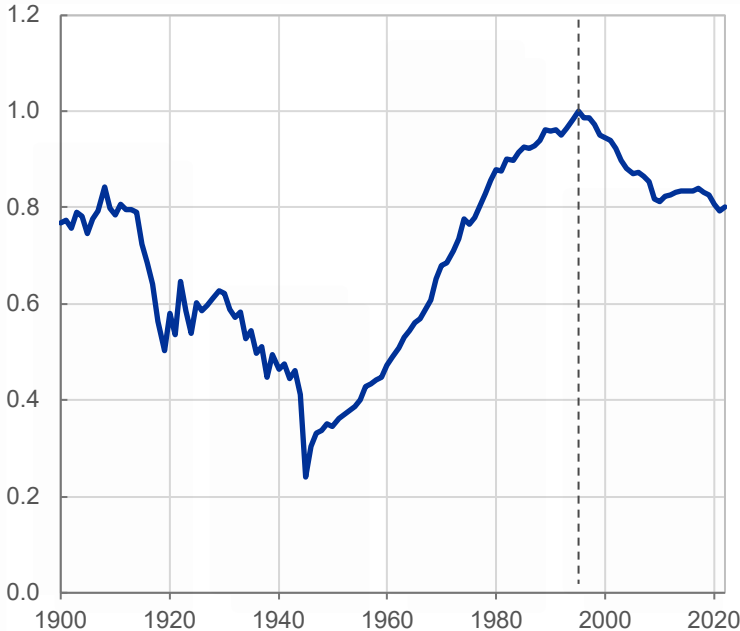# From laggard to leader? Closing the euro area's technology gap

Isabel Schnabel, Member of the Executive Board of the ECB
Inauguration lecture, EMU Lab, European University Institute

16 February 2024

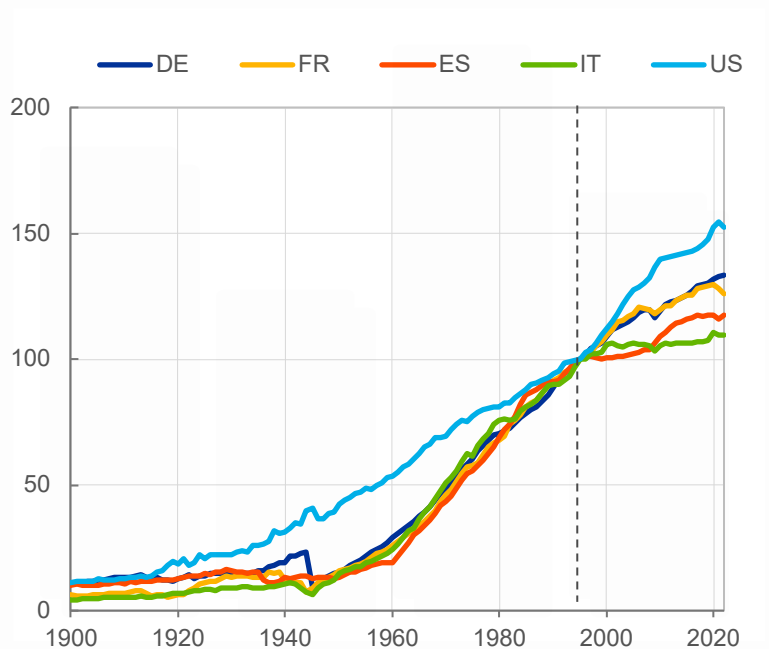EUROPEAN CENTRAL BANK
EUROSYSTEM

Long-term developments in productivity per hour worked

Ratio of EA-4 to US

Index: 1995 = 100

Source: Long-Term Productivity Database and ECB calculations.
Notes: EA-4 is a weighted average of productivity developments in Germany, France, Italy and Spain.
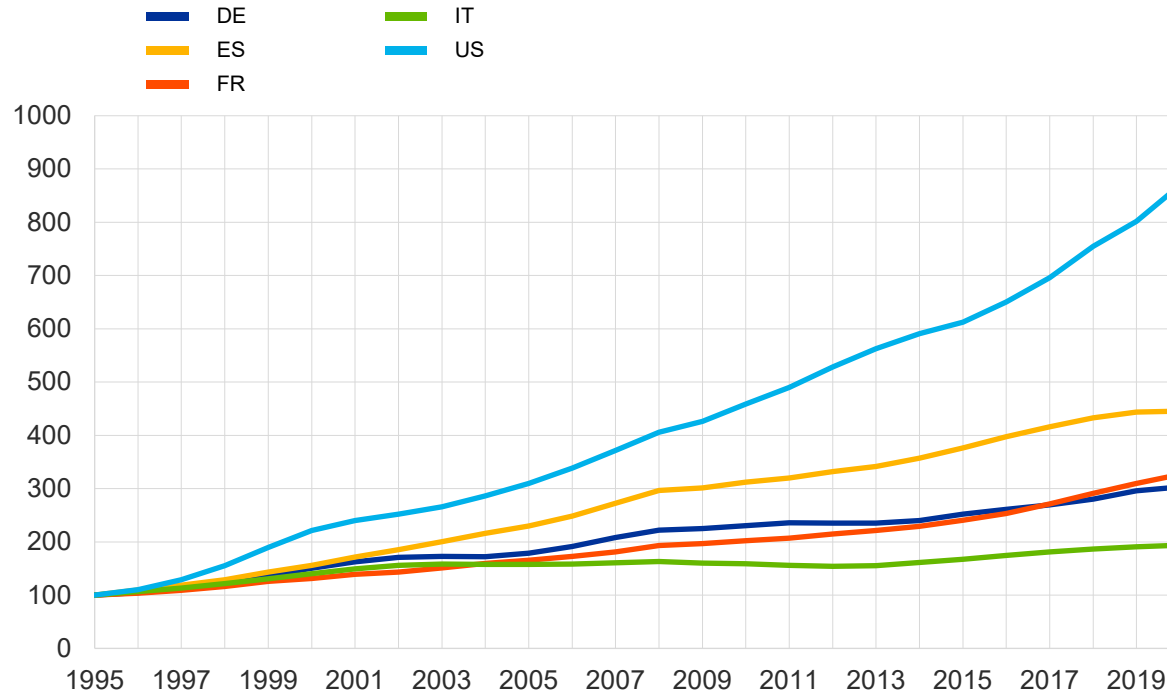
Source: Long-Term Productivity Database and ECB calculations.

