

*Robots and the Workforce
in a Super Aging Society*

Prof. Nicolas van Zeebroeck

October 2018

Robots & the Workforce in a Super Aging Society

Two types of digital automation

Digital automation & productivity: the digital divide

The future of work

Automation is no longer for simple,
repetitive, mechanical tasks...



THREE STEPS TO DIGITAL

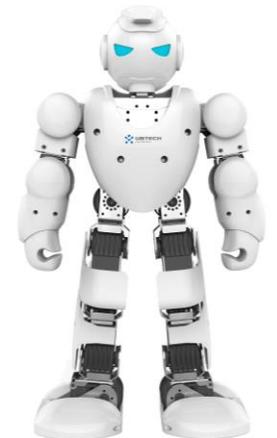


1. DATAFY

2. SOFTWAREIFY



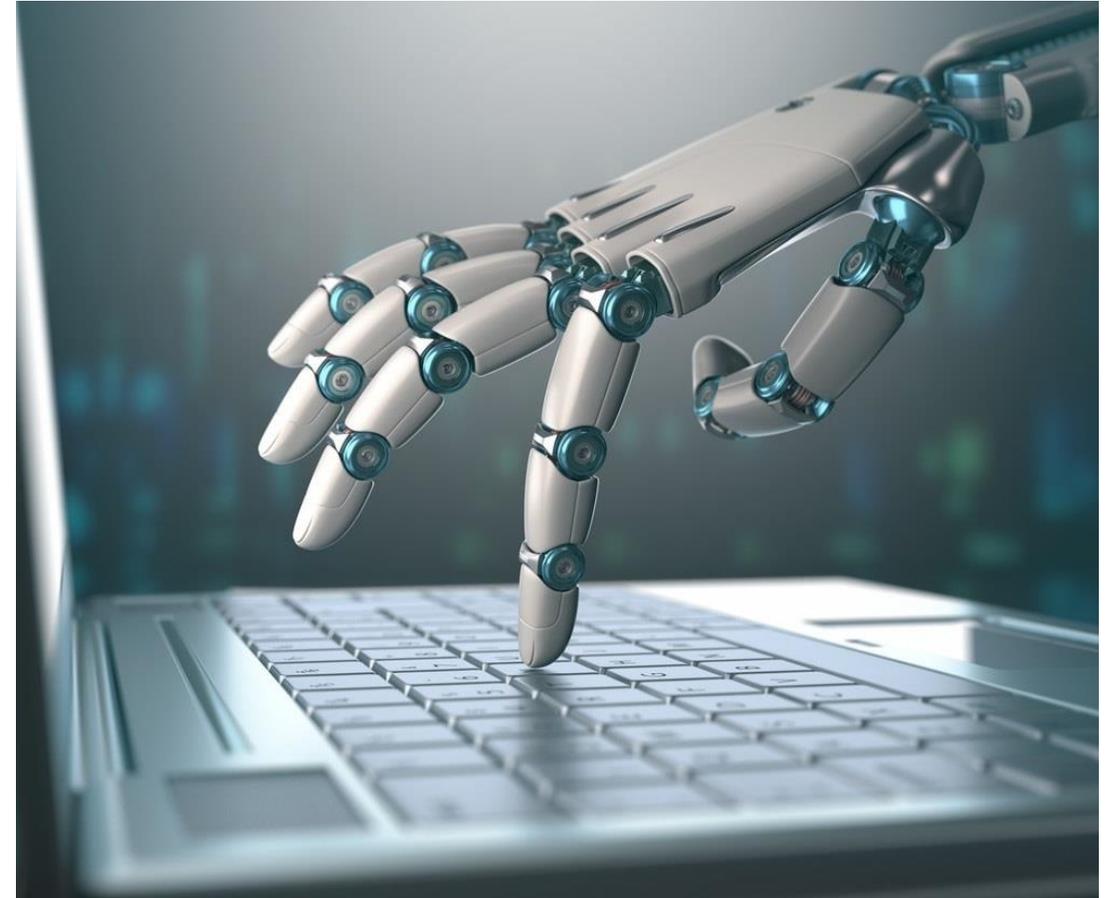
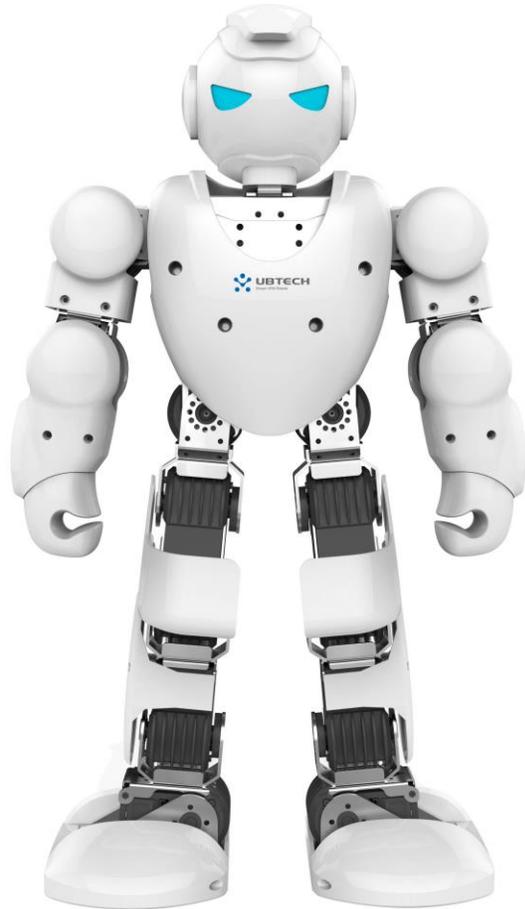
3. ROBOTIFY





Robots are now
thinking machines

DIGITAL AUTOMATION IS OF TWO TYPES



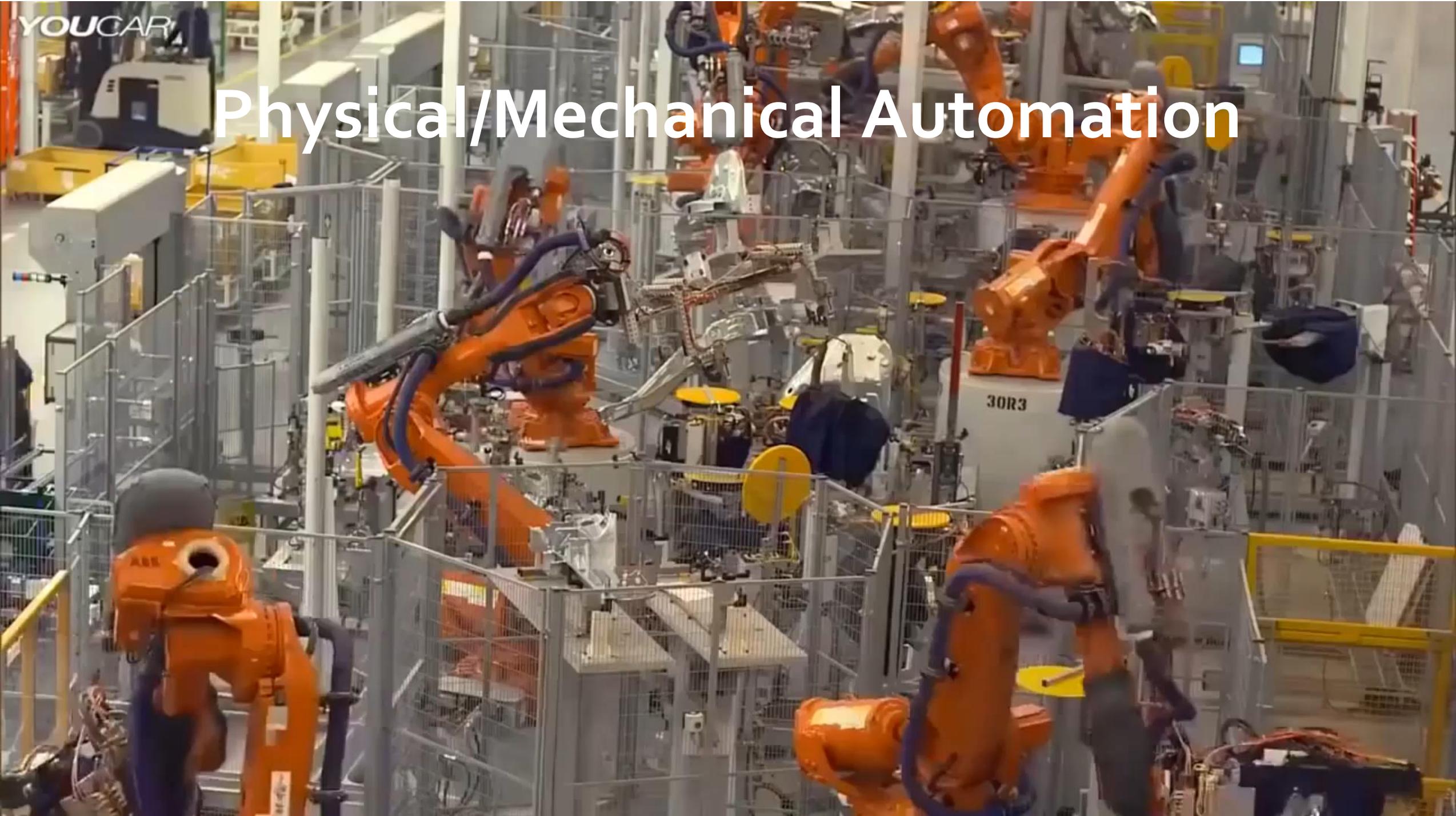
Physical/Mechanical Automation



Physical/Mechanical Automation



Physical/Mechanical Automation



Intellectual/Decision Automation

Translate

From: English ▾



To: French ▾

Translate

English Spanish French

It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to heaven, we were all going direct the other way - in short, the period was so far like the present period, that some of its noisiest authorities insisted on its being received, for good or for evil, in the superlative degree of comparison only.



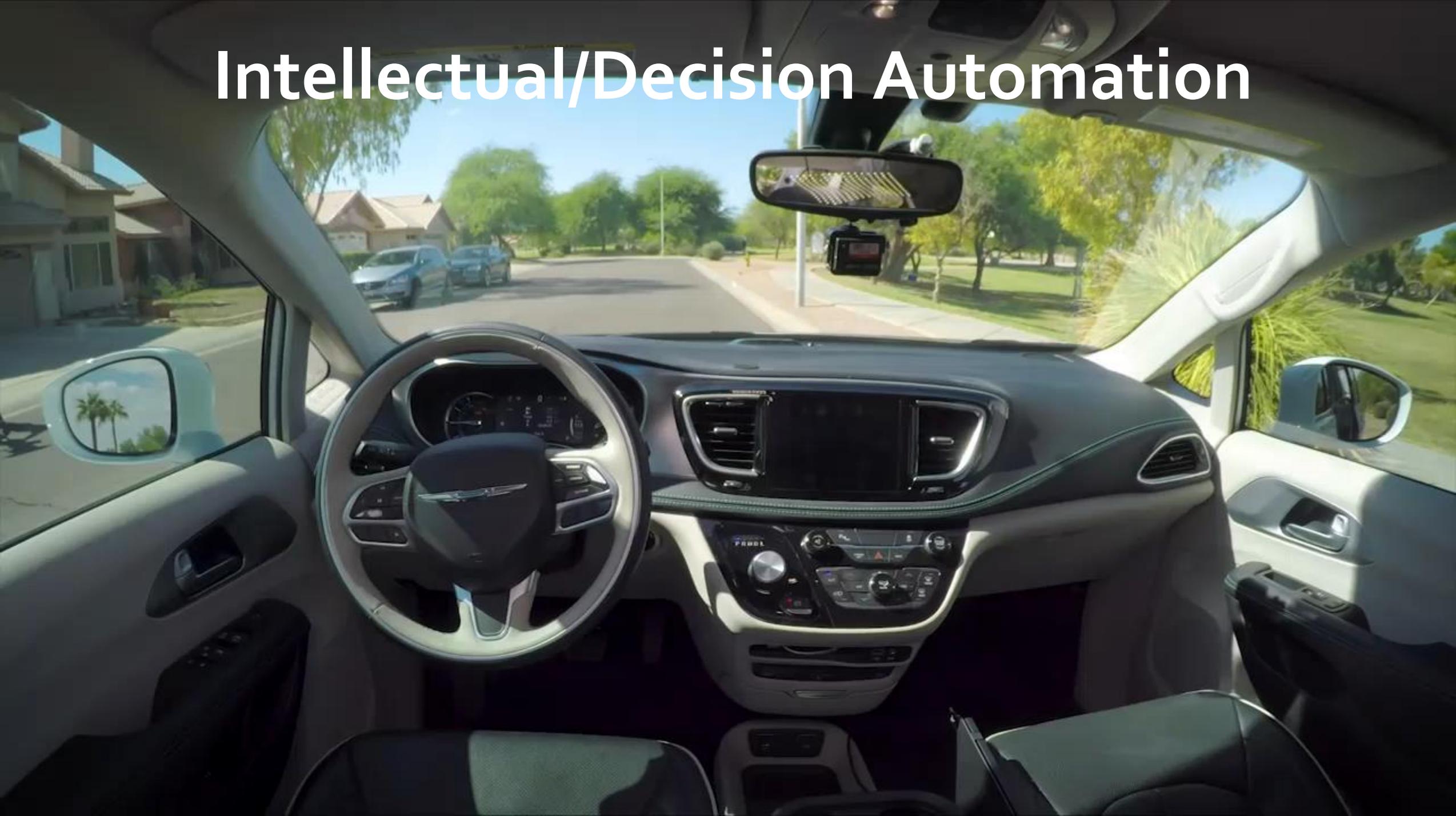
French English Spanish

Il était le meilleur des cas, il était le pire des temps, c'était l'âge de la sagesse, c'était l'âge de la folie, c'était l'époque de la croyance, c'était l'époque de l'incrédulité, c'était la saison de la lumière, il a été la saison des ténèbres, c'était le printemps de l'espoir, c'était l'hiver du désespoir, nous avons tout ce dont nous sommes saisis, nous n'avons rien devant nous, nous étions tous d'aller directement au ciel, nous allions tous directement dans l'autre sens - en bref, la période était si loin comme la période actuelle, que certains de ses plus bruyants autorités ont insisté sur son reçu, pour le meilleur ou pour le mal, dans le degré superlatif de comparaison seulement.



