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Developing country debt: implications for agricultural trade

H. Don B.H. Gunasekera, Bruce Bowen and Neil Andrews

Australian Bureau of Agricultural and Resource Economics, GPO Box 1563, Canberra, A.C.T. 2601 (Australia)

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ABSTRACT

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There has been a sharp decline in the rate of economic growth in many developing countries in the 1980s compared with the 1970s. Reduced availability of external finance following the international debt crisis has been identified as one of the most important factors responsible for this decline. At the same time there has been a slowdown in the rate of growth of food imports to these countries, particularly to the highly indepted ones.

The focus in the paper is on the implications for international agricultural commodity markets of a dept write-off in developing countries. To analyse these implications a world agricultural trade model is used. Specifically, the analysis covers the effect of existing debt on the permanent incomes of developing debtor countries and developed creditor countries, and hence the effect on agricultural commodity markets.

The results indicate that, if the debts of the developing countries were written off, prices would improve in consequence of the resulting rise in their permanent incomes. If the debt write-off also led to growth in developing countries returning to the levels prevalent before the debt crisis, the improvements in world prices would be likely to be much larger.

Introduction

Economic growth in developing countries has slowed from an annual average of just over 5% in the 1970s to around 3% in the 1980s (see Table 1). While there are several reasons for this decline in growth, the reduced availability of capital for investment, emanating from the international debt crisis stands out as one of the most important (IMF, 1988; World Bank, 1988).

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TABLE 1

Annual growth of real GDP in developing countries, 1973 – 1985

Country group	Average 1973 – 80 (%)	Average 1980 – 85 (%)
All developing countries	5.4	3.2
Low-income	4.6	7.4
Excluding China and India	3.4	3.0
China and India	4.9	8.6
Low-income Africa	2.0	0.7
Middle-income	5.7	1.6
Oil exporters	5.9	0.9
Exporters of manufactures	6.0	5.8
Highly indebted countries	5.4	0.1

Source: World Bank (1988).

The reduction of external finance since the early 1980's has forced many developing countries to undertake rigorous domestic adjustments to reduce their current-account deficits and improve trade balances. Attempts to restore macroeconomic stability and growth have, in many of the debtor countries, had certain policy components in common. Because improvement in export performance in response to policy changes has a time lag, these countries have addressed their severe external imbalances by focussing on reducing imports.

Growth in food imports by developing countries – particularly by the highly indebted countries in Latin America and Africa – has fallen sharply or even reversed (see Tables 2 and 3) since the early 1980s, as domestic absorption has become more restrained. The same has been true, however, of food exports by highly indebted countries, especially in Latin America (see Table 2). This latter decline could be partly a response to the fall in real prices in world markets caused by the heavy subsidisation of food exports from major developed countries. A decline in exports of these countries more generally could also be a consequence of the reduction of investment due to the reduced inflow of finance.

The purpose here is to examine the relationship between a reduction of debt in developing countries and world agricultural commodity prices and trade. Given that (a) some commercial banks have already begun reducing their debt holdings by sales of debt at discounted values in the secondary loan market, and (b) reduction of debt is a key component of the U.S. government's Brady Plan for addressing the debt problem, debt reduction has some topical importance (Brookins, 1989; World Bank, 1989).

TABLE 2

Annual growth of food trade of developing countries, 1974 – 1986

Country group	Average 1974 – 80 (%)	Average 1981 – 86 (%)
Imports		
All developing countries	10.0	1.5
Asia	7.3	3.7
Middle East	13.6	3.2
Latin America	10.7	– 3.5
Africa	10.5	1.7
Other	5.8	3.0
Exports		
All developing countries	2.7	1.6
Asia	6.5	6.0
Middle East	2.7	– 0.2
Latin America	3.5	0.3
Africa	– 2.9	– 0.1
Other developing	6.7	0.3

Source: Based on FAO (1987).

TABLE 3

Annual growth of cereal imports in developing countries, 1972 – 76 to 1982 – 86

Country group	Average 1972 – 76 to 1977 – 81 (%)	Average 1977 – 81 to 1982 – 86 (%)
Group of 14 heavily indebted countries[a]	12.0	2.3
Other developing countries	6.8	6.0

[a]Bolivia, Brazil, Chile, Colombia, Costa Rica, Côte d'Ivoire, Ecuador, Jamaica, Mexico, Morocco, Nigeria, Peru, Philippines and Venezuela. Source: Bautista (1988).

