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Technology, work and international economic relations

Shamik Dhar, Chief Economist at the Foreign and Commonwealth Office

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Top of the international agenda

Unleashing peoples' potential

“Technological change is extraordinary in its magnitude and speed. The emergence of new technologies has led to the development of new forms of work that are rapidly changing production processes worldwide. This offers huge opportunities to accomplish fair and sustainable development; yet it also presents challenges that are putting pressure on the employment, welfare and education agendas.

Policy responses need to ensure that embracing technological change will not engender exclusion, social disintegration, or backlash. Providing these responses in a coordinated manner will also help prevent excessive gaps in technology adoption across countries and surging inequality among them”

Overview of Argentina’s 2018 G20 Presidency

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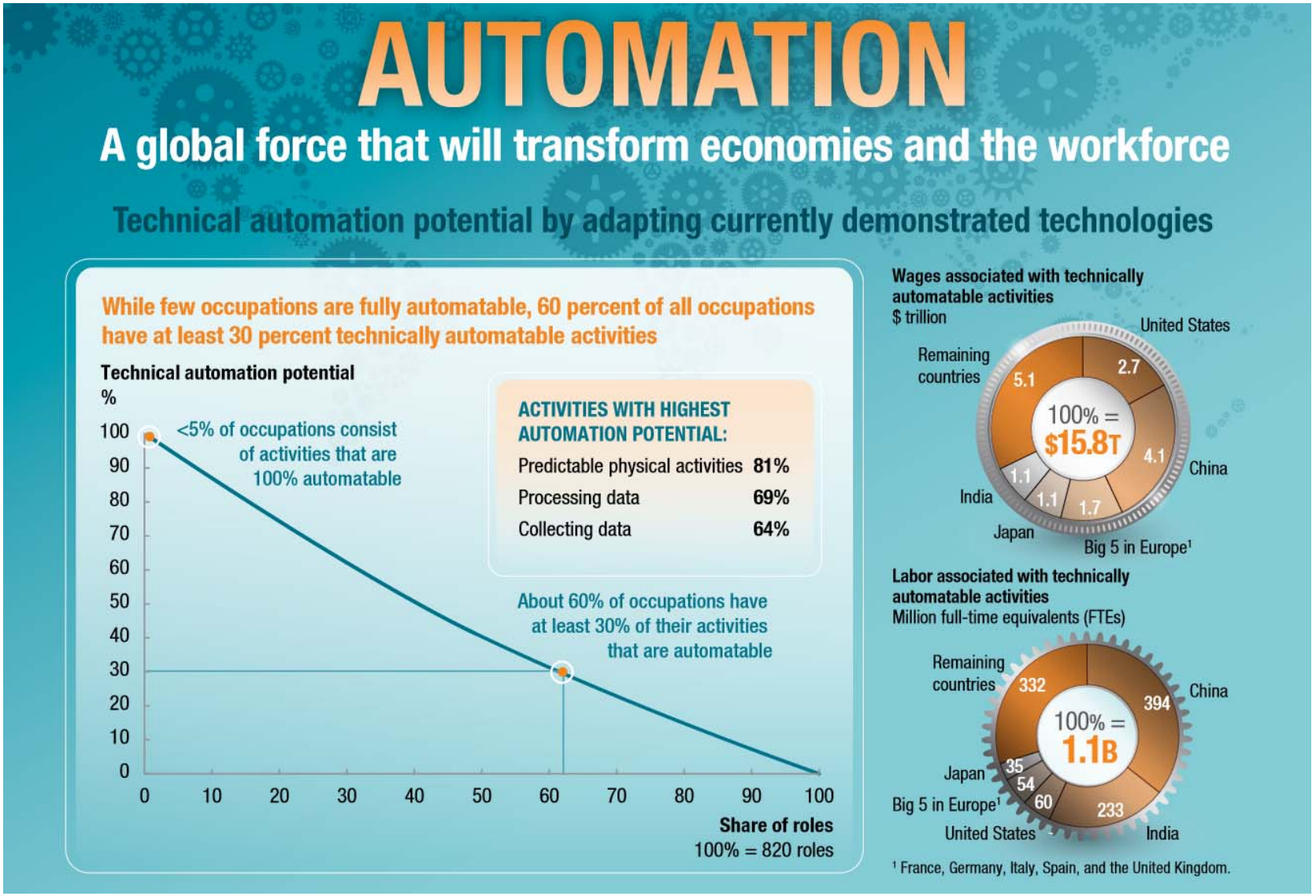
The number of jobs at risk



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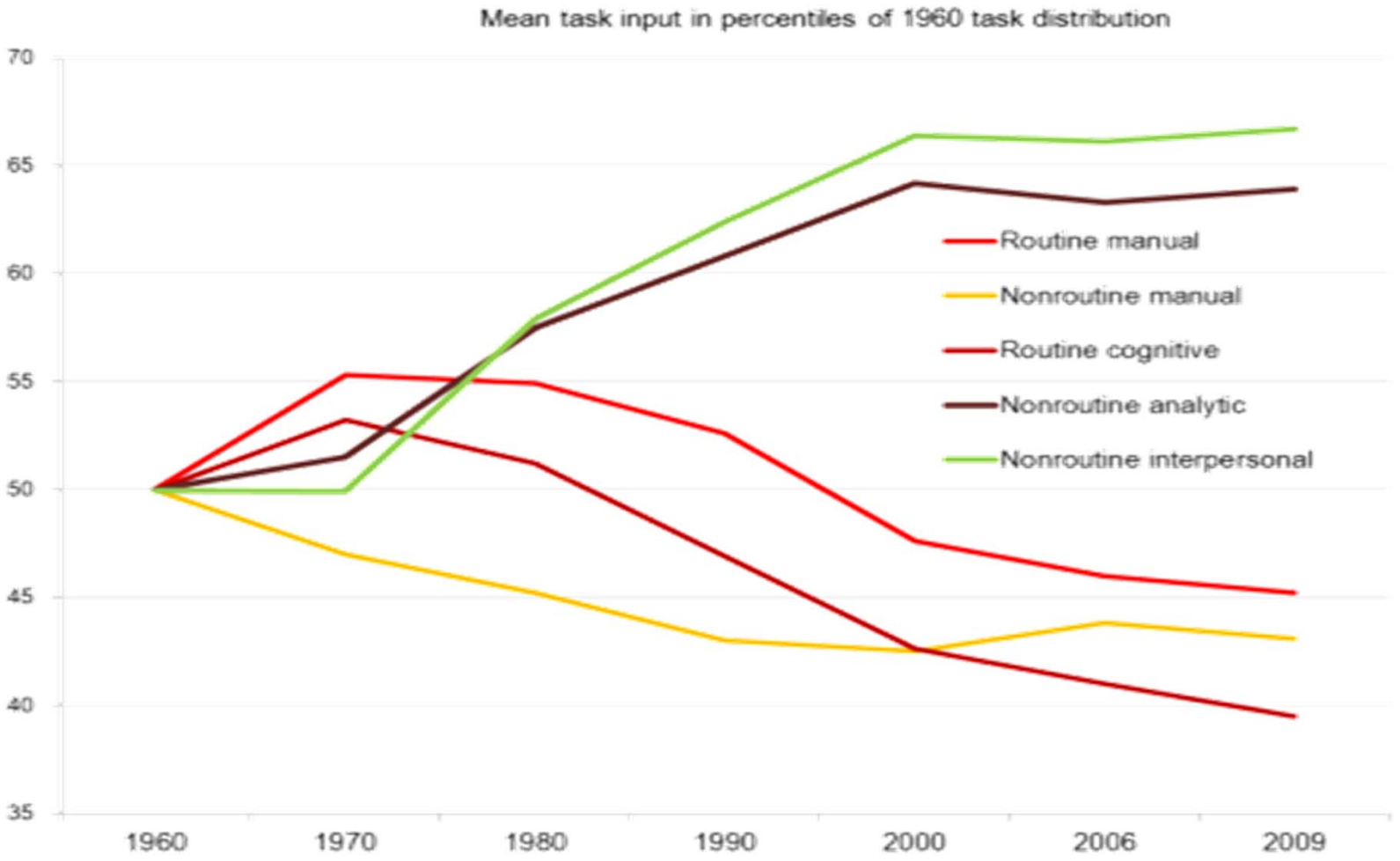
The type of jobs at risk



Source: Levy and Murnane (2013), Dancing with Robots: Human Skills for Computerized Work, Third Way