New! Click the words above to edit and view alternate translations. [Dismiss](#)

Intellectual/Decision Automation



Intellectual/Decision Automation

Siri Alert



NICOLAS

You speak too much.
I predict you will have an overrun of 4 minutes.
I will now skip the next slide.

Qui

Non

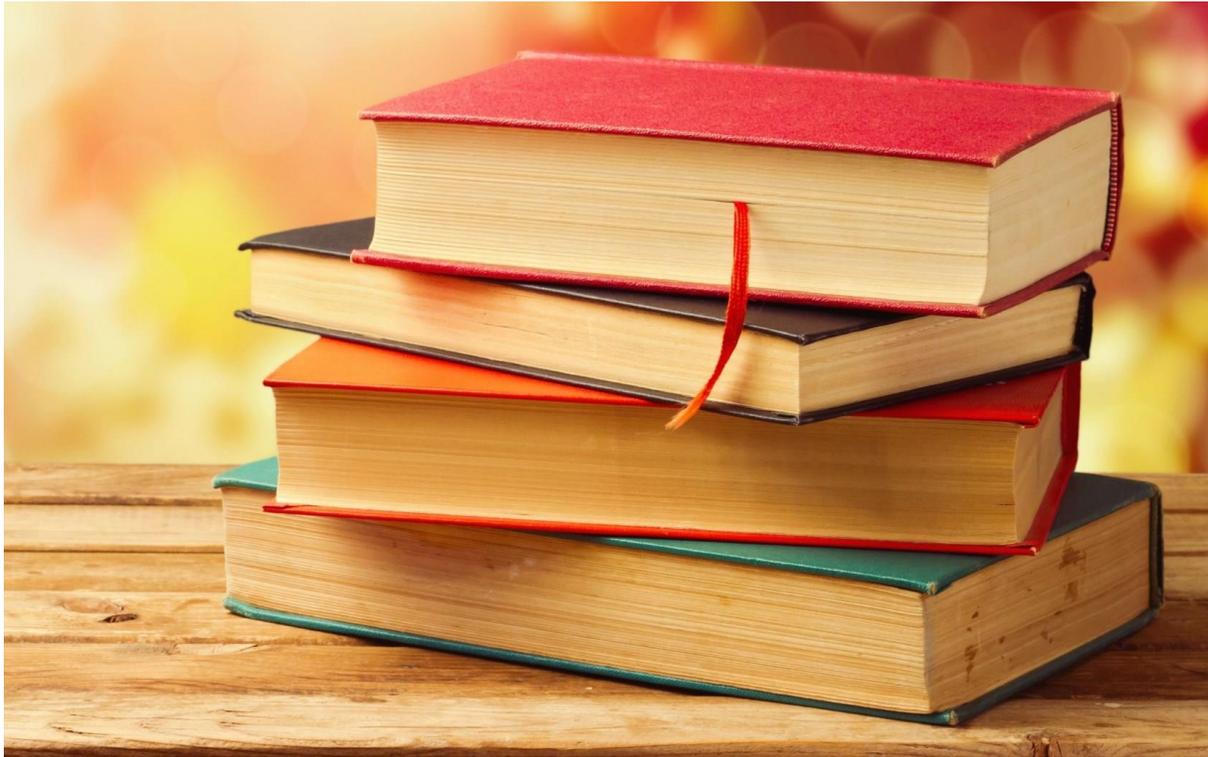
DeepMind's Go-playing AI doesn't need human help to beat us anymore

The company's latest AlphaGo AI learned superhuman skills by playing itself over and over

By [James Vincent](#) | [@jjvincent](#) | Oct 18, 2017, 1:00pm EDT



Digital automation enjoys zero marginal costs



It can therefore SCALE without MASS

BARNES & NOBLE
BOOKSELLERS

€ € € € €



amazon

.be .fr .de
.ca .co.uk
.com .au .cn

Zero marginal costs
Scale without mass



**I remember one of the
senior management of**

Jumping on the right side of the digital divide

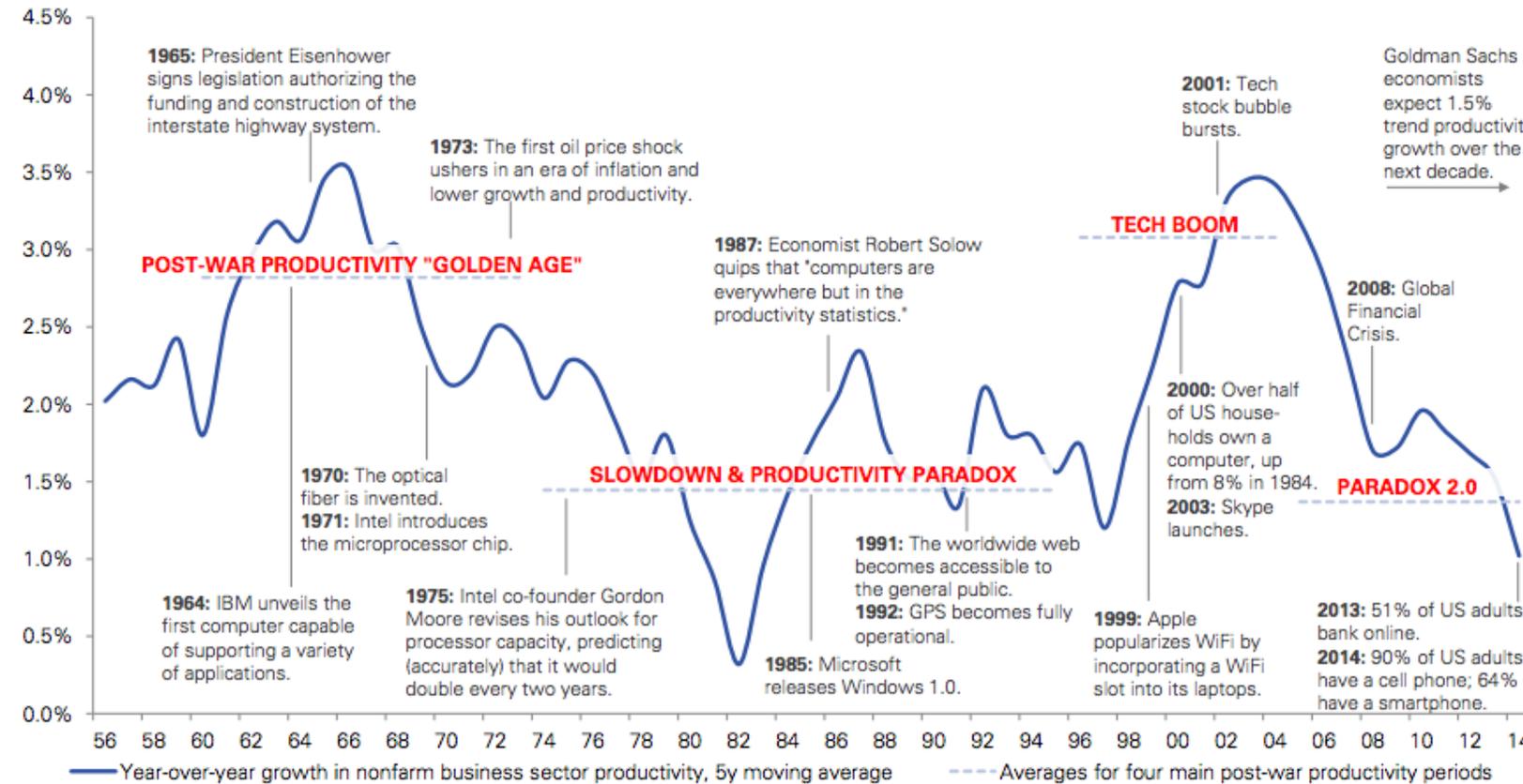
Two types of digital automation

Digital automation & productivity: the digital divide

The future of work

The productivity paradox

Putting productivity growth in perspective



Source: BLS, Pew Research Center, US Census, PBS, various news sources, Goldman Sachs Global Investment Research.

Goldman Sachs Global Investment Research

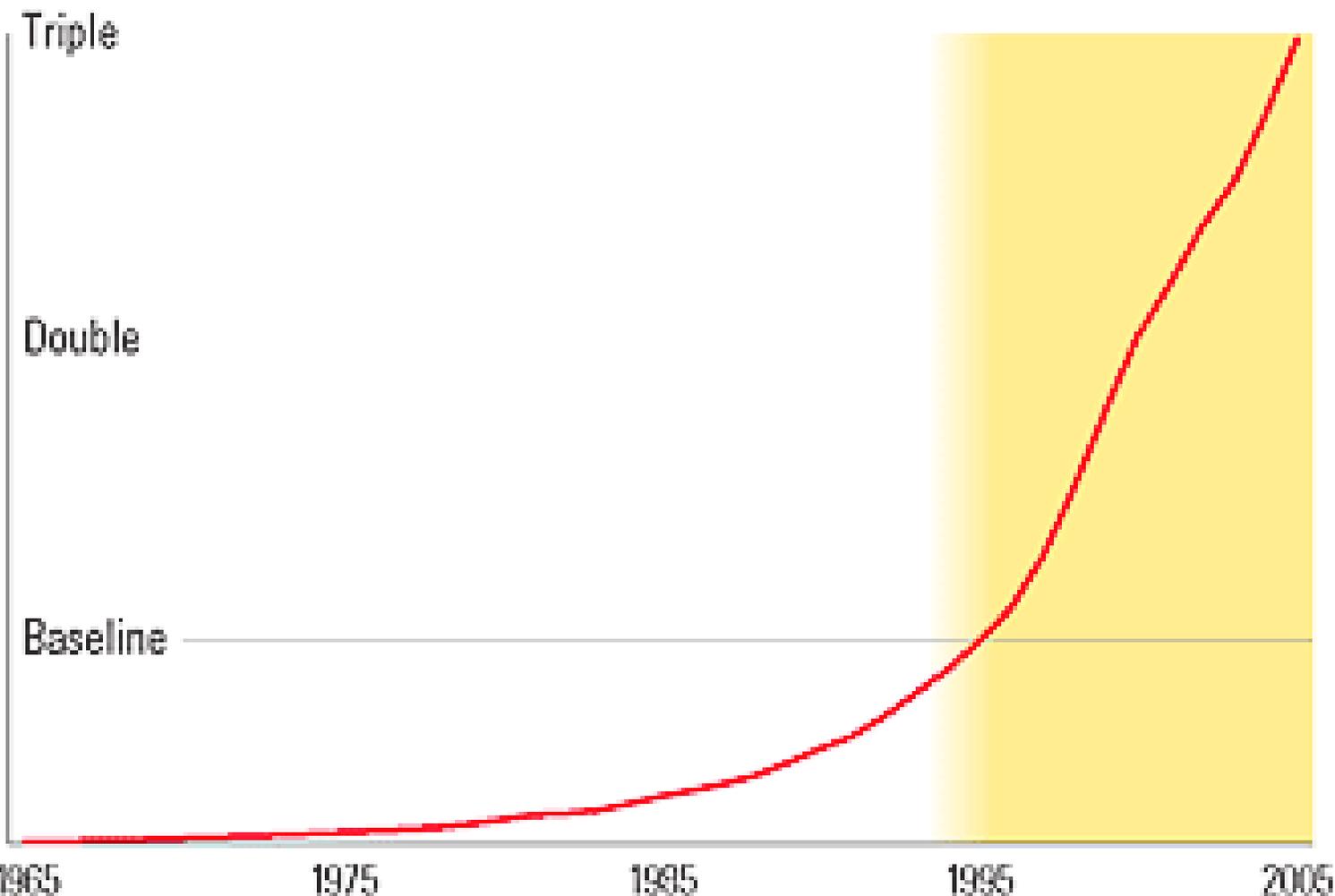
“One can see computers everywhere, except in productivity statistics.”