In this paper, an attempt is made to put into perspective some of the effects of debt reduction by examining a hypothetical case of total debt removal. The focus is on the effect on world agricultural commodity prices and trade of writing-off most developing country debt. Examples of measures which could be interpreted as debt write-offs, and which have already been implemented, include the following. The proportion of

developing country debt which has been exchanged between creditors at discounted values in the secondary loan markets has more than doubled since 1986, albeit from a low base (World Bank, 1989). In addition, at the Toronto Economic Summit in June 1988, leaders of the seven major developed countries announced that, to assist low income African countries overcome their debt problems, individual creditor countries could choose such options as partial debt write-offs and rescheduling of loans at lower interest rates (World Bank, 1989). As well, in 1987 a number of major banks in the U.S.A. and Europe raised their balance sheet provisions for bad debts against loans to problem debtors, writing the cost of bad debts off against 1987 profits. These responses by both banks and creditor governments to the debt crisis since 1986 suggest that some of the effects of debt write-offs examined in this study may have already occurred or be in process in different commodity markets.

The paper is organised in the following way. In the next section the methodological framework used to examine the effect of debt write-off in developing countries on world agricultural commodity markets is decribed. The effects on world agricultural commodity prices and trade of a debt write-off in developing countries are discussed in Section 3. In the final Section some implications are considered, particularly in relation to agricultural exporters such as Australia.

Methodological framework

The analytical approach used in examining the implications of writing off debts of developing countries for international agricultural commodity markets consists of two steps. In the first, the effects of existing debt on the permanent incomes of developing debtor countries and developed creditor countries are analysed. The second involves examining effects on world agricultural trade: (a) those of the permanent income effects of debt write-off, both in debtor developing countries and in creditor developed countries, and (b) the additional effects of associated higher growth prospects in debtor developing countries.

If the present value of the existing stock of debt, W, is expressed as an annuity flow spread over an infinite time period, the annuity will be rW where r is the interest rate. The permanent income of the debtor (creditor) countries could then be said to be lowered (raised) by rW. Because the repayment period of a loan is finite, the change in permanent income exceeds rW to different extents for different loans. Nevertheless, it is a reasonable simplifying assumption that changes in permanent income resulting from debt write-off can be approximated by rW. In other words, a total write-off of the existing debt would imply a rise in permanent income of approximate-

ly rW in developing debtor countries and a fall in permanent income of the same amount in developed creditor countries. These changes in permanent income will shift the levels of consumption of different commodities, depending on their income elasticities of demand.

In a formerly indebted country, debt write-off could also have a stimulatory effect on the rate of growth of GDP itself. The present difficulties of debtor developing countries in attracting foreign capital provides a clear indication that investors demand a high risk premium on returns to their investments in these countries, relative to comparable investments in other countries. This risk premium reflects such factors as the exchange rate and inflation expectations of investors, as well as their views of the general economic and political prospects and path of future economic policy in debtor developing countries.

It is likely that, if debt write-off were to improve the general economic and political prospects of these nations and were accompanied by structural adjustment and demand management policies, this would reduce the risk premium demanded by investors. Consequently, investors would be willing to accept lower returns on any given investment, and this might increase the number of prospective investment opportunities in developing countries. Higher investment would generally be likely to increase future income growth and hence demand for consumption goods, including agricultural products.

Modelling approach

Among the approaches to examining the effects of income changes on commodity trade are those which employ partial and general equilibrium models. Partial equilibrium analysis can be either single commodity analysis using descriptive and statistical methods or multi-commodity analysis using large-scale econometric modelling. Partial equilibrium analysis can also be either cross-sectional or time series. General equilibrium analysis involves simulating the interactions of various economic agents across all markets by incorporating the optimising behaviour of these agents in profit and utility maximisation. Each method has its strengths and weaknesses.

Partial equilibrium analysis which employs single commodity models is a useful tool if the analysis is focussed on a detailed examination of only one commodity in one or a number of countries. An important advantage of such analysis is that it can work with extremely disaggregated data. Partial equilibrium analysis can also incorporate a large amount of detailed information on the structure of the commodity-producing industry. Moreover, in an international context, comparisons can be made between similar commodity producing industries in different countries using such analysis.

In contrast to partial equilibrium analysis, general equilibrium models provide an analytical framework which captures the essential interdependent nature of production, demand and trade within a general equilibrium system. Furthermore, such models allow for appraising the effects of policy changes on resource allocation as well as for assessing economy-wide gains and losses from simulated policy changes. Since general equilibrium models require a complete specification of both the supply and demand sides of all markets, they are expensive to construct in terms of data requirements.

