

Aging, Deflation, and Secular Stagnation

R. Anton Braun, Federal Reserve Bank of Atlanta

Summary:

Prior to the COVID pandemic, industrialized countries experienced a sustained episode of low inflation, low real interest rates, and low per capita gross domestic product (GDP) growth. As the logistical and other disruptions created by the COVID pandemic fade, will industrialized economies once again face downward pressure on prices, real interest rates, and output growth? We present evidence that the aging of the population was depressing the inflation rate, as well as real interest rates and GDP growth, prior to the COVID pandemic. Aging is ongoing in industrialized countries, and it will continue to put large and steady downward pressure on prices, interest rates, and output growth in future years.

Key findings:

1. Aging is occurring in industrialized and emerging economies.
2. Aging put large and steady downward pressure on the inflation rate, as well as GDP growth and real interest rates, in the years prior to the COVID pandemic.
3. Given that aging is ongoing, this downward pressure will continue for many years.
4. Aging pressures may be less pronounced in the United States compared to Asia and Europe. But the external pressures of aging may also depress US inflation and real interest rates.

Center Affiliation: Center for Quantitative Economic Research

JEL Classification: E52, E62, G51, D15

Key words: demographics, prices, output, interest rates, economic growth, aging

<https://doi.org/10.29338/ph2022-13>

**CENTER FOR QUANTITATIVE
ECONOMIC RESEARCH**

CENTER FOR HUMAN
CAPITAL STUDIES

CENTER FOR FINANCIAL
INNOVATION AND STABILITY

CENTER FOR HOUSING
AND POLICY

ECONOMIC SURVEY
RESEARCH CENTER

AMERICAS CENTER



**Federal Reserve
Bank of Atlanta**

The Federal Reserve Bank of
Atlanta's Policy Hub

leverages the expertise of Atlanta Fed economists and researchers to address issues of broad policy interest. Our research centers coordinate this work and seek to influence policy discussions. Areas of interest include: forecasting, fiscal policy, and macroeconomics (Center for Quantitative Economic Research); financial stability, innovation, and regulation (Center for Financial Innovation and Stability); human capital, labor markets, health, and education (Center for Human Capital Studies); and government-sponsored entity reform, mortgage markets, and affordable housing (Center for Housing and Policy). Sign up for email updates at frbatlanta.org/research/publications/policy-hub.

Aging, Deflation, and Secular Stagnation

Summary: Prior to the COVID pandemic, industrialized countries experienced a sustained episode of low inflation, low real interest rates, and low per capita gross domestic product (GDP) growth. As the logistical and other disruptions created by the COVID pandemic fade, will industrialized economies once again face downward pressure on prices, real interest rates, and output growth? We present evidence that the aging of the population was depressing the inflation rate, as well as real interest rates and GDP growth, prior to the COVID pandemic. Aging is ongoing in industrialized countries, and it will continue to put large and steady downward pressure on prices, interest rates, and output growth in future years.

About the Author:

R. Anton Braun is a research economist and senior adviser in the Research Department of the Federal Reserve Bank of Atlanta. His research interests include monetary and fiscal policy and the economics of aging. He was previously a full professor at the University of Tokyo.

Acknowledgments: This article summarizes joint research with Daisuke Ikeda of the Bank of Japan in [Braun and Ikeda \(2022\)](#). The author thanks Pablo Troncoso for his invaluable research assistance on this project.

