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Does Agricultural Growth in Poor Countries Harm Agricultural-Exporting Rich Countries?

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Abstract

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The commonly held view that agricultural-exporting developed countries would lose from agricultural growth in less-developed countries (LDCs) is shown to be based on an incomplete argument. It considers only the effects on LDC agricultural supply, or at best only that and the first-round effects of increased farmer incomes on the demand for tradables. What also needs to be considered is the effect on the demand for nontradables and hence the second-round effects of increased spending by producers of nontradables. When all these effects are considered, the positive correlations obtained between agricultural output growth in LDCs and agricultural imports from developed countries is not surprising. It is then shown that selling or giving away agricultural research and management skills to developing countries can be beneficial to developed countries, including agricultural exporters: by setting out to do good, they may end up also doing well.

Introduction

Since the 1960s, developing countries have provided the fastest-growing markets for farm exports from North America and Australasia. It is therefore understandable that farmers in those regions have been and continue to be concerned about rapid agricultural growth in developing countries, particularly during periods of extraordinarily low export prices as occurred in the mid-1980s. They see such growth as reducing developing countries' net imports of food and fibre, thereby lowering their export earnings. Indeed, rich-country farmers may well feel that part of the *reason* for depressed commodity prices in the mid-1980s is the very success of scientists in boosting crop yields in the tropics. As a result they are questioning the wisdom of selling, or of giving away in the form of foreign aid, the agricultural research and management skills, genetic material from livestock studs and the like which are perceived to be the sources of their comparative advantage.

The purpose of this paper is to demonstrate that the argument supporting

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this conventional view – that agricultural growth in developing countries harms agricultural-exporting rich countries – is incomplete. That conventional argument focuses only on agricultural *supply* in developing countries and omits a number of offsetting demand considerations. When demand factors are also taken into account – particularly in the nontradables sector – it becomes clear that the economic interests of North America and Australasia may well be enhanced by agricultural growth abroad. In fact, empirical evidence suggests that there is a quite strong positive correlation between the two. The paper then asks whether it could be in those rich countries' economic interest to actively promote agricultural growth in poor countries. Again contrary to popular opinion there are a number of arguments which suggest a positive answer.[1]

Conventional argument

The simplest way to present the conventional argument is with the help of Fig. 1, which shows the domestic demand and supply curves (D and S) for staple food in a developing country. In the absence of distortionary price or trade policies, the world price P_w will also be the domestic price and the country

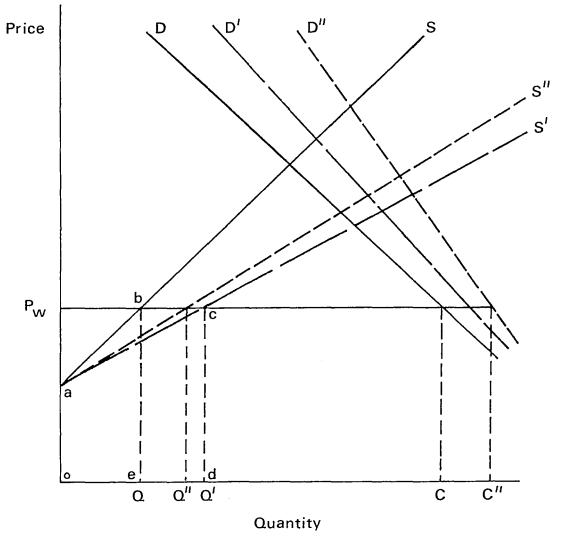

Fig. 1. A developing country's market for staple food.

[1]Since first drafting this paper a number of publications have appeared which address the question posed in the title of this paper from a United States perspective. None of them specifically highlight the importance of nontradables demand growth on agricultural factor supplies, however. See, for example, the volume edited by Purcell and Morrison (1987) and the conference papers by de Janvry and Sadoulet (1986), Kellogg et al. (1986), Paalberg (1986), Brady (1987) and Falcon (1987).

will consume C units, of which Q will be produced domestically and QC will be imported. Should the supply curve move to S′ because of an improvement in technology, domestic production would expand to Q′ and imports would fall to Q′C. If the country is a large participant in world food markets or this happens in enough developing countries – regardless of whether they are staple food exporters or importers – then P_w will fall. For both reasons (reduced net imports and a possible fall in the international price) North America and Australasia could expect to reduce their export earnings, so the argument goes.