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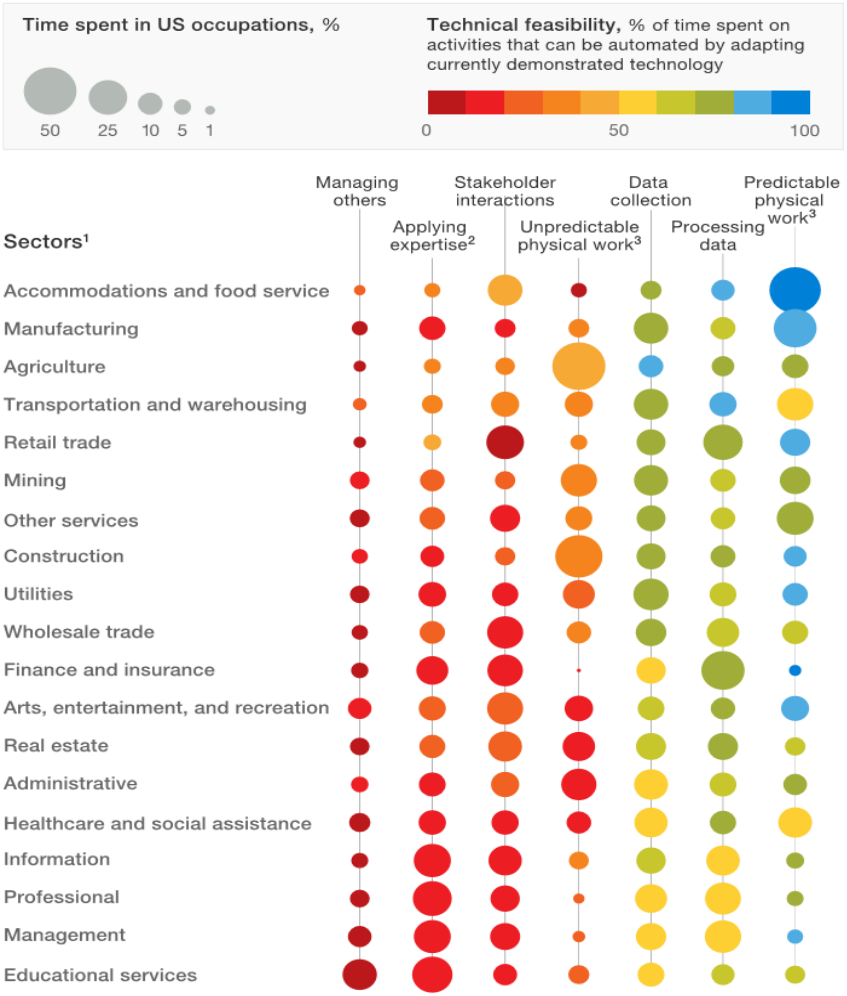
The type of jobs at risk

Automation is technically feasible for many types of activities in industry sectors, but some activities can be more affected than others.

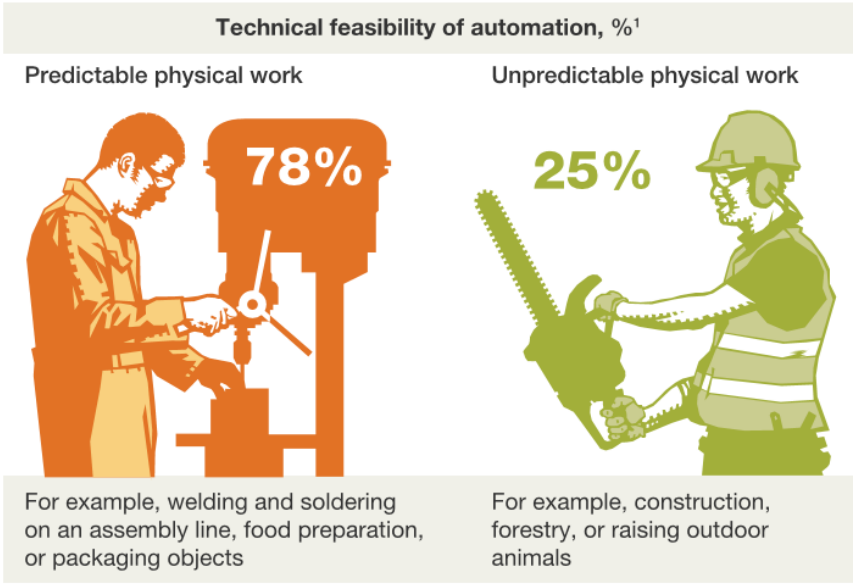


In practice, automation will depend on more than just technical feasibility. Five factors are involved: technical feasibility; costs to automate; the relative scarcity, skills, and cost of workers who might otherwise do the activity; benefits (eg, superior performance) of automation beyond labor-cost substitution; and regulatory and social-acceptance considerations.

[1]**Agriculture** includes forestry, fishing, and hunting; **other services** excludes federal-, state-, and local-government services; **real estate** includes rental and leasing; **administrative** includes administrative support and government administration; **healthcare and social assistance** includes private, state-government, and local-government hospitals; **professional** includes scientific and technical services; **educational services** includes private, state-government, and local-government schools.
[2]Applying expertise to decision making, planning, and creative tasks.
[3]Unpredictable physical work (physical activities and the operation of machinery) is performed in unpredictable environments, while in predictable physical work, the environments are predictable.

McKinsey&Company

It's more technically feasible to automate predictable physical activities than unpredictable ones.



[1]% of time spent on activities that can be automated by adapting currently demonstrated technology.

McKinsey&Company

https://www.mckinsey.com/featured-insights/digital-disruption/harnessing-automation-for-a-future-that-works

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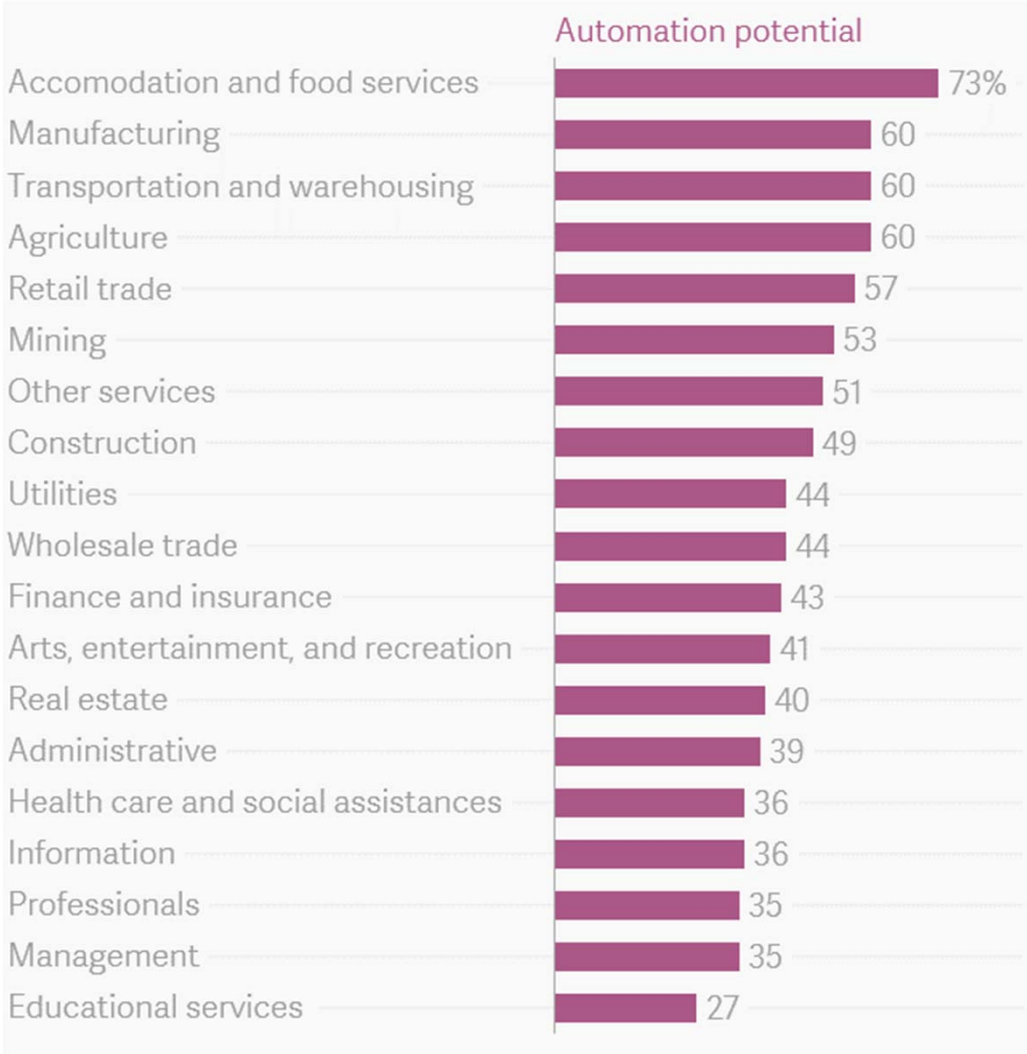
The type of jobs at risk



- Source: US Bureau of Labour Statistics; McKinsey Global Institute

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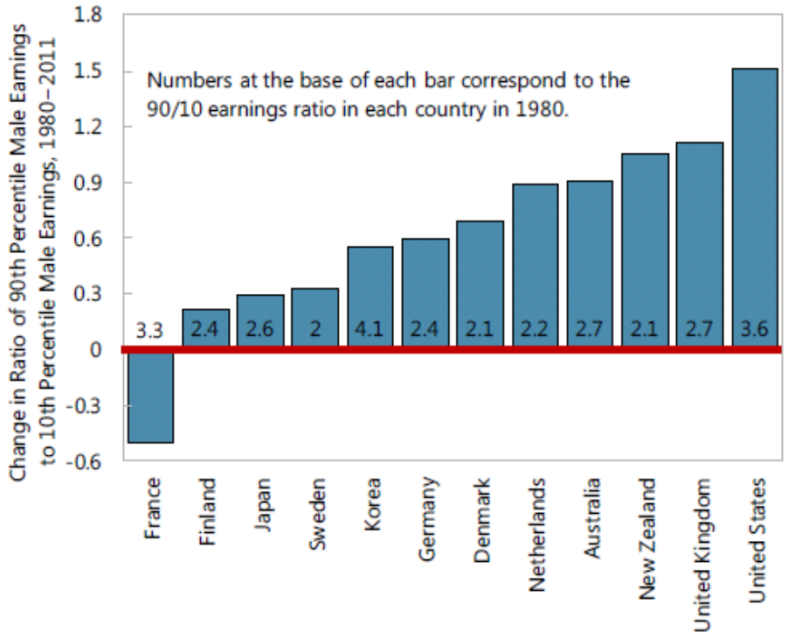
The kinds of workers who benefit