Solow, 1987

The productivity paradox

Dollar value of total U.S. corporate IT stock

Spending compared to 1995 level



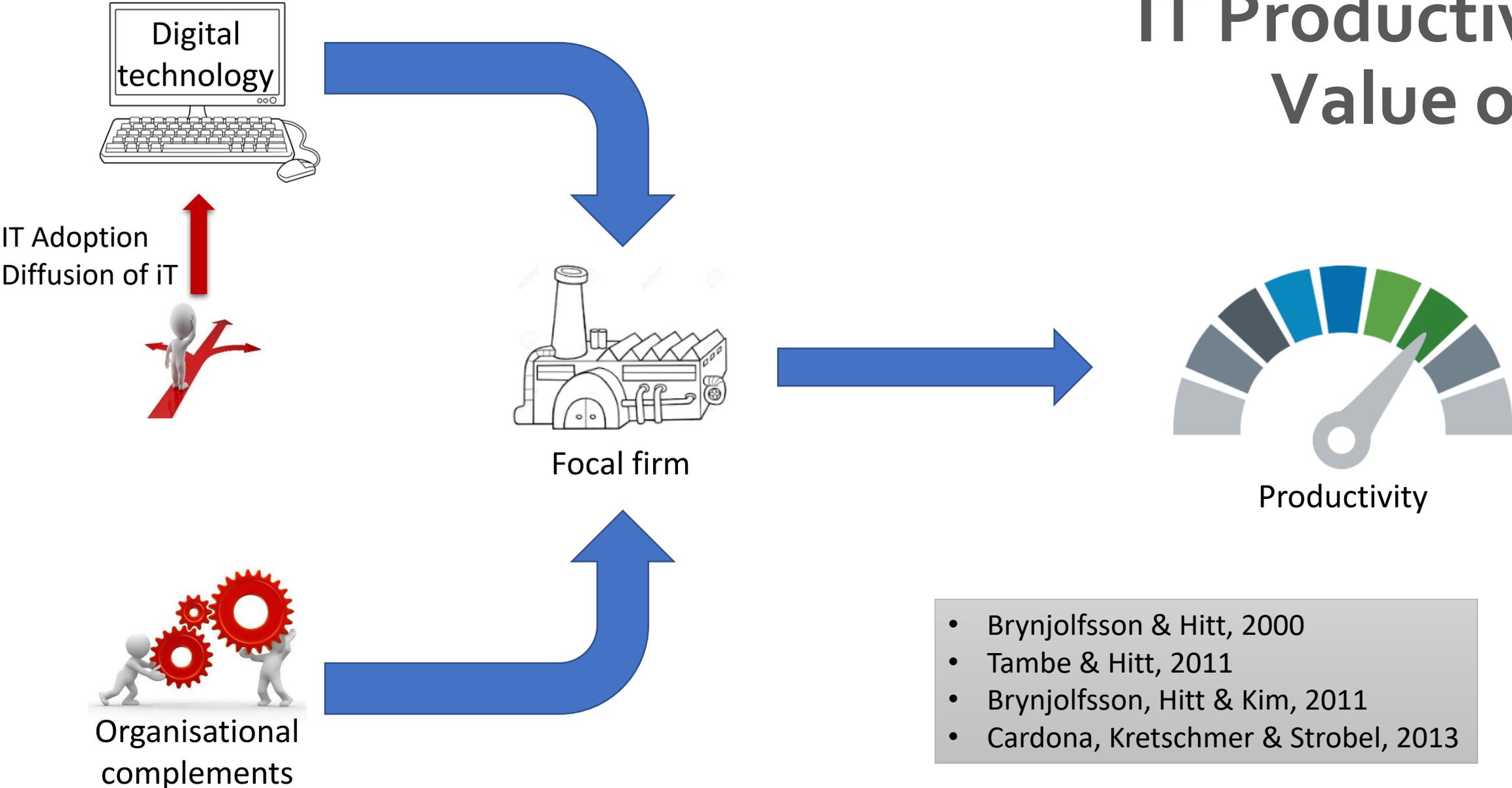
Source: U.S. Bureau of Economic Analysis

Sources: McAfee (2006), Brynjolfsson & McAfee (2008)

The productivity paradox

- High adjustment costs?
 - Organizational assets (Brynjolfsson and Hitt, 2000)
 - Managerial practices (Bloom et al., 2012)
- Not enough innovation (or not sufficiently powerful)?
 - Carr, 2003; Gordon, 2010
- Measurement issues?
 - Productivity in services (Griliches, 1994)
 - Lag (David, 1990)
 - Economics of free / Intangible benefits (Brynjolfsson & Oh, 2012)
- Unequally distributed gains?
 - Digital divide?

IT Productivity Value of IT



- Brynjolfsson & Hitt, 2000
- Tambe & Hitt, 2011
- Brynjolfsson, Hitt & Kim, 2011
- Cardona, Kretschmer & Strobel, 2013

Digital turbulence hits incumbent firms

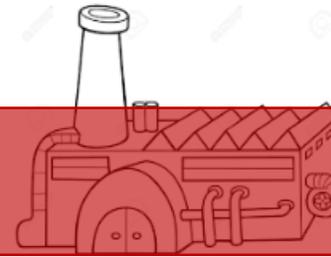


Digitalizing Competitors



Digital Turbulence
(competitive pressure)

-7%



Focal firm



Growth



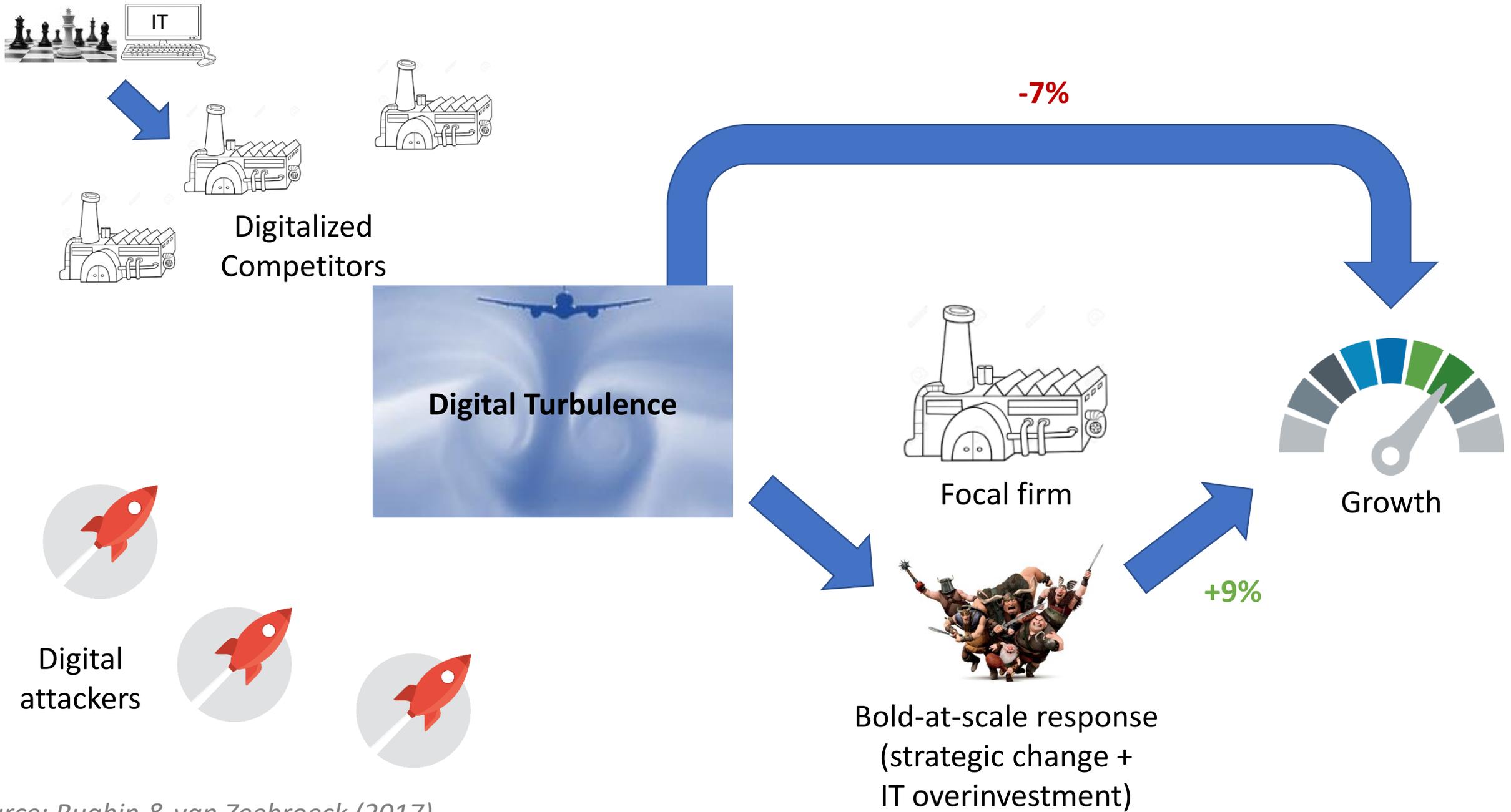
Digital attackers



Digital turbulence varies across industries

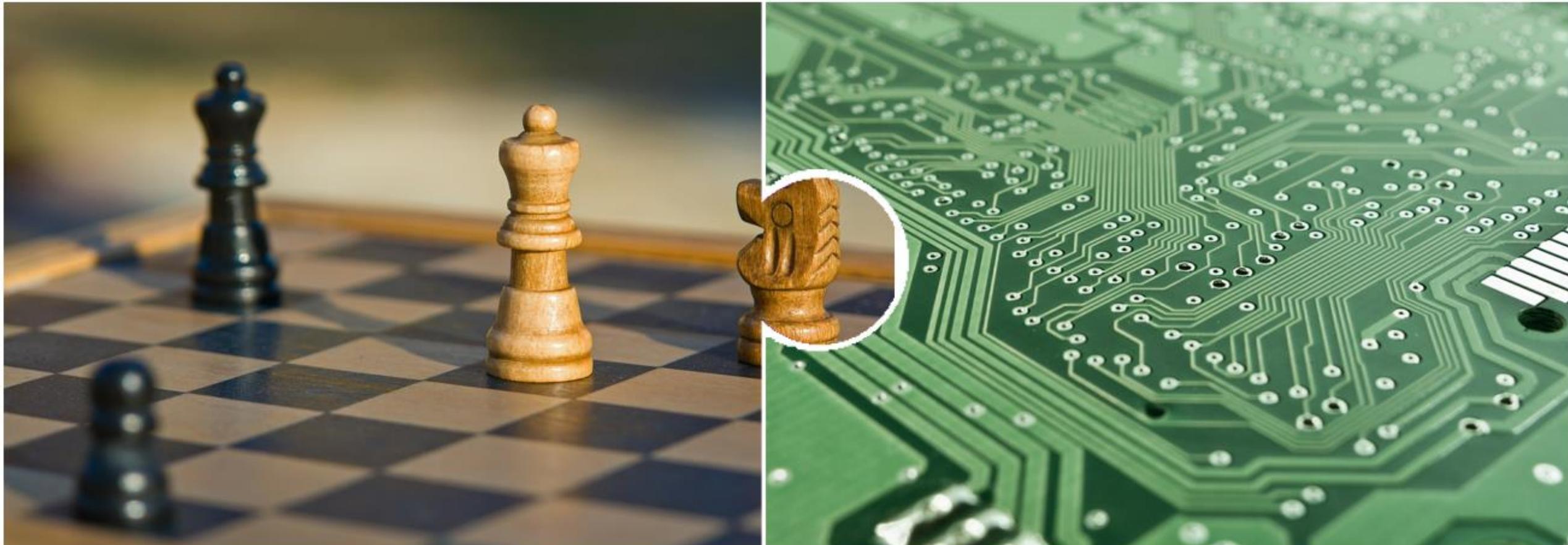
- Digital turbulence measured as the average of strategic reaction across firms in the same industry (22 industries in total), except focal firm

Industry group	Firms	Share of firms	Mean turbulence	SD Turbulence
High Tech & Telecom	403	19%	3,76	0,12
Services: Prof., Media, Transport & Retail	585	27%	3,14	0,18
Public, Social, Healthcare and Other Services	353	17%	3,05	0,12
Financial Services	341	16%	3,02	0,17
Manufacturing	453	21%	2,83	0,24
Total	2135	100%	3,16	0,36