Ommissions in the conventional argument

The above commonly held view is incomplete, however, because it is based on an argument that focuses only on the developing country's supply conditions. In particular, it omits a number of demand considerations which are especially important in an economy where the majority of resources are employed directly or indirectly in agriculture.

When farmers adopt a new technology their gross incomes increase, represented by the area bcde in Fig. 1. Part of that increase is spent on extra inputs (oacd−oabe) and the rest (area abc) is available to spend on consumer items or to invest. Thus in Fig. 1 the demand for agricultural products shifts to the right, to D′, as a result of farm income growth. So do the demand curves for other (both intermediate and final) goods. In the case of other tradables this is accommodated simply by a reduction in their net exports (from CQ to C′Q in Fig. 2), with no change in domestic production.

If all products were internationally tradable, this would be the end of the story: the expenditure increase associated with the two demand curve shifts could not be more than the increase in income due to the shift in the food supply curve at existing international prices, ceteris paribus, and so this developing country's net imports from food-exporting countries would still be likely to fall in value even after taking into account these demand shifts.

However, a substantial share of expenditure is on products and services which by their nature cannot be traded internationally. An increase in farm incomes therefore also increases the demand for nontradables. Since by definition such goods must be produced domestically, this requires a shift along the supply curve for nontradables in Fig. 3 so that the quantity of nontradables marketed increases, as does their price relative to that of tradables, P_n. This has two important effects. One is that less resources are available to produce traded products as labour and capital are drawn into nontradables' production, so the supply curves in Fig. 1 and 2 shift to the left (to S″). The other is that incomes of producers of non-tradables rise. This is represented in Fig. 3 by area abcdef, of which cdef is spent on extra inputs and abcf is available for consumption or investment. That is, the direct income boost for farmers due to the new tech-

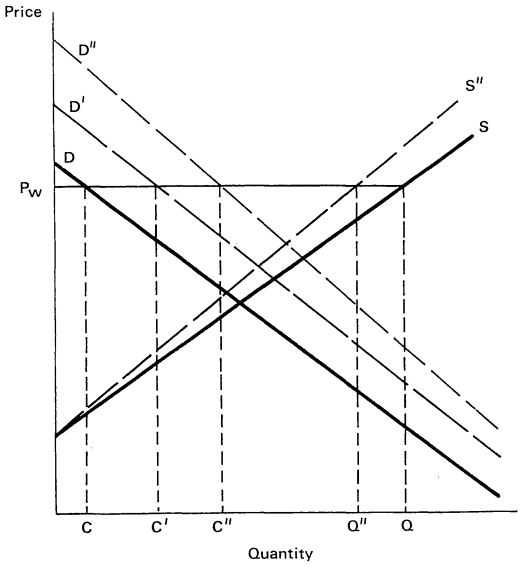

Fig. 2. A developing country's market for tradables other than staple food.

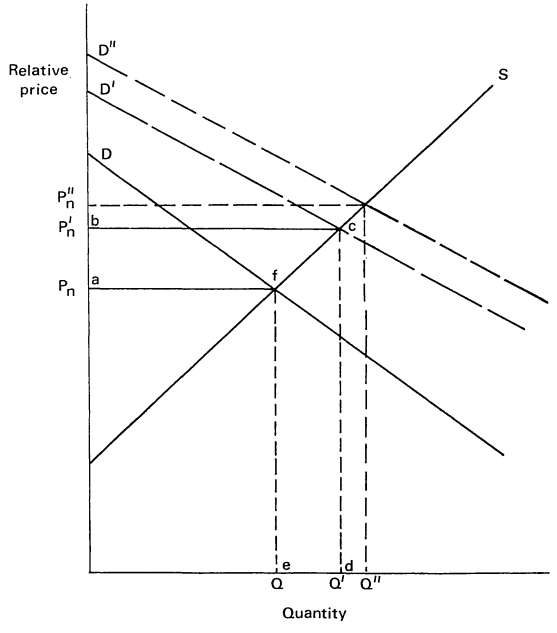

Fig. 3. A developing country's market for nontradables.

nology generates a second round of effects due to the spending by producers of nontradables, shifting to D″ the demand curve in each of the three figures.[2]