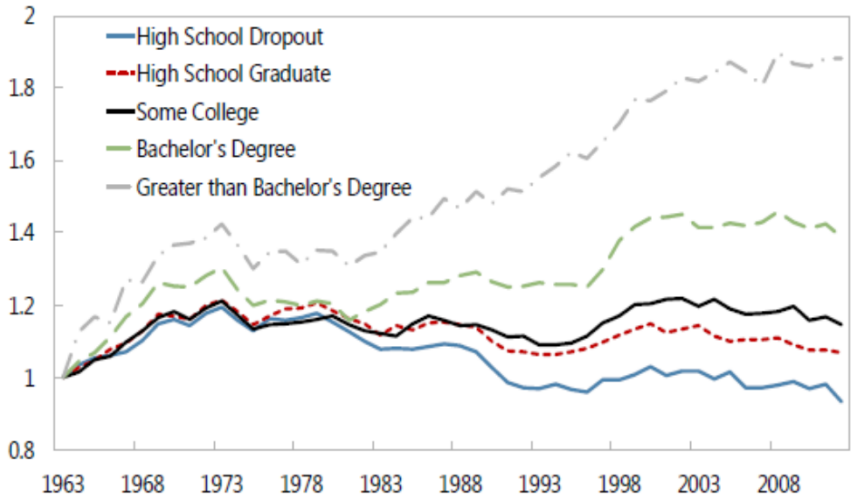
Figure 5. Earnings Polarization Accompanied by…



Source: Autor (2014).

Figure 6. … an Increasing Educational Wage Premia in Some Economies

(real wage level of full time U.S. male workers relative to 1963)



Source: Autor (2014).

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Two types of progress

- Automation
  - Including falling relative price of capital

- Digital/'gig'
  - Improved matching of producer with consumer

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Automation

$$Y = AK^{\alpha}L^{1-\alpha}$$

$$K = B(\gamma M^{\frac{s-1}{s}} + (1-\gamma)H^{\frac{s-1}{s}})^{\frac{s}{s-1}}$$

$$L = D(\theta V^{\frac{t-1}{t}} + (1-\theta)R^{\frac{t-1}{t}})^{\frac{t}{t-1}}$$

$Y: output;\ K: capital;\ L: Labour;\ M:' machines' \ or \ traditional \ capital;$

$H: human \ capital \ or \ skilled \ labour; V: automatable \ labour; R:' Robots';$
$s: elasticity \ of \ substitution \ in \ capital; t: in \ labour$

- Automation can be modelled as rise in t: degree of substitutability between automatable labour and some types of capital (‘robots’)
- But also, falling price of ‘robots’ can induce greater substitution of ‘robots’ for automatable labour for a given level of substitutability

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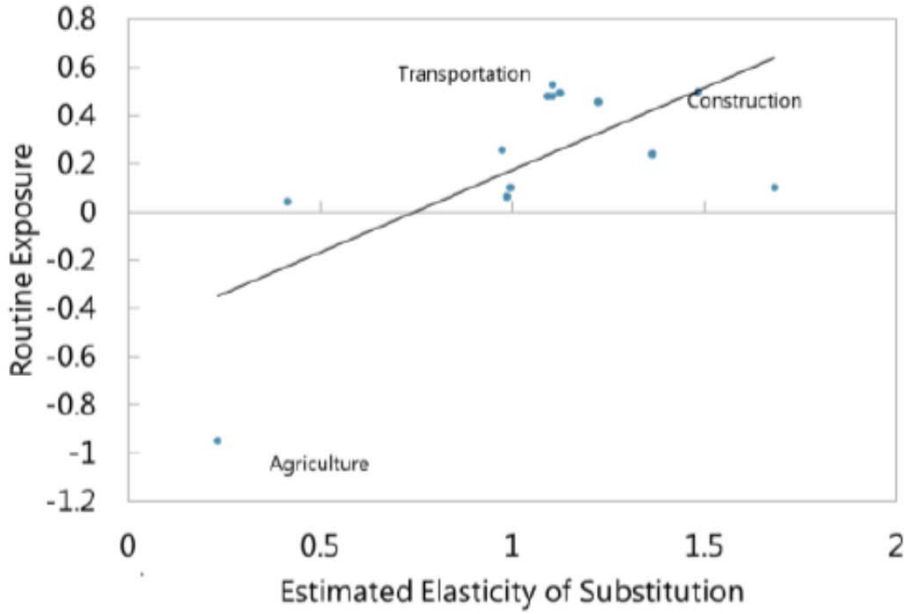
Increasing substitutability

Figure 10. Elasticity of Substitution Correlated with Degree of Task Routinization

(by sector, 1992–2014)



Source: April 2017 WEO.

Notes: Routine exposure is measured by aggregate routine task intensity index (Autor and Dorn, 2013); smaller number reflects lower exposure to "routinizability."

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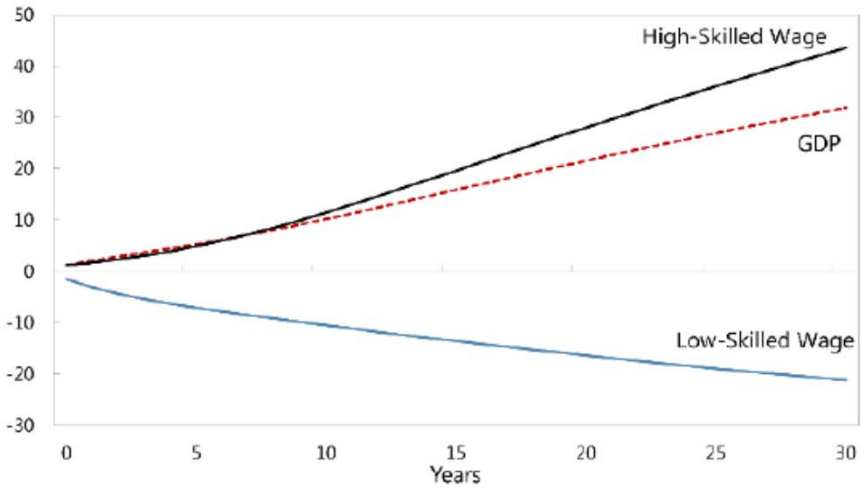
IMF simulation

Figure 14. With Higher Substitutability, High-Skilled Wages Increase and Low-Skilled Wages Decline…

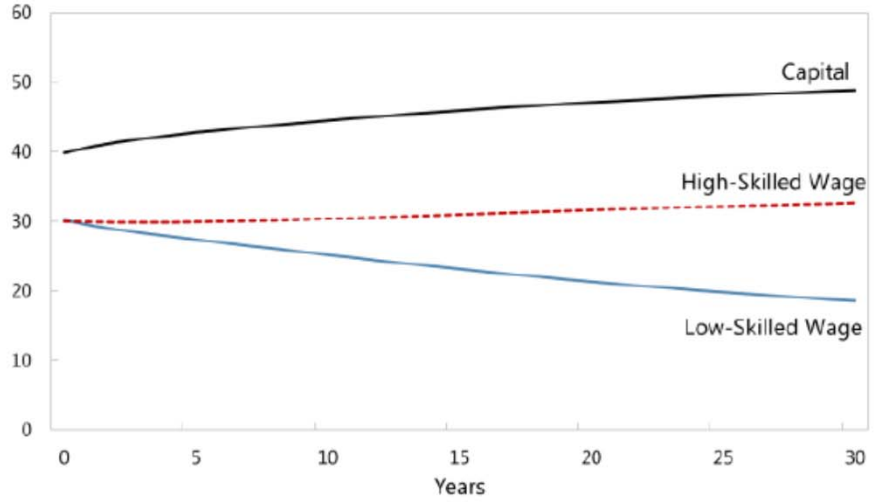
(percent change from the baseline)



Source: IMF Staff Calculations.

Figure 15. …while Low-Skilled Income Share Plummets

(percent)



Source: IMF Staff Calculations.