In the second step of the present analysis, where the focus is on potential price and trade effects in world agricultural commodity markets of changes in income, a multi-commodity multi-country partial equilibrium model is used. It is based on the static world policy simulation (SWOPSIM) modelling framework developed in the Economic Research Service of the US Department of Agriculture. A detailed description of the SWOPSIM framework used in this study is presented by Roningen (1986) and Dixit and Roningen (1986). Given the partial equilibrium nature of the model used in this study, the effect of income growth in debtor developing countries on their demand both for non-tradables and for tradables other than the agricultural commodities included in the model is not captured in the present analysis. It is plausible to assume that higher incomes would generate increased demand for both these types of goods. In developing countries where capital and skilled labour are in short supply, any movement of limited resources to these sectors could reduce the availability of resources for agriculture. This could limit the capacity of agriculture to expand in response to any increased demand associated with income growth. Therefore, it can be argued that this reduced supply response in debtor developing countries is likely to underestimate the potential price and trade effects in world agricultural commodity markets of changes in income.

A recent empirical application of the SWOPSIM modelling framework used in the present analysis is reported by Kirby et al. (1988). A descriptive overview of this modelling framework based on Kirby et al. (1988) is provided below. The SWOPSIM framework provides for models to be created with economic structures that include constant-elasticity supply and demand equations. They are non-spatial agricultural trade models, based on the assumption that world prices are determined simultaneously with supply-demand balances in international and in all domestic markets. In deriving a solution, prices are adjusted in the model until exports equal imports for each commodity. The SWOPSIM model structure does not allow for stocks of commodities; thus, stocks are in effect assumed to remain constant. It is assumed that a country could export a commodity to or import it from any other country, regardless of differences in transport costs. Therefore, no definite conclusions can be drawn from the model results about the specific

destinations for or sources of a country's traded commodities. Exogenous changes to levels of income can be imposed, resulting in demand shifts via income elasticities of demand.

The nine-region, 22-commodity model used in this study is an aggregated

TABLE 4

Country and commodity groupings in model

Country or group		Commodity	
Debtors			
HI	Highly indebted countries: Mexico, Brazil, Argentina, Venezuela, other Latin America, Philippines and Nigeria	RI	Rice
		WH	Wheat
		DM	Dairy fresh milk
		DB	Dairy butter
		DC	Dairy cheese
AF	African countries: Egypt and other Sub-Saharan Africa	DP	Dairy milk powder
		ML	Mutton and lamb
		SU	Sugar
OL	Other debtor developing countries: India, other South Asia, Indonesia, Thailand, Malaysia, other South-East Asia, other Central America, and Caribbean countries	SB	Soybeans
		SM	Soybean meal
		SO	Soybean oil
		OS	Other oilseeds
		OO	Other oils
		OM	Other meals
		CT	Cotton
Creditors		TB	Tobacco
		BF	Beef and veal
CR	United States, European Communities, Spain, Portugal, other Western European countries	PK	Pork
		PM	Poultry meat
		PE	Poultry eggs
		CN	Corn (maize)
		CG	Other coarse grains
Residual group			
AU	Australia		
JP	Japan		
OI	Other industrial market economies: Canada, New Zealand, South Africa		
NI	Newly industrialising countries: Korea, Taiwan, other East-Asian Countries		
RW	Rest of the World: Eastern Europe, U.S.S.R., China, Middle East and North African oil producing countries, the rest of the world		

version of the basic 36-region, 22-commodity model developed by Roningen (1986). The countries in each group, and the commodities, are listed in Table 4. The nine countries or country groupings include three major developing country debtor groups: the highly indepted developing countries (HI); most African developing countries (AF); and other debtor developing countries (OL). One group consists of the major developed country creditors: the U.S.A., the European Community and several other developed countries (CR). The remaining groupings are: Australia (AU), Japan (JP) and other developed countries (OI) whose exposure as creditors to the present debt crisis has been relatively small; and East Asian newly industrialising countries (NI) and the rest of the world (RW) – countries whose external financial position has had relatively little influence on the debt crisis.

Five sets of information are required to implement the model in order to analyse both the implications of a changes in permanent income in debtor and creditor countries, and the additional effects of improved growth prospects in debtor countries. For each country or country grouping and commodity included, information or estimates are needed on: production, consumption and net trade and associated world and domestic prices; agricultural support and tax policies; various elasticities, including demand, supply and income elasticities; the change in permanent income that would result from debt write-off; and the additional changes in income in debtor countries which could result from a stimulatory effect on economic growth of debt write-off.

