Are Productivity Growth Rates Diverging Again?

Bart van Ark

World KLEMS conference
Tokyo, 27 March 2025

MOTIVATION

- **Global economic growth** remained weak since pandemic.
- **Productivity slowdown** plays a big role
- But signs of **increased divergence in productivity growth**. Between countries:
  - Is this just a U.S. success story?
  - Is it structural or cyclical?
- What could be driving **differences in productivity growth rates**?
  - Sector composition? (De Vries, Erumban and van Ark, 2021)
  - Weak investment? (Van Ark, Pilat and de Vries, 2023)
  - Productivity contributions from intangibles? (Van Ark, de Vries and Erumban, 2024)
  - Tech productivity and/or adoption? (De Vries, Erumban and van Ark, 2021)
  - Other? E.g. Measurement? Slowbalisation? Business dynamics? Regulation? Macro? Demographics?

AGENDA

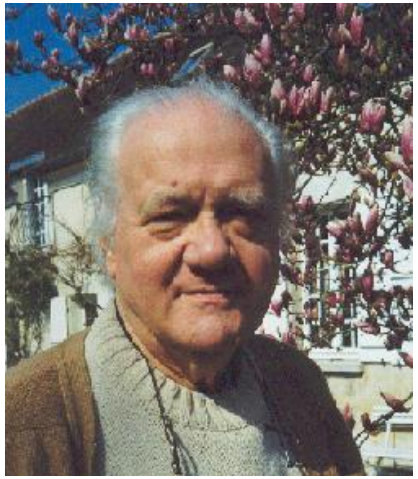
Is productivity growth structurally diverging?

Looking beneath the surface for explanations for productivity growth differentials

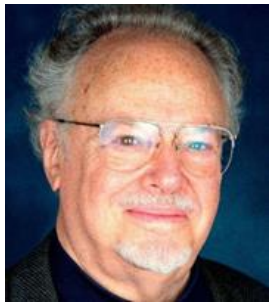
Industrial strategy, pro-productivity policies, and inclusive growth

ON THE SHOULDERS OF GIANTS

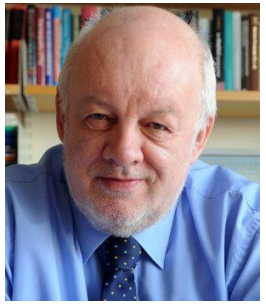
Dale Jorgenson (1933-2022)



Angus Maddison (1926-2010)



Paul David
(1935-2023)



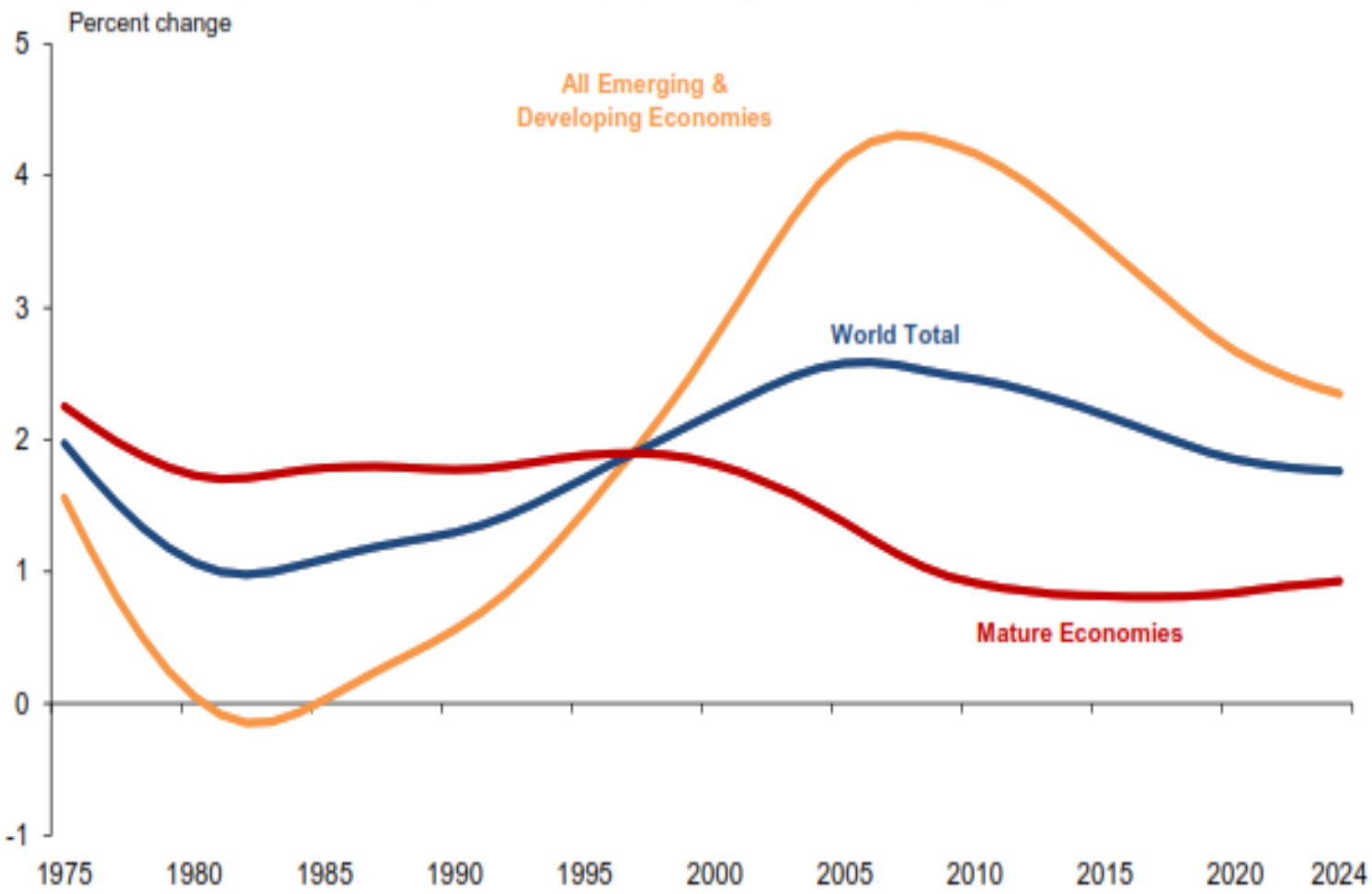
Nick Crafts
(1949-2023)

"You know my methods, Watson"

INCREASED DIVERGENCE?

THE GLOBAL ECONOMY IS FACING LARGE PRODUCTIVITY CHALLENGES ALL AROUND

Growth in Labour Productivity (GDP per hour worked) by Major G-20 group, annual average growth rates



Note: Trend growth rates are obtained using HP filtering method.
Source: The Conference Board, Total Economy Database, 2024

G20 AGGREGATE PRODUCTIVITY GROWTH TREND HIDES THAT ALMOST ALL INDIVIDUAL COUNTRIES SLOWING …

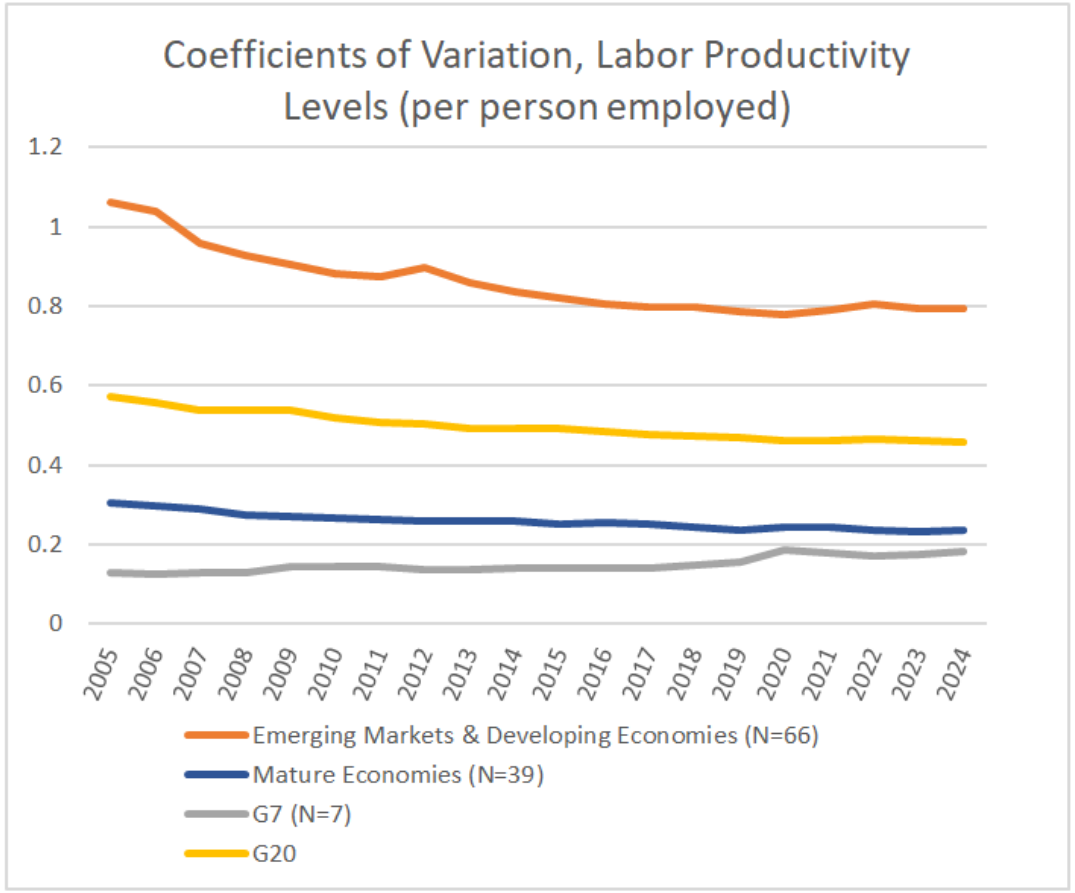
Growth in Labour Productivity (GDP per unit of labour input) by Major G-20 group, annual average growth rates

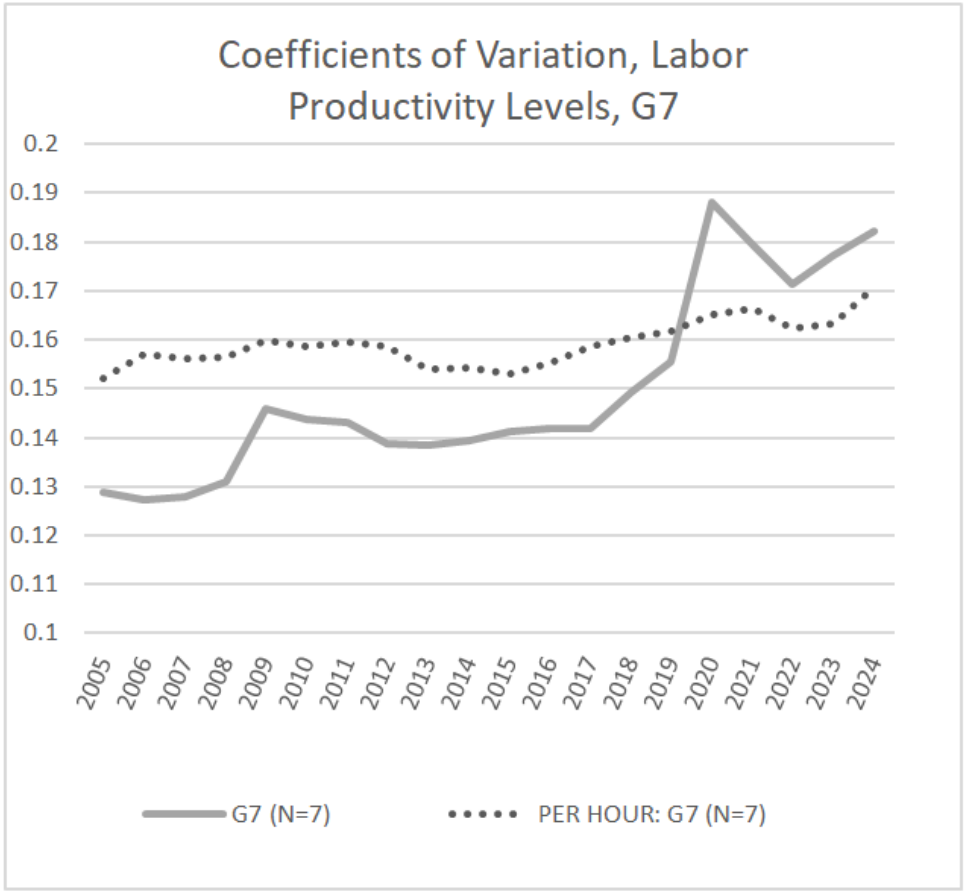
		1970s	1980s	1990s	2000s	2010s	2020s*
G20	***Total***	***2.8***	***1.6***	***1.9***	***2.9***	***2.8***	***2.1***
Leading but slowing	***Total***	***2.9***	***2.0***	***1.9***	***1.5***	***0.9***	***0.7***
	Japan	4.7	3.6	2.3	1.0	1.1	0.9
	United States	1.7	1.4	1.7	2.2	0.8	0.9
	United Kingdom	3.0	2.0	2.0	1.3	0.6	0.2
	France	4.1	2.9	1.8	1.0	0.9	-0.7
	Germany	3.9	2.3	2.2	0.9	1.2	0.5
	Australia	1.8	1.2	2.2	1.2	1.2	1.9
	Italy	3.9	1.7	1.4	0.0	0.4	0.4
	Canada	1.9	0.9	1.4	1.1	1.0	0.9
Lagging but growing	***Total***	***2.9***	***4.2***	***5.1***	***6.9***	***6.2***	***4.0***
	China	4.1	6.2	7.8	9.2	7.1	5.5
	India	0.4	3.2	3.9	5.7	6.6	1.6
	Turkey	4.1	3.3	1.7	3.5	3.4	3.0
	Indonesia	3.6	2.4	1.7	3.1	3.4	1.6
	South Korea	5.9	5.4	6.4	4.7	2.9	1.6
Muddling through	***Total***	***2.7***	***-0.6***	***-0.6***	***1.9***	***0.9***	***0.2***
	Russian Federation	2.5	0.9	-3.1	4.7	2.0	0.9
	Brazil	4.7	0.1	0.5	1.1	0.9	-0.1
	South Africa	2.4	-0.6	-0.7	2.7	0.5	1.4
	Argentina	2.0	-1.8	2.1	1.1	0.9	0.7
	Mexico	1.4	-1.5	0.6	0.3	0.7	-1.3
	Saudi Arabia	2.8	-8.3	0.9	-0.6	-1.5	0.2