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Digital/Gig

- Many different influences here
- But one key dimension is improved matching technology
- Linking producers with consumers more directly
- Network effects and increasing returns to scale favour market concentration
- Reducing influence of (labour-intensive) traditional gatekeepers

- A bigger issue for services than manufacturing

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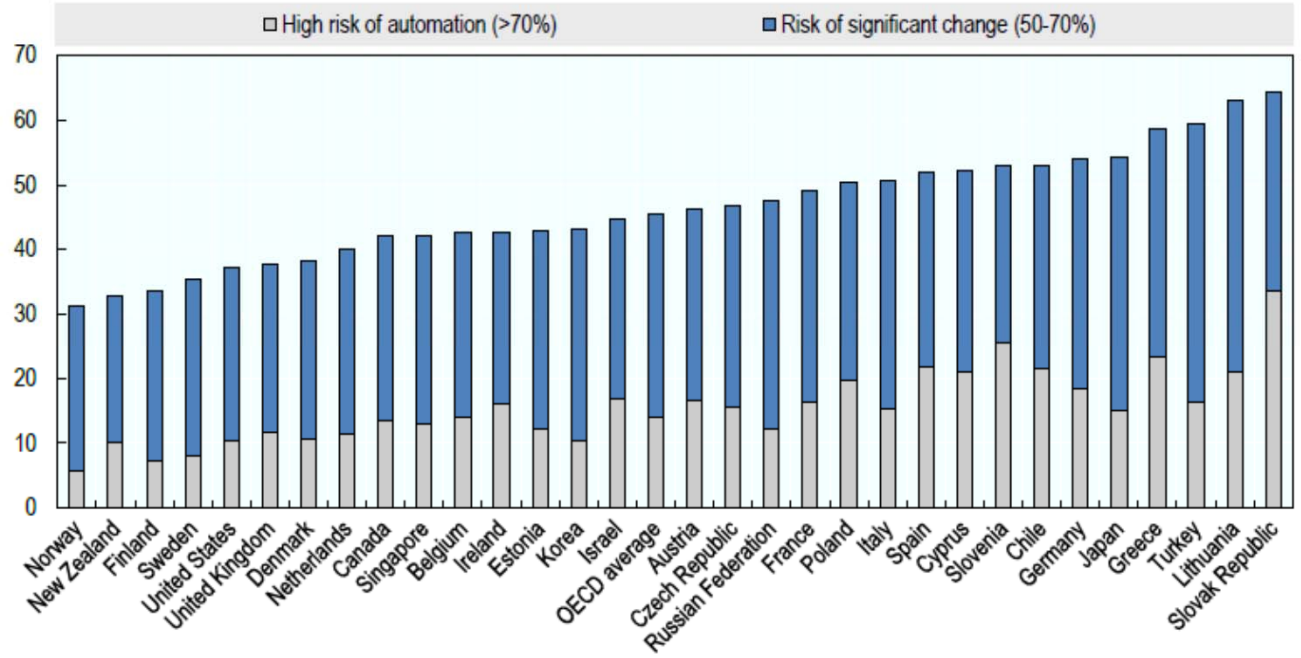
Mostly in the West?

Chart 1. Large shares of jobs are at risk of automation or significant change
Percentage of jobs at risk by degree of risk



Notes: High risk – more than 70% probability of automation; risk of significant change – between 50 and 70% probability.

Source: OECD (2018), Survey of Adult Skills (PIAAC) 2012, 2015.

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Mostly in the West?

- McKinsey: 375m jobs at risk worldwide by 2030; US – 23% jobs affected or 44% in fast automation scenario
- Comparable numbers in China (16%), Mexico (13%), India (9%)
- Reflects current structure of production
- But will this change?
- Much of EM advance predicated on large growth in relatively low-skill manufacturing jobs (outsourcing)

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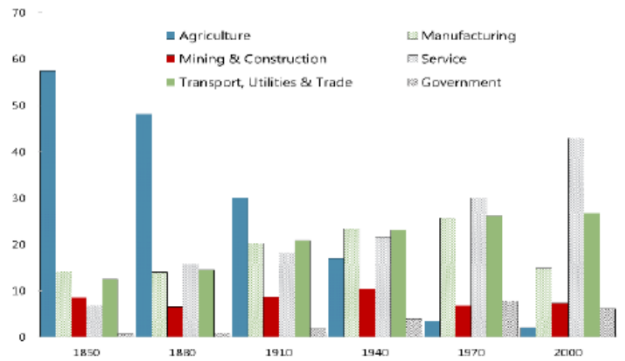
Why Luddism was wrong

Figure 4. Technological Change has Contributed to Sectoral Reallocation within the U.S. Economy
(percent of labor force)



Source: U.S. Census Bureau and IMF Staff Calculations.
Notes: In the 1850-1910 samples, the industry of employment was inferred from the reported occupation.

- Lots of examples from history: from Thames river boatmen to 1990s Bank tellers
- Reallocation of resources towards more productive technologies and sectors raises investment and demand, wages and employment

- Pareto improvement – second welfare theorem.
- Policy question – how do you compensate the transitional losers?

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Is it different this time?

$$Y = AK^{\alpha}L^{1-\alpha}$$

$$K = B\left(\gamma M^{\frac{s-1}{s}} + (1-\gamma)H^{\frac{s-1}{s}}\right)^{\frac{s}{s-1}}$$

$$L = D\left(\theta V^{\frac{t-1}{t}} + (1-\theta)R^{\frac{t-1}{t}}\right)^{\frac{t}{t-1}}$$

$Y: output;\ K: capital;\ L: Labour;\ M:' machines' \ or \ traditional \ capital;$

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- As t gets larger, greater substitutability and problem gets bigger the larger is initial θ

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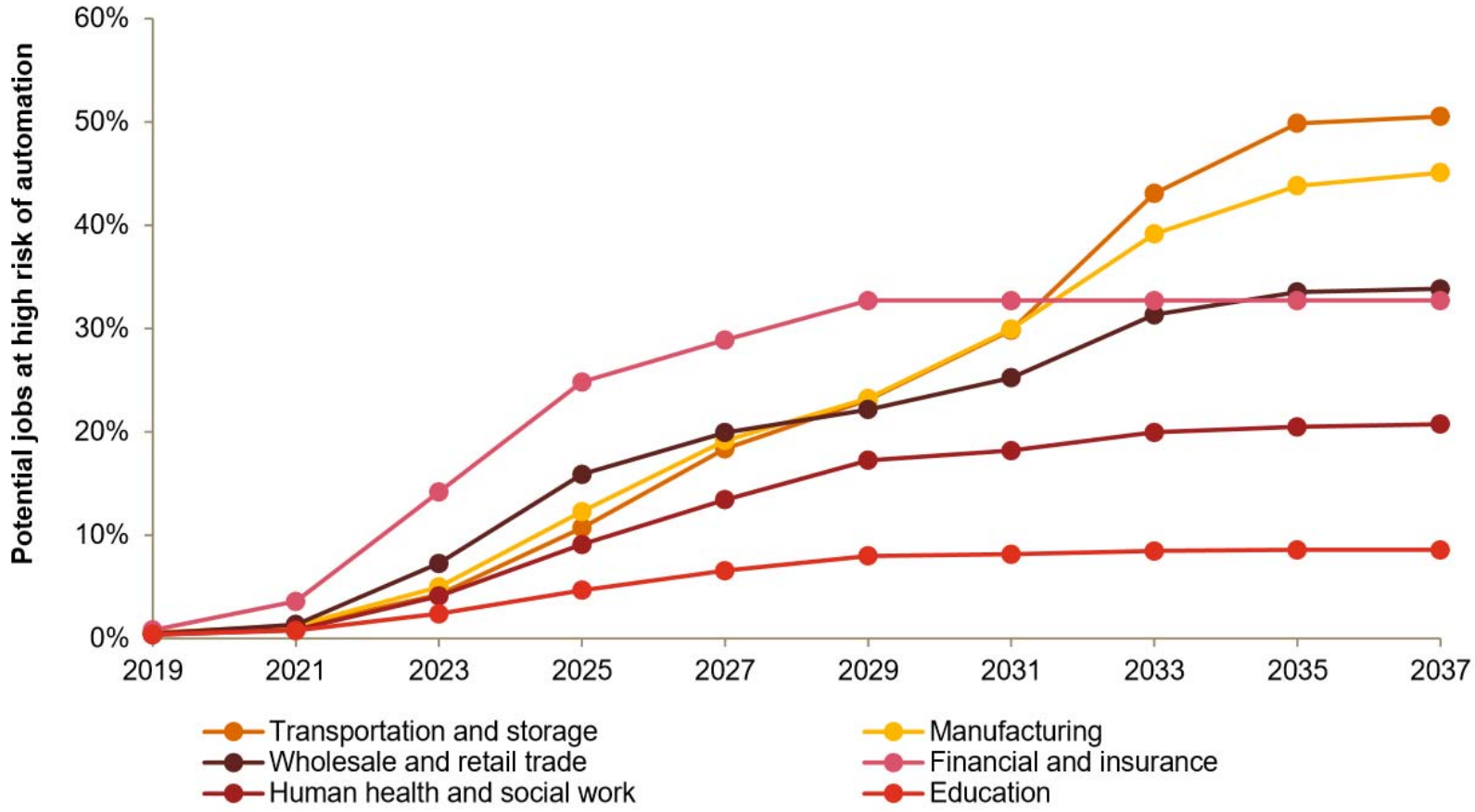
Impact likely to rise over time

Figure 4.2 – Potential impact of job automation over time across industry sectors



Source: PIAAC data, PwC analysis

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Dramatic changes

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Policy recommendations

- Typically:

