Seminar Paper 89-06

HOW DEVELOPING COUNTRIES COULD GAIN FROM FOOD TRADE LIBERALIZATION IN THE URUGUAY ROUND

Kym Anderson and Rod Tyers

CENTRE FOR
INTERNATIONAL
ECONOMIC STUDIES

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October 1989

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ISBN 0 86396 084 7

Revised version of a paper presented at a joint OECD/World Bank symposium on Agricultural Trade Liberalization: Implications for Developing Countries, Paris, 5-6 October 1989. To be published in Agricultural Trade Liberalization: Implications for Developing Countries, edited by I. Goldin and O. Knudsen, Paris: OECD Development Centre, 1990.

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ABSTRACT

The common presumption that food-importing developing countries would be harmed by a liberalization of food trade as a result of the Uruguay Round of multilateral trade negotiations is questioned in this paper. Both theory and empirical modelling evidence lead to the distinct possibility of the opposite conclusion. Even if just OECD countries were to liberalize their food trade, most developing countries would gain provided that farm productivity growth responds positively to producer price changes. That gain would be even greater if developing countries also were to liberalize their food policies of course. Moreover, fluctuations in international prices for food would be much reduced by such liberalization, and income distribution within developing countries would be more equitable as farmers on average are typically poorer than urbanites in poor countries.

HOW DEVELOPING COUNTRIES COULD GAIN FROM AGRICULTURAL TRADE LIBERALIZATION IN THE URUGUAY ROUND

Kym Anderson and Rod Tyers
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There is a commonly-held presumption that if markets for temperate food products were to be liberalized as a result of the Uruguay Round of multilateral trade negotiations, developing countries would be harmed. The basis for this view is that, as a group, developing countries are net importers of those food staples and so would be worse off with liberalized trade because food prices in international markets would be higher.

The purpose of this paper is to show that for a number of reasons this is too restrictive a view of the effects of including agriculture in the Uruguay Round. In fact it is quite possible the majority of developing countries would be net beneficiaries of such a liberalization.

The first section of the paper uses standard economic analysis to demonstrate key steps in the conceptual argument leading to that opposite conclusion. It begins with the conventional, static, partial-equilibrium view, adds distributional and risk considerations, and then raises further issues that add increasingly to the probability that developing countries as a group could gain from the inclusion of agriculture in the Uruguay Round. No one empirical model is available to illustrate all of the steps in the argument. However, the second section of the paper draws on results from a dynamic, stochastic, multi-commodity, partial-equilibrium model of world food markets to illustrate at least some of the points made in Section 1. These results show that even when attention is confined just to the markets for temperate food staples, it is plausible that virtually all developing countries could benefit from a global liberalization of those markets and that the vast majority of the world's poor would be better off. The third and final section points to areas where more complex quantitative models could contribute further to our empirical understanding, before drawing out some policy implications of the analysis.

1. CONCEPTUAL STEPS IN THE ARGUMENT

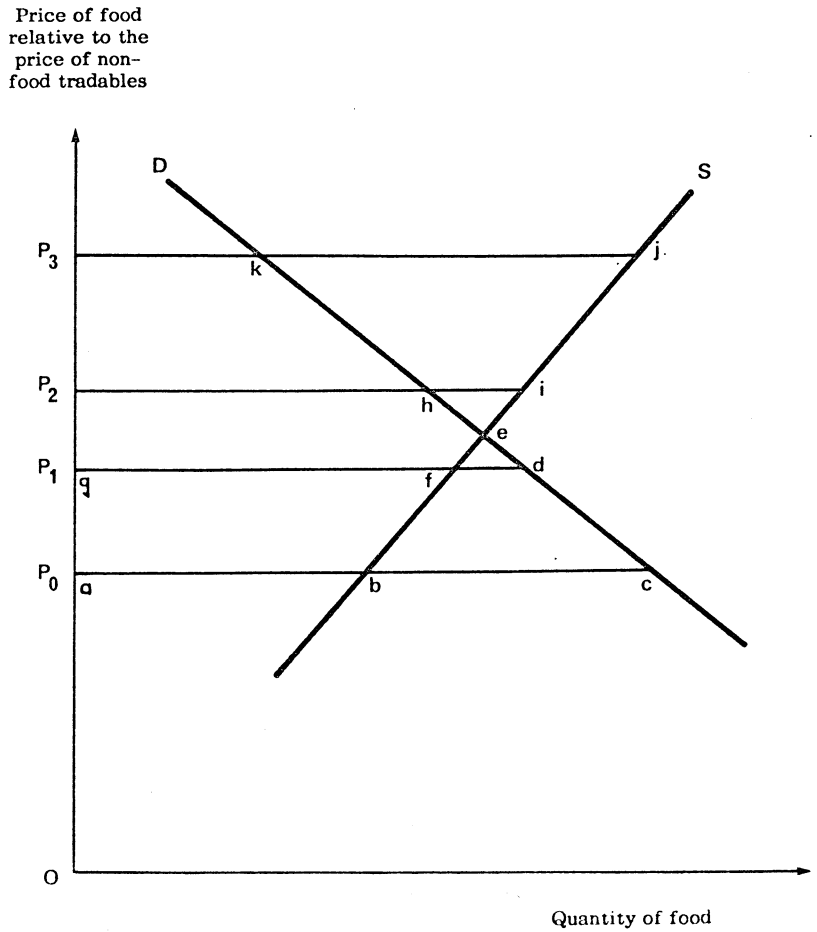
1.1 The conventional view of effects of OECD food trade liberalization

Figure 1 depicts the conventional view of what would occur if the advanced industrial countries alone liberalized their protectionist policies toward food trade. Suppose that following the international price rise the domestic producer and consumer prices in a food-importing developing country rose from P_0 to P_1. (Throughout the P's refer to the price of food relative to the price of other tradables. For the moment assume there are no distortions in the developing country.) Then producer surplus would rise by area abfg while consumer surplus would fall by area acdg. The net loss to this economy therefore is seen as area bcdf.

However, it need not be the case that this developing country continues to be a net food importer. Suppose, for example, that the post-liberalization price is P_2 rather than P_1. In that case it is possible that the country's loss would be less than if the price rose only to P_1. The required condition is that area fde is less than area eih, and the net welfare loss in this case is area bce less area eih. It therefore follows that if the international price rose sufficiently, this country could even be a net beneficiary. If it rose to P_3, for example, the net gain would be area ejk less area bce.

Needless to say, an undistorted developing country which is a net food exporter at the pre-liberalization price gains unequivocally from liberalization. If P_2 and P_3 were the pre- and post-liberalization prices, for example, then the net gain to that exporting country would be area hijk if the price change is fully transmitted. (If none of the change was transmitted to the domestic market, the gain would be confined to the export tax revenue which is hi times the international price rise P_2P_3).

FIGURE 1: Comparative static partial equilibrium effects on a food-importing economy of a higher international price for food



1.2 Risk considerations associated with stability of markets

If OECD countries were to fully liberalize their food markets, this would mean reductions in the degrees to which they export their domestically generated market instability and insulate their domestic market from international price fluctuations. The net effect of several large countries liberalizing in this way would be a reduction in the degree of fluctuation in international food prices. Insofar as developing countries transmit those fluctuations to their own domestic markets, and insofar as their food producers and consumers are averse to risk, welfare in those countries would be enhanced by the reduction in food price instability that would follow from the reductions in protectionism and insulation in OECD countries.

