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EUROSYSTEM

# The Future of Inflation

*Boris Vujčić, Governor*

**London School of Economics, November 18th, 2024**

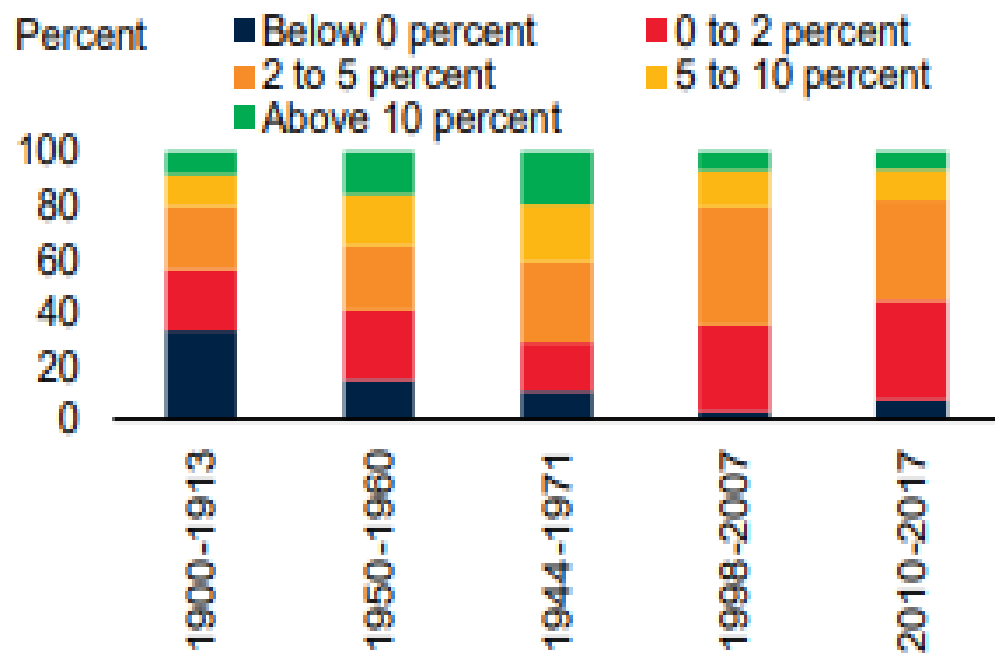
## Outline

- Long-term trends in inflation and interest rates
- Impact of structural factors on inflation trends, 5 D's
  - (De)globalization
  - Demographics
  - Digitalisation
  - Decarbonization (climate change)
  - Defense

# Long-term trends in inflation and interest rates

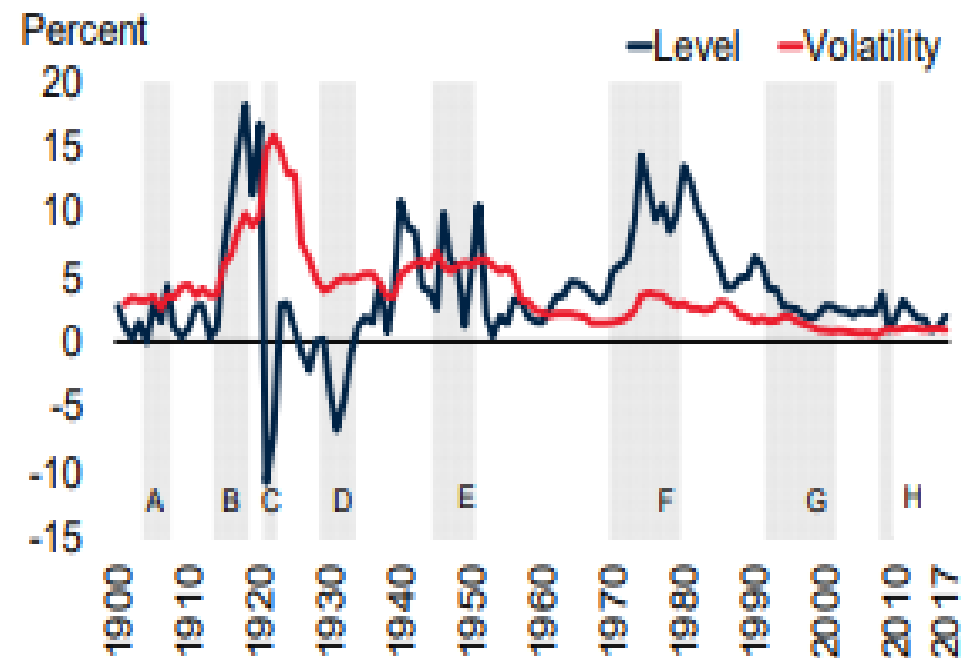
# Pre-pandemic inflation has been lowest and least volatile in over 50 years

Inflation distribution



Source: World Bank

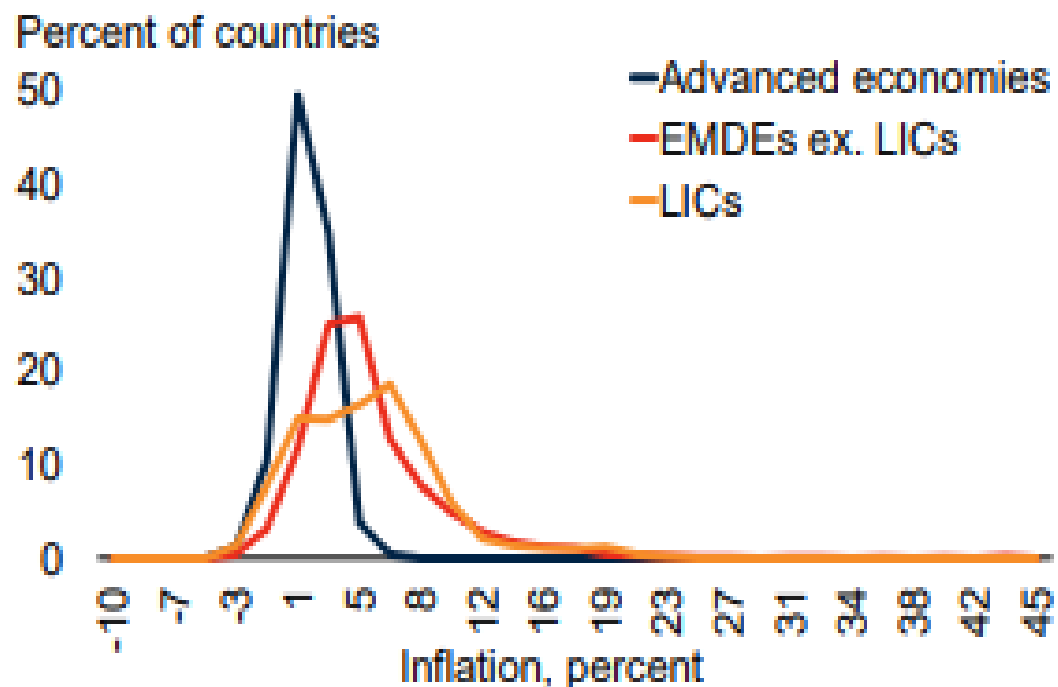
Inflation and inflation volatility



Source: World Bank

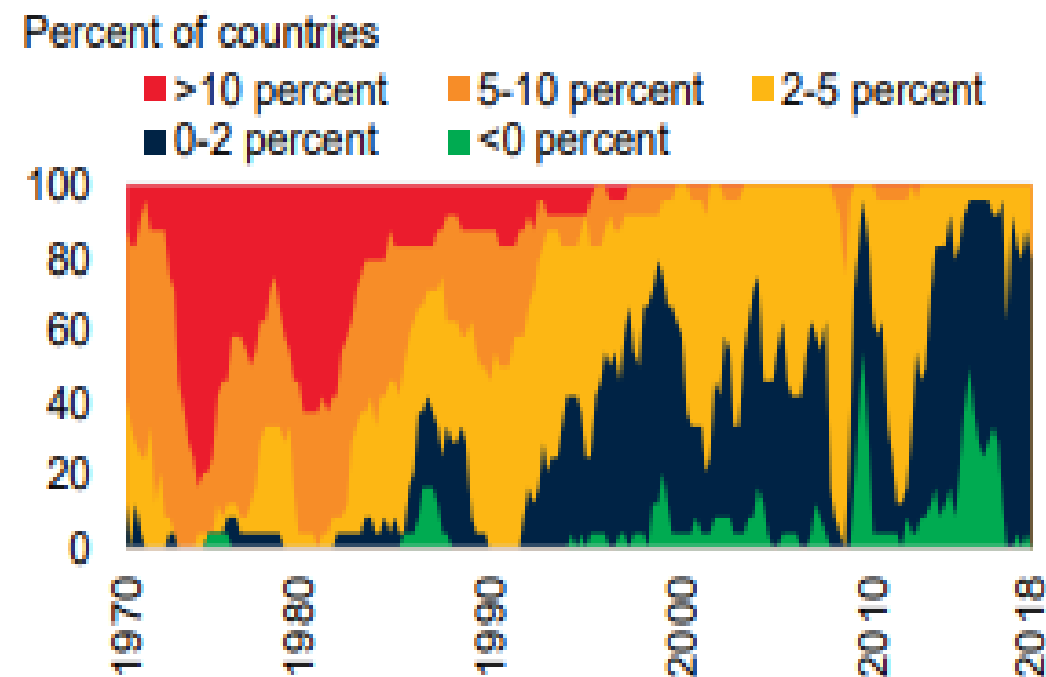
In the decade before the pandemic, more than half of advanced Economies have experienced average inflation below 2%, but not as much negative inflation as at the beginning of 20th century

CPI Inflation distribution: 2010-17



Source: World Bank

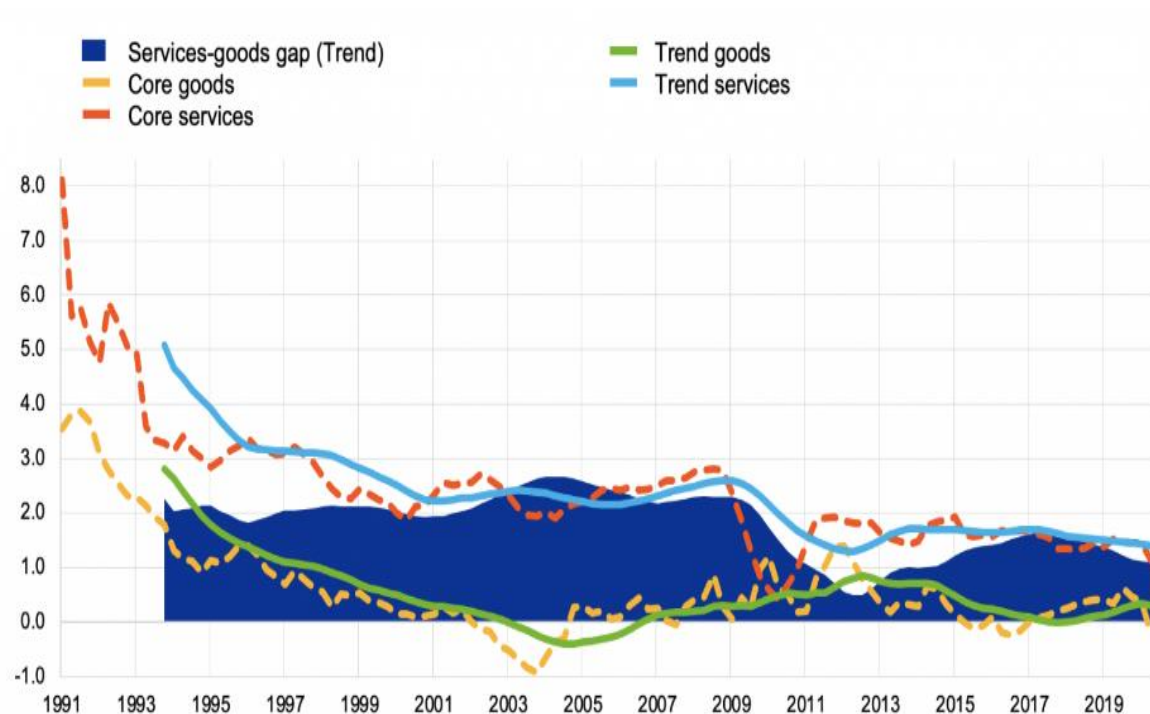
Inflation distribution: Advanced economies



Source: World Bank

# Lower inflation a result of similar underlying developments, although core inflation still under impact of idiosyncratic factors

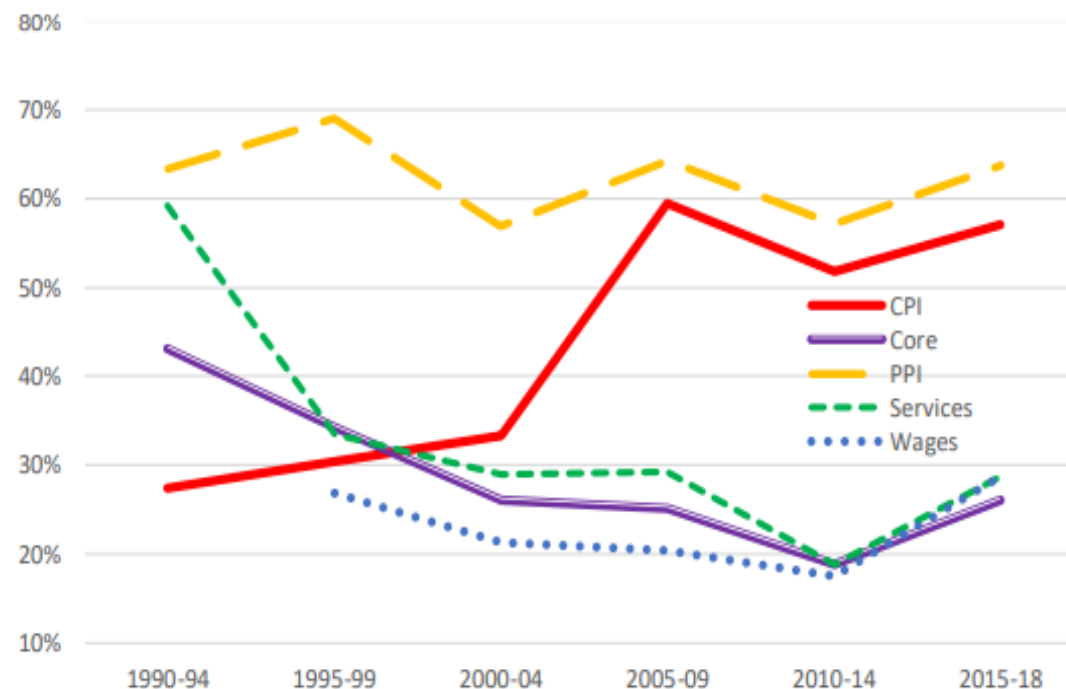
Trend inflation in goods and services in advanced economies



Sources: ECB calculations and national sources.