- Education
- Redistribution

- … yes, but

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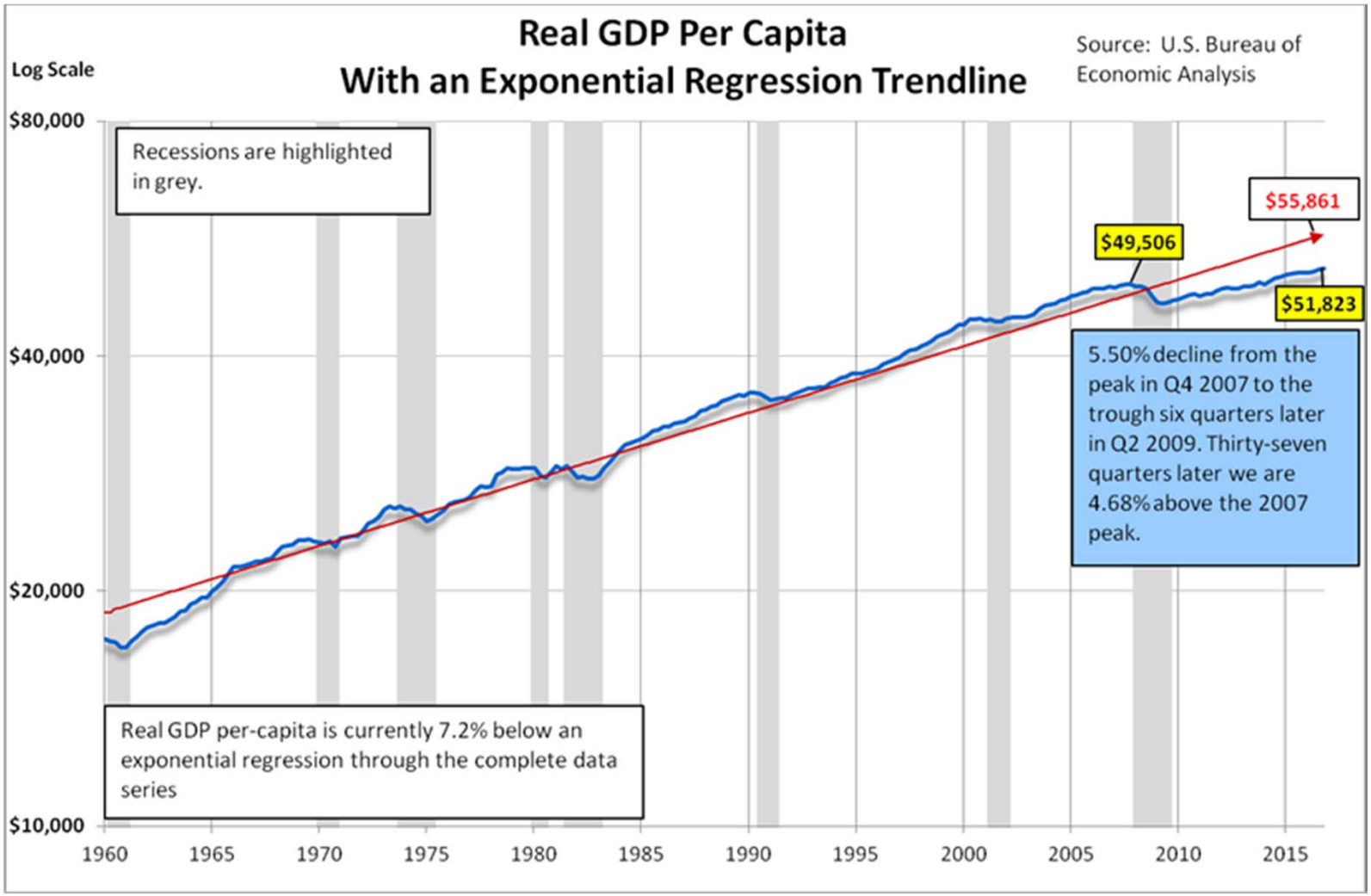
Aggregate demand more important?



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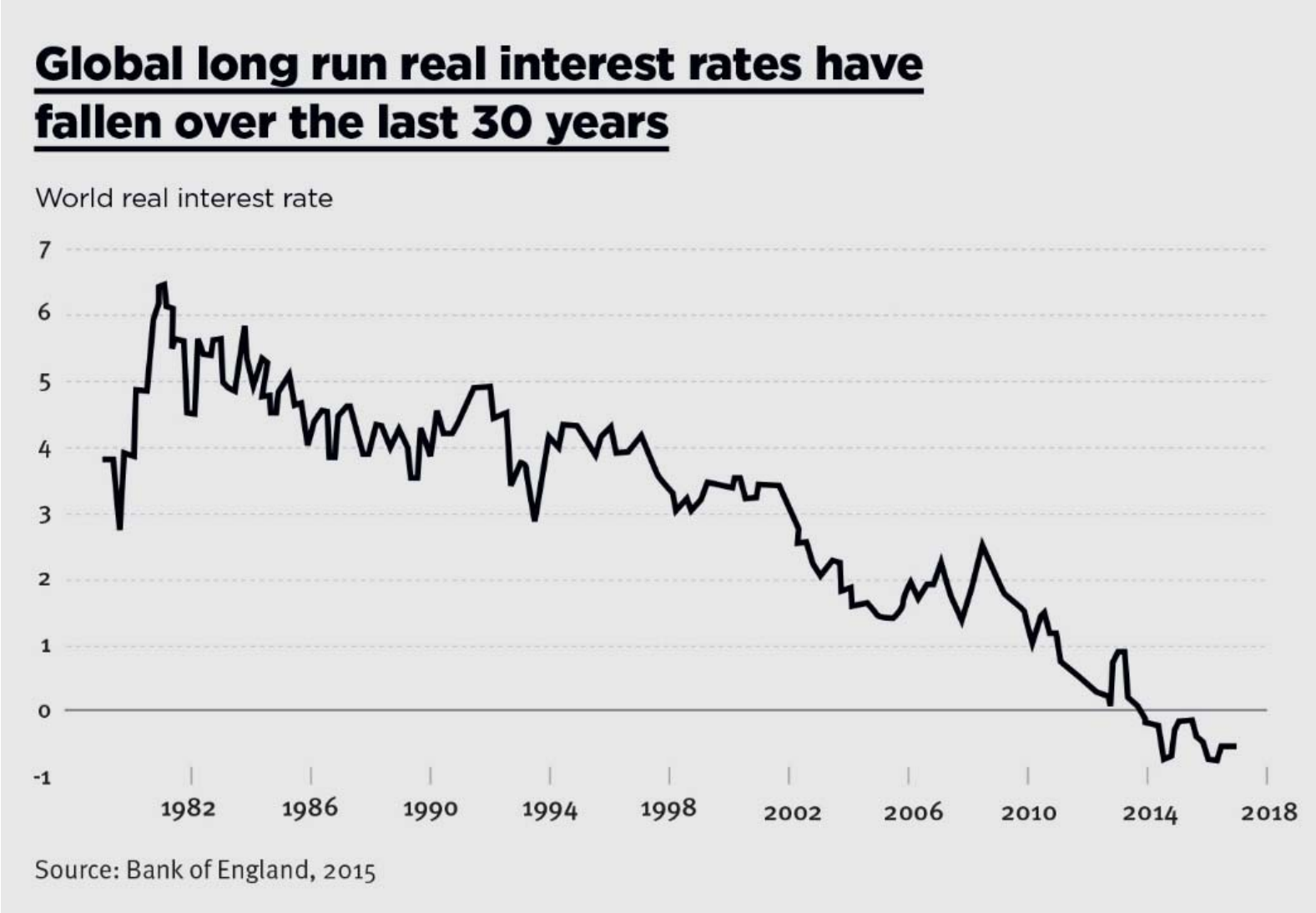
Global interest rates



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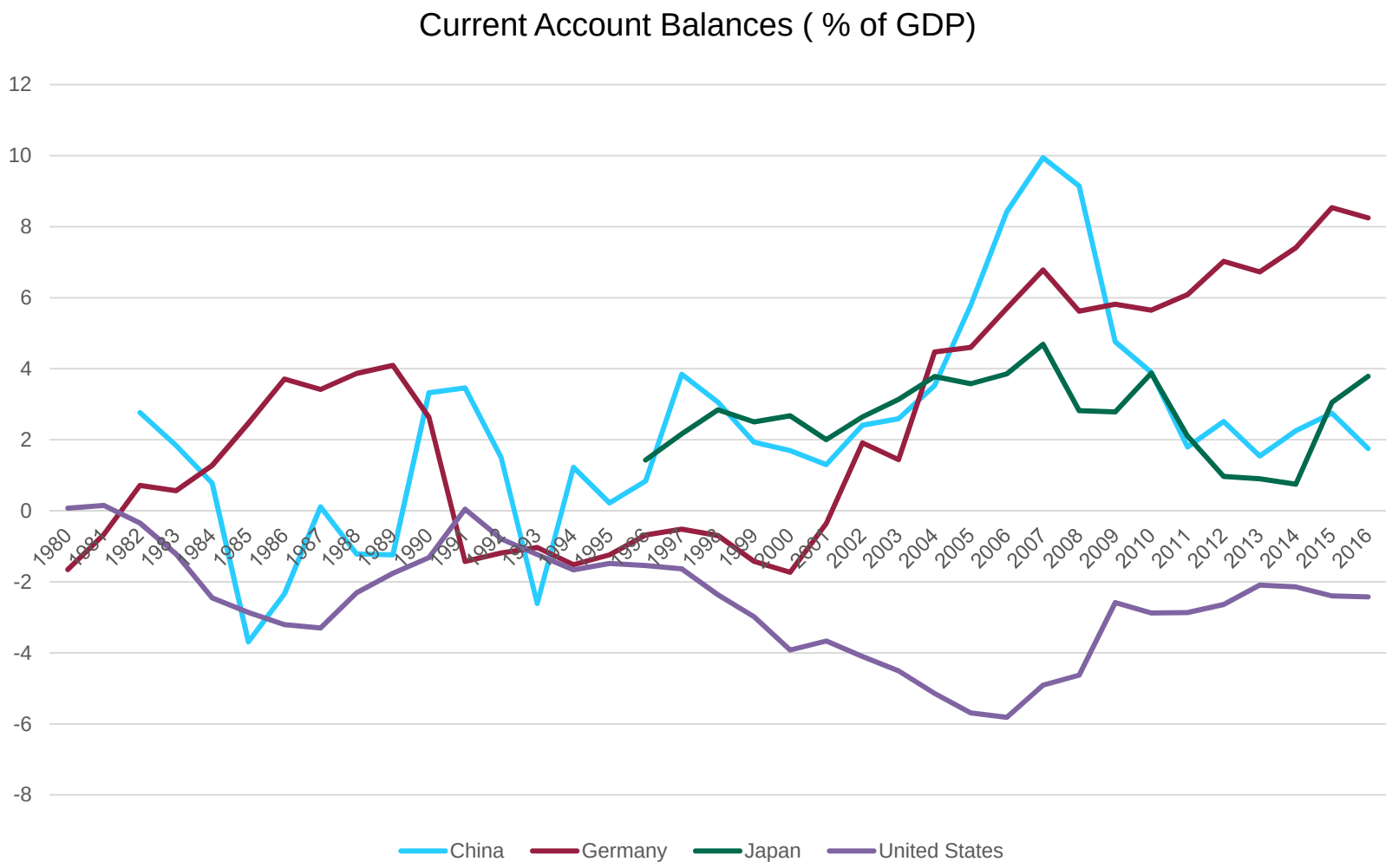
Global imbalances