The price and quantity data on agricultural commodities, the estimates of agricultural support or tax for different countries, and the supply, demand, income and price transmission elasticities were taken from the world agricultural database maintained by the Foreign Agricultural Service of the U.S. Department of Agriculture. The income and price elasticities of demand used in the analysis are presented in Appendix Tables A1 and A2, and they reflect medium-term responses over about 5 years [see Kirby et al. (1988), Gardiner et al. (1989) and Sullivan et al. (1989) for a detailed discussion on the data in relation to agricultural assistance and elasticity estimates].

The first step of the analysis, as described before, provided the changes in permanent income. For this purpose the 1986 debt statistics given in World Bank (1989) were used (see Table 5). This year was chosen because the base data used in the SWOPSIM model relate to 1986.

The additional changes in income in debtor countries were based on their annual averages of GDP growth between 1965 and 1973, given in World Bank (1987). These growth rates were assumed to be indicative of the economic growth achievable in the debtor countries without building up a substantial level of external debt. They were the growth rates of debtor

TABLE 5

Derivation of changes in permanent income for debtor and creditor country groups, 1986

Country group	Total debt[a], W (US$ billion)	Real interest rate[b], r (%)	Change in permanent income, rW (US$ billion)	Change in permanent income as a proportion of GDP
Highly indebted countries (HI)	422	8	34	4.3
African countries (AF)	146	4	6	3.5
Other developing countries (OL)	184	8	15	3.5
Creditor countries (CR)	–	–	−55	−0.7

[a] Total external debt, including short-term and use of International Monetary Fund credit.
[b] Nominal interest rates (based on average terms for new loan commitments in 1986) less the 1986 U.S. consumer price index. Source: Based on World Bank (1989).

countries prior to both the large inflow of capital to these countries which began after 1973 and the subsequent repayment difficulties.

Agricultural trade and price effects of debt write-off

The analysis using the SWOPSIM modelling framework employed two simulations. Both were compared with a 'base version' of the model representing the 1986 values of production, consumption and net trade for each commodity in all countries or country groups. The changes in the values of world prices and net trade from those in the 'base version' were used to indicate the effects of debt write-off.

In the first simulation, the estimated increases in permanent income as a proportion of the GDP in debtor developing countries and the corresponding fall in permanent income as a proportion of the GDP in creditor countries (see Table 5) were introduced into the SWOPSIM model as exogenous changes in income, and the price and net trade effects were estimated.

In deriving the change in permanent income (see Table 5) a lower real interest rate was used for African countries since their borrowings have in most cases been from official sources at concessional rates, whereas borrowings by the other country groups have been largely from private creditors, mostly at variable interest rates.

In the second simulation, both (a) effects of changes in permanent income

TABLE 6

Changes in world prices and net trade, first simulation

Commodity[b]	World price change (%)	Change in net trade[a] (%)								
		Debtors			Creditors	Others				
		HI	AF	OL	CR	AU	JP	OI	NI	RW
Rice	8.2	[c]	4.5	−5.9	5.3	2.4	[c]	–	–	−7.3
Wheat	2.2	3.8	–	5.6	–	–	–	–	–	–
Butter	6.7	16.7	–	–	2.5	–	[c]	–	na	–
Cheese	4.2	[c]	18.9	[c]	15.1	–	–	–	na	–
Milk powder	2.2	2.6	na	[c]	–	–	–	–	na	–
Mutton and lamb	2.2	12.6	[c]	[d]	–	6.2	–	–	–	–
Sugar	6.0	2.2	−14.9	–	6.3	2.3	–	[c]	–	–
Soybean oil	3.7	−2.0	4.1	4.0	4.1	–	[c]	−4.9	−4.3	–
Other oilseeds	4.5	−25.0	[d]	[d]	−23.0	28.2	–	4.4	–	–
Other oils	5.8	–	10.4	−5.3	−5.8	−7.8	−4.1	24.8	–	−5.3
Other meals	2.1	–	−6.2	−12.3	–	[c]	−5.7	4.7	–	7.1
Cotton	3.1	[c]	–	−32.4	21.9	–	–	−3.5	–	–
Tobacco	2.2	−2.6	–	−7.4	−4.2	−3.6	−4.1	5.2	[c]	–

[a] See Table 4 for countries included in each grouping.
[b] Commodities for which change in world price was less than 2% are not reported.
[c] Large proportionate change from a small base.
[d] Trade switches from a low volume of exports to imports, na, Commodity not included in the model for this country group.
–, less than 2% change in absolute value.
Note: Underlined figures indicate the country or group is a net exporter.

