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The Future of Inflation

Boris Vujčić, Governor of the Croatian National Bank

LC-MA Forum, 20 January, 2025

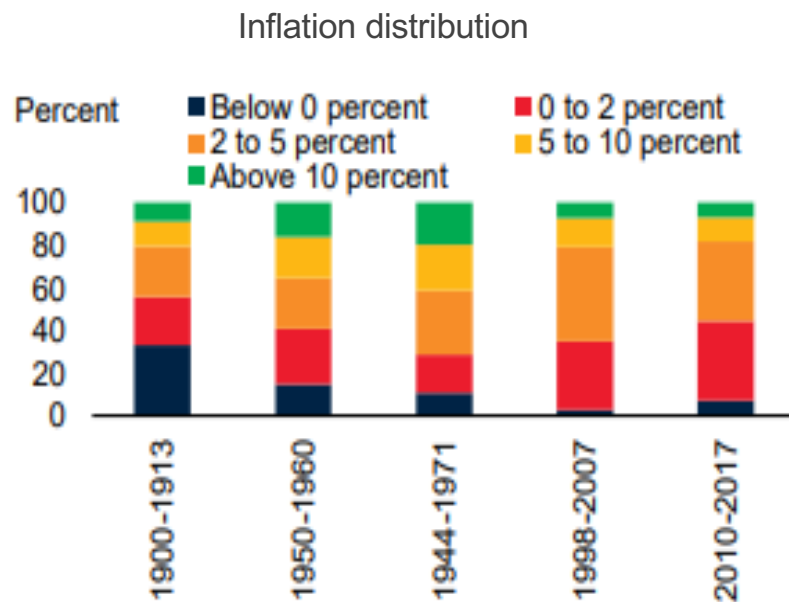


Outline

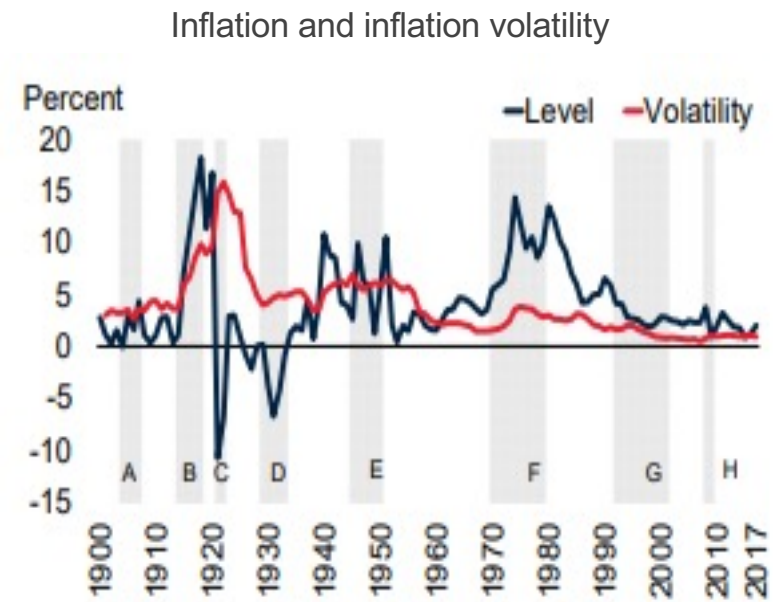
- Long-term trends in inflation and interest rates
- Impact of structural factors on inflation trends
 - (De)globalization
 - Demographics
 - Digitalisation
 - Climate change
 - Defense

Long-term trends in inflation and interest rates

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



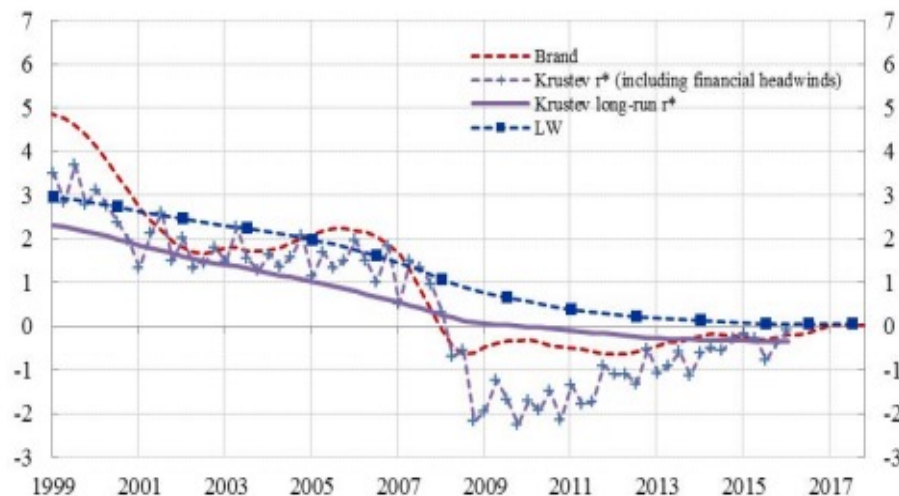
Source: World Bank



Source: World Bank

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

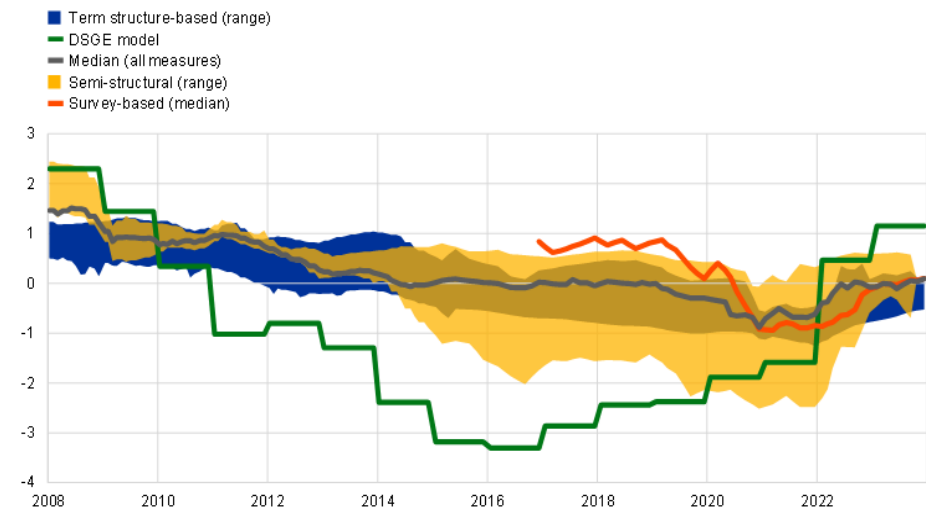
Econometric estimates for the US



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)

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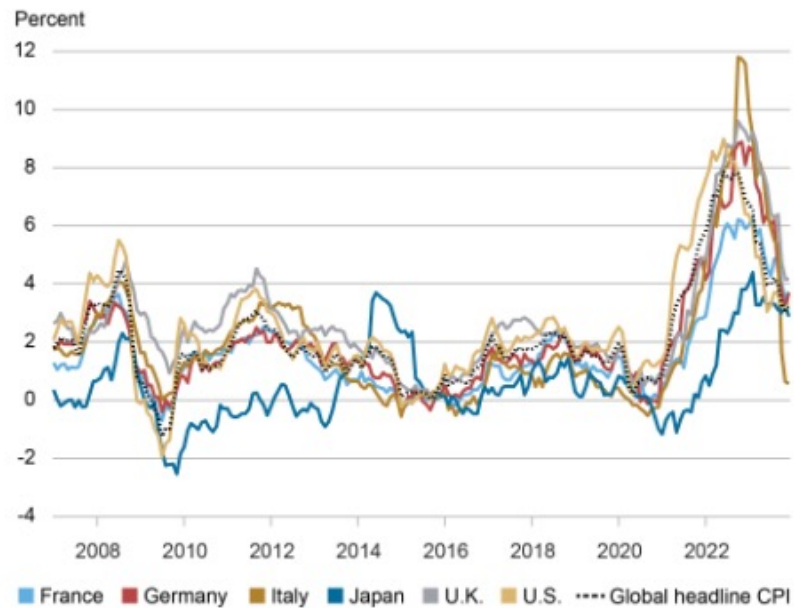
Real natural interest rates in the euro area



Sources include Eurosystem estimates, ECB, Federal Reserve Bank of New York, and Consensus Economics. Survey-based estimates reflect long-run interest rate expectations minus inflation. Term structure-based, semi-structural, and DSGE-based estimates are derived from key academic studies. Data covers up to Q3 or Q4 2023, depending on the estimate. Source: Eurosystem estimates, ECB calculations

Recent period of strong surge and gradual return of inflation towards the target arose the question of future trends in inflation and interest rates