1.3 Distributional considerations within developing countries

To focus only on the net national welfare change, as in Section 1.1, is to mask the important fact that there are large welfare transfers between groups within each developing country. Typically, the gain to producers and the loss to consumers, following a rise in international food prices that would result from agricultural trade liberalization in OECD countries, will be much greater than the net change in national welfare which, in the absence of distortions in the developing country, is simply the difference between these two. This is especially so if a developing country is and remains close to self sufficient in food products. As well, in most low-income countries the number of people who are net sellers of food is well above the number who are net buyers of food, and the former group is usually poorer on average than the latter group. Thus in terms of numbers of people affected and in terms of income inequalities, the food price rise might well be judged to be an improvement in social conditions.

1.4 Dynamic effects through induced innovations

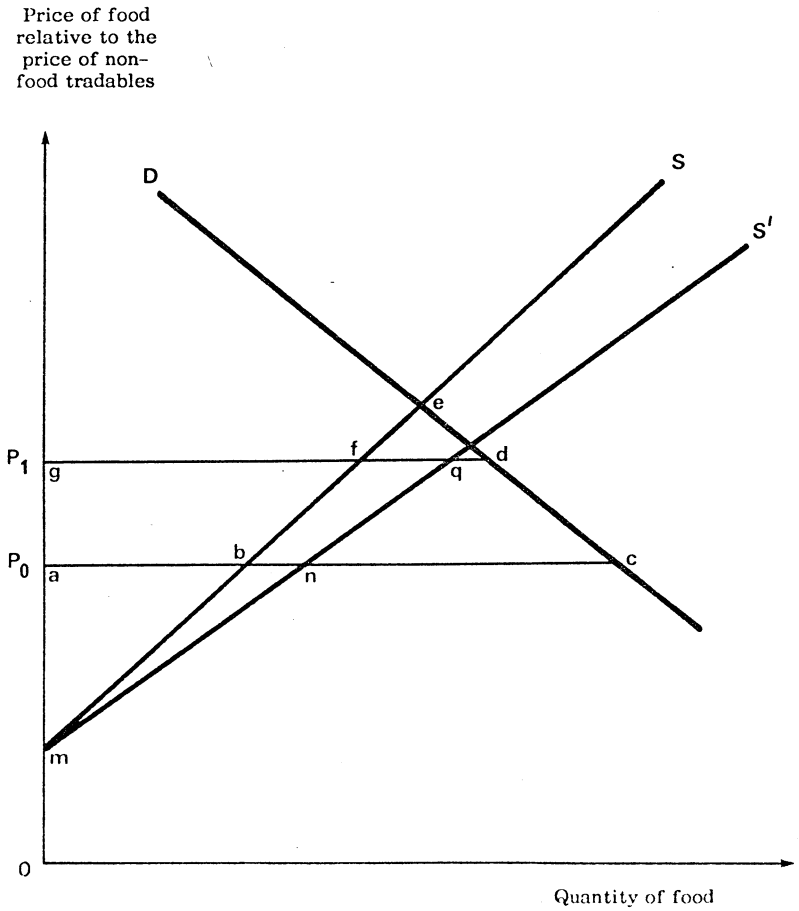
The above comparative static view ignores the dynamics of innovation. It is likely that the rate of induced technical change in a sector is positively related to

the sector's expected mean level of profitability (Ruttan 1982; Alston, Edwards and Freebairn 1988). It is probably also negatively related to the expected variability of profits through time. Therefore the permanent reduction of protection which would lower domestic food price levels (and perhaps their stability) in industrial countries on the one hand, and the once and for always increase in the level and stability of food prices in developing countries on the other, following a liberalization of OECD agricultural policies, is likely to boost agricultural productivity growth in developing countries while slowing it in industrial countries. (This would be especially so if some of the gains to OECD countries from their trade liberalization were to be redistributed in the form of increased foreign aid to agricultural research programs in developing countries.)

The welfare effects of this in a developing country are shown in Figure 2 where it is assumed (a) that the rise in the average international price for food and the greater stability of that price level has induced a shift in the country's food supply curve, for example from S to S'; (b) that the net effect of the faster shift of food supply curves in developing countries as a group, the slower shift in the food supply curves of industrial countries, and the increased excess demand for food in industrial countries because of their food policy reform, is to raise the mean level of the international price of food; and (c) that the increase in the international price is passed on to the domestic food market in the developing country.

In the case of a food-importing developing country faced with a rise in the price of food from P_0 to P_1, consumer welfare is still reduced by area acdg in Figure 2 but producer welfare is increased not just be area abfg but also by area mqf less the amortised cost of the research which generated the shift in the supply curve (assuming producers paid for that research). It is possible that the gain in producer welfare could outweigh the loss in consumer welfare in this dynamic case, **even if the country were to remain a net food importer.** This would be the case if area mqf minus the amortised cost of research exceeded area bcdf, which is more likely the larger the shift in the supply curve and the smaller the cost of the investment required to generate that shift, ceteris paribus.

FIGURE 2: Dynamic partial equilibrium effects on a food-importing economy of a higher international price of food

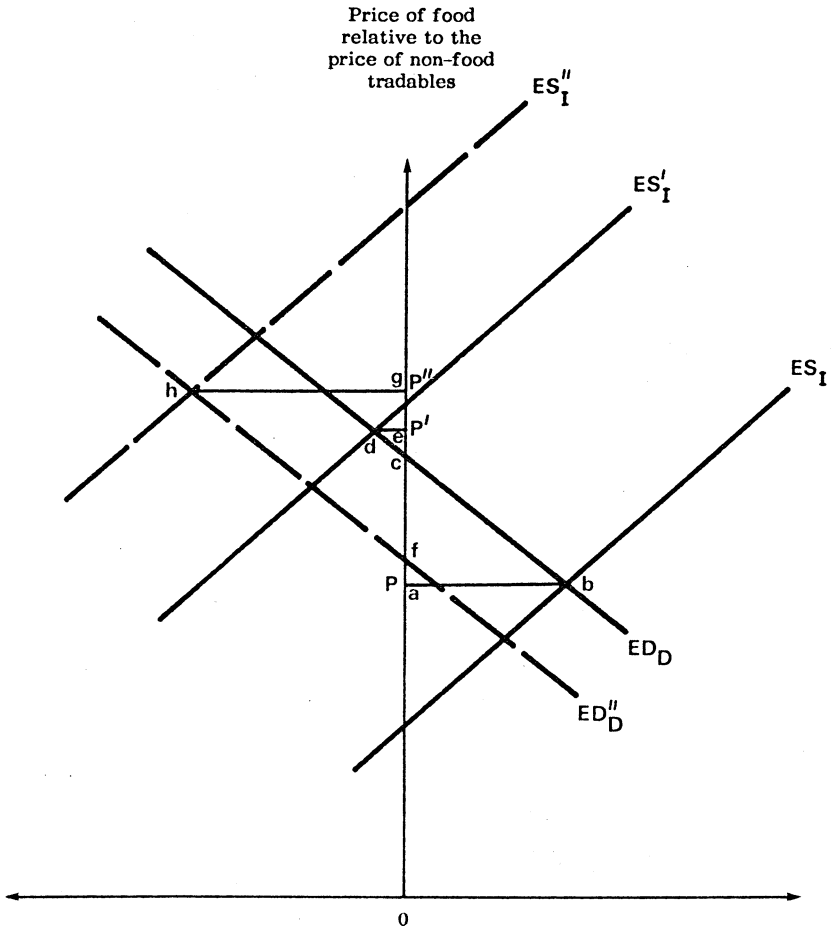


For the food-exporting developing country, dynamic considerations simply add further to their positive net benefit from the international food price rise.