Rising gap in IT-related capital stock between euro area and United States

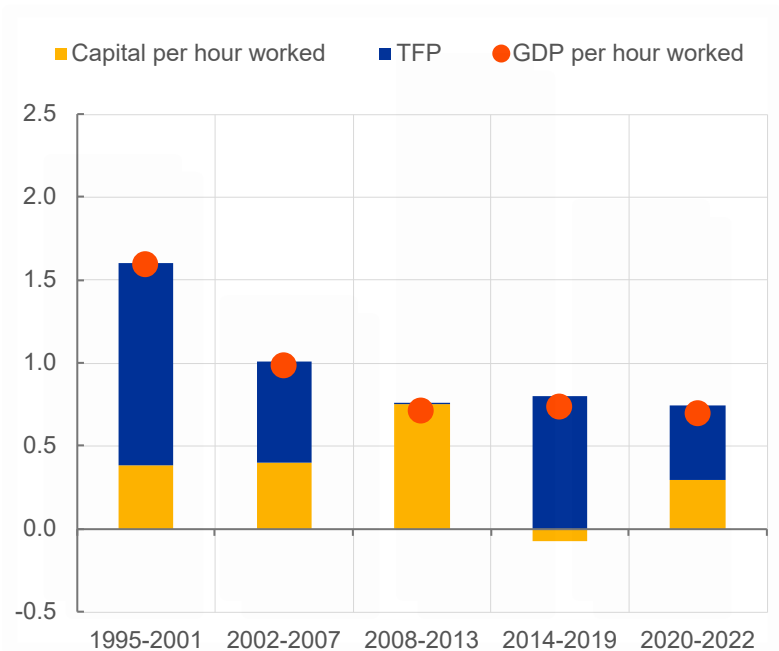**Real IT-related capital stock**
(index: 1995 = 100)

Legend: DE, ES, FR, IT, US

Contributions to growth in GDP per hour worked
(%)

Euro Area

Legend: ■ Capital per hour worked   ■ TFP   ● GDP per hour worked

Chart axis (y): -0.5, 0.0, 0.5, 1.0, 1.5, 2.0, 2.5

Categories (x): 1995-2001, 2002-2007, 2008-2013, 2014-2019, 2020-2022

United States

Legend: ■ Capital per hour worked   ■ TFP   ● GDP per hour worked

Chart axis (y): -0.5, 0.0, 0.5, 1.0, 1.5, 2.0, 2.5

Categories (x): 1995-2001, 2002-2007, 2008-2013, 2014-2019, 2020-2022

Source: AMECO data and ECB calculations.
Note: Refers to Euro Area 19.
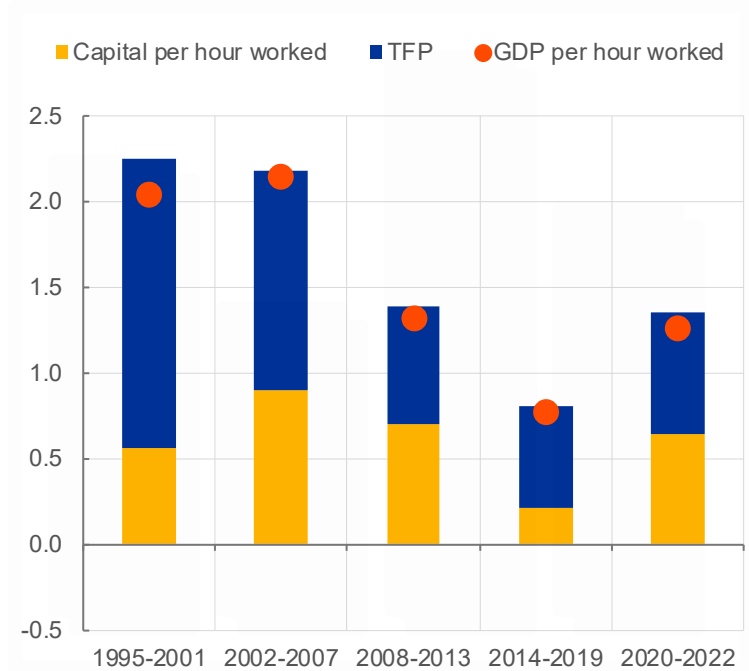
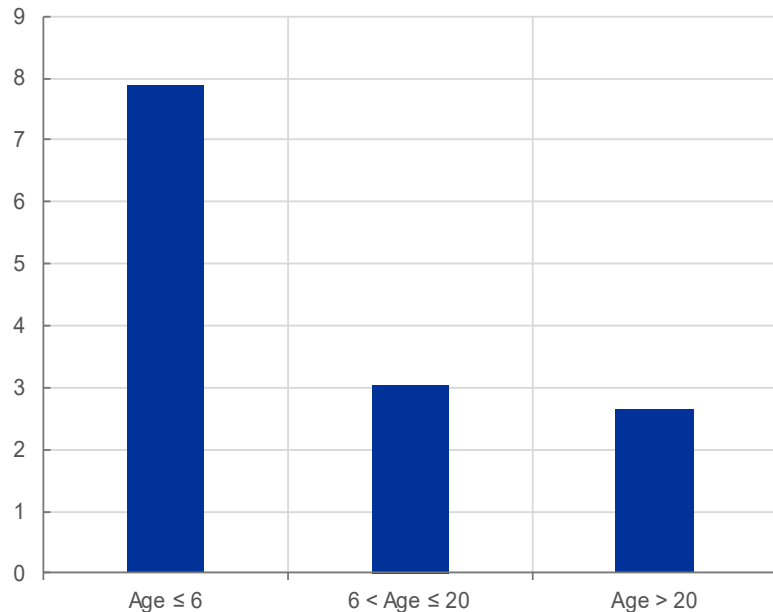Source: AMECO data and ECB calculations.

Lower barriers to entry and higher competition support rise of young superstar firms

