# Unemployment through digitization?

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# Profound changes through digitization

## Threats or opportunities?

# Digitalization in the public debate

## A worldwide hype in the media?

FUTURE TENSE | THE CITIZEN'S GUIDE TO THE FUTURE. | APRIL 28 2016 9:00 AM

Slate

FROM SLATE, NEW AMERICA, AND ASU

# Killer Robots? Lost Jobs?

The threats that artificial intelligence researchers actually worry about.

362 239 28

*By Cecilia Tilli*

Elon Musk, Stephen Hawking, and Bill Gates .

Photo illustration by Sofya Levina. Images by Mike Windle/Thinkstock, Bryan Bedder/Thinkstock, and Joshua Lott/Getty Images.

# The pessimistic scenario of technological development in the German media

## An example

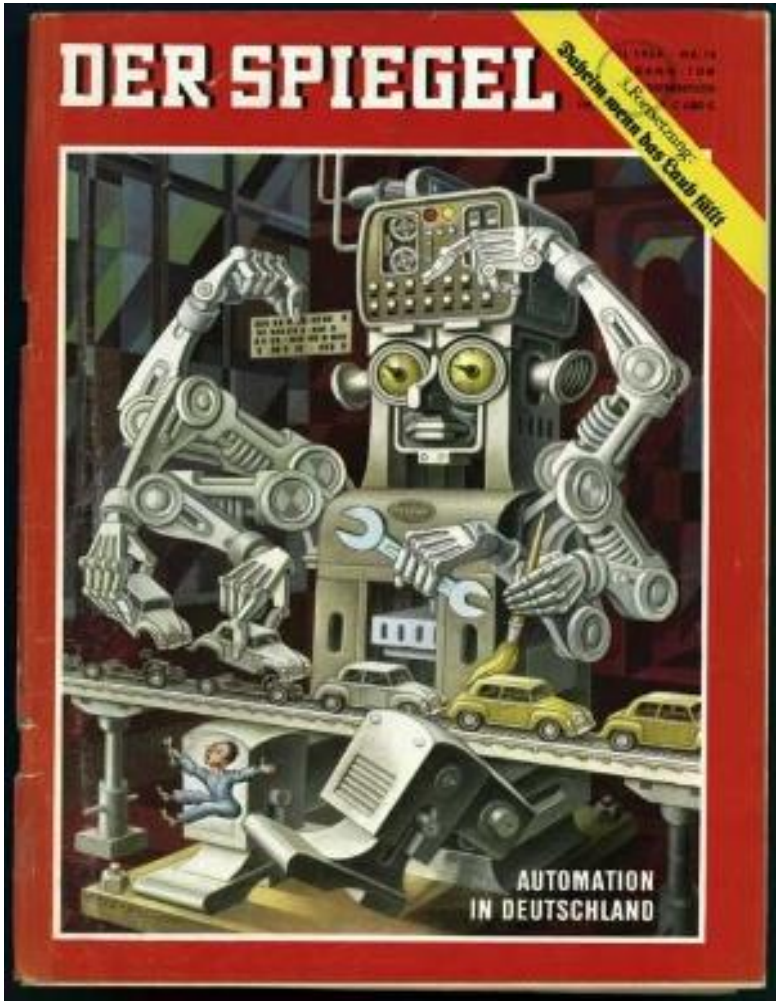
» The experts are split into two camps. Some claim that the tide is rapidly rising and 80 percent of the jobs are destroyed in 20 years. The others believe that this will happen only later.«

Der Spiegel, 17.4.1979

## 2016

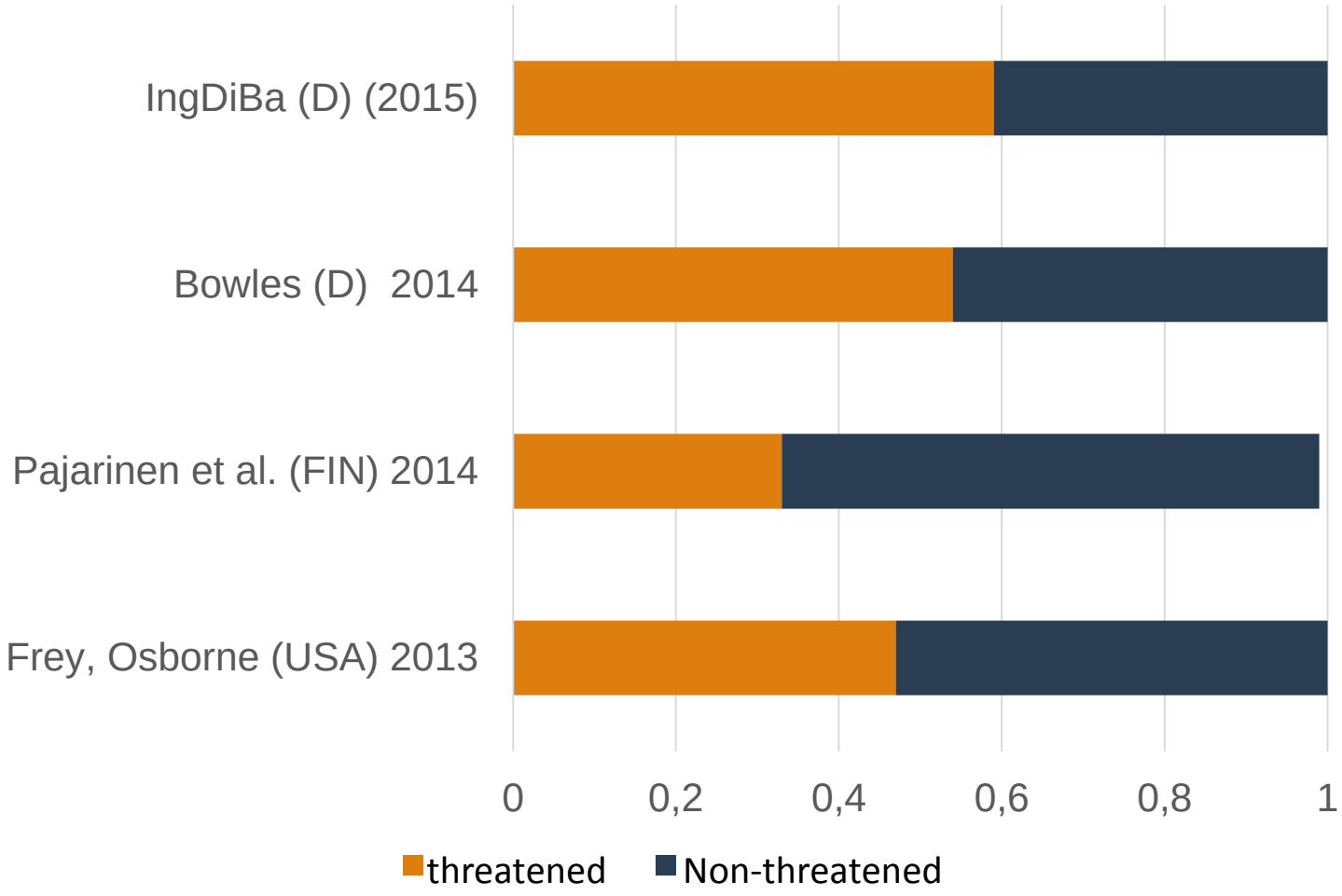

DER SPIEGEL
Nr. 36
3.9.2016
Sie sind entlassen!
Wie uns Computer und Roboter die Arbeit wegnehmen –
und welche Berufe morgen noch sicher sind
Heilende Hände, aber
Probleme mit den Finanzen
Erst Gefängnis, dann
Präsidentenpalast?
Warum Neandertaler
zu Kannibalen wurden

## 1964


DER SPIEGEL
AUTOMATION
IN DEUTSCHLAND

# Elimination of jobs on a broad front?

## Some empirical studies draw gloomy scenarios …



# Are the threats exaggerated?

## Critical assessment of pessimistic scenarios …

- Experts often overestimate the technical possibilities (D.Autor 2014)

- Technical potential is not equated with actual substitution of human labor:
  - legal hurdles (e.g. for autonomous driving),
  - cultural preferences, reservations (robot service?)
  - Profitability Hurdles

- Share of specific activities within the professions assumed to be constant → not realistic!