To examine the trade and welfare effects for developing countries as a group vis-a-vis industrial countries, it is helpful to use Figure 3 which depicts the international market for food. In the absence of liberalization the excess supply curve for OECD or industrial countries is ES_I and the excess demand curve for developing countries is ED_D. (Centrally-planned Europe is ignored to simplilfy the diagram.) With liberalization in the OECD their excess supply curve is assumed to shift to ES'_I after full adjustment and normal technical change. As a result the international food price is P' rather than P. If this was the end of the story, developing countries as a group would lose in the case illustrated because, even though they have switched from being net importers to being net exporters of food, the welfare triangle ced is less than abc (c.f. the individual developing country effect of a shift from P_0 to P_2 in Figure 1). But what if, in the process of moving to a new long-run equilibrium following liberalization, technical change were to be faster in developing countries and slower in the OECD than assumed above? In that case there is a higher probability of developing countries being net gainers. For example, suppose the OECD curve shifted not to ES'_I but to ES''_I and the developing countries' curve shifted to ED''_D in Figure 3 because of changes in the inducement to innovate or import superior technologies from abroad. Then the international price would be P" (which could be higher or lower than P'). In this case if area fgh exceeded area abc by more than the amortized cost of extra agricultural research, developing countries would have gained.

Not mentioned to date is the effect of liberalization on national income levels and their growth rates, which in turn affects the demand for food. Since food products valued at the farm gate account for less than 5 per cent of national income and expenditure and have a low income elasticity of demand in the advanced industrial countries, this second-round effect on the ES''_I curve can be

FIGURE 3: Partial equilibrium effects on the international food market and on welfare in developing countries of liberalizing OECD food policies



ignored. For developing countries it would not be insignificant, however. Higher national incomes would ensure the $ED"_D$ curve was somewhat steeper and further to the right in Figure 3 (given that the income elasticity of demand for food is positive and the price elasticity of food demand declines as incomes rise in developing countries). But higher incomes also would affect the demand for other tradables and for nontradable goods and services, a point which is taken up in Section 1.9 below.

1.5 What if developing countries also liberalized their own food markets?

So far it has been assumed that developing countries do not distort their own food markets. To the extent that they in fact do, the economic gains to developing countries could be even greater if those distortions also were to be removed. In the case of foods grown in temperate zones, developing countries on average (across all countries and commodities) probably keep the domestic price level close to the international price level than OECD countries but still above it at official exchange rates (Tyers and Anderson (1986) and Table 1 below). Thus a liberalization of those markets as well would raise further the international price of temperate foods in aggregate. In addition, there would be the usual gains to each liberalizing country from removing differences in rates of assistance/taxation between the various food markets within its food sector.

Furthermore, if all developing countries reduced their market-insulating behaviour, the instability of international food prices would be reduced even more than if just OECD countries were to liberalize. While the latter may raise the extent of price fluctuations in the developing countries that currently have the most insulated food markets, it would reduce fluctuations in the somewhat more-open, less-insulated economies.

Whether food consumers or producers in developing countries would be better or worse off depends on whether the terms of trade change more or less than offsets

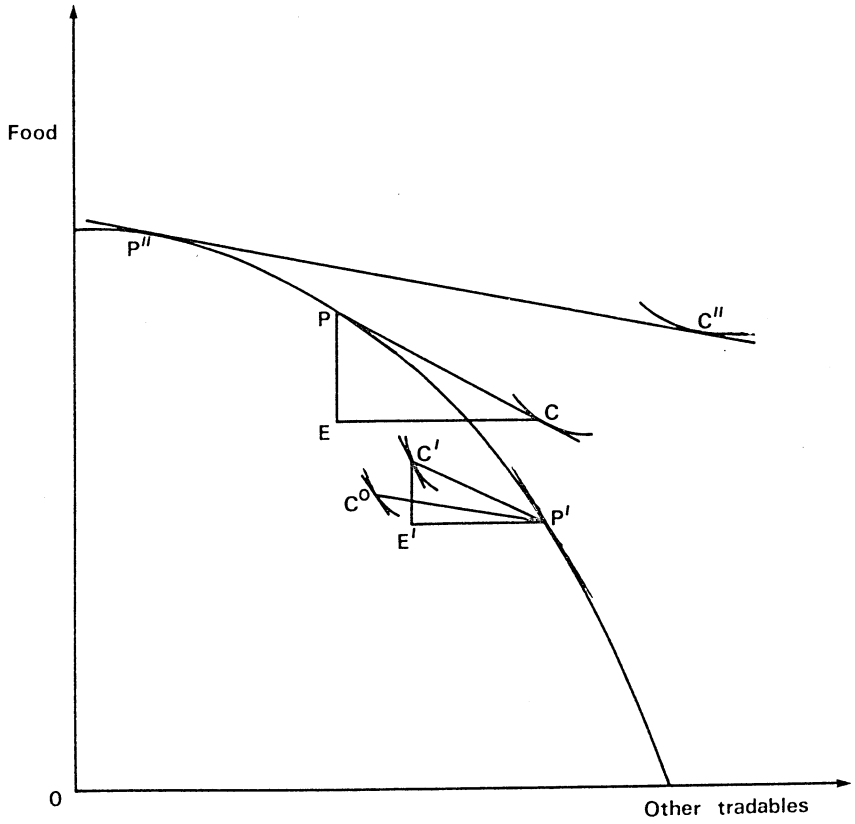
the effect on domestic prices of eliminating the country's own food policy. The net change in national economic welfare also depends on whether prices in other sectors are distorted and whether the net distortion in the relative domestic price of food is increased or decreased, a point to which we now turn.

1.6 What if developing countries liberalized their industrial and foreign exchange markets as well?

The World Bank/IFPRI study led by Krueger, Schiff and Valdes (1988) shows clearly that agricultural production is effectively taxed and food consumption subsidized in developing countries not so much directly but rather in indirect ways, particularly via manufacturing protection policies and overvalued official exchange rates. According to the Krueger et al. estimates, these indirect ways of lowering the relative price of food much more than offset the positive effect on the food sector of export taxation of non-food primary products. Reducing the latter distortions would give a tremendous boost to farmers in developing countries, and alone would be sufficient to turn many food-importing poor countries into food exporters. In the absence of these policy distortions in non-food sectors such developing countries (i.e. those with a natural compartive advantage in food production) would gain unequivocally from the international price change that would accompany OECD agricultural trade liberalization. However, in the presence of price distortions in non-agricultural sectors they may not gain.

This point is illustrated easiest with the help of the general equilibrium diagram in Figure 4. The slope of line PC represents the pre-liberalization international price of other tradables relative to food. If the developing economy is distorted by, for example, trade restrictions which alter its domestic price ratio to the slope of the tangent at P', then instead of producing at P and consuming at C, as it would under free trade, this country produces at P' and consumes at C'.