## Annual labour productivity growth of surviving firms by age group
(mean, in %)

Source: ECB Economic Bulletin Issue 1(2022). Data from Bureau van Dijk Orbis, the Bank for the Accounts of Companies Harmonized (BACH) database and ECB staff calculations.
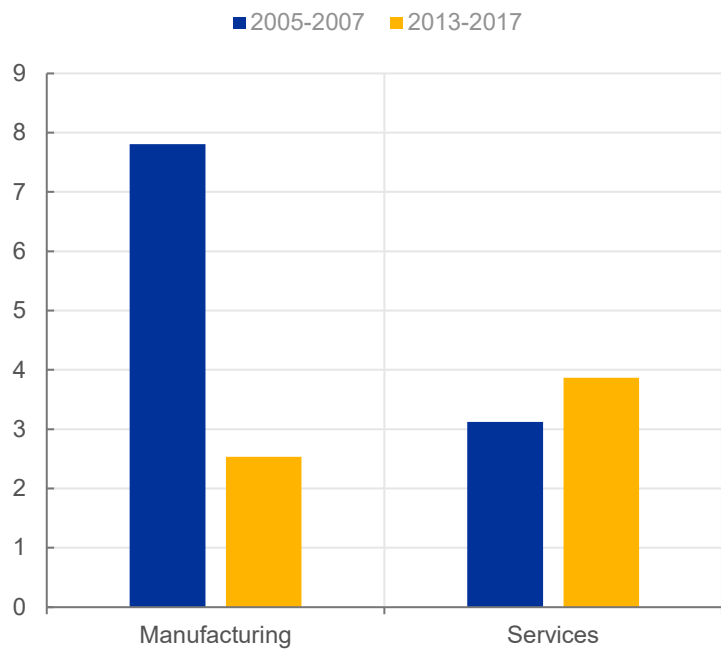
Average characteristics of young superstar firms and other young firms
(lhs: ratio; rhs: number of employees, intangible intensity in EUR thousands, labour productivity in EUR ten-thousands)
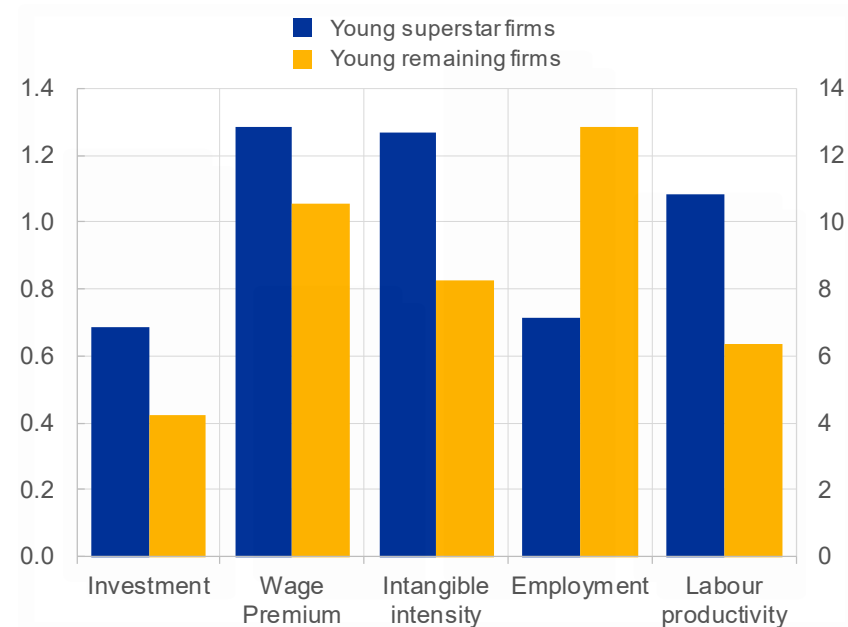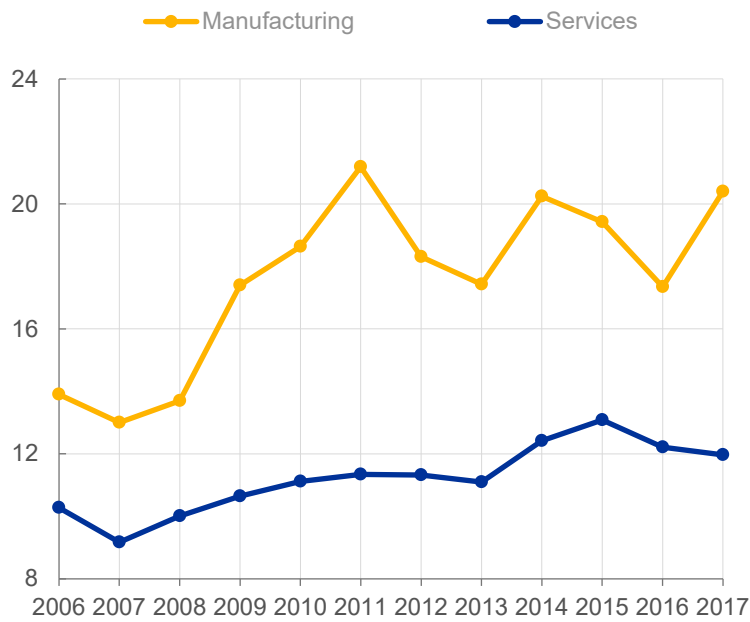

Notes: Each bar represents the coefficient from a regression of each variable listed in the x-axis on a dummy for the firm being a young superstar firm and a set of fixed effects controlling for the different countries, sectors and years. Productivity is computed as real value added per employee at the firm level. Intangible intensity is computed as the ratio of intangible capital to number of employees. Investment is computed as the change in real fixed tangible capital over the previous period's real fixed tangible capital. The period considered begins after the great financial crisis to avoid potential slumps.

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Decline in productivity growth in manufacturing coincided with lower business dynamics

TFP growth of high-tech frontier firms

Legend: ■ 2005-2007 ■ 2013-2017

(Bar chart with categories: Manufacturing, Services; y-axis 0 to 9)

Age of high-tech frontier firms
(years of activity)

Legend: ● Manufacturing ● Services

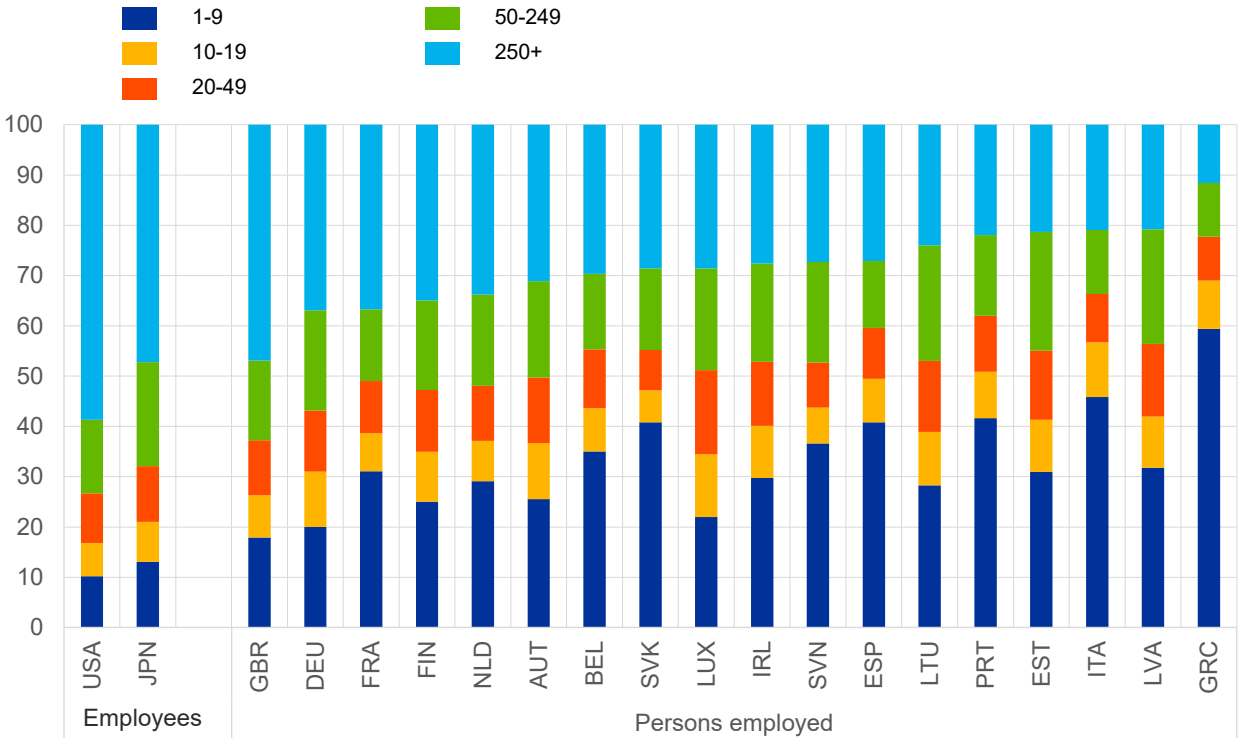(Line chart, x-axis 2006–2017, y-axis 8 to 24)

Sources: Occasional Paper Series No. 268 (ECB). Own calculations using ECB iBACH-Orbis Database.
Notes: Weighted average annual TFP growth rates of the top 5% most productive firms in a given year in a 4-digit industry. Manufacturing industries are classified according to their R&D intensity (R&D by value added of the industry) into high-technology and medium high-technology on the one hand, and medium low-technology and low-technology on the other hand following the Eurostat classification. Service industries are classified into knowledge-intensive services and less knowledge-intensive services based on the share of tertiary educated persons at NACE 2-digit level, also following Eurostat standards.