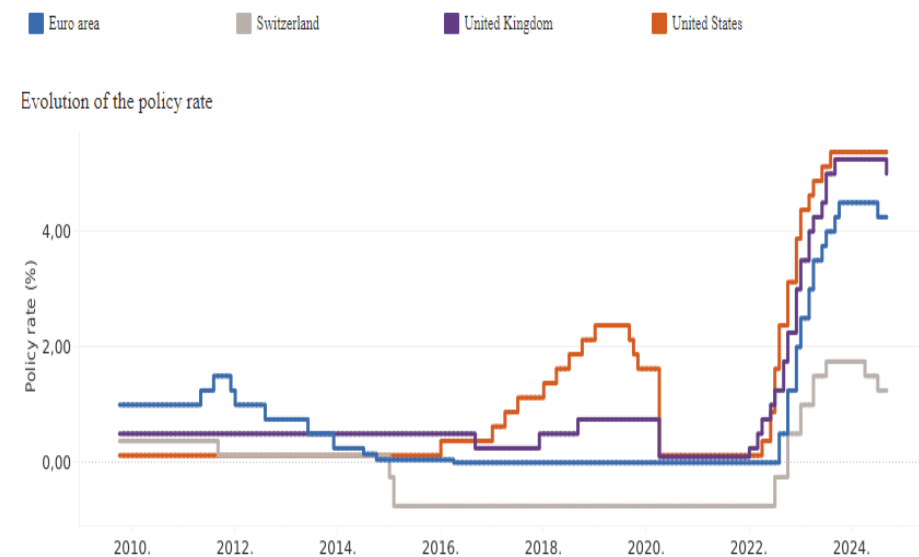
Headline CPI inflation in selected countries



Source: OECD

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Central bank interest rates



Source: BIS

Impact of structural factors on inflation trends

Globalization: Disinflationary impact for over 50 years

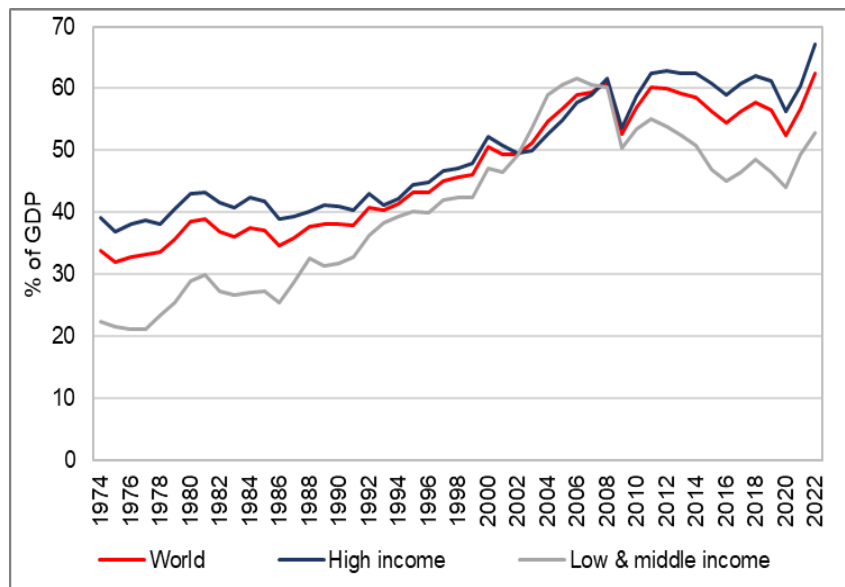
- Rapid economic integration due to globalization has reduced barriers to the free movement of people, capital, goods, services, information, and knowledge
- Trade liberalization and falling tariff rates, as features of globalization, have led to an increase in the share of global imports and exports 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.

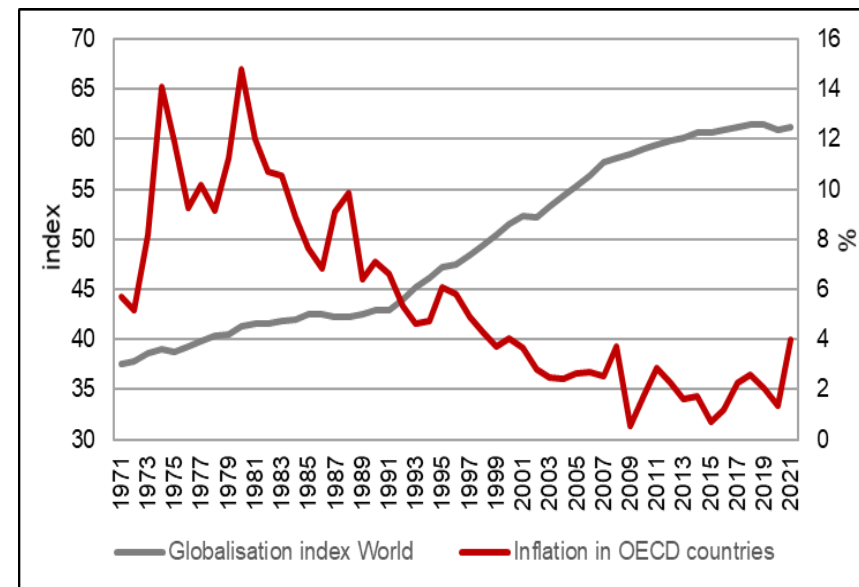
Higher level of openness of countries has contributed to lower inflation globally for a long time,...

Trade openness



Source: World Bank

Globalisation index and inflation in OECD countries

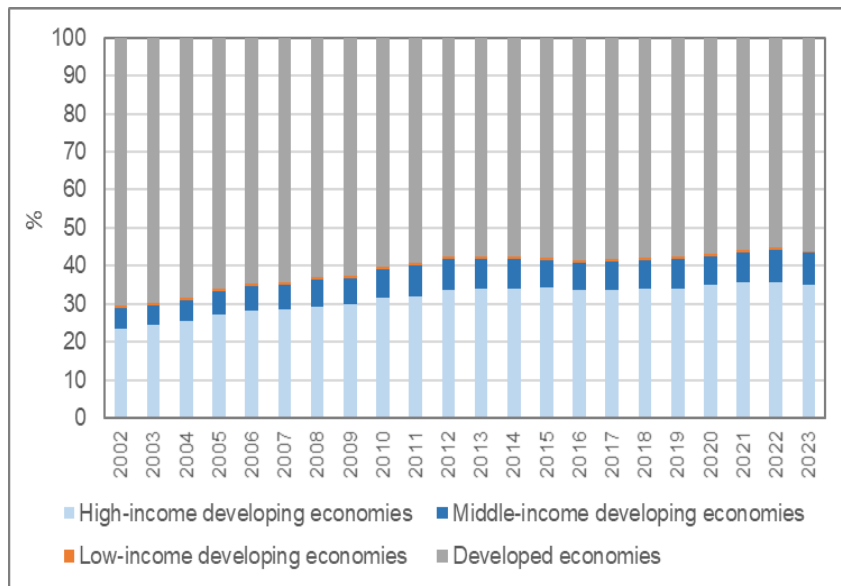


Note: The index measures globalization on a scale from 1 to 100, where higher values indicate a higher degree of globalization.

Sources: KOF Swiss Economic Institute, OECD

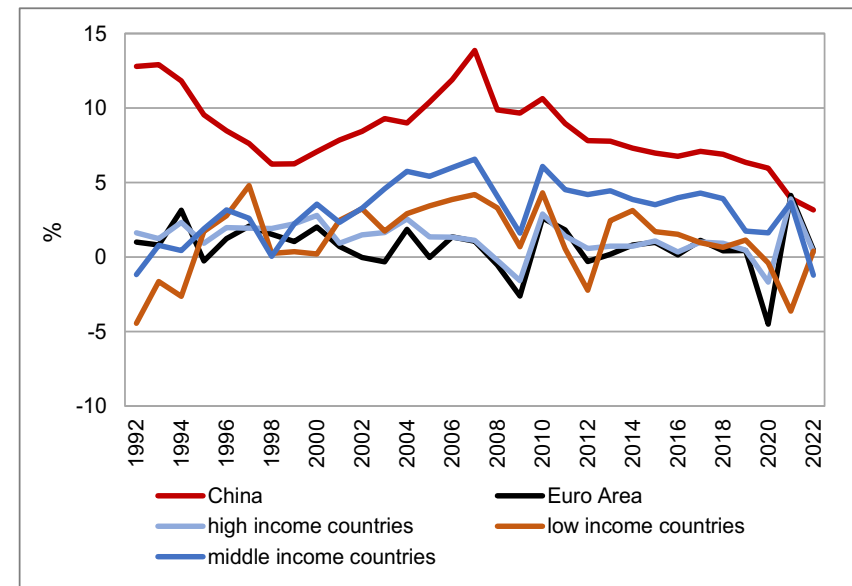
...which reflected higher productivity growth in the China, middle and low income countries and higher involvement in global trade flows

