

Can Innovation slow down Inflation?

SERAFIN

ASSET MANAGEMENT

Role of demographic change

AS A RESULT OF THE INCREASED INFLATION RATES AFTER THE FIRST CORONA WAVES, THERE IS A FEAR THAT THIS EFFECT COULD BE PERMANENT. LONG-TERM TRENDS SUCH AS THE AGING OF THE WESTERN BUT ALSO GLOBAL POPULATION HAVE AN IMPACT ON INFLATION. THE RATIO OF THE WORKING POPULATION TO RETIREES LEADS TO INCREASED PRESSURE ON WAGES/SUPPLY AND MAY INCREASE INFLATION. HOWEVER, INNOVATION OFFERS THE OPPORTUNITY TO INCREASE PRODUCTIVITY TO THE EXTENT THAT THE INCREASED INFLATION THREAT DUE TO LONG-TERM MACRO TRENDS CAN BE ABSORBED.

LONG-TERM PERSPECTIVES ON INFLATION, DEMOGRAPHIC CHANGE & INNOVATION

Global population growth is primarily determined by the development of the birth rate, which has declined significantly in recent decades.

In combination with increased life expectancy, this ensures that populations in all countries are getting older. By 2050, one in six people in the

DEPENDENCY RATIO

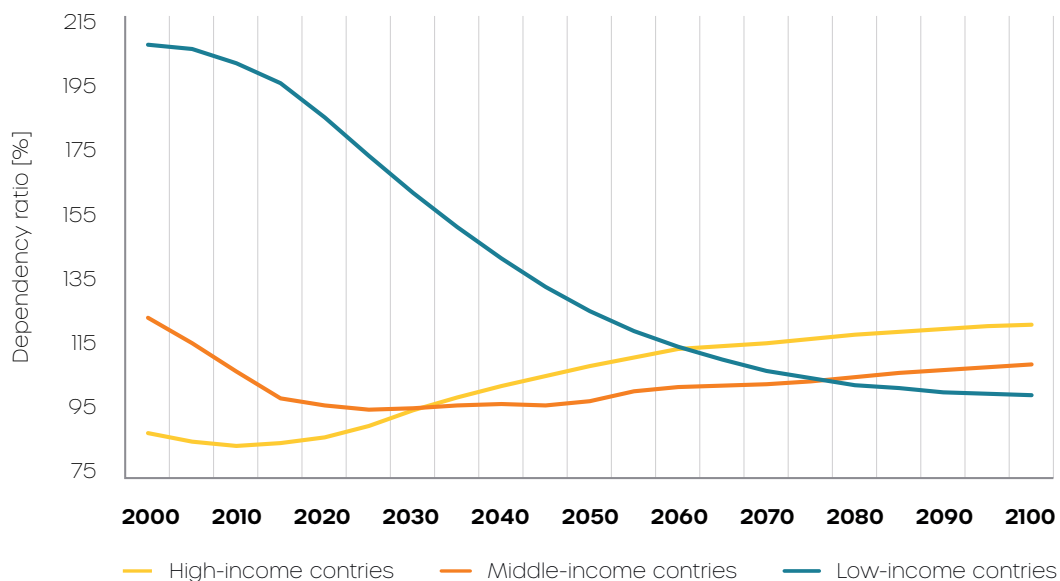


Figure 1: Total dependency ratio (<25 & 65+-year-olds)/(25-64-year-olds) by aggregate and constituent, 1950-2100 (ratio of population 0-24-year-olds and 65+-year-olds per 100 population). Source: Department of Economic and Social Affairs, Population Division (2019)