With this more-complete analysis it is now possible to see that the effects on agricultural-exporting rich countries of a new technology for staple food production in developing countries are unclear, for two reasons. One is that food staple imports change from QC to Q″C″ in Fig. 1, and it is an empirical question as to whether that is an increase or a decrease. The other reason is that the developing country's net exports of tradables other than staple food have decreased (from CQ to C″Q″ in Fig. 2). Since agricultural-exporting rich countries export goods in addition to staple foods, it is quite possible that even if there is a decrease in staple food imports it will be more than made up for by an increase in imports (or decrease in exports) of other tradables exported by the rich countries. Indeed the latter may even include enough (non-staple) agricultural goods for growth not only in those rich countries' total exports but even in their agricultural exports to this developing country. For example, a new rice technology may result in increased net imports of more-luxurious and higher-valued foods such as meat and dairy products and/or of wheat that, after processing into bread, etc. involves less food preparation time at home. Or it might simply be that newly adopted intensive livestock techniques expand the demand for feedgrain imports.

For this combination of reasons, it is quite possible for agricultural productivity growth in developing countries to be associated with increased imports, including agricultural imports, from developed countries. Whether *in fact* the two are positively correlated depends on the extent to which the supply-curve shift from S to S′ in Fig. 1 is more or less than outweighed by the other shifts in the markets for tradable products. It is to this empirical question which we now turn.

Empirical evidence

A formal algebraic model would show that the answer to this empirical question depends not only on the nature and extent of the technological change but also on the elasticities of transformation in production as between sectors, the share of resources employed in each sector, the elasticities of substitution in

[2]These demand and supply curve shifts are referred to by Corden (1984) as the 'spending effect' associated with (in this case) the new food-producing technology. Corden also identifies a 'resource movement effect' which relates to the need for mobile resources to move into the staple food sector. The present analysis assumes this is zero, that is, that the new technology requires the same amount of labour and capital (though not intermediate inputs) to produce the extra output of staple food (QQ′ in Fig. 1). In practice, some new technologies would actually save on the use of these primary factors while others would require more of them to be used in the food sector. The neutral assumption of a zero resource movement effect is adopted simply to avoid complicating the analysis further.

consumption, the share of expenditure on each sector's output and the income elasticities of demand. Reliable estimates of all these parameters are of course not available even for just the main developing countries, so such a formal approach to answering the question is not possible.[3]

What is possible, however, is to examine the correlation across developing countries between real growth in agricultural GDP per capita or per farm worker and real growth in their imports from developed countries. While causation could not be inferred from a positive correlation, since output in other sectors might have grown even more than in agriculture and it is that rather than agricultural growth which may have stimulated imports, it would at least not be inconsistent with the above reasoning. A stronger test would be to examine the correlation between agricultural GDP growth and import growth from individual agricultural-exporting countries such as the United States of America or Australia. Even stronger would be to test the correlation with not total but just agricultural imports by developing countries from developed countries. Data for such tests are available, for at least 53 developing countries with populations in excess of one million, from the World Bank, FAO, and the international trade tapes of the UN. Details are provided in the footnotes to Table 1.

It is clear from the first set of rows in Table 1 that these data for the period 1970–1984 do *not* support the argument that agricultural output or labour productivity growth in developing countries is negatively correlated with those countries' growth in imports from developed countries. On the contrary, the correlations are all positive and in some cases are statistically significant. (With 53 observations, the coefficients are significant at the 5% level if they exceed 0.27.)

Thus it would appear that agricultural growth in developing countries may not be inconsistent with the economic interests of developed countries, including those countries with a comparative advantage of agriculture. In addition, there is the possibility that faster agricultural growth in developing countries also benefits developed countries in the form of lower-priced imports of tropical products such as edible oils and vegetables, as well as in the form of any new technologies that may be transferable to developed-country agriculture.[4]

Farmers in the United States and Australia, however, are concerned not about their country's *total* exports to developing countries but simply *agricultural* exports. Yet even when one's perspective is narrowed to that sectional interest, as distinct from the national economic interest, the conventional view is found wanting. As the second set of rows in Table 1 shows, the correlations

[3]There are of course some models now available for individual developing countries, such as Bautista's (1986) for The Philippines, which might be used to provide case studies.