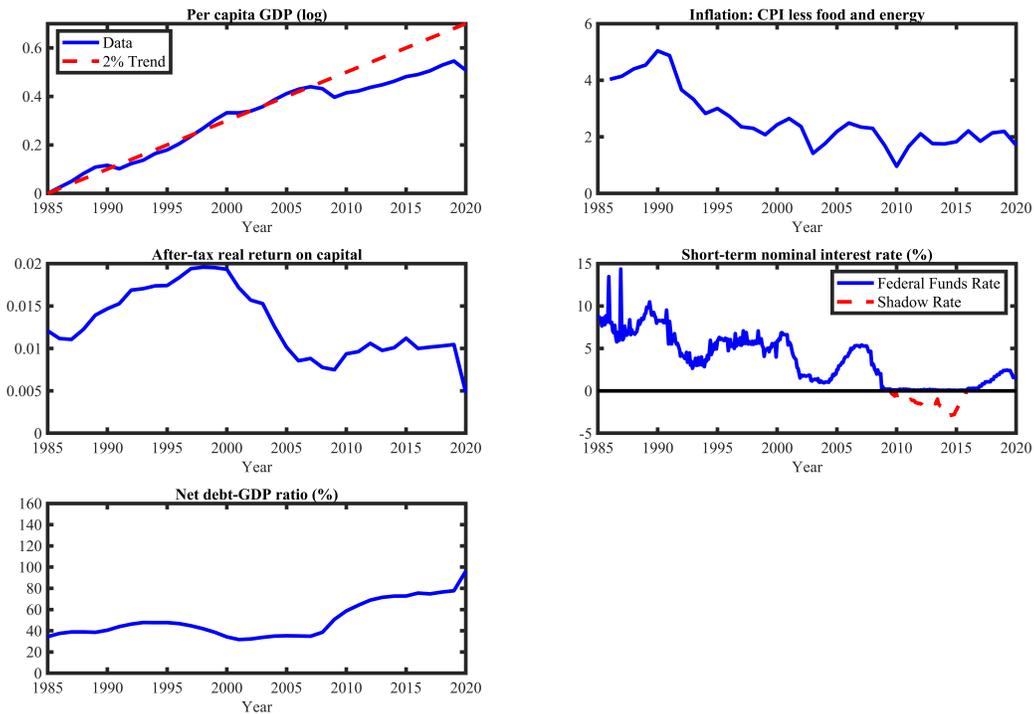
In the aftermath of the 2007–08 great financial crisis, important conceptual and policy questions regarding *secular stagnation* arose and were making their rounds in economic circles. In particular, why were industrialized economies experiencing protracted episodes of below-trend GDP growth, low real interest rates, and low or even negative inflation rates (see [Summers, 2020](#))? Although current policy discussions are focused on the cause, consequences, and cure for our current high inflation rates, when the disruptions created by the COVID pandemic fade, we may again have to confront the secular stagnation question. In new joint research with Daisuke Ikeda, we find that industrialized countries will indeed continue to have to deal with the consequences of secular stagnation and that an important force driving these outcomes is the aging of the population. During the next 10 to 20 years, aging will create a savings glut that puts large and steady downward pressure on both the inflation rate and real interest rates. Aging will also depress output growth, as the size and average skill level of the working-age population decline and older households reduce their consumption in reaction to lower returns on their nest eggs. Our research indicates that all of the outcomes associated with secular decline can be accounted for by an aging population.

Low inflation and secular stagnation

Low inflation and secular stagnation were common phenomena in many industrialized countries before the onset of the COVID pandemic in 2020 and are readily discernible in US data. The US core consumer price index (CPI) inflation rate, as reported in figure 1, fell from 5 percent per year in 1990 to 2.1 percent in 2000 and then averaged 1.9 percent between 2008 and 2019. Figure 1 shows that low inflation was accompanied by empirical evidence of secular stagnation, that is, low real GDP growth and low real interest rates. The growth rate of US per-capita real GDP was persistently below its trend between the years 2008 and 2019 and the real interest rate, which we measure here by the after-tax real return on investing in physical capital, was low between 2005 and 2019.

These observations are troubling to economists. Low real interest rates should provide a stimulus to aggregate investment and consumption, the two biggest components of GDP, but this did not occur in the United States and other industrialized countries in the years prior to the COVID pandemic. A possible breakdown in the transmission channels of monetary and fiscal policy compounded these concerns, as both monetary and fiscal policy were unusually easy in the years prior to the COVID pandemic. In particular, the Federal Reserve reacted to low inflation and low GDP growth by lowering the federal funds rate, as figure 1 shows. Once policymakers felt that they couldn't lower the federal funds rate further, a variety of unconventional monetary policy (UMP) initiatives were undertaken. The red line in figure 1 depicts the implications of these measures for the effective, or shadow, federal funds rate using the methodology of [Wu and Xia \(2016\)](#). Fiscal policy was also unusually easy in the period prior to 2020. I measure the overall stance of fiscal policy by the ratio of government debt held by the public to GDP. This indicator more than doubled, rising from 35 percent in the year 2005 to 77 percent in 2019.

