledge, lessened physical and cognitive abilities and lower effectiveness of adaptation to new technologies. See, for example, International Monetary Fund (2016), "The Impact of Workforce Aging on Euro Area productivity", IMF Country Report No. 16/220, July; Dixon, Sylvia (2003), "Implications of Population Aging for the Labor Market", Labor Market Trends, February. On the other hand, the accumulation of experience over time tends to increase productivity. See, for example, Disney, Richard (1996), "Can we Afford to Grow Older? A Perspective on the Economics of Aging", MIT Press, Cambridge: Mass. Arguably, the impact of workforce aging on productivity will differ from sector to sector, with a likely negative effect in basic jobs (such as tillers) but a positive effect in such professional areas as medicine or law, in which the accumulation of knowledge and experience may have a favorable influence on efficiency. It is a key issue for researchers to analyze whether a smaller, but older, labor force in the future can be as productive as the previous generations. Another factor to consider when assessing the prospects for productivity in an aging world is that each new cohort of workers tends on average to be better educated than the retiring cohort as a more educated labor force is more productive than a less educated labor force.

2000s, the mechanism in the model leads to higher levels of deflation. Likewise, a greater contraction in the labor force size increases the magnitude of deflation.

Lower expectations of future economic growth

Former Bank of Japan Governor Masaaki Shirakawa, has long claimed that a declining and aging population will lead to deflationary pressure. To quote him: "A cross-country comparison among advanced economies reveals intriguing evidence: Over the decade of the 2000s, the population growth rate and inflation correlate positively across 24 advanced economies [...] A closer look at the case of Japan confirms the increasingly positive correlation between inflation and population growth since the 1990s" [see Shirakawa (2012)]³¹. According to Shirakawa, the key to the link between population aging and deflation is reduced expectations of future earnings. It is well recognized that a decline in the growth of the labor force will reduce a country's capacity to grow³², which should raise concerns about a future slowing of economic growth and thus about future earnings.

Shirakawa believes that lower expectations of future earnings associated with a declining and aging population will lead to deflationary pressure by prompting forward-looking households to consume less and save more today. Moreover, he emphasizes that the public generally tends to underestimate the negative impact of demographic changes which has the potential to magnify the downward pressure on prices. As public awareness of yet-to-materialize declines in GDP growth slowly builds up, he argues, forward-looking responses will likely come into play, precipitating current falls in aggregate demand, with their attendant deflationary effects.

Demography as a source of underestimated shocks

Katagiri (2012) also stresses the implications of a faster-than-expected aging phenomenon for price dynamics³³. This author argues that the repeated upward revisions in the official forecast for the speed of Japanese population aging have worked as unexpected

³¹ See, for example, Masaaki Shirakawa (2012), "Demographic Changes and Macroeconomic Performance – Japanese Experiences", Opening remarks by Mr Masaaki Shirakawa at the 2012 BOJ-IMES Conference, hosted by the Institute for Monetary and Economic Studies, at the Bank of Japan, Tokyo, 30 May.

³² The impact on aggregate real GDP of a declining and aging population is straightforward given the direct effect on the size of labor inputs.

³³ See Mitsuru Katagiri (2012), "Economic Consequences of Population Aging in Japan: Effects through Changes in Demand Structure", Discussion Paper N°2012-E-3, Institute for Monetary and Economic Studies, Bank of Japan, March. Katagiri notes that the forecast is revised upward every time officials make a new forecast.

demand shocks leading to deflationary pressure of about 0.3 percentage points a year. Katagiri's reasoning is as follows: young people, he observes, tend to buy more manufacturing goods (like cars and electric appliances) than old people who spend more for services such as medical care and tourism. It follows that population aging should lead to a demand shift from manufacturing sector products to the services sector which may, in turn, bring about a (re)allocation of resources (labor output) from the manufacturing sector to the services sector³⁴. However, the productivity of the services sector is typically lower than that of the manufacturing sector.

As a result, the argument goes, aging countries will likely experience significant resource reallocation from high productivity sectors to low productivity ones, leading to a decline in aggregate productivity. Lower aggregate productivity, however, lowers the trend growth rate of potential GDP which, according to standard economic theory, should push down the level of the natural rate of interest³⁵. Katagiri argues that, because population aging in Japan has continuously surprised on the upside, the central bank may not have relaxed its monetary stance sufficiently to accommodate the decline in the natural rate of interest, which has opened up a negative output gap that has fueled deflationary pressure.