FIGURE 4: General equilibrium effects in a developing country of a higher international price for food with and without reform to its own non-food policies



This means instead of **exporting** the quantity PE of food and importing EC other tradables, the economy **imports** C'E' food and exports E'P' other tradables. And its overall welfare is lower than it would be in the absence of its own trade restrictions, as indicated by the indifference curve through C' being below that through C. In this situation, an increase in the relative price of food internationally, from the slope of lines PC or P'C' to the slope of line $P'C^{o}$ (or P"C"), worsens welfare for this developing country if its government chooses to maintain the original domestic price ratio. This is shown by the move in the consumption bundle to C^{o}, which is on a lower indifference curve than is C'. Had this economy not used trade restrictions, on the other hand, its welfare would have **increased**: production would have shifted from P to P" and consumption from C to C", the latter representing a higher level of national welfare than at C. That is, a trade-restricting developing economy of the sort depicted in Figure 4 would be worse off as a result of OECD agricultural trade liberalization simply **because of its own policy choice**; a reform of its own policies would ensure it benefitted in a comparative static sense from liberalization of food policies in industrial economies.

Three caveats are worth noting at this point. The first is that if some of the increase in the relative price of food internationally is transmitted to the domestic market, and/or domestic price support for other tradables is lowered, then it is possible for this country to gain from that relative price change, **even if the developing country remains an importer of food.** In terms of Figure 4, all that is required is for P' to move sufficiently toward P, as a result of the higher relative price of food domestically, such that the new consumption point to the left of the new production point along a ray parallel to $P'C^{o}$ is on a community indifference curve further from the origin (but still within the production possibility curve) than the curve through C'. As Tyers and Falvey (1989) have pointed out in a somewhat different context, an important determinant of whether

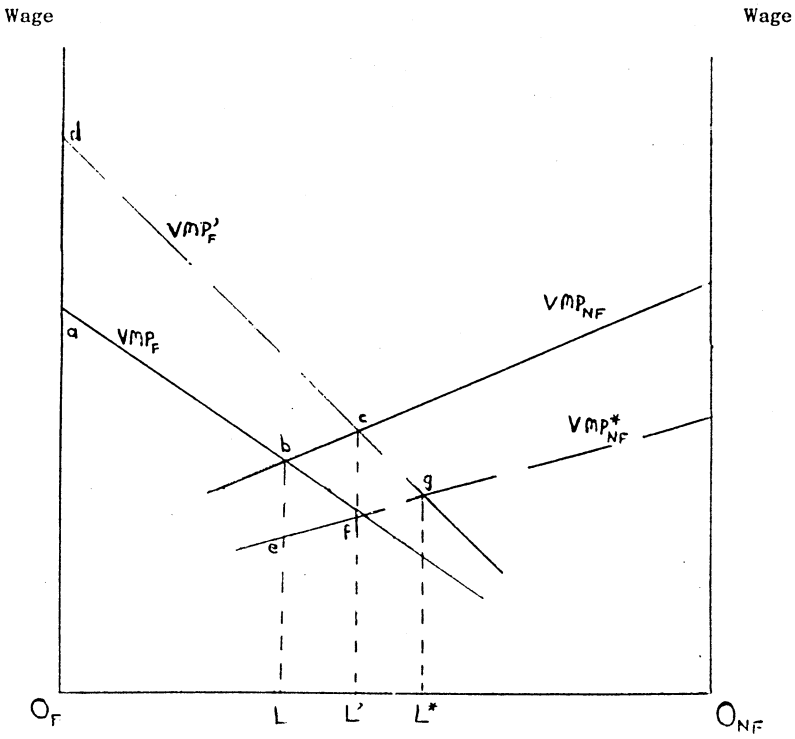
a distorting country gains from a change in its terms of trade is the extent to which that country insulates its domestic market from that relative price change in the international marketplace.

The second caveat is a corollary to the first: **even if the country would be a net food importer under free trade** and has anti-food sector policies in place, it is possible to be made better off by OECD liberlization which worsens its terms of trade if enough of the increase in the relative price of food internationally is transmitted to its domestic market and/or domestic price support for other sectors is lowered enough. This is a specific example of one of Bhagwati's (1971) general points that apparently paradoxical outcomes are possible in a distortion-ridden economy.

And thirdly, if the developing country's own policy bias against the food sector is not sufficient to have switched it from being a food exporter to a food importer, then that country would benefit from an increase in the relative price of food internationally even if none of that increase is transmitted to the domestic market or if there is no reduction in price support for other tradable sectors.

Another useful way to illustrate the general equilibrium gains on the production side of the developing economy from an increase in the international price of food is with the help of the beaker diagram in Figure 5. If we assume both the food sector and the aggregate of other sectors each employ a specific factor plus intersectorally mobile labour, then the value of marginal product of labour curve in the food sector with origin O_F can have superimposed on it the mirror image of a similar curve for all non-food sectors with origin O_{NF}, positioned such that the length of the horizontal axis represents the economy's total labour supply. If VMP_F and VMP_{NF} are the two sectors' labour demand curves at domestic prices, then at full employment O_FL units of labour will be employed in the food sector and LO_{NF} in non-food production. Should the international price of food rise, the VMP_F curve shifts to VMP'_F, (and moreso the

FIGURE 5: Production efficiency gains resulting from international and domestic price changes in a developing country



more the price rise induces farm productivity growth), which encourages labour to move from non-food to food production. In the absence of distortions the welfare gain on the production side is area abcd - which may be more or less than the loss to food consumers from the higher price, depending on whether the country is a net exporter or importer of food. However, suppose established non-food policies have raised the domestic price of non-food above the international price such that the social value of marginal product of labour curve for the non-food sector is only VMP^*_{NF}. In that case the gain to society on the production side includes not just area abcd but also area befc, the latter being the difference between the private and social values of the LL' units of labour in the non-food sector. If these non-food policies also were to be liberalized, an additional L'L* units of labour would transfer to food production and there would be a further welfare gain, area cfg. It is therefore possible that a food-importing country, whose food consumers lose more from the higher food price than food producers gain (viz. area abcd), may nonetheless be better off because area befc with or without area cfg exceeds the difference between the food consumers' loss and the food producers' gain.[1] These areas, incidentally, play an important role in the general equilibrium results reported in Loo and Tower (1989).

1.7 Liberalizing trade in tropical agricultural products also

If OECD countries also liberalized their import restrictions on tropical agricultural and forest products (particularly processed products), it is even more likely that food-importing developing countries would be net beneficiaries. This is because many of them are net exporters of tropical agricultural products. In terms of Figure 1, if P_2 was the pre-liberalization price of tropical farm products and P_3 the post-liberalization price, the developing country would gain area hijk from the international price rise.

Such a liberalization on the part of OECD countries might well stimulate developing countries to reduce their discrimination against these products also.

Currently, many tropical countries tax their exports of these products not only directly but also indirectly by way of the industrial protection and exchange rate overvaluation policies mentioned in the previous section. Again such reforms would increase the prospects of developing countries gaining from OECD agricultural trade liberalization under the Uruguay Round. The comparative static argument can be seen from Figure 4 simply be broadening the title of the vertical axis to 'all agricultural and forest products'.

1.8 What if non-agricultural trade also is liberalized in the OECD?

It needs to be kept in mind that agricultural trade reform is not being considered in isolation. Manufacturing and service sector trade negotiations are also part of the Uruguay Round, including trade in labour-intensive manufactures and processed primary products. Thus even the developing countries with the strongest comparative disadvantage in food production might consider supporting agricultural trade liberalization in the Uruguay Round in return for concessions in the form of, for example, lower barriers in OECD countries to imports of processed tropical products or light manufactures from developing countries. With the current Multifibre Arrangement expiring in July 1991, the time is ripe for seeking improved market access for textiles and clothing in particular. Should that eventuate, it would also have the feedback effects of expanding the demand for natural fibres which would in turn help farmers in numerous developing countries including Bangladesh (jute), Egypt (cotton) and Southern Cone countries (wool).