in debtor and creditor countries, and (b) a possible effect of future growth prospects in debtor countries were simulated *together*. In this simulation, the permanent income changes of debtor and creditor countries were introduced into the SWOPSIM model as in the first simulation. To simulate a possible effect of write-off on future growth prospects in debtor countries, the annual average rates of real GDP growth prevalent in these countries in 1965 – 73 (World Bank, 1987), were substituted for the 1986 real GDP growth rates used in the previous simulation. Thus, the growth rates were increased from 2.5% to 6.9% for highly indebted countries (HI), from 0.5% to 6.4% for African countries (AF) and from 3.2% to 7.0% for other debtor developing countries (OL), as *one-off* exogenous changes in income. The reason for introducing the alternative growth rates as one-off changes was that there is no provision within the SWOPSIM framework for year-to-year changes in income growth.

The world price and net trade changes in the first and second simulations are presented in Tables 6 and 7, respectively. Overall, world prices rise for all commodities, to differing extents. On a priori grounds, price increases are consistent with the higher income elasticities of demand for agricultural commodities, particularly food, in developing countries compared with developed countries. Accordingly, in the first simulation, the positive effect on demand for agricultural commodities of increased income in debtor countries outweighs the negative effect of a fall in income in creditor countries, resulting in an overall positive net effect on world prices. Increases in world prices are higher in the second simulation because of the larger simulated income in debtor countries.

In both simulations, the largest percentage increase in the world price is for rice. This price increase results from increased imports of rice by African countries (AF) and a reduction in exports from the other debtor developing countries (OL) – most of which are Asian countries – due to increased domestic consumption. Creditor-developed countries (CR) as well as Australia increase their rice exports in response to the higher prices. Increases in the world prices of dairy products, particularly butter and cheese, are also relatively larger in both simulations. This is due to a rise in imports of butter by the middle-income developing countries in the debtor group (HI) and in imports of cheese by African countries (AF), predominantly Egypt.

It is important to recognise that the magnitudes of world price increases for different commodities are influenced not only by the demand, supply and income elasticities but also by the proportion of production of each commodity that is traded and the extent to which changes in world prices are transmitted to domestic markets. If a relatively small share of a commodity's production is traded on world markets and the extent to which

TABLE 7

Changes in world prices and net trade, second simulation

Commodity[b]	World price change (%)	Change in net trade[a] (%)								
		Debtors			Creditors	Others				
		HI	AF	OL	CR	AU	JP	OI	NI	RW
Rice	18.3	[c]	13.8	−10.9	11.2	5.1	[c]	−3.4	–	−15.5
Wheat	5.0	7.3	4.5	11.6	–	–	–	–	–	−2.1
Butter	15.8	33.9	3.0	–	3.8	2.3	[c]	10.3	n.a.	–
Cheese	12.4	[c]	48.8	[c]	30.1	5.3	–	–	n.a.	–
Milk powder	8.1	4.8	na	[c]	–	–	–	6.0	n.a.	–
Mutton and lamb	4.9	17.0	[c]	[d]	−3.2	13.3	–	3.6	–	–
Sugar	13.4	5.8	−41.6	−3.3	11.4	5.0	–	[c]	–	–
Soybean oil	7.9	−3.7	11.2	8.4	8.4	2.9	[c]	−10.0	−9.0	–
Other oilseeds	10.5	−54.9	[d]	[d]	−50.0	64.5	–	10.2	–	–
Other oils	13.2	–	29.7	−10.6	−12.3	−16.9	−9.0	53.2	−2.4	−11.6
Other meals	5.4	4.0	−17.5	−25.3	−3.6	[c]	−13.1	10.4	–	15.8
Cotton	6.9	[c]	−2.4	−65.3	45.0	2.3	−2.0	−7.5	–	–
Tobacco	4.9	−5.1	−5.1	−14.7	−8.4	−7.9	−9.1	11.4	[c]	–
Beef	2.0	−35.4	18.1	−36.0	[c]	–	–	7.1	–	–
Eggs	3.1	[d]	[c]	–	[c]	[c]	−25.2	[c]	−3.8	–
Maize	2.1	[c]	8.6	[d]	2.2	–	–	–	–	–
Other coarse grains	3.4	−13.2	−8.5	[d]	–	–	–	–	–	−3.4

[a] See Table 4 for countries included in each grouping.
[b] Commodities for which change in world price was less than 2% are not reported.
[c] Large proportionate change from a small base.
[d] Trade switches from a low volume of exports to imports. n.a., Commodity not included in the model for this country group.
–, less than 2% change in absolute value.
Note: Underlined figures indicate the country or group is a net exporter.

changes in world prices are transmitted to domestic markets is low, a larger price adjustment will be required to clear the market for any given change in demand and supply. The large price increases for rice in both simulations are likely to be partly attributable to the relatively small share of rice production traded in world markets (3% in 1986) and the lesser degree to which change in the world price for rice is transmitted to domestic markets in many countries. This pattern tends to apply to other commodities of which only a small share is traded on world markets including cheese (5%) and 'other' oilseeds (6%).