Professions do not disappear, they are adjusting!

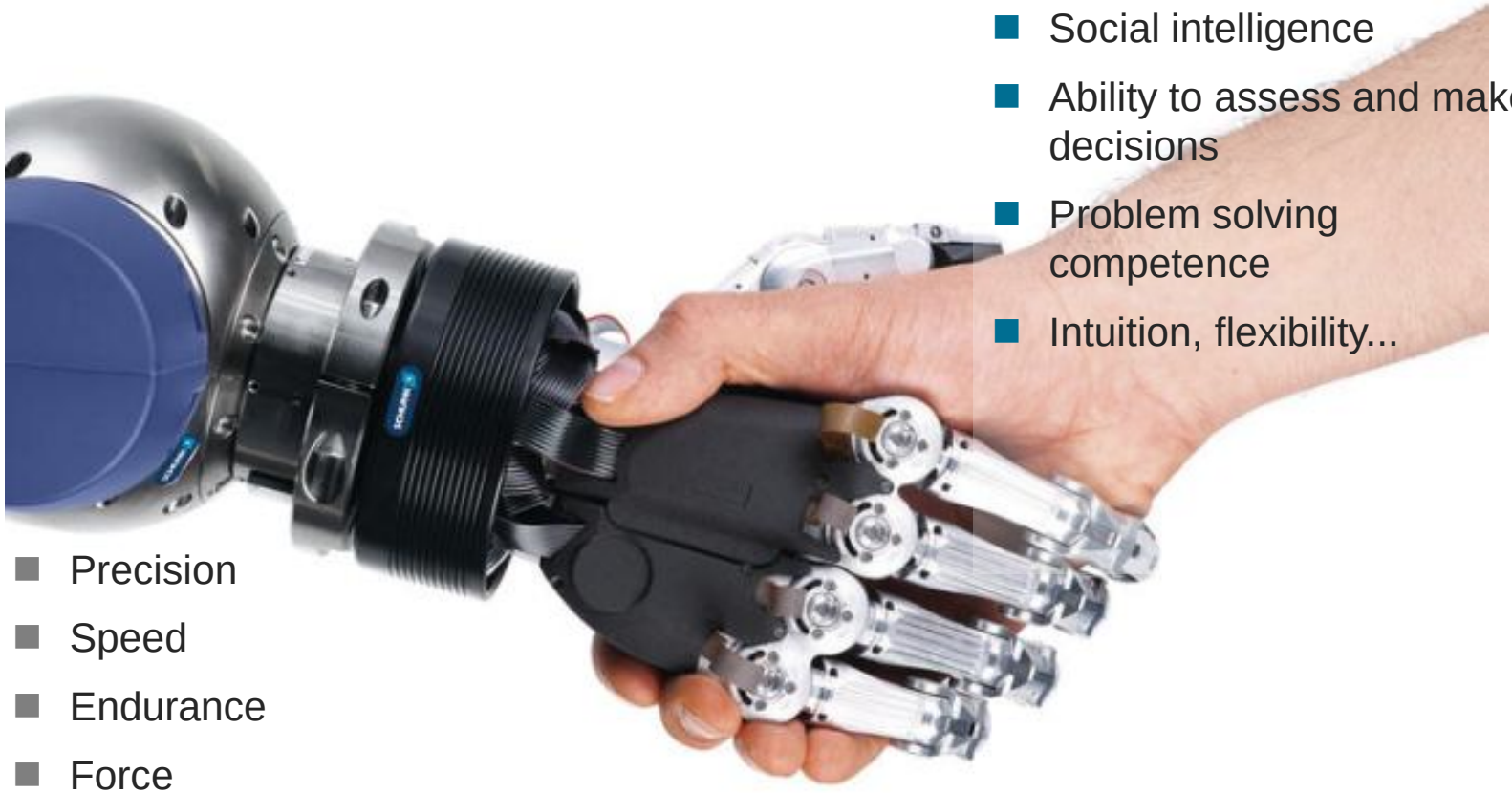
# The work does not go out, but it is changing

## Technological progress leads to new activities within professions

# The robots leave their cages...

## Cobots are directly interacting with workers …

- Creativity
- Emotions, empathy
- Social intelligence
- Ability to assess and make decisions
- Problem solving competence
- Intuition, flexibility...



- Precision
- Speed
- Endurance
- Force
- Predictability
- Low maintenance costs

# What kind of tasks can be replaced?

## Frey, Osborne (2013)

- Technical developments (cobots, machine learning, KI), not only displace simple standardized (routine) activities but also more complex activities!

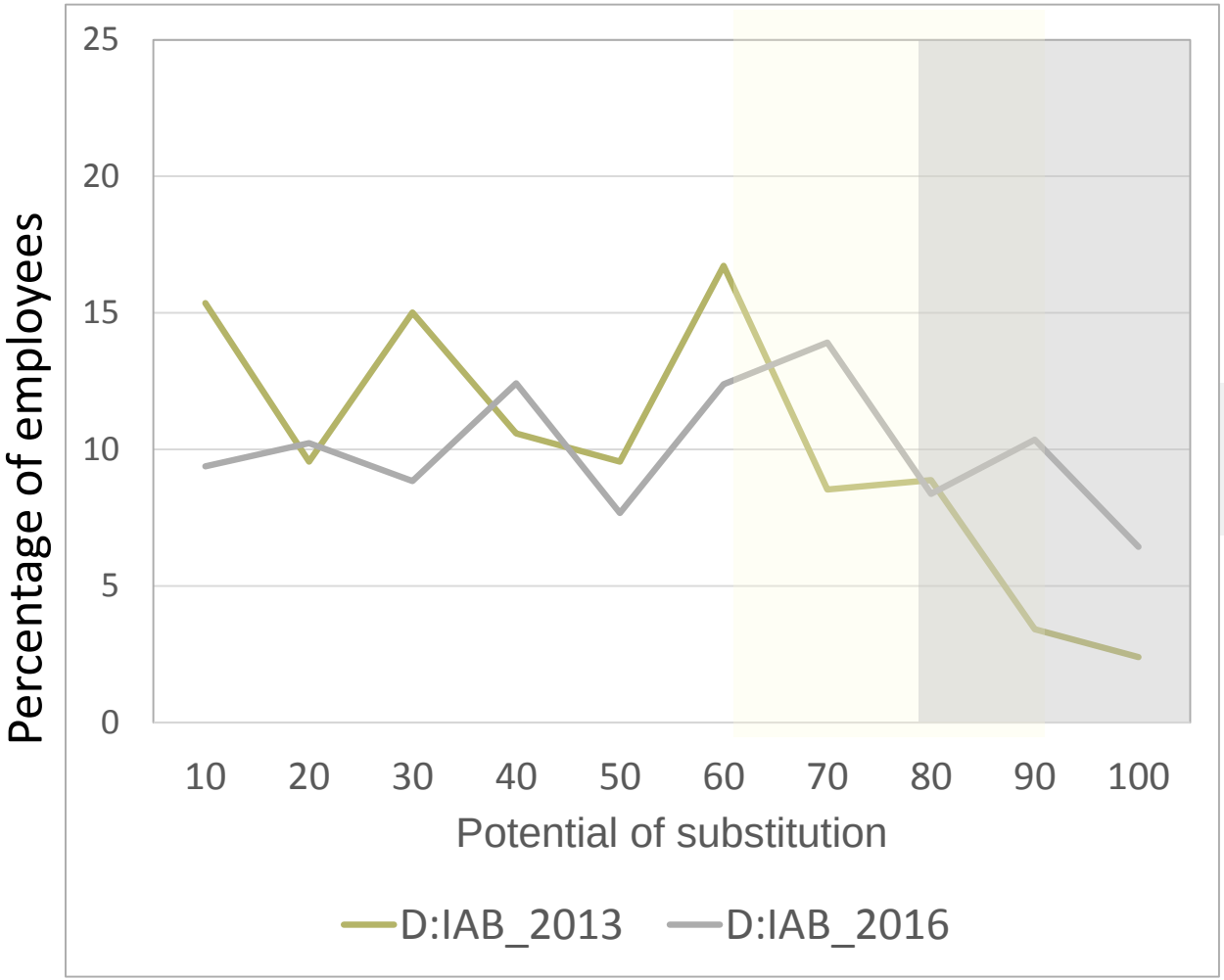
Less endangered, however:

- Activities of hand-eye coordination
- Creative-intelligent activities
- Social-intelligent activities

→Calculation of the substitutability of (current) activities in the professions

# Substitutability on the basis of tasks/ activities

## Much lower values compared to F&O …




Total in hatched area:

IAB_2013: 15% of employees

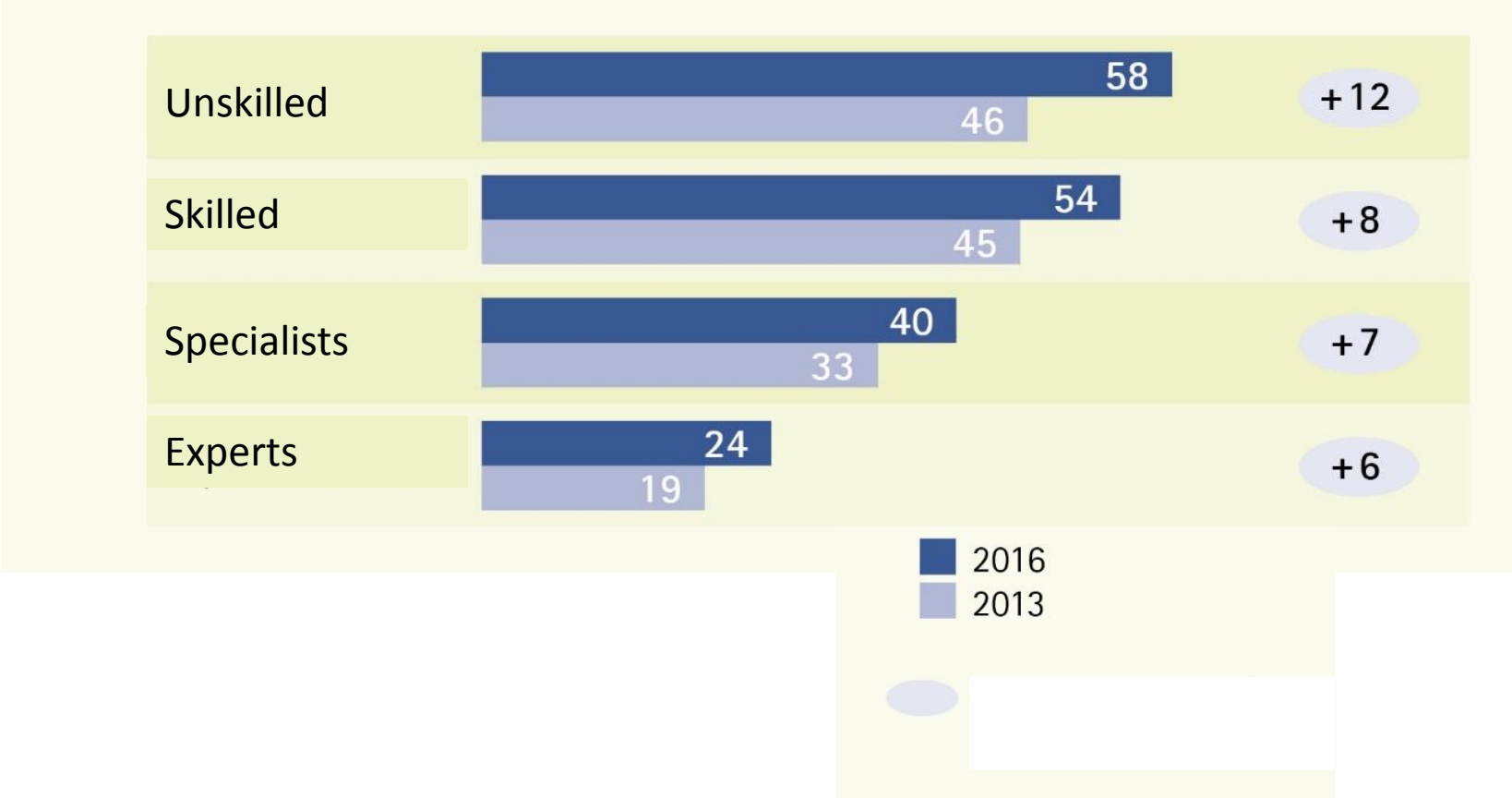
IAB_2016: 25% of employees

Source: Own presentation with data from Dengler, Matthes (2015, 2018)