Figure 1: Indicators U.S. aggregate activity and government policy



Source: GDP: US Bureau of Economic Analysis; CPI: US Bureau of Labor Statistics; After-tax real interest rate: US Bureau of Economic Analysis and author’s calculations; Federal funds rate: Federal Reserve System; Shadow federal funds rate: Federal Reserve Bank of Atlanta; Ratio of public debt to GDP: US Department of the Treasury

Aging

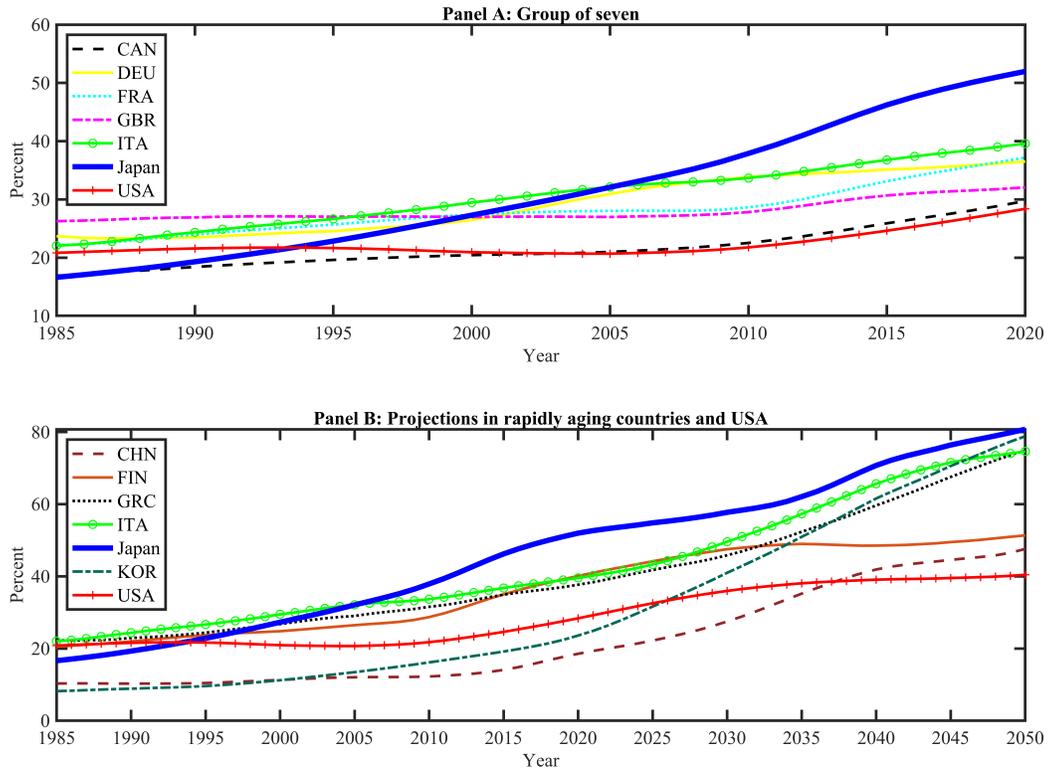
What are the possible economic forces that could put large and steady downward pressure on the inflation rate, real interest rate, and GDP growth against a background of significant monetary and fiscal stimulus? The candidate that we identify and analyze in [Braun and Ikeda \(2022\)](#) is the aging of the population distribution. Aging is occurring in many industrialized economies. Panel A of figure 2 indicates that the old-age dependency ratio, which we measure as the ratio of the 65-and-older population to the working age population, has been increasing in all of the Group of Seven countries.¹ Japan is noteworthy because aging has been particularly rapid and large. Japan had the lowest old-age dependency ratio in the Group of Seven as recently as 1985, but it had the highest old-age dependency ratio in 2005. By 2020 the old-age dependency ratio in Japan was more than 10 percentage points higher than Italy—the country with the second-highest old-age dependency ratio.