Export share of selected groups of countries in total world export



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

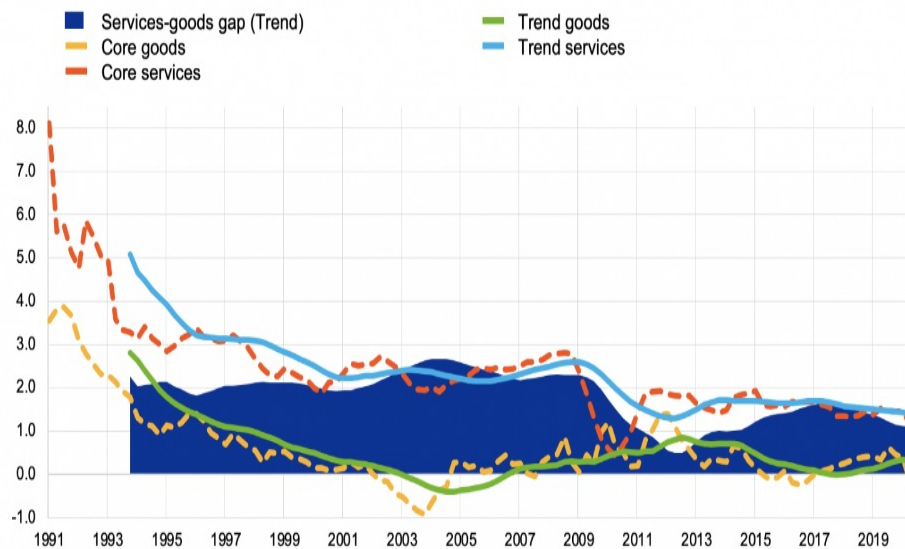
Annual growth rate of labour productivity in China and selected groups of countries



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

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

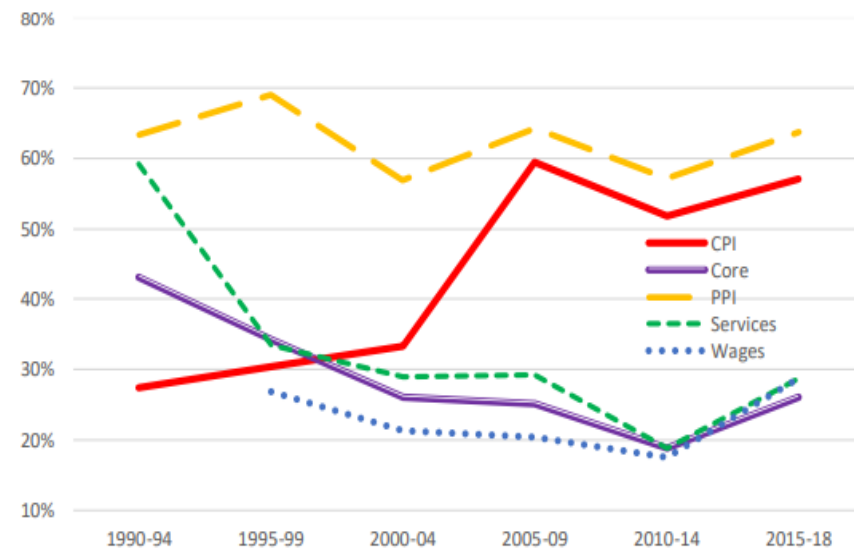


Sources: ECB calculations and national sources.

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.

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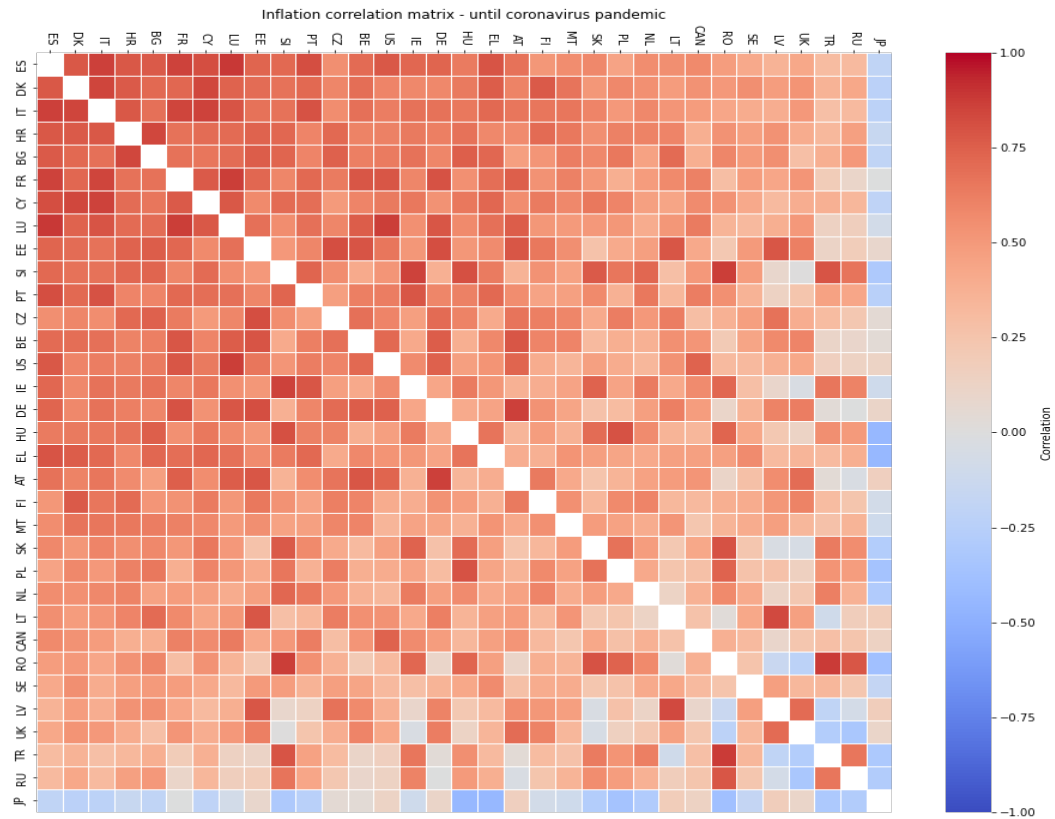
Percent of variance of inflation measures in advanced economies explained by 1st Principal Component