Notes: Inflation trends are computed based on 12-quarters moving averages of core inflation in advanced economies, computed as weighted average (GDP PPP weights) of six advanced economies (Australia, Canada, euro area, Japan, UK, and US). Latest observation: 2020 Q2.

Percent of variance of inflation measures in advanced economies explained by 1st Principal Component

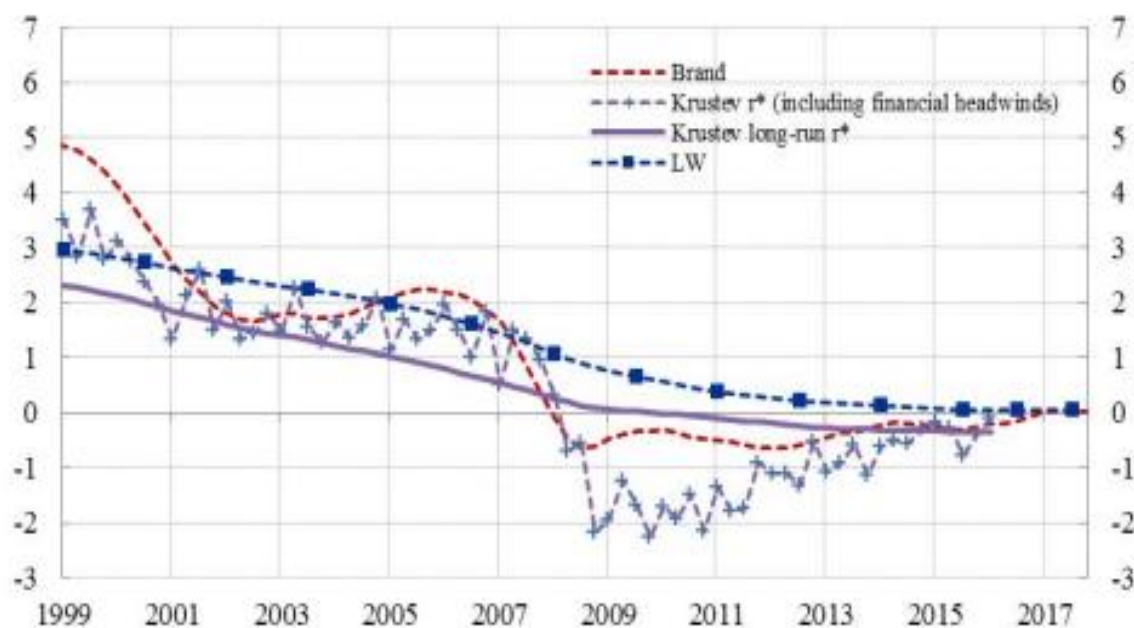


Note: Percent of variance for each measure of inflation explained by first principal component over 5-year windows starting in 1990-94.

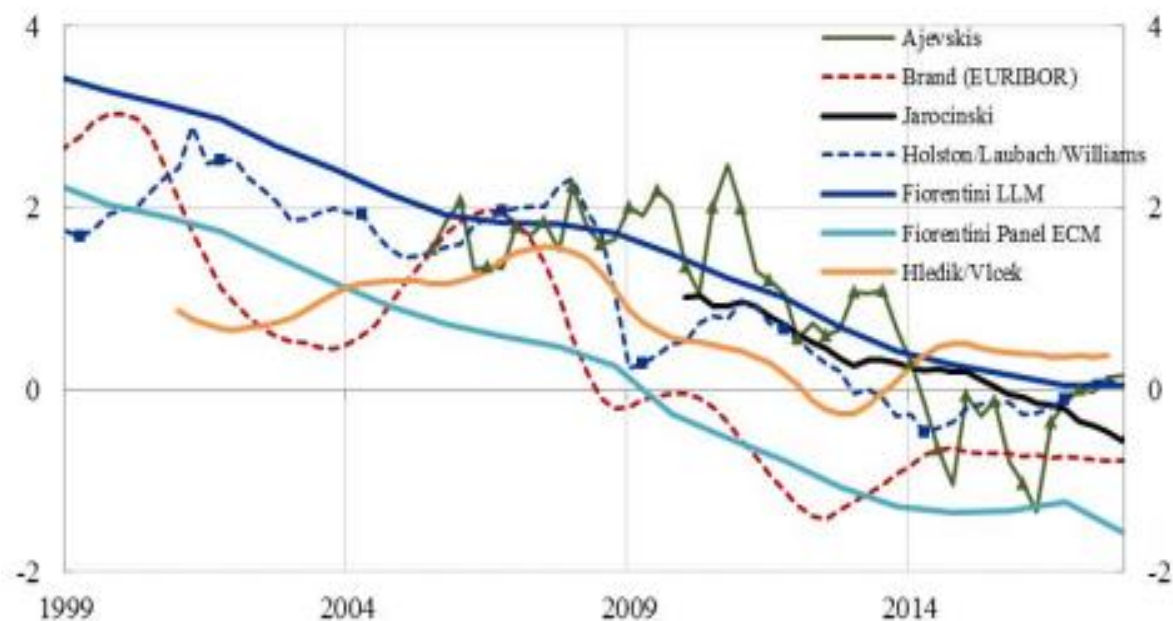
Source: BIS

Along with the decrease in inflation, structural factors affected the  $r^*$  as well, with various estimates pointing to a decreasing trend of its value

Econometric estimates for the US



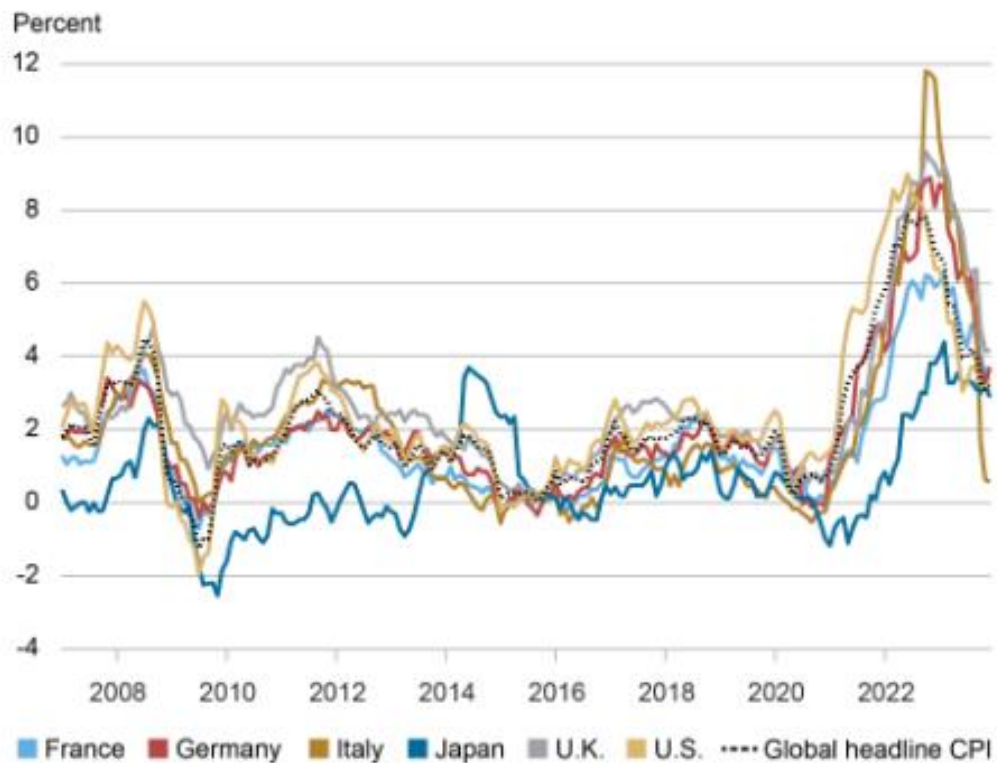
Econometric estimates for the euro area



Notes: Both euro area estimates from Holston et al. (2017) and (updated) US estimates from Laubach and Williams (2003) are obtained from the homepage of the Federal Reserve Bank of San Francisco with latest observation being 2017Q4 in both cases. Holston et al. (2017) based on filtered estimates and Brand and Mazelis (2018) based on smoothed estimates of states.  
Source: ECB (2018)

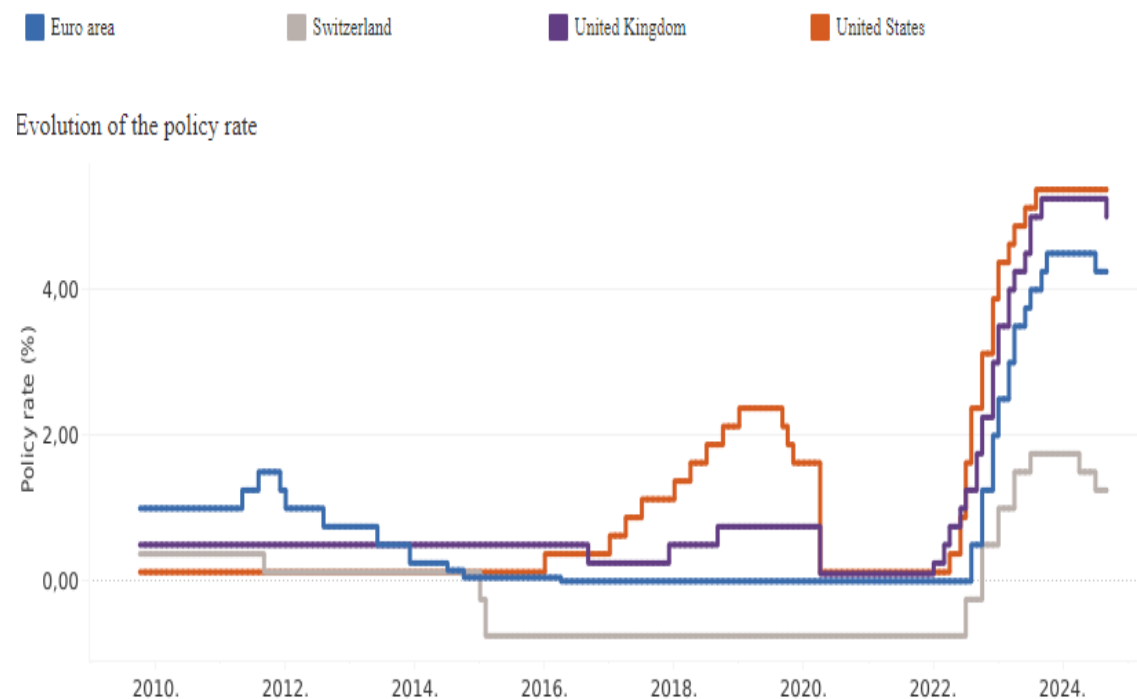
# Recent period of surge and gradual return of inflation towards the target first opened the question of transitory vs. permanent and then of future trends in inflation and interest rates