If trade is liberalized globally in non-agricultural products as well as in farm products, then the change in the international terms of trade, instead of being from the slope of line PC to that of P"C" in Figure 4 in the case of just food trade liberalization, would be smaller or may even be in the opposite direction. Computable general equilibrium models of the world economy as a whole are

needed to estimate the possible direction and extent of such changes, early prototypes of which have been developed by John Whalley and his colleagues and by Burniaux and Waelbroeck (1985). Ideally they would be ones with growth included endogenously so that the growth-stimulating impacts of liberalization are captured (Helpman 1988). And they would of course also include nontradable sectors to capture endogenously the indirect effects of the above adjustments on the real exchange rate, to which we not turn by way of conclusion to this section.

1.9 Indirect effects through adjustments in the market for nontradables

The possibility of a developing country gaining from OECD agricultural trade liberalization is amended further when one considers the indirect effects of such liberalization on the market for nontradables in that country.

Consider Figure 2 again, which shows the partial equilibrium effect of an innovation induced by an international price-raising liberalization affecting food products. The liberalization by OECD countries benefits food producers in this developing country. That income growth will be spent, however, which will shift to the right the income-compensated demand curves not only for food (to D' in Figure 6) which reproduced Figure 2) but also for other tradables and for nontradable goods and services (assuming they are substitutes for food in final consumption, added to which is the possibility they are inputs into food production). In a slightly different context this has been labelled the 'spending effect' of the boom in the agricultural sector (Corden 1984). These rightward shifts in the demand curves for non-food products are additional to the shifts due to the rise in the price of food. The sum of these two changes is represented by the shift from D to D' in Figure 7 for nontradables and in Figure 8 for non-food tradables.

FIGURE 6: Feedback effects from the market for nontradables in a food-importing economy of a higher international price for food

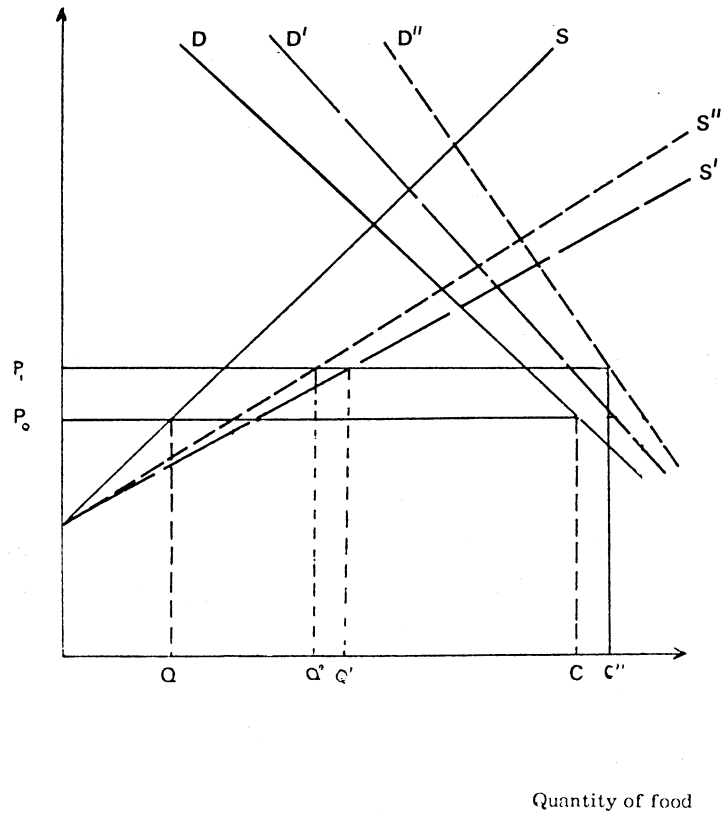


FIGURE 7: Effect of liberalizing OECD food policies on the market for nontradables in a developing country

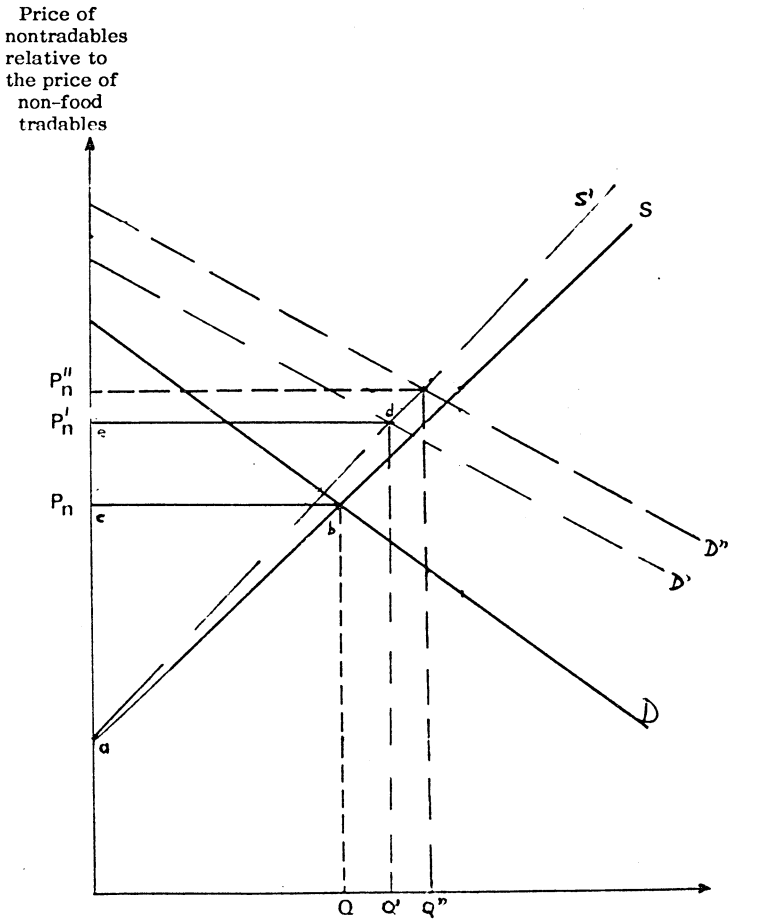
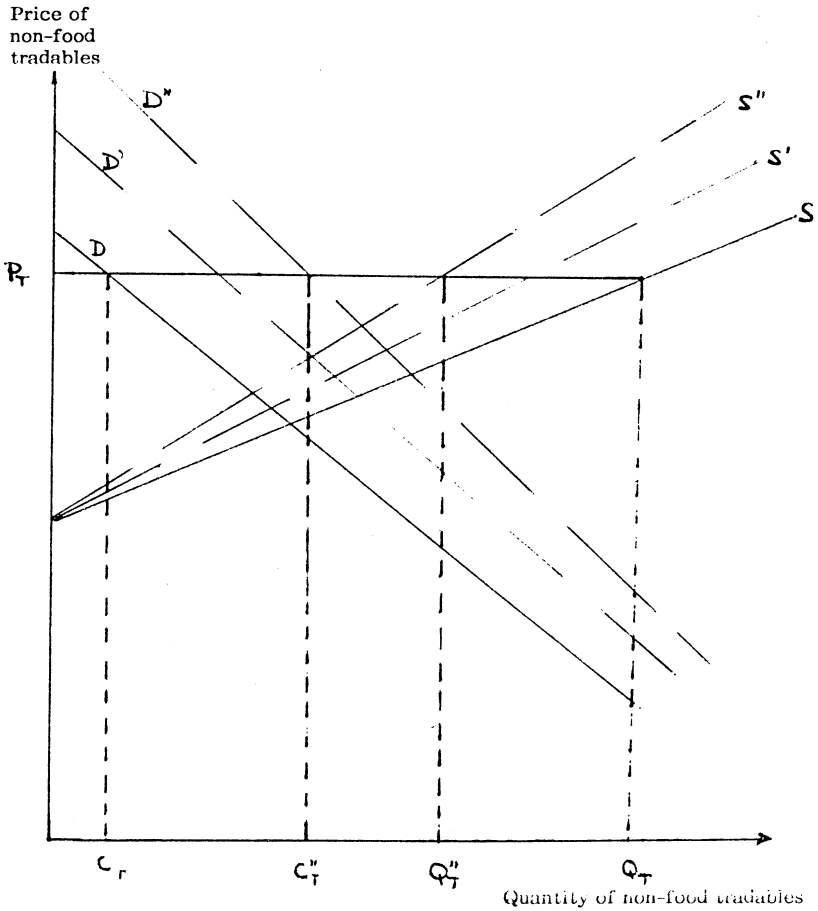