Increases in income in debtor developing countries in both simulations also lead to rises in the world prices of sugar, cotton and beef. Accompanying these price increases are reductions in exports of these commodities by debtor countries: of sugar by African (AF) and other debtor developing (OL) countries; of beef by the highly indebted countries (HI); and of cotton by other debtor developing (OL) countries. These reductions in exports result from increases in domestic demand exceeding the increases in domestic supply. The lower supply responses are due to smaller supply elasticities for certain commodities in some countries (for example, for sugar in Africa). Since commodities such as sugar, beef and cotton are important sources of export earnings for some debtor countries, the simulation results indicating reductions in their exports may seem implausible. In practice, governments may intervene in domestic markets to prevent any reduction in exportable surpluses. Analysis of such government responses is beyond the scope of this study, but if they occurred it is likely that world prices for the commodities concerned would increase less than is shown in Tables 6 and 7.

According to these tables, increases in world prices for certain commodities are accompanied by a reduction in their imports by some debtor developing countries (for example, of 'other' oilseeds and 'other' coarse grains by the highly indebted (HI) developing countries). This effect is due to increased domestic production which satisfies the rise in domestic demand, thereby reducing import demand. At the same time certain other countries switch from being small exporters to being importers.

For Australia, the simulation results show an improvement in export income, of which around 60 per cent is derived from higher world prices and the remainder from increased export volumes. In the first simulation, exports increase by $307 million, or 2.5% in the 1986 total value of agricultural exports. In the second, the rise in exports is $703 million, or 5.8%.

As the model includes only some of the important parameters which might influence agricultural production, consumption and trade, simulation results should be viewed as indicative rather than as precise forecasts of changes in world prices and trade. There is no provision for treating investment in the SWOPSIM model. As a result, the effects on world prices and

trade of any changes in agricultural supply resulting from changes in agricultural investment are not simulated. It is important to recognise that the increases in world prices reported in Tables 6 and 7 are therefore unlikely to be maintained indefinitely. In practice, world prices would be expected to ease once investment-led supply expansions begin to materialise.

Sensitivity analysis

The question naturally arises as to how sensitive the model simulation results may be to values of various parameters. For reasons of time and space, the emphasis here is on the key parameters relevant to the present study, namely certain income elasticities of demand and price transmission elasticities, specified below. In both simulations, the exogenous changes in income have their effects via income elasticities of demand; thus these elasticities are of particular importance. The price transmission elasticities, which express the extent of transmission of changes in world prices to the domestic markets, are of particular significance because many major developed countries and some developing countries insulate their domestic markets from developments in the world markets. To test the sensitivity of some important model results to these parameters, a method proposed by Pagan and Shannon (1984) was used. This method involves computing sensitivity elasticities for each key parameter – that is, the percentage changes in the results produced by a 1% change in each parameter value.

The particular parameters tested were the income elasticities of demand (for debtors and creditors) and the price transmission elasticities (for all country groups) for rice and sugar (chosen due to their large price changes in both simulations). The first simulation was repeated four times, with each of these parameters in turn separately increased by 10% and all the other parameters at their 'benchmark' values. It was assumed that the effect of a 10% change is ten times that of 1% change.

The results of the sensitivity analysis are given in Table 8. For example, a 10% increase in the income elasticities of demand for rice in debtor and creditor countries leads to a 0.9% increase in the world price of rice. Similarly, a 10% increase in the price transmission elasticities for sugar in all the country groups in the model leads to a 1.0% decline in the world sugar price. (The higher the price transmission elasticity, the more closely will changes in demand and supply in domestic markets be related to developments in world markets. Since domestic markets will then respond more to changes in excess supply and excess demand in world markets, the world market clearing price will be lower than with the previous, lesser price transmission elasticity.)