SUPPORT RATIO

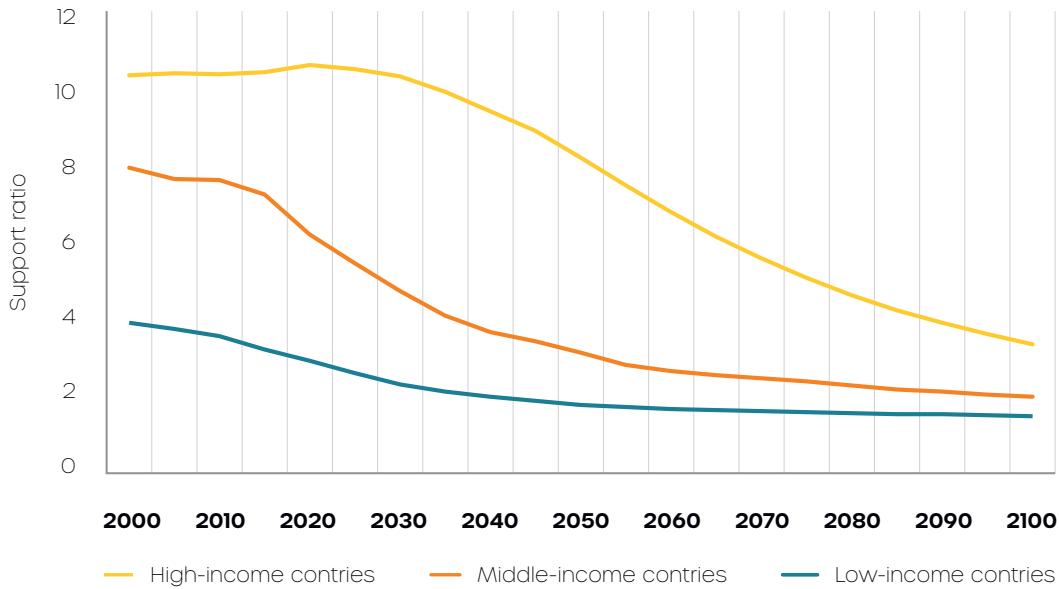


Figure 2: Potential Support Ratio (25-64-year-olds/65+-year-olds), 1950-2100 (ratio of population 25-64-year-olds per population 65+-year-olds). Source: Department of Economic and Social Affairs, Population Division (2019)

world will be over 65 (16%), compared with only one in eleven (9%) in 2019. However, the share of the working population (25-64-year-olds) is already declining, especially in industrialized countries, and thus the dependency ratio is already rising in high-income countries (see Figure 1). The demographic dependency ratio compares working-age populations with those who do not respectively cannot participate in the labor force. It can be used to determine the relative economic burden on the labor force and has taxation implications. If the proportion of the population that is not working increases, working citizens will likely have to pay higher taxes to compensate for the larger dependent population.

The support ratio describes the burden on the working population due to the non-working elderly population.

The potential support ratio (see Figure 2) makes this demographic change even more visible. The share of the working population is steadily declining, especially in high- and middle-income countries. At the same time, life expectancy continues to rise, amplifying the effect of the low birth rate on the support ratio. Thus, the burden of the working population to care for the elderly (pensioners) increases more and more. In contrast to the strong