Data: World Bank

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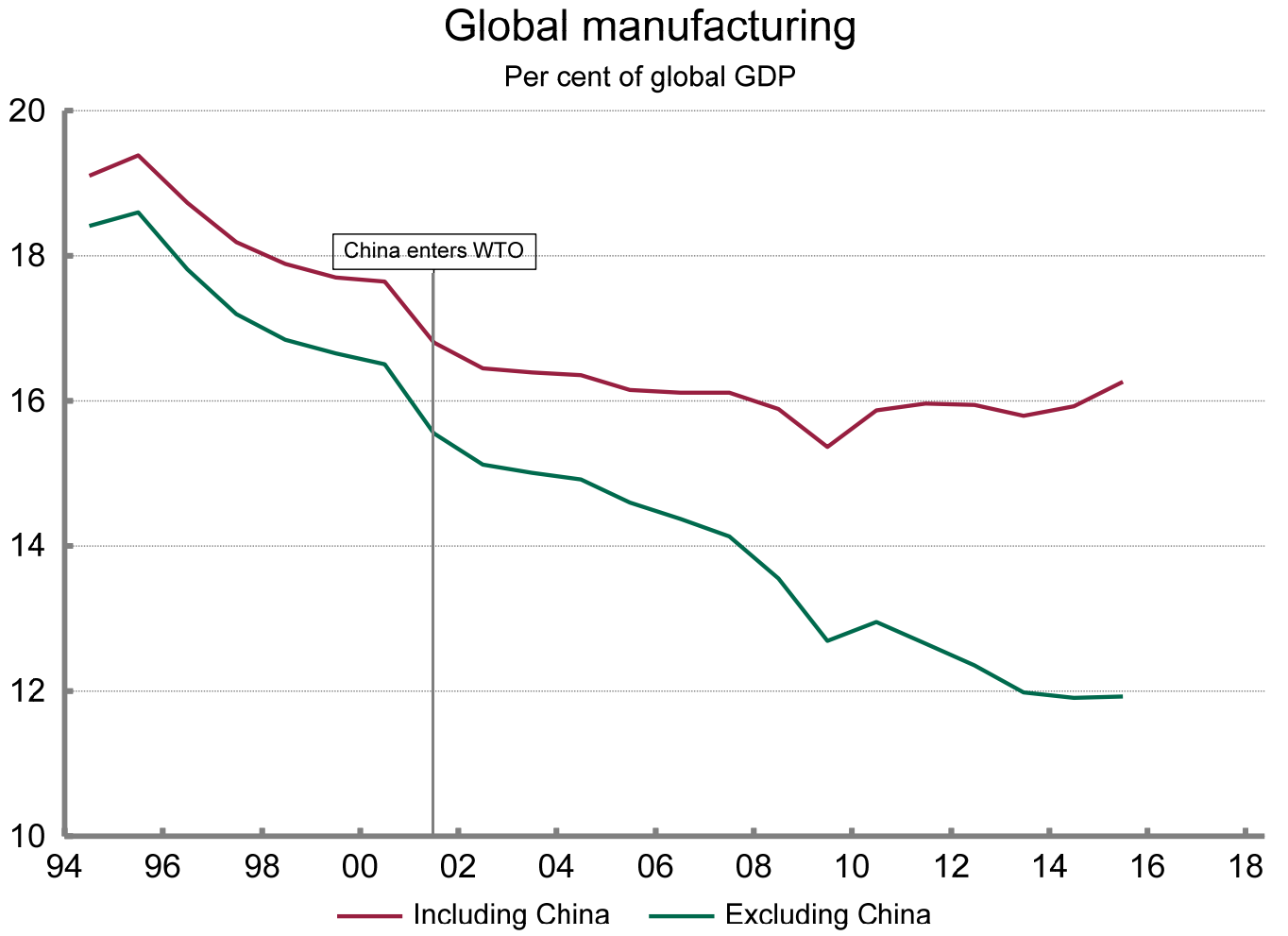
Macro shocks: global manufacturing labour force



Source: Thomson Reuters Datastream

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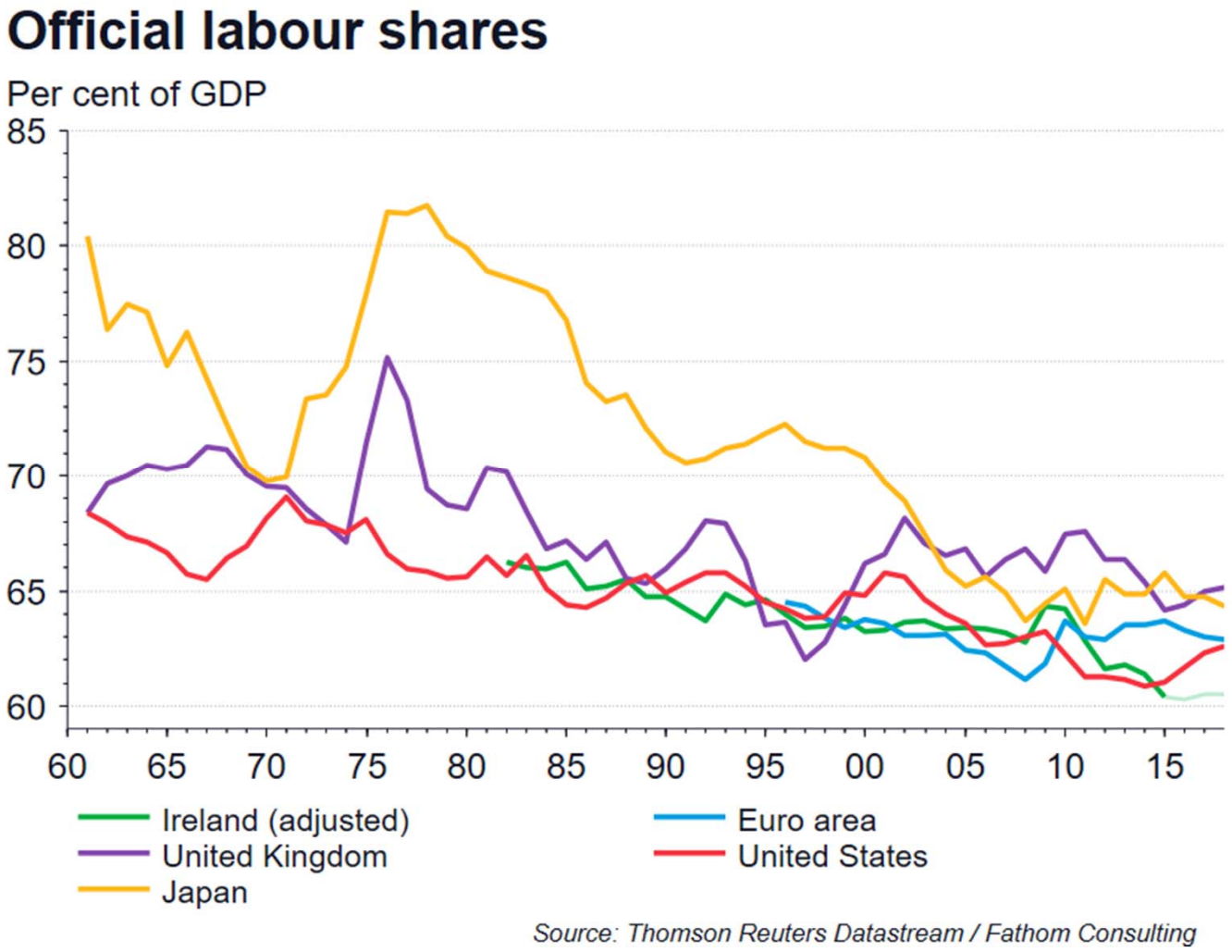
Capital vs. Labour