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

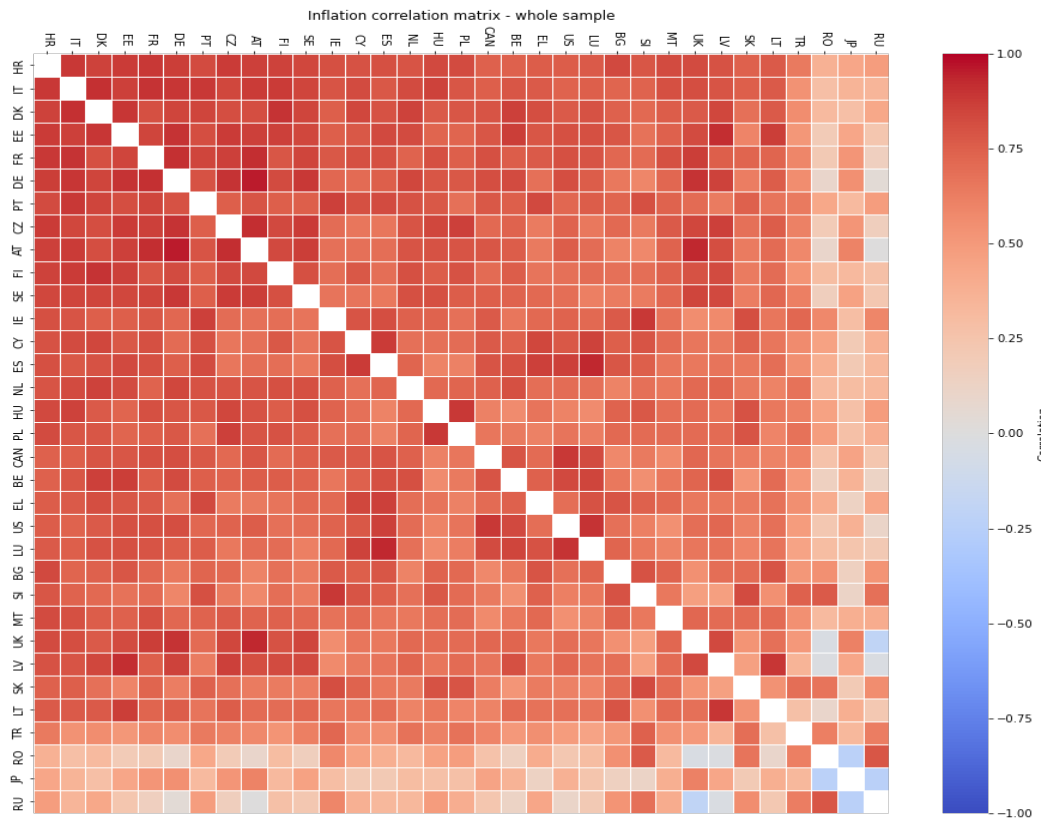
Source: BIS

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

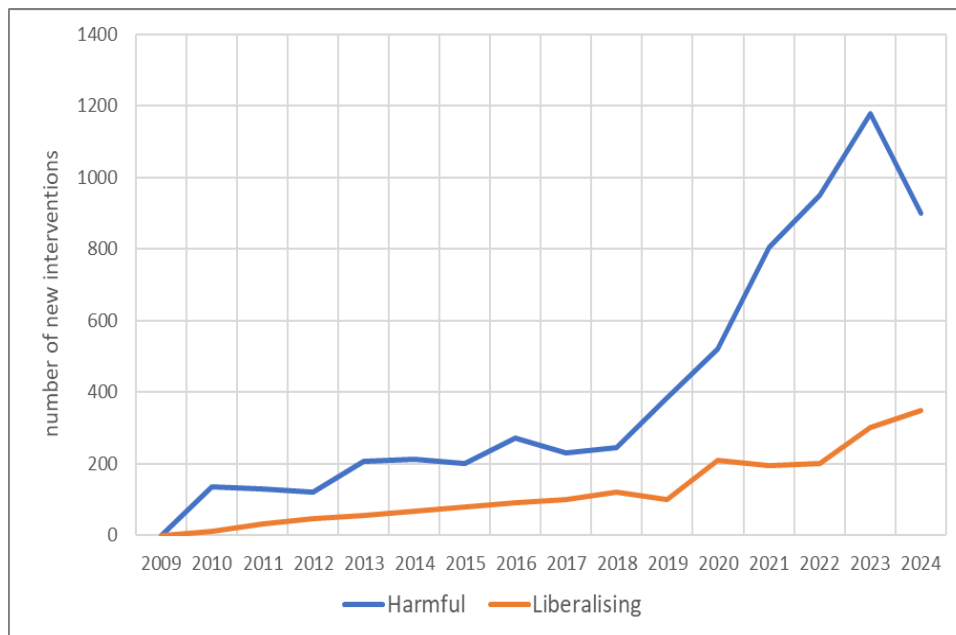
Recently, the issue of deglobalization and fragmentation is becoming more and more important

- 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

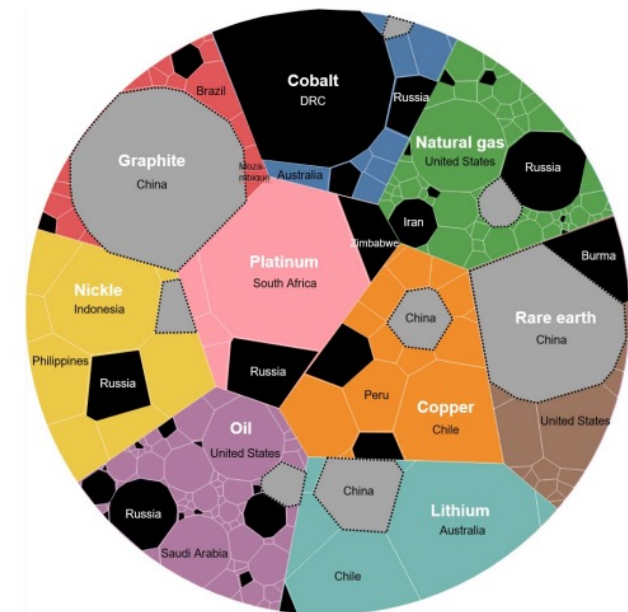
New trade interventions per year



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

Demography impacts inflation through two main channels

1. Savings rate effect

- 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 increases the saving rate and thus drives down the natural rate -> **disinflationary effect**

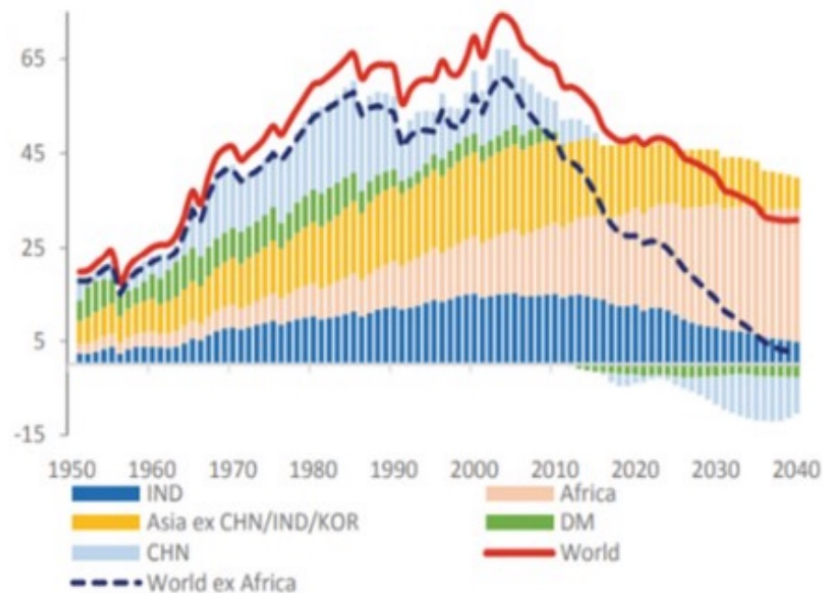
2. Different preferences among different age groups

- 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
- The overall impact depends on the demographic structure and preferences. With a higher proportion of young people, the effect is **inflationary**, particularly in services, whereas with a larger share of older people, the effect is **disinflationary**

Demographic trends: Decrease in working age population expected to continue, whereas dependency ratio could increase significantly

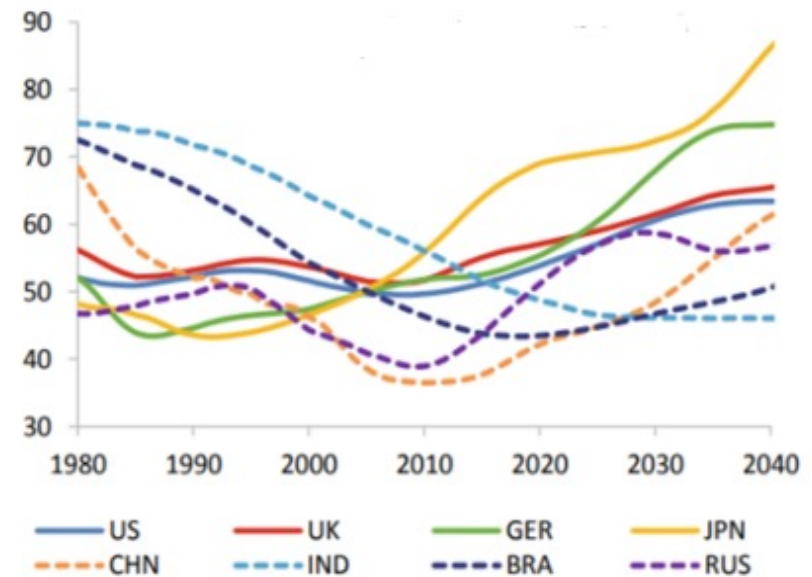
Lower labour supply could, in the long run, result in increased inflationary pressures

Working age population



Sources: UN Population Statistics

Dependency ratio (per 100 people)