- Eight developed G-20 members (G7: Japan, US, UK, France, Germany, Italy and Canada + Australia) in the **"leading levels but slowing growth"**-group.
- Five G-20 members (China, India, Turkey, Indonesia, and South Korea) are in the **"lagging levels but accelerating growth"**-group
- Remaining six G-20 members (Russia, Argentina, Brazil, South Africa, Mexico and Saudi Arabia) are in the **"muddling through"**-group showing neither much growth in productivity nor any sizeable improvement in productivity levels relative to the leading group.

Note: Analysis is for 19 individual members of G-20, excluding European Union aggregate;
* 2020s includes projection for 2023.
Source: Van Ark, De Vries and Pilat (2024), based on The Conference Board, Total Economy Database, April 2023.

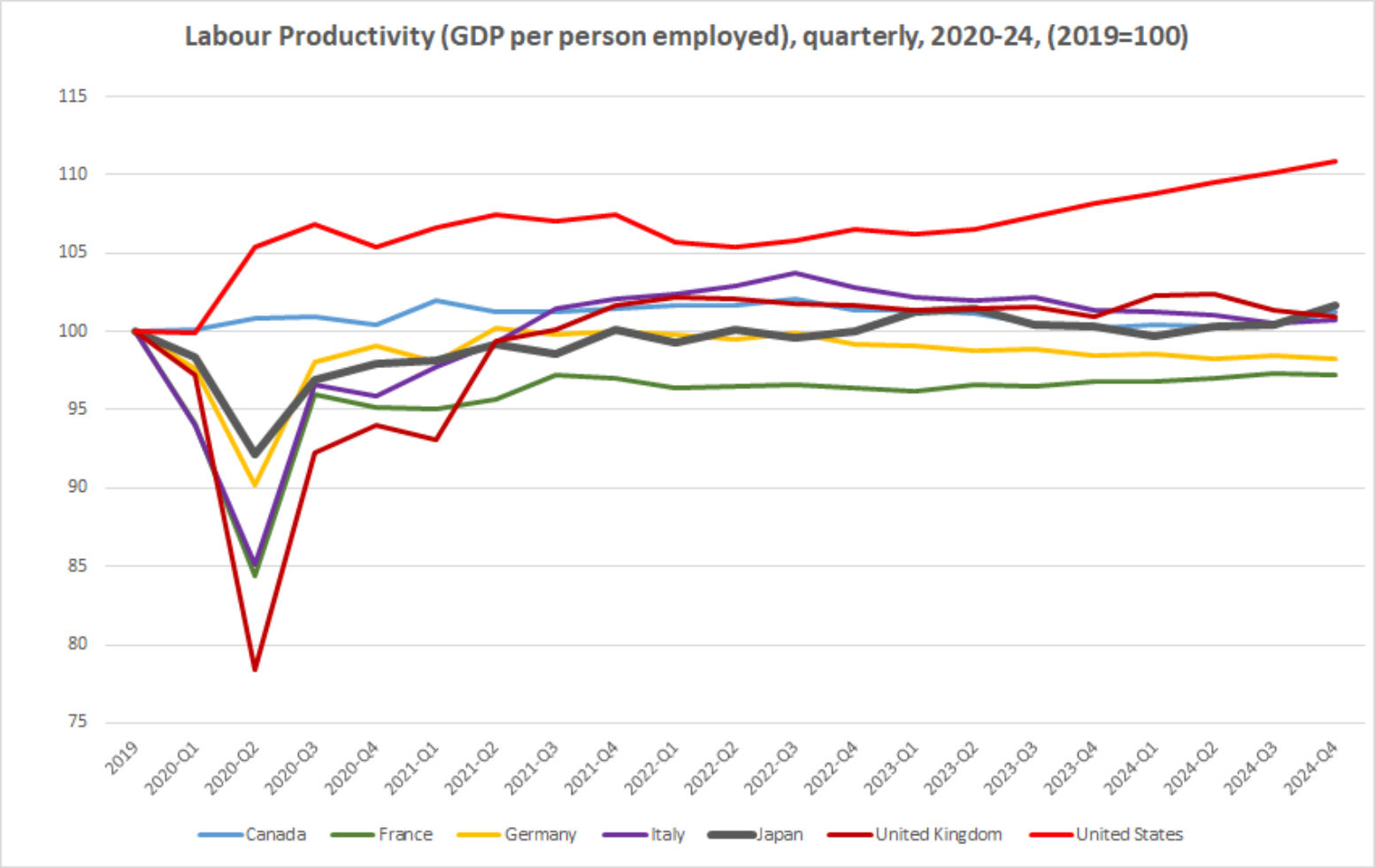
BUT GLOBAL PRODUCTIVITY IS STILL LARGELY A CONVERGENCE STORY, EXCEPT FOR G7





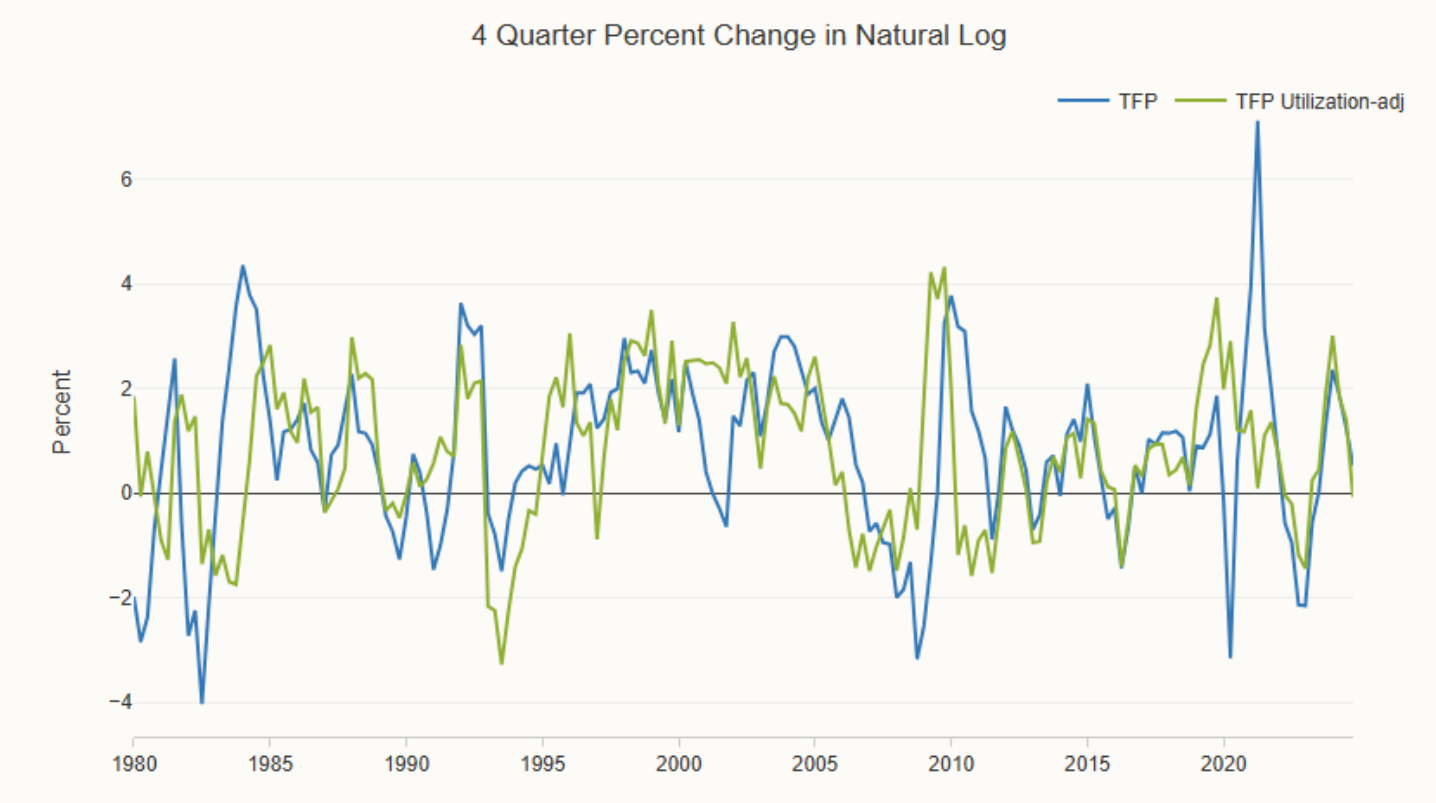
Note: estimates are based on productivity in "person employed" terms, except where indicated.
Source: Calculated from The Conference Board, Total Economy Database, April 2024; with updates for G7 for 2023 and 2024 based on own calculations using latest quarterly figures (as of March 2025)

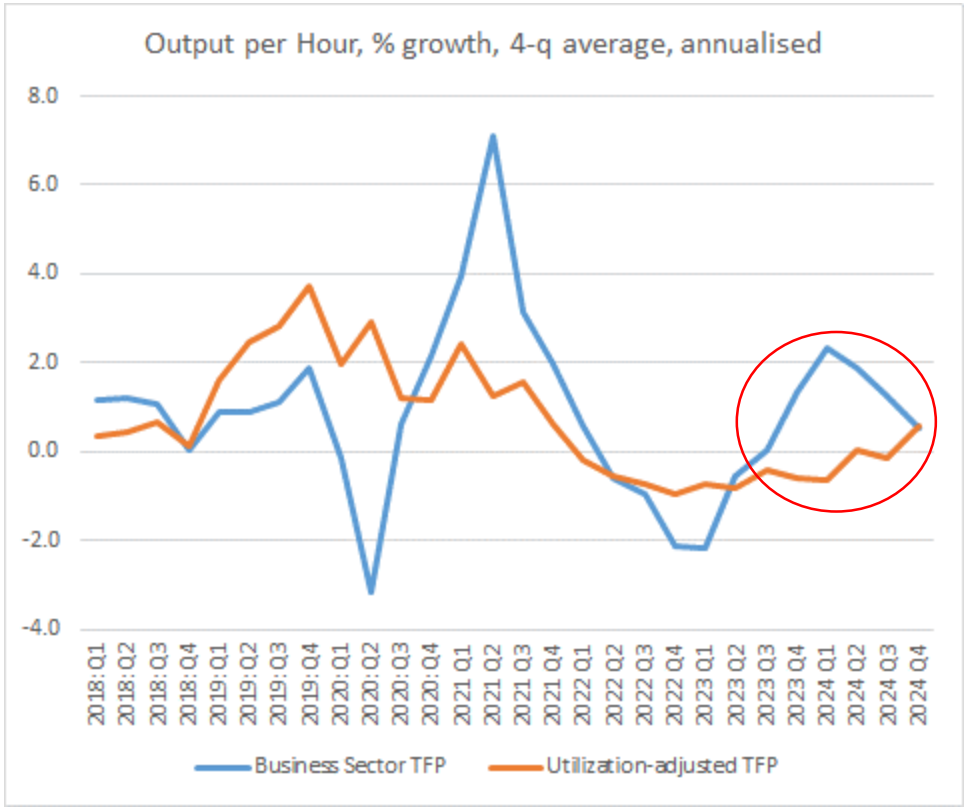
RECENT G7 DIVERGENCE SUGGESTS DIFFERENT RECOVERY PATHS SINCE PANDEMIC



Source: OECD quarterly productivity accounts. For Q4-2024 updated with national quarterly estimates