# Change in required skills and sectors of the economy

# Substitutability decreases with the requirement level

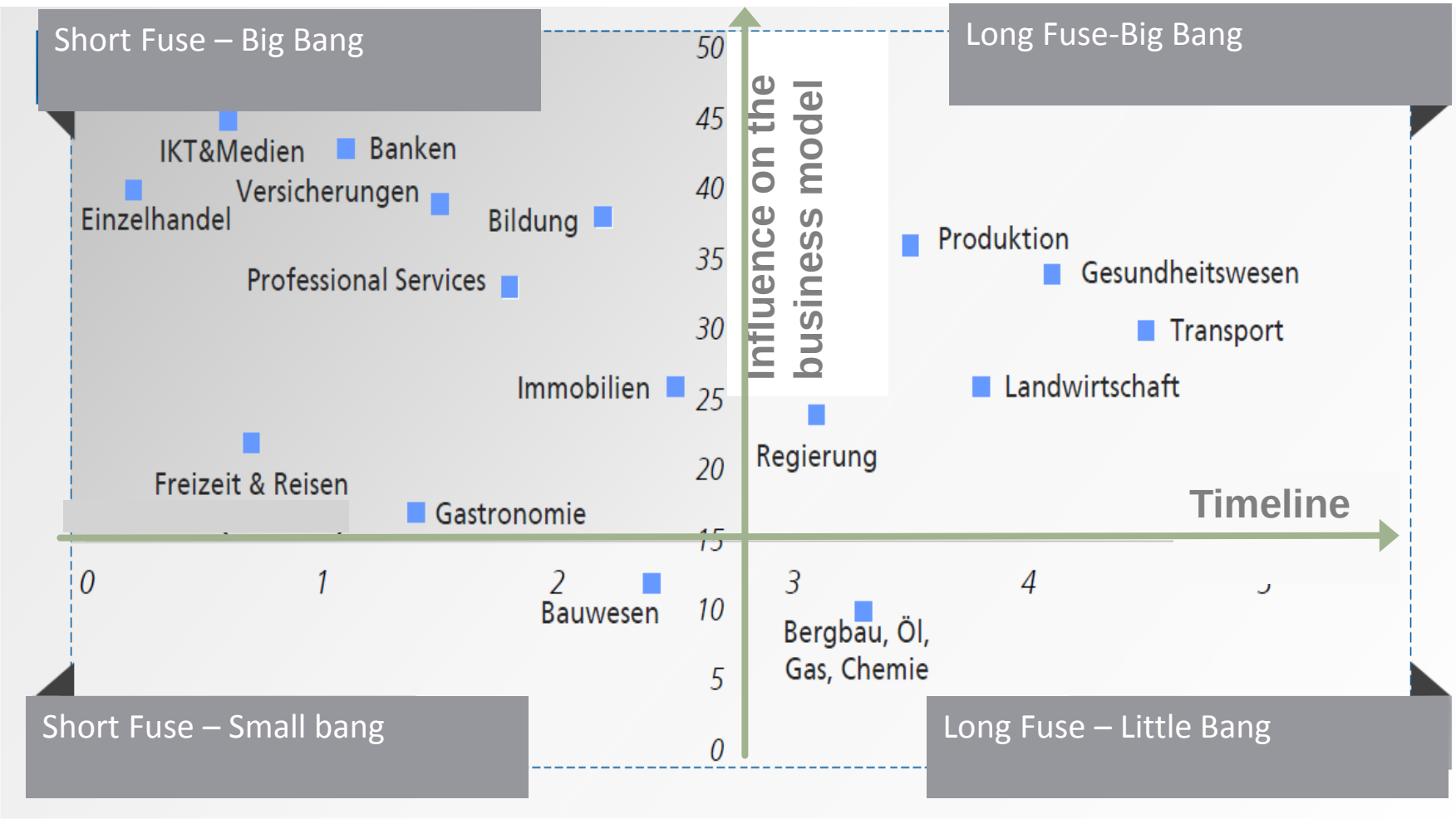
## Proportion of activities that can be replaced in principle today




Source: Dengler, Matthes (2018): IAB-Kurzbericht, 4/2018

# Disruptions and projected effect size

## Sectors affected differently …




Quellen: Heads! und Deloitte Digital

# Technological unemployment

# Technological unemployment

## The famous definition of Keynes …

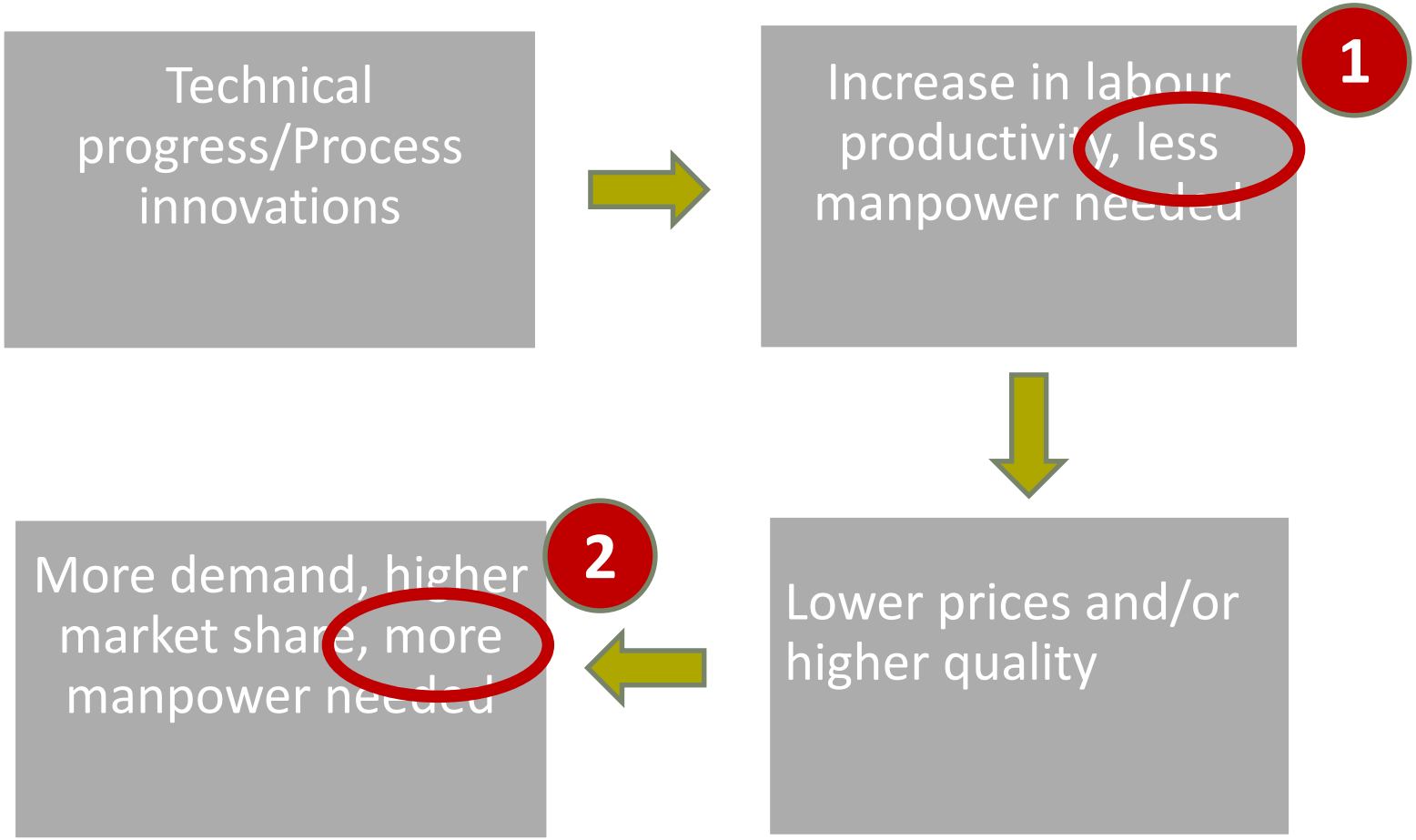
» We are being afflicted with a new disease of …– namely, technological unemployment. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour.«

» Those countries are suffering relatively which are **not** in the vanguard of progress.«

*John Maynard Keynes:*
*Economic Possibilities for our Grandchildren (1930), (my highlighting)*

# Technical progress is Janus-headed

## Effects on employment ambivalent




→ What is the net effect on employment?

# What effect of technical progress?

## Competition and price elasticity

| | Price Elasticity of demand | Competition | Employ-ment effect |
|---|---|---|---|
| New Products/ Competitive markets | High | High | Positive |
| New Products/ Markets with low competition | High | Low | (Positive) |
| Old Products | Low | High/ Low | Negative |

# Further important aspects

## Product Innovations, Reshoring

- Technology creates new services and products (product innovations) → positive employment effects
- *Reshoring* → Does the surge in robots/digitalization harm the emerging countries?