Employment by enterprise size, business economy
(percentage of total employment)

Legend:
- 1-9
- 10-19
- 20-49
- 50-249
- 250+

Employees: USA, JPN

Persons employed: GBR, DEU, FRA, FIN, NLD, AUT, BEL, SVK, LUX, IRL, SVN, ESP, LTU, PRT, EST, ITA, LVA, GRC

Source: OECD.
Notes: Legend refers to number of employees/ persons employed at firm level.

Estimated impact of digitalisation on TFP growth of firms with different initial TFP levels
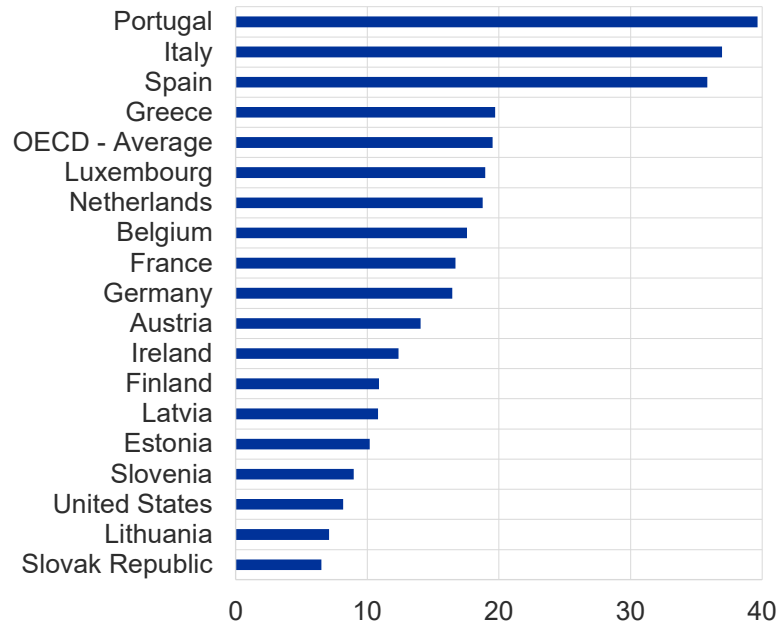### (digital investment intensity)

Share of adults without upper secondary education
(% of 25-64 year-olds)
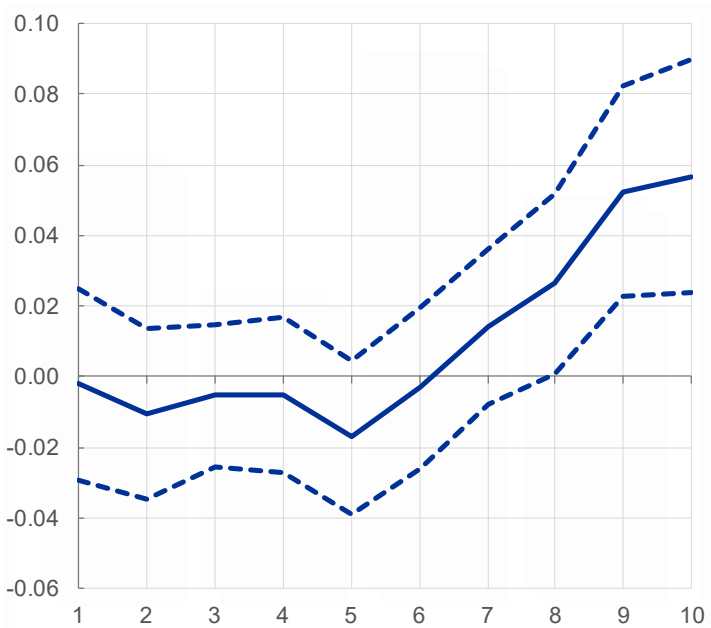
Source: Anderton, R., Botelho, V. and Reimers, P., "Digitalisation and productivity: gamechanger or sideshow?", Working Paper Series, No 2794, ECB, March 2023.
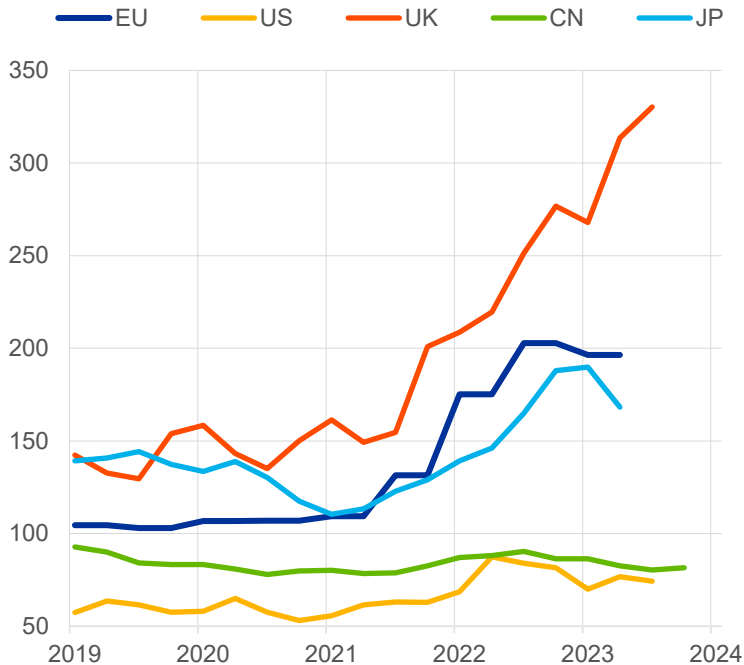Note: x-axis: proximity to frontier (decile, lowest-highest). Dashed lines refer to confidence intervals.

Source: OECD.
Notes: Data refer to 2022 or latest available.

