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Productive Robots and Industrial Employment: The role of national innovation systems

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The price of self-controlled industrial robots has fallen substantially in recent years, inducing a large increase in their use. This led many authors to investigate their impact on employment, with fears that robots are taking jobs away from workers. At first sight these fears appear justified. The vast majority of robot use is in manufacturing and manufacturing employment has been steadily falling for many years. In this paper we investigate this question with data from fourteen counties, thirteen from Europe and the United States. We focus mainly on manufacturing, although we also study three nonmanufacturing sectors, agriculture, utilities and mining and quarrying.

We find that there are two key parameters that determine whether robots take jobs from workers or whether they complement labour; the elasticity of substitution between robots and humans in production and the elasticity of demand for the final products produced by robots and labour combined. Simple estimates of the impact of robots on employment across industrial sectors do not show any consistent results. But when countries are distinguished by their innovation capabilities, as determined by international organizations, we find robust results. Countries with good innovation capabilities, such as the United States, Germany and the Nordics, increase their employment when robots are introduced, whereas countries with poor innovation capabilities, such as the Southern Europeans, use robots to replace labour. There are differences across industrial sectors, such as more substitutability in non-manufacturing and in the automotive sector than in electronics and elsewhere, but the overall message is clear. Robots are much friendlier to labour when the country has a good innovation environment than when it has a poor environment.

We speculate about the reasons for this divergence. We find anecdotal and some more formal evidence of a correlation between innovation capabilities and stakeholder objectives, including employees' interests. Also, the introduction of robots in a country with a better innovation environment would normally be associated with higher productivity growth and so with more exports. The association between robot-labour substitution and innovation capabilities seems to be robust enough to justify more research into these links.