Headline CPI inflation in selected countries



Source: OECD

Central bank interest rates



Source: BIS



# Impact of structural factors on inflation trends

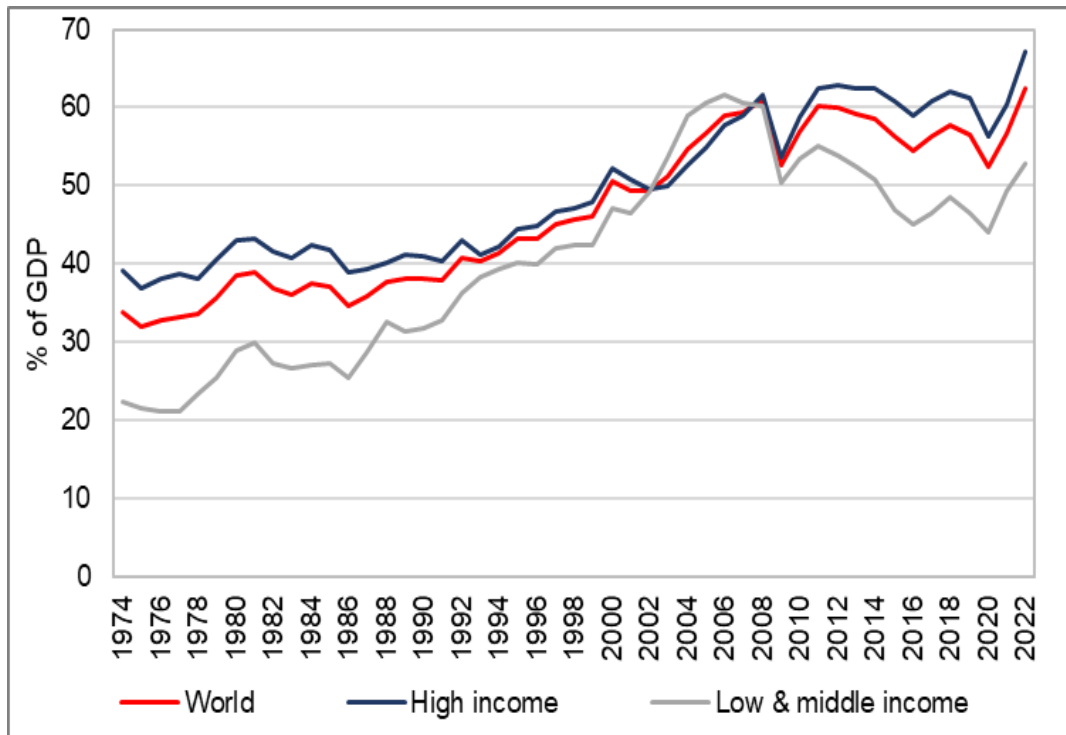
## 5 D's

# 1) (De)globalization: Globalization had a long term disinflationary impact

- Rapid economic integration due to globalization has reduced barriers to the free movement of people, capital, goods, services, information, and knowledge
- Trade liberalization and falling tariff rates, as features of globalization, have led to an increase in the share of global imports and exports in GDP, boosting economic growth worldwide
  
- Globalization can have a **disinflationary** impact on inflation through four channels:
  1. Increased trade integration - enhances competition that results in lower prices
  2. Greater role of emerging markets – introduces lower-cost goods and services
  3. Expansion of global value chains - increases efficiency and reduces production costs
  4. Reduced bargaining power of workers - Limits wage growth pressures
  
- The economy of scale, resulting from the increase in global trade, has led to a decrease in transportation costs. This trend has been further fueled by technological improvements, higher competition, and the rapid increase in information availability.

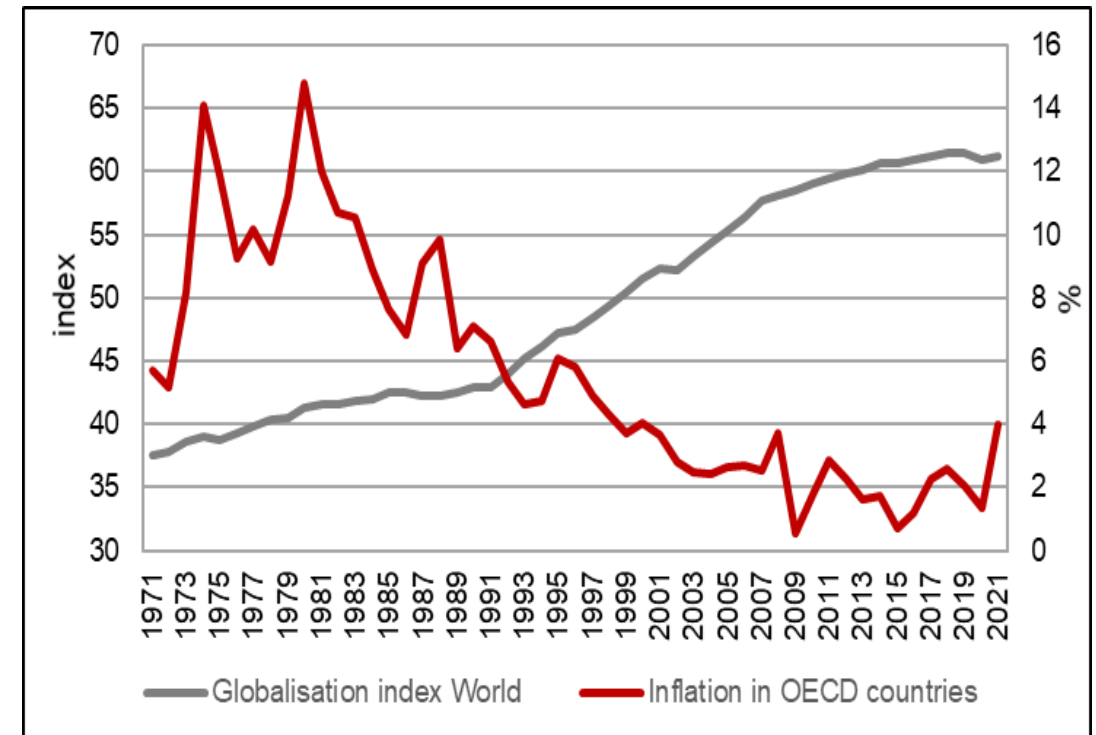
Higher level of openness of countries has contributed to lower inflation globally for a long time,...

Trade openness



Source: World Bank

Globalisation index and inflation in OECD countries

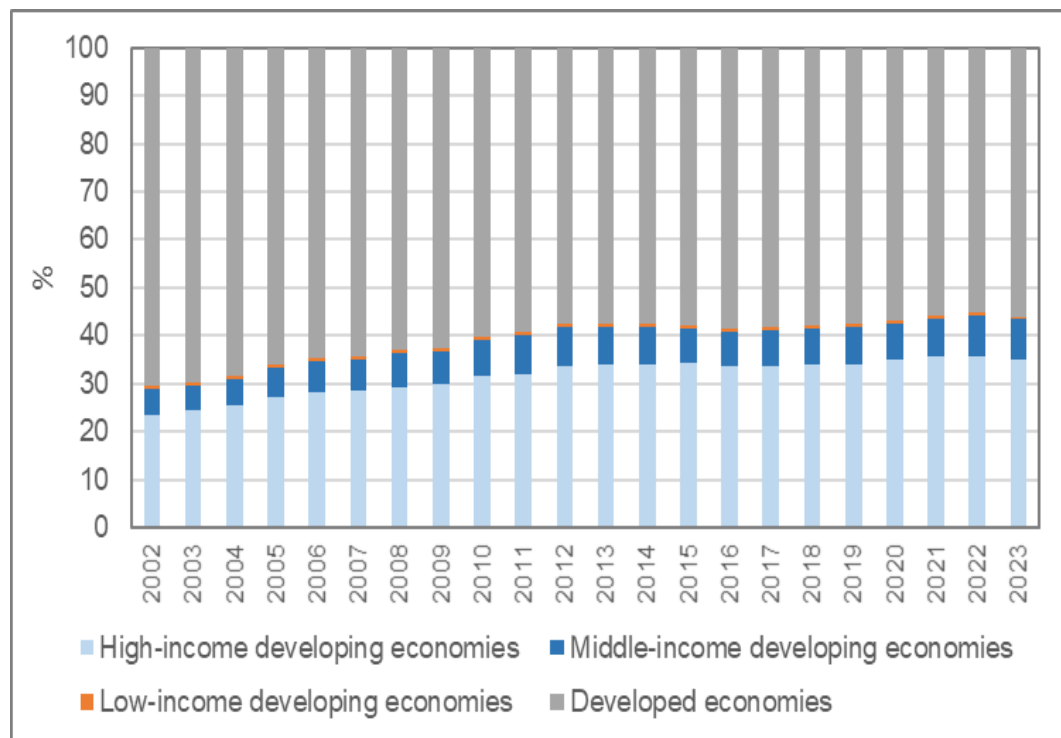


Note: The index measures globalization on a scale from 1 to 100, where higher values indicate a higher degree of globalization.

Sources: KOF Swiss Economic Institute, OECD

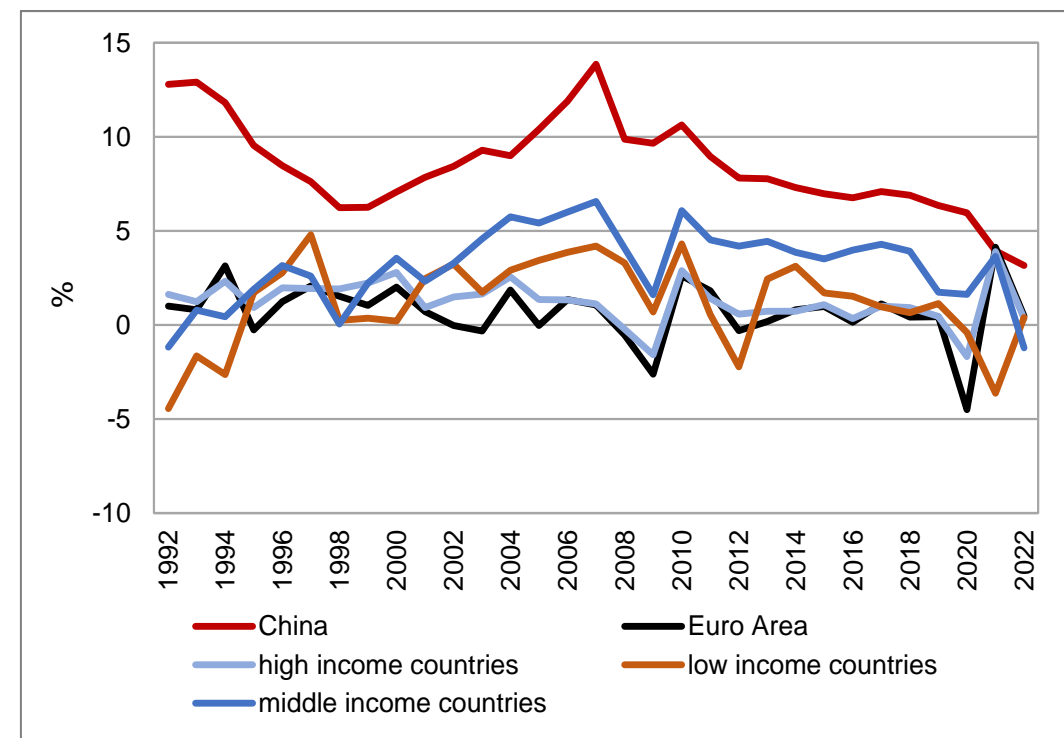
...which reflected higher productivity growth in China, middle and low income countries and higher involvement in global trade flows

Export share of selected groups of countries in total world export



Note: Data refer to exports of goods.  
Source: UNCTAD

Annual growth rate of labour productivity in China and selected groups of countries



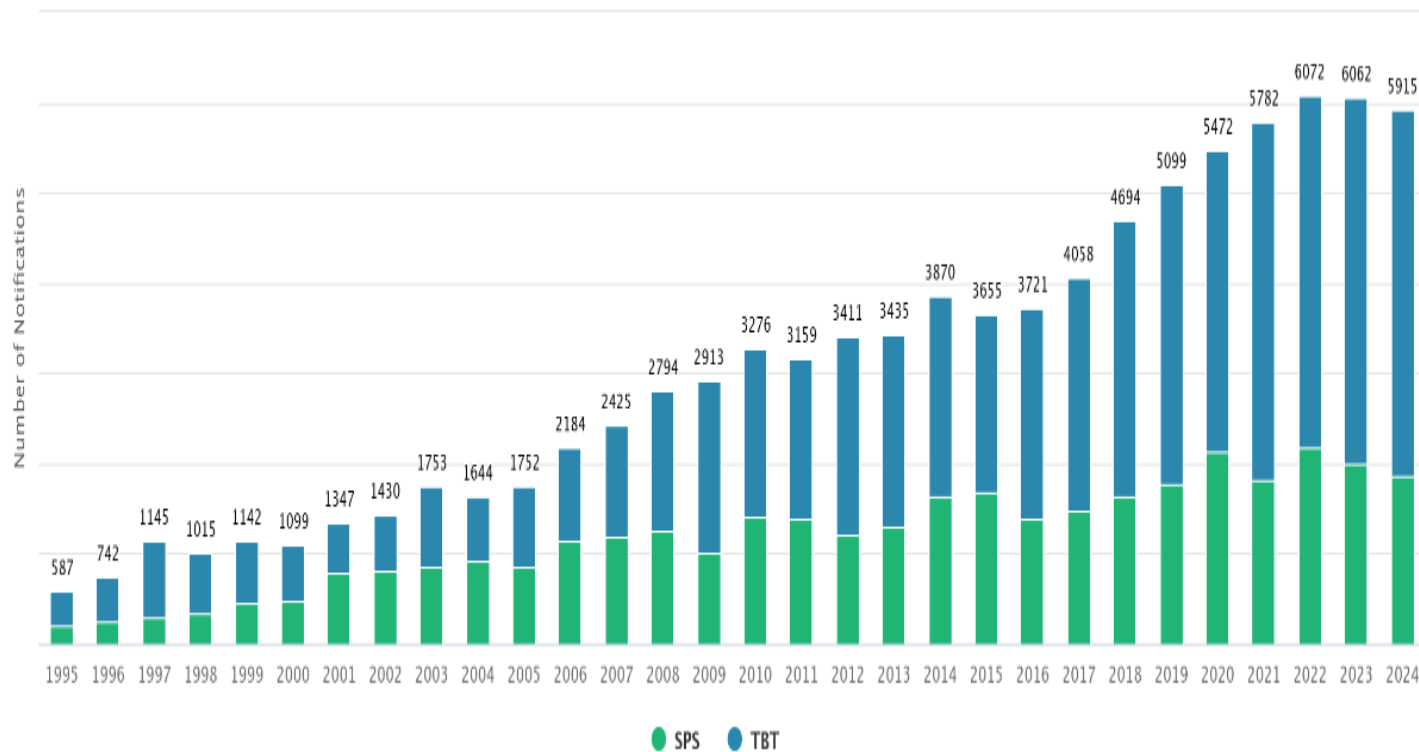
Note: Labour productivity is measured by GDP per employed person.  
Source: World Bank; author's calculations