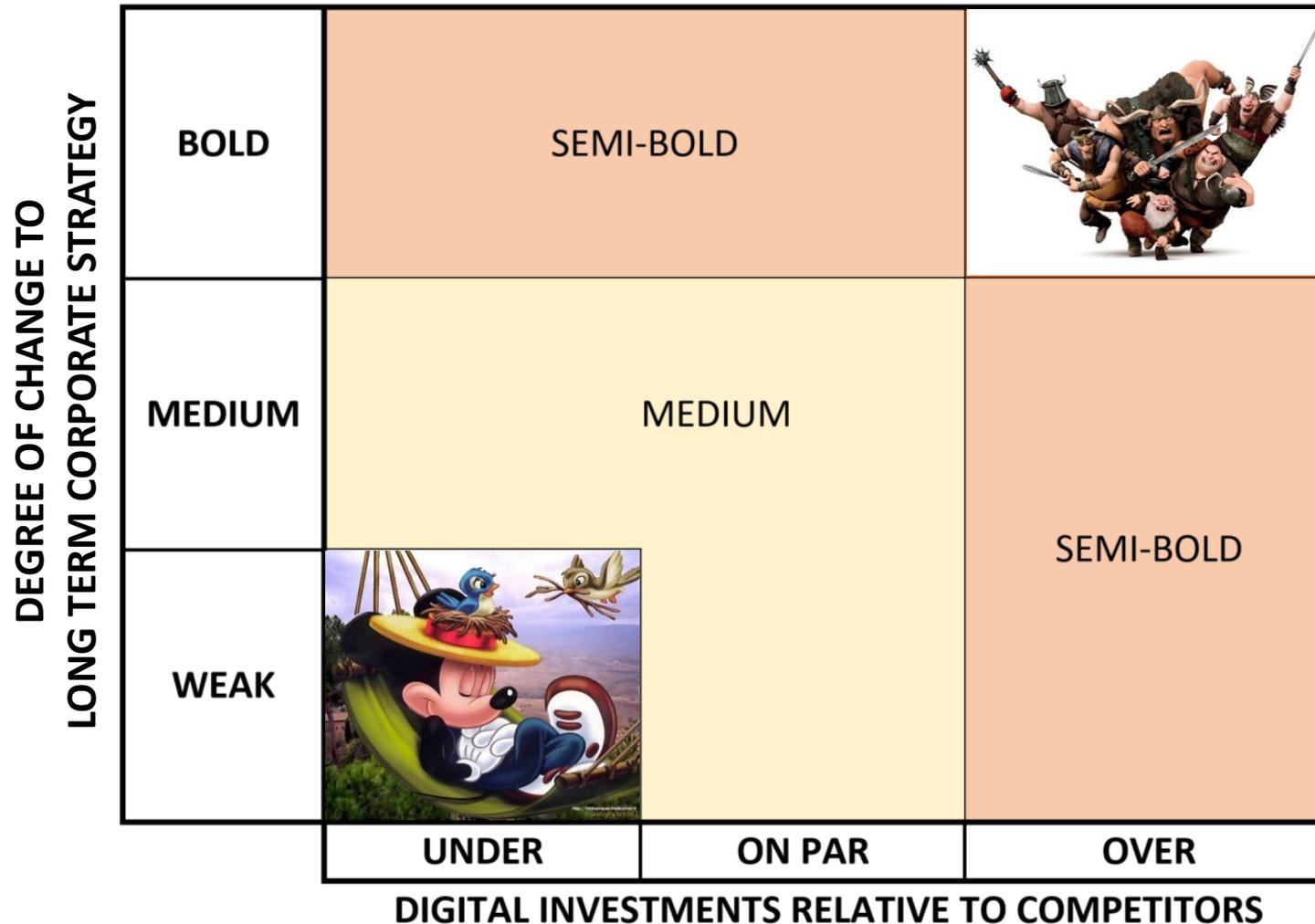


Source: Bughin & van Zeebroeck (2017)

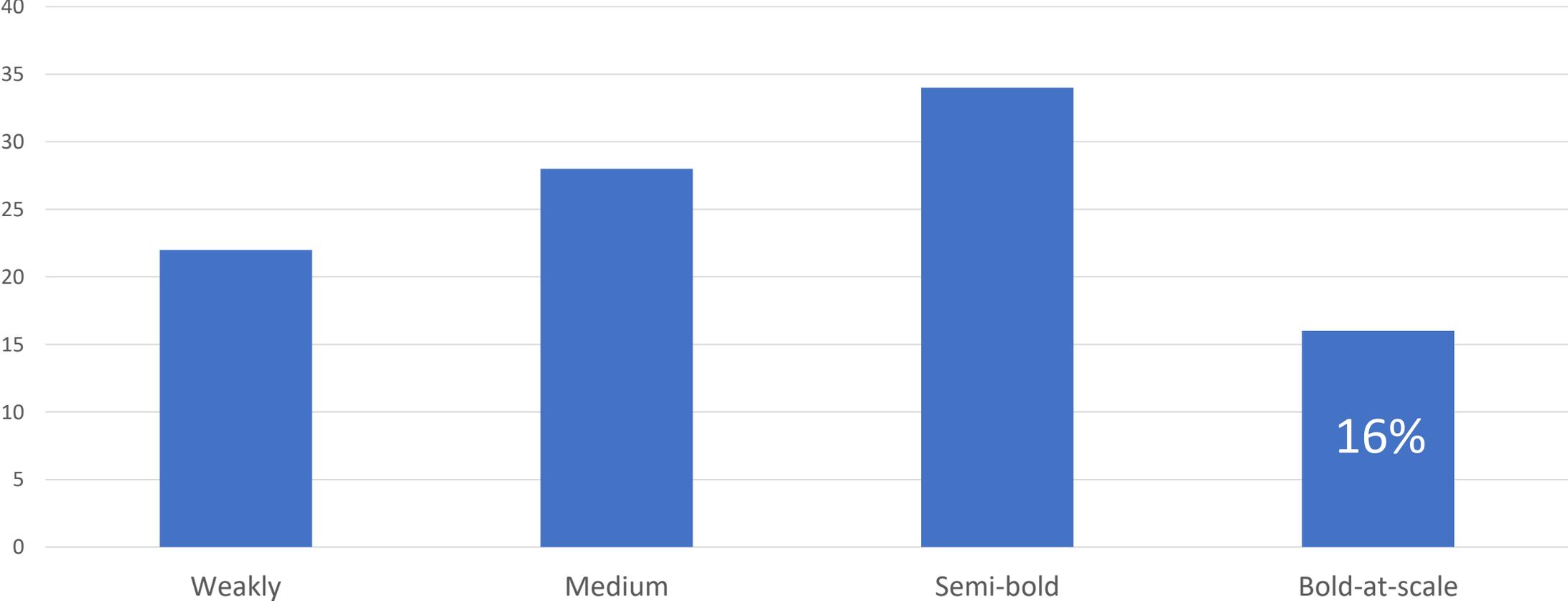
Digital success requires a blend:
strategy change + **technology** investment



Digital success requires a blend: strategy change + technology investment



Observed postures



Data & empirical strategy

Cross-section of CxO responses to McKinsey Digital Surveys (2016+2017) (N = 400-2000 firms depending on spec.)

Estimate following log linear prod. function (with OLS)

$$\text{dlog}(R_{ij}) = \alpha + \beta \text{dlog}(MS_{ij}) + \gamma \text{dlog}(CI_{ij}) + \delta \log(D_{ij}) + \lambda \log(D_{ij}) \times S_{ij} + \mu F_j + \sigma X_{ij} + \varepsilon_{ij}$$

Revenue growth

Market share

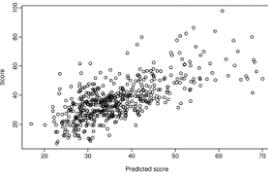
Market share of digital players

Digital investment

Strategic change

Industry F.E.

Firm controls



Strategy mediates impact of digital investment

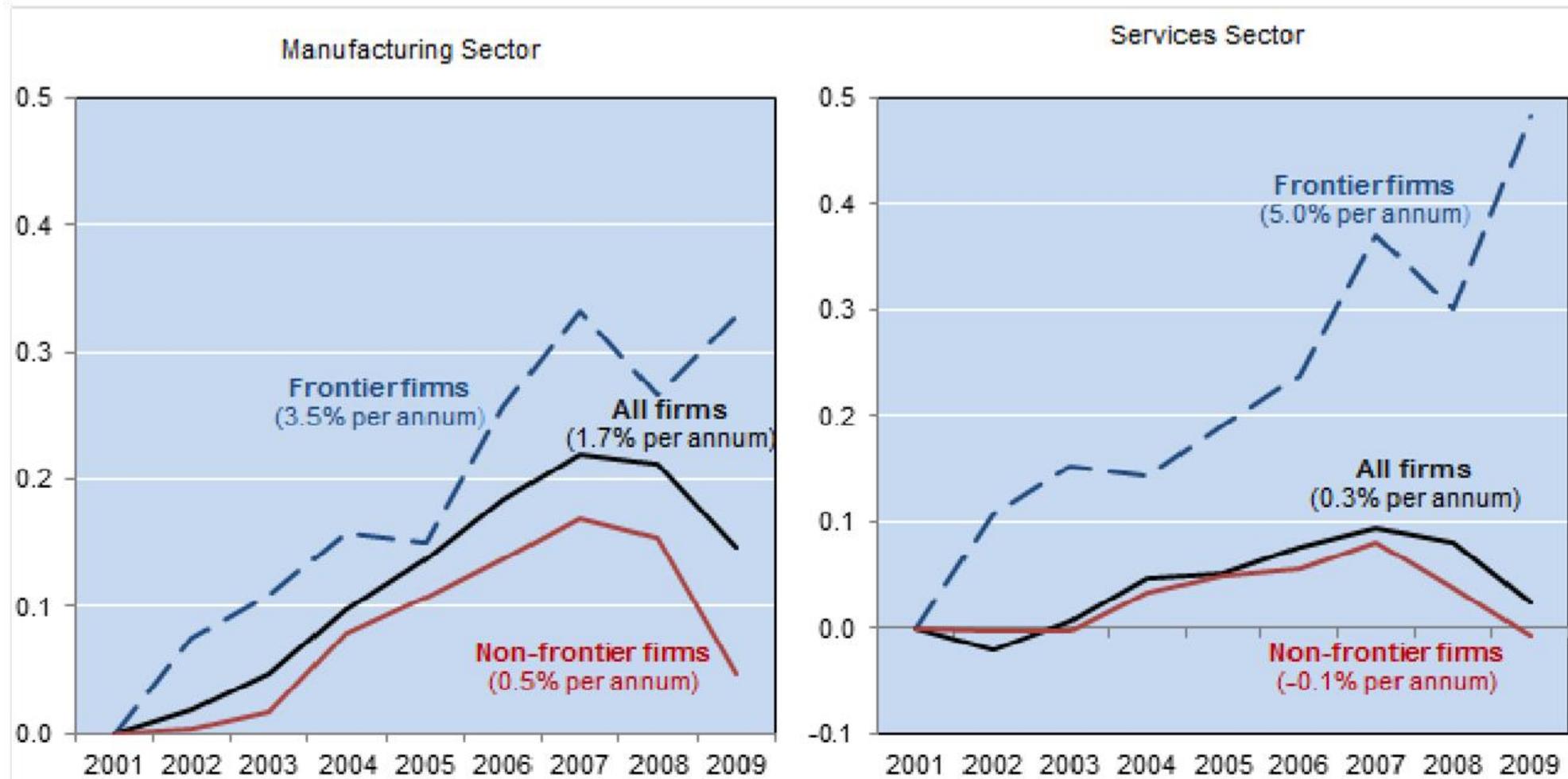
	Baseline	By strategy profile	Baseline: Low Turbulence	Baseline: High Turbulence	By strategy profile: Low Turbulence	By strategy profile: High Turbulence
Log of digital investment	0.2855*** (0.0957)		0.3463** (0.1447)	0.2211 (0.1378)		
Log of digital investment X Low strategy		0.1067 (0.1243)			0.2462 (0.2009)	-0.0539 (0.1696)
Log of digital investment X Medium strategy		0.3756*** (0.1187)			0.4299** (0.1725)	0.2675 (0.1914)
Log of digital investment X Bold strategy		0.3695*** (0.1021)			0.4081*** (0.1537)	0.2893** (0.1436)
Nb of employees (range)	-0.1649** (0.0822)	-0.1263 (0.0779)	-0.0499 (0.1149)	-0.2842*** (0.1090)	-0.0773 (0.1198)	-0.2062** (0.0963)
Firm revenues (range)	-0.0041 (0.0834)	-0.0645 (0.0811)	-0.0989 (0.1267)	0.0980 (0.1056)	-0.1465 (0.1338)	0.0573 (0.0976)
Market share of the focal firm	-0.0013 (0.0051)	0.0024 (0.0054)	-0.0057 (0.0078)	0.0067 (0.0067)	0.0004 (0.0079)	0.0062 (0.0077)
Market share held by digital competitors	0.0044 (0.0051)	0.0046 (0.0051)	0.0093 (0.0068)	0.0010 (0.0078)	0.0095 (0.0069)	0.0013 (0.0079)
Firm is public	-0.0325 (0.3272)	0.1663 (0.3276)	-0.0717 (0.3977)	0.1381 (0.5557)	0.2361 (0.4159)	0.1046 (0.5558)
Firm's main focus is B2C	-0.1353 (0.2826)	-0.3335 (0.2847)	0.0956 (0.3477)	-0.7637 (0.4802)	-0.0158 (0.3539)	-0.8186* (0.4923)
Firm portfolio is mono-product or mono-service	0.5294* (0.2841)	0.8416*** (0.3006)	0.4167 (0.3926)	0.6376 (0.4186)	0.8138** (0.3788)	0.8244* (0.4626)
Firm portfolio includes products	-0.2267 (0.2608)	-0.4198* (0.2528)	-0.4546 (0.4149)	-0.1593 (0.3455)	-0.5535 (0.4021)	-0.3580 (0.3436)
Constant	7.6855*** (0.7953)	8.0580*** (0.6664)	7.7258*** (1.0063)	9.9950*** (1.3926)	8.2556*** (0.8858)	9.5252*** (1.2797)
R^2	0.15	0.19	0.22	0.14	0.23	0.20
N	417	378	214	203	187	191
Industry F.E.	Y	Y	Y	Y	Y	Y
Region F.E.	Y	Y	Y	Y	Y	Y

Most firms only stay afloat thanks to digital



This creates a digital divide among firms...