CYCLICAL FACTORS FOR THE UNITES STATES HAVE BEGUN TO WANE IN RECENT QUARTERS

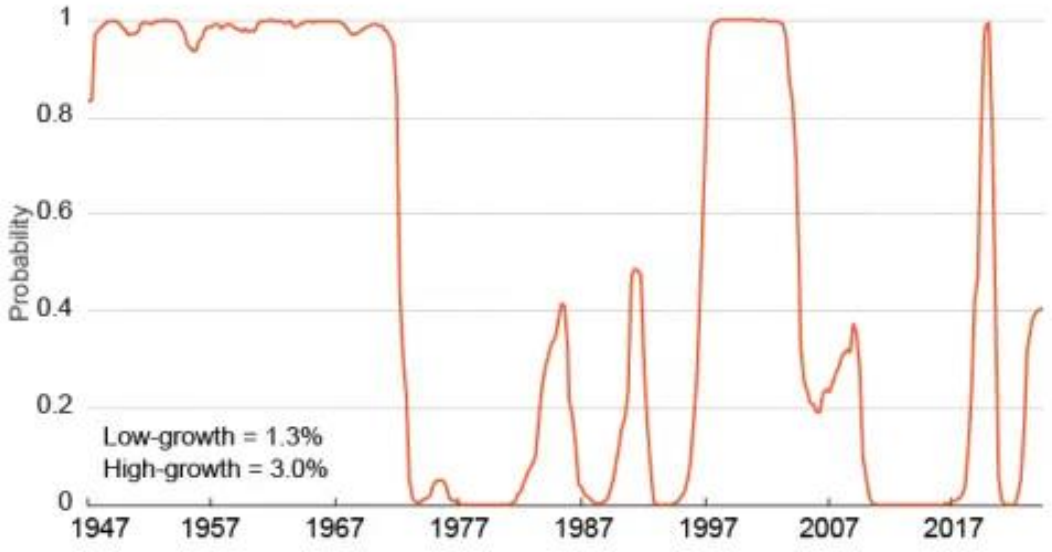




Source: San Francisco Federal Reserve, March 2025 (https://www.frbsf.org/research-and-insights/data-and-indicators/total-factor-productivity-tfp/); John Fernald. 2014. "A Quarterly, Utilization-Adjusted Series on Total Factor Productivity." FRBSF Working Paper 2012-19

IS THE US IN A HIGH PRODUCTIVITY GROWTH REGIME? MAY BE JUST ABOUT (40% PROBABILITY)

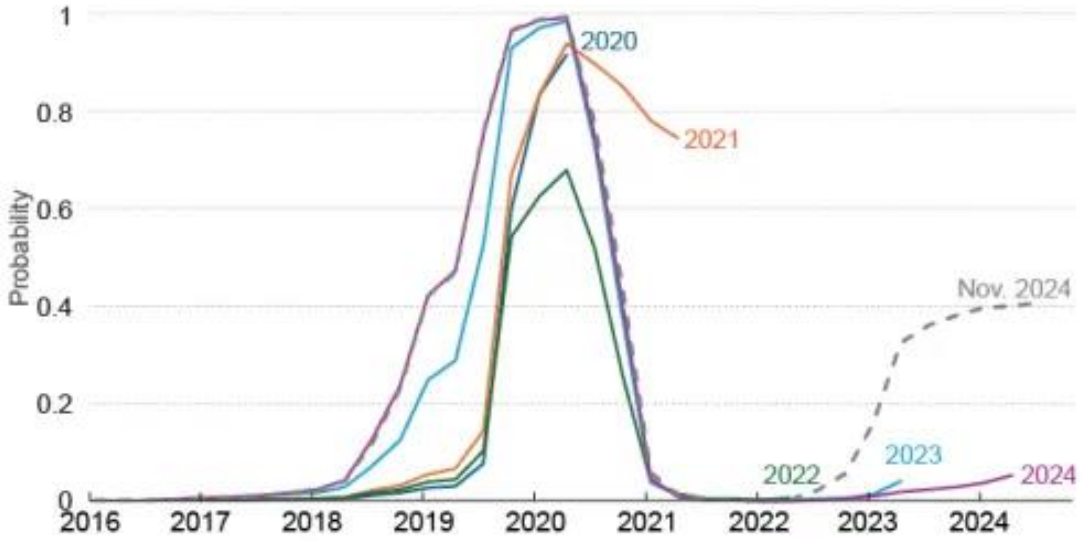
Figure 3: Probability of Being in High-Growth Productivity Regime in Postwar Period



Source: Authors' calculations

Note: Figure shows November 2024 retrospective estimates.

Figure 6: High-Growth Productivity Regime during the Pandemic and More Recently

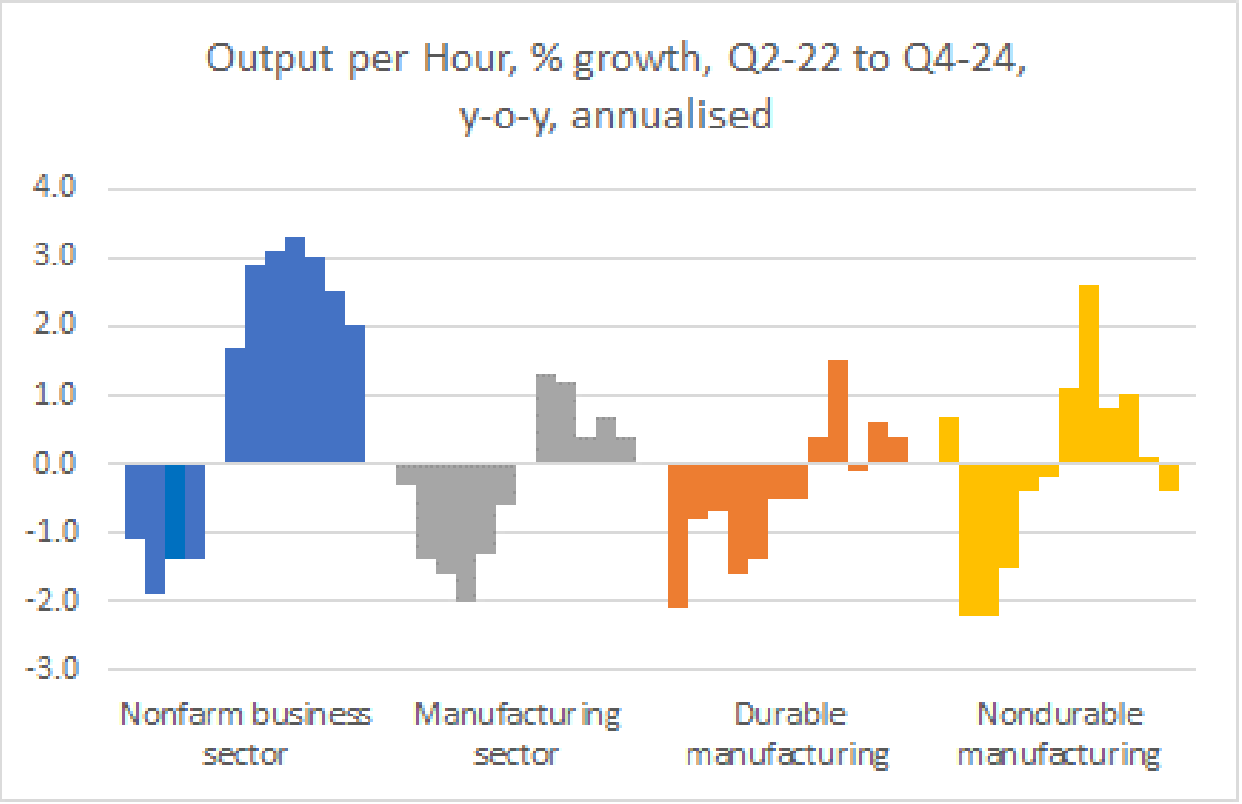


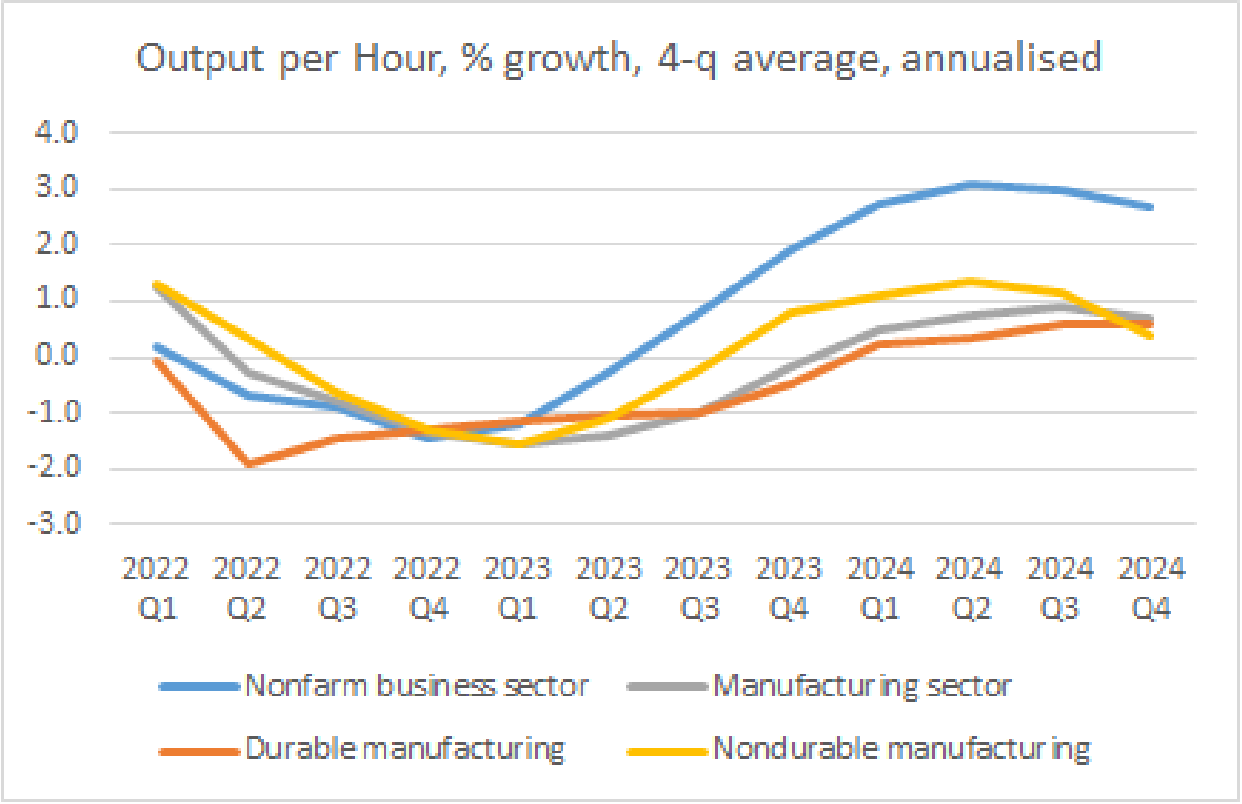
Source: Authors' calculations

Notes: Real-time estimates of the probability of the high-growth productivity regime. Probability estimates are as of August of each year unless otherwise indicated. Each year demarcation indicates the first quarter of that year.

Source: Alexander Cline, James A. Kahn, Robert W. Rich (2025), Is High Productivity Growth Returning?, Federal Reserve Bank of Cleveland

THE U.S. PRODUCTIVITY REVIVAL SEEMS LARGELY A NON-MANUFACTURING STORY





Source: U.S. Bureau of Labor Statistics, https://www.bls.gov/productivity/ (March 2025).