Aging reflects three main factors: lower birth rates, the aging of the baby boomer cohorts, and higher life expectancy. A decline in birth rates today only affects the size of the

¹ Our measure of the old-age dependency ratio is the ratio of the 65-plus population to the population between 20 and 64.

working population and thus the old-age dependency ratio 20 years down the road, and the latter two factors have relatively high predictability. Thus, we can be reasonably confident in predicting how the old-age dependency ratio will evolve during the next 20 to 25 years.

Figure 2: Population Aging in Different Countries: Historical and Projected Old-Age Dependency Ratios



Note: Data depict the ratio of the 65-plus population to the working-age population (age 20–64). Source: Panel A: Organisation of Economic Co-Operation and Development; Panel B: World Bank World Population Division. World Population Prospects (2019).

Panel B of figure 2 reports projections for some of the most rapidly aging industrialized countries as well as the United States and China, the two largest economies in the planet. Aging is a global phenomenon that is occurring in Europe, North America, and Asia. Many of the most rapidly aging countries are just starting to see their old-age dependency ratios accelerate. Note that by 2050 the old-age dependency ratios in Korea, Italy, and Greece are nearly on a par with Japan. Even so, Japan stands out in this group of rapidly aging countries because it is experiencing the earliest and largest demographic transition.

Panel B of figure 2 also reports projections for China and the United States. China's current old-age dependency ratio is low but is projected to increase rapidly. Indeed, China—which has the largest population on the planet—appears to be embarking on the same demographic transition as Japan with a delay of about 30 years. The US old-age dependency ratio is also projected to rise, but in a more gradual fashion. According to the World Bank, the

United States will rank at the bottom of this group of rapidly aging societies in 2050. Thus, aging may be a less severe issue for the United States. However, a large flow of young immigrants and immigration has benefited the United States. A recent analysis by the US Census Bureau suggests that the US old age-ratio will rise to about the level of Finland by 2045 if immigration flows in to the United States cease.

Is aging putting downward pressure on the inflation rate, real interest rates, and GDP growth?

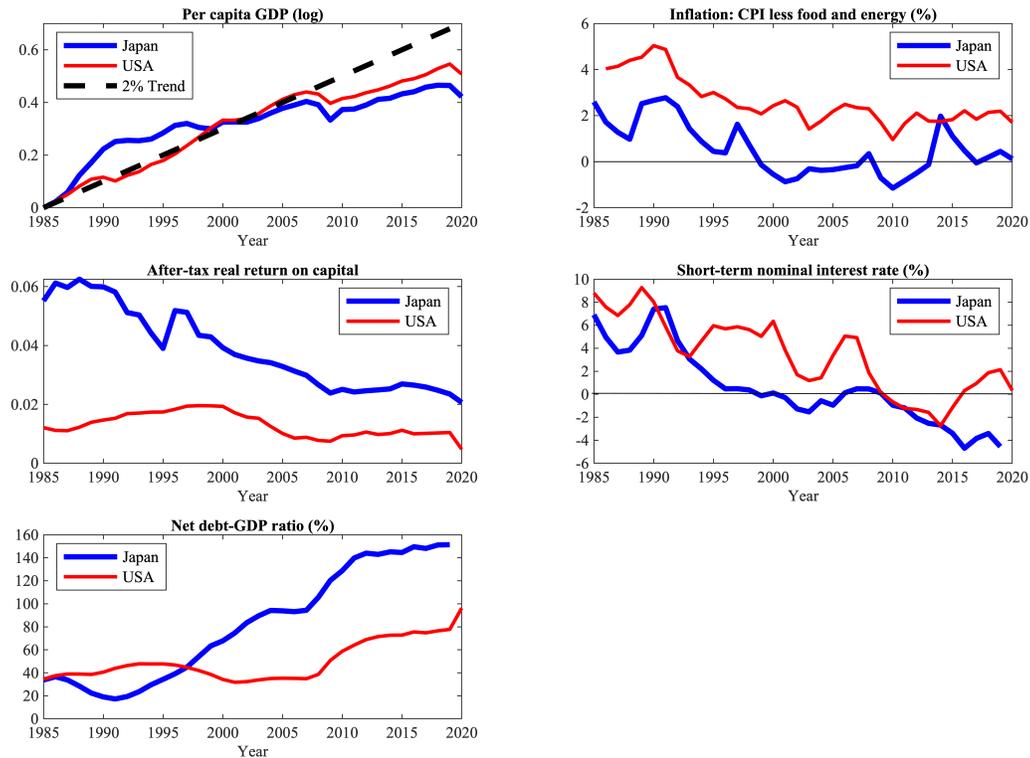
One simple way to get a handle on this question is to compare the United States with Japan. Japan is experiencing an early and particularly rapid pace of aging relative to the United States. If aging is important, then one would expect inflation and aggregate activity in Japan to decline earlier and be more depressed compared to the United States. One would also expect to see earlier and stronger reactions of monetary and fiscal policies in Japan. Figure 3 compares US indicators of private aggregate activity and government policy to similar indicators for Japan. Notably, inflation, interest rates, and GDP growth have been depressed for longer in Japan than in the United States. Japanese per capita GDP starts to fall below the 2 percent trend line in about the year 2000, and the Japanese inflation rate turns negative in 1998. The level of the after-tax real return on capital is higher in Japan than in the United States. However, it starts to decline from the year 1990 in Japan, and the overall magnitude of decline is about 3 percentage points between 1990 and 2020. Monetary and fiscal policies have been also been much easier in Japan. Japan's shadow monetary policy interest rate has been lower than the US rate for most of the post-2000 sample period, and Japan's net debt-to-GDP ratio is higher and has increased by considerably more during the past 20 years. These facts support, but do not demonstrate our claim that aging is inducing large and steady downward pressure on inflation, real interest rates, and output growth.