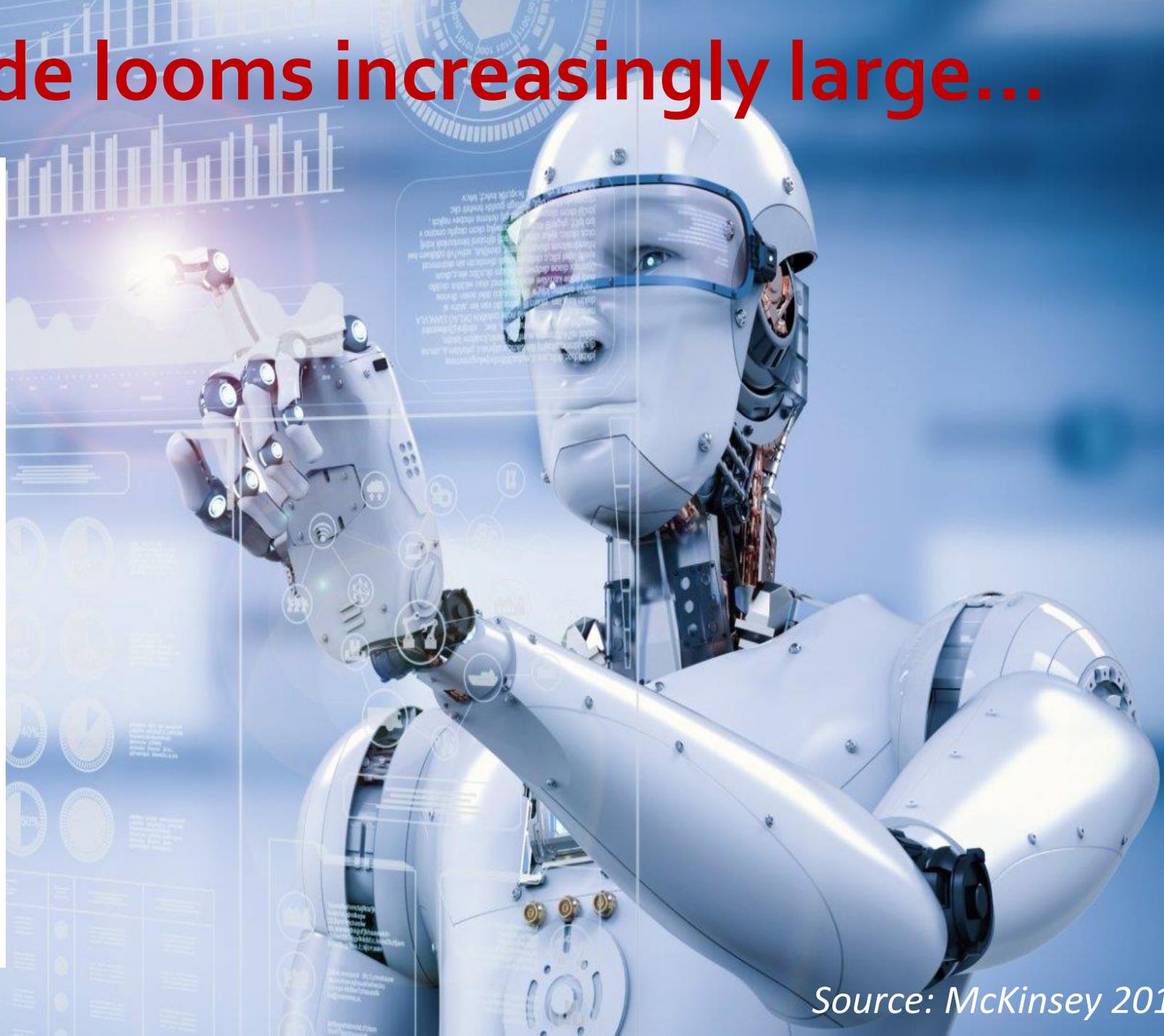
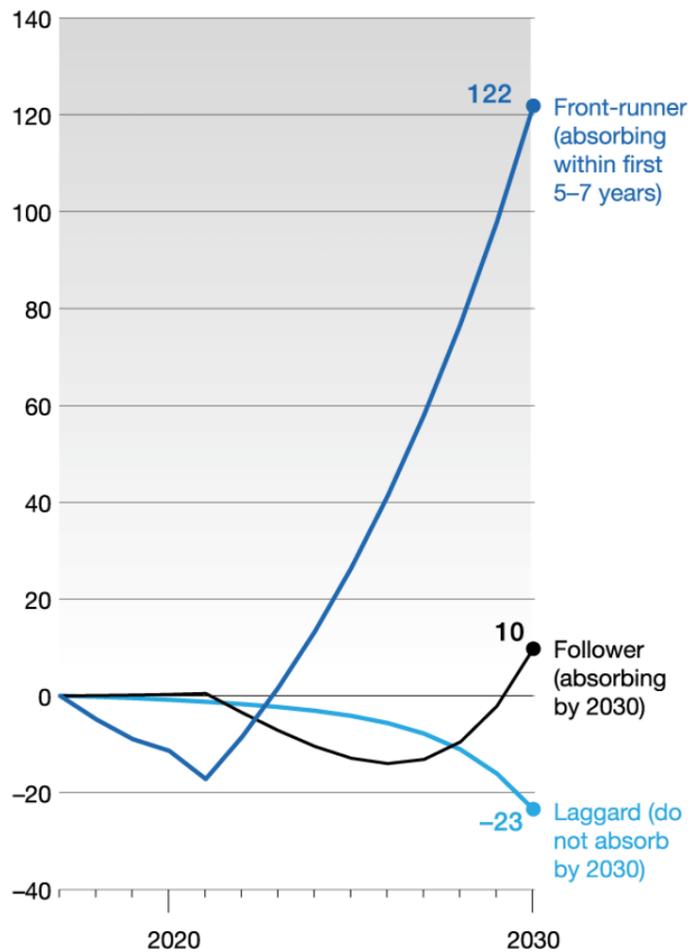
Labour productivity; index 2001=0



Source: OECD 2015

A digital divide looms increasingly large...

Relative changes in cash flow by AI-adoption cohort, cumulative % change per cohort



Source: McKinsey 2018

Bad news for Europe!

La déconfiture relative des indices européens des actions



Dorval Asset Management

Sources : MSCI, Macrobond

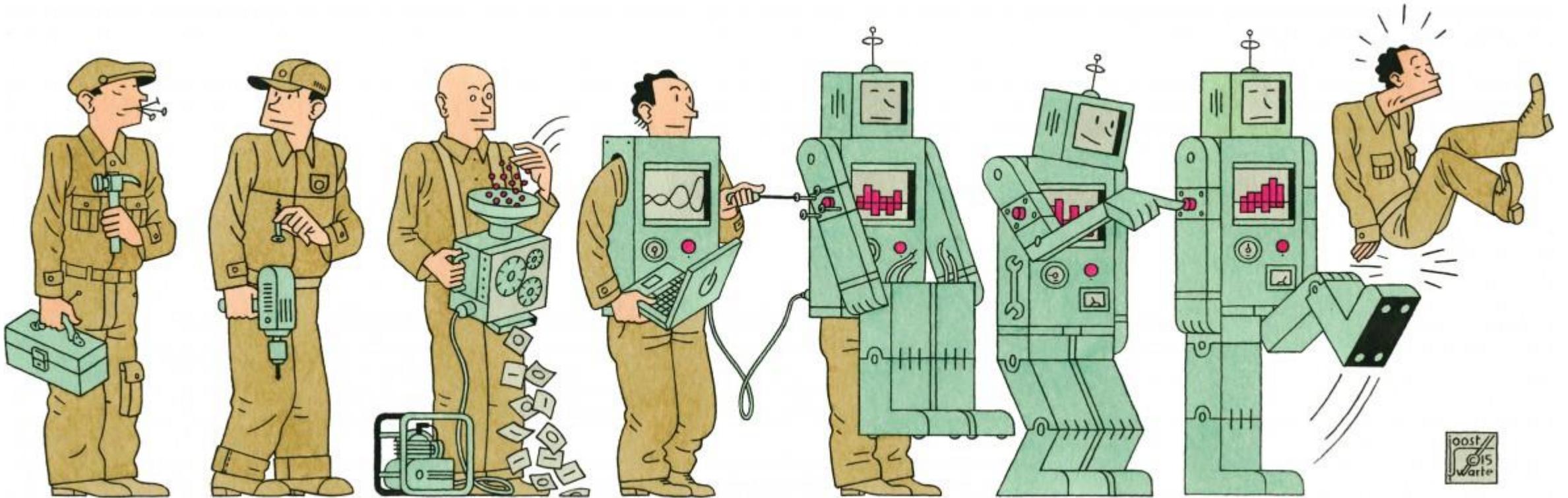
Jumping on the right side of the digital divide

Two types of digital automation

Digital automation & productivity: the digital divide

The future of work

Are digital tools taking our jobs?



Robots, new working ways to cost five million jobs by 2020, Davos study says

3 MIN READ



DAVOS, Switzerland (Reuters) - Disruptive labor market changes, including the rise of robots and artificial intelligence, will result in a net loss of 5.1 million jobs over the next five years in 15 leading countries, according to an analysis published in Davos on Monday.

Artificial Intelligence WARNING: Can intelligent robots replace human jobs by 2025?

ARTIFICIALLY intelligent robots could trigger a “fourth industrial revolution” and displace more than half of the human workforce by 2025, a Swiss think-tank has warned.

By **SEBASTIAN KETTLEY**

PUBLISHED: 16:39, Mon, Sep 17, 2018 | UPDATED: 16:51, Mon, Sep 17, 2018

4,037 views | Sep 5, 2018, 10:56pm

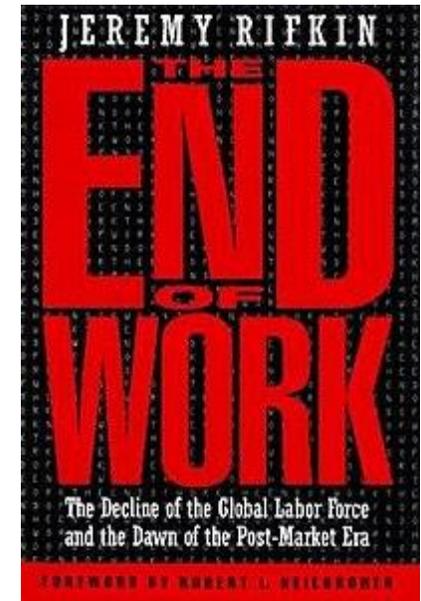
Robots Will Take Our Jobs And We Need A Plan: 4 Scenarios For The Future



Blake Morgan Contributor ⓘ

CMO Network

Customer Experience Futurist, Author, Keynote Speaker



The end of work

Rifkin, 1995

- *“We are entering a new phase in world history, one in which fewer and fewer workers will be needed to produce the goods and services for the global population”.*
- *“More sophisticated software technologies are going to bring civilization ever closer to a near-workerless world.”*
- *“Today, all sectors of the economy are experiencing technological displacement, forcing millions onto the unemployment rolls.”*
- *“Coping with this displacement is going to be the single most-pressing issue of the coming century.”*

Foxconn reportedly installing robots to replace workers

Following a rash of suicides and criticism of factory working conditions, the Taiwanese hardware maker announced the move last year, saying it was designed to improve efficiency and combat rising labor costs.

