

Rome Seminar Next Challenges

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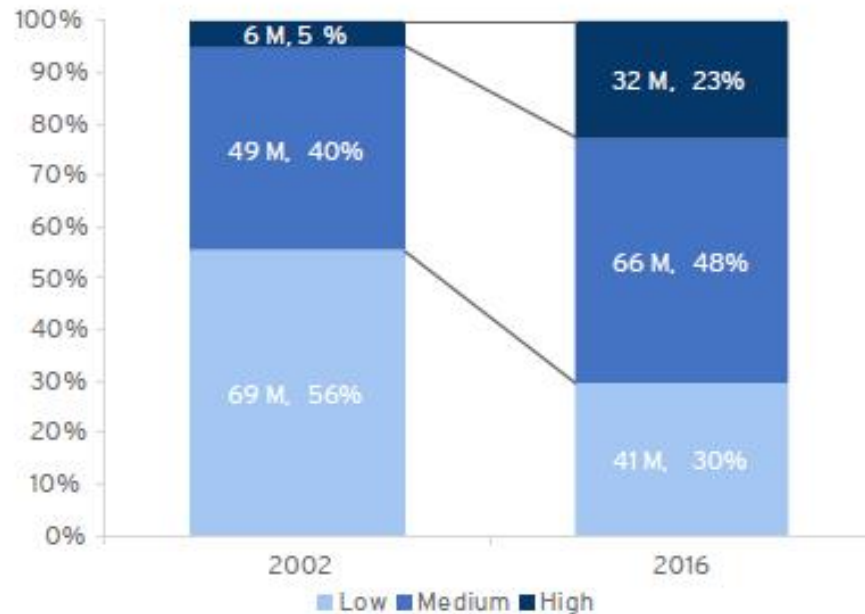
Issues

1. The Pace and Extent of Change (recent Brookings Analysis; Hal Varian recent mimeo Bots versus Tots)
2. AI, Economic Growth and Singularity

1. The Pace and Extent of Change

FIGURE 2

Employment by levels of job digitalization
2002 and 2016



Source: Brookings
Digitalization and the
American Workforce
Nov. 2017

Source: Brookings analysis of O*NET and OES data

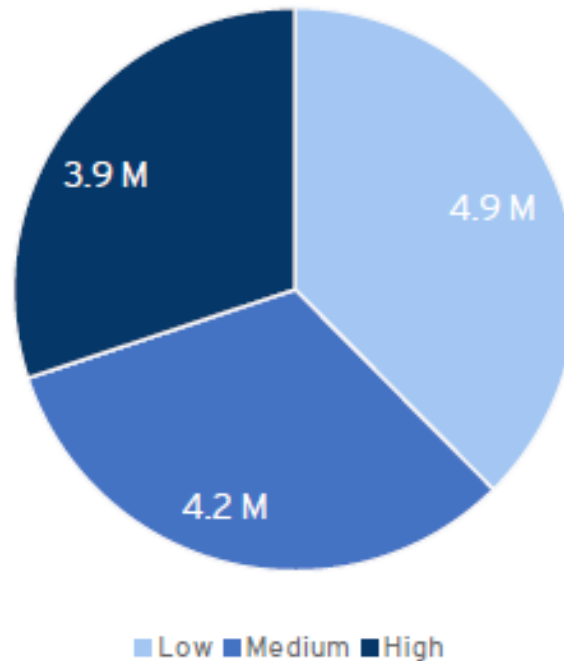
Nov 2017

* Uses Dept. of Labor Occupational Information Network (O*NET) job specific info. on education, training, experience, and skill related work requirements