GLOBAL ELDERLY CARE MARKET IS EXPECTED TO ACCOUNT FOR USD 1,944,028.05 MILLION BY 2027

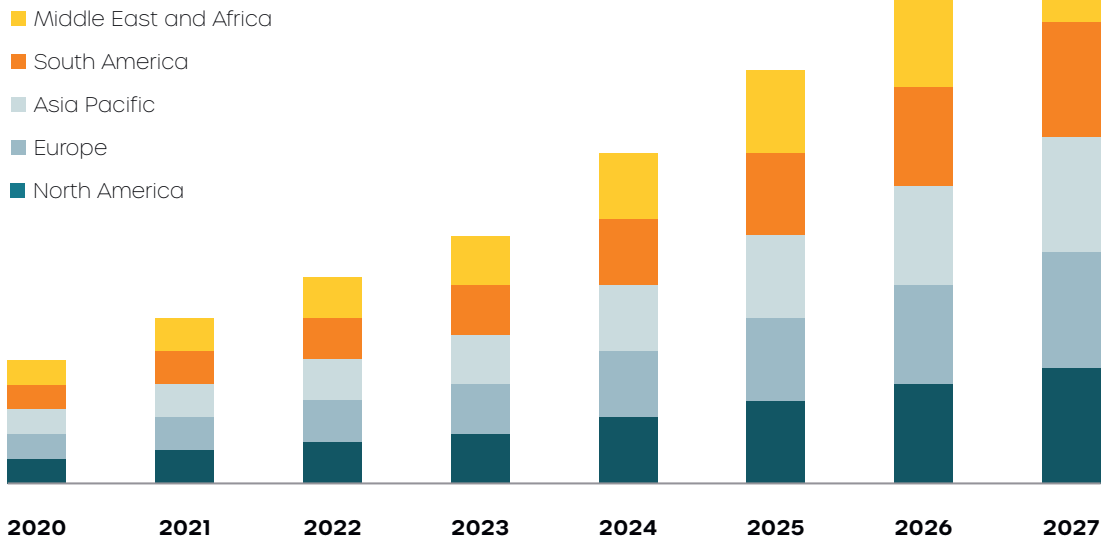


Figure 3: Elderly Care Market Development. Source: Data Bridge Market Research Market Analysis Study (2020).

growth in life expectancy, the retirement age has increased only slightly in recent years. The only exception is Japan, where the retirement age is higher than the OECD average. Both healthcare spending and spending on public pension transfers will continue to rise as industrialized nations age. People of retirement age are now living longer and receiving pension benefits for longer than generations before. This demographic change directly affects the following factors: the size of the labor force, consumption and savings patterns, as well as labor productivity. All these

above changes have a significant impact on real economic factors. Due to higher inflation, aging in developed countries leads to lower growth, lower investment, and rising real interest rates.

Figure 4 shows that age-related consumption stays constant or even increases with age. Medical spending increasingly dominates the spending patterns of the elderly, especially in the last years of life. Much of this increased spending is provided by the public sector at no cost to the individual through the insurance system.

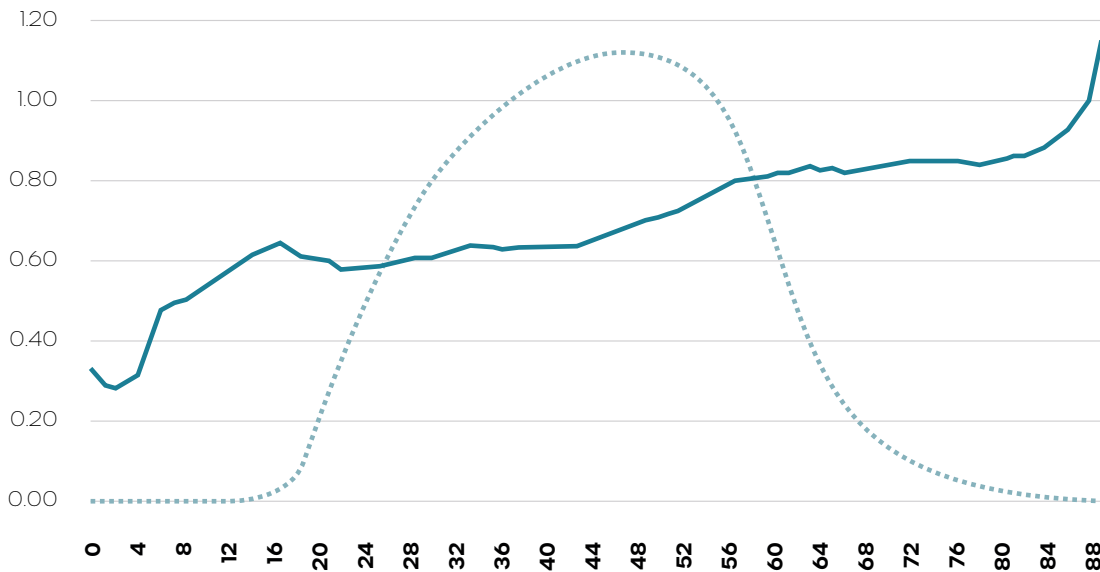
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AGING IN DEVELOPED COUNTRIES LEADS TO LOWER GROWTH, LOWER INVESTMENT, AND HIGHER REAL INTEREST RATES.

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CONSUMPTION RISES OVER THE LIFE CYCLE

Annual per capita normalized flows of incomes, in dashed lines, and consumption, continuous lines.