[4]For example, as much as half Australia's wheat area is grown to cultivars with some connection with CIMMYT in Mexico. The estimated benefit to Australia of that research at CIMMYT is conservatively estimated to be more than 10 times Australia's contribution to date to all of the international agricultural research centres around the world (Brennan, 1986).

TABLE 1

Coefficients of correlation between developing countries' per-capita growth rates in agricultural output and imports, 1970 to 1984[a]

Growth in real agricultural GDP[b]	Growth in real per-capita imports from			
	World	Developed countries	United States	Australia
	Total imports			
- per capita	0.34	0.33	0.28	0.23
- per farm worker[c]	0.23	0.22	0.24	0.09
	Agricultural imports[d]			
- per capita	0.15	0.07	0.07	0.09
- per farm worker[c]	0.10	0.08	0.10	0.01

Sources for data: World Bank (1986), FAO (1986 and earlier) and the trade data files of the International Economic Data Bank, Australian National University, Canberra.

[a]Growth between 1970–72 and 1982–84. The 1982–84 import values are deflated to 1970–72 dollars using the UN index of the unit value of total imports by developing countries and the FAO index of the unit value of agricultural imports by developing countries.

[b]Available from the World Bank source only for the period 1973 to 1984.

[c]The number of people engaged in agricultural work is obtained from the FAO's *Production Yearbook*.

[d]Agricultural imports are classified as sections 0, 1, 2 (excluding 27, 28) and 4 of the Standard International Trade Classification (SITC).

are positive even between agricultural growth in the developing countries and *agricultural* imports from developed countries.

Nevertheless, sceptics might suspect that agricultural imports would not grow for developing countries whose agricultural growth covers a wide spectrum of farm products. For that reason it is useful to examine the case of China, which has had one of the fastest-growing agricultural sectors in the past decade.

A case study: China. Farm output in China increased by more than 50% between 1978 and 1984. Increases occurred in virtually all commodities produced in China: grain by 5% per year, red meat and sugar by 10%, cotton by almost 20%, etc. As a result, China's share of world markets for grain, livestock products and sugar rose from 12 to 17% over that period. Yet China's self sufficiency in these foods actually *fell*, from 100% in 1970–74 to 97% in 1980–84, because domestic demand growth outpaced the growth in domestic production.

Indeed, China's agricultural imports have grown almost as rapidly as its total imports: between 1970–72 and 1982–84, China's total imports increased eight-fold in nominal terms, and agricultural imports increased seven-fold (Table 2). From developed countries as a group, agricultural imports increased ten-fold, which was even more than total imports. For the United States the increase in agricultural exports to China was somewhat less than its total export

TABLE 2

China's total and agricultural imports 1970–72 and 1982–84[a] (current US$ millions per year)

	Total imports			Agricultural imports[b]		
From	1970–72 (1)	1982–84 (2)	(1)/(2) (3)	1970–74 (4)	1982–84 (5)	(4)/(5) (6)
World	1 827	15 194	8.3	558	3 867	6.9
Developed Countries	1 388	12 590	9.1	304	2 985	9.8
United States	212	2 685	12.7	204	1 232	6.0
Australia	68	637	9.4	53	455	8.6

Source: International Economic Data Bank, Australian National University, Canberra.
[a]Based on the reported exports of other countries to China, which are more complete than China's import statistics.
[b]Agricultural imports are classified as Sections 0, 1, 2 (excluding 27, 28) and 4 of the Standard International Trade Classification (SITC).

growth, but that was because of a virtual embargo on non-food exports to China in the early 1970s.

Moreover, even if agricultural output in China continues to expand at the rapid rates targeted by the government for the next decade or so, it is likely that China will still have to increase its agricultural imports, notwithstanding its small agricultural trade surplus in 1984–85. One series of projections is summarised in Table 3, taken from Anderson and Tyers (1987). The reference case projection incorporates the government's production targets, assumes food prices will be kept at their 1980–82 levels in real terms, and assumes China's population and real national income grow at 1.2% and 6.3% per year to 1995. In that reference case, self sufficiency falls for all foods shown except rice. This is largely because the effect of assumed rapid income growth on demand outstrips the effect of the targeted rates of technical change in agriculture on domestic food supplies.