1. The Pace and Extent of Change

FIGURE 3

Digitalization levels of new jobs
2010-2016



Source: Brookings
Digitalization and the
American Workforce
Nov. 2017

Source: Brookings analysis of O*NET and OES data

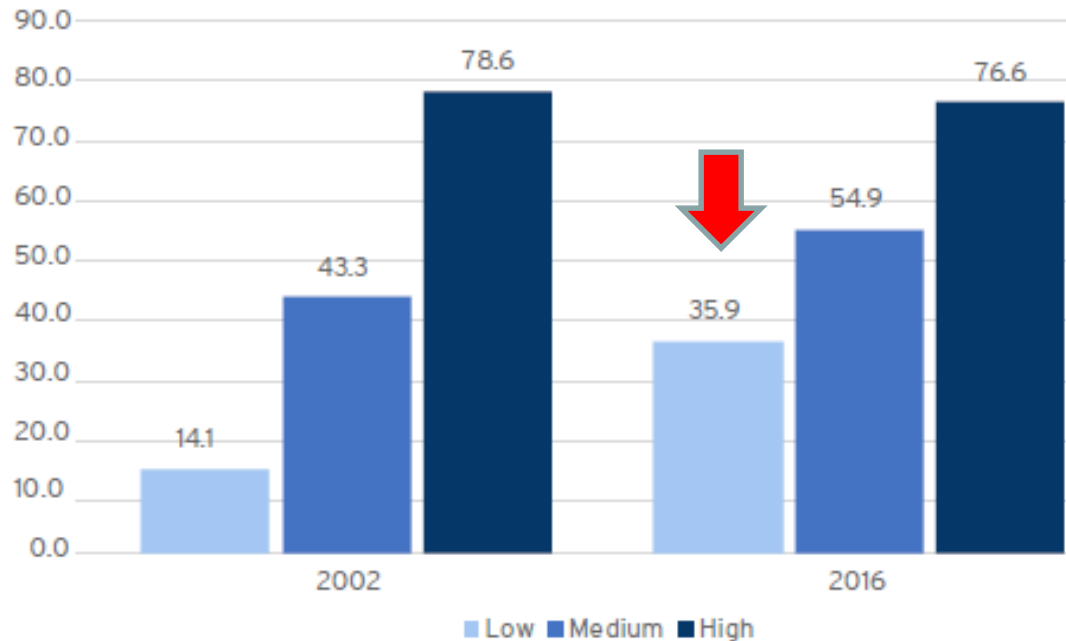
16 ——— Brookings Metropolitan Policy Program

1. The Pace and Extent of Change

FIGURE 4

Mean digital scores of occupational tiers by 2002 scores

2002 and 2016



Source: Brookings
Digitalization and the
American Workforce
Nov. 2017

Source: Brookings analysis of O*NET and OES data

Note: Occupations' digital tier (low, medium, high) in both years based on their 2002 digital score and therefore do not reflect score changes over the period.