REASONS FOR AND AGAINST US TREND RECOVERY

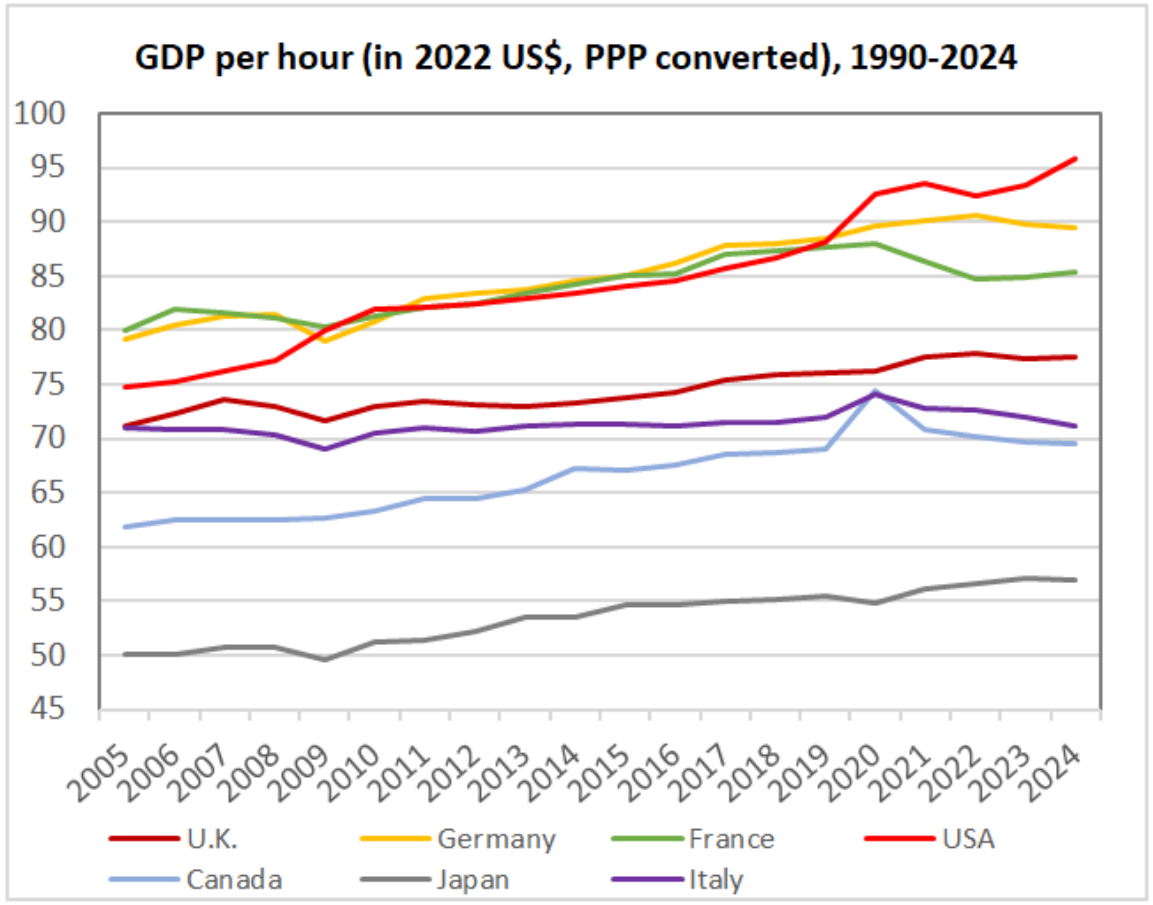
FOR:

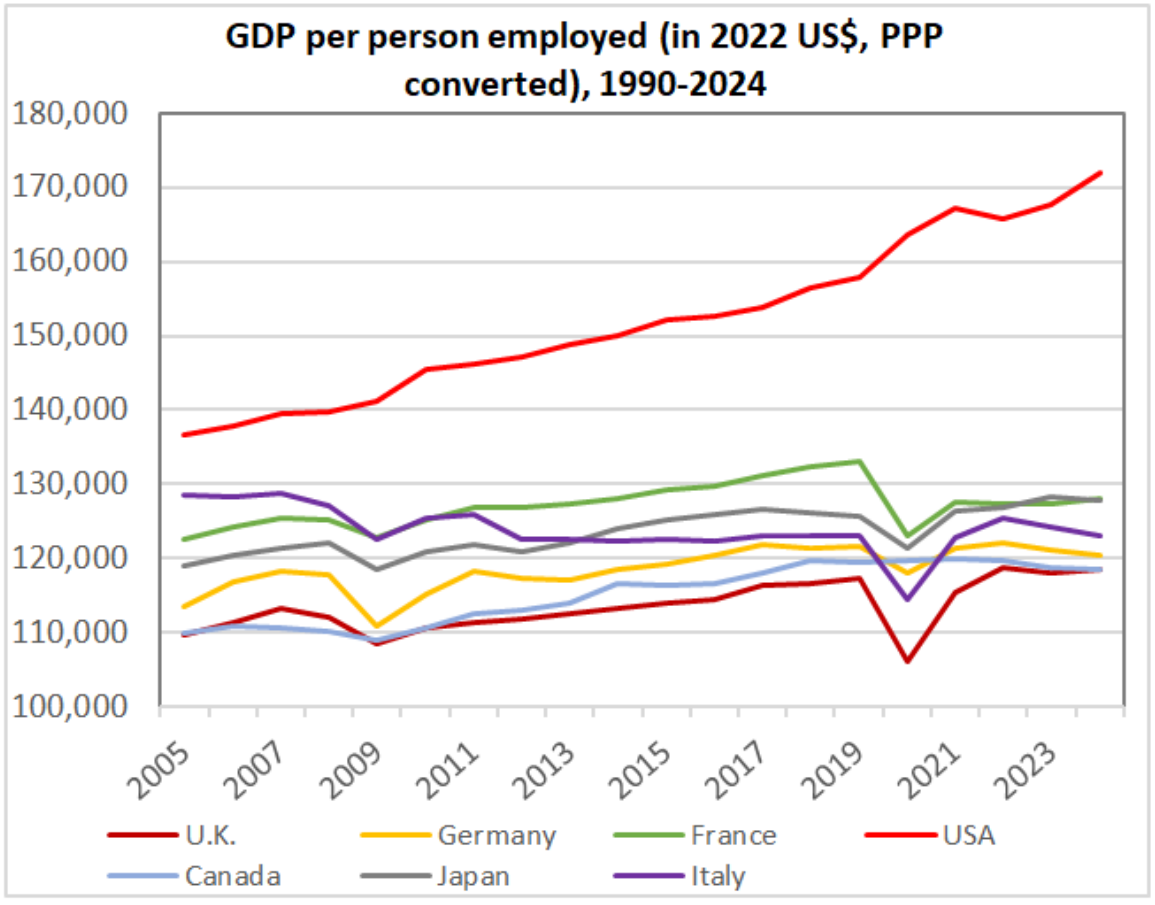
- Sustained rapid technological advancement (Brynjolfsson et al.)
- Undermeasurement of impacts of new products and unmeasured intangibles (productivity J-curve)
- Gains from remote working (Barrero et al., 2021)
- New business formation and worker reallocation (Decker & Haltiwanger, 2023)
- Recovery of prime-age labor force participation and growth in immigrant labor force.

AGAINST:

- Transitory effects post-pandemic wane
  - Easing of supply chain disruptions
  - Return to office
- End of Biden's stimulus.
- Generative AI will take time to diffuse and translate into productivity effects
- (Geo-)political and economic disruptions

WHAT MEASURE FOR LABOUR PRODUCTIVITY: *PERSONS OR HOURS?*



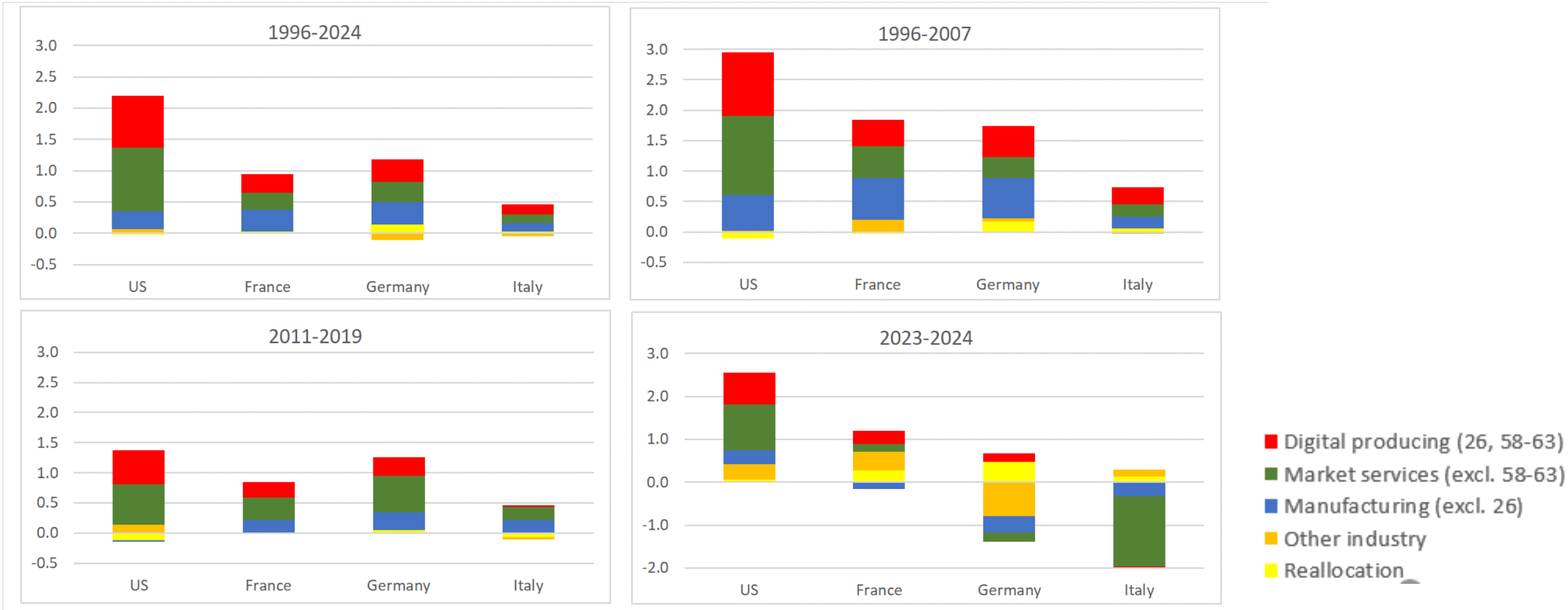


Source: The Conference Board, Total Economy Database, April 2024; with updates for 2023 and 2024 based on own calculations using latest quarterly figures (as of March 2025)

LOOKING BENEATH THE SURFACE FOR SIGNS OF DIVERGENCE

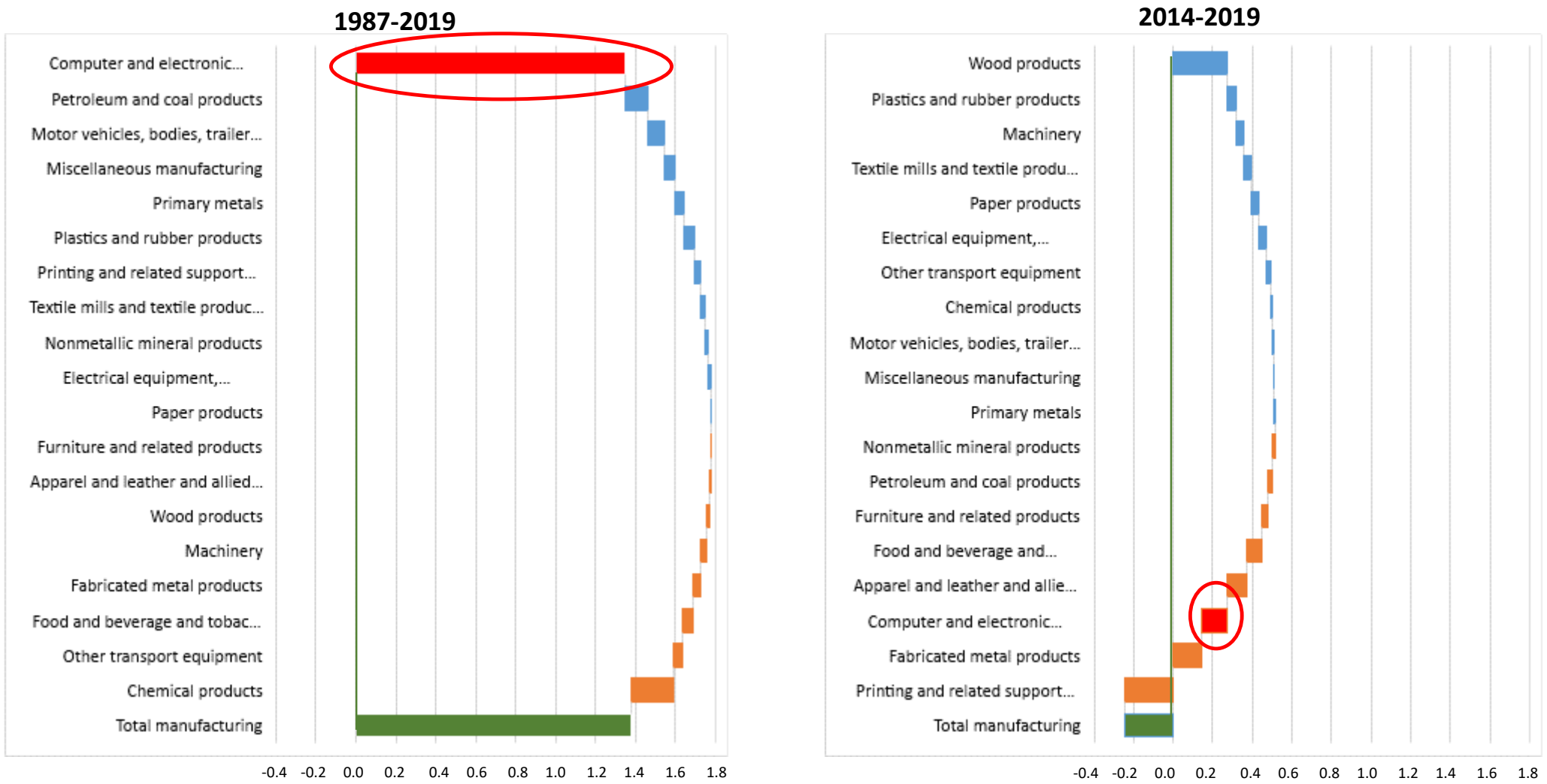
SECTOR DECOMPOSITION: PERIODS OF CONVERGENCE AND DIVERGENCE BETWEEN EUROPE AND US

