

When Robots Do It All and Leisure is Mandatory

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Engineers insist that sometime between 2030 and 2050 is when fiction will become reality, and artificial intelligence (AI) will exceed that of a human. Economists have a different answer - it will be at least another 100 years before that point. Despite the strides that have already been made in AI, there is a lack of evidence for rapid AI integration into national economy.

No doubt, automation is penetrating the human domain of reasoning and sensing. Automation has moved from the manufacturing sector into the service sector reviving the fear of technological unemployment. However, despite the rapid growth in machine learning and mobile robotics, economists are puzzled by consistently slow growth in productivity and strong increase in employment.

We are in the first stage of AI development, the Artificial Narrow Intelligence stage. In this stage, machines specialize in a single area - playing chess, translating languages, high frequency algorithm trading. For example, our smartphones are a collection of Artificial Narrow Intelligence. The passage from Artificial Narrow Intelligence to the next stage, when the machines reach and exceed the intelligence level of a single human (Artificial General Intelligence stage), has proven to be incredibly challenging. In this stage, the machine should be able to think abstractly, reason, comprehend complex ideas and learn from experience.

Economists have a special interest in the third, final, stage, Artificial Super Intelligence, in which the machine should be smarter than all of the humanity combined. Singularity, as defined in Economics, is when economic growth is accelerated due to the rapid growth in the productivity of intelligent machines. Singularity serves as economists' metric for distance from the Artificial Super Intelligence. Noted economist Nordhaus has formalized seven empirical tests to gauge the viability of Singularity, and only two of them yielded positive outcomes. The extrapolation of estimated trends suggests that Singularity can be reached in 100 years or later.

The productivity gains from the intelligent machines have yet to materialize and reach the scale where cost-benefit analysis spurs private companies to start large-scale development and production. The preferences should move increasingly towards high-productivity, high-growth industries. Production should increase the utilization of the fast improving digital capital as an increasing share in its bundle of inputs.

Nevertheless, AI is gaining traction as an attractive investment within the tech industry. Investments in AI are proliferating in the portfolios of private equity investors. The first quarter of 2017 has marked the highest number of AI funding deals by venture capitalists, corporate investors, and other investors. AI has a potential to become one of the hottest investment trends in the start-up scene since the launch of "big data" investments, as the global AI investments are estimated to grow to \$188 billion by 2020.

However, large-scale job losses are not expected. Studies finding very high percentage of job replacement with AI have two crucial flaws to their estimate. First, the estimate violates the fallacy of composition

assumption in economics -- something is true of the whole because it is true of part of the whole. The automation of tasks within the evaluated occupations does not necessarily translate into automation of the occupation itself. Occupations consist of a bundle of tasks and not all of those tasks may be easily automated, as many incorporate face-to-face interaction, flexibility, judgment and common sense. Considering the specifics of tasks decreases the estimates of job loss close to fivefold.

Secondly, while the AI-caused job loss estimates can be derived, new jobs created by AI are much harder to estimate. Large shifts in employment between industries/occupations and adjustments in tasks within occupations can be expected. Furthermore, worker hours may decrease, while the living standards may grow. The major documented impact of automation on the labor is the slow decline in the standard 40-hour work week.

No matter when the Artificial Super Intelligence stage is reached, the nations' strategic investment in human capital is what matters the most, particularly in developing skills that complement rather than substitute smart machines. Nurturing those skills of the future -- social intelligence, problem-solving, creativity, coordination, and the ability to cope with the uncertainty of rapidly changing technology -- will fuel the future productivity growth, improve labor market conditions and increase wages.

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