1. The Pace and Extent of Change

TABLE 3

Selected occupations by 2016 digital score

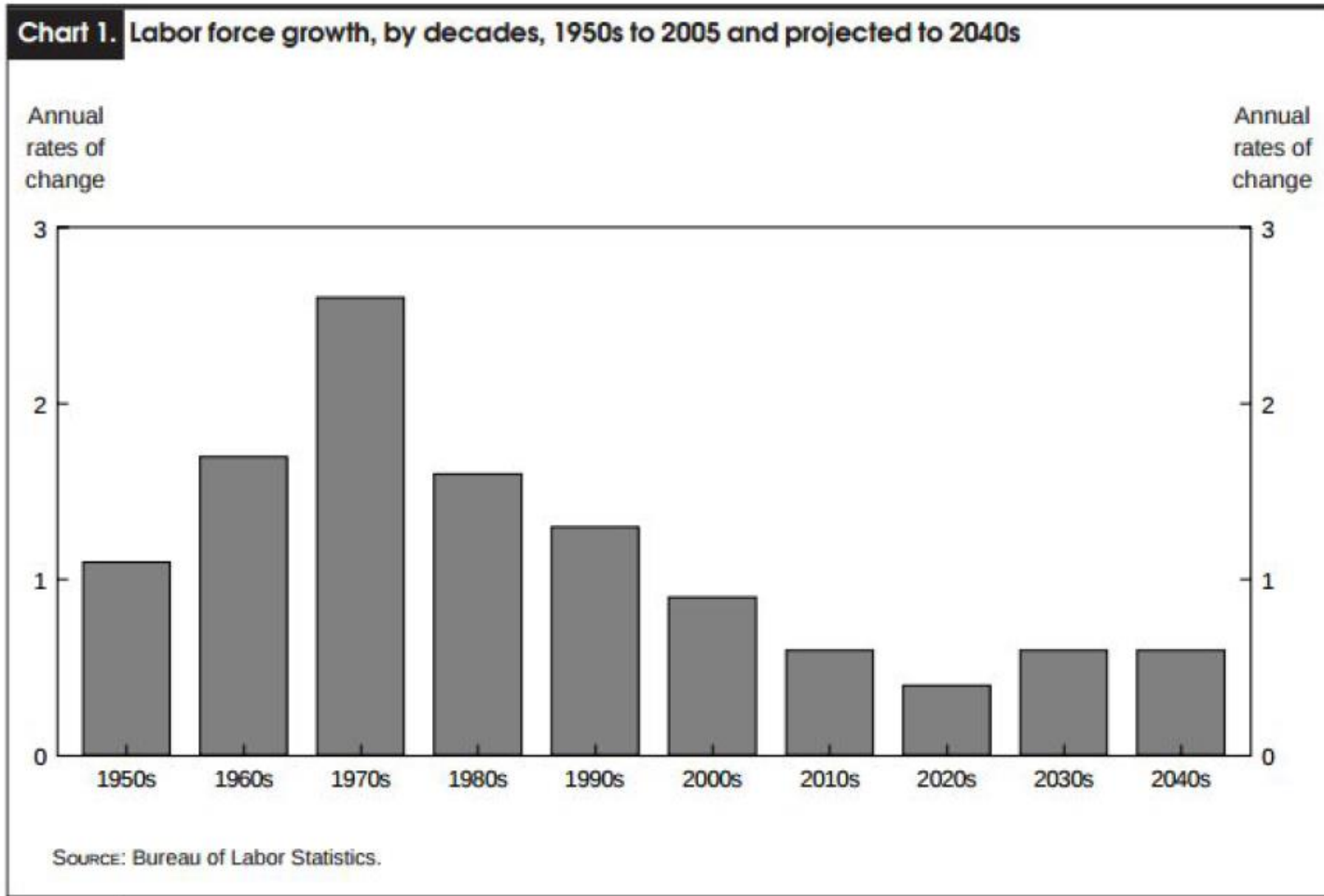
Occupation	Digital score, 2002	Digital score, 2016	Score change, 2002-2016
Software Developers, Applications	97	94	-3
Financial Managers	41	61	+20
Construction Managers	17	60	+43
Human Resources Specialists	37	60	+22
Lawyers	34	58	+23
Automotive Service Technicians and Mechanics	39	55	+17
Registered Nurses	38	55	+17
Office Clerks, General	53	55	+2
Tool and Die Makers	3	51	+48
Security Guards	28	31	+3
Welders, Cutters, Solderers, and Brazers	3	23	+20
Construction Laborers	2	17	+15
Personal Care Aides	16	14	-2