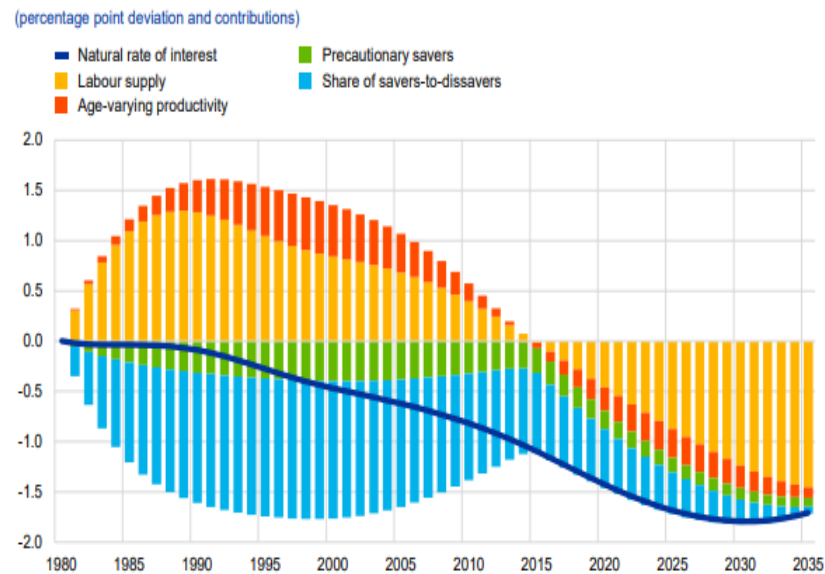


Source: UN Population Statistics

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

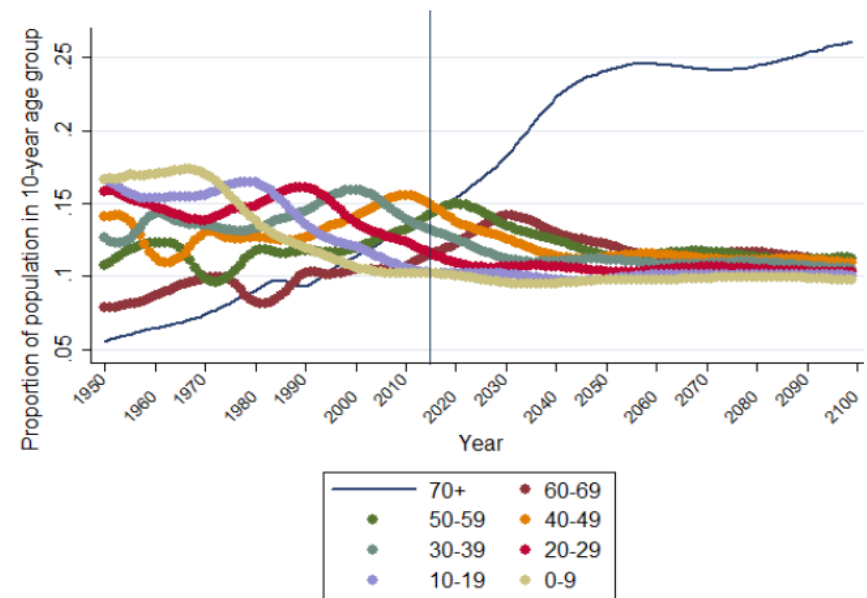
Illustration of demographic drivers of the natural rate of interest



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.

Demographic structure in the euro area



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

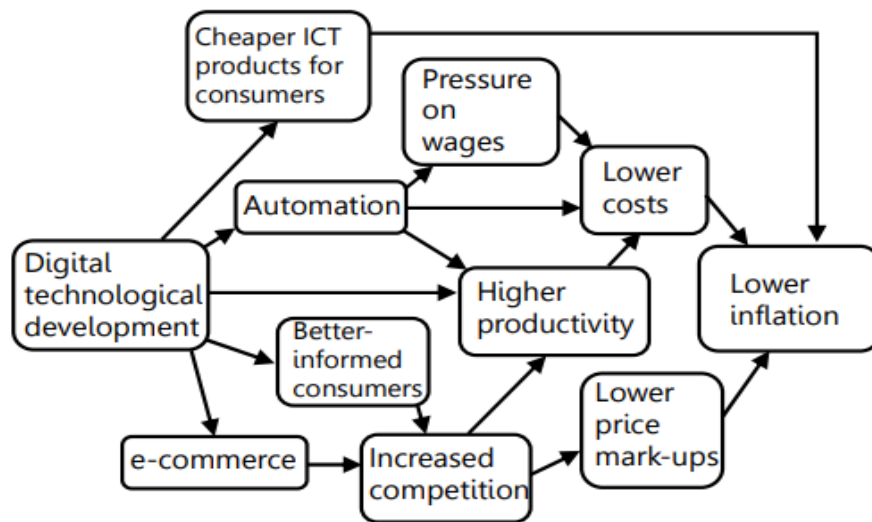
Source: UN Population Statistics

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Digitalization: impacts inflation through three main channels

The effects of digitalisation on inflation



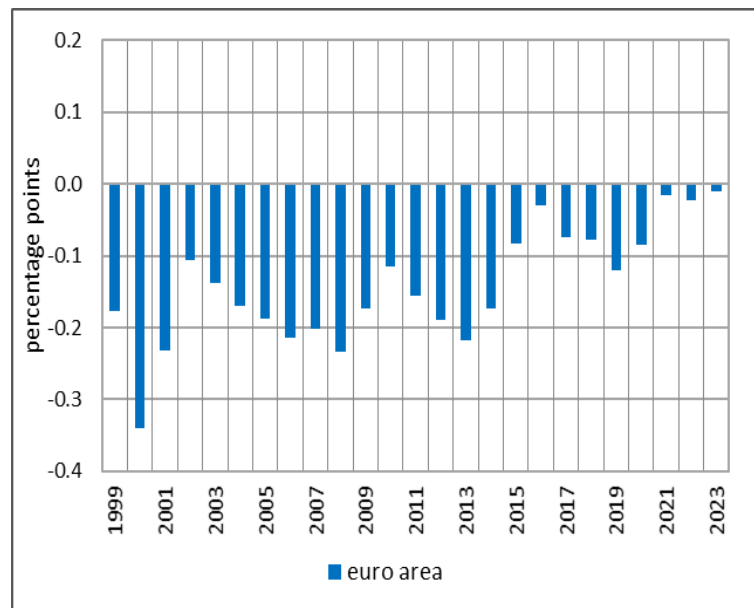
- Digitalization is one of the structural factors influencing inflation over the past 20 years
- It can impact inflation either directly through cheaper ICT products for consumers or indirectly through the use of the internet and automation
- As a result of digitalization, inflation is on average lower 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

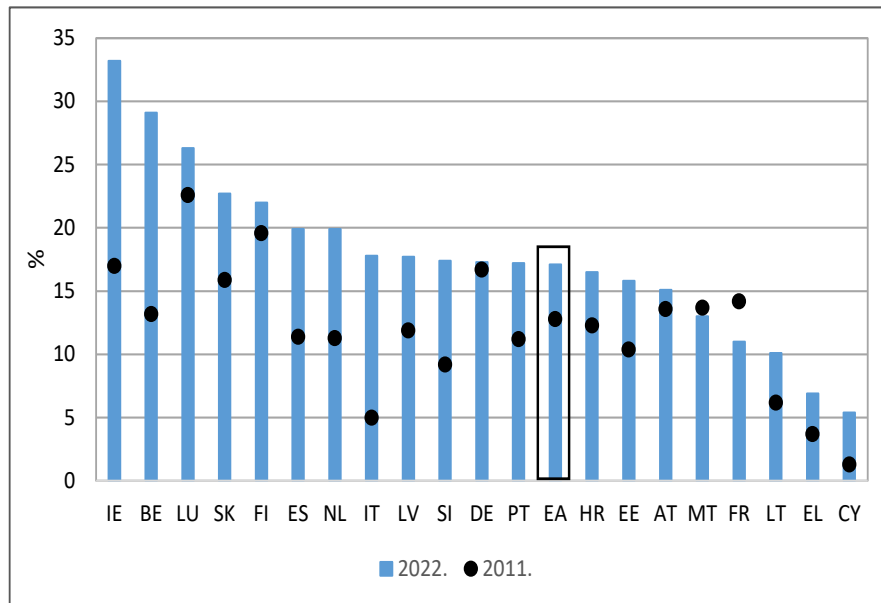
- Digitalization can directly lead to lower prices of ICT products due to technological advancements and increased production efficiency
- The availability of cheaper digital products enhances consumer access to advanced technology at reduced costs, contributing to lower inflation
- Rapid technological 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