If the sensitivity of world rice and sugar prices can be taken as a general

TABLE 8

Sensitivity elasticities of world prices with respect to parameter changes (first simulation)

Variable	Parameter	
	Income elasticity of demand	Price transmission elasticity
World price of rice	0.092	−0.088
World price of sugar	0.129	−0.101

guide, the results in Table 8 suggest that the changes in the world prices of the commodities included in the model are generally not sensitive to changes in income elasticities of demand and price transmission elasticities. In other words, key results of the simulations, such as world price changes of agricultural commodities, are relatively robust to changes in these key parameter values.

Concluding remarks

The simulation results of this study indicate that, if purchasing power constraints imposed by the debt crisis could be eased and an increased rate of income growth in developing countries could be achieved and sustained, an associated expansion in demand for agricultural commodities, particularly food, would be likely. In low-income countries such as those in Africa, where the income elasticity of demand for food is particularly high, a large proportion of incremental income is likely to be spent on food. Growth in income in these countries is often associated with a decline in absolute expenditure on traditional crops such as roots and tubers and a rising demand for cereals such as rice and wheat. In middle income developing countries a large proportion of incremental income is likely to be spent on relatively high protein foods such as dairy products.

As past experience demonstrates, only in a few developing countries has domestic food production been able to keep pace with the growth in domestic demand for food (Islam, 1988). The extent of import increases resulting from income growth in developing countries will also depend on the composition of their agricultural output. Where this predominantly comprises non-food tropical crops and agricultural raw materials, the increase in food demand resulting from income growth will be met mostly by the expansion of imports.

Expansion of imports (or reduction of exports) of food commodities in response to income growth would be expected to raise world prices. Both in-

creases in prices and in imports by developing countries are likely to increase export opportunities for efficient agricultural exporting countries such as Australia. World prices would, however, be expected to ease as agricultural supply expands in response to a likely increase in agricultural investment.

Domestic agricultural production in developing countries would also be likely to expand, if an increase in income growth in these countries were accompanied by a corresponding growth in domestic agricultural investment. An important question in such a situation is whether agricultural growth in developing countries would lead to a decline in their agricultural imports. Recently, several studies relevant to this question have appeared [see, for example, Kellogg et al. (1986) and de Janvry and Sadoulet (1986)]. These studies suggest that agricultural growth can be associated with increased agricultural imports – that it is an important determinant of income growth in many developing countries, and that increases in these countries' agricultural imports are often positively related to their income growth.

Furthermore, even the net agricultural exporters among developing countries can be expanding markets for certain agricultural imports. Malaysia and Thailand provide good illustrations of rapidly growing developing countries where successful agricultural development has sustained a broad-based industrial growth which has led to increasing import demand for coarse grains and feedstuffs (de Janvry and Sadoulet, 1986). These examples show that growth in agricultural production along comparative advantage lines in developing countries can complement, rather than compete with, increasing agricultural exports to these countries.

Availability of increased resources in debtor developing countries for investment and consumption, resulting from debt write-off, is unlikely to ensure improved economic growth prospects unless complemented by sound demand management and broad-based structural reforms. If this condition is met, however, reduction of the present debt levels of developing countries should improve their growth prospects and strengthen their creditworthiness, leading to an improvement in market sentiment and lender confidence. It is possible that this could eventually permit a resumption of voluntary commercial lending to developing countries.

It must be borne in mind that the findings of this study are based on a partial equilibrium framework confined to agricultural commodities. Nevertheless, the results suggest that if developing countries' debt were written off, an improvement in agricultural commodity prices could be expected, despite creditor countries simultaneously having to forgo a proportion of their permanent income flow. Furthermore, if as a result of debt write-off debtor developing countries were also able to return to the higher growth rates they experienced prior to the debt crisis, larger increases in commodity prices might be possible. Both situations would clearly be of benefit to agricultural exporting countries.