Sector decomposition of growth in value added in the market sector, 1996-2024 (%)



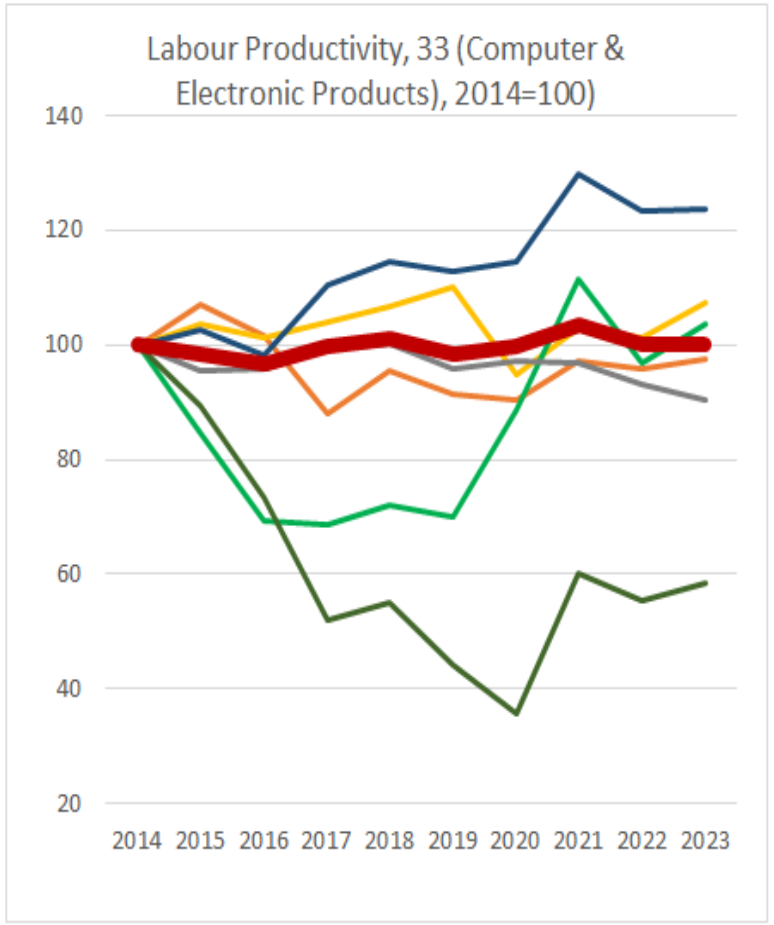
Source: Van Ark, de Vries and Erumban (2021), updated, based on BEA/BLS and Eurostat data.

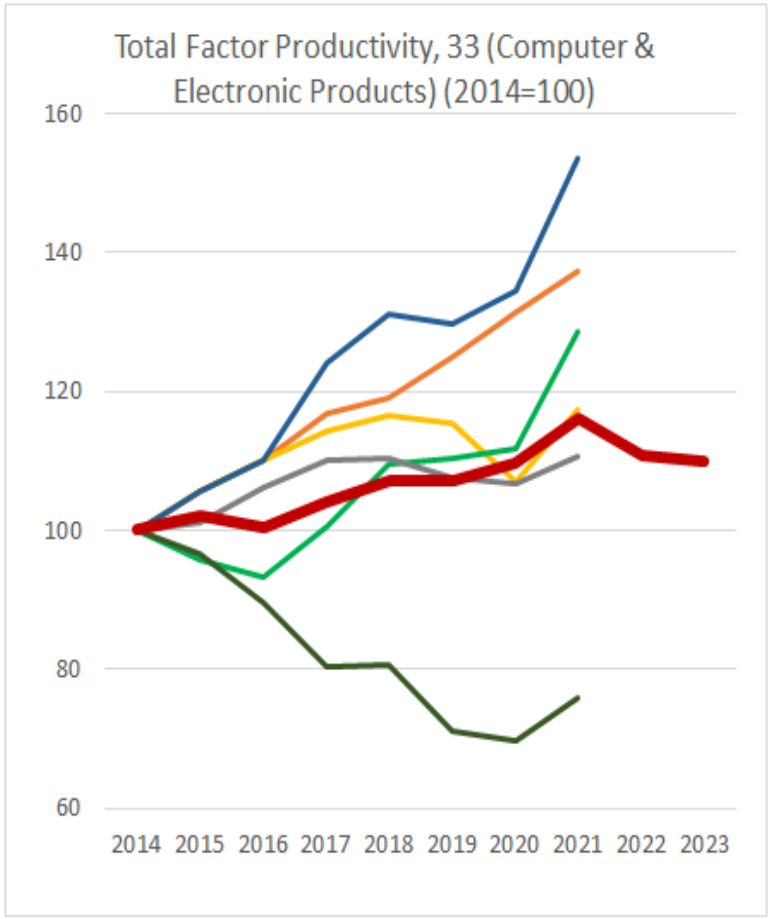
DIGITAL HARDWARE PRODUCTIVITY GROWTH DRAMATICALLY DECLINED

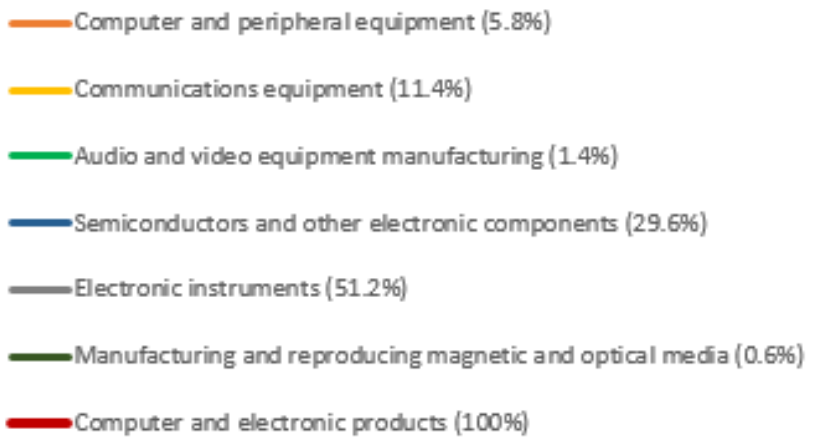


Source: Martin Baily (2020), "Lessons from Past Productivity Research and Implications for the Future, Brookings

LATEST ESTIMATES FOR DIGITAL HARDWARE SLIGHTLY, BUT NO SIGNS IT CAN LAST

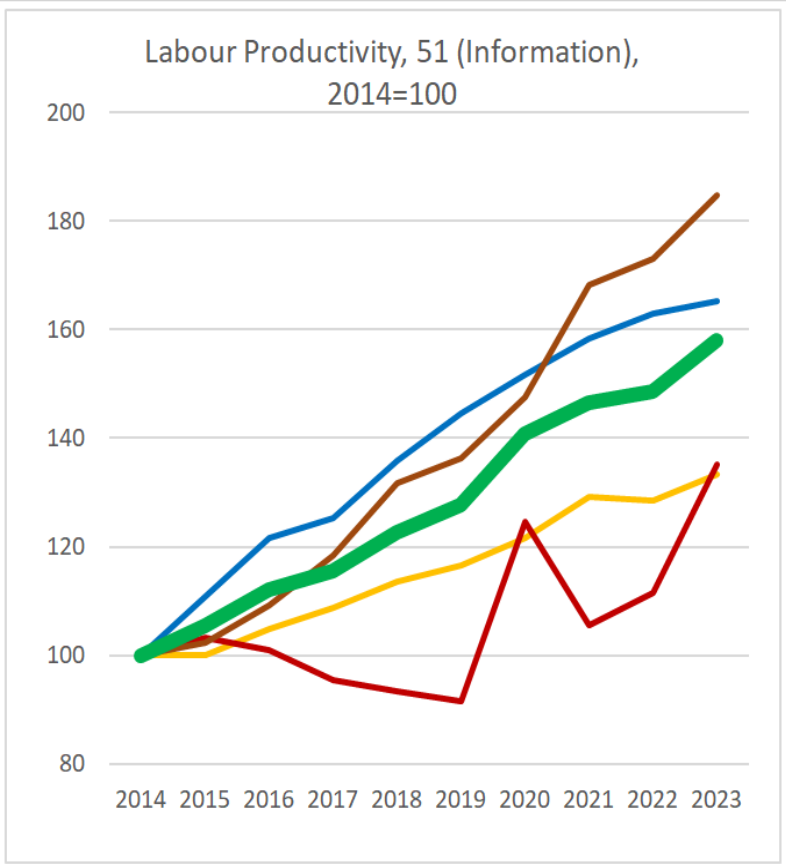


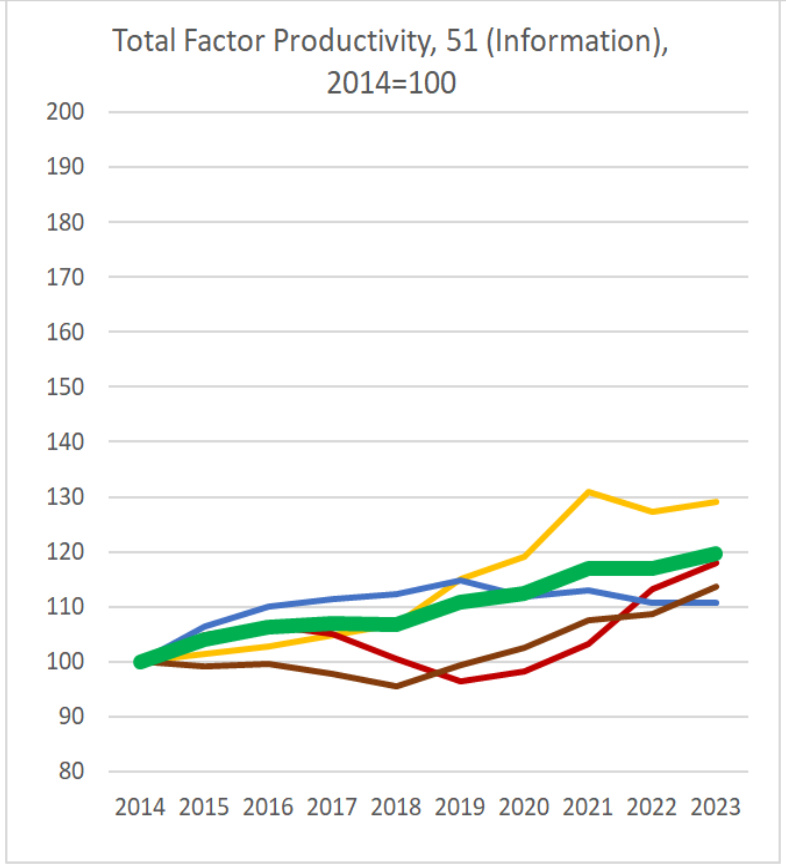


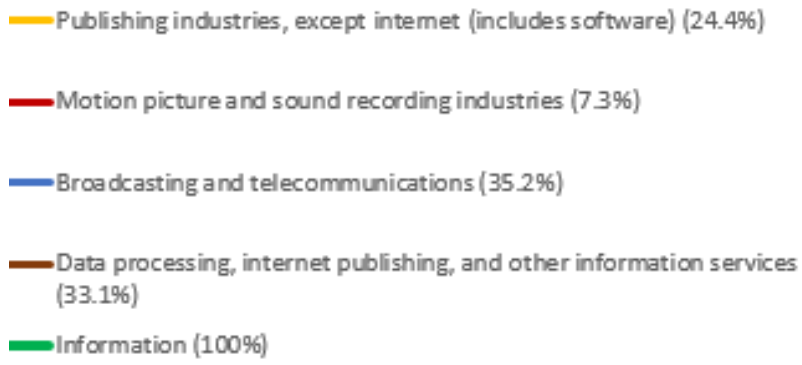


Source: BLS, Total Factor Productivity, Major and Detailed Industries, January 2025 (https://www.bls.gov/productivity/tables/major-industry-total-factor-productivity-klems.xlsx)

PRODUCTIVITY GAINS IN DIGITAL SERVICES ARE MUCH BETTER SUSTAINED, BUT HIGH CAPITAL INTENSITY







Source: BLS, Total Factor Productivity, Major and Detailed Industries, January 2025 (https://www.bls.gov/productivity/tables/major-industry-total-factor-productivity-klems.xlsx)

