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A Note on the Link Between Agricultural Development and Agricultural Imports

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Technical and economic aid to agriculture in less-developed nations by the United States has been criticized on several grounds. One such criticism is that assistance by U.S. Land Grant universities, government agencies, and multilateral institutions, if successful, leads to expansion in agricultural output by the recipient nations. This expansion, it is argued, causes direct or indirect reduction in U.S. agricultural exports. The line of reasoning, simply put, is that we teach them how to grow commodities that we are good at producing. Then they do it and replace our exports.

In this short paper, we examine the central core of this argument with 1983 data from a sizable cross section of less-developed nations. The objective was to see if differences in agricultural productivity are linked to imports of food and related products by these particular nations. The countries in this sample are from the group classified by the World Bank as "low- or lower-middle-income economies." The specific countries included are those for which data were available and which displayed Gross Domestic Products less than $1,400 per capita in 1983. They are listed in the Appendix. (The sample does not include "upper-middle-income economies.") All data employed in this analysis were drawn from the World Development Report: 1985 (New York: World Bank and Oxford University Press, 1985), Annex tables 1, 6, 9, and 11.

Here is how the investigation unfolded. First, we adopted the premise that if agricultural assistance is successful, then the economic value of

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agricultural workers in the recipient nation must increase. So, for our basic sample, which amounted to 44 nations, we collected the "value added" per worker in agriculture. This particular measure is the total annual value of agricultural output in each nation less the value of purchased inputs used in production, all divided by the number of agricultural workers. This variable indicates the economic performance of agriculture in each sample country.

Second, we related this value added measure for each nation to its per capita Gross Domestic Product (GDP). The idea here is that since virtually all of these countries depend heavily on agriculture for employment and output, the link between economic performance in agriculture and economic performance in total is likely to be significant. (Incidentally, GDP is quite similar to the familiar Gross National Product (GNP) as an overall measure of national economic activity and somewhat more suitable for international comparisons.)

Third, we linked per capita GDP data across our sample to national imports of food and related products. In one version, we used per capita cereal imports, and in another version we used the per capita value of food imports. This linkage enabled us to examine how overall economic performance across this sample of nations affected their agricultural importing behavior.

Agricultural Development and Economic Performance

Across our 44-nation sample in 1983, there emerged a relatively close association between agricultural productivity, as measured by value added per worker, and per capita GDP. The following ordinary least squares equation indicates the nature of this association.

(1) $$GDP^* = \underset{(-.88)}{-0.74} + \underset{(8.03)}{1.15}\ VAW^*$$

$r^2 = .61$ N = 44

where GDP* is the natural logarithm of Gross Domestic Product per capita, VAW* is the natural logarithm of value added per worker in agriculture, r^2 is the coefficient of determination, and the values in parentheses are t-ratios. Over this group of nations, 61 percent of the variation in GDP* was positively associated with variation in VAW*, a highly significant relationship. Among cross-sectional studies, this is a relatively high value for r^2.

Note that the estimated regression coefficient on VAW* is quite close to 1.0, suggesting that the relation between changes in VAW* and GDP* is nearly equi-proportional across this group of nations. In general, a 1 percent increase in agricultural productivity, however achieved, is associated with a 1.15 percent change in GDP per person. Of course, there are other factors that influence GDP, even among low-income nations. However, the dominance of agriculture in these nations makes this simple relation rather compelling.

Economic Performance and Food Imports

Now consider a cross-section relation between GDP per capita and per capita cereal imports. Equation (2) is the least squares estimate of this relation for the 44-nation sample.

$$(2) \qquad \underset{(-2.52)}{CIC^* = -3.377} + \underset{(4.58)}{1.15\ GDP^*}$$

$$r^2 = .33 \qquad N = 44$$

where CIC* is the natural log of per capita cereal imports (wheat, rice, rye, and coarse grains) and GDP* is as described before. Note the strong statistical significance of the estimated regression coefficient, the positive overall relation, and the nearly equi-proportional relation between total economic activity and cereal imports.

Next consider the cross-section relation between GDP per capita and an alternative measure of agricultural trade, food imports per capita.

(3) $$FIC^* = -4.06 + 1.11\ GDP^*$$
$$(-3.32)\ (5.51)$$
$$r^2 = .46 \qquad N = 37$$

where FIC* is the natural log of food imports per capita (including food products in SITC sections 0, 1, and 4, plus live animals, beverages, tobacco, nuts, fats, oils, and oilseeds). All else is the same as before except that FIC data were not available for several nations in the sample. Hence, equation (3) was calculated from 37 observations (see the Appendix).

Both equations (2) and (3) are very similar with highly significant coefficients, a positive overall relation between the variables, and almost identical, equi-proportional coefficients. The r^2 values in both of these equations are reasonably strong for cross-sectional analyses.

In general, a 1 percent increase in per capita GDP in these less-developed nations is associated with a 1.1 percent increase in agricultural imports, whether the latter are measured in terms of either cereals or a broader category of food items.

Conclusions

This little analysis does not purport to show a direct causal link between agricultural assistance and agricultural trade. However, it does illustrate in a simple, aggregate way that improved economic performance in agriculture across a broad sample of poorer nations is associated with improvements in the total level of national economic activity. In turn, economic development is positively associated with increases in agricultural and food imports. Nothing in this study suggests that agricultural development, whether fostered by outside assistance or occurring naturally, leads to <u>decreased</u> overall trade

in farm products among less-developed nations--quite the reverse.

Naturally, some instances of trade decreases in some products for some nations probably can be identified and associated with agricultural assistance. However, the estimated relationships in this paper, as general and simple as they are, suggest that the burden of proof clearly rests with those who argue that agricultural assistance for low-income nations is usually a trade-stifling undertaking.

Appendix

Country Listing

1. Ethiopia
2. Bangladesh
3. Mali*
4. Nepal
5. Zaire*
6. Burma
7. Uganda
8. Burundi*
9. Niger
10. Tanzania
11. India
12. Central African Republic*
13. Togo
14. Benin*
15. China
16. Guinea*
17. Ghana*
18. Madagascar
19. Sierra Leone
20. Sri Lanka
21. Kenya
22. Pakistan
23. Sudan
24. Senegal
25. Liberia
26. Mauritania*
27. Bolivia
28. Yemen Arab Republic
29. Indonesia
30. Zambia
31. Honduras
32. Egypt, Arab Republic
33. El Salvador
34. Ivory Coast
35. Morocco
36. Papua, New Guinea
37. Philippines
38. Nigeria
39. Cameroon
40. Thailand
41. Peru
42. Congo, People's Republic
43. Jamaica
44. Ecuador

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*Because of data limitations, these nations were omitted from analyses involving Food Imports per Capita (FIC). But Somalia was added.