Changing consumption preferences

According to the life-cycle theory developed by Franco Modigliani, individuals smooth their consumption over their lifetimes, buying housing and going into debt when young, saving and buying assets during their adult lives and running down their savings and selling their assets once they retire³⁶. So it is often held that household

demand for housing services and housing capital (as a conduit of saving) goes through a life cycle, peaking during people's working life, as individuals start and maintain a family, and then declining when they retire, as they move to smaller houses or peripheral locations or shift from homeownership to renting³⁷. If true, this should be reflected in changes in housing and land prices. Using the IMF's Global Integrated Monetary and Fiscal (GIMF) model, Anderson, Botman and Hunt (2014) find that, in Japan, an aging and declining population created substantial deflationary pressures mainly through a fall in land prices and declining growth³⁸. They also show that the repatriation of huge amounts of foreign assets by Japanese retirees to pay for their consumption in retirement led to real exchange rate appreciation, which added to deflationary pressure by making imports cheaper. Finally, they stress that, in Japan, the deflationary effects of aging were magnified by the large fiscal consolidation need.

Based on a panel dataset covering 30 OECD economies for the period 1960-2013, Yoon, Kim and Lee (2014) also find that an aging or declining population is significantly deflationary³⁹. These authors argue that, while an aging or declining population tends to increase inflationary pressure by reducing the effective supply of labor in the economy, it also leads to multifarious deflationary demand-side effects through notably lower consumption, changing relative prices reflecting different consumption preferences⁴⁰, and a negative wealth effect from falling asset prices. While emphasizing that the specific channels through which aging affects the inflation rate are yet to be examined, Yoon and al. argue that the deflationary effects of an aging population should dominate the inflationary

³⁴ On the impact of aging on the supply-side of the economy, with the expansion of the service sector relative to manufacturing, see, for example, Siliverstovs, Boriss, Kholodilin, Konstantin, Thiessen, Ulrich (2011), "Does Aging Influence Structural Change? Evidence from panel data, *Economic Systems*, Elsevier, vol. 35(2), pp. 244-260, June.

³⁵ The natural rate of interest – a concept which was first proposed by Wicksell in 1898 – is the real, or inflation-adjusted, interest rate that is consistent with an economy at full employment and with stable inflation. If the effective real rate of interest is above (below) the natural rate then monetary conditions are tight (loose), leading to underutilization (overutilization) of resources and thus lower inflation. Lower potential growth can affect the natural rate of interest via two channels. First, it lowers the return on capital and thus leads to lower investment demand. Second, it lowers households' permanent income and thus encourages forward-looking households to consume less and save more. Lower investment demand combined with higher savings pushes down the natural rate of interest.

³⁶ See Modigliani, Franco and Richard Brumberg (1954), "Utility Analysis and the Consumption Function: An interpretation of Cross-section Data", In *Post-Keynesian Economics*, ed. Kenneth K. Kurihara, 388-436. New Brunswick, N.J.: Rutgers University Press. Also see Modigliani, F. and Ando, A. (1957), "Test of the Life-cycle Hypothesis of Savings", *Bulletin of the Oxford University*

Institute of Economics and Statistics 19, pp.99-124. See Franco Modigliani (1970), "The Life-Cycle Hypothesis and Inter-country Differences in the Saving Ratio", pp. 197-225 in W. A. Eltis, M. F.G. Scott, and J. N. Wolfe, eds., "Induction, Growth, and Trade: Essays in Honor of Sir Roy Harrod", (Oxford University Press).

³⁷ See, for example, Pitkin, J.R and D. Myers (1994), "The Specification of Demographic Effects on Housing Demand: Avoiding the Age-Cohort Fallacy", *Journal of Housing Economics*, 3(3): 240-250; Flavin, T. and Yamashita (2002), "Owner-Occupied Housing and the Composition of the Household Portfolio", *American Economic Review*, 92(1): 345-362; Kraft H. and C. Munk (2011), "Optimal Housing, Consumption, and Investment Decisions over the Life Cycle", *Management Science*, 57(6): 1025-1041.

³⁸ Anderson, Derek, Dennis Botman, and Ben Hunt (2014), "Is Japan's Population Aging Deflationary?", *IMF Working Paper*, WP/14/139, August.

³⁹ See Yoon, J. W., Kim, J., and J. Lee (2014), "Impact of Demographic Changes on Inflation and the Macroeconomy", *IMF Working Paper* WP/14/210.