Values are normalized by dividing the simple average of labor income for individuals 20–49 years old

Figure 4: Consumption rises over the life cycle. This chart only applies to advanced economies. Source: National Transfer Account

INFLATION & DEFLATION CAUSES

Inflation is the rate at which the general price level rises. High inflation rates are frequently associated with „overheated“ economies, i.e., economies in which demand for goods and services exceeds production capacity, resulting in upward pressure on prices. Mostly, the economic policy seeks to balance the fine line between stimulating close-to-full employment and the resulting upward pressure on inflation. Sustained real product growth coupled with deflationary headwinds describes the past performance of economies in industrialized nations. This has been

caused by a combination of demographics and globalization, which led to the largest-ever supply shock in labor availability. The development was supported by labor-saving technologies.

One effect of the labor supply shock was a decrease in real wages (due to the decline in union influence), especially for unskilled labor, and an increase in returns to capital and skilled labor. Demand surpluses can cause inflation to rise, and supply surpluses can cause inflation to fall. Based on this, it can be argued

**THE PREVIOUS
DEFLATIONARY CAUSES
WERE:**

- The entry of baby boomers into the labor market
- The decline in birth rates, which caused the young population to shrink relative to the labor force
- The increasing participation of women in the labor force
- The emergence of China as a productive dynamo in the global economy
- The development of Europe into a unified trading system

that demographic change in the form of aging is inflationary if it is held responsible for creating excess demand. In the economy, excess demand can arise for several reasons. However, people of retirement age are crucial, as well as the low proportion of young people (<25 years old) in the total population. As a discrepancy between aggregate demand and supply arises, inflation is likely to increase to approach a new equilibrium (steady-state). At the same time, a shrinking labor supply puts upward pressure on wages, which further fuels inflation through the supply-side price channel.

The bottom line is that demographic change will lead to a change in the distribution of the active labor force. There will be inflationary pressure if fewer people are working compared to retirees. A decline in the share of the labor force, therefore, leads to a reduction of production capacity and thus to higher inflation. The effect is compounded by the fact that even more people from