Foxconn, the Taiwan-based electronics manufacturing giant frequently criticized for poor working conditions, has reportedly begun replacing its factory workers with robots.

After a rash of worker suicides at Foxconn factories in China, the manufacturer of hardware for Apple, Hewlett-Packard, Dell, and Sony announced its intention last year to [replace some of its workers with robots](#). Terry Gou, founder and chairman of the company, told employees at a dance in July 2011 that the move was designed to improve efficiency and combat rising labor costs.

The first batch of 10,000 robots -- nicknamed "Foxbots" -- have arrived in at least one Foxconn factory, with another 20,000 due by the end of the year, according to a [Singularity Hub](#) post. The robots cost between \$20,000 and \$25,000 apiece to produce -- about three times the average annual salary of Foxconn's factory workers, according to a report on the Chinese Web site [TechWeb](#).

CNET has contacted Foxconn for comment and will update this report when we learn more.

Related stories

- [New U.S. address in Foxconn's future? Don't bet on it](#)
- [Foxconn looks to U.S. to open manufacturing plants, report says](#)
- [Fair Labor Association too easy on Apple, Foxconn, study says](#)

reportedly committed suicide since the beginning of 2010 at Foxconn's factory in Shenzhen, China, a plant that employs hundreds of thousands of workers. Another three have attempted

Foxconn, which has 1.2 million employees in China, has come under scrutiny in the past few years amid reports of employees committing suicide at company facilities. The company has also been accused of employing underage laborers, providing poor living conditions at its dormitory housing, and overworking employees.

Prior to the announcement of the the robot initiative last year, at least 16 workers



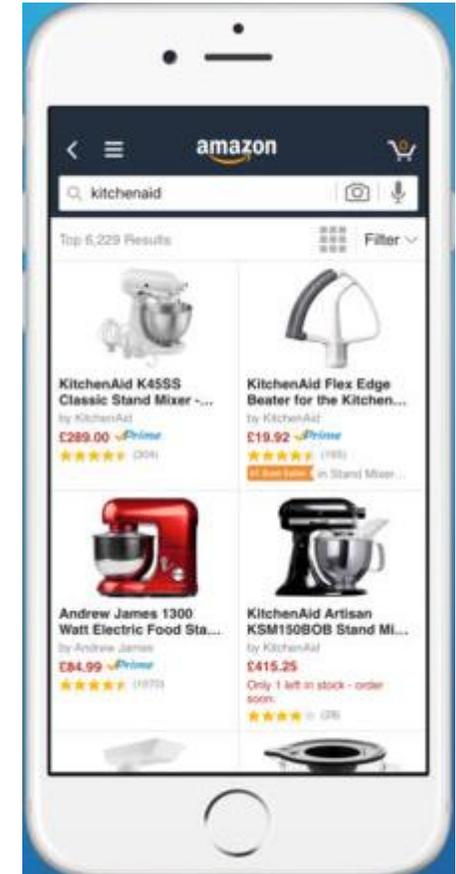
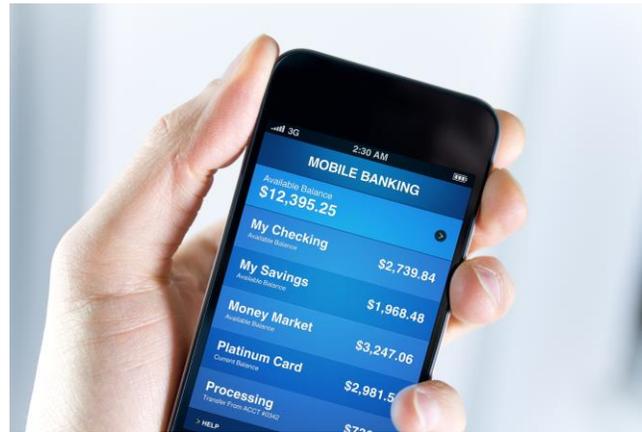
by Steven Musil | November 13, 2012 9:25 PM PST

[Follow](#)



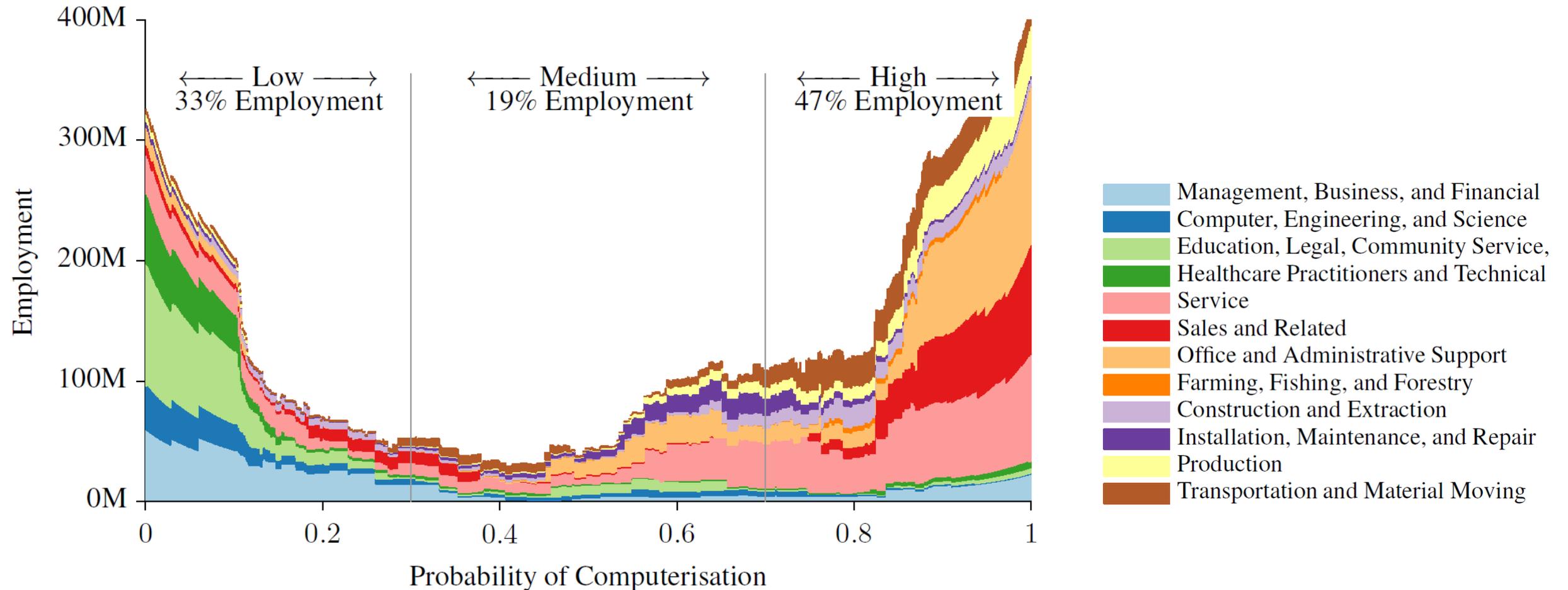
Chinese tech site TechWeb says the robots cost up to \$25,000 a piece to manufacture.

(Credit: TechWeb)



The scary scenario

Frey & Osborne 2013



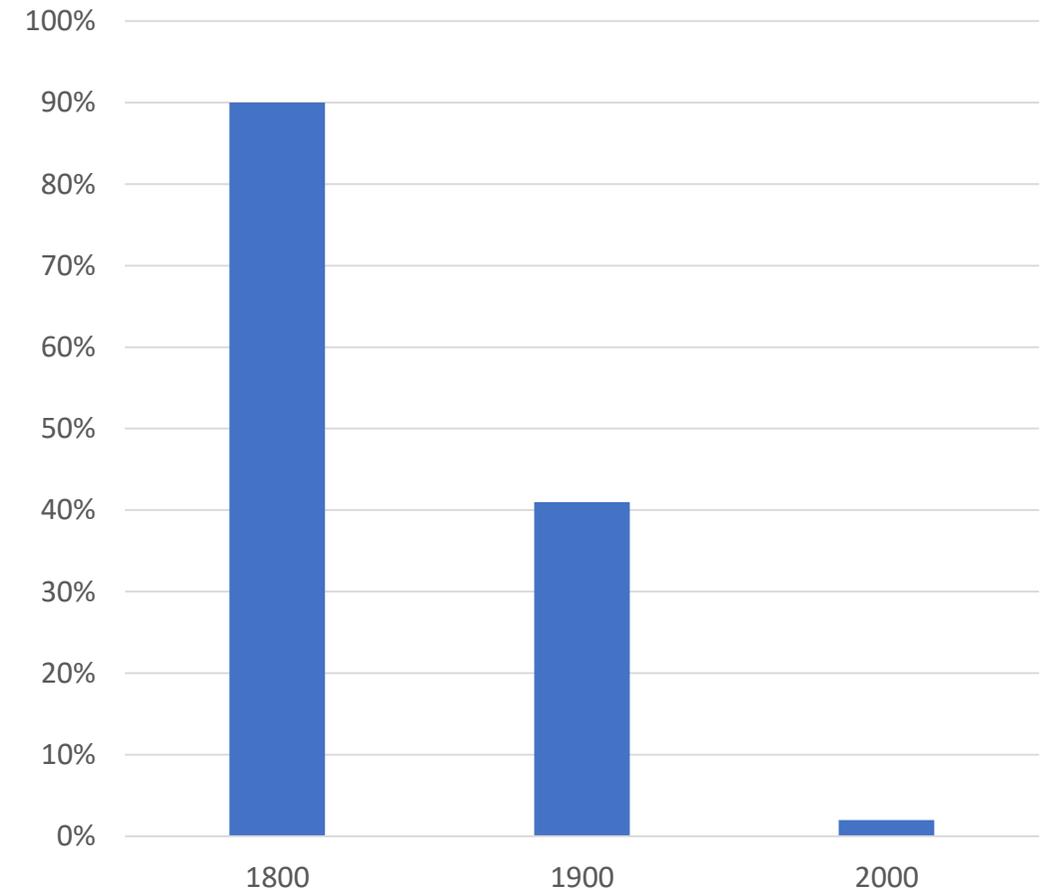
Optimism



1 Productivity gains lead to new jobs

- Okun's law
 - Productivity & jobs grow together
- Earlier industrial revolutions proved it right
 - Agriculture jobs absorbed by industry
 - Industry jobs absorbed by services
- But is the digital revolution comparable?
 - Faster? More pervasive? More generic?

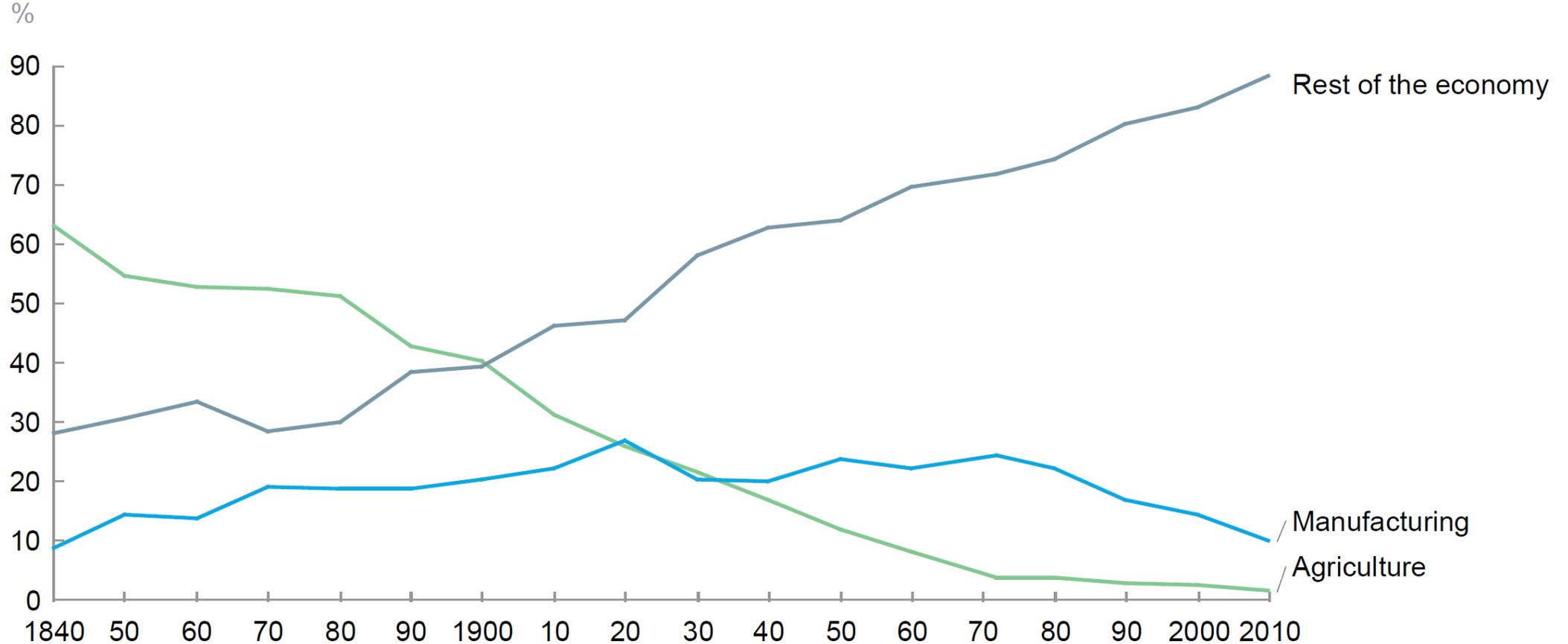
Agricultural employment
as % of workforce