» Robots turn out to have a statistically significant negative impact on worldwide employment. While it is small in developed countries, for emerging economies it amounts to -14% between 2005 and 2014 … Robots in developed countries decrease off-shoring just as employment in emerging economies.«

Carbonero, Ernst, Weber (2018), Robots worldwide: Ilo Working Paper # 36-.

# Digitization and distribution

# The distribution problem

## Digitization exacerbates inequality

- Outstanding importance of cutting edge technology, extreme scale yields
- Markets (Big four of the digital economy)
- "The winner takes it all"-structures
- Segmentation of companies (polarized structure: "Lovely and lousy jobs")
- Selection of highly productive workers in good companies, less productive in bad companies (card, Heining, Kline, QJE 2013)

# New social conflicts?

## Redistribution of property rights instead of redistribution of income

» As companies substitute machines and computers for human activity, workers need to own part of the capital stock that substitutes for them to benefit from these new "robot" technologies. … Without ownership stakes, workers will become serfs working on behalf of the robots´ overlords.

*Richard Freeman (2015), IZA Discussion Paper 2015*

# Conclusions

# Conclusions

- Significant drop in labor demand rather unlikely but structural change
- Professions will generally not disappear, but changing job content → Increased training efforts needed!
- Adaptation requirements between qualifications, professions, companies and countries or regions
- Technological unemployment tends to be a second-order problem
- Distribution effects a first-order problem!

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# A recent plan: robots producing robots …

## Only marketing or revolutionary production technique?

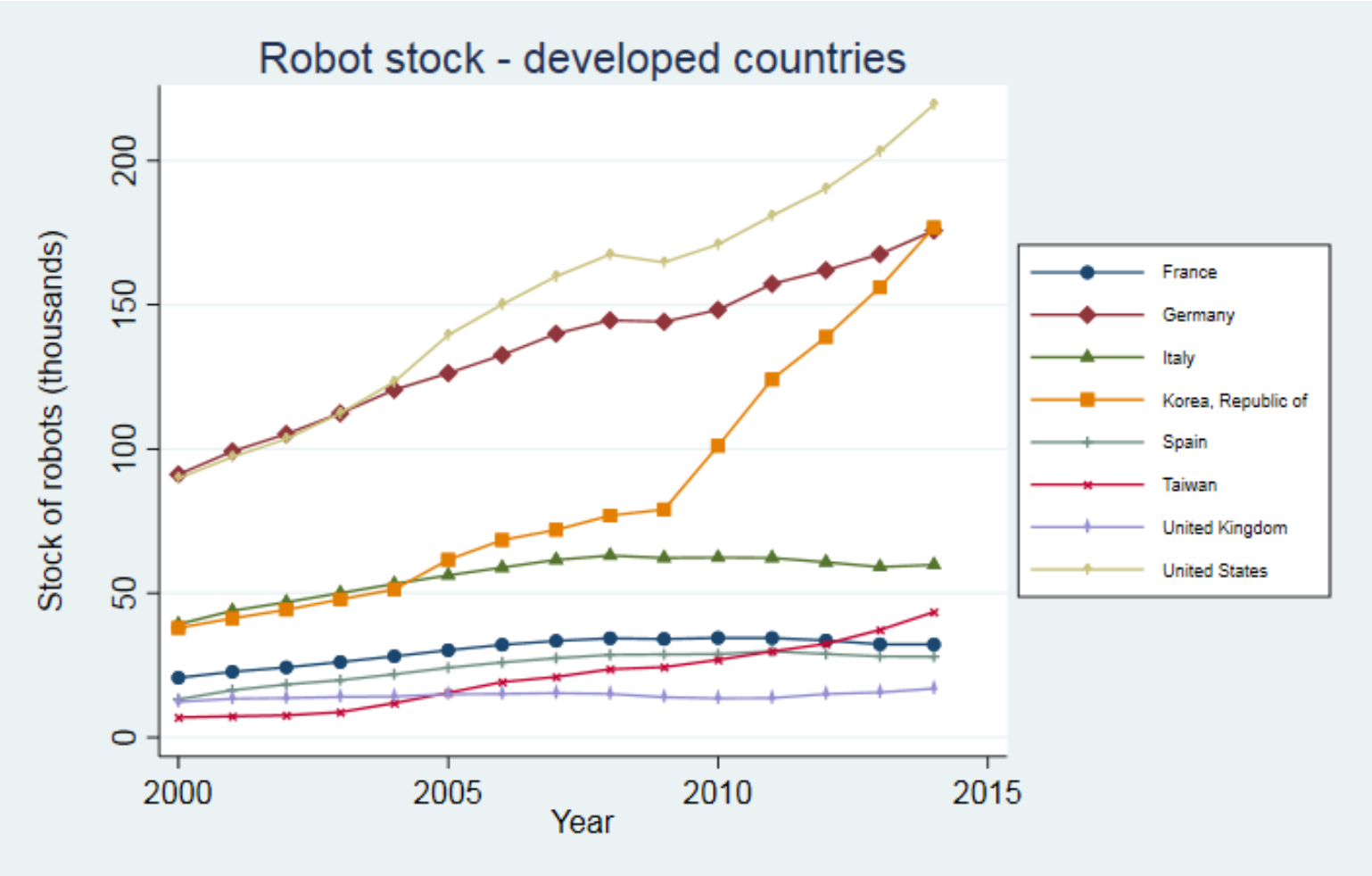
**ABB to build the world's most advanced robotics factory in Shanghai**

**Milestone investment will combine connected digital technologies, state-of-the-art collaborative robotics and cutting-edge artificial intelligence research to create the most sophisticated, automated and flexible Factory of the Future.**


Source: https://new.abb.com/news/detail/9410/abb-to-build-the-worlds-most-advanced-robotics-factory-in-shanghai