FIGURE 8: Direct plus indirect effects on the market for non-food tradables in a food-importing economy of a higher international price for food



A second point to note from Figure 6 is that the quantity of mobile resources used in the production of food is likely to have expanded with output increasing from Q to Q'. This increased demand for mobile resource bids up their price (see the earlier Figure 5) and thereby raises the supply curve in other sectors, as does the diversion of investable resources to agricultural research. This 'resource-movement effect' (to use Corden's (1984) term) is represented by the shift from S to S' in Figure 7 for nontradables and in Figure 8 for non-food tradables.

Since nontradables by definition must be produced domestically, such changes require the price of nontradables (relative to the price of non-food tradables) to rise from Pn to P'n in Figure 7. The quantity of nontradables may increase or decrease depending on the relative extent of the supply and demand curve changes.

These changes in the market for nontradables have two effects on tradables markets. The net incomes of producers of nontradables will increase from area abc to area ade, which shifts rightward the demand curves for food and other tradables (as well as for nontradables) — a shift that is additional to the rightward shift in those demand curves due to the increase in the price of nontradables insofar as they are substitutes for tradables. And if there is a bidding up of the price of mobile resources to attract them into nontradables production, this raises costs of producing tradables and thereby shifts upwards the supply curves for food and for other tradables. These shifts are represented in Figures 6 and 8 by the shift from D' to D" and from S' to S". The quantity of food produced domestically is thus Q" which is more than before the liberalization (Q), while the quantity of food consumed is now C" which may be more or less than the original consumption level C. Net imports of food must necessarily be less, however, because the value of non-food exports with which to pay for food imports has shrunk: export revenue is now P_T times $C"_T$ $Q"_T$ instead of P_T times C_TQ_T (see Figure 8), and since the

price of food imports has risen the volume of food imports must shrink to an even smaller proportion than $C''_T Q''_T / C_T Q_T$ of QC for the trade balance to be restored. That is, net imports of food are even smaller once these indirect effects are taken into account than when only the direct effects on the food sector are considered. Since in what follows only the food sector effects are included, it should be kept in mind that the analysis below understates the reductions in net food imports.

2. ESTIMATING THE MAGNITUDE OF THE DIRECT EFFECTS

2.1 A multicommodity model of world food markets

Numerous models are now available for estimating the magnitude of the various effects discussed in Section 1. One of the early models developed for this type of policy analysis is by Rod Tyers (1984, 1985). It has since been updated and revised a number of times, including for reports published by the World Bank and the Trade Policy Research Centre. As it happens, though, most of its applications to date have focussed on industrial country interests (e.g. Anderson and Tyers (1984, 1986, 1987, 1989), Tyers and Anderson (1986, 1988) and Tyers and Falvey (1989)). It is a dynamic, stochastic, multi-commodity simulation model of world food markets involving the major traded staples: wheat, coarse grain, rice, meat of ruminants (cattle and sheep), meat of non-ruminants (pigs and poultry), dairy products and sugar. These seven commodity groups account for about half of world food trade (edible oils and beverages account for most of the rest) and one tenth of global trade in all commodities. This grain, livestock products and sugar (GLS) model is not a general equilibrium model, in that markets for other tradable goods, services and physical and financial factors of production and for non-tradables are excluded, so currency exchange rates have to enter as exogenous variables. So too do productivity growth rates. Offsetting these drawbacks, however, are the model's following features:

- it is global in coverage, involving 30 countries or country groups spanning the world, so that the international as well as the domestic effects of policy or structural changes in one or more countries or commodities can be determined endogenously;

- it incorporates the cross effects in both production and consumption between the interdependent grain, livestock product and sugar markets;

- it has a dynamic mode, in which the effects of policy or structural changes in a particular year can be simulated for every subsequent year, as well as a static equilibrium mode which can simulate the effects of those changes after any desired degree of adjustment (full adjustment, for example, being provided simply be using the long-run elasticities, as illustrated below);

- it is stochastic in that production uncertainty is included via probability distributions associated with each commodity's production level;

- stock-holding behaviour is endogenous, based on empirical analysis of stock level responses to price and quantity changes in each country; and

- policy is endogenous to the extent that price transmission equations are used to incorporate the two key features of each country's food price policies, namely, the protection component, which raises the trend level of food prices faced by domestic producers and consumers around which prices fluctuate, and the stabilisation component, which allows trade fluctuations to limit the degree to which domestic prices change in response to shifts in domestic supply or in international prices.

Production behaviour is represented by Nerlovian reduced-form partial-adustment equations which are log-linear, resulting in constant supply elasticities. In dynamic mode, production in each country is subject to random

disturbances from the distribution of residuals to the fitted production equations and to exogenously set productivity growth rates which shift out the supply curves each year. Allowance is also made for the effect on production of land set-aside policies such as those used in the United States during the 1980s.

Direct human consumption is assumed to be characterised by income and price elasticities of demand which are set to decline slightly over time as incomes grow. The demand for livestock feed is based on input-output coefficients for each livestock product which again are assumed to change over time as the proportion of livestock output that is feed-based changes.

Policies affecting domestic prices are incorporated via econometrically estimated price transmission equations for each country and commodity. These equations capture both the protection and the stabilisation components of food price and trade policies. They are based on estimates of reduced form Nerlovian partial adjustment equations which distinguish short-run from longer-run elasticities of price transmission. Separate elasticities are used for producer and consumer prices. In general, even the long-run price transmission elasticities are less than unity, reflecting the prevalence of non-tariff protection instruments in food markets. In the face of volatile and declining real prices in international commodity markets, governments limit the extent to which both the long-run trend and the short-run changes in domestic prices follow those of international prices. The smaller the short-run elasticity of price transmission in relation to its long-run counterpart, the greater the degree of market insulation and the more sluggish is the eventual transmission of any sustained change in the international price. In a few extreme cases domestic prices are completely insulated, which means both the short- and long-run elasticities of price transmission are zero.

