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Policy, Technology, and Efficiency of Brazilian Agriculture

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What Is the Issue?

Between 1985 and 2006, Brazilian agricultural production grew by 77 percent and Brazil emerged as a major international agricultural exporter. The authors postulate that Brazil's agricultural development was boosted by sustained public investments in science and technology, leading to a stream of new technologies. These investments, in an environment of improving economic liberalization (initiated in the late 1980s) and stability (post-Real plan), may have given farmers incentives to boost farm efficiency and production. However, other policy drivers likely affected farm efficiency, namely, public infrastructure and rural credit investments. To test their hypothesis that science and technology investments were the main impetus to Brazil's agricultural productivity growth, the authors measure Brazil's national total factor productivity (TFP—ratio of total output to total inputs employed in production) and analyze the impact of each of the policy drivers on that productivity growth.

What Did the Study Find?

We hypothesize that Brazil's agricultural development is a result of sustained investments in science and technology that led to a stream of new technologies. These policies, embedded in an environment of macroeconomic stability and economic liberalization, provided farmers with the incentives to boost farm efficiency and production. The study finds:

- That Brazil's national average farm TFP growth increased at an annual rate of 2.55 percent between 1985 and 2006.
- That TFP growth was driven by factor productivity of the most efficient farms, which progressed at an average of 4.4 percent each year. Total factor productivity of the most efficient farms (4.4 percent) is composed of impressive productivity growth in the livestock (7.1 percent annually) and crops (2.9 percent) subsectors.
- The most efficient producers achieved rapid TFP growth, enabling these farms to produce 138 percent more in 2006 than in 1985, while maintaining the earlier input levels.

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- The TFP growth of average farms was slower, with mean technical efficiency levels declining from 93 percent in 1985 to 84 percent in 1995/6 and to 64 percent in 2006. These efficiency levels imply that the average farm produced 93 percent of what the most efficient farms produced in 1985, but only 64 percent of what those most efficient farms produced in 2006.
- Despite an enlarging productivity gap between the most efficient and average farms, the average farmer was able to produce 62 percent more in 2006 than in 1985, while maintaining the earlier input levels.
- Public agricultural research—provided through Embrapa, the agricultural research agency linked to the Ministry of Agriculture and Food Supply—appears to have had more influence on the most efficient farms, widening the TFP gap between those farms and average producers by 0.2 percent for each 1-percent increase in Embrapa’s research stock.
- Embrapa’s national commodity research centers have been especially important in boosting TFP growth, while its regional resource research centers have not had the same measurable impact. Boosting the national commodity research stock by 1 percent widened the TFP gap by 0.23 percent, while a similar boost to the regional resource stock did not change that TFP gap.
- Of the policies exerting a narrowing influence on the productivity gap between the most efficient and the average producers, rural credit and transportation infrastructure investments have been factors, but primary school infrastructure investments exerted the greatest impact.

How Was the Study Conducted?

To analyze Brazil’s TFP growth, the authors use decennial Brazilian farm census data obtained from the Brazilian Institute of Geography and Statistics (IBGE). These data are combined with data from Avila and Evenson (1995), Barros (1999), Brazil’s agricultural research agency, Embrapa, and Brazilian statistical yearbook information. The authors use these data, controlling for a number of factors, to evaluate Brazil’s national agricultural productivity growth and analyze policy impacts on productive efficiency. The analysis entails estimating a stochastic distance frontier, which makes it possible to distinguish technical change among Brazil’s principal commodity groups. The method further allows estimation of the TFP growth of both the most efficient farms and the average farms and of the TFP gap separating them. Technical efficiency statistics are estimated for each microregion and year and are used in evaluating the effects of Government policy on Brazilian farm productivity.