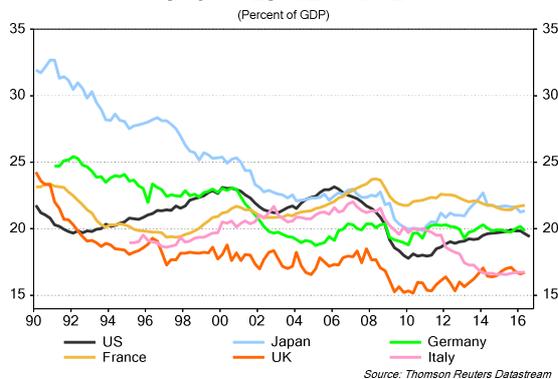
⁴⁰ Typically, young people tend to spend more on housing, transportation, communication, and education, while old people tend to spend more on services expenditures such as medical care and travel.

effects because aggregate supply will likely adjust at a slower pace than aggregate demand.

Lower desire to invest and to save

In the late 1930s, Alvin Hansen argued that the decline in the birth rate in the United States was a major cause of the shortfall in investment and hence the lack of aggregate demand which characterized the Great Depression⁴¹. Firms need a given capital stock (equipment, structures and land) per worker. So if population growth slows, the demand for new houses, new office buildings and new capital goods to equip new workers falls. Hansen argued at the time that “secular stagnation”⁴² was threatening the US. Slowing population growth, he emphasized, implies an enduring decline in investment demand, which can create a chronic oversupply of savings that can push the economy into a semi-permanent slump with associated deflationary pressures. The (unexpected) post-World War II baby boom altered the population dynamics in the USA and rebutted Hansen’s predictions, but the current demographic landscape gives renewed relevance to the secular stagnation hypothesis, as argued by Summers (2016)⁴³ and others. Secular stagnation will arise if desired investment remains persistently below desired saving, creating chronically deficient aggregate demand and hence deflationary pressure.

Gr19. INVESTMENT RATE



So a critical question for future price dynamics is whether slowing worker and population growth, or an outright decline, will reduce the rate of investment by more than it reduces saving. There is little dispute among economists that a lower rate of population growth will reduce the demand for new investment while lowering the potential growth rate of the economy. At

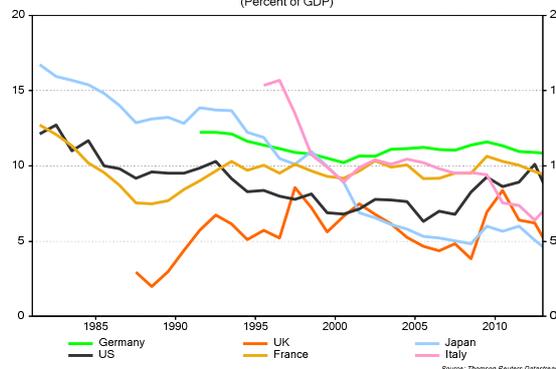
⁴¹ See Hansen, Alvin (1939) "Economic progress and declining population growth", *American Economic Review*, 29(1): 1-15.

⁴² The term “secular stagnation” was coined by Hansen in his 1938 address to the American Economic Association.

⁴³ See Lawrence H. Summers (2013), “Speech given at the IMF Fourteenth Annual Research Conference in Honor of Stanley Fischer”, November 8. Also see Lawrence H. Summers (2016), “The Age of Secular Stagnation: What It Is and What to Do About It,” *Foreign Affairs*, February.

the same time, however, many economists anticipate that as populations grow older, aggregate saving will eventually decline as a percentage of national income⁴⁴. This is what the widely accepted life-cycle theory of saving predicts⁴⁵. The life-cycle theory holds that the savings pattern of households tends to follow a path that changes as households age, with savings first rising, as working households increase their provision for retirement, then reaching a lifetime peak when workers are at the middle and near the end of their careers, and ultimately falling as these households move through retirement and begin to dissave to live off accumulated assets. So, according to the life-cycle theory, countries undergoing aging should eventually expect a fall in aggregate savings as an increasingly large share of households move through into retirement and begin to dissave.

Gr20. HOUSEHOLD GROSS SAVING RATE (Percent of GDP)