Higher electricity prices undermine price competitiveness and industrial production
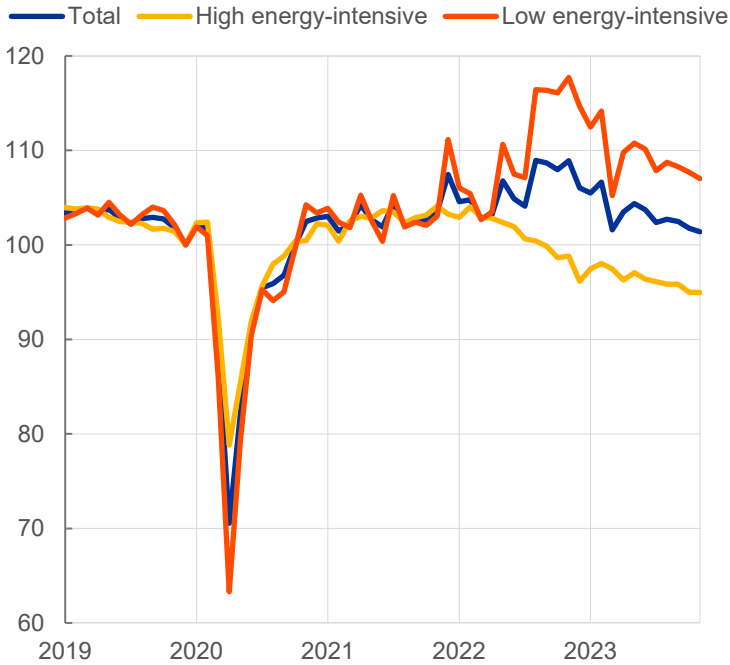
Industrial retail electricity prices
(EUR/MWh)

Legend: EU, US, UK, CN, JP

Sources: Eurostat, EIA, DESNZ, CEIC, METI and ECB staff calculations.
Latest observation: Q2 2023 for EU and JP, Q3 2023 for US and UK and Q4 2023 for KR and CN.

Euro area industrial production
(index: December 2019 = 100)

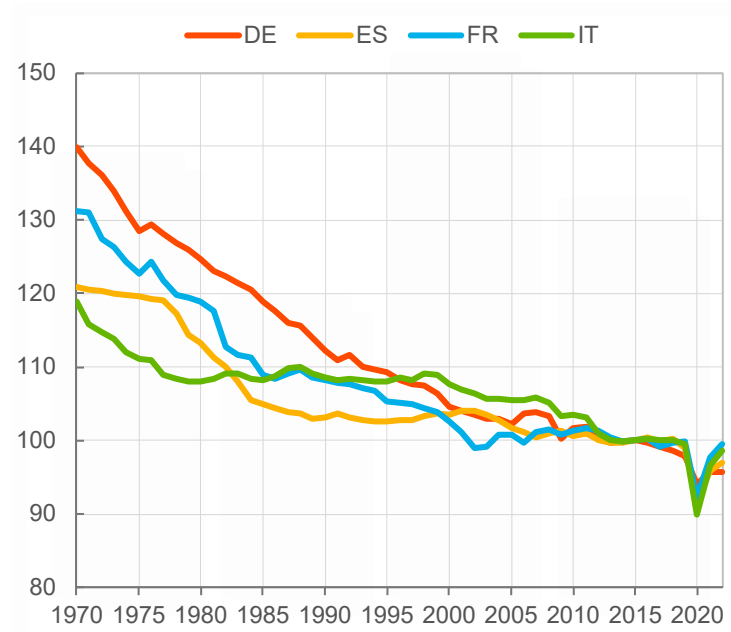Legend: Total, High energy-intensive, Low energy-intensive

Sources: Eurostat, Trade Data Monitor and ECB staff calculations.
Notes: Data are seasonally-adjusted. Industrial production indices for individual sectors are aggregated with value-added weights. Low (high) energy-intensity sectors are defined as those with an energy intensity lower (higher) than that of the median sector. For more details, see Chiacchio, De Santis, Gunnella and Lebastard (2023).
Latest observation: November 2023.

Old-age dependency ratio in 2022 and increase until 2070
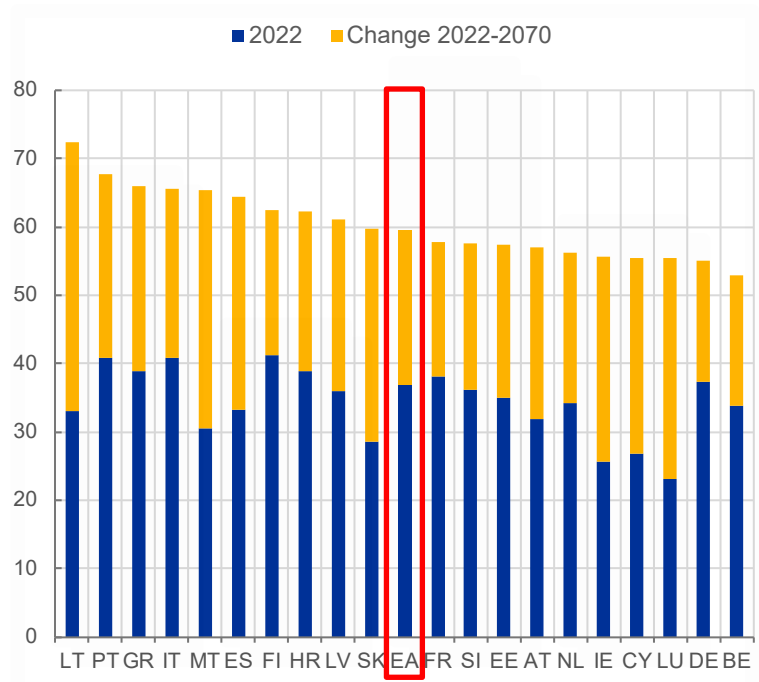
Source: European Commission Europop 2023 population projections.
Note: The old-age dependency ratio is the population aged 65 and over as a % of the population aged 20-64. Data are shown as the proportion of dependents per 100 persons of working-age.
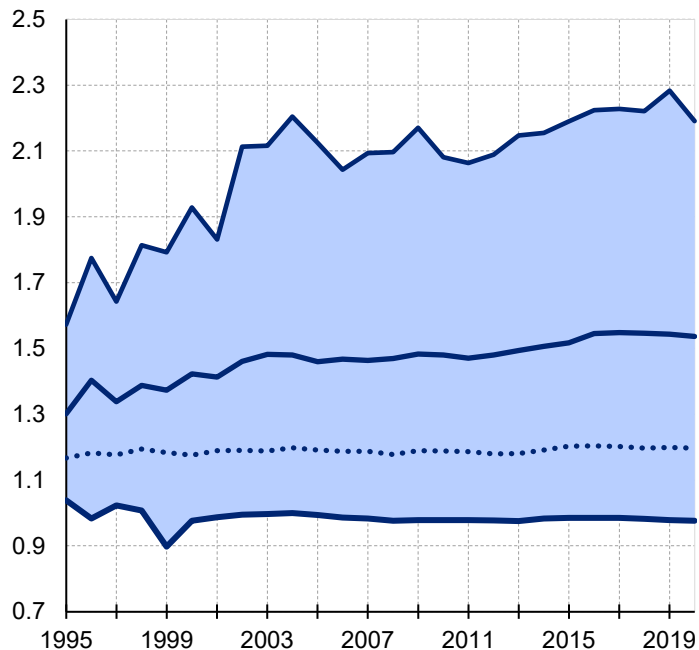
Average hours worked per person employed
(index: 2015=100)

Source: OECD data.