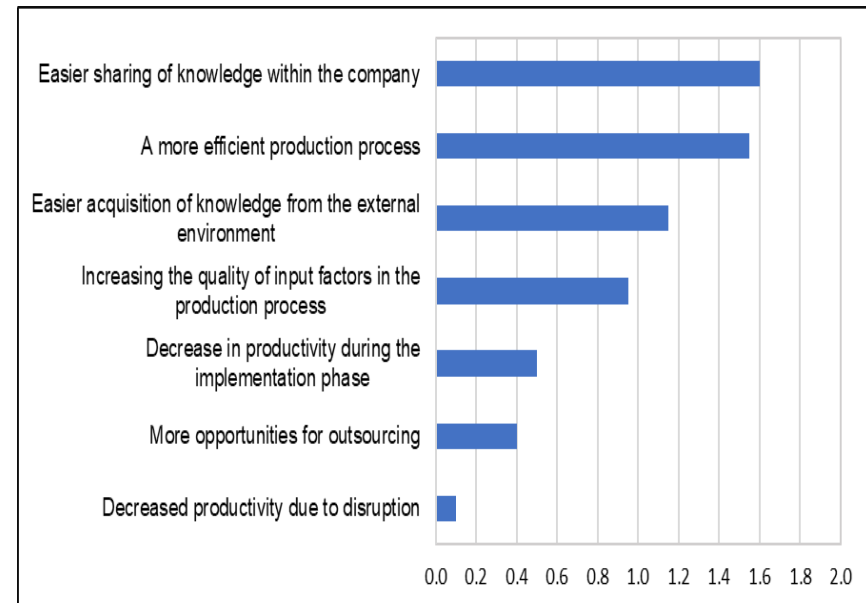
Share of e-commerce in total retail



Source: Eurostat

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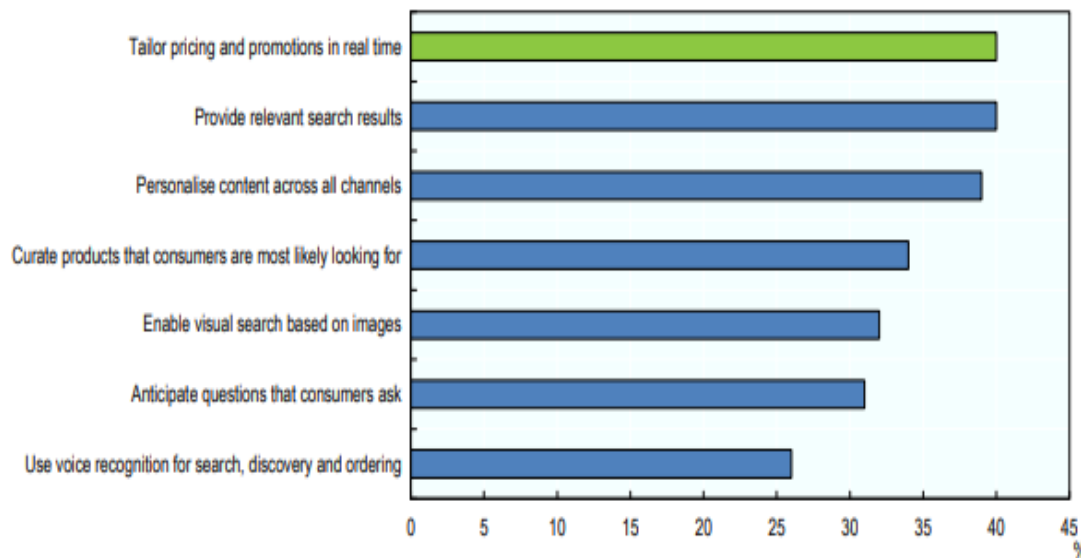
The impact of digitization on labor productivity



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

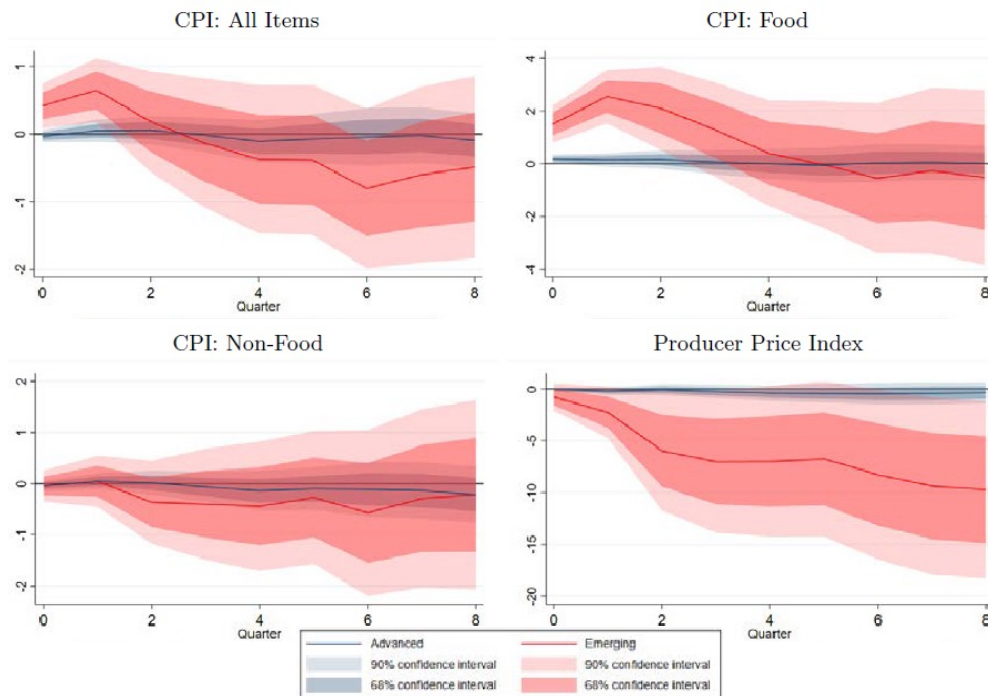
Climate change and the impact on inflation

Physical and transition risks \longleftrightarrow *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)
- Isabel 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

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 asses the changes in consumer preferences towards sustainable products and services

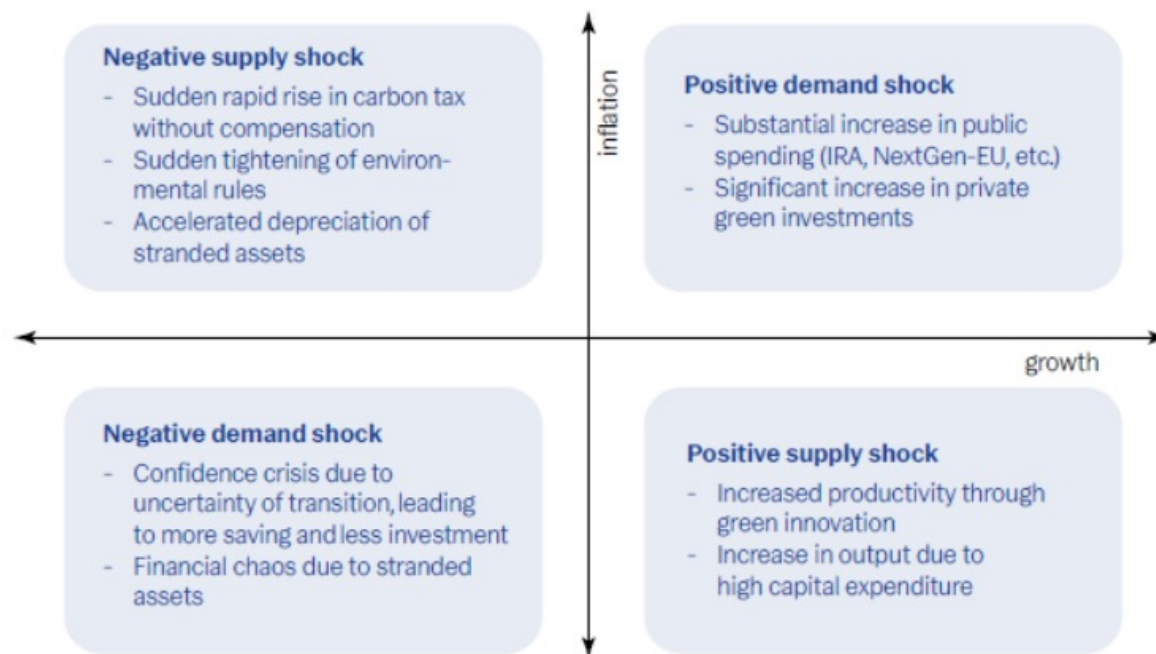
Climate change and the impact on inflation

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.