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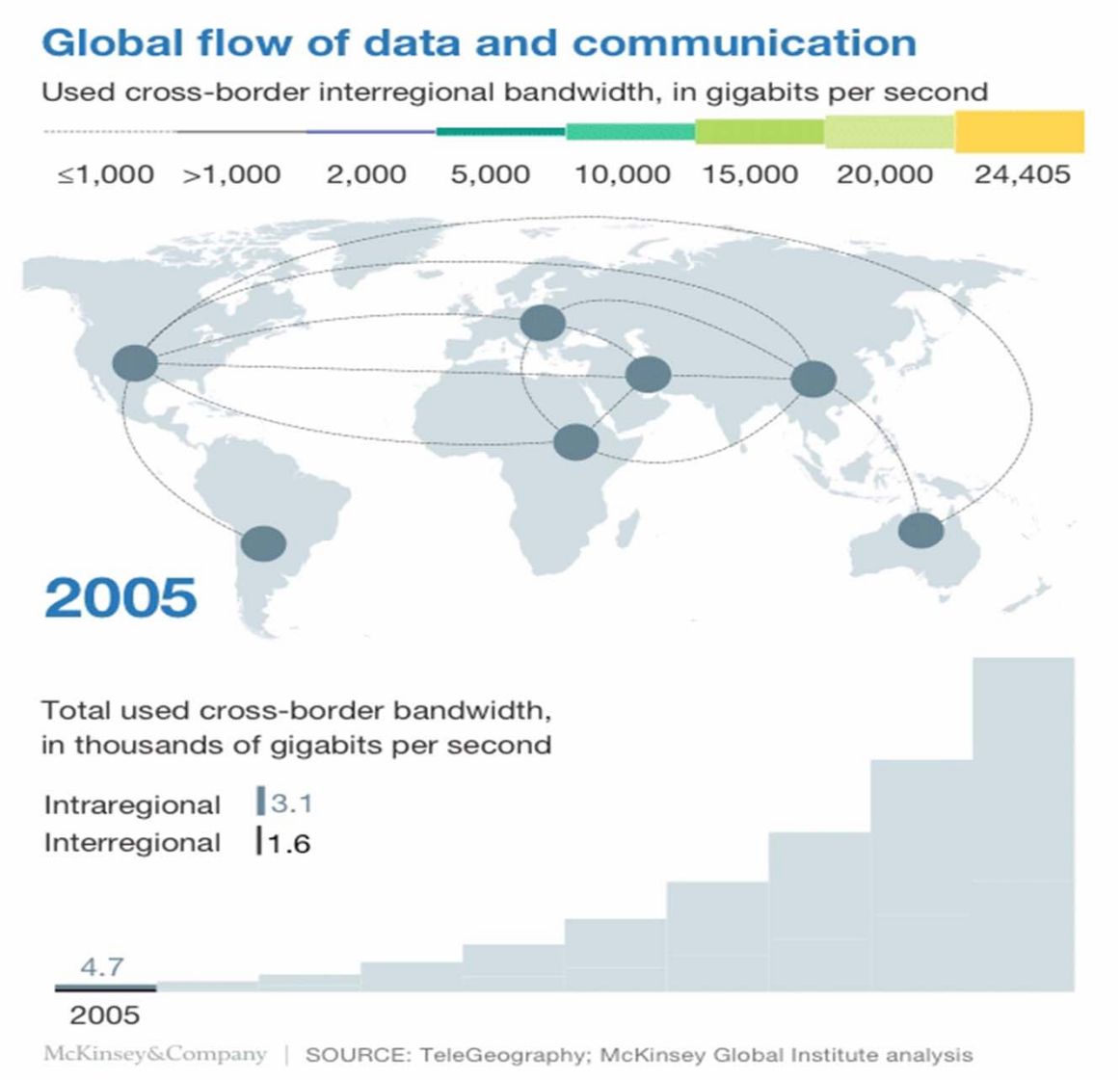
Technology vs. Globalization



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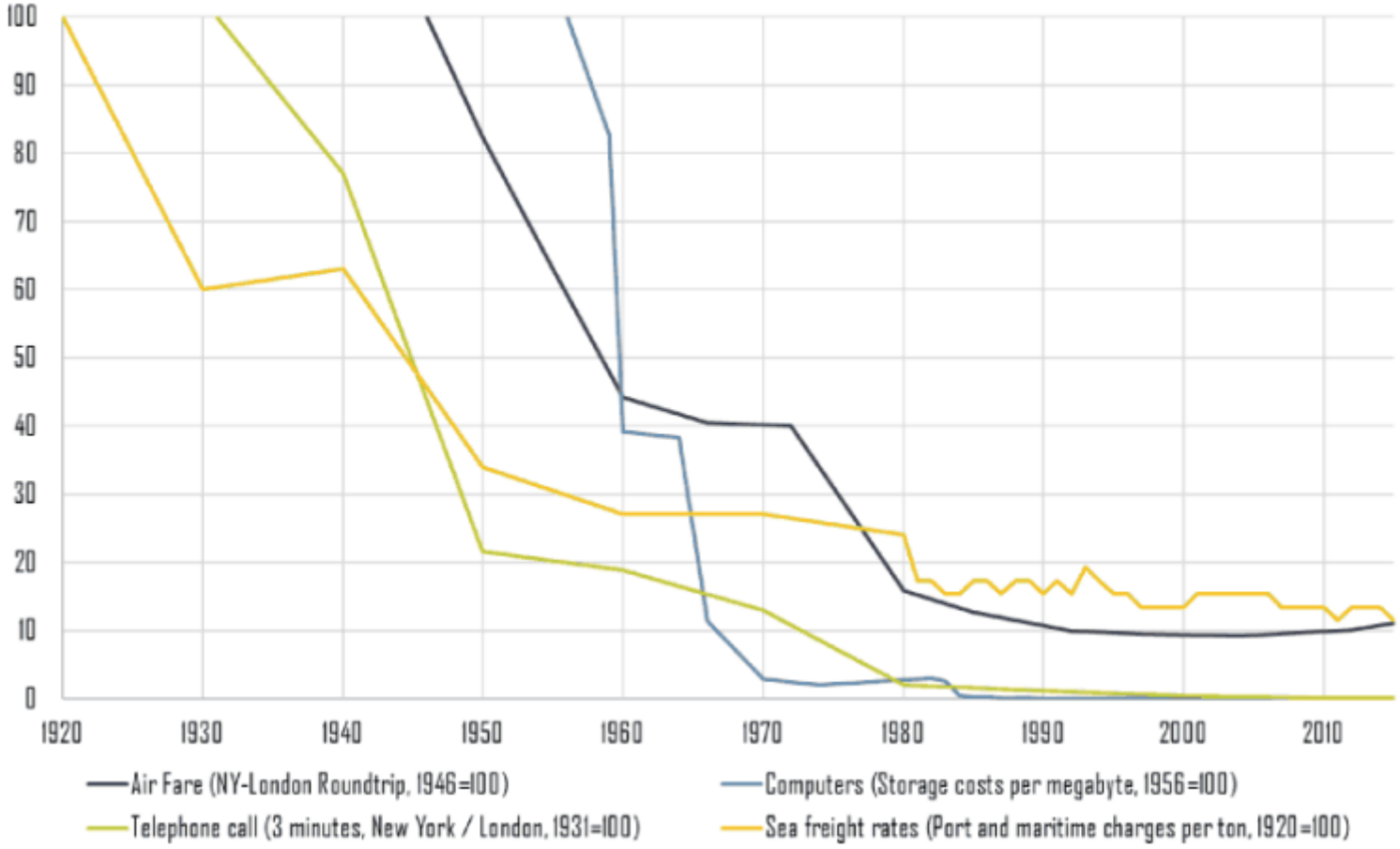
Transport and Communication Costs Indexes, 1920-2015



https://transportgeography.org/?page_id=271

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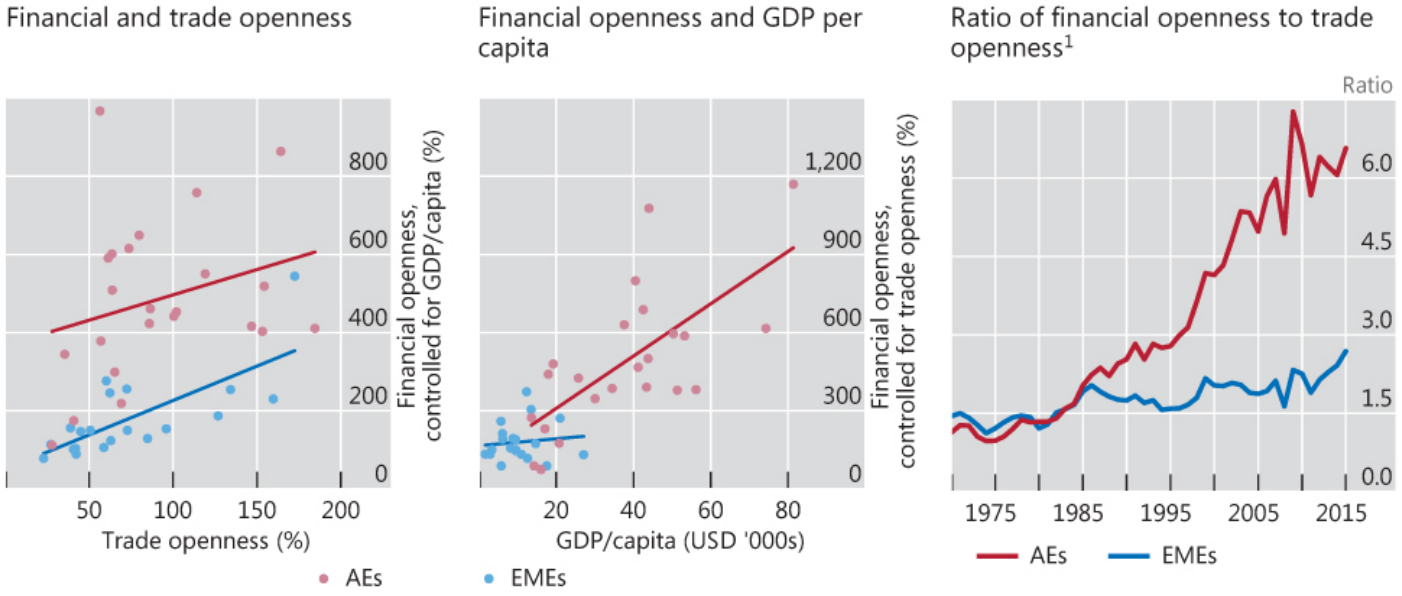
Openness – trends and welfare

Financial openness increases with trade openness and GDP per capita — Graph VI.1



Financial openness = (foreign assets + liabilities) / GDP; trade openness = (exports + imports) / GDP; financial openness controlling for GDP/capita (trade openness) = financial openness less that part explained by demeaned GDP/capita (trade openness) in a regression of financial openness on both GDP/capita and trade openness.