# Robot stock (developed countries, excl. Japan)

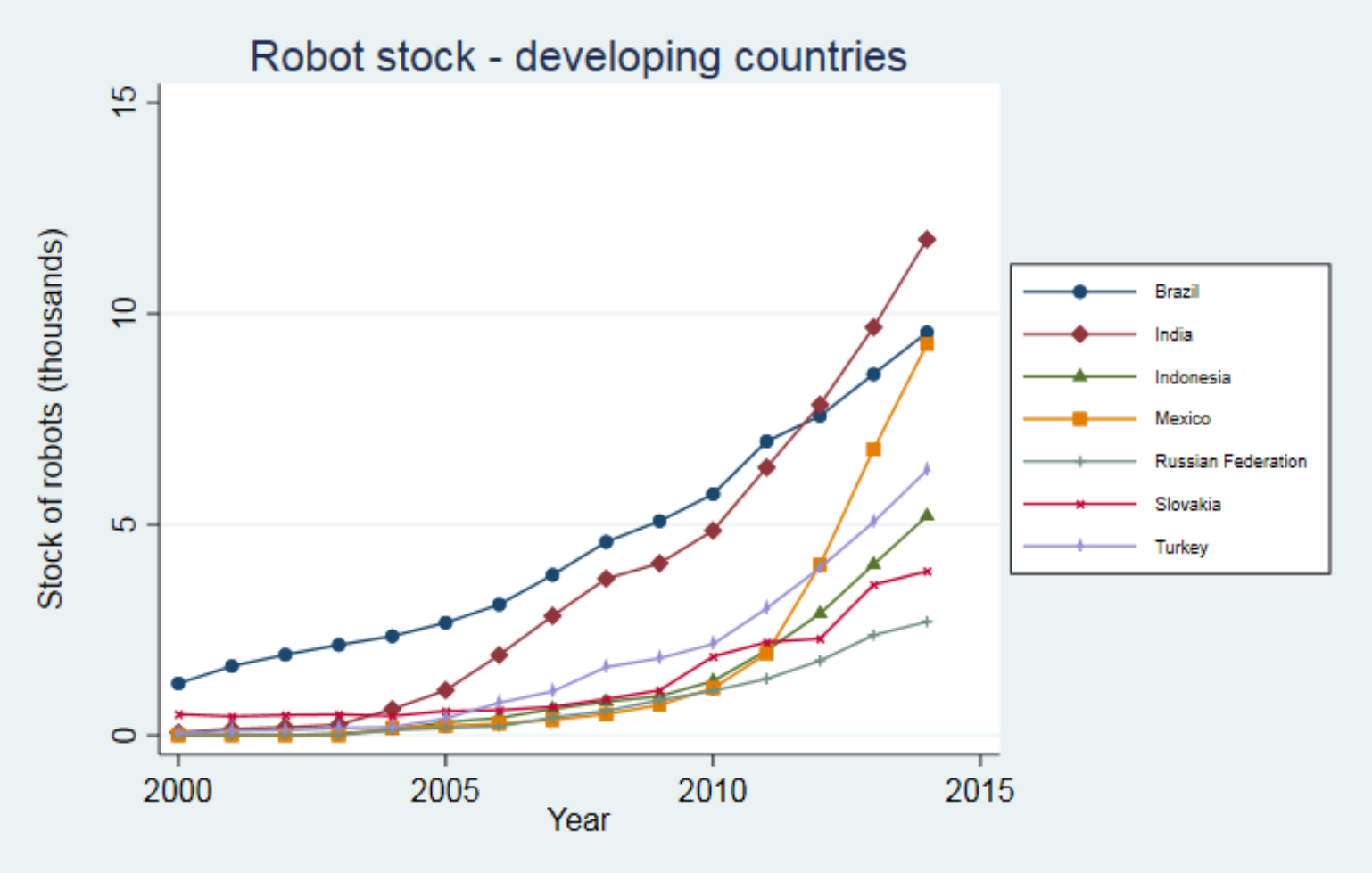
## High dynamics in US, Korea, Germany




Source: Carbonero, Ernst, Weber (2018), Robots worldwide: The impact of automation on employment and trade, Ilo Working Paper # 36-

# Robot stock (emerging countries, excl. China)

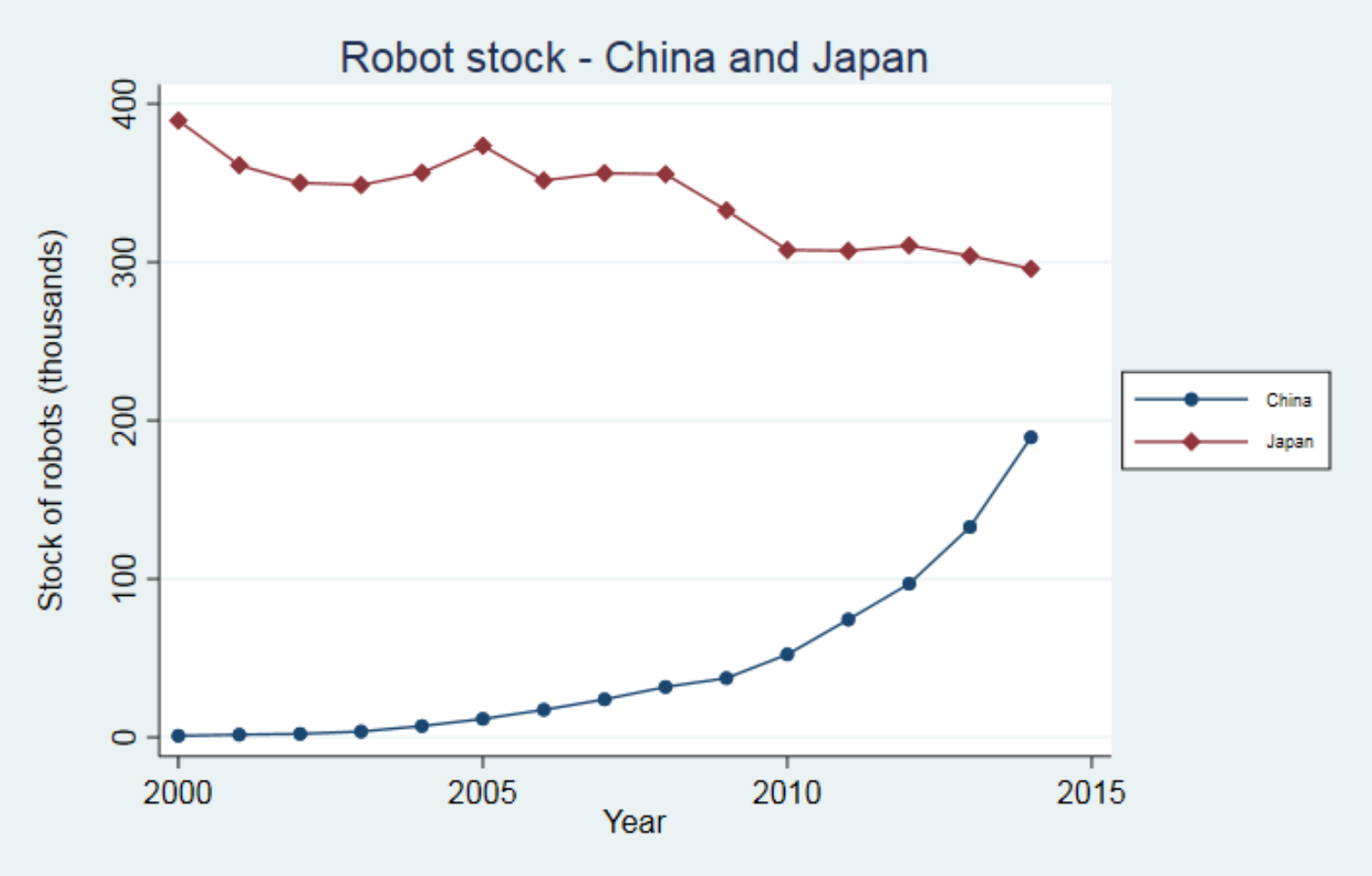
## High dynamics in several countries




Source: Carbonero, Ernst, Weber (2018), Robots worldwide: The impact of automation on employment and trade, Ilo Working Paper # 36-