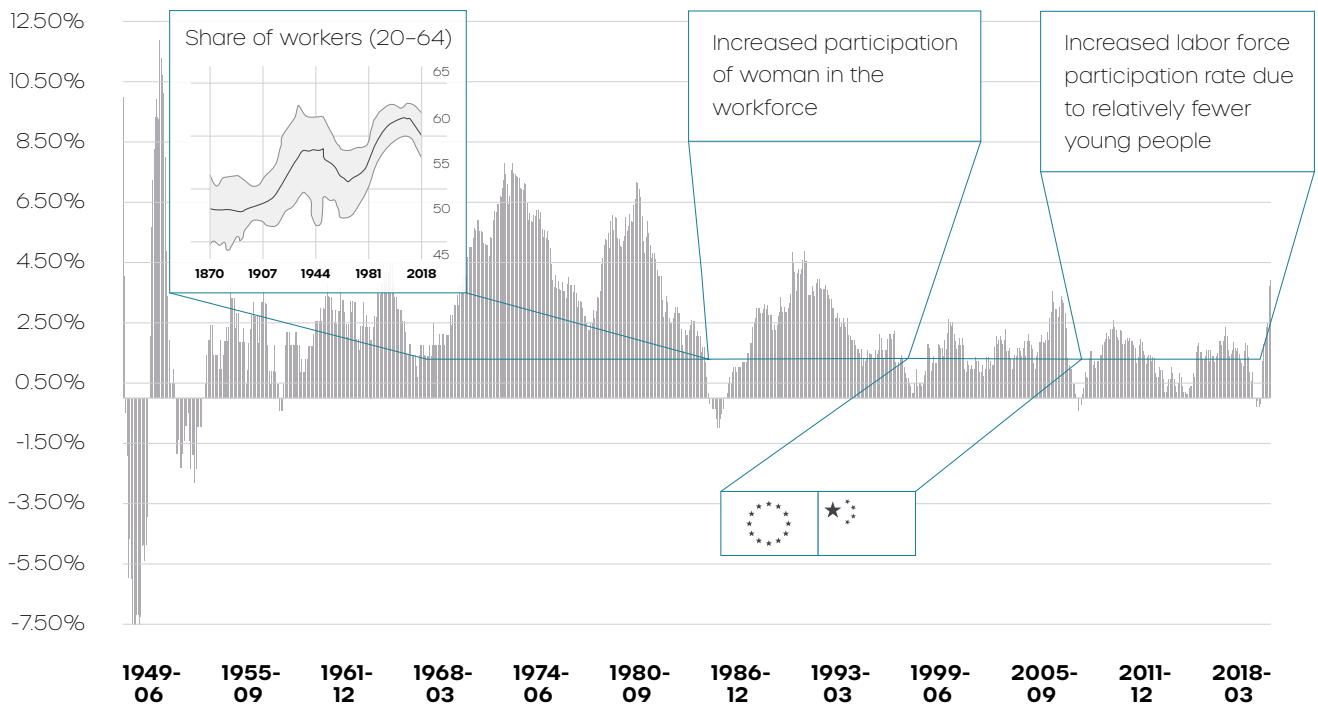


Figure 5: Inflation rate in Germany Source: Bundesbank(2021)

the labor force are needed to care for the older part of the population. This increases the costs of the health care system. These costs can only be covered by taxes, which in turn puts pressure on the increase in real wages. The increased real wages, in turn, increase inflation. This is primarily due to labor shortages, which put workers in a stronger bargaining position to negotiate higher wages. This can lead to a self-reinforcing vicious circle if innovations are not found that can increase productivity per individual worker.

TECHNOLOGICAL CHANGE AND INNOVATION AS A SOLUTION TO HIGHER INFLATION

In contrast, there are arguments that technological change and innovation can be a solution to reduce higher inflation. Often the argument has been made by economists that technological innovation is an important driver of economic growth. Technology covers the current body of production techniques used to develop, manufacture, package, and deliv-

er goods and services in the economy. Technology is therefore the application of selected parts of the stock of knowledge to production activities. Within a firm, the technology used, in combination with other resources, determines innovation capability. Inventions and discoveries expand the stock of knowledge that can be used in innovations. Innovations refer to new or renewed products, services, processes, or business models that are designed to improve the current state and are successfully implemented. Depending on the degree of novelty, these are either incremental (renewed) or radical (fundamentally new) innovations. New technologies enable new types of innovation.

In general, an increase in efficiency can be observed in various domains. These developments often resulted in inflation not rising.

IN RECENT YEARS WE HAVE SEEN THAT TECHNOLOGICAL CHANGE AND INNOVATIONS HAVE DRIVEN GROWTH ACROSS MULTIPLE CHANNELS:

- Machines have automated many low-skill tasks, allowing workers to focus on areas where human intelligence and creativity can add more value.
- Improvements in communications technology have led to faster transmission of ideas and reduced many frictions that hindered productivity growth and innovation.
- Technology is constantly improving to be more energy-efficient and use fewer raw materials.
- The advent of Big Data has led to insights into improving processes and eliminating inefficiencies.
- The Internet has removed many of the traditional market entry barriers that protect companies from competition and has triggered a price race to the bottom in several categories.
- The smartphone in combination with the Internet has enabled direct price comparisons since 2007. As a result, pricing power has been lost.