1

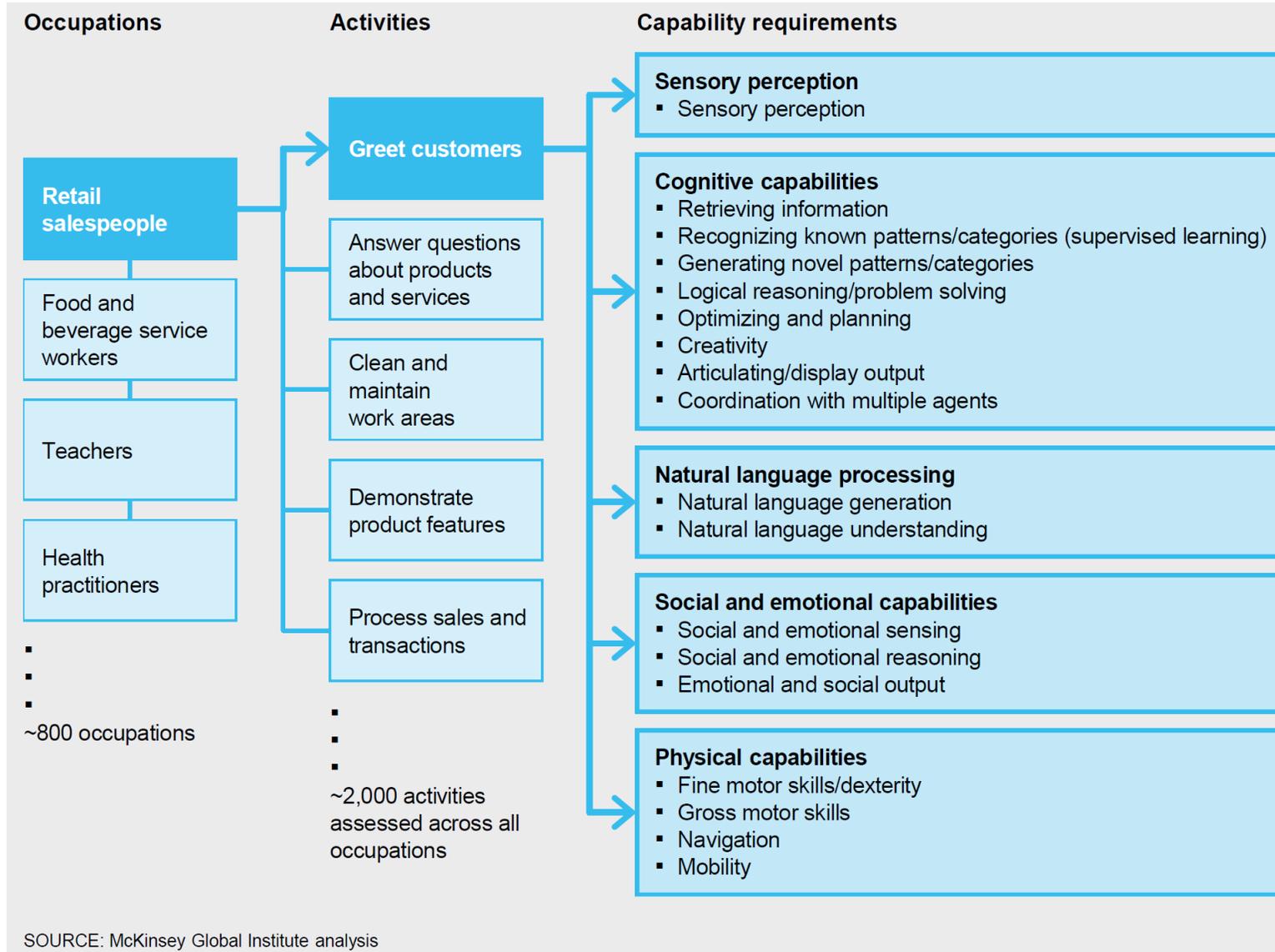
Productivity gains lead to new jobs

Distribution of labor share by sector in the United States, 1840–2010



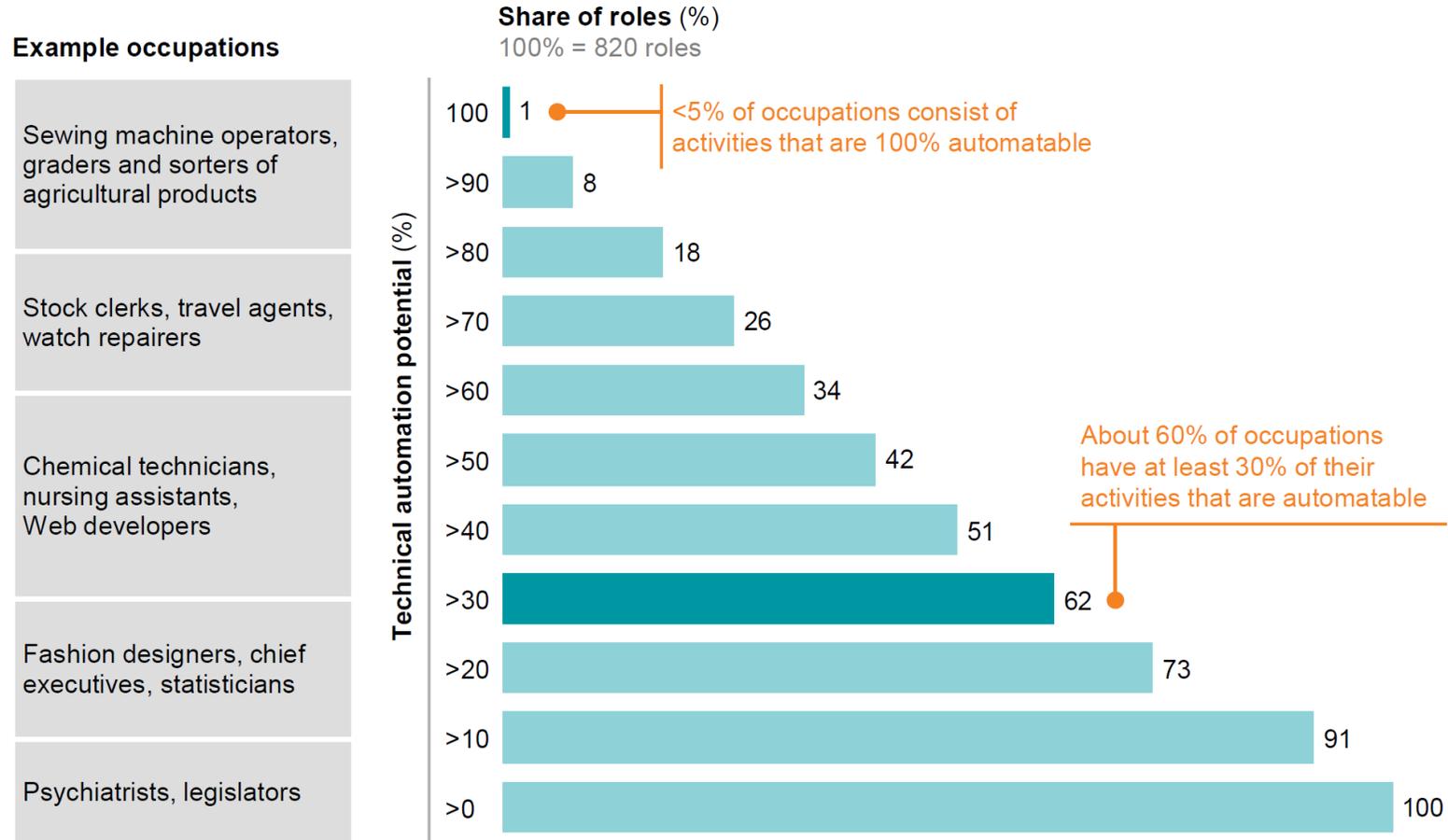
SOURCE: Stanley Lebergott, "Labor force and employment 1800–1960," in *Output, employment, and productivity in the United States after 1800*, Dorothy S. Brady, ed., NBER, 1966; World Data Bank, World Bank Group; FRED: Economic Research, Federal Reserve Bank of St. Louis; Mack Ott, "The growing share of services in the US economy—degeneration or evolution?" *Federal Reserve Bank of St. Louis Review*, June/July 1987; McKinsey Global Institute analysis

2 Jobs will change, not disappear



2 Jobs will change, not disappear

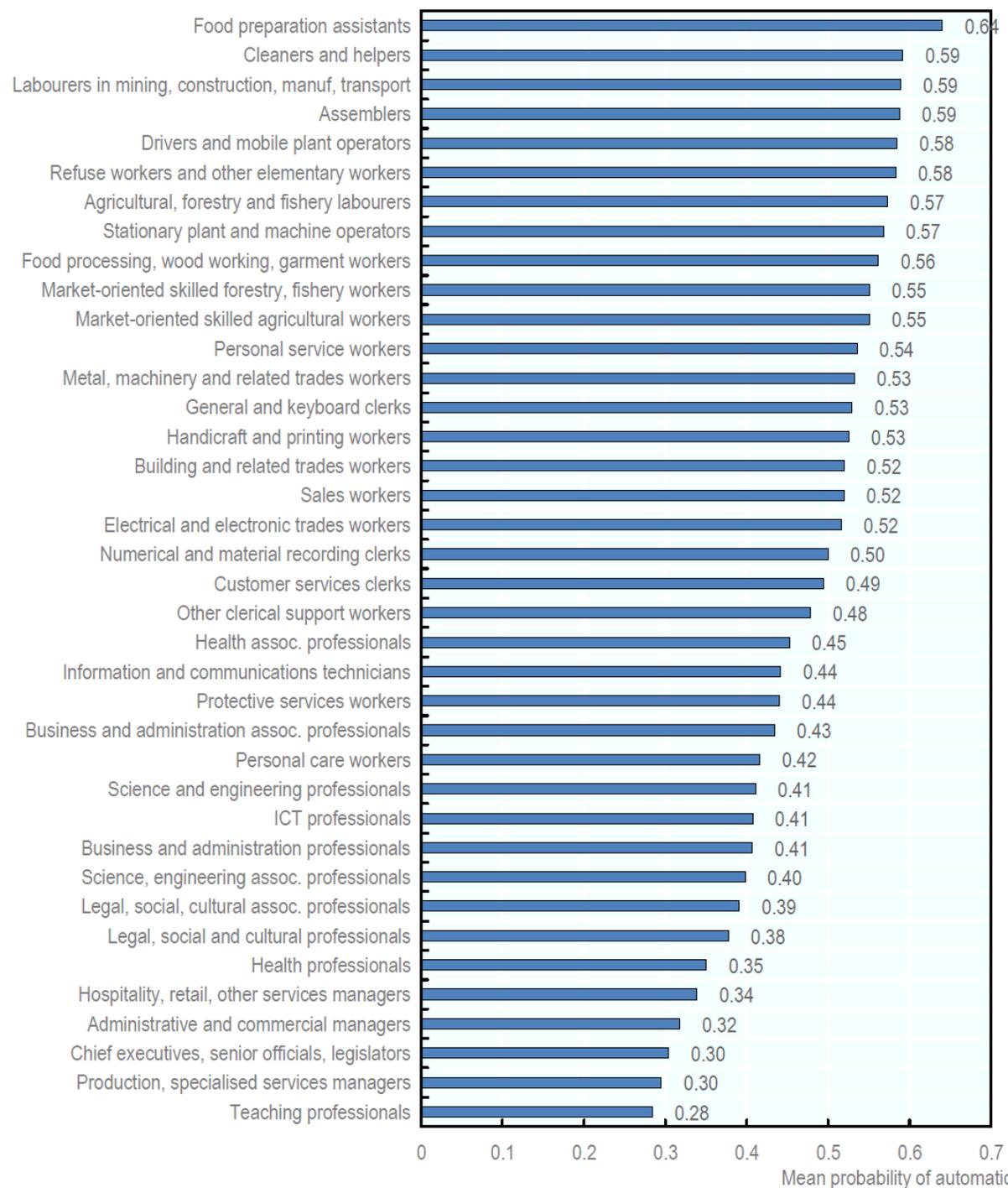
Automation potential based on demonstrated technology of occupation titles in the United States (cumulative)¹



¹ We define automation potential according to the work activities that can be automated by adapting currently demonstrated technology.