Euro area markup distribution

TFP levels of frontier and non-frontier firms in the services sector

(2006=1)
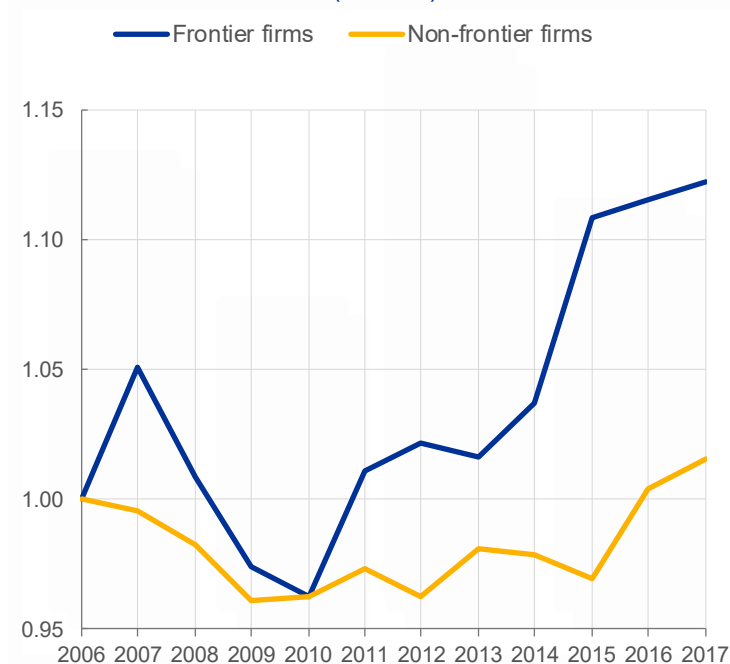
Frontier firms   Non-frontier firms

Restrictive monetary policy needed to contain pass-through of rising unit labour costs

Headline inflation in the euro area (HICP)
(annual percentage changes)

Source: Eurostat.
Last observation: January 2024 (flash).

Unit labour costs
(annual percentage changes)

Legend:
- Productivity
- Wages
- Unit labour cost
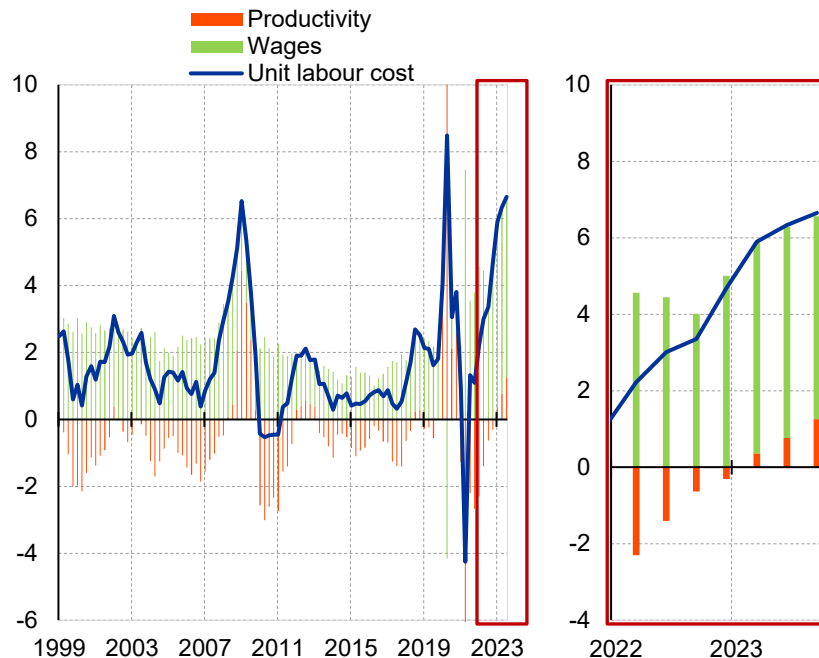
Source: Eurostat and ECB calculations.
Note: A positive contribution of productivity to unit labour costs implies negative productivity growth.
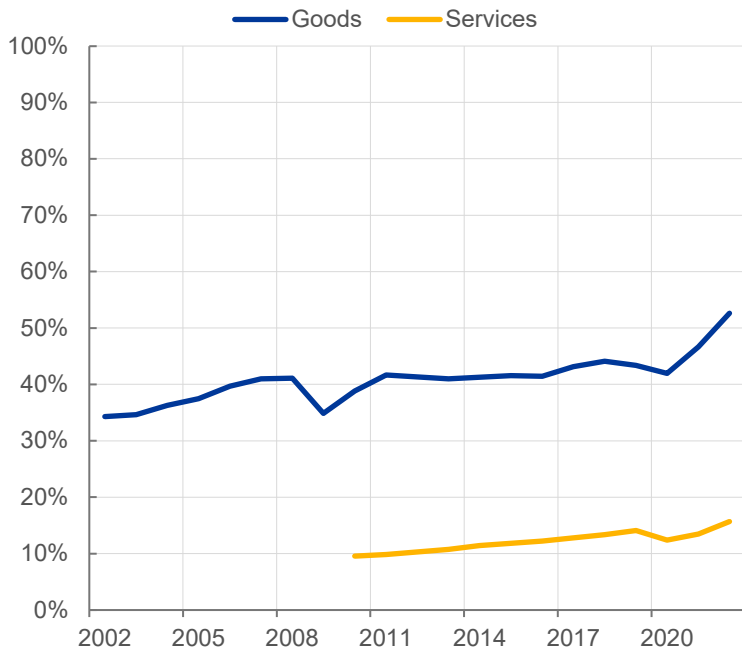Last observation 2023 Q3.

How much would overall manufacturing sector productivity rise if firms at the national frontier were as productive and large as firms at the global frontier?
(percentages)

Legend:
- Cross term (productivity & size gap)
- Size gap
- Productivity gap
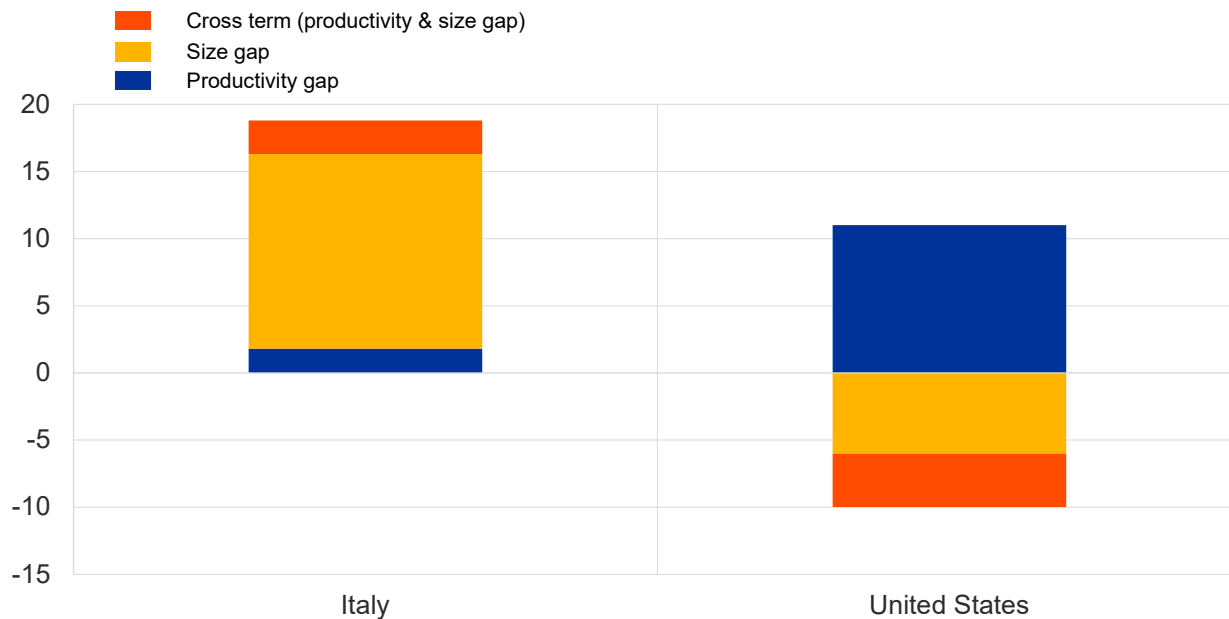
Source: Andrews, D., Criscuolo, C. and Gal, P. (2015), "Frontier Firms, Technology Diffusion and Public Policy: Micro Evidence from OECD Countries," OECD Productivity Working Papers. Note: The productivity (size) gap shows how much higher manufacturing productivity would be relative to baseline if the national frontier firms (NF) were as productive (large) as the global frontier (GF) benchmark. The cross term shows the impact on aggregate productivity of simultaneously closing the productivity and size gaps. The estimates are constructed by taking the difference between counterfactual labour productivity and actual labour productivity. The counterfactual gaps are estimated by replacing the labour productivity (employment) of the top 10 NF firms with the labour productivity (employment) of the 10th most globally productive firm in each two-digit sector. The industry estimates are aggregated using US employment weights.