# Recently, the issue of deglobalization and fragmentation, mainly due to the geopolitics, is becoming more and more important

- Deglobalization can affect inflation through several channels:
  1. Tarrifs and other trade barriers -> **inflationary effect** directly through higher prices, but also due to lower total supply
  2. Higher energy prices -> **inflationary effect** due to lower availability of all sources of energy
  3. Increased procurement and production costs -> **inflationary effect** due to lower availability to move production to low-income countries
  4. Increased labour costs -> **inflationary effect** due to inability to substitute relatively more expensive domestic labour by relatively less expensive labour in low-income countries
  5. Reduced external demand for domestic products and services -> **disinflationary effect**
  
- Fragmentation -> **can have both inflationary and disinflationary effects**

# Fragmentation could only add-up to ever increasing number of non-tariff barriers to trade, voluntary export restrictions and (threats of) tariffs

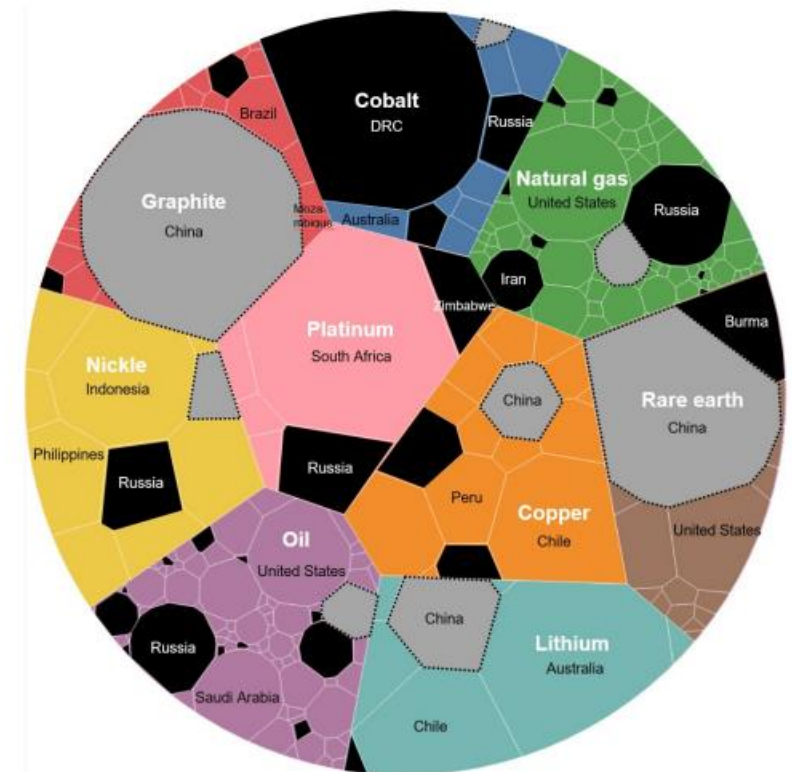
Number of SPS and TBT notifications per year



Source: ITC, UN and WTO

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World production of selected commodities



Note: Different colors represent different commodities. Countries under sanctions are colored black, and China is colored grey.

Source: Aiyar, S. et al. (2023), Goeconomic Fragmentation and the Future of Multilateralism, IMF Staff Discussion Notes No. 2023/001

## 2) Demography impacts inflation through two main channels

### 1. Natural interest rate channel

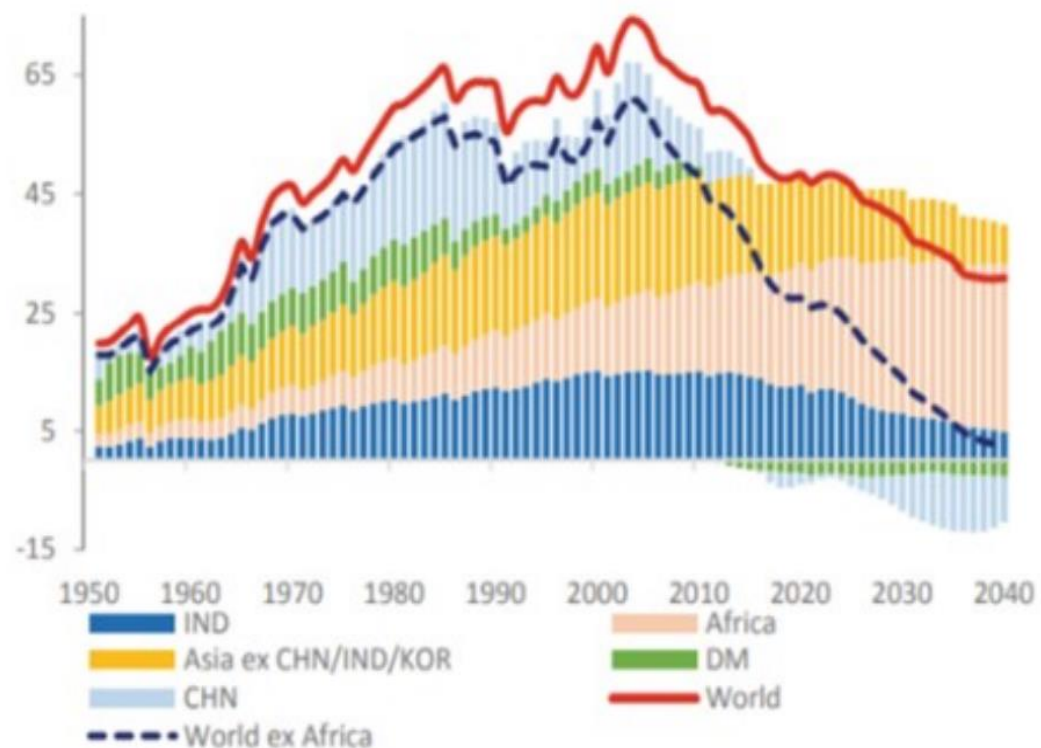
- Changes in labour supply and/or age-varying productivity affected the decrease in natural interest rate, but the trend is expected to revert
- An increase in the share of the dependent population (the young and the old), lowers the savings rate and therefore drives up the natural rate -> **inflationary effect**
- Increasing longevity (with perfect foresight) increases the saving rate and thus drives down the natural rate -> **disinflationary effect**
- Decrease in effective labor population ratio – slowdown in TFP for output pc growth – lower demand for capital/lower MP of K and so the  $r^*$  (substitutability L/K?) – **disinflationary effect**

### 2. Political economy channel

- Young and old people might prefer different levels of inflation (young are often borrowers, whereas the opposite holds for the old)
- Different age groups have different preferences towards goods and services

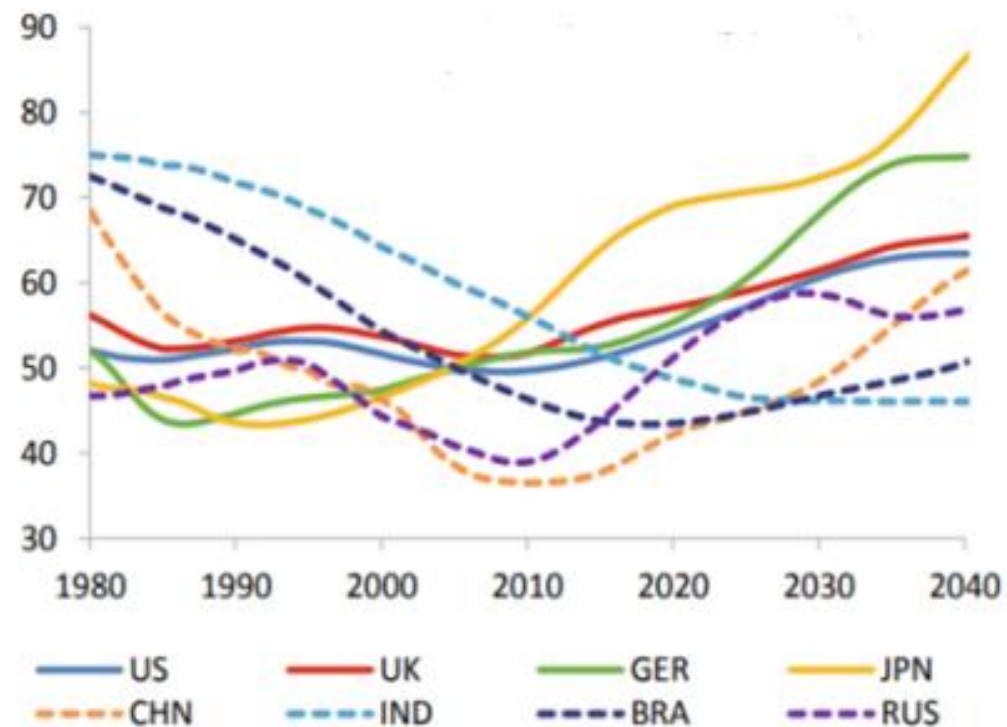
Demography: The impact has been disinflationary, but the trend is reverting recently, huge positive labor supply shock is gone for good

Working age population



Sources: UN Population Statistics

Dependency ratio (per 100 people)

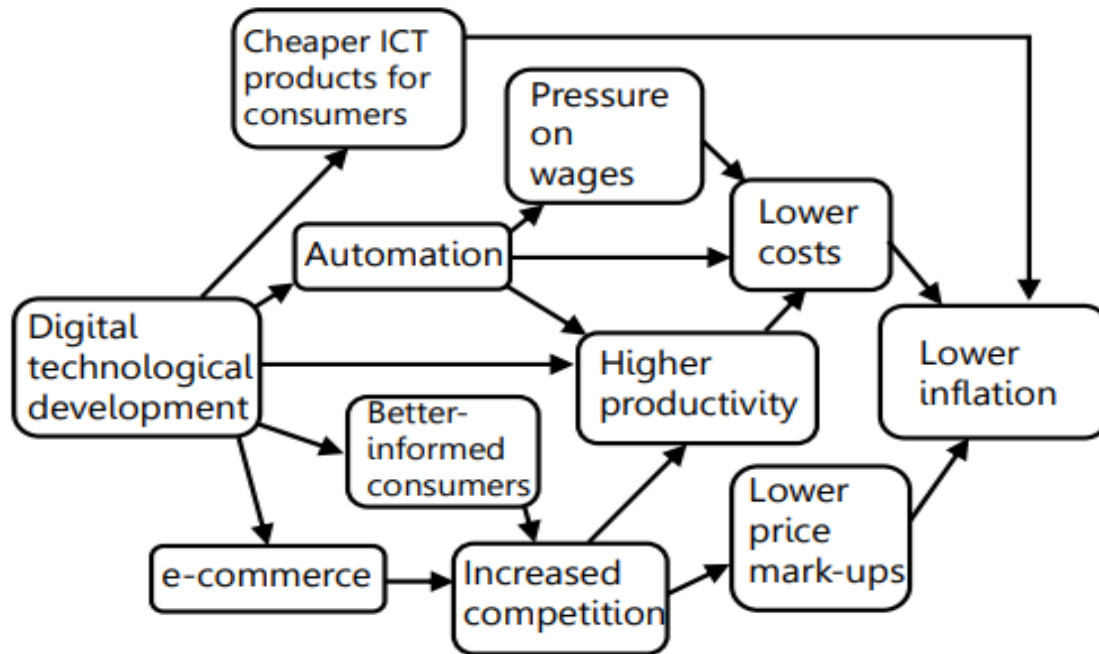


Source: UN Population Statistics



### 3) Digitalization (AI including): impacts inflation through three main channels

The effects of digitalisation on inflation



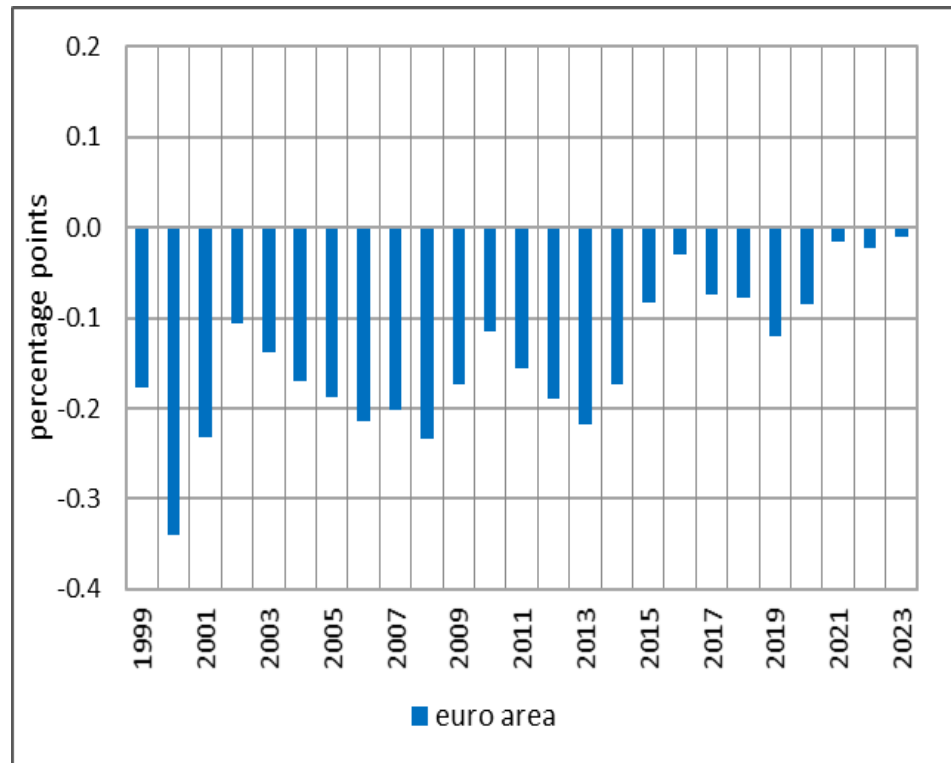
- Digitalization is one of the structural factors influencing inflation over the past 20 years
- It can impact inflation either directly through cheaper ICT products for consumers or indirectly through the use of the internet and automation
- As a result of digitalization, inflation is on average lower than it would be without it

Source: Sveriges Riksbank (2015.), *Digitalisation and inflation*, Monetary Policy Report (February), 55. – 59.