AEs = AT, AU, BE, CA, CH, DE, DK, EE, ES, FI, FR, GB, GR, IT, JP, LT, LV, NO, PT, SE, SI, SK and US; EMEs = AR, BR, CL, CN, CO, CZ, HU, ID, IN, KR, MX, MY, PE, PH, PL, RU, SA, TH, TR and ZA.

[1] Median across countries listed in each group. Excluding CH, CN, CZ, EE, HU, KR, LT, LV, PL, PT, RU, SI and SK.

Sources: Lane and Milesi-Ferretti (2017); World Bank; BIS calculations.

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Flexibility vs. Job Security

"The Philadelphia case, Razak v. Uber Techs., Inc., was filed in February 2016. The plaintiffs, seeking to represent all drivers in Philadelphia for Uber's limousine service, UberBLACK, argued that Uber failed to pay them overtime and minimum wage in violation of the Fair Labor Standards Act (FLSA). The FLSA sets minimum wage, overtime and recordkeeping standards and only applies to employees, not independent contractors. Judge Baylson held that Uber does not exercise enough control over its limo service drivers for them to be deemed employees under the FLSA. The drivers have the flexibility to work when they want to, where they want to and are free to tend to personal matters in between rides..“

(National Law Review)

Uninsurable risk?

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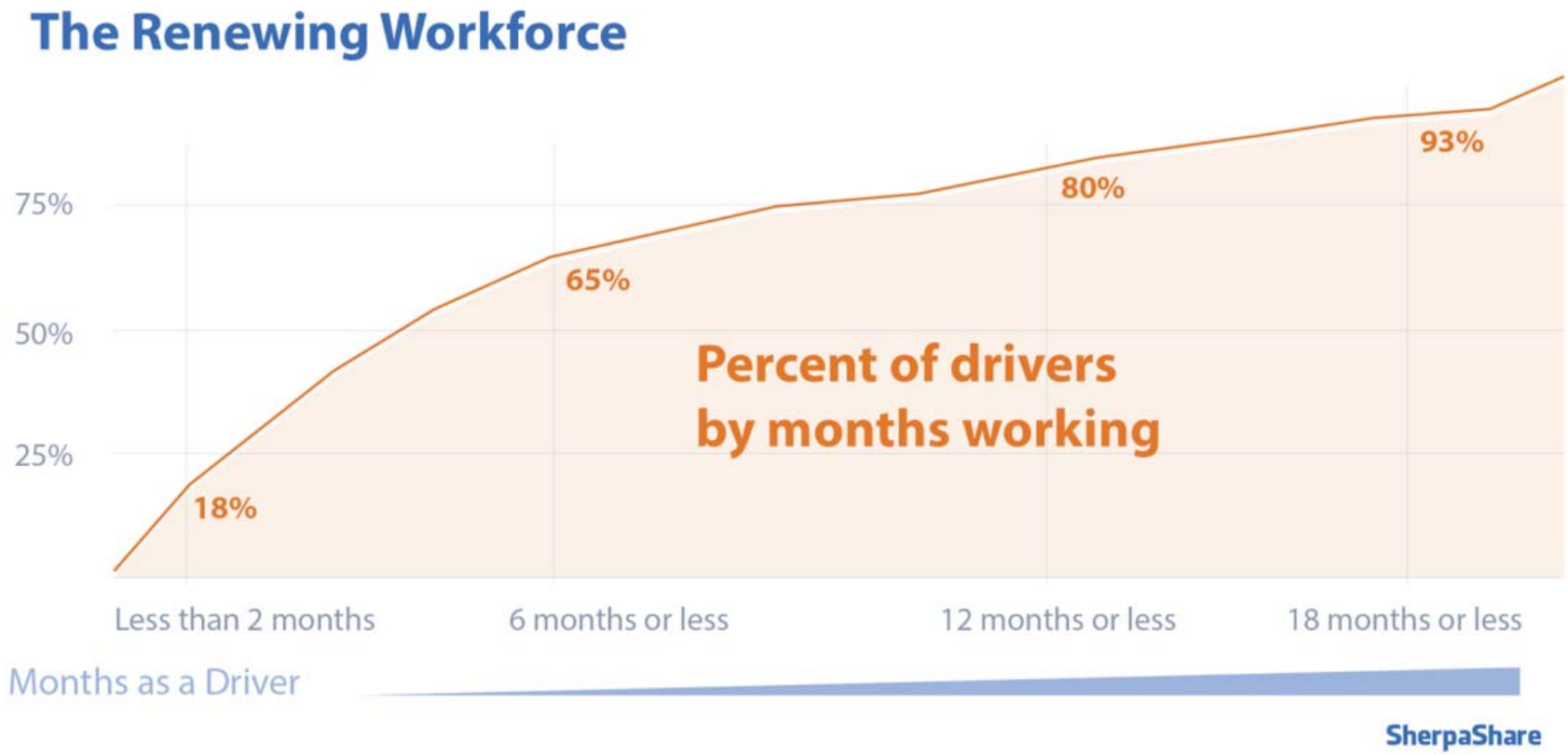
Uber Drivers



Current worldwide estimates are around 3 million Uber Drivers.

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Forces vs. relations

"At a certain stage of development, the material productive forces of society come into conflict with the existing relations of production or – this merely expresses the same thing in legal terms – with the property relations within the framework of which they have operated hitherto. From forms of development of the productive forces these relations turn into their fetters. Then begins an era of social revolution. The changes in the economic foundation lead sooner or later to the transformation of the whole immense superstructure”

Source: K. Marx, *A Contribution to the Critique of Political Economy*

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Geopolitics: illustrative benign scenario

- The shock:
  - Fast automation contribution to skill-biased technical progress; continued Moore's Law contribution to improved matching technologies
- The Economic Environment:
  - Low substitutability between robots and routine labour
  - Substitutability remains greater in AEs than DEs
  - Complemented by compensating supply-side policies where substitutability is greatest – education, training etc.
  - And aggregate demand management is successful:
    - Animal spirits revive, high-saving corporates start to invest, banks resume lending, cash balances fall, bond yields rise, AEs move out of secular stagnation
    - There is some global rebalancing as China and EU age
  - Income losses in routine sectors are more than compensated by demand boost and income gain associated with higher investment, productivity
    - Perhaps active redistributive policies as well

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Illustrative benign scenario

- Possible geopolitical consequences
  - China and India continue to grow rapidly, becoming largest economies in the world by mid-2030s
  - China ‘gets rich before it gets old’ and moves up the value chain, disbursing excess saving more productively through ‘Belt and Road’ before starting to draw down overseas assets as population ages (rebalancing)
  - Western economies cope well with automation and benefit from rebalancing. Current AEs as a bloc remain large and Western alliance remains largely intact and militarily more powerful than rising powers
  - Population ageing, the relatively benign international political backdrop and the threat of economic obsolescence bring Russia back into the fold
  - Strong global growth and the displacement of routine non-automatable jobs towards DEs promotes job growth in Africa and the Middle East
  - The international economic architecture evolves but broadly supports these transitions. Belt and Road complements and strengthens existing Bretton Woods institutions, as does continued openness and healthy trade growth

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Illustrative nasty scenario

- The shock:
  - Even faster automation contribution to skill-biased technical progress; major shock to one or more traditional industries e.g. auto production
- The Economic Environment:
  - High substitutability between robots and routine labour
  - Substitutability rises sharply in key DEs as they develop
  - Fiscal constraints prevent widespread deployment of education policies and/or such policies are ineffective
  - Global aggregate demand remains subdued:
    - Low growth and rising unemployment reinforce caution; desired saving and investment in safe assets remain high
    - Lack of rebalancing reinforces popular mistrust of liberal trade policies; rising protectionism reduces world trade
  - This time it's different; widespread job losses fuel self-fulfilling fear that investment isn't worthwhile. Capital accumulation fails to offset.
    - Redistributive policies are insufficient or ineffective, further weighing on aggregate demand

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Illustrative nasty scenario

- Possible geopolitical consequences
  - Rapid automation threatens Chinese growth and social model. Maintenance of high employment requires debt-fuelled policies that may ultimately trigger a financial crisis; and/or resistance to automation reduces productivity growth further.
  - Domestic vulnerability encourages China to take a more acquisitive approach through ‘Belt and Road’ increasing the risk that a large number of projects fail to generate sufficient economic return or local employment; standards decline
  - High unemployment in the West (and India?) further damage support for Western liberal alternative, both domestically and internationally. Authoritarian/protectionist politics thrives.
  - Russia remains assertive on international stage. Seeks to further destabilize Western alliance through strategic intervention and new alliances (Turkey/Eastern Europe?). Threat to both NATO and the EU.
  - Weak global growth and decarbonisation lead to a low oil price. Combined with technological unemployment, youth job opportunities are limited in Africa and the Middle East. Region remains unstable and prone to extremism. Large migration pressure and lack of jobs forments anti-immigrant sentiment (notably in EU).
  - Bretton Woods institutions fissure; post WW2 multilateralism gives way to more bilateral, transactional international politics. Global supply chains shrink despite falling communications costs, further diminishing international trade and growth.