How does aging induce deflation and secular stagnation?

In our research (Braun and Ikeda, 2022), we use a dynamic model of government policy and household decision making over their lifecycle to isolate the qualitative and quantitative effects that aging induces on the inflation rate, real interest rates, and output. We isolate the effects of aging by comparing an economy without aging to one that embodies Japan's recent experience and government projections for the future evolution of Japan's age distribution, and we find that the aging exerted significant downward pressure on the inflation rate, real interest rates, and output between the years 2015 and 2019. More importantly, aging continues to put large and steady downward pressure on prices, real interest rates, and output growth until about the year 2040. Using 2015 as a reference point (see figure 3 for Japan's situation in 2015), Japan's aging "shock" depresses the inflation rate by 1.1 percentage points, the real interest by 2.0 percentage points, and (detrended) output by 3.1 percentage points at a horizon of 17 years.

Lower output and real interest rates reflect the fact that aging depresses aggregate labor input. Aging reduces the relative size of the working-age population because the birth rate falls and life expectancy increases. As the Japanese baby boomers move into retirement, the average

Figure 3: Indicators of Aggregate Activity and Government Policy: Japan and the US



Note: The nominal interest rate panel reports the shadow interest rate in each country in periods where it is negative.
 Source: Japan: GDP growth: Cabinet Office of Japan; CPI: Ministry of Internal Affairs and Communications; After-tax real return on capital: Cabinet Office and author's calculations; Call rate: Bank of Japan; Shadow call rate: [Ueno \(2017\)](#); Net debt-to-GDP ratio: International Monetary Fund. United States: See [figure 1](#).

skill level of the working-age population also declines until about the year 2040.² These two responses depress aggregate labor input and output. Real interest rates also fall because labor is relatively scarce compared to capital.

A more subtle question is how this model produces concurrent declines in real interest rates and the inflation rate. This result relies on two ingredients. The first ingredient is that aging increases aggregate household demand for liquid and illiquid assets until about the year 2040, and the increase in demand for liquid assets is particularly pronounced. In our model, and in Japanese data, households save for retirement by accumulating assets. Households choose to provide for retirement by accumulating a relatively large amount of liquid assets such as bank deposits and certificates of deposit in their portfolios. Liquid assets help them replace income losses at retirement and allow them to retain holdings of illiquid assets such as a home until late

² Older working-age individuals have higher earnings than young working-age individuals, and we attribute these wage differences to differences in skill. Thus, when the large baby boomer cohorts retire, the aggregate average skill level among workers falls.