## Direct channel: lower prices of ICT goods and services

### Contribution of ICT products and services to average annual inflation in most countries negative

Contribution of ICT products to average annual inflation in euro area



Source: Eurostat; HNB calculations

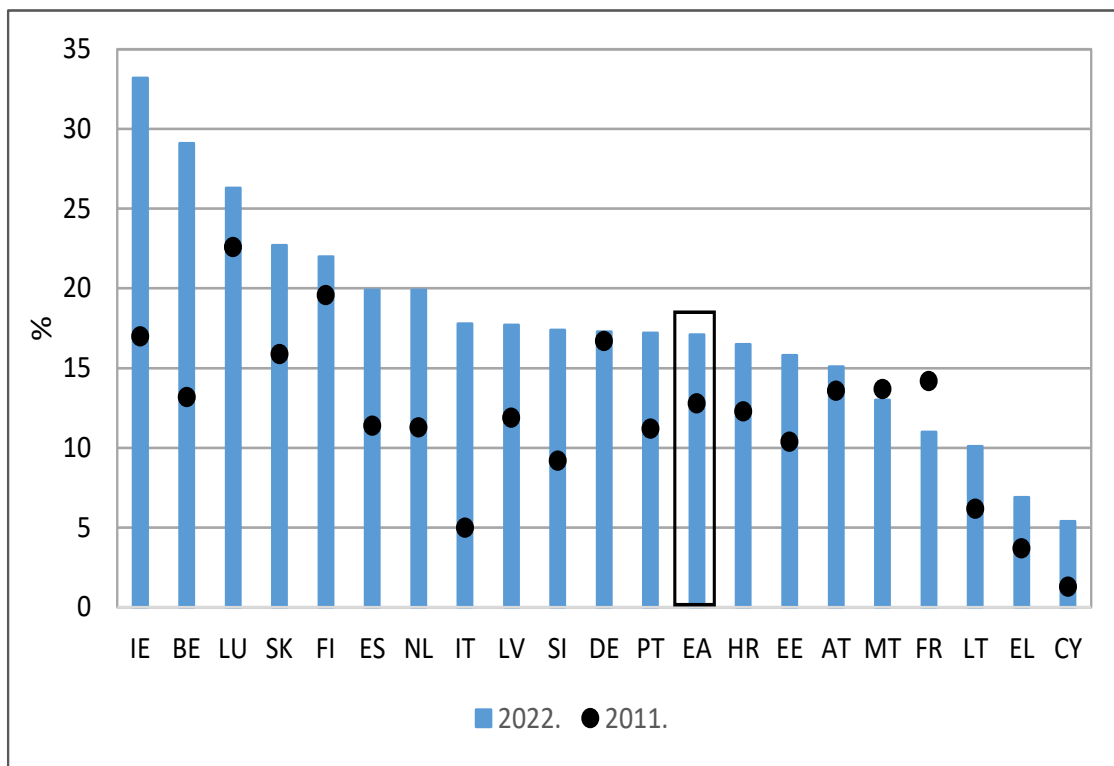
- Digitalization can directly lead to lower prices of ICT products due to technological advancements and increased production efficiency
- The availability of cheaper digital products enhances consumer access to advanced technology at reduced costs, contributing to lower inflation
- Rapid technological changes in the ICT sector drive continuous price reductions as newer, more efficient products replace older ones

# Indirect channels: Increased use of digital technologies and automation

Use of digital technologies: increased competition, e-commerce growth

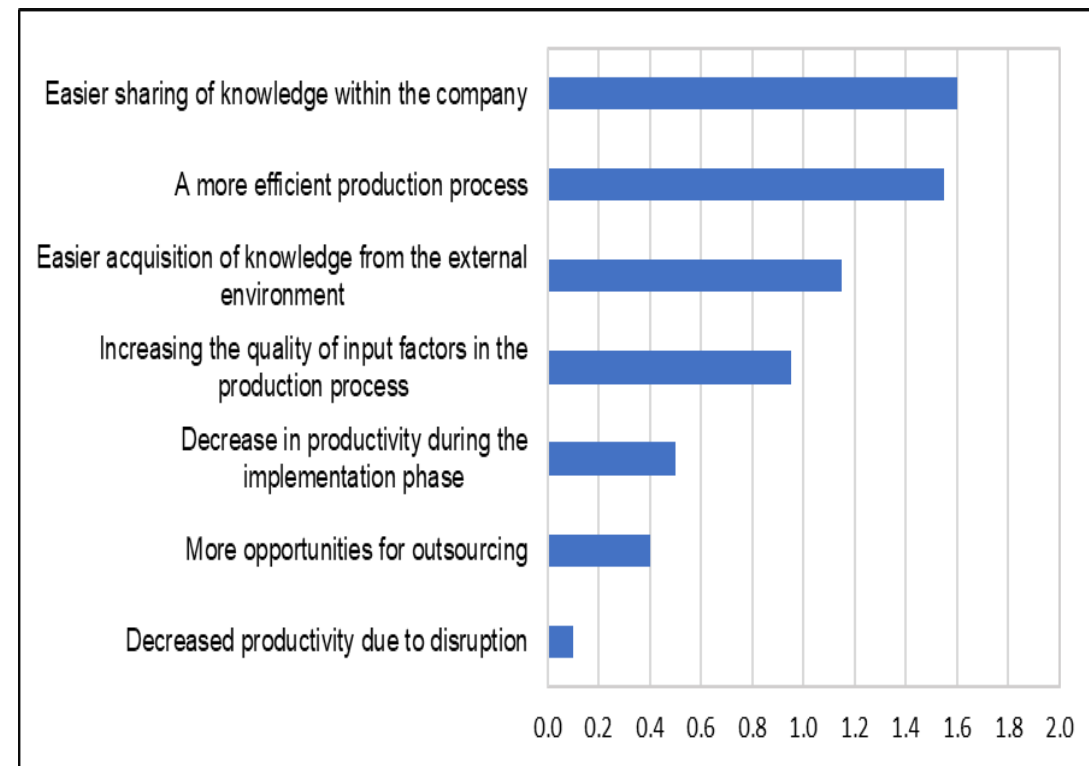
Automation: operational efficiency, labour replacement, lower investments in physical capacities, thus lower demand

Share of e-commerce in total retail



Source: Eurostat

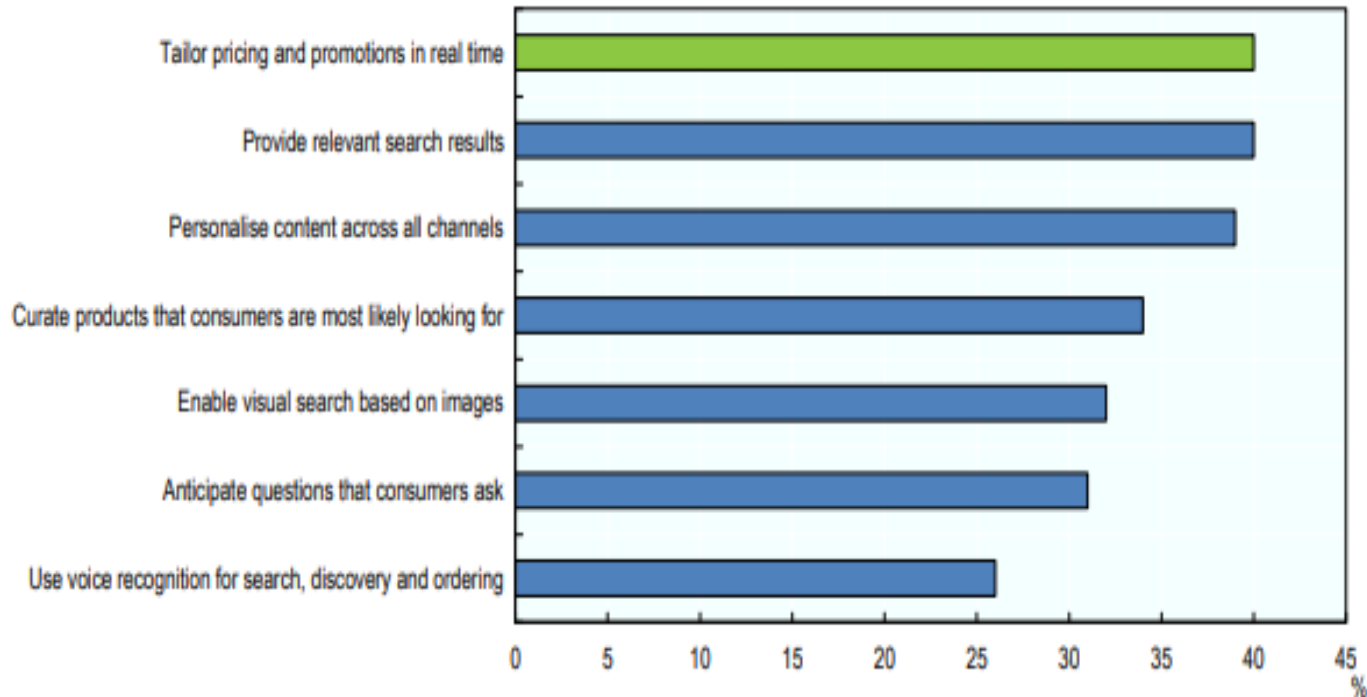
The impact of digitization on labor productivity



Note: The calculation is based on respondents' answers to the question of how digital technologies affect company productivity. The answer values refer to the average of the answers of all respondents; 0 = unimportant; 1 = important; 2 = very important. Source: Elding, C. i Morris, R. (2018.), *Digitalisation and its impact on the economy: insights from a survey of large companies*, ECB Economic Bulletin, Issue 7/2018, 67. – 69.

## On the other hand, digitalisation has enabled the development of personalized pricing models, which has inflationary effects

Usage of AI to personalize the consumer experience



Note: "Based on a survey to more than 500 traditional retail, pure play, consumer goods, and branded manufacturing leaders from around the world."

Source: Hogan, K. (2018), Consumer Experience in the Retail Renaissance: How Leading Brands Build a Bedrock with Data

- Personalized pricing can increase firms' market power by allowing them to charge higher prices to consumers with a higher willingness to pay, driving inflation up
- With personalized pricing, firms can effectively engage in price discrimination, often leading to higher average prices, especially from wealthier consumers who can afford more, thus raising the general price level
- PTM - PTP

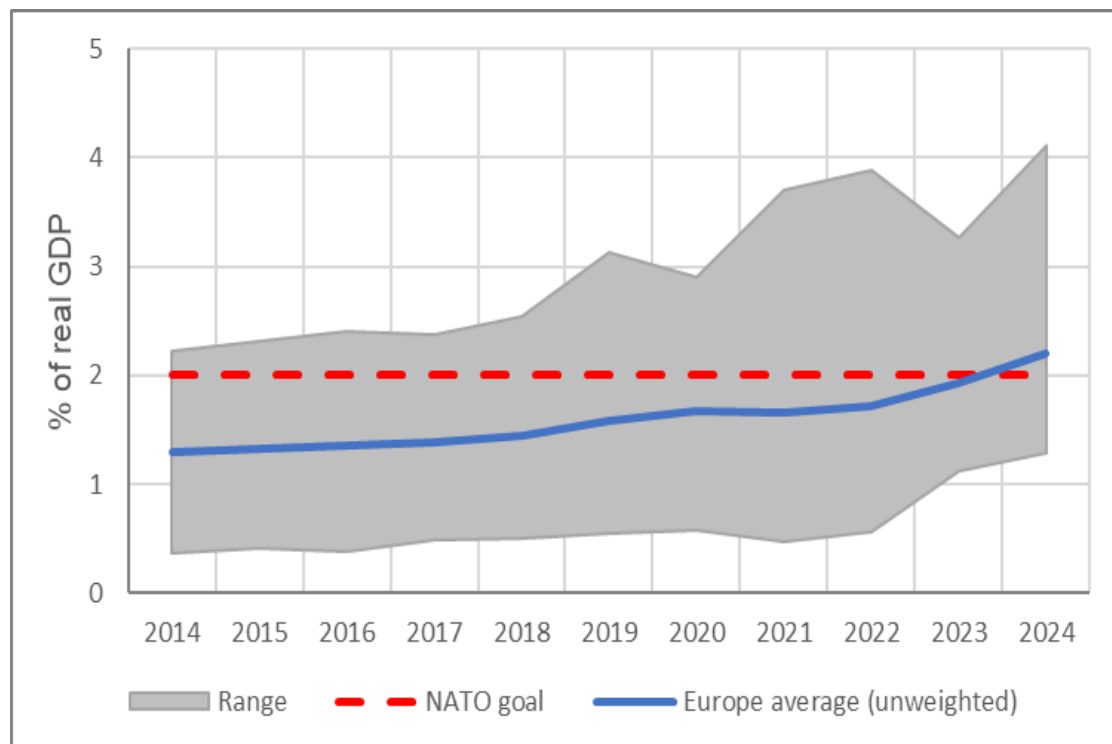
## 4) Decarbonization (climate change) and the impact on inflation