TIME TO TALK AI

“Thousands of Cat-Eared Robots Are Waiting Tables in Japan’s Restaurants”

Source: Bloomberg, https://www.bloomberg.com/news/features/2025-03-06/thousands-of-cat-eared-robots-are-waiting-tables-in-japan, downloaded 6-3-25

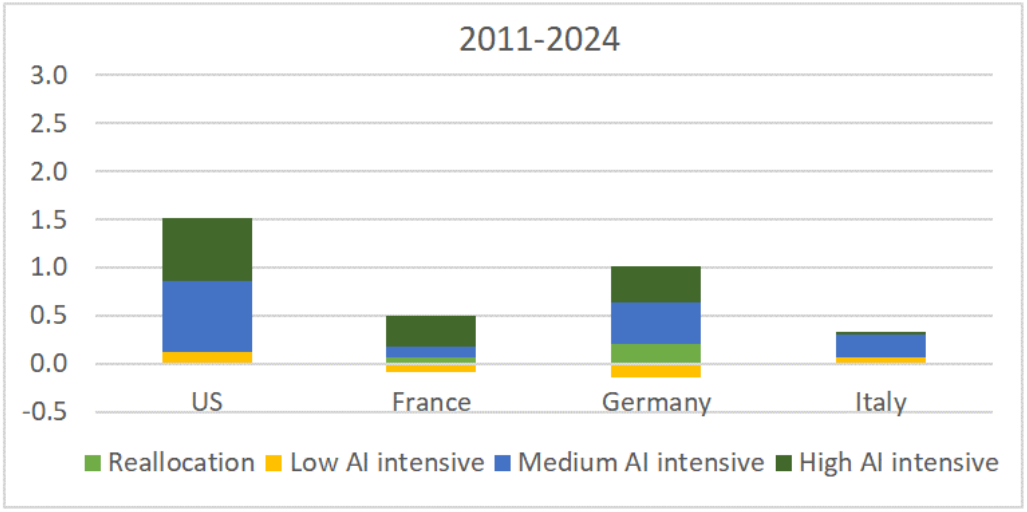
A BIRD'S EYE VIEW ON THE PRODUCTIVITY IMPACTS OF AI

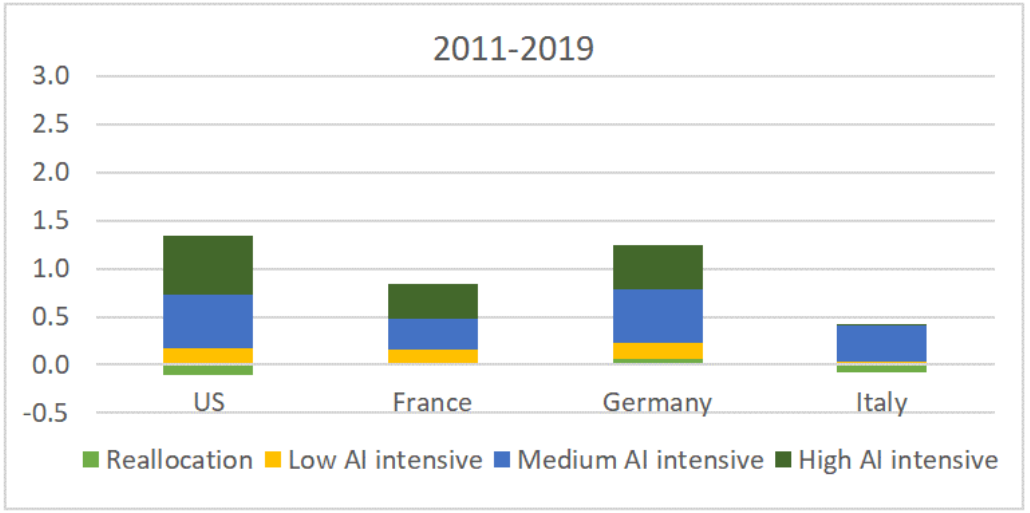
- Filippucci et al. (2024a) shows large productivity gains for use cases of generative AI:
  - Firm-level productivity gains from pre-Generative AI is comparable to previous digital technologies (up to about 10%)
  - Generative AI seem to show substantially larger productivity benefits, with widely varying magnitudes from 20-50%
- Filippucci et al. (2024b) shows macro-effects of AI to be highly uncertain ranging from 0.55% over 10 years (Acemoglu, 2024) to 2.5-3.5% per year (Brynjolfsson, McKinsey, etc.), depending on assumptions regarding:
  - Micro-level productivity gains and cost-savings
  - Job exposure to AI
  - Firm's adoption rates of AI
  - Ultimately arrives at between 0.25 and 0.6% productivity gains annually, depending on level of adoption, I/O multipliers and uneven effects by industry (Baumol effect)
- Calvino et al. (2024) expanded OECD's original industry taxonomy of digital intensity (as applied in Van Ark et al, 2021) to AI intensity.

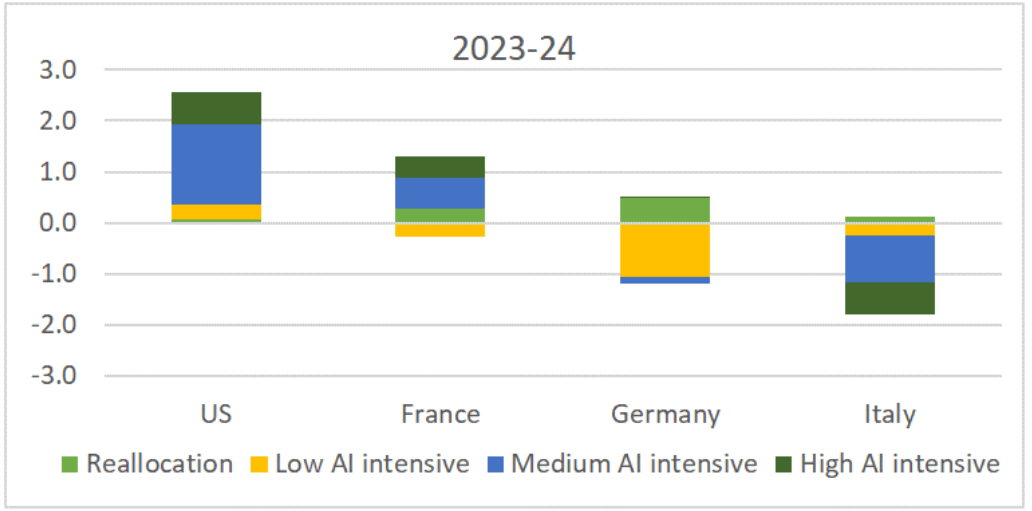
ISIC rev.4		Sector denomination	Sectors	Digital intensity	AI intensity
A	01-03	Agriculture, forestry, fishing	Other industry	Below average digital intensive	Low AI intensive
B	05-09	Mining and quarrying	Other industry	Below average digital intensive	Low AI intensive
C	10-12	Food products, beverages and tobacco	Manufacturing	Below average digital intensive	Low AI intensive
C	13-15	Textiles, wearing apparel, leather	Manufacturing	Below average digital intensive	Low AI intensive
C	16-18	Wood and paper products, and printing	Manufacturing	Above average digital intensive	Low AI intensive
C	19	Coke and refined petroleum products	Manufacturing	Below average digital intensive	Low AI intensive
C	20	Chemicals and chemical products	Manufacturing	Below average digital intensive	Medium AI intensive
C	21	Pharmaceutical products	Manufacturing	Below average digital intensive	Medium AI intensive
C	22-23	Rubber and plastics products	Manufacturing	Below average digital intensive	Low AI intensive
C	24-25	Basic metals and fabricated metal products	Manufacturing	Below average digital intensive	Low AI intensive
C	26	Computer, electronic and optical products	Digital Producing	Digital Producing	High AI intensive
C	27	Electrical equipment	Manufacturing	Digital Producing	Medium AI intensive
C	28	Machinery and equipment n.e.c.	Manufacturing	Above average digital intensive	Medium AI intensive
C	29-30	Transport equipment	Manufacturing	Above average digital intensive	Medium AI intensive
C	31-33	Furniture; other manufacturing; repairs of comput	Manufacturing	Above average digital intensive	Medium AI intensive
D	35	Electricity, gas, steam and air cond.	Other industry	Below average digital intensive	Medium AI intensive
E	36-39	Water supply; sewerage, waste management	Other industry	Below average digital intensive	Medium AI intensive
F	41-43	Construction	Other industry	Below average digital intensive	Low AI intensive
G	45-47	Wholesale and retail trade, repair	Market services	Above average digital intensive	Medium AI intensive
H	49-53	Transportation and storage	Market services	Below average digital intensive	Medium AI intensive
I	55-56	Accommodation and food service activities	Market services	Below average digital intensive	Low AI intensive
J	58-60	Publishing, audiovisual and broadcasting	Digital Producing	Digital Producing	High AI intensive
J	61	Telecommunications	Digital Producing	Digital Producing	High AI intensive
J	62-63	IT and other information services	Digital Producing	Digital Producing	High AI intensive
K	64-66	Finance and insurance	Market services	Above average digital intensive	High AI intensive
L	68	Real estate, excl. owner occupied housing*	Market services	Below average digital intensive	Medium AI intensive
M	69-71	Legal and accounting activities, etc.	Market services	Above average digital intensive	High AI intensive
M	72	Scientific research and development	Market services	Above average digital intensive	High AI intensive
M	73-75	Advertising and market research; other business se	Market services	Above average digital intensive	Medium AI intensive
N	77-82	Administrative and support service activities	Market services	Above average digital intensive	Medium AI intensive
O	84	Public administration and defence	Non-Market services	Above average digital intensive	Medium AI intensive
P	85	Education	Non-Market services	Below average digital intensive	Medium AI intensive
Q	86	Human health activities	Market services	Below average digital intensive	Medium AI intensive
Q	87-88	Residential care and social work activities	Market services	Below average digital intensive	Low AI intensive
R	90-93	Arts, entertainment and recreation	Market services	Above average digital intensive	Low AI intensive
S	94-96	Other service activities	Market services	Above average digital intensive	Low AI intensive

Note: Highlighted areas for AI intensity are guesstimates by me.
Source: Update from Van Ark, De Vries and Erumban (2021) based on Calvino (2018) and Calvino et al. (2024).

AI SEEMS TO HAVE BECOME AN IMPORTANT FORCE OF PRODUCTIVITY DIVERGENCE



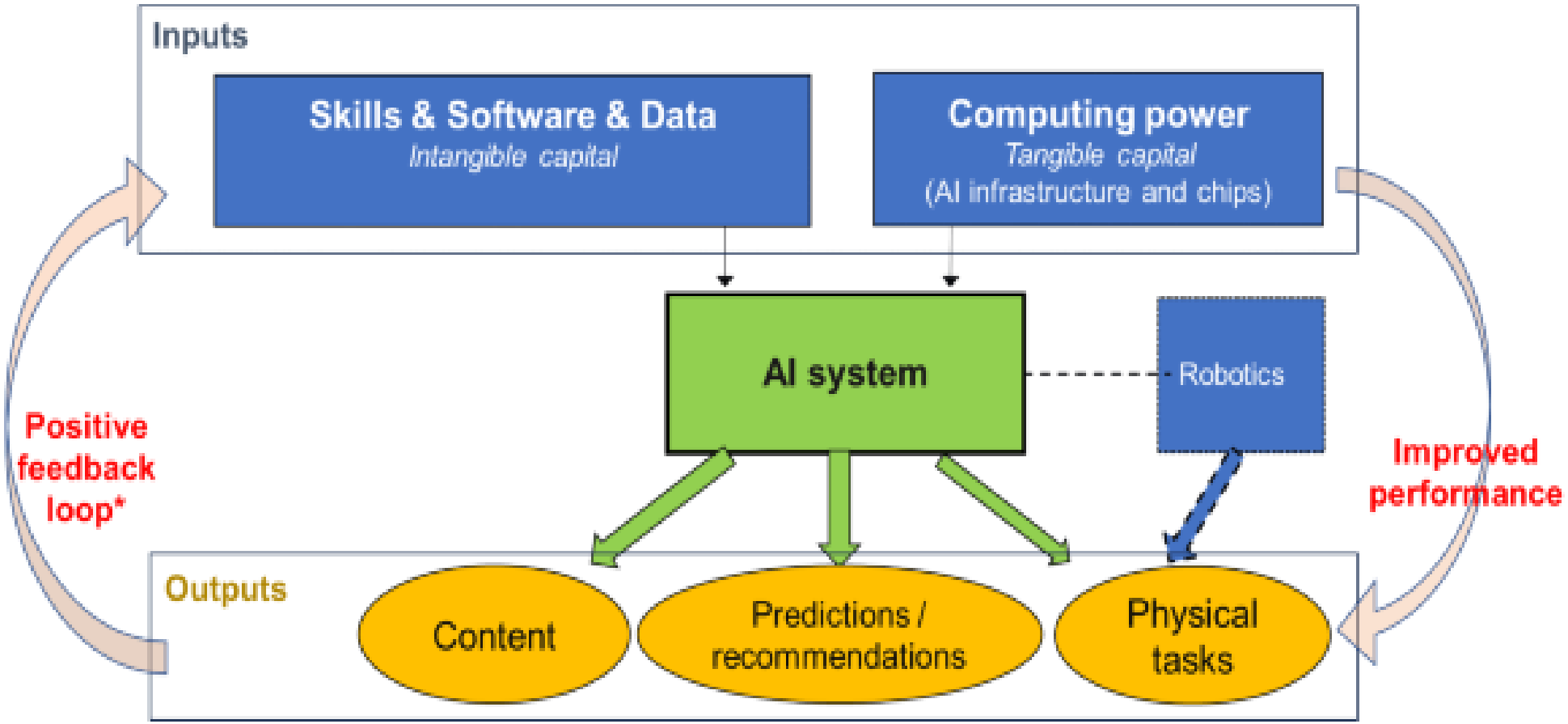




Source: Decomposition as in Van Ark, de Vries and Erumban (2019), using AI industry taxonomy from Calvino (2024) and computed on BEA/BLS and Eurostat industry data.