Technological trends of inflation dynamics

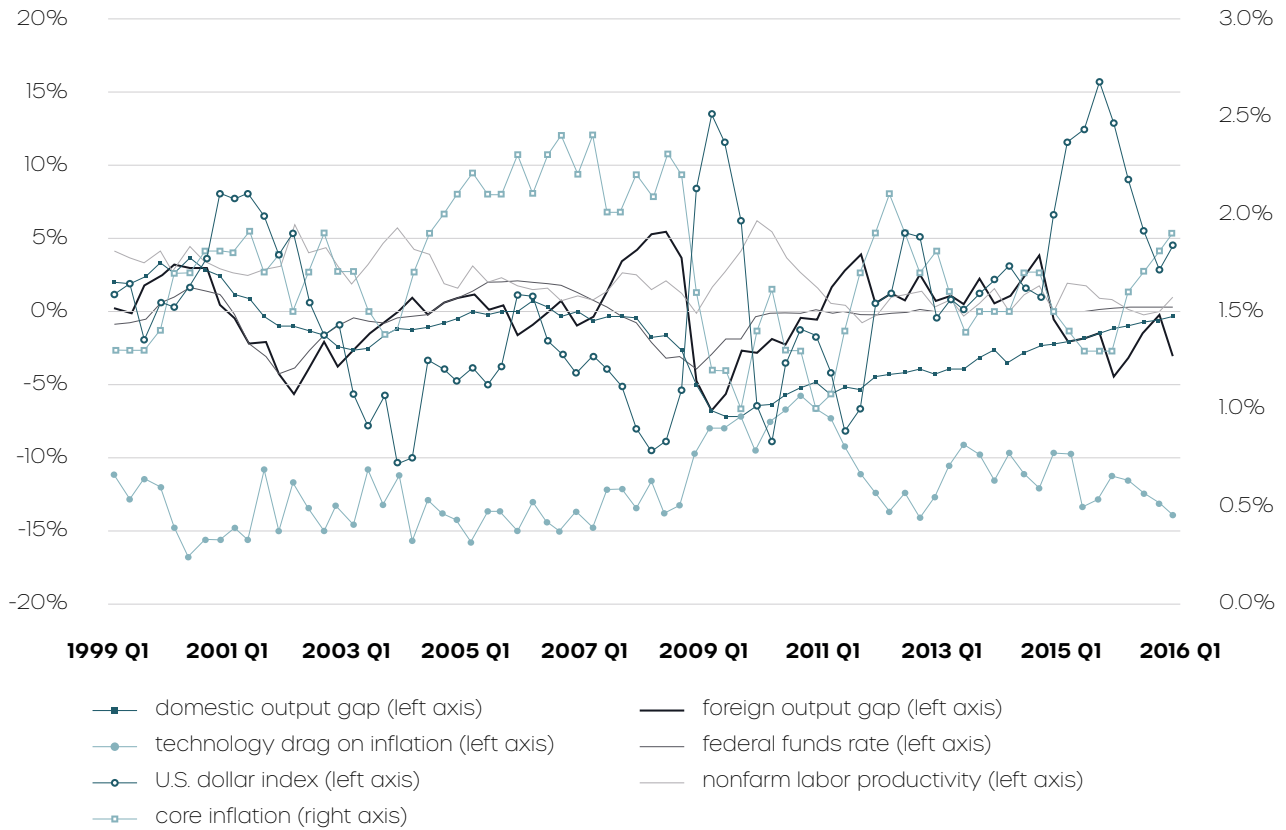


Figure 6: U.S. core inflation, domestic and foreign output gap, technology drag, federal funds rate, U.S. dollar index and nonfarm labor productivity: 1999–2016. (Lv, Liu et al., 2019)

An extended hybrid New Keynesian Phillips curve model was used to quantify the contribution of technology and globalization variables to inflation in the US and showed that globalization and technology have different effects on inflation in the US (see Figure 6). Currently, technology has a stronger impact on inflation in the US than

globalization. Therefore, studies that neglect the role of technology and consider only globalization are unlikely to accurately capture trends in inflation dynamics.

OTHER IMPORTANT TECHNOLOGICAL TRENDS IN THE FUTURE THAT MIGHT REDUCE INFLATION INCLUDE:

- The increasing sophistication of artificial intelligence and robotics could automate some of the work done by doctors, teachers, and nannies.
- Best practices in medicine, teaching, and childcare can be disseminated globally at extremely low cost (e.g., eLearning courses).
- 3D-printed homes are already emerging and could be built more cost-effectively soon.
- A variety of innovations, ranging from self-driving tractors to artificially produced meat, promise radically cheaper food supplies.

Briefly, several reasons for decreasing and increasing inflation have been introduced so far. These are summarized in Figure 7.

Globalization and trade unions have made it possible to produce and trade goods more cheaply, which had a negative impact on inflation. In addition, the share of the labor force increased more and more. Technological developments and innovation have increased efficiency and thus productivity per working person. This led to low inflation rates overall. In the future, however, there will be increased demand due to an increased dependency ratio caused primarily by aging versus a shrinking supply due to a smaller labor force. The cost of care for the elderly in particular will rise sharply in the future.