Limited progress in cross-border trade in services and in financial market integration

Intra-EU trade in goods and services
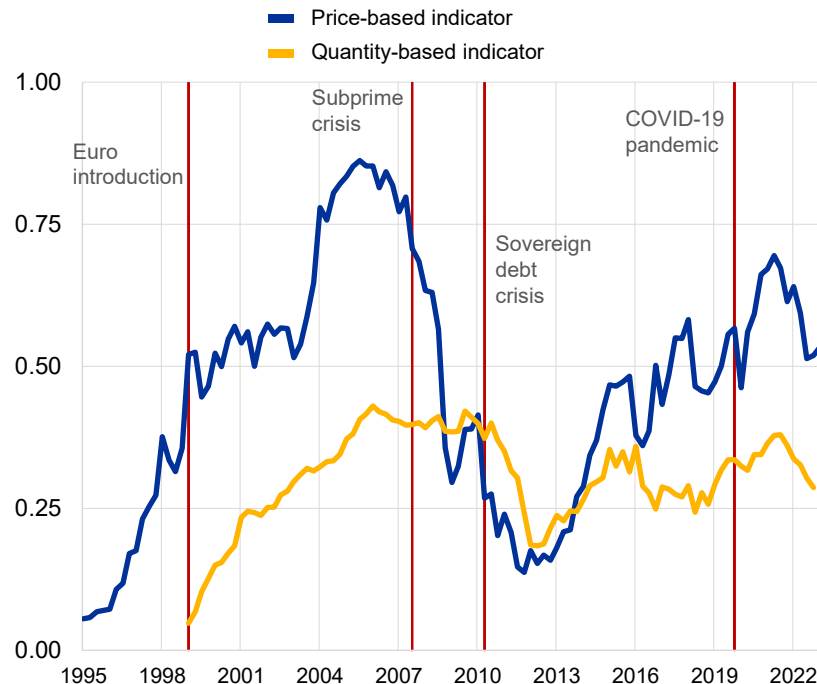### (annual, in percentage of GDP)

Source: Eurostat and ECB staff calculations.
Notes: Intra-EU trade is obtained by summing intra-exports and imports as a ratio of GDP, measured in euros.
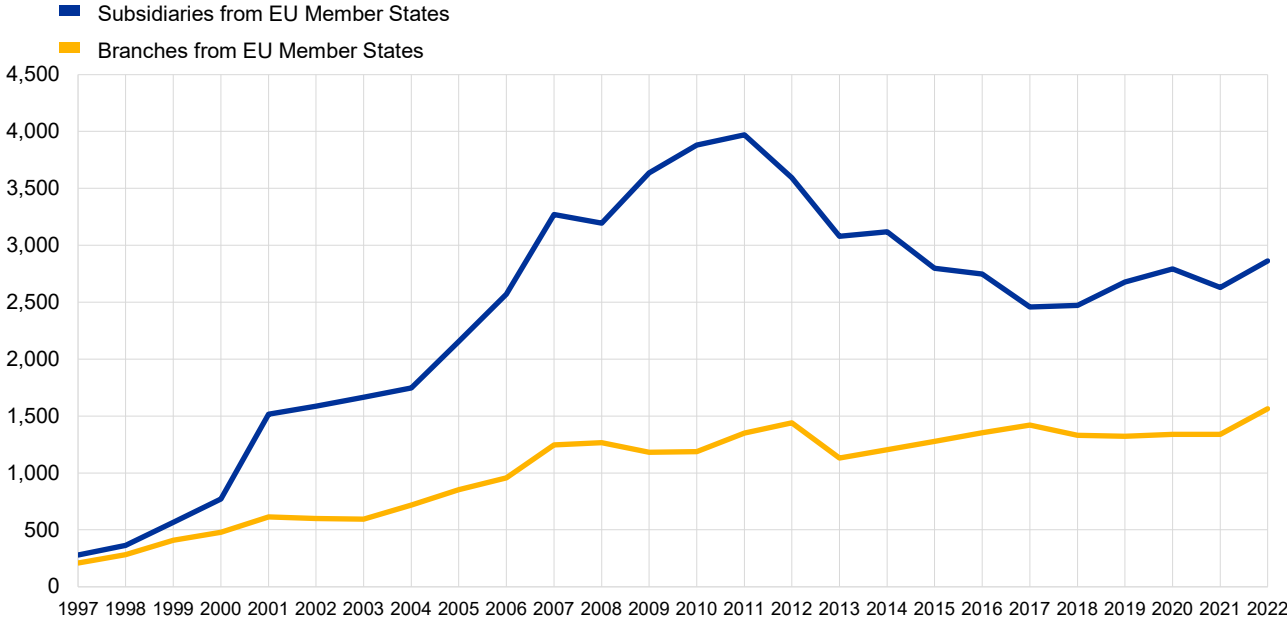Latest observation: 2022.