Climate shocks – supply vs. demand

Four types of shocks and their impact on growth and inflation



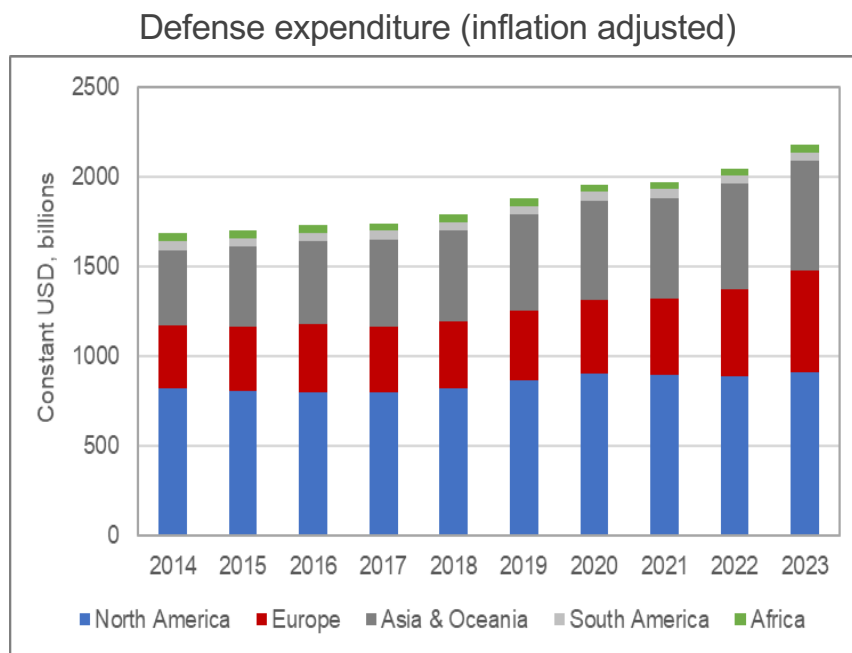
Source: BNP Paribas

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

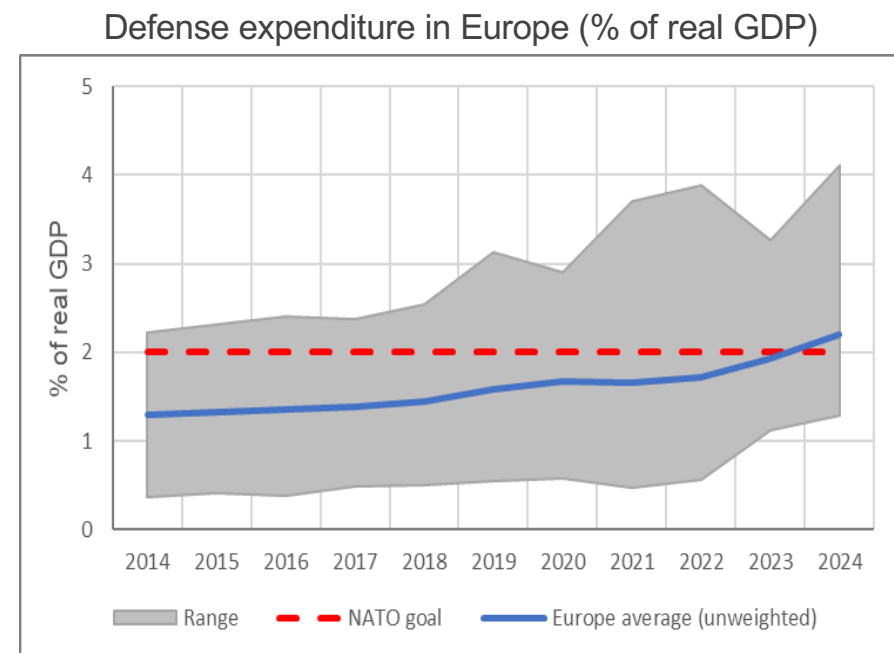
- Uncertain times brought an increase in defense expenditure across the world, which could have significant impact on inflation through fiscal expenditure that could be financed by higher taxes.

- Additionally, there are three 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** and thus higher purchasing power with unchanged supply of goods and services

Europe has reached a 2% goal only recently; Further increases, particularly in case of the change of NATO goal, would result in higher inflationary pressures



Source: Stockholm International Peace Research Institute (SIPRI)



Source: NATO

Concluding remarks – goods vs. services

Factors affecting prices in the long-run

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

Concluding remarks

- **Even if inflation is sometimes asleep, it is never dead:**
 - Recent inflation outburst remind us not to take low and stable inflation for granted.
- **Independence and credibility built upon that independence are of key importance for maintaining low inflation:**
 - Credibility is the key mechanism anchoring long-run inflation expectations, it is the main reason why we currently face relatively low sacrifice in bringing down the inflation.
- **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.
- **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.



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Thank you very much for your attention!

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Additional slides

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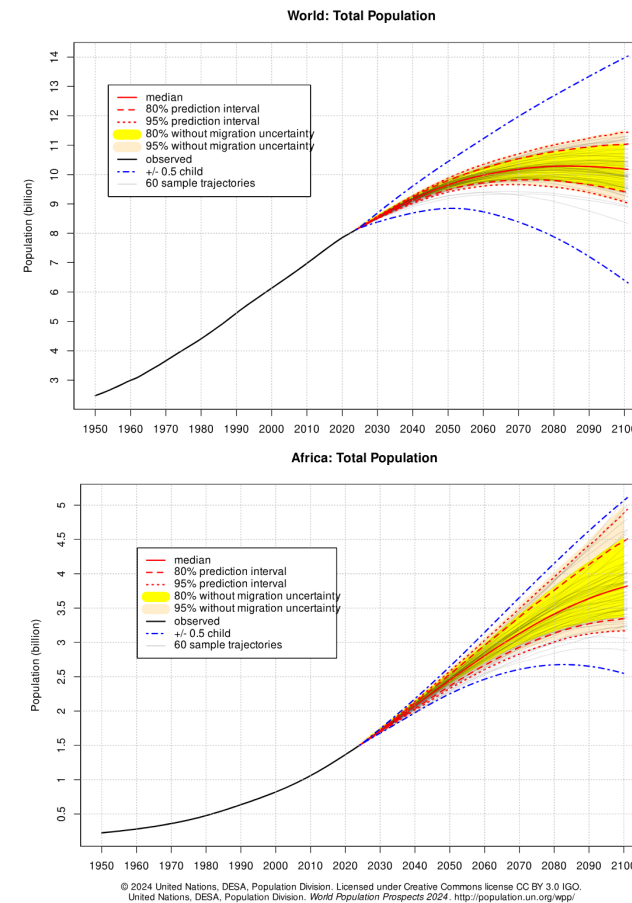
Demographic trends

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

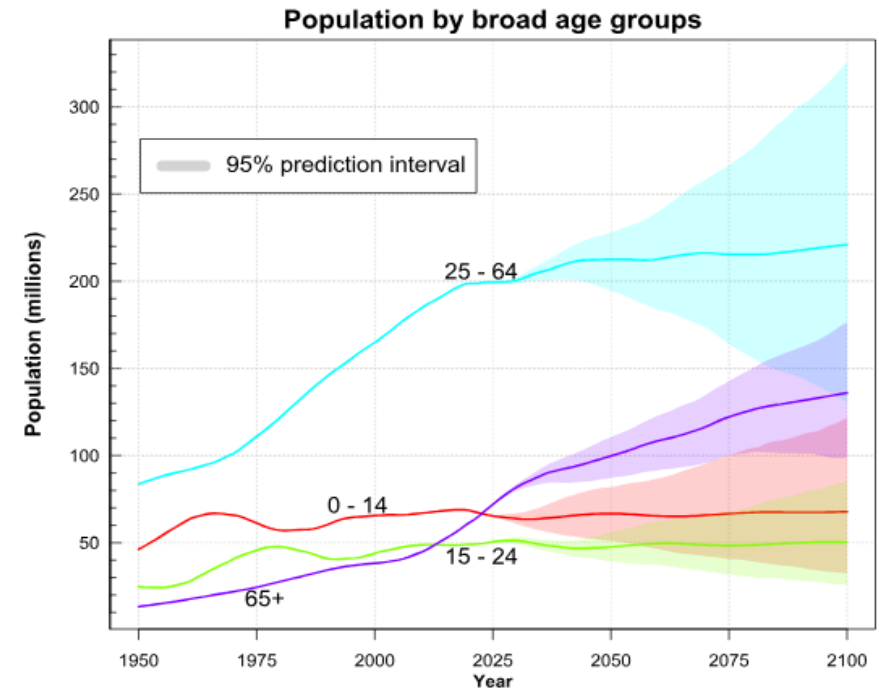
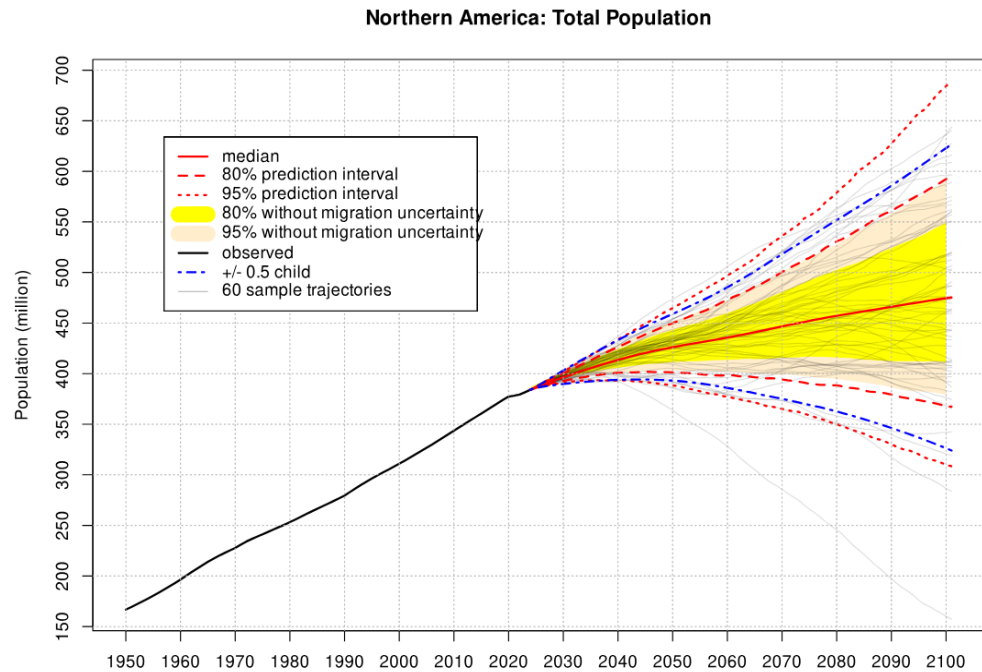
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Demographic trends