# Robots: Japan vs China

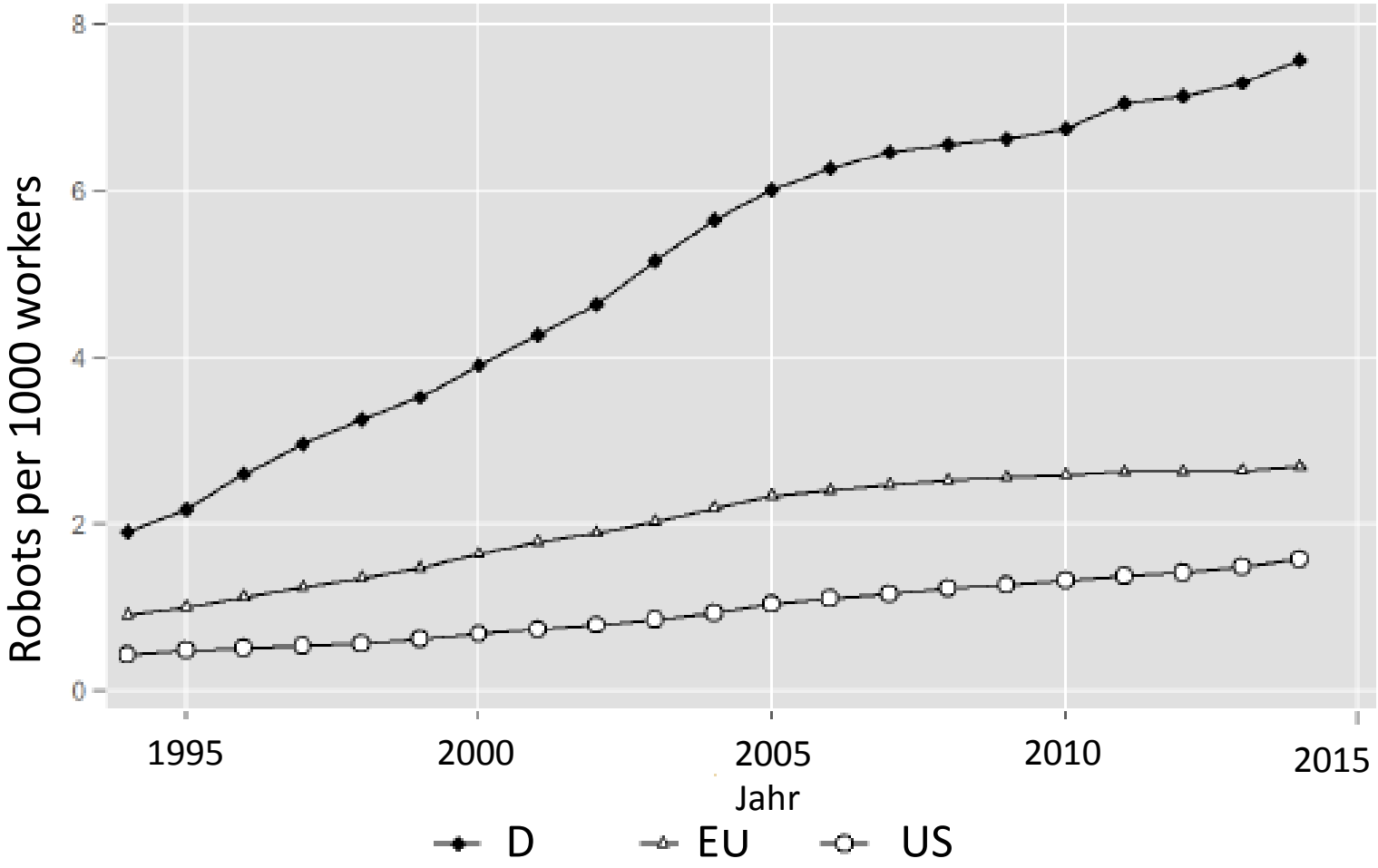
## Exponential growth in China




Source: Carbonero, Ernst, Weber (2018), Robots worldwide: The impact of automation on employment and trade, Ilo Working Paper # 36-

# The use of robots increases

## Germany one of the leading countries...




Source: Dauth et al., IAB-Discussion Paper 30/2017

# Higher unemployment through digitization?

**e.g. Korinek, Stiglitz (2017)**

Assumption: digitization leads to more fluctuation between companies/sectors/regions

→ higher separation rate → higher unemployment in equilibrium

Assumption : digitization leads to devaluation of specific human capital

Consequence in imperfect labor markets:
higher unemployment in equilibrium

Conclusion: tending to increase unemployment possible, but a second order effect!

# Paradoxes in the ongoing debate

Paradox 1:
“Digitization makes millions of skilled workers redundant."
“Demography leads to an intensified shortage of skilled workers."

Paradox 2:
"Digitization leads to an enormous increase in productivity."
"The growth of productivity is exceptionally weak in long-term comparison.“

Paradox 3:

“Digitalization leads to labor saving.”
“Some of the forerunners in digitalization are expanding their workforce.”

→ How does this fit together?

# Technological unemployment through digitisation

## A counter position

» The idea that people would always have a unique ability that is unattainable for non-conscious algorithms is pure wishful thinking.«

*Yuval Noah Harari:* Homo Deus, 2017,S.430f.