### Physical and transition risks ↔ *climateflation, greenflation, fossilflation*

- Climate change is one of the most significant structural forces shaping the global economy. Its impact will be significant and diverse, and will affect all economic actors and sectors around the world (NGFS, 2020)
- Schnabel (2022) – lists three different, but interconnected channels/shocks that can be expected to lead to a prolonged period of pressure on inflation in the coming period due to climate disasters (physical risks) and green transition (transition risks):
  - **climateflation** – natural disasters and unfavourable weather conditions can affect economic activity and prices – a consequence of the physical risks of climate change
  - **greenflation** – the transition to green technologies is likely to lead to a significant increase in demand for certain commodities whose supply is limited, which affects prices (e.g. it takes 5 to 10 years to open a mine; demand and supply mismatch) – a consequence of the green transition
  - **fossilflation** – the fight against climate change makes fossil fuels more expensive due to introduction of a carbon tax, through which their harmful impact on the environment is more clear – the consequence of the green transition

## 5) Defense spending increased amid heightened uncertainty, likely to further increase, could generate additional inflationary pressures

Defense expenditure in Europe (% of real GDP)



Source: NATO

- Uncertain times brought an increase in defense expenditure in Europe, which could have significant impact on inflation through increased fiscal expenditure

- There are few channels of impact of higher defense expenditure on inflation:

1. **Higher energy prices** – higher demand for energy to produce or use military equipment
2. **Higher commodities prices** – higher demand for commodities used for production of military equipment
3. **Higher incomes** as a result of fiscal expansion

## Many structural factors that will affect inflation in the medium to long run

### Some of the factors affecting prices in the long-run

|                        | Disinflationary forces   | Inflationary forces   |
|------------------------|--|---|
| <b>Goods prices</b>    | <ul style="list-style-type: none"> <li>- China with its excess capacity</li> <li>- Globalisation - increased integration, expansion of GVC, greater role of emerging markets, lower bargaining power</li> <li>- Deglobalisation - reduced external demand</li> <li>- Digitalisation - cheaper ICT goods, improved competition, easier access to information, automation</li> </ul> | <ul style="list-style-type: none"> <li>- Fragmentation in global trade</li> <li>- Increase in protectionist barriers</li> <li>- Deglobalisation - leading to higher energy prices, labour and other production costs</li> <li>- Demography - constrained labour supply due to ageing</li> <li>- Digitalization - "superstar" firms, personalised pricing</li> <li>- Climate change - shift towards greener energy</li> <li>- Defense spending - higher taxes, higher purchasing power due to higher incomes without new supply, higher energy prices</li> </ul> |
| <b>Services prices</b> | <ul style="list-style-type: none"> <li>- Globalization in services trade</li> <li>- Digitalisation - cheaper ICT services</li> <li>- Digitalisation - easier price comparison and increased competition</li> <li>- AI, automation and digitalisation could increase productivity and lower costs, perhaps disproportionately in the services sector</li> </ul>                     | <ul style="list-style-type: none"> <li>- Higher income levels and population ageing gradually shift domestic demand towards services</li> <li>- Constrained labour supply due to ageing may increase workers bargaining power</li> <li>- Digitalization - rise of dominant "superstar" firms</li> <li>- Digitalisation - development of personalized pricing models</li> <li>- Climate change - shift towards greener energy</li> </ul>   |

# Do I know what the future of inflation is, or where the $r^*$ is? No.

- **What I believe we learned (again) from recent inflation episode:**
- **Even if inflation falls asleep, it is never dead - to quote R. Dornbusch: The beast is asleep not slain**
  - Recent inflation outburst reminds us not to take low and stable inflation for granted. It also reminds us how unpopular it is (incumbent politicians...)
- **Independence of central banks and credibility built upon that independence are of key importance for maintaining low inflation**
  - Credibility is the key mechanism of anchoring long-run inflation expectations, it is the main reason why we currently face relatively low sacrifice in bringing down the inflation, **like low inflation it should never be taken for granted**
- **Independence needs strong governance, transparency, and accountability arrangement**
  - Those are necessary to maintain public trust and effective policy-making, while enhancing credibility at the same time
- **The magnitude of the challenge may increase in the future**
  - Potentially higher and more volatile inflation in the future will make preserving central bank independence even more important.





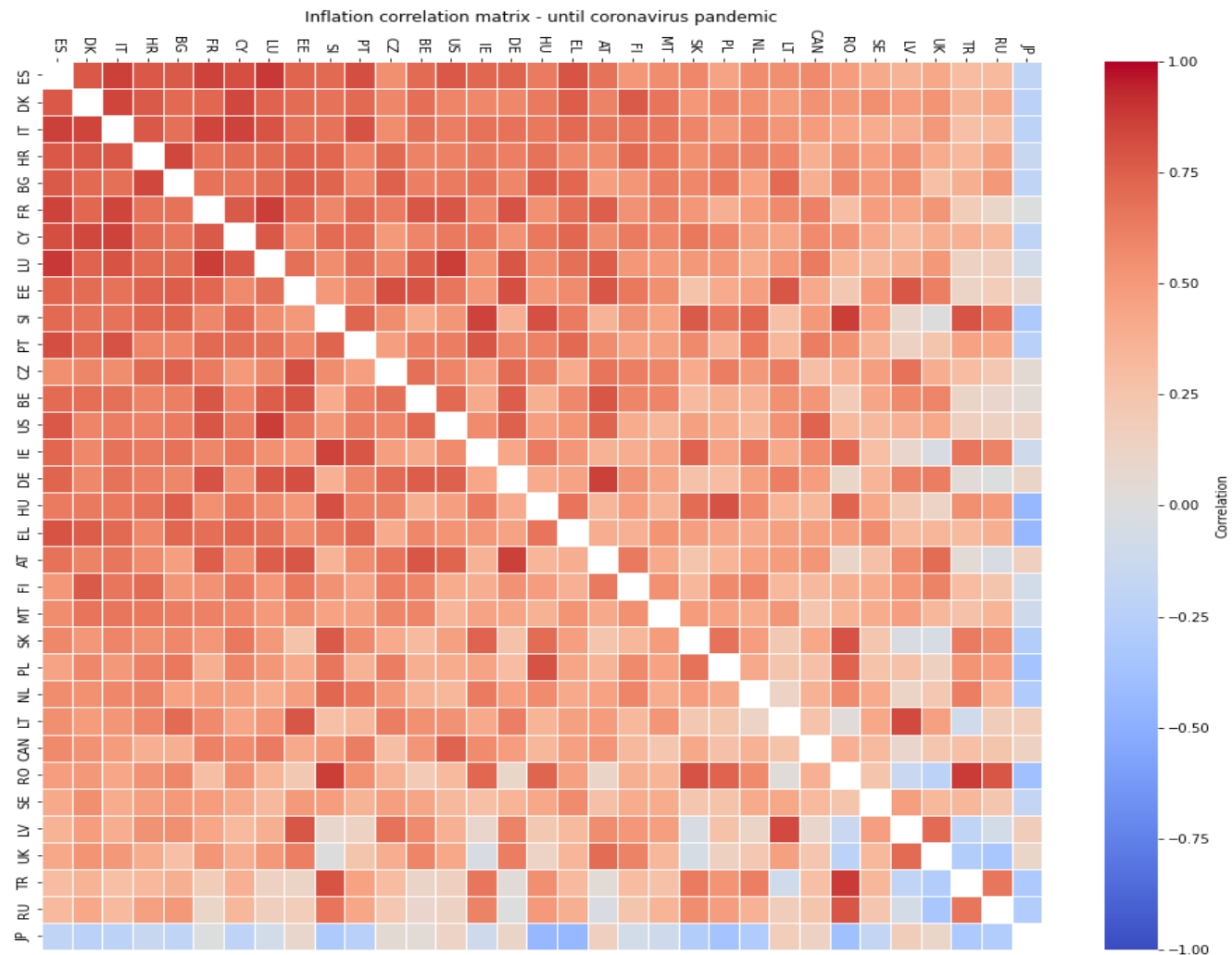
**Thank you very much for your attention!**



HNB

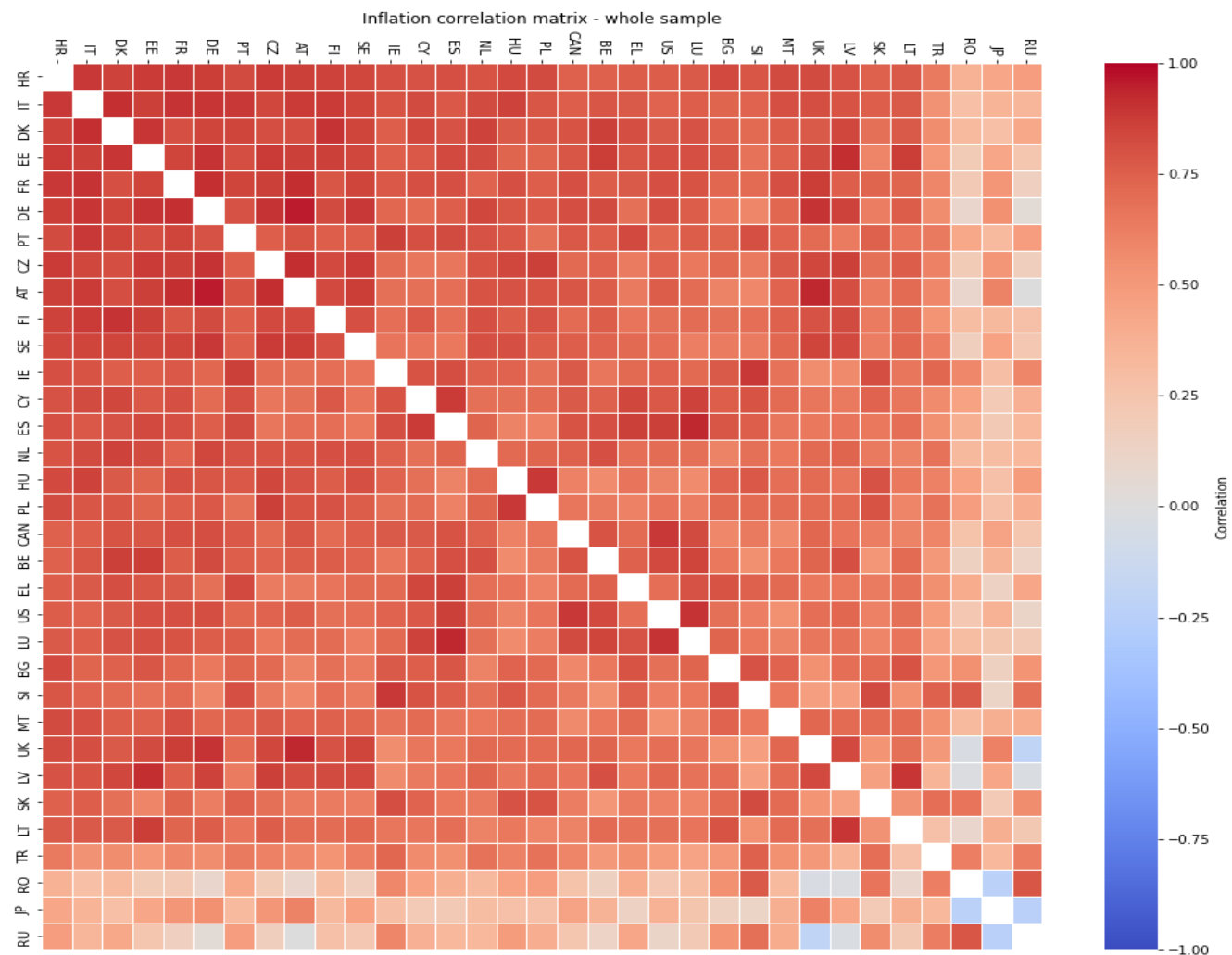
# Additional slides

# The correlation of inflation across the world was high before the pandemic...



Note: Correlation matrix. The data covers the period from January 2000 to February 2020.  
Source: Eurostat, OECD; HNB calculations

...and in the period following the pandemic, it further increased as a result of joint global shocks



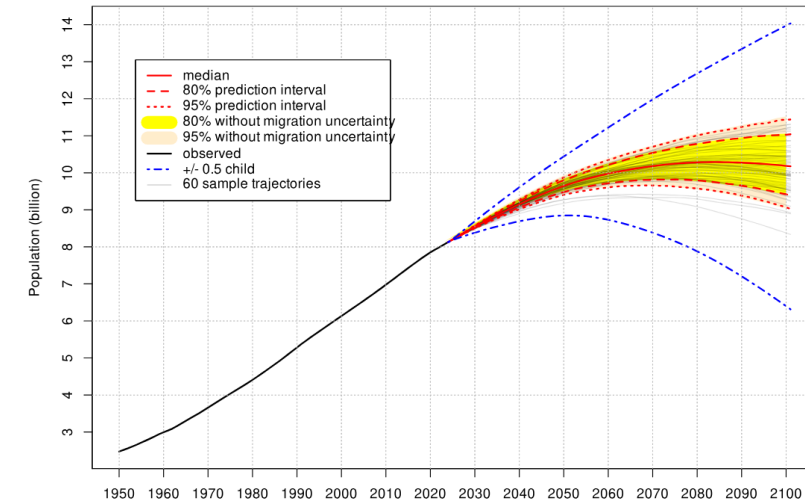
Note: Correlation matrix. The data covers the period from January 2000 to July 2024.  
Source: Eurostat, OECD; HNB calculations