in life. Aging increases aggregate household asset demand and has a particularly large impact on demand for liquid assets until about the year 2040. The increase in household asset demand reflects the move by Japanese baby boomers into retirement and also longer retirement periods as a result of a longer life expectancy. The increase in aggregate household demand for liquid assets puts downward pressure on prices.³

The second important ingredient in our model is that monetary policy reacts to the downward pressure on prices by lowering its policy (nominal) interest rate.⁴ Lowering the policy interest rate has two effects. First, it attenuates and spreads out the decline in the inflation rate over time. A lower policy nominal interest rate also lowers the real interest rates on liquid assets and illiquid assets. The real return on liquid assets falls by proportionately more than the return on illiquid assets and the interest rate spread widens persistently.⁵

This analysis indicates that efforts by the central bank to counteract the deflationary pressure induced by aging by lowering its policy interest rate are not an effective way to stimulate aggregate demand for goods during the demographic transition. Pushing down real interest rates works against older working-age and retired households. They want to save for their retirement, and lower real interest rates constrain their ability to save, so they respond by reallocating their savings away from liquid assets and toward illiquid assets and consuming less. Because this age group is large, it more than offsets any positive effects that a lower policy interest rate might have on demand for goods by younger working-age households. Surprisingly, the demographic shock continues to produce deflation and secular stagnation even if the size of the government debt–output ratio is allowed to increase by 75 percent between the years 2015 and 2040.

The downward pressure on the inflation rate, real interest rates, and GDP growth induced by the demographic shock ends around the year 2040 and a period of gradually increasing inflation and aggregate activity follow. However, these increases are very gradual and relatively small in magnitude. For instance, the maximum positive deviation of the Japanese inflation rate from its terminal value in our model is only 1 percent. Thus, the concerns expressed in [Goodhart and Pradhan \(2017\)](#) about a demographic induced surge in the inflation rate do not emerge in this model.

Aging is a global phenomenon, and our research suggests that aging has been exerting large and steady downward pressure on inflation rates, real interest rates, and output growth for some time—and will continue to do so for many years. Aging may be less rapid in the United States compared to Europe and Asia. Is it reasonable to conclude that deflationary pressures and secular stagnation will be less pronounced here? If individuals in foreign countries view the

³ A simple way to understand this point is to think of liquid (nominal) assets as being interest-bearing money and then to note that an increase in money demand puts downward pressure on the price level.

⁴ Formally, following the quantitative monetary policy literature, assume that the central bank follows a nominal interest rate targeting rule.

⁵ If the two assets were perfect substitutes, the real return on both assets would fall by the same amount and the spread would not change, but illiquid assets are costly to adjust, and it takes time for the real return on illiquid assets to fall.

United States as an attractive location to invest part for their retirement savings, then even if the US pace of aging is more gradual, rapid aging in other countries will exert downward pressure on US inflation and real interest rates in future years.

References

- Braun, R. Anton, and Daisuke Ikeda. 2022. “Why aging induces deflation and secular stagnation.” Federal Reserve Bank of Atlanta Working Paper 2022-12. Available at <https://doi.org/10.29338/wp2022-12>.
- Goodhart, Charles, and Manoj Pradhan. 2017. “Demographics will reverse three multi-decade global trends.” Bank of International Settlements Working Papers 656. Available at <https://www.bis.org/publ/work656.pdf>.
- Summers, Lawrence H. 2020. “Accepting the Reality of Secular Stagnation.” *Finance & Development*, 17–19. Available at <https://www.imf.org/en/Publications/fandd/issues/2020/03/larry-summers-on-secular-stagnation>.
- Ueno, Yoichi. 2017. “Term Structure Models with Negative Interest Rates.” Institute for Monetary and Economic Studies, Bank of Japan IMES Discussion Paper Series 17-E-01. Available at <https://ideas.repec.org/p/ime/imedps/17-e-01.html>.
- Wu, Jing Cynthia, and Fan Dora Xia. 2016. “Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound.” *Journal of Money, Credit and Banking*, 48(2-3): 253–291. Available at <https://onlinelibrary.wiley.com/doi/abs/10.1111/jmcb.12300>. DOI <https://doi.org/10.1111/jmcb.12300>.