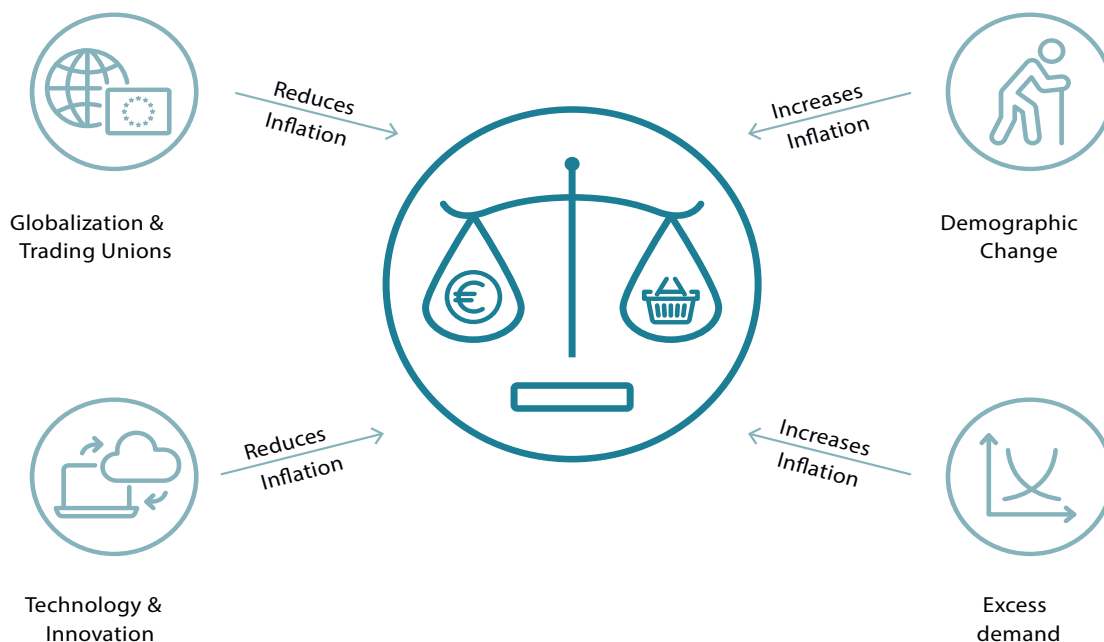


Figure 7: Technological progress, globalization and low-inflation: Evidence from the United States. (Lv, Liu et al., 2019)

In the following, innovations are presented that could solve these unfavorable circumstances.

TECHNOLOGICAL DRIVERS IN MEDICAL CARE SERVICES

The future potential of technology for care services through telemedicine will continue to grow and is a key component, especially for elders living at home. The use of humanoid robots for the care and maintenance of elders with schizophrenia and dementia shows promising developments. Virtual medical care, security alarm service, and memory support are only some of the so-called social technologies.

TECHNOLOGICAL DRIVERS IN BIOTECH

In the treatment of diseases that occur more and more frequently in old age, developments in the biotech sector offer new opportunities to reduce costs in the future and increase the effectiveness of treatment. Among novel nucleic acid therapies, messenger RNA (mRNA) technology offers a variety of opportunities for developing

therapies beyond vaccines. Still, a fairly young technology, mRNA technology has yet to prove itself, either through scalable, out-of-the-box therapies or through highly personalized niche drugs, like BioNTech's and Moderna's vaccines.

ARTIFICIAL INTELLIGENCE CAN BECOME A CRITICAL DRIVER OF PRODUCTIVITY

Acceleration of technological innovation resulting from the unfolding of the „second machine age“ could thereby offset the effects of adverse demographic trends and increase potential output growth.

Like other general-purpose technologies, AI (Artificial Intelligence) has the potential to be an important driver of productivity. Increased productivity per worker is important to offset the share of the labor force that is shrinking. AI patent applications have an additional positive effect on business labor productivity. The effect is concentrated in small and medium-sized enterprises and service industries.