Source: Brookings
Digitalization and the
American Workforce
Nov. 2017

Source: Brookings analysis of O*NET and OES data

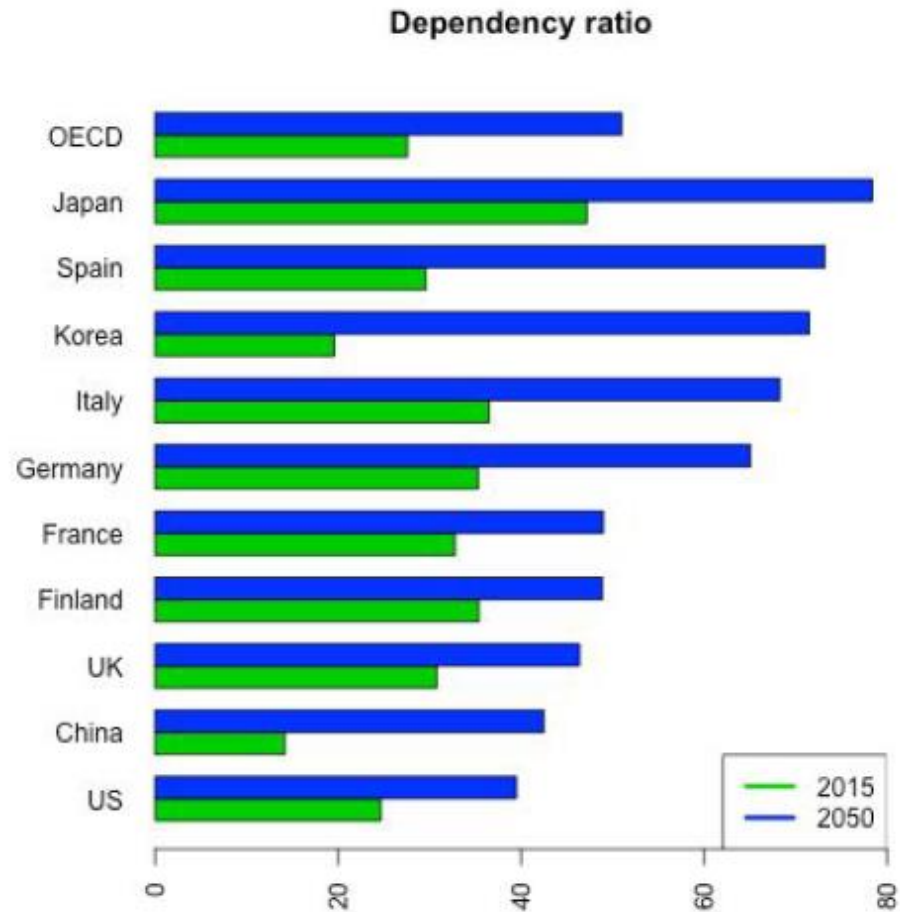
$$\begin{aligned} \text{output/person} &= \text{output/hour} \times \text{hours/worker} \times \text{workers/person} \\ &= \text{productivity} \times \text{employment} \times \text{participation} \end{aligned}$$

?



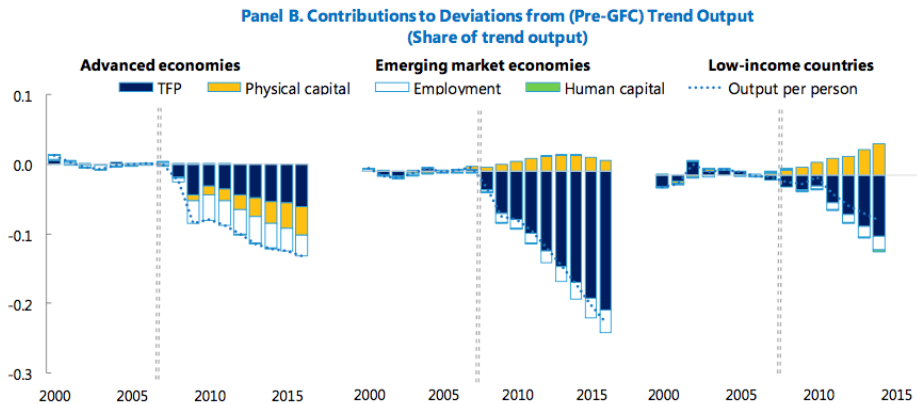
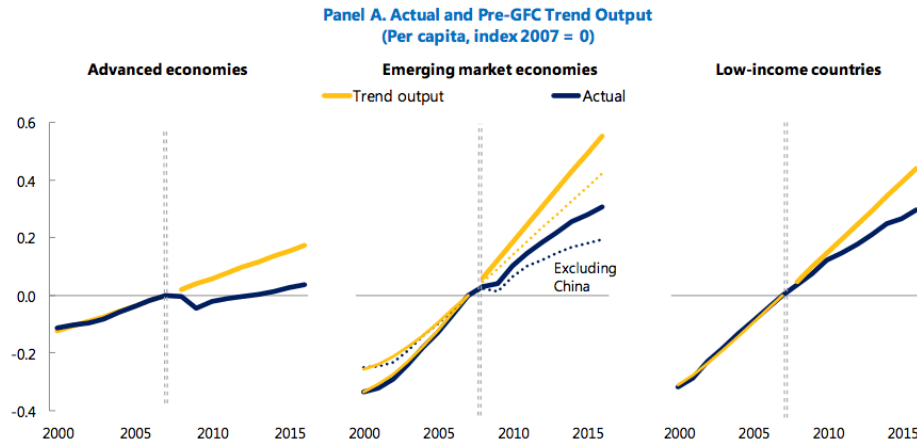
**Source:
Varian
Bots vs.
Tots
Mimeo
2018**