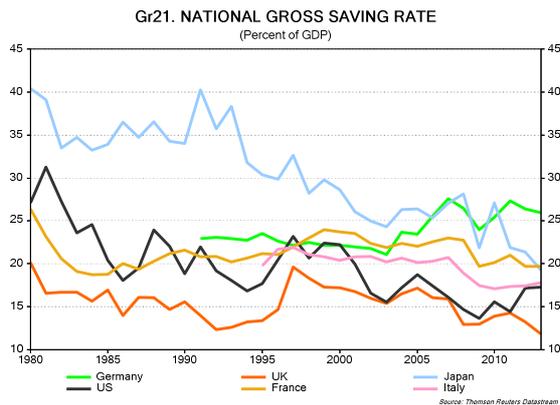
It is on this basis that Goodhart and Erfuth (2014) predict that population aging will cause savings rates to fall and real interest rates to head back up⁴⁶. Dissaving by retirees, in turn, could start to put upward pressure on inflation as this should support aggregate demand at a time when aggregate supply is declining owing to a declining workforce. Goodhart and Erfuth expect that, as aging progresses, excess demand, owing to declining aggregate saving, will combine with rising wages, due to competitive bidding for increasingly scarce labor, to create sustained inflationary pressure. For these authors, the ex-ante desire to invest should fall somewhat as the population ages, but it should fall less than the decline in the ex-ante desire to save – hence,

⁴⁴ See, for example, Bosworth, P. Barry, Ralph C. Bryant, and Gary Burtless (2004), “The Impact of Aging on Financial Markets and the Economy: A Survey”, *Brooking Institution Working Paper* (Washington: Brookings Institution); Mc Morrow, K., and Roeger, W. (2004), “The Economic and Financial Market Consequences of Global Aging”, *Journal of Economics*, Volume 83, Issue 2, pp. 202-204.

⁴⁵ See Modigliani, Franco and Richard Brumberg (1954) (op. cit.).

⁴⁶ Op.cit. Goodhart and Erfuth (2014) argue that by 2025 real interest rates should have returned to the historical equilibrium value of around 2.5–3%, with nominal rates at 4.5–5%.

their conclusion that real rates of interest will go back up⁴⁷.



Yet whether the aggregate saving ratio will rise or decline when the population ages is a moot point. Based on a panel of 6 OECD nations⁴⁸ between 1970 and 1991, Poterba (1994), for instance, finds little evidence supporting the life-cycle hypothesis⁴⁹. In particular, he finds that virtually everywhere the elderly do not dissave to finance their consumption during retirement (possibly because of a desire for inter-generational transmission of wealth), and that young families in their twenties and thirties save a positive and increasing proportion of their income. Both observations stand in sharp contradiction to the hump-shaped pattern of saving predicted by the life-cycle theory. In general, the empirical microeconomic evidence that has emerged in the past twenty years tends to suggest that the elderly do not dissave as much as the original version of the life-cycle theory predicts they should⁵⁰.

⁴⁷ Goodhart and Erfuth (2014) predict that as the cost of labor rises relative to capital owing to declining availability of labor, the capital-to-labor ratio will rise again.

⁴⁸ Namely, Canada, Germany, Italy, Japan, the UK and the USA.

⁴⁹ Poterba, James M. (1994), "International Comparisons of Household Saving", Chicago, London: University of Chicago Press.

⁵⁰ There is a very substantial difference between the results of studies based on macroeconomic or cross-national panel evidence (which usually confirm the predictions of the life cycle model) and those based on microeconomic evidence (which often find no, or only modest, effects on savings of aging populations). These differences stem at least in part from the use of different types of data and methods. On this point see, for example, Bosworth et al. (2004) (op.cit.). These authors note that the distribution of wealth and saving across households tends to be highly skewed - notably in the USA which has been the object of many studies -, and that the small percentage of households that accounts for an out-size fraction of private saving is poorly represented in most microeconomic studies. However, they emphasize, the saving behavior of the most-affluent households will likely differ significantly from that of average households (i.e. the saving behavior of median households will most probably differ from that of average households), which could explain, at least in part, the differences in results between the macroeconomic studies and the microeconomic analyses.

Some argue that aggregate saving could even rise as countries undergo aging. Bloom et al. (2003, 2009), for example, find that increased life expectancy – and thus longer anticipated periods of retirement – is generally associated with higher savings rates⁵¹. Higher adult survival and the anticipation of longer periods of retirement, coupled with precarious prospects for social security payments will likely induce individuals to increase savings over their working life (especially in countries where policies and institutions deter people from working past their early or mid-60s) in order to finance a continued high standard of living during retirement. This may also induce them to remain in the workforce for longer and draw down savings at a later stage. Skill and education is also set to play a role as better-educated older people are far more likely to work for longer and to accumulate more savings and assets than they will draw down during retirement. All in all, increased longevity, pension reform and a rising share of well-educated elderly are likely to be drivers of higher desired saving as people will want to prepare for a longer prospective retirement period.

At this stage in the research, the question as to whether slower workforce growth will reduce the desire to invest by more than it reduces the desire to save remains largely undetermined. If older people were to work longer and prefer to carry higher levels of saving into retirement than they have done to date at a time when investment intentions are falling due to slowing growth in the labor force, a condition of the sort envisaged by Hansen, with persistently low growth, underemployment of resources and deflationary pressure, could clearly come about.