The estimated welfare effect of a policy change has four components. The benefit to food consumers is the expected Hicksian equivalent variation in income;

the benefit to food producers is the expected change in producer surplus; the government revenue benefit is the expected net budgetary effect of food producer, consumer and trade taxes and subsidies; and the storage benefit is the expected increase in profits from stockholding. All benefits are evaluated assuming risk-neutrality. These are thus partial equilibrium measures only: whether the total general equilibrium effects are larger or smaller depends crucially on whether there are other distortions in the economy which affect food markets, as discussed above in Section 1.6.

Structurally, the model is simply a set of expressions for quantities consumed, produced and stored, each of which is a function of known past prices and endogenous current prices. The dynamic version of the model is solved iteratively by starting from the 1980-82 base period and beginning each subsequent year with the assumption that all prices are the same as those in the preceding year, generating random disturbances in production and calculating new production, consumption and closing stock levels in each country. The resulting excess demands are then totalled and international prices adjusted to move world markets towards clearance. The procedure is then repeated until a satisfactory degree of market clearance has been achieved for each commodity. Thus, the model selects that series of international and domestic prices, production, consumption, and closing stock levels which simultaneously clear all markets in each successive year, from 1983 to 1995. Once 100 simulations of this type have been completed, each using a different set of generated random disturbances from the distributions of each error term, forecast means and standard deviations are calculated for all key variables in the model for each year of the simulation period. The solution procedure is conventional, but it is not based on a standard software package. It is described in more detail for an earlier version of the model in Tyers (1984, 1985) and for the version used here in an appendix of Tyers and Anderson (forthcoming).

2.2 Extent of distortions in world food markets

Any estimate of the effects of a future liberalization of trade in agriculture necessarily has to be forecast-dependent. That is, the model used first has to forecast a reference scenario for the world economy, against which liberalization scenarios can be compared. In the present case in which the GLS model forecasts to 1995 from a base period of 1980-82, a wide range of reference cases could be produced by altering assumptions about productivity growth rates on the supply side, about income and population growth rates on the demand side, and about the various elasticities of demand, supply and price transmission. Also important are the estimates of the distortions in food markets in the base years and the assumptions made about how government policies respond to changing market conditions over the forecast.

For the reference case used to produce the results we have published in recent years, the GLS model forecasts that the average real international food price by 1995 would decline to 54 per cent of the (very high) 1980-82 level. This scenario assumes developing countries retain their relatively low rates of transmission of international price changes to their domestic markets even in the long run. A consequence of this is that developing countries are forecast to have domestic prices somewhat above border prices on average by 1995.

It is possible, however, that developing country governments who so often favourconsumer interests over farmers would, during a long period of low international prices, transmit more of the change in those prices to their doemstic markets than they have tended to do in the past. The net import demand for food by developing countries would be greater in that case, which would reduce the decline in real international food prices. The extreme case would be where they fully transmit those changes in the long run, thereby returning their nominal protection coefficients in long-run equilibrium to those of the base period. In this alternative reference scenario the price level by 1995 is forecast to decline to 69 per cent instead of 54 per cent of the 1980 82 level.

These two forecasts are on the lower and upper bounds of other recent forecasts. The World Bank (1989, Table 3), for example, forecasts real international food prices in 1995 to be 60 per cent of the 1980-82 level. And the U.S. Department of Agriculture forecasts grain and soybean prices for the year 2000 to be about 70 per cent of the 1980-82 level and sugar, meat and dairy prices to be somewhat higher (Roningen, Dixit and Seeley 1989).[2] Thus the first set of results presented below, which uses the standard reference run with imperfect price transmission, is compared with a second set of results based on the assumption of perfect price transmission in the long run for developing countries and hence lower domestic food prices in those countries and higher international prices.

The domestic-to-border price ratios (or nominal protection coefficients in the case of producer prices) to be used are shown in Table 1 for all countries and country groups represented in the GLS model. These are the forecast protection coefficients for 1995 under the standard and alternative refernece runs. The forecast ratios for the alternative reference case involving full price transmission are similar for developing countries to those in the 1980-82 base period; furthermore, 1995 protection coefficients in OECD countries are closer to 1980-82 levels in the alternative reference case because international prices fall less over th forecast period in that case.[3]

Food prices are affected by government policies not only directly but also indirectly via overvalued (or undervalued) exchange rates and industrial protection policies. The latter are of comparatively minor importance in OECD countries but, as Krueger, Schiff and Valdes (1988) and others have stressed, they have typically had sizeable negative effects on relative food prices in developing countries. Based on the Krueger et al. estimates of these indirect effects for 17 developing countries, and in the absence of reliable estimates for other countries, we have categorized developing countries into one of three groups: those with no net indirect distortions affecting agriculture (South Korea and Taiwan); those with non-food policies which are equivalent to an additional effective tax of 15 per

cent on food prices (Bangladesh, Brazil, China, India, Indonesia, North Africa and the Middle East, South Africa and Thailand); and those whose non-food policies are equivalent to an additional effective tax of 30 per cent on food prices (all other developing countries). The domestic-to-border price ratios shown in Table 1 are the GLS model's estimates of the distortion to food prices without and then with the above amounts included to account for the indirect distortions. Even with the indirect distortions included these ratios are still not as much below unity as it assumed in Loo and Tower (1989) and Zietz and Valdes (1989). Thus results generated with these parameters can be expected to be less likely to show developing countries gaining than these other recent studies.

What Table 1 suggests is that the OECD countries' policies are highly protectionist toward farmers and hurt consumers and taxpayers, whereas the staple food prices of developing countries are somewhat closer to but still above international prices converted at official exchange rates. By contrast, tropical export crops and other primary exports are often heavily taxed by developing countries. If our adjustments for policies which indirectly affect food prices are correct, the second and fourth columns of Table 1 indicate that policies in total are likely to be neutral to or in many cases negative toward farmers and in favour of food consumers in developing countries.

2.3 Effects of agricultural trade liberalization

Two sets of results are presented here for theyear 1995. The first is based on the standard reference scenario using the price transmission elasticities estimated from past price data. The second assumes eventually full transmission on the part of developing countries to the decline in international food prices over the 1980-1995 period. Since the latter is probably an over-correction to the limited adjustment assumed in the standard reference cause, these two sets of results can be considered upper- and lower-bound cases with the most likely situation being somewhere in between.

TABLE 1: Projected average domestic-to border price ratios for food products[a], 1995