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Appendix

TABLE A1

Income elasticities of demand

Commodity	Country or group[a]								
	AU	CR	JP	OI	HI	AF	OL	NI	RW
Beef	0.18	0.18	0.29	0.24	0.36	0.59	0.63	0.42	0.36
Pork	0.31	0.18	0.46	0.20	0.44	[b]	0.56	0.44	0.54
Sheep meat	0.05	0.21	0.30	0.34	0.42	0.62	0.78	0.47	0.55
Chicken	0.35	0.19	0.42	0.37	0.58	0.67	0.76	0.56	0.60
Eggs	0.29	0.18	0.36	0.30	0.54	0.69	0.92	0.56	0.43
Milk	−0.03	0.03	0.22	0.06	0.44	0.66	0.90	[b]	0.27
Butter	0.24	0.17	0.45	0.19	0.58	0.63	0.68	[b]	0.52
Cheese	0.31	0.34	0.35	0.23	0.55	1.09	1.10	[b]	0.48
Non-fat milk powder	−0.04	0.34	0.37	0.25	0.53	[b]	1.05	[b]	0.41
Wheat	−0.10	−0.13	−0.03	−0.05	0.32	0.43	0.56	0.26	0.20
Corn	−0.08	−0.11	−0.08	−0.04	0.05	0.11	0.12	0.04	0.03
Other coarse grains	−0.05	−0.08	0.04	−0.07	−0.01	0.11	0.02	[c]	−0.07
Rice	0.24	0.16	[c]	0.27	0.35	0.62	0.46	0.30	0.43
Soybeans	0.15	0.04	0.22	−0.01	−0.13	0.35	0.29	−0.10	0.19
Soybeans meal	0.13	0.24	0.21	0.27	−0.13	0.17	0.08	−0.08	−0.04
Soybeans oil	0.19	0.04	0.24	0.18	0.65	0.89	0.93	0.72	0.69
Other oilseeds	0.17	0.10	0.23	−0.05	−0.10	0.97	0.60	−0.03	0.14
Other meals	0.13	0.21	0.21	0.12	−0.13	0.85	0.63	−0.09	0.12
Other oils	0.19	0.13	0.24	0.31	0.72	0.90	0.93	0.60	0.67
Cotton	0.38	0.31	0.36	0.38	0.54	0.83	1.13	0.64	0.70
Sugar	0.11	0.08	0.14	0.15	0.31	0.59	0.70	0.32	0.30
Tobacco	0.70	0.31	−0.05	0.26	0.52	0.81	0.66	0.38	0.62

[a] See Table 4 for countries included in each grouping.
[b] The corresponding commodity is not included in the model for this country grouping.
[c] Less than 0.01 in absolute value.
Source: Economic Research Service, U.S. Department of Agriculture.

TABLE A2

Own price elasticities of demand [a]

Commodity	Country or group[b]								
	AU	CR	JP	OI	HI	AF	OL	NI	RW
Beef	0.78	0.70	1.00	0.69	0.73	0.40	0.49	0.72	0.26
Pork	1.02	0.79	0.95	0.81	0.90	[c]	1.00	0.62	0.38
Sheep meat	1.20	0.84	0.35	0.56	0.59	0.60	0.50	0.41	0.31
Chicken	0.80	0.68	1.10	0.62	0.86	0.60	0.70	0.66	0.36
Eggs	0.25	0.27	0.30	0.33	0.40	0.50	0.98	0.32	0.15
Milk	0.16	0.18	0.05	0.14	0.06	0.06	[d]	[c]	0.05
Butter	0.45	0.47	0.54	0.59	0.79	0.30	0.60	[c]	0.21
Cheese	0.40	0.48	0.68	0.65	0.55	0.30	0.40	[c]	0.20
Non-fat milk powder	0.45	0.42	0.63	0.49	0.60	[c]	0.50	[c]	0.34
Wheat	0.24	0.31	0.40	0.20	0.38	0.32	0.33	0.49	0.19
Corn	0.35	0.25	0.50	0.21	0.43	0.26	0.46	0.48	0.23
Other coarse grains	0.36	0.41	0.55	0.24	0.31	0.22	0.59	0.84	0.27
Rice	0.45	0.36	0.30	0.28	0.40	0.30	0.41	0.21	0.13
Soybeans	0.42	0.42	0.34	0.39	0.43	0.42	0.34	0.17	0.23
Soybean meal	0.60	0.34	0.35	0.41	1.04	0.29	0.75	0.76	0.37
Soybean oil	0.93	0.41	0.47	0.42	0.96	0.21	0.64	0.86	0.22
Other oilseeds	0.63	0.99	0.87	0.75	0.96	0.96	1.32	0.54	0.62
Other meal	0.44	0.71	0.75	0.84	1.07	0.27	0.28	1.01	0.30
Other oils	0.65	0.59	0.35	0.62	0.70	0.20	0.61	0.87	0.27
Cotton	0.20	0.40	0.30	0.40	0.49	0.43	0.55	0.43	0.14
Sugar	0.25	0.38	0.54	0.26	0.53	0.21	0.56	0.72	0.23
Tobacco	0.50	0.36	0.50	0.32	0.27	0.15	0.64	0.45	0.13

[a] Absolute values.
[b] See Table 4 for countries included in each grouping.
[c] The corresponding commodity is not included in the model for this country grouping.
[d] Less than 0.01 is absolute value.
Source: Gardiner et al. (1989).