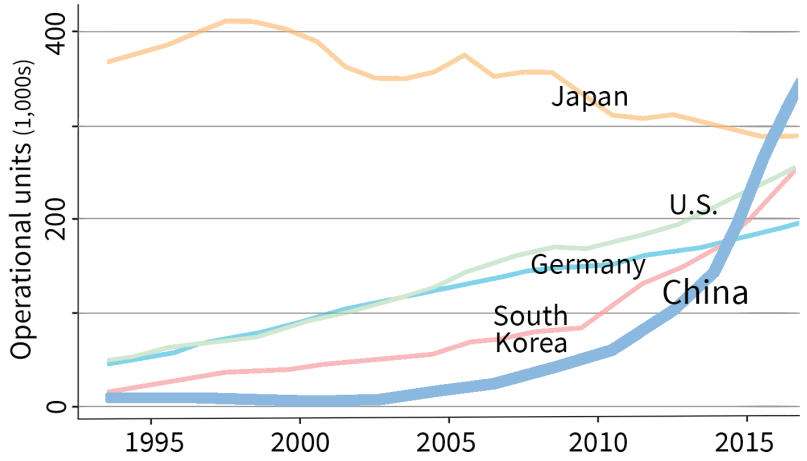
Rise of the Robots in China



In 2016 China led major countries in stock of operational robots.

China's production and adoption of robotic technology have accelerated rapidly in recent years, surpassing Japan, the U.S., South Korea, and Germany with 339,970 units in 2016, constituting the largest share of operational robots in the world at 19%. Moreover, of the $128.7 billion spent globally on robotics in 2020, China's share was 36% ($46.9 billion), while the U.S. share was 14% ($17.5 billion), and the EU was 11% ($14.4 billion).

INSIGHTS

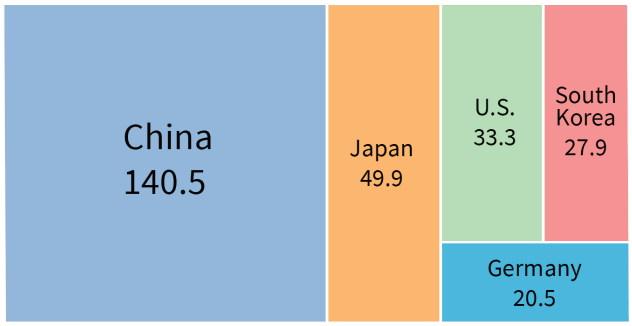
- China uses more industrial robots than Japan, the U.S., South Korea, and Germany combined.
- The growth of automation in China is driven by a labor shortage, rising wages, and the desire to keep the industrial value chain in China.
- China's use and production of robots will continue to rise rapidly in response to both market factors and government policies.

Key drivers behind China's robot expansion include a manufacturing sector dominated by automobiles and electronics, a growing labor shortage, rising wages, and government subsidies aimed at keeping important aspects of the industrial value chain within China.

The data. Using the novel China Employer-Employee Survey (CEES), researchers conducted a longitudinal study of more than 2,000 of China's manufacturing firms and more than 20,000 firm workers from five different provinces. The study included two surveys: one directed at firms and one directed at workers. Firms were randomly sampled from the third National Economic Census in 2014 and 10 workers were randomly selected from each firm.

Survey questions directed at firms included more than 1,000 variables: characteristics about the firm and its head, as well as information on the firm's management, sales, production, innovation, quality control, and human resources. Sampled workers answered hundreds of questions on their background, current job, work history, social insurance, and personality traits.

2019 installation of industrial robots (1,000s).



China tops list in new robot installations. In 2019, China exceeded industrial robot installations compared to the next four countries combined. Yet, it lags in density of robot usage per 10,000 workers. Robot density is higher in Japan, the U.S., South Korea, and Germany. But the gap is narrowing.

DATA & METHODS

■ The China Employer-Employee Survey (CEES) is a longitudinal study initiated in 2015 of manufacturing firms and workers.

■ Researchers collected data from about 2,000 firms and 20,000 workers from five provinces in 2015, 2016, and 2018.

■ Firms were randomly sampled from the third National Economic Census in 2014, and 10 workers were randomly selected from each firm.

SOURCE PUBLICATION

Hong Cheng, Ruixue Jia, Dandan Li, and Hongbin Li (2019). **The Rise of Robots in China.** *Journal of Economic Perspectives.*

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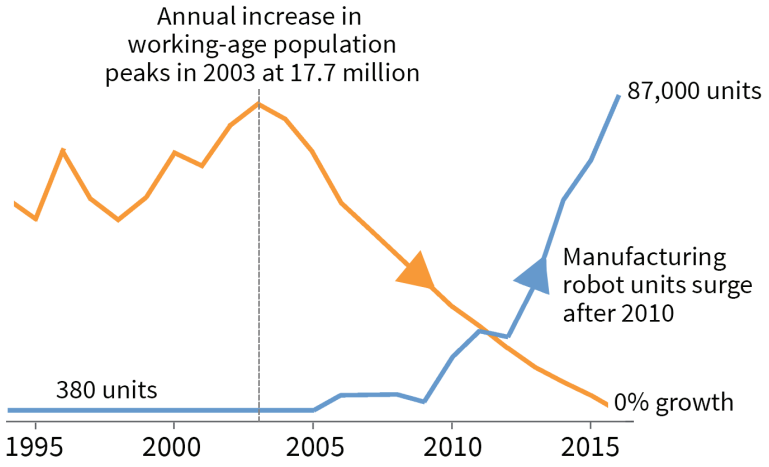
Robot production is also catching up. Approximately 5,800 robots were produced in China in 2012. By 2017, that number had risen more than 20-fold to 131,000.

The automobile and electronics industries use the most robots. Since 2009, annual production of automobiles in China has exceeded that of the U.S. and Japan combined. And more than 70% of the world's computers and electronics are made in China today. These industries are likely to continue expanding, and with them, China's use of robots.

Labor shortage and industrial policy are main drivers of robot adoption. China's adoption of robots is driven in large part by a shortage of labor. Although China's original success as the "world's factory" was built upon cheap labor, China has been experiencing both a shrinking labor force and rapidly rising labor costs over the last decade.

China's working-age population (ages 15–64) is declining both in absolute size and as a share of China's overall population. The rise of robots corresponds to the declining labor force. And although robots have taken on many manual, dirty, and health-hazardous tasks, they have not yet been able to replace more delicate routine tasks cost effectively.

China's surge in robot adoption corresponds to its declining working-age population.



Industrial policy also drives robot adoption in China. As a strategically important sector, the government aims to increase its global market share of high-end robotics to 45%. The "Made in China 2025" program set production goals of 100,000 industrial robots, with a density of 150 robots per 10,000 workers, by 2020. Of the four publicly listed robotic firms, 40% of net profits are derived from government subsidies.

The threat of job replacement, however, is apparently not a high-priority concern for the government and its citizens. Policies are more motivated by the challenges of labor shortages and rising wages, as well as the imperative to lead a new wave of industrial revolution.

Based on these trends, our analysis suggests the use and production of robots will continue to rise in China in response to both market factors and government policies.