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Agriculture and aggregate productivity: A quantitative cross-country analysis ☆

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Abstract

A decomposition of aggregate labor productivity based on internationally comparable data reveals that a high share of employment and low labor productivity in agriculture are mainly responsible for low aggregate productivity in poor countries. Using a two-sector general-equilibrium model, we show that differences in economy-wide productivity, barriers to modern intermediate inputs in agriculture, and barriers in the labor market generate large cross-country differences in the share of employment and labor productivity in agriculture. The model implies a factor difference of 10.8 in aggregate labor productivity between the richest and the poorest 5% of the countries in the world, leaving the unexplained factor at 3.2. Overall, this two-sector framework performs much better than a single-sector growth model in explaining observed differences in international productivity.

JEL classification: O4; O1

Keywords: Productivity; International comparisons; Agriculture; Intermediate inputs; Barriers; Two-sector model

1. Introduction

This paper examines the role of agriculture in accounting for international differences in output per worker. To see why agriculture is important, consider the following facts. In 1985, the average gross domestic product

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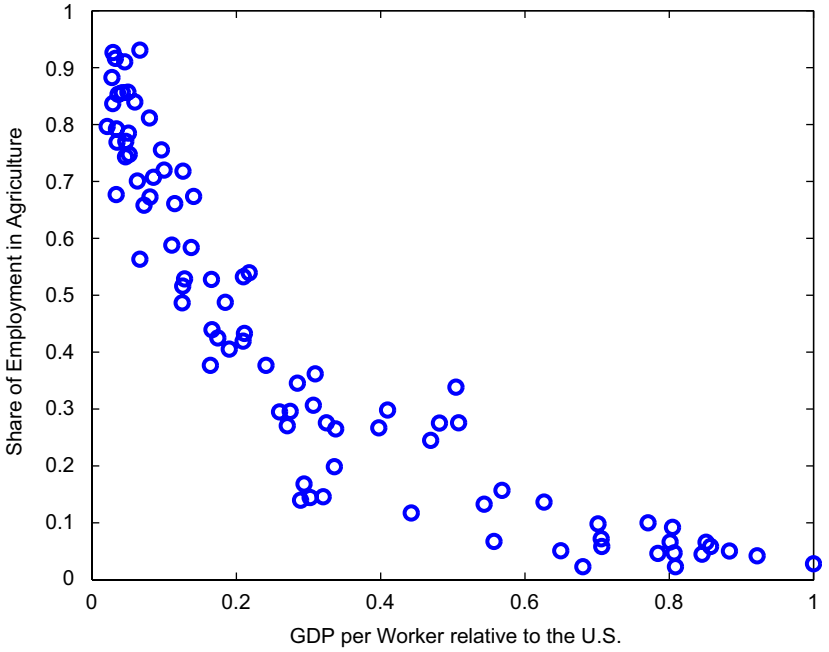

Fig. 1. Share of employment in agriculture—1985. Aggregate GDP per worker from PWT5.6 is reported relative to the U.S. The share of employment data is from FAO.

(GDP) per worker in the richest 5% of the countries in the world is 34 times that of the poorest 5%. This is an enormous difference in aggregate productivity. However, the labor productivity difference in agriculture is even larger: GDP per worker of the richest countries is 78 times that of the poorest countries. In contrast, the difference in GDP per worker in non-agriculture is a factor of 5. Despite very low productivity in agriculture, the poorest countries allocate 86% of their employment to this sector, as compared to only 4% in the richest countries.

These facts are general to other comparisons across the distribution of countries. Fig. 1 shows that poor countries tend to allocate more employment in agriculture than rich countries, while Fig. 2 shows that not only poor countries observe lower GDP per worker in agriculture and non-agriculture than rich countries (Panel A), but also that the ratio of GDP per worker in agriculture to non-agriculture is lower in poor than in rich countries (Panel B). The fact is that poor countries are much less productive in agriculture than in non-agriculture in comparison to rich countries.[1] These facts provoke two important questions. First, why do so many people in poor countries work in the extremely unproductive agricultural sector? Second, why is agricultural labor productivity so low in poor countries? Clearly, satisfactory answers to these questions are essential to understanding aggregate income differences across countries.[2]

[1]The data for aggregate GDP are from the Penn World Tables (PWT5.6); the data for agriculture are from the Food and Agricultural Organization (FAO) of the United Nations (see Prasada Rao, 1993). In our sample of 86 countries, the richest 5% are the U.S., Canada, Switzerland, and Australia; the poorest 5% are Burundi, Tanzania, Burkina Faso, and Ethiopia. Table 1 of the Appendix provides summary statistics from these data. This Appendix is available from the authors upon request and can be accessed at: http://www.economics.utoronto.ca/diegor/research/research.html.

[2]The joint importance of employment share and sectoral productivity in accounting for cross-country productivity differences can be shown by the decomposition of aggregate GDP per worker (Y/N) : $Y/N = Y_n/L_n(1 - L_a/N) + (Y_a/L_a)(L_a/N)$, where Y_i/L_i and L_i/N are per-worker GDP and share of employment in sector $i \in \{a, n\}$; a denotes agriculture and n non-agriculture. Consider a counterfactual scenario: if the richest 5% of the countries have the average employment share of the poorest countries (see Table 1 of the Appendix), aggregate productivity of the richest countries relative to the poorest countries in this hypothetical case would be 2 to 1, only $\frac{1}{17}$ of the actual difference between the richest and the poorest countries. Alternatively, if the richest countries have the sectoral productivity of the poorest countries, the productivity gap would be 5 to 1, about $\frac{1}{7}$ of the actual difference between the richest and the poorest. Hence, both sectoral productivity and employment share are essential in understanding the differences in aggregate productivity across countries.