Suppose, however, that China's national income were to grow less rapidly than assumed in that reference projection. This would of course reduce the growth in demand for food and other products. But since more than two-thirds of China's workforce is still employed in agriculture and the farm sector accounts for more than one-third of national income, it is likely that a slower growth in income would be the result of slower growth in farm output. The net effect on food import demand would then depend on the extent to which these two effects, on domestic supply and domestic demand, offset each other. A second scenario is therefore reported in Table 3, in which the rate of growth of national income is assumed to be one percentage point less than in the reference case (5.3% instead of 6.3% per year, or 16% lower) and food output growth is also reduced by 16%. The net result is that with slower growth, China is

TABLE 3

China's net imports and self sufficiency in food products, 1980–83 and 1995

	Net imports (kt)	Self sufficiency (%)
Wheat		
Actual 1980–83	12 400	84
Projected 1995		
- reference	39 500	71
- slower growth	37 100	71
Coarse grain		
Actual 1980–83	1 080	99
Projected 1995		
- reference	12 200	91
- slower growth	13 400	89
Beef and sheep meat		
Actual 1980–83	−60	108
Projected 1995		
- reference	190	89
- slower growth	140	91
Pork and poultry meat		
Actual 1980–83	−60	100
Projected 1995		
- reference	5 400	82
- slower growth	4 390	84
Dairy products		
Actual 1980–83	320	96
Projected 1995		
- reference	15 480	49
- slower growth	11 000	54
Rice		
Actual 1980–83	−530	100
Projected 1995		
- reference	−1 400	101
- slower growth	1 470	99
Sugar		
Actual 1980–83	1 090	81
Projected 1995		
- reference	6 150	64
- slower growth	5 100	65

Source: Anderson and Tyers (1987, Table 6).

projected to reduce its net imports of virtually all these agricultural products except coarse grains (which increase slightly to help supplement the reduced volume of domestically produced feed for animals). These results provide fur-

ther support for the above argument that agricultural output growth in a developing country can be consistent with agricultural import growth.

Should food-exporting rich countries promote LDC agricultural growth?

Having established that agricultural growth in less developed countries (LDCs) may be associated with a rise in those countries' agricultural imports from developed countries, could it be in the latter's economic interest to actively promote such growth? One way to do so is to sell agricultural management and research skills, technological knowledge, genetic material and the like to LDCs. A more generous way is to give away such items as part of aid programs.

Selling skills, genes, etc. to LDCs

A number of concerns have been expressed about selling what are perceived to be the sources of agricultural comparative advantage in developed countries. Wool producers in Australia, for example, have long argued for prohibitions or at least limitations on the export of Merino genetic material from Australia (Australian Bureau of Agricultural Economics, 1986). Similar arguments have been made about exporting the agricultural research and management skills of developed countries. The fear is that such exports will reduce those countries' competitive edge in agricultural products. It ignores, however, the fact that such skills provide an internationally tradable service that is highly valued. Indeed, the net export earnings generated by the research and consulting activities of some agricultural scientists would be considerably higher per person than that generated by the average farmer in North America or Australasia. Yet it is unlikely that any one country has a monopoly on such skills, so it is not in their national interests to restrict exports of those skills, especially in the longer run. If restrictions were imposed by a country, two adverse effects would result. First, scientists would tend to emigrate to countries where they were free to operate internationally, so reducing the restricting country's export earnings from consulting as well as reducing the number of agricultural scientists in the country. And second, developing countries would simply turn to non-restricting countries for such skills, so the effects on their economies would be no different than if the restricting country supplied those skills.

Giving away skills, genes, etc. to LDCs

This is not the place to argue the pros and cons of providing foreign aid in general. But given that developed countries wish to spend a particular sum on foreign aid, is it in the national interest to spend that aid on boosting food

production in developing countries by providing skills, genes and other perceived sources of those countries' agricultural comparative advantage? The answer is: probably. To see this it is necessary to consider the effects, from both the recipient country's viewpoint as well as the donor's viewpoint, of tying aid in this way.