**Source:
Varian
Bots vs.
Tots
Mimeo
2018**



People over 65 for every 100 people of working age. Source: OECD

Figure 1. Trend Output and Post-Global Financial Crisis Total Factor Productivity Losses (Per capita)



Sources: Penn World Table 9.0; IMF, *World Economic Outlook*; and IMF staff calculations.
 Note: GFC = global financial crisis, TFP = total factor productivity. Purchasing power parity GDP weighted average of largest 20 economies per income group is reported. Trend output refers to a projection based on the Hodrick–Prescott filter trend in the years preceding the GFC.

**KEY IS
PRODUCTIVITY**

AI IS A NEW FACTOR OF PRODUCTION CAPITAL AND LABOR ALONE CANNOT DRIVE SUFFICIENT GROWTH

AI can help:

- Double annual economic growth rates
- Boost labor productivity
- Shorten the timeline to growth

12 COUNTRIES STUDIED



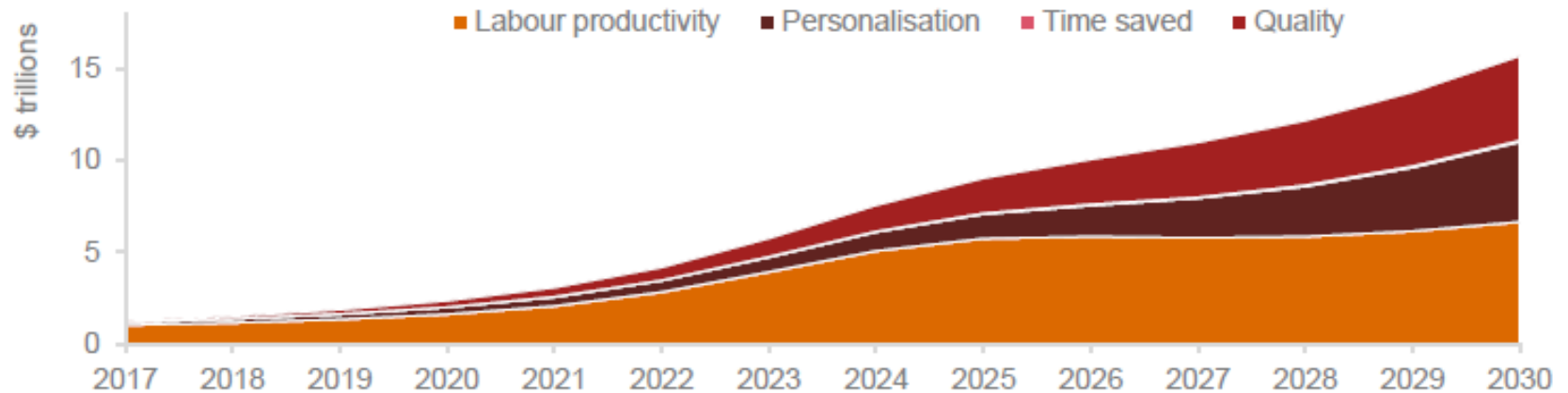
accenture

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Real gross value added (% growth)
Source: Accenture and Frontier Economics

2

Figure 1.2 – Global GDP impact by effect of AI in main scenario



Source: PwC Analysis

The Macroeconomic Impact
of Artificial Intelligence
PwC February 2018

2. Economists Newer Analyses: AI, Economic Growth and Singularity

Thomas Malthus Principle of Population 1798

Immiserization

“The increase in numbers is necessarily limited by the means of subsistence. Population invariably increases when the means of subsistence increase, unless prevented by powerful and obvious checks.”

Ray Kurzweil 2017

SINGULARITY = Unlimited Wealth

“We’re going to be able to meet the physical needs of all humans. We’re going to expand our minds and exemplify these artistic qualities that we value.”

2. Economists Newer Analyses: AI, Economic Growth and Singularity

- William Nordhaus 2015

“The major insight of economics is to emphasize the heterogeneity of both inputs and outputs of the economic system”

- Phillipe Aghion, Benjamin Jones and Charles Jones 2017

“growth may be constrained not by what we are good at but rather by what is essential yet hard to improve”