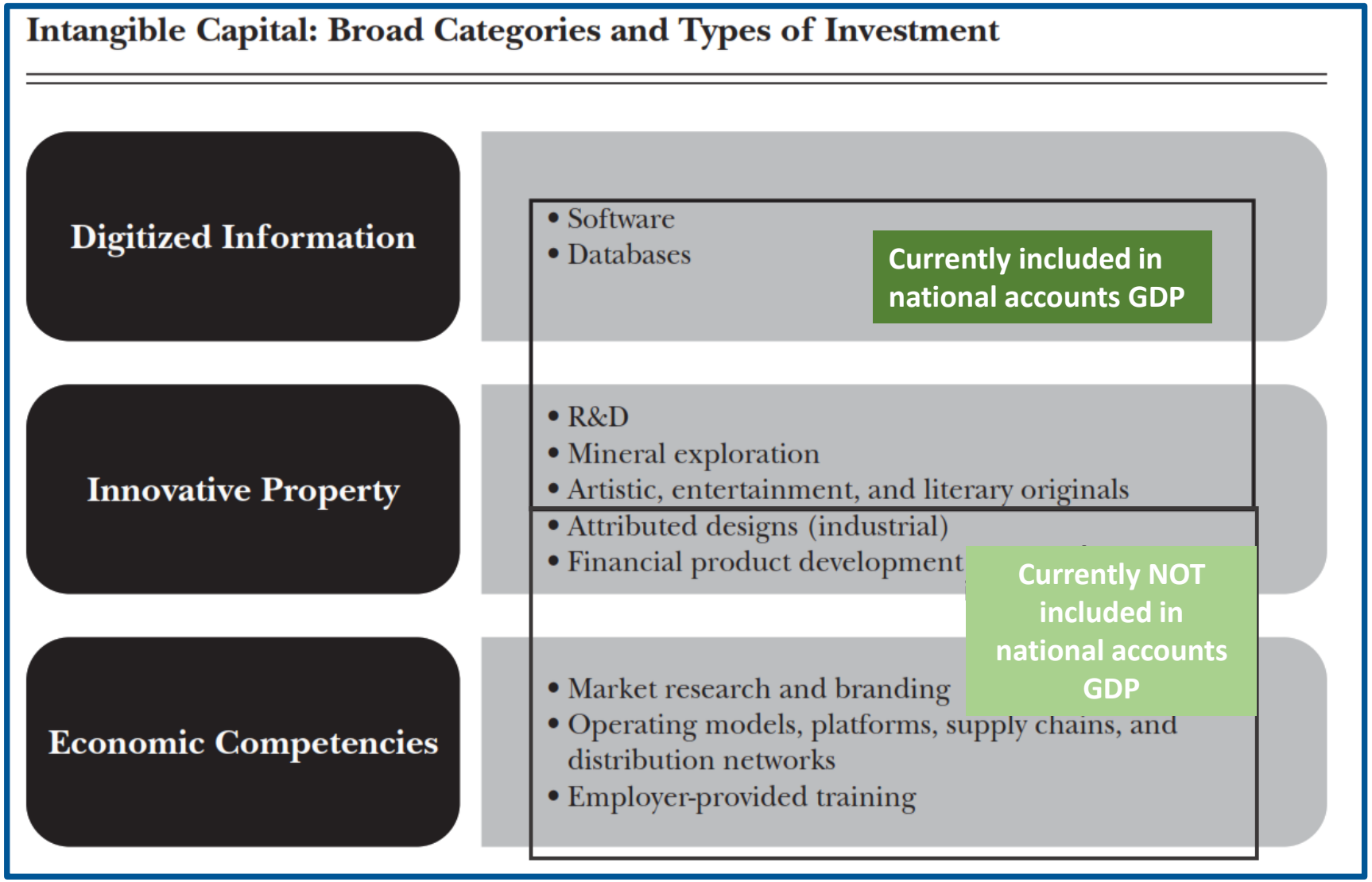
THE PRODUCTION FUNCTION OF AI IS LARGELY AN INTANGIBLES STORY

Figure 1. AI systems in a production function view: inputs and outputs



Source: Fillppucci et al. (2024), The impact of Artificial Intelligence on productivity, distribution and growth: Key mechanisms, initial evidence and policy challenges, OECD Artificial Intelligence Papers No. 15.

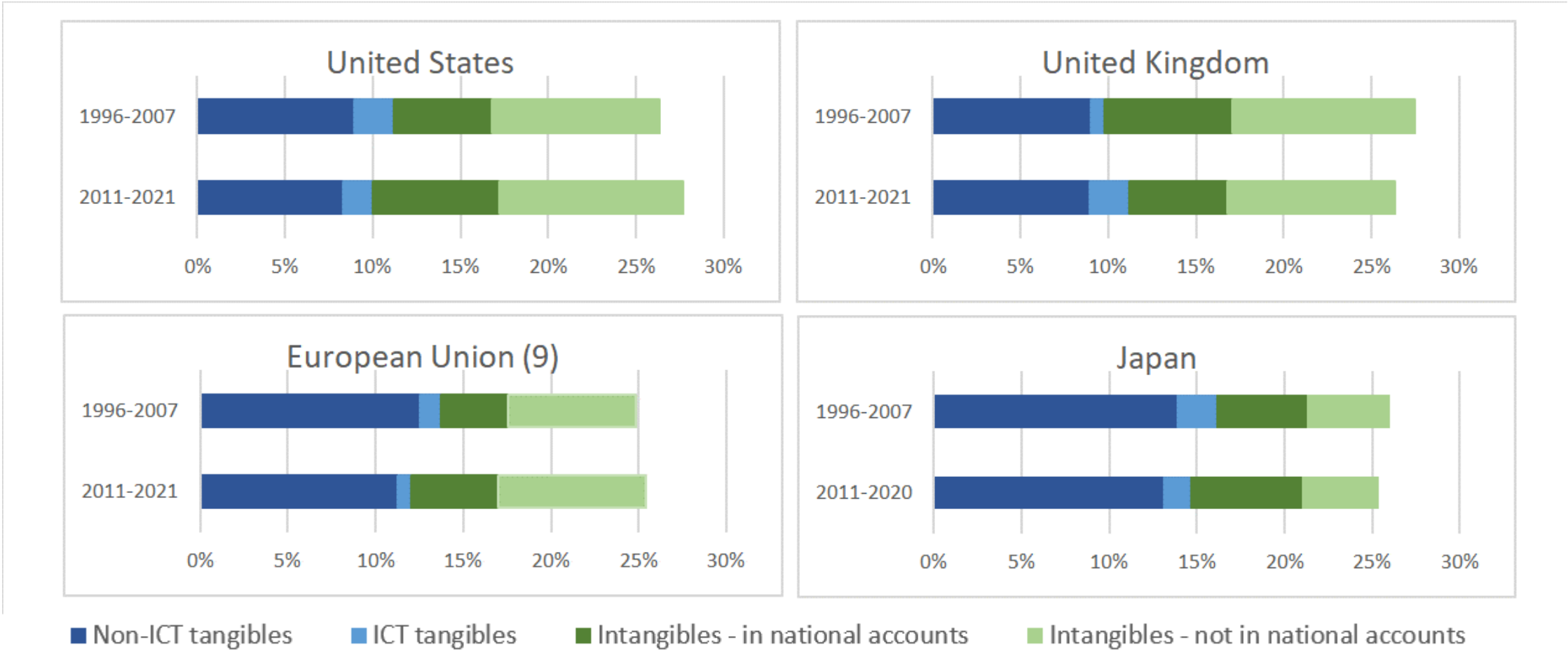
EXTENDING INVESTMENT AND GROWTH ANALYSIS TO INCLUDE INTANGIBLE CAPITAL



Source: based on Corrado et al. (2022)

DISTRIBUTION OF TANGIBLES AND INTANGIBLES QUITE DIFFERENT BETWEEN REGIONS.

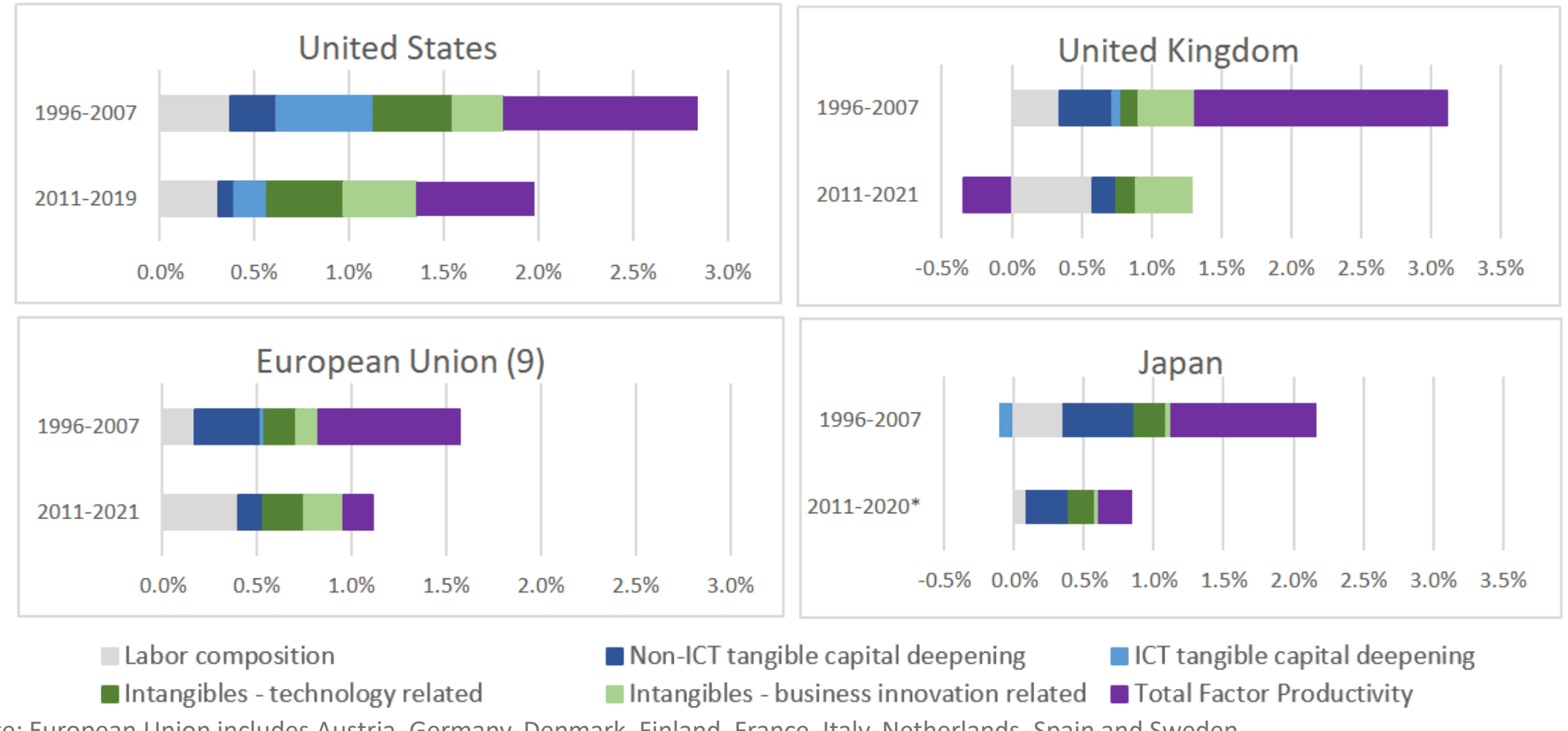
Investment Share in Value Added, Tangibles and Intangibles, Market Economy, 1996-2007 and 2011-2019



Note: European Union includes Austria, Germany, Denmark, Finland, France, Italy, Netherlands, Spain and Sweden.
Source: Updated from Van Ark et al. (2024), Are Intangibles Running out of Steam, International Productivity Monitor using EUKLEMS, January 2025

IS PRODUCTIVITY DIVERGENCE AN INVESTMENT OR A TFP STORY?