Stronger constituency to keep inflation low

Bullard, Garriga, and Waller (2012) resort to a politico-economic hypothesis to argue that population aging can put downward pressure on inflation or even lead to deflation⁵². Typically, the elderly are richer in financial and real capital while the young are richer in human capital. So, while the former will tend to depend more on the return of their assets, the former will rely on wages as their main source of income. As older societies will typically have higher average asset and wealth holdings, a graying society should be expected to have higher concern for, and hence, aversion to inflation. In contrast, societies dominated by young

⁵¹ See Bloom, D. E., D. Canning and B. Graham (2003), "Longevity and Life-Cycle Savings", *Scandinavian Journal of Economics* 105(3): 319-38. Also see Bloom, D. E., Canning, D., Mansfield, R. K., and Moore, M. (2007), "Demographic Change, Social Security Systems, and Savings", *Journal of Monetary Economics*, Volume 54, pps.92-114.

⁵² See Bullard, James, Carlos Garriga, and Christopher J. Waller (2012), "Demographics, Redistribution, and Optimal Inflation", *Federal Reserve Bank of St. Louis Review*, November/December, Vol. 94, No. 6, pp. 419-39.

households will prefer relatively high wages and high inflation since they do not initially have any assets and are generally borrowers. Rising aversion to inflation because of population aging, Bullard et al. argue, could affect a central bank's perception of what its objection function should be and lead to a lower optimal inflation target. As central banks may be inclined to cater to the inflation preferences of dominant age groups, they could employ monetary policy more aggressively to combat inflation. If true, more elderly societies should be associated with lower inflation.

In a similar vein, Katagiri, Konishi and Ueda (2014) suggest that government policies may reflect voter preferences. These authors establish a distinction between aging caused by an increase in longevity and that produced by a decline in the birth rate⁵³. Increased longevity, they argue, causes the ranks of pensioners to rise and thus the political influence of the older generation to increase, which may impel the government to embrace fiscal austerity by raising its income tax rates (thus, harming the younger generation) in order to prevent inflation from eating into the value of the older generation's assets. In contrast, when population aging is caused by a decline in fertility, which is mainly reflected in a falling tax base, a short-lived government may well be tempted to monetize its debt, pushing inflation up, hence benefiting the young at the expense of the older generation. These authors find that in Japan the deflationary effect of higher longevity overwhelms the inflationary effect of falling fertility. This is partly because, they believe, the main surprise in Japanese demography has been ever-increasing longevity. The authors' simulations of the model show that population aging in Japan depressed inflation by about 0.6 percentage points annually over the past 40 years.

A MIXED INFLUENCE VIA FISCAL POLICY VARIABLES

Graying populations will inevitably exert upward pressure on public budgets. Population aging will deteriorate fiscal balances while leading to greater spending in such areas as pensions, health care and other welfare programs for the elderly, at a time when the falling share of the productive labor force will slow economic growth, thereby reducing the tax base. To cope with these mounting fiscal pressures, some governments may choose to implement fiscal consolidation measures (possibly because of the increased political influence of the elderly) which would cause deflationary pressures by leading to slow growth and an increased output gap [see, for example,

Anderson et al. (2014)]⁵⁴. But other governments may resort to money printing, which may prove, by contrast, inflationary. So depending on the policy response by governments, we might expect that demographic shifts will have inflationary or deflationary consequences.

ENTERING UNCHARTERED TERRITORY

The analysis of the effects of expected population aging on inflation represents uncharted waters, partly because the ongoing demographic shift is unprecedented in world history, both in its nature and its magnitude. Only Japan has so far entered into this challenging new world. Assessing the applicability of Japan's deflationary experience to other advanced economies is clearly a key issue for researchers. The influence of demographic aging on inflation is bound to become a high-profile topic in the public debate in the years ahead. As for the theoretical debate, it is far from over.

⁵³ See Katagiri, Hideki Konishi, and Kozo Ueda (2014), "Aging and Deflation from a Fiscal Perspective", WINPEC Working Paper Series No. E1413, November.

⁵⁴ Anderson, Derek, Dennis Botman, and Ben Hunt (2014), *op.cit.* These authors suggest that the deterioration in fiscal balances brought on by population aging, coming on top of elevated initial deficit and debt burdens, can lead to a rising risk premium and/or fiscal consolidation which can cause aggregate output to fall below potential, thus fueling deflationary pressure.

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