# The productivity puzzle

# Technology and productivity

## Is there a puzzle?

»You can see the computer age everywhere but in the productivity statistics.«

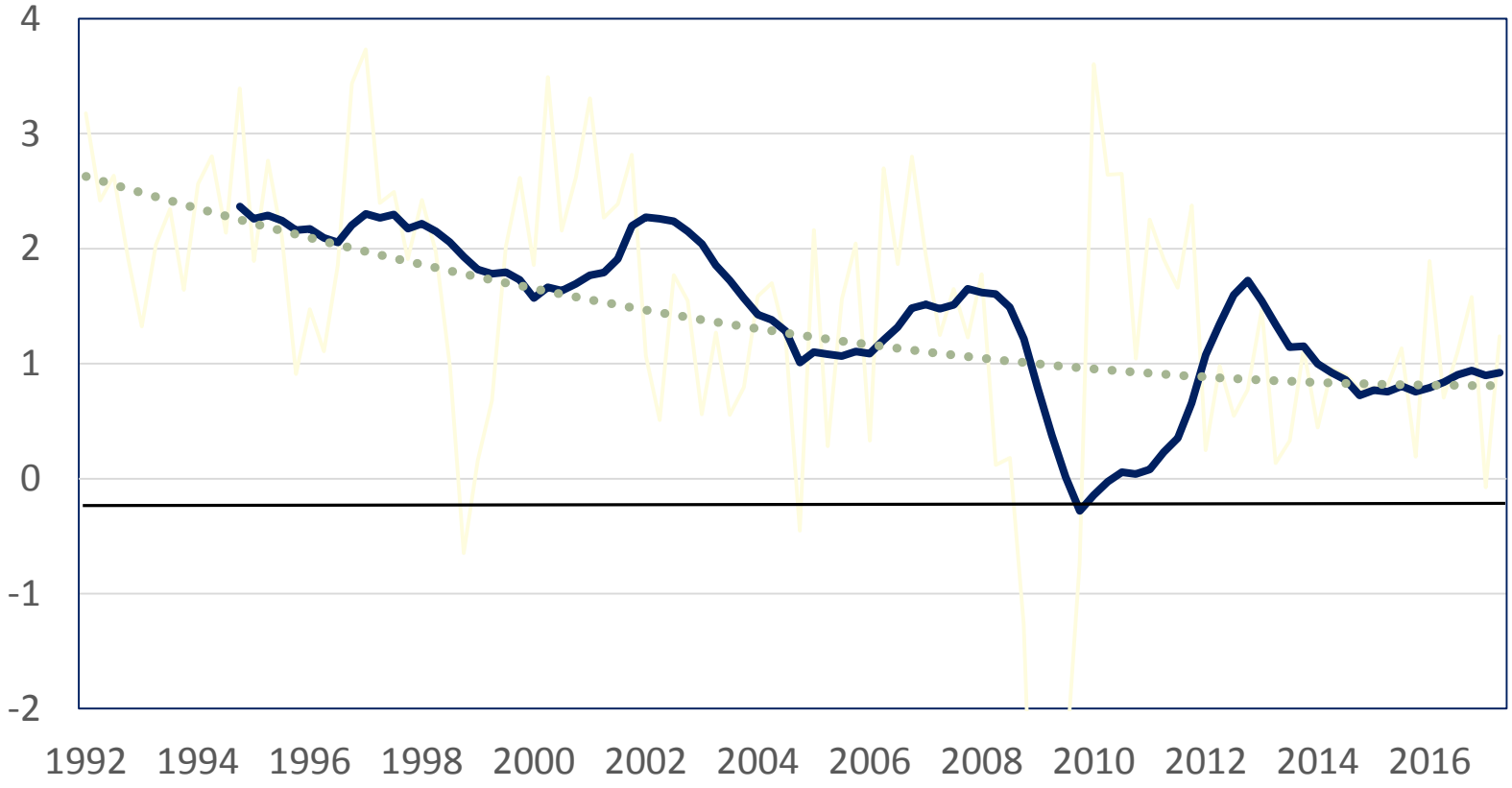
*Robert Solow 1987*

» ... measured productivity has increased rather slowly in recent years, even as the world seems to be captured by AI (Artifical Intelligence) fever.«

*Anton Korinek ,Joseph E. Stiglitz (2017)*

# Productivity growth per hour

## Decline and stabilization at low-level




Own presentation with data of the Bundesbank; Growth rate vs prior-year quarter; 3-year moving averages and polynomial trend.

# *Artificial Intelligence* as a new basic technology

## Approaches to explaining the productivity puzzle

E. Brynjolfsson, D. Rock, C. Syverson (2017):
Basically four possible explanations for the productivity puzzle:

- Higher expectations
- Measurement problems
- Distribution effects (zero-sum games)
- Implementation delays (J-Curve effect)

Favored: The J-curve effect: effects only after complementary innovations and investments; these are often incomprehensible (intangible); e.g. adjustments, organizational changes, qualification in advance)

# Backup

# The digital revolution is progressing rapidly...

## Development areas

Cyber-physical systems offer radically new possibilities of networking...

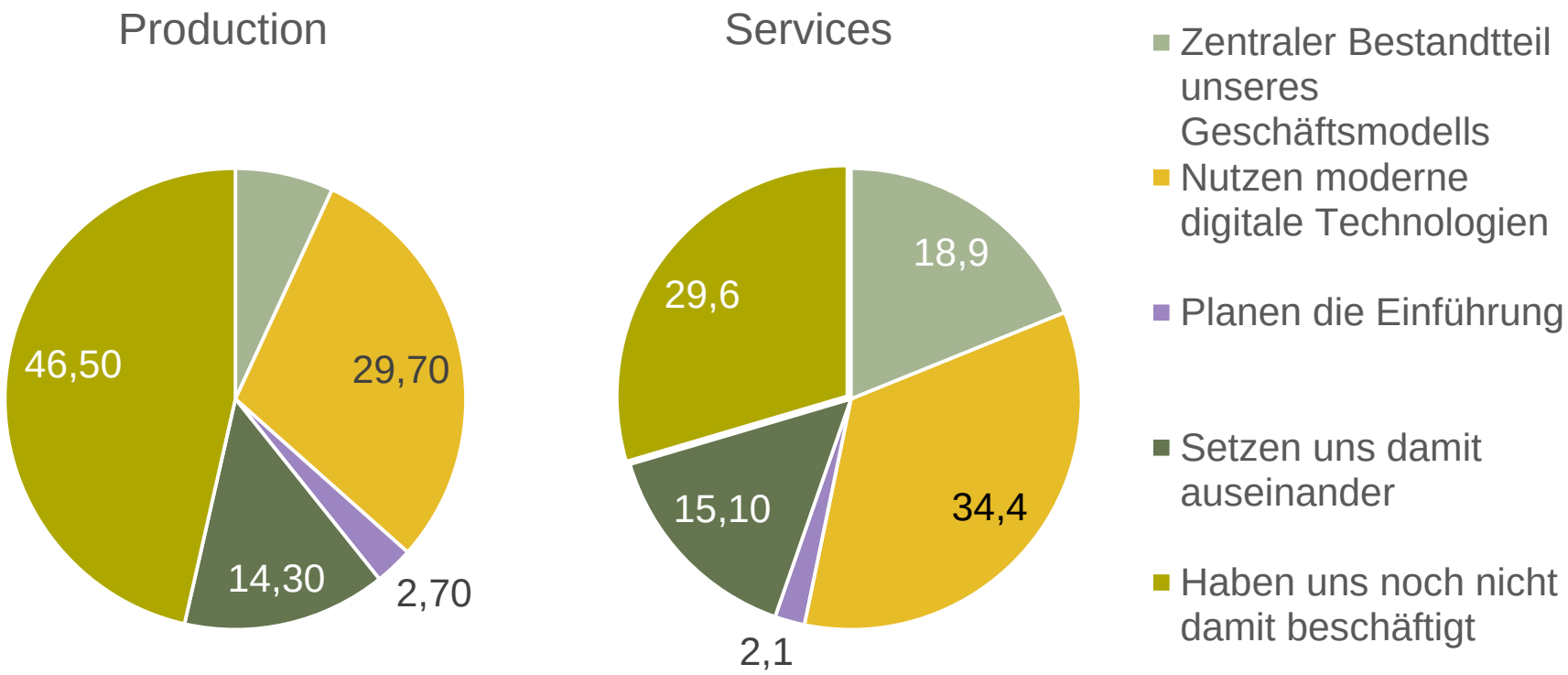
- Mobile robots, cobots
- Assistance systems, remote maintenance, 3D printing
- Platforms, e-commerce
- Artificial Intelligence, machine learning

Within companies → "Internal digitization", smart factories

Between suppliers and customers → "external digitization"

# Use of digital technologies by sector

## Information of firms in April/May 2016, percentage of shares




Quelle: IAB-ZEW-Betriebsbefragung „Arbeitswelt 4.0“, IAB Kurzbericht 22/2016

# Gewinner und Verlierer

## Entstehen neue Abhängigkeiten?

»Künftig gibt es zwei Kategorien von Menschen: jene, die Computern sagen, was sie tun sollen – und jene, die von Computern gesagt bekommen, was sie tun sollen..«

*Marc Andreessen, (Netscape Communications)*

»Roboter, d.h. alle Arten der Maschinerie von Computern bis hin zu künstlicher Intelligenz … können zunehmend Arbeitskräfte ersetzen, sogar die Hochqualifizierten, und damit die Möglichkeiten für gute Arbeit und Bezahlung verringern.«

*Richard Freeman (Harvard)*

# Die optimistische Sicht

## Könnte technologischer Fortschritt sogar zu mehr Jobs führen?

APR 19, 2016 @ 04:57 PM 1,288 VIEWS The Little Black Book of Billionaire Secrets

### Advanced Manufacturing Is Not A Job Killer, It's A Job Creator

**Harold Sirkin,** CONTRIBUTOR

*I cover business leadership in the fast-changing globalized world.* FULL BIO

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In his time, the late Herman Kahn, one of the Cold War era's leading nuclear strategists, became more broadly recognized as a "futurist": a crystal ball gazer par excellence in a world largely inhabited by narrower minds.

From his perch at the Hudson Institute, which he founded in the early 1960s, Kahn held forth on "energy, pollution, resources, population, food supplies, economics and technology," among other topics, according to *The New York Times*.

Kahn's overall view was one of optimism, arguing that advances in