The recipient developing country will be largely indifferent to whether the aid is tied or not, provided that country would have otherwise acquired such goods and services anyway (either domestically or from the international market). The reason has to do with the fungibility of aid. The conventional wisdom is that aid in the form of agricultural research and management skills, genetic material, etc. shifts the developing country's production possibility curve out from S to S′ in terms of Fig. 1. This reduces the country's net imports of food (or expands its net exports in the case of a food-surplus LDC), it is argued, and possibly shifts the international terms of trade against food if the production shift is large enough, thereby harming food exporters such as North America and Australasia. Apart from the reasons already outlined as to why this conventional argument is incomplete, there is a further question to consider: namely, what would have occurred in the absence of that aid? Presumably this developing country would have invested in various development projects which shifted its supply curves for goods in general to the right. If that country in any case would have invested in the particular agricultural project the donor has funded (along with its numerous other investment activities), then the provision of that aid for this part of its investment program simply adds to the country's total investable resources and allows its aid from elsewhere to be diverted to other projects. Aid enables the developing country's supply curves for all three sectors depicted in Figs. 1 to 3, not just for food, to be further to the right. Moreover, since incomes would be boosted by this foreign aid, all three demand curves would also shift to the right, including that for nontradables. And, as argued earlier with respect to second-round effects, the increased demand for nontradables attracts resources from the tradables sectors, including food, and so may well ensure the country's food imports increase rather than decrease as a result of an agricultural-exporter's foreign aid.

If aid is so fungible, why should the United States or Australia bother to tie it to agricultural projects requiring national skills? Presumably this is done mainly to ensure those skills, etc. are purchased from the donor country rather than from other countries. As argued above, this does not necessarily mean less of those skills are available in the donor country, since the aid project is likely to be too small to have an impact on the global demand and hence the international price for those skills. It simply means that the donor country's excess supply of those skills would be partly absorbed by the aid project, so adding a more-specifically and more-visibly United States or Australian image to the project, which may be considered desirable for political reasons.

Summary and policy implications

The conventional view that agricultural growth in developing countries reduces their agricultural imports and therefore is against the interests of agricultural-exporting countries like the United States or Australia does not appear to be supported by empirical evidence. The argument on which that view is based is incomplete because it considers only the effects on LDC agricultural supply. What also needs to be considered is the effect of increased rural productivity on per-capita incomes and hence on the demand for agricultural and other products, including nontradables. When demand as well as supply conditions are taken into account, especially in the nontradables market, it is not surprising that there is a positive correlation between agricultural output growth and agricultural import growth of LDCs. Moreover, since more than 60% of United States and Australian exports are non-agricultural, LDC agricultural growth is even more positively correlated with growth in *total* imports from those countries.

China provides a striking example for illustrating these points. Agricultural output in China increased by 50% between 1978 and 1984. Yet, despite that, agricultural exports to China have grown enormously over the past decade. And, according to one set of projections at least, they are likely to continue to be positively correlated with agricultural output growth during the next decade.

It then follows that if agricultural growth in developing countries is consistent with the economic interests of even agricultural-exporting developed countries, it may well pay the latter to actively promote such growth, for example through exporting agricultural research and management skills, genetic material and the like. Paying for such exports via the foreign aid budget is another way to promote agricultural growth abroad. Assuming the United States or Australia wish to spend a particular sum on foreign aid, and assuming the recipient country would have purchased such skills, etc. for its development program anyway (though not necessarily from the United States or Australia), then that country would be largely indifferent between aid in cash or aid in kind, since in the latter case it would simply divert funds that would have been spent on such goods and services to other development projects.

Is it possible to say anything about on which commodities donor countries might concentrate their aid efforts? Wool producers have argued, for example, that Australia should explicitly exclude wool production assistance projects from its aid program, presumably on the grounds that this is more likely to reduce Australia's export prospects than aid for, say, rice production. Such a conclusion is not possible, however, when it is recognised that demand considerations and intersectoral effects need also to be taken into account in addition to direct effects on commodity supply. It would be a brave person who tries to predict the *net* effect on United States or Australian export earnings of any particular form of aid to developing country farmers: the outcome depends

among other things on myriad elasticities of substitution in production and consumption both within agriculture and between agriculture and other sectors in the recipient country.

To conclude, it need hardly be said that assistance to developing countries is motivated by more than just economic gains to donor countries by way of trade expansion. What this paper has tried to demonstrate is that the other gains from aid (investment opportunities, greater political stability overseas, reduced global poverty, etc.) need not necessarily be at the *expense* of trade. In short, while the donor country's objective might be to do good, it may also end up doing well!

Acknowledgements

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