# Demographic trends

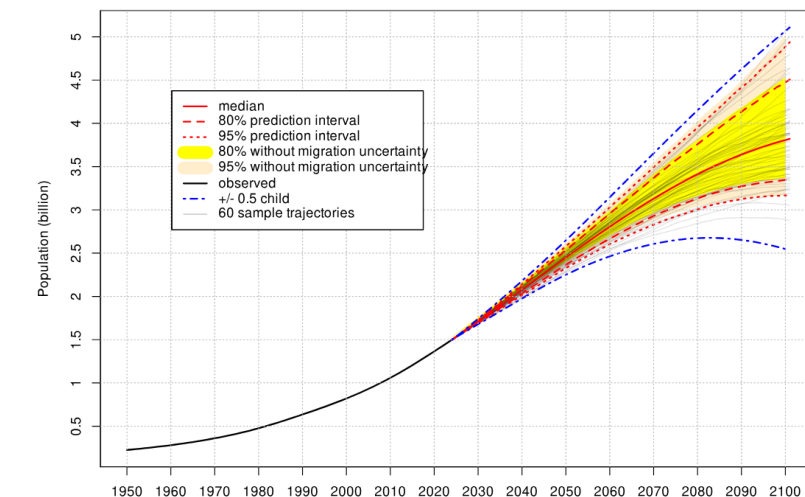
## Population growth is slowing or declining on all continents, except Africa

- By 2100 the world's population could increase by about 2 billion people (from 8 to 10 billion)
- In the same period, the population of Africa is expected to grow by about 2.5 billion (from 1.5 to 4 billion)
- Africa is much less integrated into global economic flows
- The global impact of African demographic trends will depend heavily on the degree and form of future integration
  - repeating the story with China from previous few decades
  - or these young people will migrate in large numbers to other countries

World: Total Population



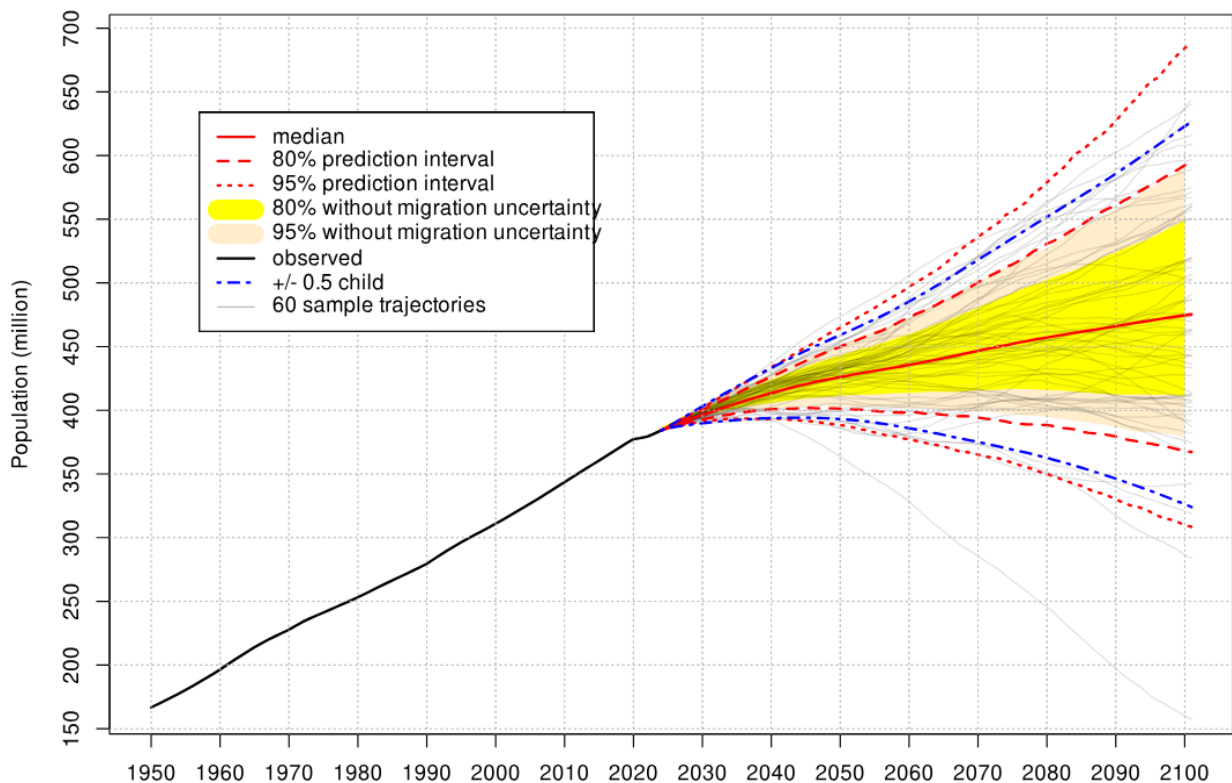
Africa: Total Population



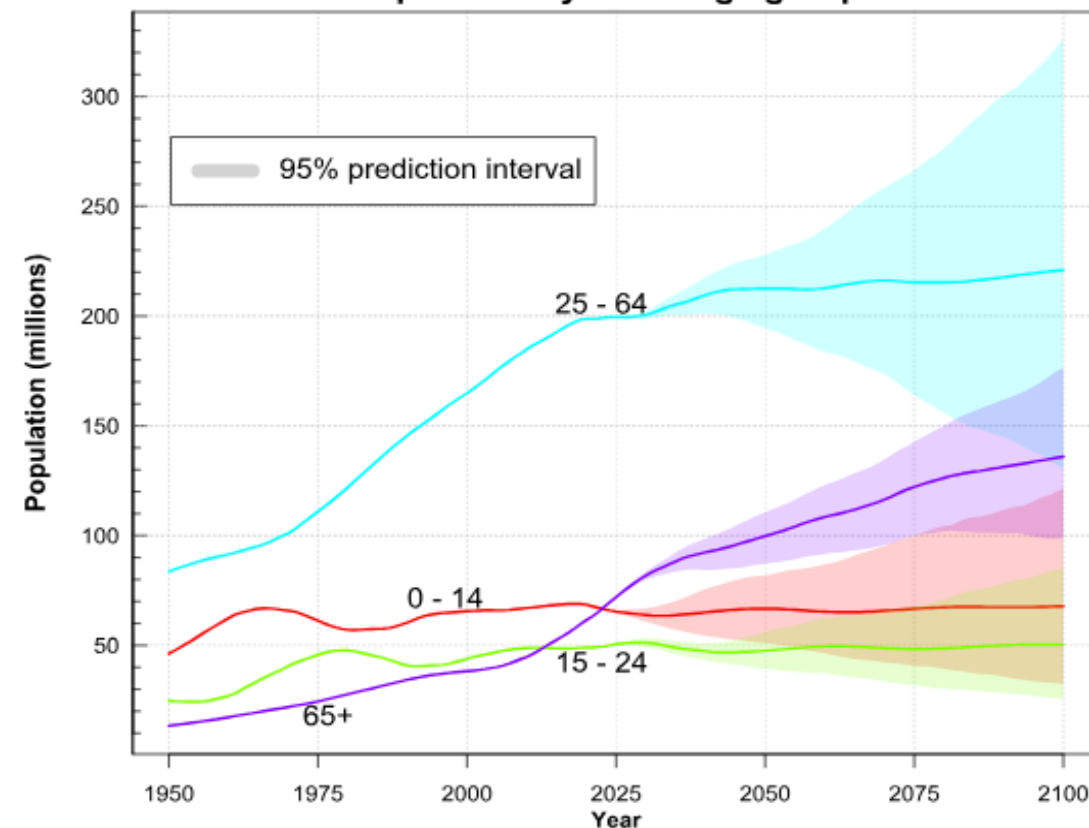
# Demographic trends

In North America, population growth is expected to slow down

Northern America: Total Population



Population by broad age groups



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United Nations, DESA, Population Division. *World Population Prospects 2022*. <http://population.un.org/wpp/>

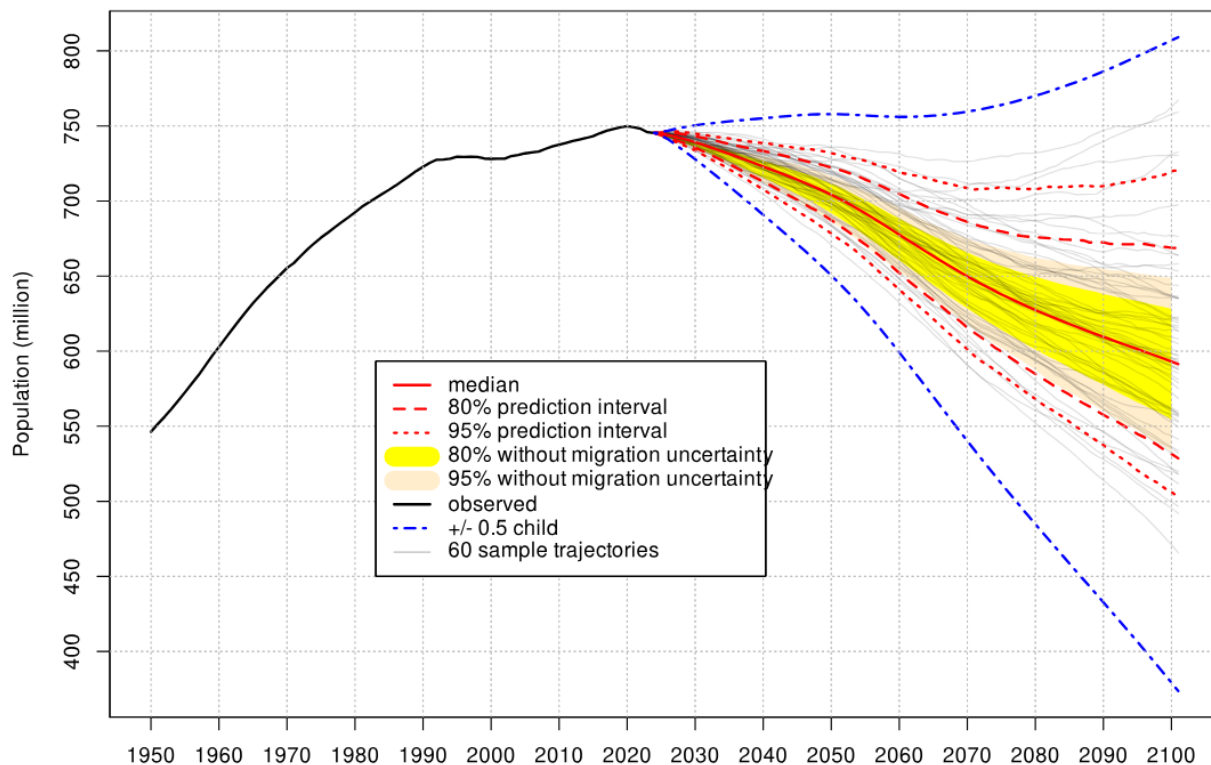
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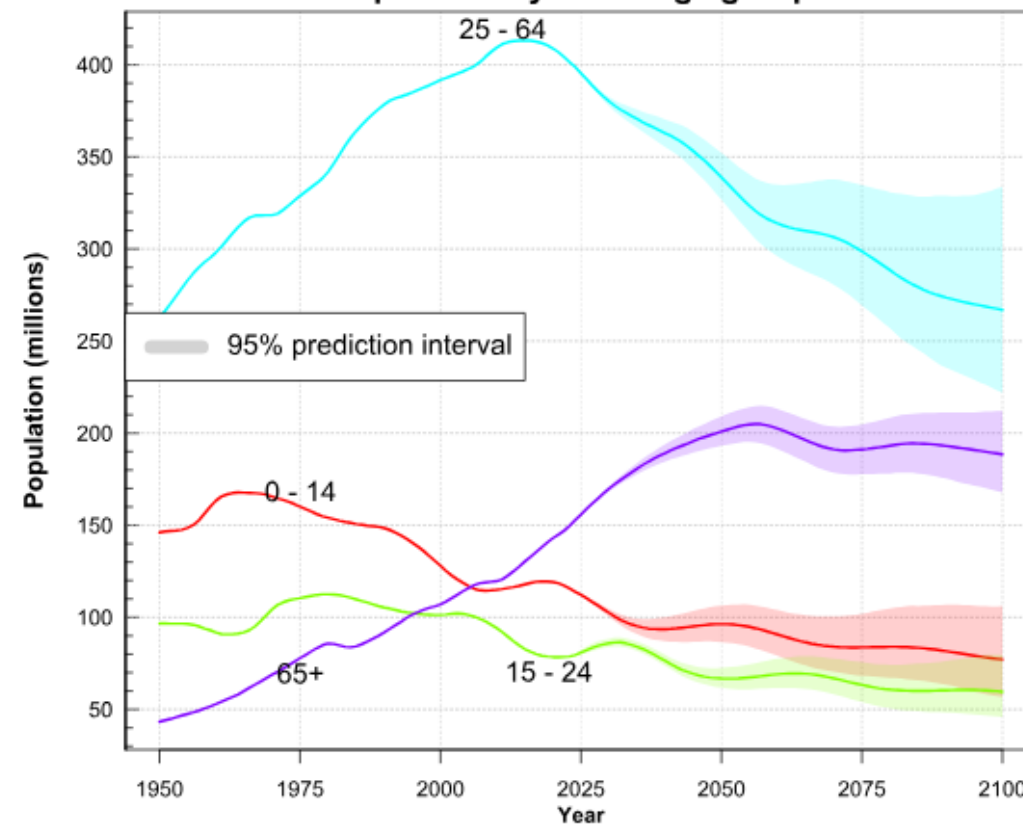
# Demographic trends

In Europe, the population is expected to decrease with the significant change in age structure

