

# Q&A: Will machines replace human workers?

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Economists have long studied the question of whether machines might one day replace human workers, but the advent of new technologies makes it particularly important as we consider the future of work in the

21st century. New research by Wake Forest economics professor Mark Curtis and co-researchers from the University of Pennsylvania, Grinnell College and Duke University, sheds light on the question by studying a tax policy that incentivized firms to invest in new machinery.

## **What did your research show?**

Firms responded by dramatically increasing new purchases of machinery and equipment. However, new machines did not replace workers. In fact, firms actually increased the size of their workforce following these new investments and historically disadvantaged workers (those with less formal education, minorities, women and young workers) saw the largest employment gains.

## **What does this suggest for concerns that machines will take our jobs?**

The research suggests that workers may actually benefit as firms invest in new machinery. Tax policies can incentivize both the addition of machines and workers. While certain investments may replace workers, the typical investment in capital results in firms hiring more workers. On the whole, concerns that machinery investment will replace workers are overblown. That workers operating production machinery saw the largest gains suggests that machines and workers continue to be complementary inputs in modern manufacturing processes.

## **How did you connect the increase in new technology to the increase in employment?**

U.S. Census Data on manufacturing establishments between 1997 and 2011 allowed us to track plants that benefited from the investment [tax policy](#), relative to those that did not. Before the policy, these two groups

looked very similar. When the policy began we observe the affected plants increasing their levels of both investment and employment. However, we did not observe increases in average wages or productivity gains.

## **If there was no increase in productivity or wages, is tax savings the sole incentive for a business to adopt new technology?**

A major reason for the new investment is the desire for growth. Firms affected by the tax policy are able to grow. This is particularly true for firms that might have had limited access to financing and as such were constrained in their ability to grow. One of the most striking results is that output and sales increased as well in response to the policy.

## **The robotization of industry is typically associated with the manufacturing sector, how do you see this trend affecting other industries?**

Labor markets are constantly changing in response to new technologies. Tasks that can be automated, will eventually be replaced. However, as certain jobs become obsolete, entirely new categories of jobs are created. Education plays a key role in ensuring that workers have skills needed to make transitions throughout their careers. Many skills, such as the ability to communicate with others and creative thinking will always be in demand.

## **At a more local level, what do these results tell us about the future of industry in the Carolinas?**

Between new tech jobs in the triangle and new plants locating here in the

Triad, there are many exciting economic stories occurring here in North Carolina. Many new jobs are being created in a variety of industries. As the state looks forward they have the ability to use the tax code to incentivize future investments here in the state. Some have argued that these [incentives](#) should always be directly tied to the number of jobs that are created. Our results suggest that policies that incentivize capital investment will also positively affect the number of workers hired and that these investments will tend to benefit historically disadvantaged workers that are most likely to interact with the new machinery.

## **Looking forward, what do you think the next steps are in this line of research?**

Moving forward we would like to understand the long-run implications of these investments for workers by tracking workers in affected industries across many years. What skills do they gain from interacting with the machines, which occupations benefit most and how does the occupational composition of the workforce change over time. We'd also like to understand the environmental implications of these investments. Do firms take advantage of these incentives to replace old and dirtier machines with cleaner technologies or do they simply add to their existing capital base and pollute more.

Provided by Wake Forest University

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