In North America, population growth is expected to slow down



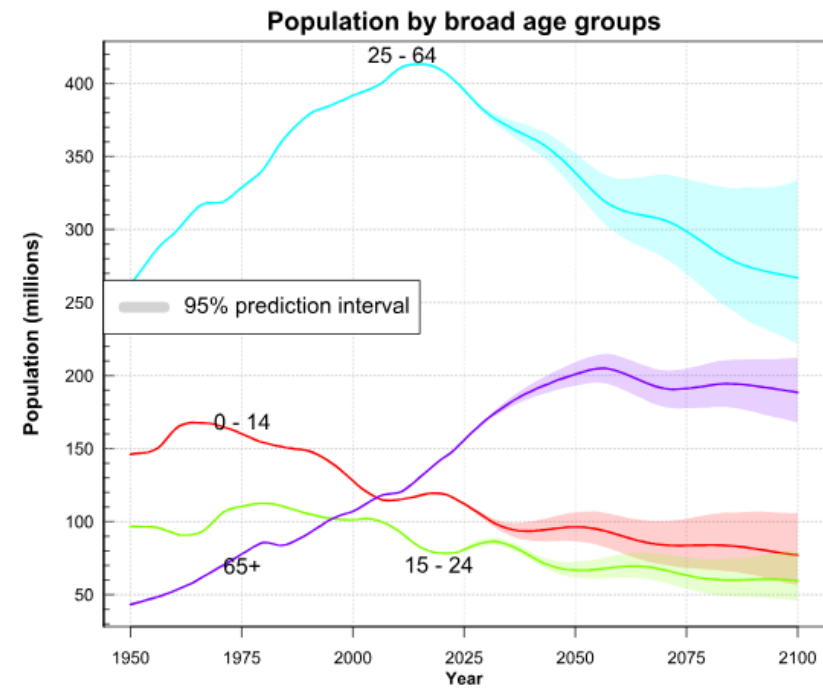
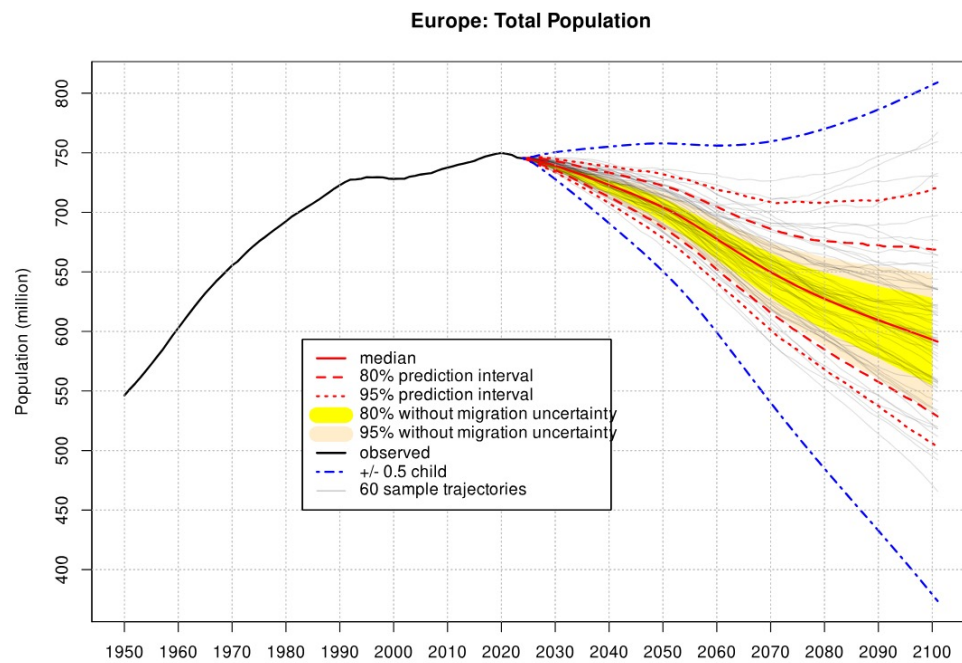
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 United Nations, DESA, Population Division. *World Population Prospects 2022*. <http://population.un.org/wpp/>

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Demographic trends

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



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

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Summary of key structural trends

HOW THE TRENDS - AS THE AUTHORS SEE THEM EVOLVING - WILL AFFECT GROWTH, INTEREST RATES & INFLATION IN DEVELOPING COUNTRIES IN THE SHORT AND LONGER TERM										
	0-10 YEARS					10-30 YEARS				
	Productivity	Real Growth	Real Rate	Inflation	Nominal Rate	Productivity	Real Growth	Real Rate	Inflation	Nominal Rate
AGEING	-	-	-	+	0/+	-	-	-	+	0/+
An ageing population is less innovative. The working population is shrinking in many industrialised countries. Real interest rates will fall due to lower real growth and higher total savings (Offer > Demand). Inflation will rise due to a declining labour force compared with a stable number of consumers. The rise in inflation is likely to exceed the fall in real interest rates, leading to higher nominal interest rates in the short and long term.										
GOVERNMENT DEBTS	0	+	+	+	+	0	-	-	+	+
A flexible budgetary policy makes money more expensive because it increases the demand for money. Real interest rates also rise because the increase in debt stimulates the economy in the short term. In the longer term, however, austerity follows, which weighs on growth and real interest rates. Higher inflation is 'allowed' by central banks because, in a context of financial repression, it keeps the huge debt pile under control. This pushes nominal interest rates higher.										
INNOVATION	0	0	0	0	0	+	+	+	-	0
In the short term, we expect innovation to have little effect on productivity and the other various economic parameters. In the medium to long term, we expect innovation to raise productivity by at least 1%. This raises growth and real interest rates. On the other hand, there is a downward pressure effect on inflation, which neutralises the effect on nominal interest rates.										
CLIMATE	-	0	0/+	+	+	+	0	0	0/+	0
In the short term, the impact on real growth is neutral, as increased investments are largely offset by lower productivity due to stranded assets and reduced investments elsewhere that could generate productivity gains. Carbon taxes remain low. Real interest rates are stable to slightly higher due to the huge investment push (large demand for money). Commodity & other shocks push inflation structurally higher. Nominal interest rates rise. Over the long term, productivity increases due to increased energy efficiency. Higher carbon taxes and increasing structural damage from climate change weigh on real growth. Investment flows remain stable at a high levels. The effect on real interest rates becomes neutral. Inflation shocks become less pronounced, but they remain due to climate disruption. Nominal interest rates stabilise at a slightly lower level than in the first years of the transition.										
MULTI-GLOBALISATION	-	0/-	0	+	+	0/+	0/+	0/+	0	+
The integration of new countries into the supply chain increases the cost of products, while the increase in traded digital services only reduces overall inflation in the long run. In the short term, therefore, we see higher inflation and somewhat lower productivity. The impact on growth is slightly negative in the coming years but rather positive in the long term. In the long run, a multi-global world may put upward pressure on real interest rates due to a higher term premium, especially if we move towards a multi-polar world. Nominal interest rates will rise in the short term because of higher inflation, and in the long run because of higher real interest rates.										
TOTAL	-	0/-	0	+	+	+	+	0/+	+	+
The combined evolution we expect for the five major trends points to stable to lower productivity and economic growth in the short term. In the long run, the strong positive impact on productivity coming from innovation and climate transition will more than offset the negative effects of ageing and austerity / savings. The impact on real interest rates is rather neutral in the short term (slightly lower real growth but higher term premium) and slightly positive in the long term. In both the short and long term, the combination of the five trends points to a predominantly higher inflation rate and a structurally higher nominal interest rate compared to the past two decades.										
<i>Source: The New World Economy in 5 Trends, Koen De Leus & Philippe Gijssels</i>										

Concluding remarks - extended

Factors affecting prices in the long-run

	Disinflationary forces	Inflationary forces
Goods prices	<ul style="list-style-type: none"> - China with its excess capacity - Deglobalisation leading to reduced external demand for domestic products and services - Digitalisation - cheaper ICT goods - Digitalisation - easier price comparison and increased competition - Automation (reducing costs: efficiency gains, replacing labour) 	<ul style="list-style-type: none"> - Geopolitical tensions driving a reorganisation of global value chains and leading to the fragmentation in global trade - Increase in protectionist barriers - Deglobalisation (leading to higher energy prices, labour and other production costs) - Constrained labour supply due to ageing may increase workers bargaining power - Digitalization enable the rise of dominant "superstar" firms with significant market power - Digitalisation - development of personalized pricing models - Climate policies and the shift towards greener energy (higher costs in manufacturing and logistic, higher energy prices) - Increase spending on defense could result in higher overall taxes and higher purchasing power due to higher incomes, without adding to new supply, resulting in higher energy prices
Services prices	<ul style="list-style-type: none"> - Globalization in services trade - Digitalisation - cheaper ICT services - Digitalisation - easier price comparison and increased competition - AI, automatition and digitalisation could increase productivity and lower costs, perhaps disproportionately in the services sector 	<ul style="list-style-type: none"> - Higher income levels and population ageing gradually shift domestic demand towards services - Constrained labour supply due to ageing may increase workers bargaining power - Digitalization enables the rise of dominant "superstar" firms with significant market power - Digitalisation - development of personalized pricing models - Climate policies and the shift towards greener energy (higher input costs in energy-intensive services like transportation)