Price-based and quantity-based composite indicators of financial integration

Source: ECB staff calculations.
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Total EU cross-border assets in the euro area
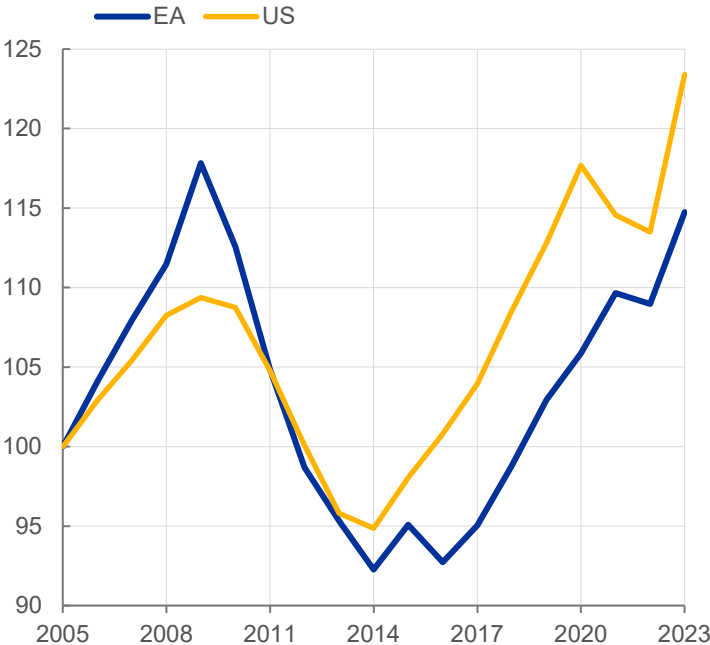(Total assets, EUR billions)

■ Subsidiaries from EU Member States
■ Branches from EU Member States

Source: ECB Structural Financial Indicators.

Public investment can boost productivity growth and potential output

Public investment
(index: 2005 = 100)

Sources: European Commission (AMECO), Bureau of Economic Analysis and ECB staff calculations. Notes: The 2023 figure for the Euro area is based on AMECO projections.
Latest observations: 2023

Impact of NGEU on potential output and growth of seven euro area countries
(impact on level in percentages, on growth and contributions in percentage points)
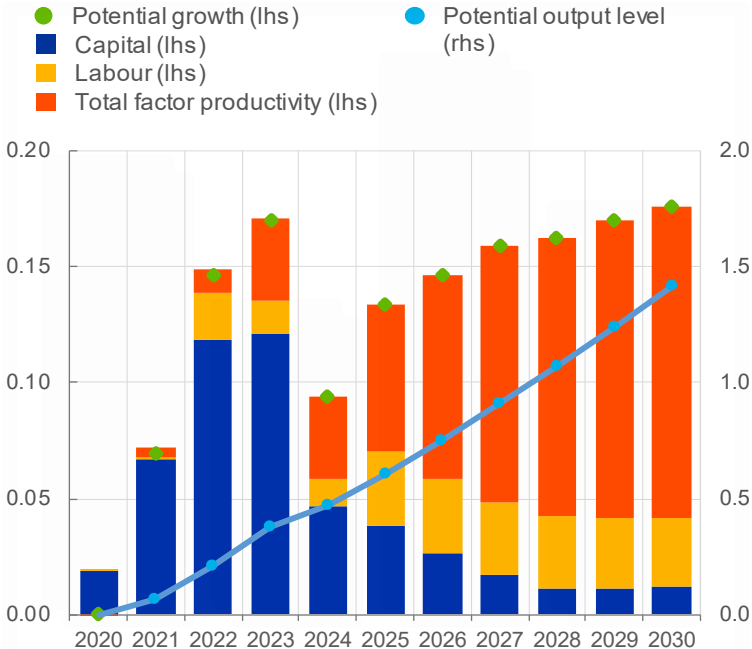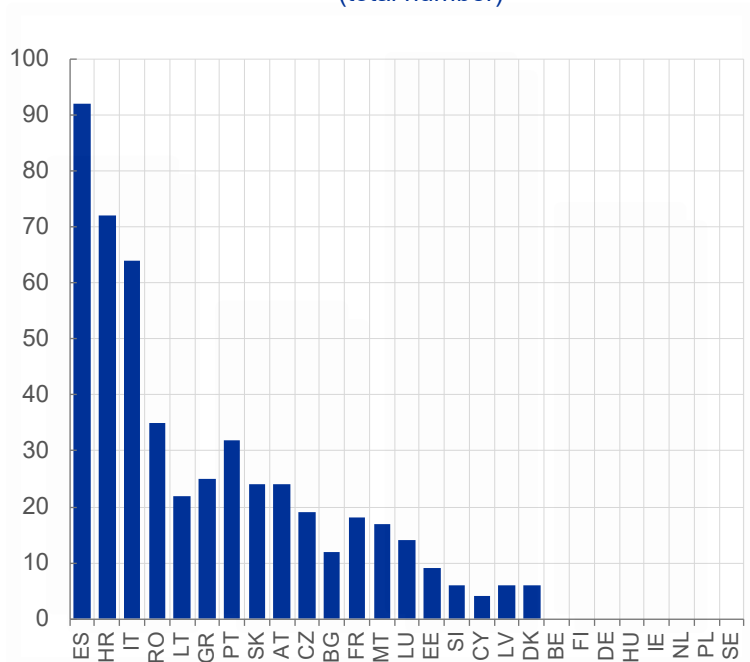

Source: ESCB staff calculations (Bańkowski et al. 2022).
Note: Countries included: DE, ES, FR, GR, IT, MT and PT.
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Significant number of reform-related RRF milestones and targets already fulfilled

RRF milestones and targets: breakdown by country
(total number)

Source: ECB illustration based on European Commission data.
Note: Database accessed on 6 December 2023. A Milestone or Target is counted as fulfilled if the Commission has assessed it as being satisfactorily fulfilled. All EU countries included.

RRF milestones and targets: breakdown by policy pillar
(percent)

- Green transition
- Digital transformation
- Smart, sustainable and inclusive growth
- Social & territorial cohesion
- Health, and economic, social and institutional resilience
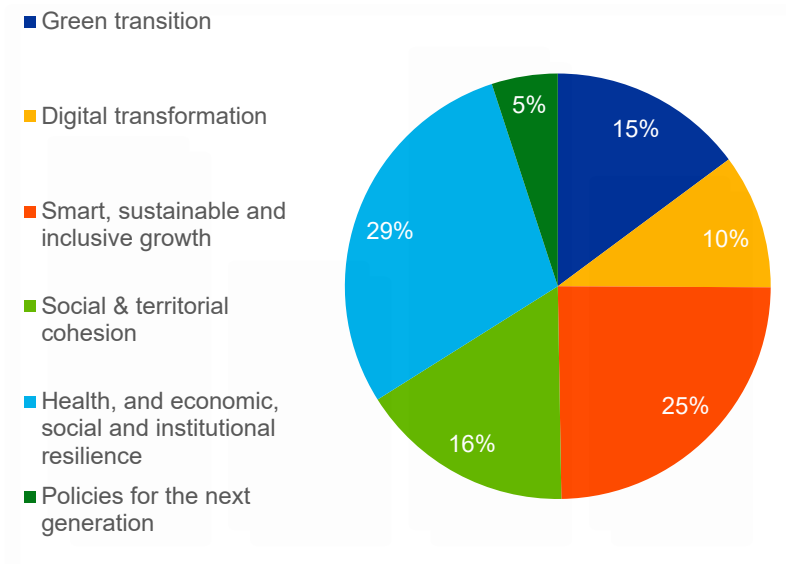- Policies for the next generation

Source: ECB illustration based on European Commission data.
Note: Database accessed on 6 December 2023. A Milestone or Target is counted as fulfilled if the Commission has assessed it as being satisfactorily fulfilled. All EU countries included.

Thank you very much for your attention!