2

Jobs will change, not disappear

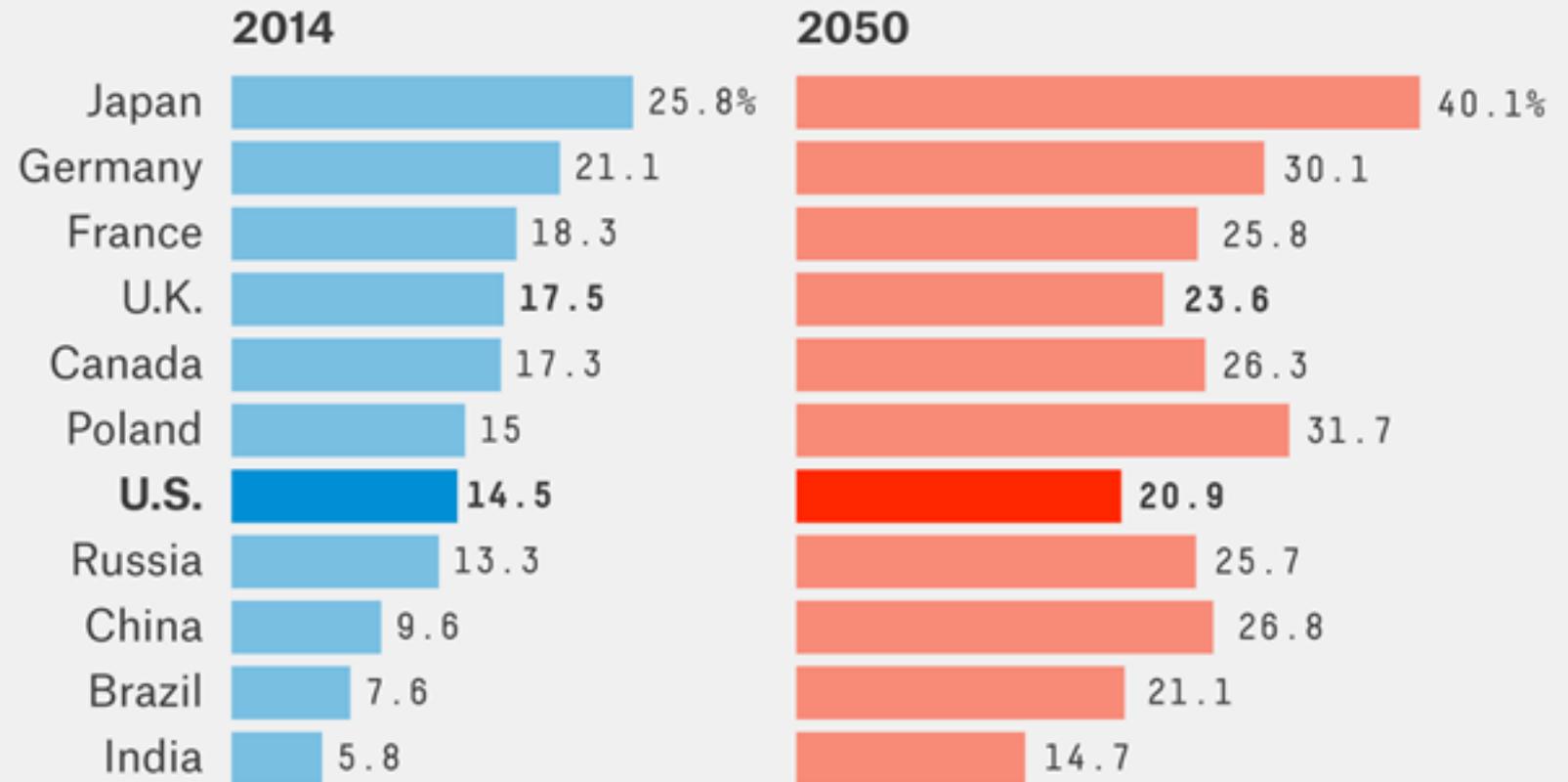


Source: OECD, 2018

3 Jobs supply is declining due to superaging

Share of Population Age 65 And Over

Selected countries



The real threats ahead



1 Skill-biased technological change

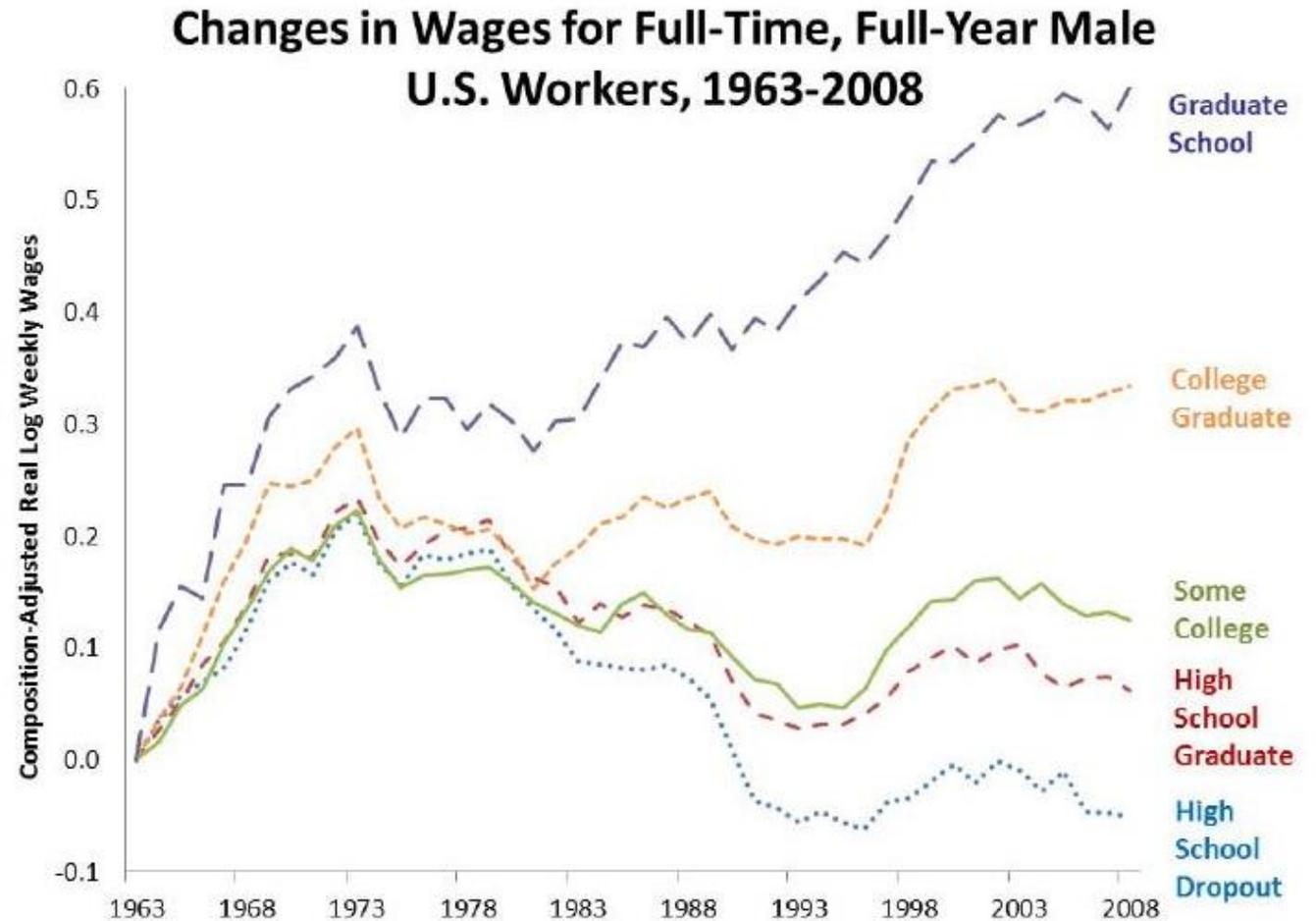
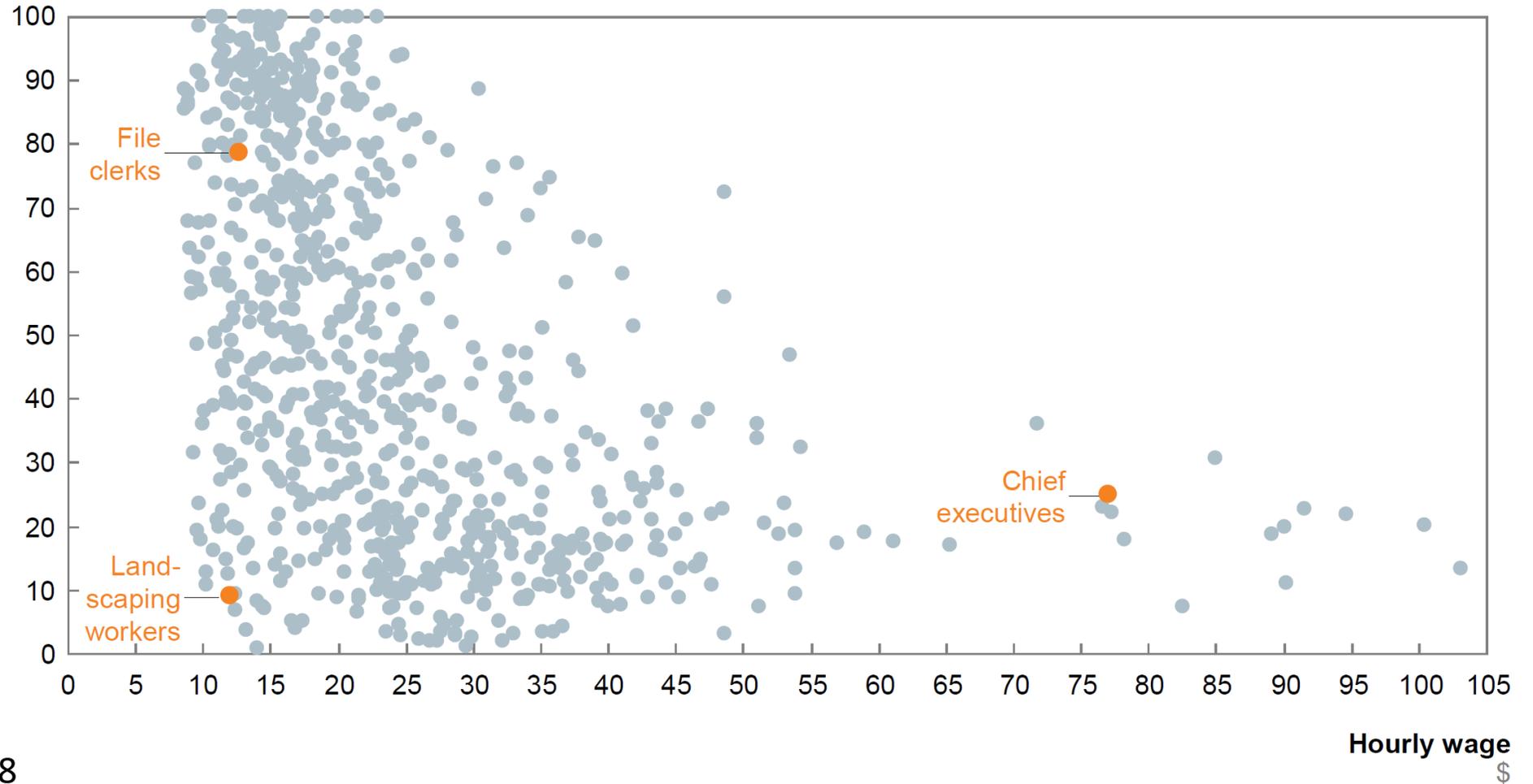


Figure 3.5: Wages have increased for those with the most education, while falling for those with the least. Source: [Acemoglu and Autor](#) analysis of the Current Population Survey for 1963-2008.

1 Skill-biased technological change

Both low and high-wage occupations have significant technical automation potential

Automatability¹
%



Source: McKinsey, 2018

Bigger inequalities ahead



2 Is education developing the right skills?



We need continuous learning & re-skilling



Digital technology reshapes the business world and the workplace





“ Software and robots are eating the world ”

It is a great opportunity... if we adapt



Thank you