Agricultural Productivity and Industrial Growth. Evidence from Brazil

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Abstract

We study the effects of agricultural productivity on industrial development. Productivity growth in agriculture can speed up industrial growth through three channels. First it releases labor, a factor intensively used in manufacturing. Second, it generates income, increasing demand for manufacturing goods. Third, it might increase savings that are channeled to finance industrial projects. However, Matsuyama (1992) notes that some of the positive effects of agricultural productivity on industrialization occur only in closed economies, while in open economies a comparative advantage in agriculture can slow down industrial growth. We provide direct empirical evidence on the impact of a new agricultural technology on industrial growth by studying the effects of the widespread adoption of genetically modified soybean seeds on Brazilian manufacturing firms. To establish causality, we exploit exogenous differences in soil and weather characteristics across geographical areas leading to a differential impact of the new technology on yields.

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Extended Abstract

We study the effects of agricultural productivity on industrial development. This question has a long tradition in the economic development literature since several scholars have noted that the industrial revolution in England was preceded by increases in agricultural productivity [Nurkse (1953), Rostow (1960)]. The literature highlighted several channels through which productivity growth in agriculture can speed up industrial growth. First, productivity growth in agriculture releases labor for the industrial sector [Matsuyama (1992), Golin, Parente and Rogerson (2002)]. Second, it generates income to sustain higher demand for industrial goods [Murphy, Shleifer, Vishny (1989), Helpman, Grossman and Fajelbaum (2011)]. Third, it generates savings that can be reinvested in industrial projects. However, Matsuyama (1992) highlighted that some of the positive effects of agricultural productivity on industrialization occur only in closed economies, while in open economies a comparative advantage in agriculture can slow down industrial growth.

We shed light on the relationship between agricultural productivity and industrial development by providing empirical evidence on the importance of each of the channels discussed above. For this purpose, we study the effects of the adoption of a new agricultural technology, namely genetically modified soybean seeds, on industrial development in Brazil. During the ten years after the technology was invented in 1996 the output of soy doubled in Brazil, becoming the most important crop in the country. To identify the causal effects of the change in agricultural productivity, we use two sources of exogenous variation in the profitability of technology adoption. First, as the technology was invented in 1996, we use the introduction of the new technology as our source of time variation. Second, as the new technology had a differential impact on yields depending on geographical and weather characteristics, we use differences in soil suitability across regions as our source of cross-sectional variation. We use data on potential soil yields at a disaggregated geographical level available in the FAO-GAEZ database. These yields are calculated by incorporating local soil and weather characteristics into a model that predicts yields for each crop given certain climate and soil conditions. Potential yields are a source of exogenous variation in agricultural productivity because they are a function of weather and soil characteristics, not of actual yields in Brazil. We can then exploit the differential impact of the new technology on yields across municipalities in Brazil as our source of cross-sectional variation in agricultural productivity. This identification strategy relies on the assumption that although Brazil is an open economy, the existence of transport costs implies that local markets are important sources of labor and demand for industrial firms. This research design allows us to investigate whether exogenous shocks to local agricultural productivity lead to changes in the size and efficiency of the local industrial sector.