Extended Growth Accounting Decomposition of Labour Productivity, Market Economy, 1996-2007 and 2011-2021*

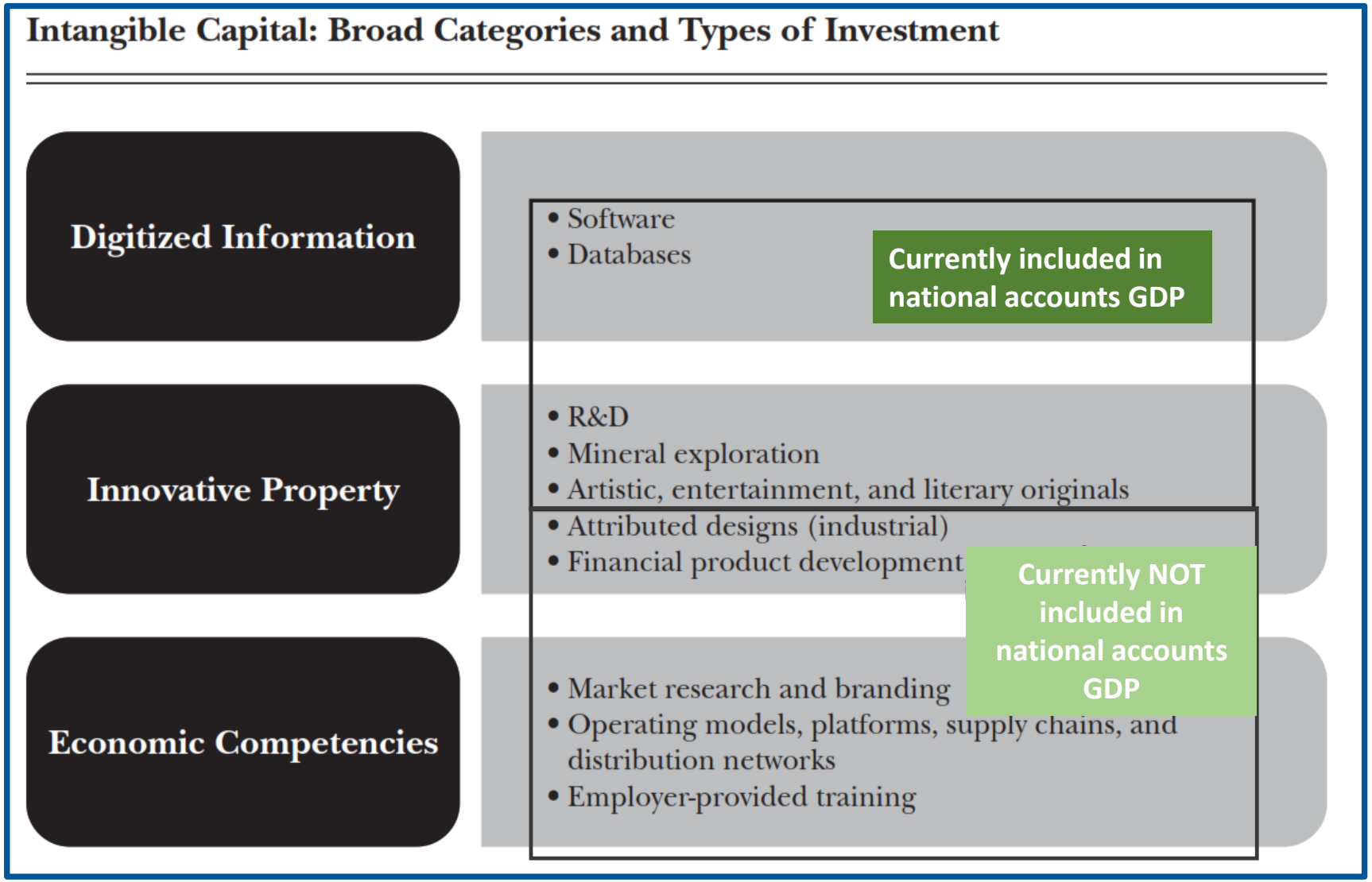


Note: European Union includes Austria, Germany, Denmark, Finland, France, Italy, Netherlands, Spain and Sweden.
Source: Van Ark et al. (2024), Are Intangibles Running out of Steam, The Productivity Institute

THE DECOMPOSITION OF GROWTH INTO CAPITAL AND TFP REMAINS A THORNY ISSUE DUE TO ENDOGENEITY

- Capital growth, and thus capital deepening are **endogenous** to TFP growth.
- When countries have a relatively low **"steady state" level of productivity**, the lack of capital deepening can be overstated as a cause of slow productivity growth when weak TFP growth is the real problem.
- Fernald (2017) and Fernald, Inklaar and Ruzic (2025) partially address the problem by looking at **changes in capital-output ratio** (instead of K/L) as "special influences" that reduce capital to output (e.g. unusual credit constraints or heightened uncertainty):
  - Original decomposition: $\Delta lnY_t - \Delta lnH_t = \alpha_t \left(\Delta lnK_t - \Delta lnH_t\right) + \left(1 - \alpha_t\right) \Delta lnLC_t + \Delta lnTFP_t.$
  - Partial adjustment for endogeneity: $\Delta lnY_t - \Delta lnH_t = \frac{\alpha_t}{1 - \alpha_t} \left(\Delta lnK_t - \Delta lnY_t\right) + \Delta lnLC_t + \frac{\Delta lnTFP_t}{1 - \alpha_t}.$
- Extending capital to intangibles may help overcome some of the endogeneity issues, e.g. if it incorporates **capital complementarities** between "technological innovation-related intangibles" (e.g. software) and "business innovation-related intangibles" (e.g. organisational capital) (Van Ark, De Vries and Erumban, 2024; Bounfour et al., 2024).

BUSINESS INNOVATION-RELATED INTANGIBLES ARE COMPLEMENTARY TO TECHNOLOGY-RELATED INTANGIBLES



"Technological innovation related intangibles"

"Business innovation related intangibles"

Source: based on Corrado et al. (2022)

OTHER POSSIBLE EXPLANATIONS

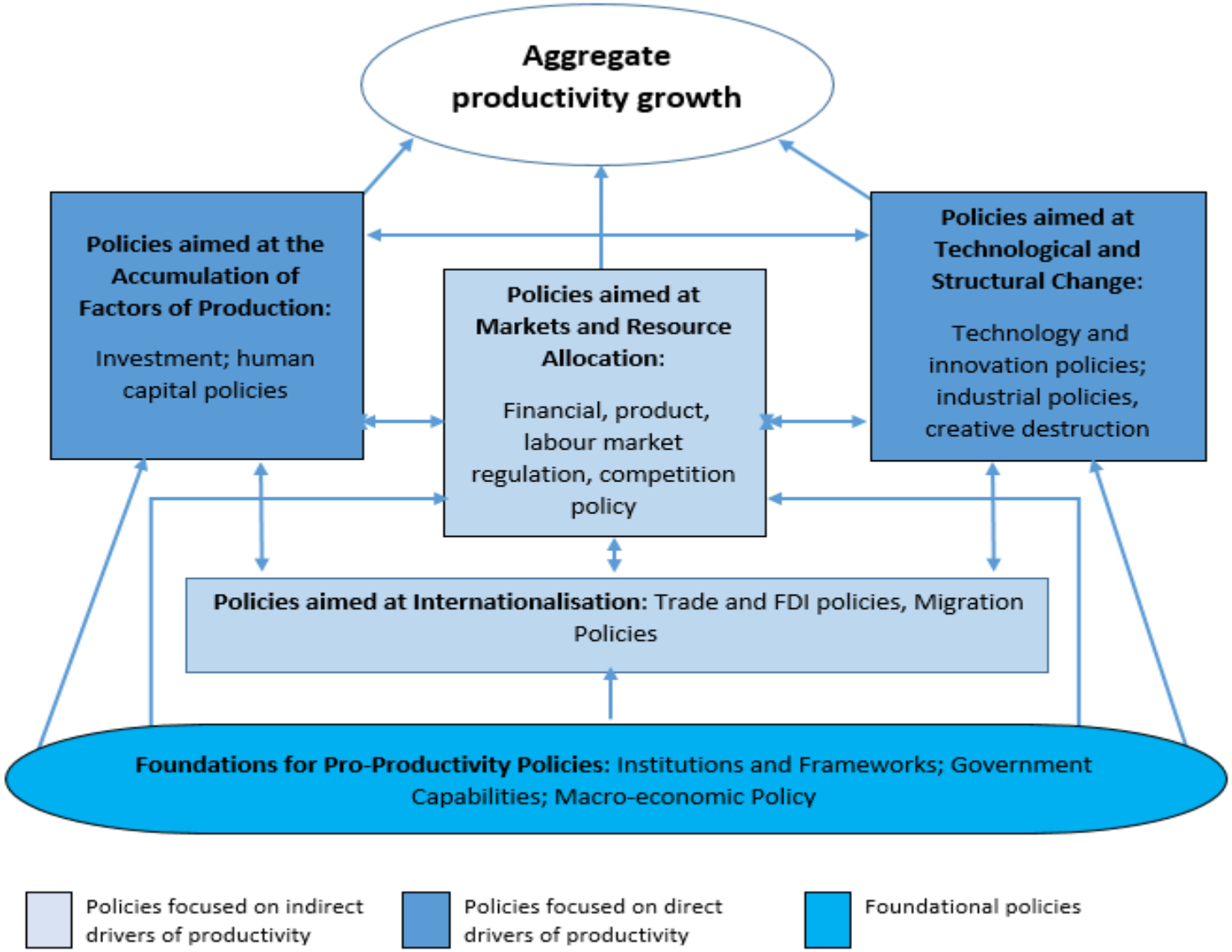
"When you have eliminated the impossible, whatever remains, however improbable, must be the truth"

THERE IS NO SILVER BULLET TO RAISE PRODUCTIVITY

- **Invest and innovation** to tackle the productivity paradox
- **Measurement issues** within and beyond the boundaries of the national accounts
- **Counter-productive policies** excessive regulations, taxes, competition laws, protectionism
- **Supply-side shocks and constraints:**
  - **Short-term:** Supply-side "shocks", including pandemic, supply chain disruptions, stagflation, political uncertainty
  - **Long-term**: "Constraints" such as end of catch-up potential of emerging markets, demographics (ageing, mobility, labour shortages), climate change
- **Demand-side issues**:
  - **Short-term**: weak productive investment (e.g. aftermath of global financial crisis or interest rate increases), weak consumption (e.g. aftermath of pandemic, inflation and cost of living crisis)
  - **Long-term:** more low-productivity personal and public services (incl. Baumol effect); "forced" public expenditure on climate, defense, etc.

HOPE FOR A PRODUCTIVITY REVIVAL?

A FRAMEWORK FOR PRO-PRODUCTIVITY POLICIES



NEW PROJECT

Source: B. van Ark, K. de Vries, D. Pilat (2023) Are Pro-Productivity Policies Fit for Purpose? Working Paper No. 038, The Productivity Institute (https://www.productivity.ac.uk/research/are-pro-productivity-policies-fit-for-purpose-productivity-drivers-and-policies-in-g-20-economies/)

SCENARIOS FOR DIFFERENT PRODUCTIVITY REGIMES MAY BE MORE USEFUL THAN FORECASTS OR PROJECTIONS

AREAS OF FOCUS	PRODUCTIVITY GROWTH POTENTIAL *SLOW*	*FAST*
PRODUCTIVITY LEVEL "STEADY STATE" *HIGH*	**Diffusion and adoption** of technologies to broaden base **Leverage demand** for high value added activities Increase **business dynamism**	Focus on **technological and structural change**. Optimise **regulatory framework** to stay at frontier (e.g. balance strategic advantage vs. competition)
LOW	Employ **underutilized production factors** (low working hours, underinvested in critical capital assets); Create **absorptive capabilities**.	**Realise catch-up potential** by investing in basic sources of investment (education, infrastructure, business support, etc.) Benefit from **trade and FDI**.

MAIN CONCLUSIONS

- **Cyclical effects on productivity** following recovery from pandemic are waning.
- **Structural drivers of productivity** are key – but countries in different "steady states" (US vs. Europe/Japan; Mature vs. Emerging; Emerging between them).
- A focus on **sectors, adoption of new technologies, and (intangible) investment** can help to detect growth differentials.
- **U.S. is mainly a digital services story**, but not clear it will last.
- **Supply side policies** need to be joined up effectively to revive productivity.
- The **role of demand** is often overlooked by productivity researchers.
- Thinking about **scenarios** might be more useful than trying to forecast the future.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