Europe: Total Population



Population by broad age groups



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United Nations, DESA, Population Division. *World Population Prospects 2022*. <http://population.un.org/wpp/>

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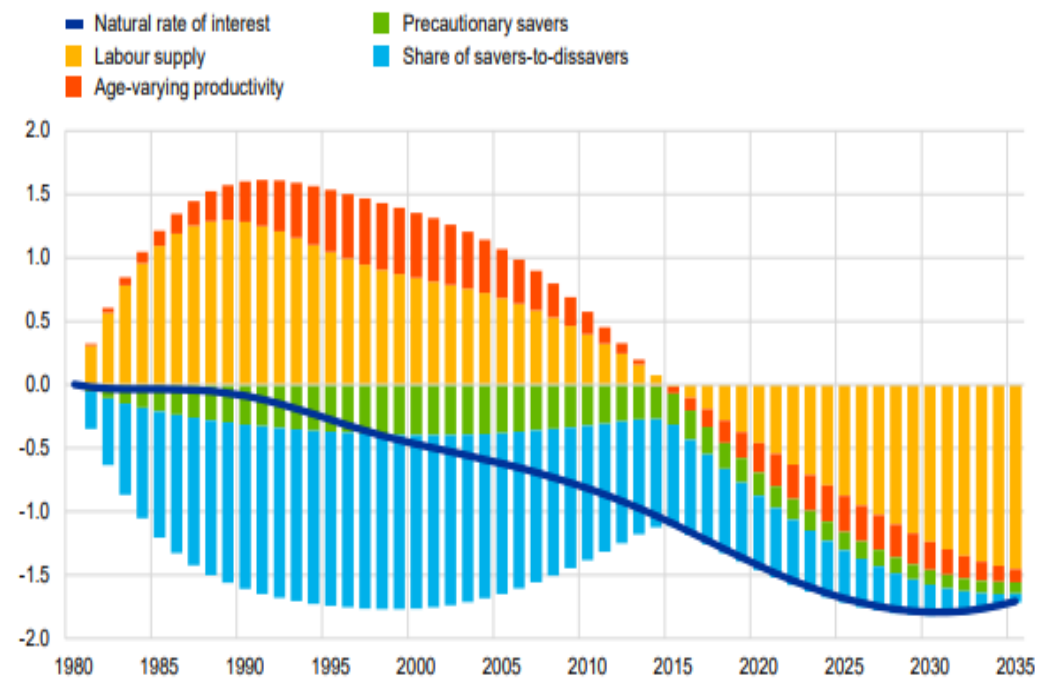
# Demographic trends: downward pressure on natural rate related to ratio of savers-to-dissavers and labour supply expected to gradually ease

It could, in the long run, result in increased inflationary pressures

Illustration of demographic drivers of the natural rate of interest

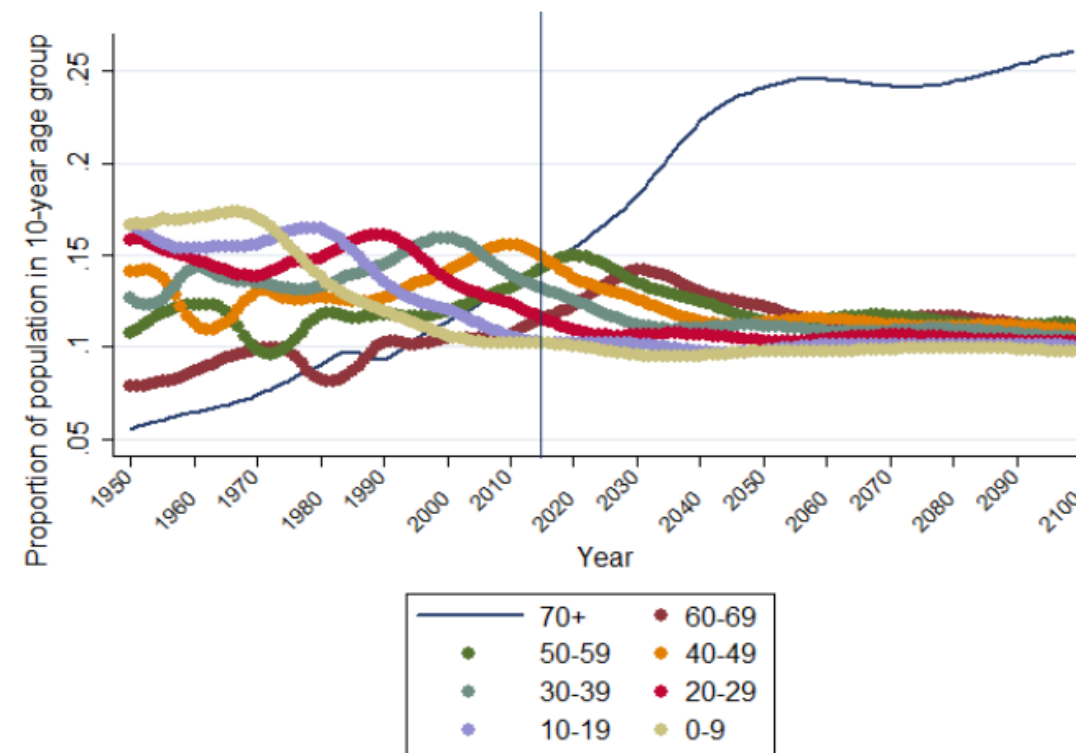
Demographic structure in the euro area

(percentage point deviation and contributions)



Sources: Brand, Bielecki and Penalver (2018), based on Papetti (2019).

Notes: The natural rate of interest is expressed as percentage point deviation from the initial steady state.



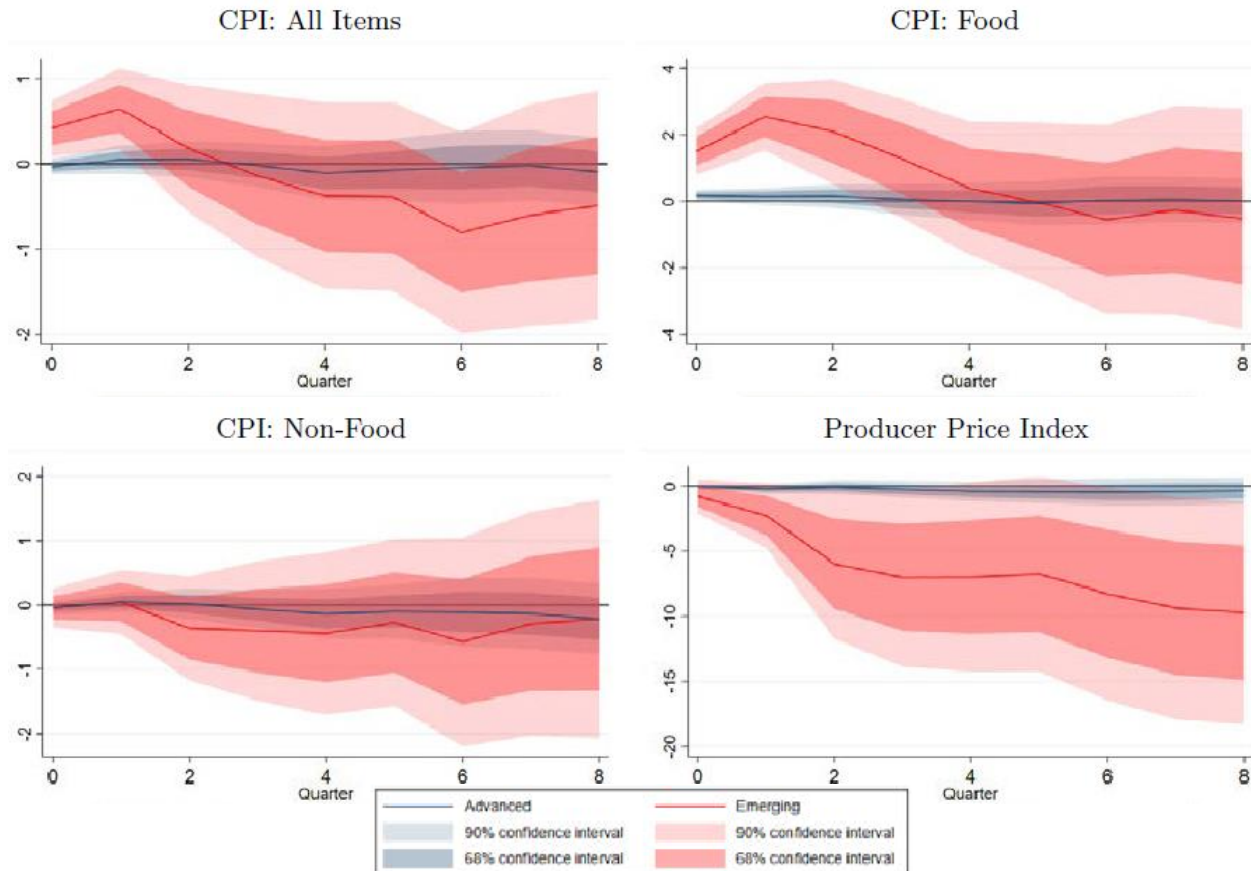
Note: Vertical line denotes the point in time at which share of 70+ year old became highest.

Source: UN Population Statistics



# Climate change and the impact on inflation

## *Climateflation* – the effect of extreme temperatures on price stability



Source: Faccia, D., Parker, M. i Stracca, M. (2021), *Feeling the heat: extreme temperatures and price stability*, ECB Working Paper Series, No. 2626

- Extreme weather conditions, such as high temperatures, often increase food prices in less developed countries, while the impact on developed countries remains limited.
- Nevertheless, climate-induced conditions are becoming more frequent and stronger, which presents a challenge for assessing their future impact on prices, so even central banks of developed economies cannot ignore this issue.
- Alongside mentioned, monetary policy should support reduction in greenhouse gas emissions and promote sustainable business practices and assess the changes in consumer preferences towards sustainable products and services

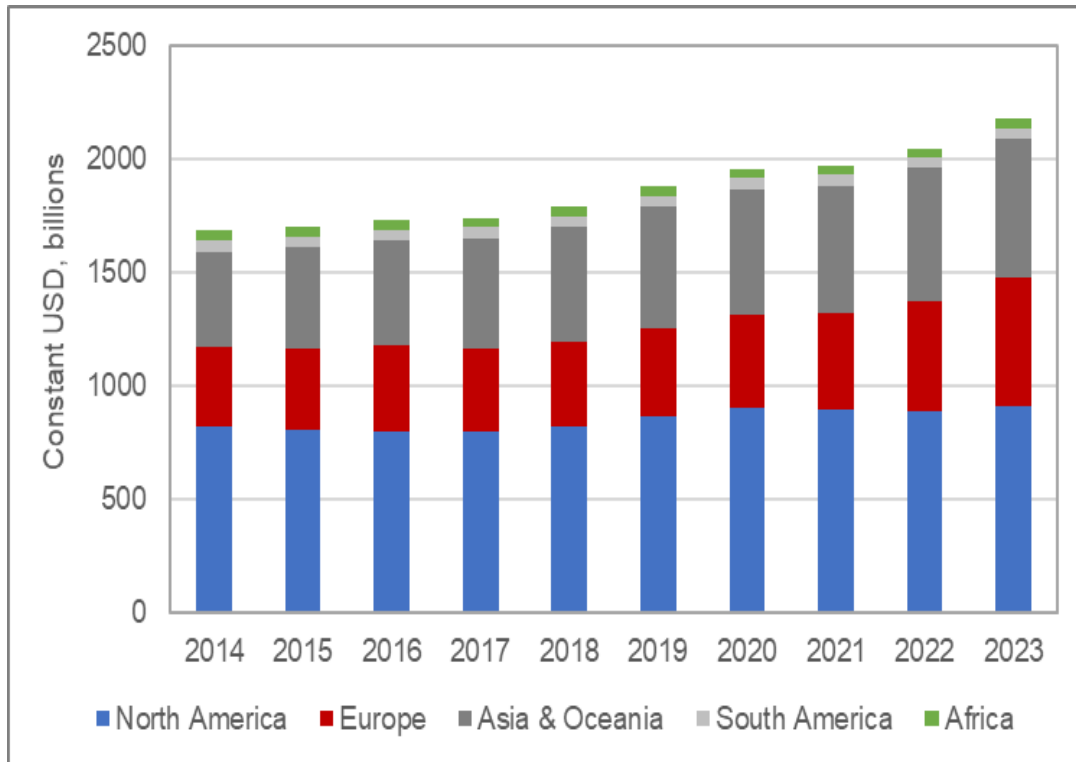
# Climate change and the impact on inflation

## Transition risks → *greenflation, fossilflation*

- Analysing the link between transition climate risks and their impact on prices is challenging, as transition climate risks include many interrelated variables, including but not limited to:
  - Different reactions of economic entities to climate change, depending on the sector and region.
  - Decisions of climate policy makers that include measures to reduce greenhouse gas emissions and promote sustainable business practices.
  - Significant investments in new technologies to reduce greenhouse gases and protect against damage caused by climate change.
  - Changes in consumer preferences towards sustainable products and services, which may affect market demand and prices.

# Defense spending increased amid heightened uncertainty, further increase could generate additional inflationary pressures

Defense expenditure (inflation adjusted)



Source: Stockholm International Peace Research Institute (SIPRI)

- Defense expenditure have inflationary effects through various channels:

- Higher energy prices** – higher demand for energy to produce or use military equipment
- Higher commodities prices** – higher demand for commodities used for production of military equipment
- Higher incomes** and thus higher purchasing power with unchanged supply of goods and services

Some estimates suggest that the further increase in defence spending is expected over the next decade