WHERE AI IS AIDING PRODUCTIVITY

Projected increase in productivity due to AI in selected economics until 2035 (in percent)

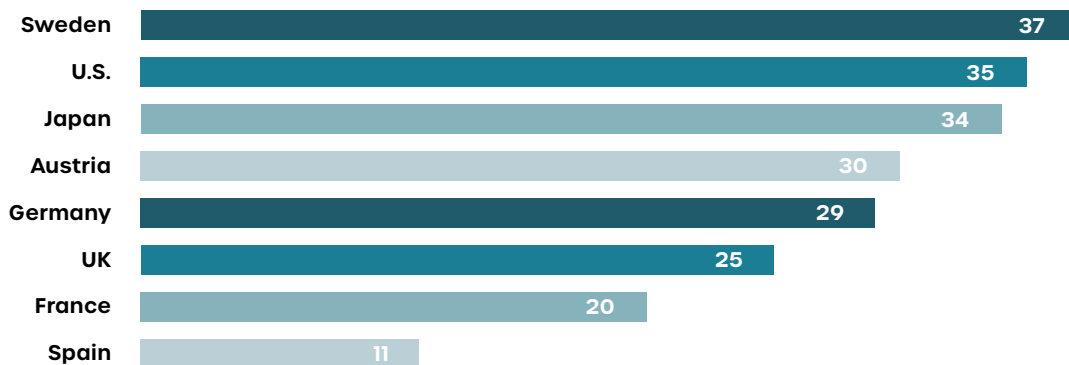


Figure 8. Artificial Intelligence and Productivity. Source: Accenture, Frontier Economicx

Inflation can be kept low through innovation & technological change

In summary, a theoretical and empirical link between demographic change and inflation can clearly be identified. The unfavorable ratio between the labor force and the elderly leads to excess demand, which has an inflationary effect. However, technological change offers the opportunity to further increase productivity per working person in the future. The best way to keep inflation low is to invest in innovation and technological change. The surplus demand due to aging can thus be offset.

IMPACT OF AI ON WORKFORCES IN ORGANISATIONS WORLDWIDE IN 2020-2023

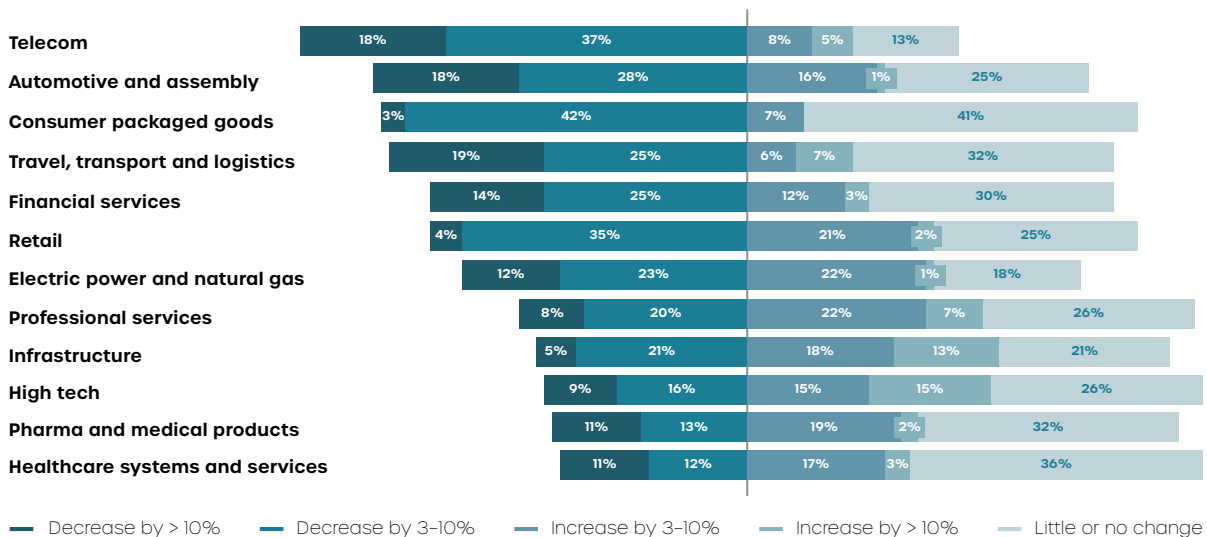


Figure 9: Impact of AI on workforces (2021, Statista). Source: McKinsey

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Niklas Bayrle works for Serafin Asset Management as an analyst. He helps to develop and improve our mathematical models according to the latest findings.

As part of his dissertation, he has worked intensively on innovation as a growth driver. Furthermore, during his time at the University of Liechtenstein, he taught on the topic of inflation and innovation.



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