	If developing countries insulate domestic markets somewhat		If developing countries transmit price changes fully	
	direct	direct plus indirect	direct	direct plus indirect
OECD COUNTRIES[b]				
Total	1.84(1.86)	1.84(1.86)	1.69(1.74)	1.69(1.74)
DEVELOPING COUNTRIES[c]				
Bangladesh	1.24(1.64)	1.06(1.41)	0.96(0.91)	0.81(0.78)
China	0.97(1.01)	0.82(0.86)	0.99(0.95)	0.82(0.82)
India	1.63(1.57)	1.39(1.33)	1.05(1.01)	0.87(0.87)
Indonesia	1.57(1.51)	1.34(1.28)	1.33(1.19)	1.12(1.02)
Korea, Rep.	3.60(2.99)	3.60(2.99)	2.60(2.36)	2.60(2.36)
Pakistan	1.35(1.38)	0.98(1.01)	1.12(1.07)	0.77(0.79)
Philippines	1.50(1.55)	1.05(1.09)	1.14(1.15)	0.79(0.80)
Taiwan	1.45(1.39)	1.45(1.39)	1.53(1.38)	1.53(1.38)
Thailand	1.03(1.14)	0.88(0.97)	0.93(1.01)	0.79(0.87)
Other Asia	1.05(1.27)	0.74(0.90)	0.82(0.83)	0.57(0.59)
Argentina	0.83(0.84)	0.58(0.59)	0.86(0.86)	0.61(0.61)
Brazil	0.84(0.84)	0.72(0.72)	0.90(0.90)	0.76(0.77)
Mexico	1.52(1.41)	1.06(0.99)	1.47(1.22)	0.98(0.85)
Other Latin America	0.86(0.90)	0.60(0.63)	1.00(1.01)	0.70(0.71)
Egypt	2.02(1.97)	1.73(1.67)	0.98(0.95)	0.76(0.81)
Nigeria	2.36(2.42)	1.65(1.70)	1.90(1.88)	1.33(1.32)
South Africa	1.35(1.40)	1.15(1.19)	1.24(1.23)	1.01(1.05)
Other Sub-Saharan Africa	1.30(1.36)	0.92(0.96)	0.86(0.88)	0.60(0.62)
Other Nth Africa & M.East	2.57(2.46)	2.18(2.09)	1.26(1.24)	1.05(1.06)
Total	1.27(1.37)	1.04(1.12)	1.05(1.04)	0.84(0.86)

a The ratio of domestic producer (consumer) prices to comparable prices at the country's border for grains, meats, milk products and sugar, averaged using production valued at border prices as weights.

b Here, and in the rest of the paper, Turkey is included as one of the 'Other North Africa and Middle East' developing countries.

c The developing country ratios in columns 2 and 4 include the indirect effect of overvalued exchange rates and of direct distortions to other tradable sectors' prices (most notable through industrial protection). Based on estimates published by Krueger, Schiff and Valdes (1988) and others, the adjustments to the direct domestic-to-border price ratios involved reducing them by 0.15 for Bangladesh, Brazil, China, Egypt, India, Indonesia, other North Africa and Middle East, South Africa and Thailand and by 0.30 for all other developing countries (except Korea and Taiwan for which, as with OECD countries, no adjustments were made).

Source: Tyers and Anderson (forthcoming).

For each set of results the relevent reference case is compared in turn with three alternative scenarios, each with either (a) exogenously set price-independent farm productivity growth or (b) productivity growth which is also affected by the producer price. In the latter case the price-independent rate of shift of the supply curve is assumed to be an extra five percentage points by 1995 for each ten per cent by which the producer price increases, and vice versa for price decreases. This adjustment is similar to increasing all long-run supply elasticities by 0.5 in terms of its net trade impact. A justification for expecting the long-run elasticity to be greater is that this is assumed to be a permanent and unprecedented change in world food policies which stimulates developing countries to reduce their current underinvestment in agricultural research and causes OECD programs of excessive investment in research (e.g. Japanese rice?) to be cut back.

The three alternative scenarios are as follows:

(1) complete liberalization of food policies in all OECD countries,

(2) complete liberalization of food policies not only in all OECD countries abut also in all developing countries, and

(3) as for (2) except liberalizing other trade and exchange rate policies in developing countries as well.

The first of these alternative scenarios corresponds to Sections 1.1 to 1.4 above, the second to Section 1.5, and the third to Sections 1.6 and 1.7 at least insofar as non-food policies directly affect food prices domestically. Sections 1.8 and 1.9 cannot be addressed with the GLS model. The motivation for considering scenario 3 is that OECD countries are pressuring developing countries to undertake such reforms to improve the latter's prospects for repaying their loans to the former and they may intensify that pressure through the Uruguay Round negotiations.

The results presented in Table 2 are derived using the standard reference case involving imperfect long-run price transmission, building on results presented in an earlier paper (Tyers 1989a); those in Table 3 assume developing countries eventually

fully transmit the declines in international food prices expected over the forecast period to 1995. To simplify the presentation, the changes in centrally planned Europe are not included in the tables, and the details for the various countries and commodities are postponed until later in the paper.

The first point to note, from row 2 of Table 2, is that if OECD food policies were completely liberalized, international food prices would rise 30 per cent. Food self sufficiency in 1995 would be 92 instead of 105 per cent in OECD countries, and self sufficiency in developing countries would be 104 instead of 95 per cent. While this change would enhance welfare for food-sector agents in the OECD by an estimated $48 billion per year (in 1985 US dollars), it would in this scenario yield a net decline for those agents in developng countries, by $13 billion, despite the fact that developing countries become slight net exporters of food as a result of the higher international prices following OECD liberalization. This is the conventional result discussed in Section 1.1 and is similar to that obtained by other modellers (e.g. OECD (1987), Valdes (1987), Parikh et al. (1988), and Ronigen and Dixit (1989)).

The above scenario 1a assumes productivity growth is independent of producer price changes. With the alternative assumption used in scenario 1b, which has an effect similar to assuming long-run supply elasticities are greater by 0.5, supplies and hence self sufficiency ratios in OECD countries are less and those in developing countries are greater. The net change in world supply is only a small positive amount so that international food prices are similar in both scenarios (28 instead of 30 per cent greater than in the reference case). However, the welfare effects for developing countries are very different. Ignoring the change in the cost of agricultural research needed to alter the productivity growth rates, the welfare results suggest food-sector agents in OECD countries would be slightly better off (with consumers benefitting more than producers lose from slightly lower price in scenaria 1b compared with 1a), but food-sector agents in developing countries would hardly lose at all (only $2 billion per year in scenario 1b compared with a $13 billion loss in scenario 1a).

TABLE 2: Effects of removing food price distortions assuming incomplete price transmission in developing countries, 1995

Scenario	Percentage change in international price of food	Food self-sufficiency (production as a % of consumption)		Change in net economic welfare[a], in constant (1985) US$ billions per year	
		OECD countries	developing countries	OECD countries	developing countries
Reference	-	105	95	-	-
1. Liberalize OECD food policies					
a. exogenous productivity growth	31	92	104	51	-13
b. price-responsive prod. growth	28	85	108	52	-2
2. Liberalize OECD and developing country food policies					
a. exogenous productivity growth	46	93	102	60	17
b. price-responsive prod. growth	33	84	107	64	58
3. Liberalize OECD and developing country food policies and developing country non-food policies					
a. exogenous productivity growth	28	84	109	63	12
b. price-responsive prod. growth	15	74	119	69	60

[a] Welfare here refers only to agents in the food sector; welfare of agents in non-food sectors may also change.

Source: GLS model simulation runs.

Thus far we have simply repeated the results presented in Tyers (1989a). We now extend the analysis, along the lines discussed after Section 1.4. Should developing countries also liberalize their own food policies but leave their other distortionary policies in place, as in scenarios 2a and 2b, the lowering of their (on average positive) nominal protection rates to zero further boosts the international price for food. This has the effect of encouraging production and discouraging consumption in all countries, so the self sufficeincy ratios are similar in this second set of scenarios as in the first. It turns out that welfare improves even more for OECD countries when they are joined by developing countries in liberalizing food policies, by an extra $12 to $14 billion per year. The welfare of food-sector participants in developing countries, however, is much greater in this set than in the first set of scenarios. There would also be gains in efficiency of resource use (area befc in Figure 5) and indirect effects via the market for nontradables (see Section 1.9) that are not captured in this partial equilibrium model.

Suppose, however, that developing countries also were to liberalize their other trade and exchange rate policies and thereby remove the indirect distortions affecting food prices. If our projected domestic-to-border price ratios in columns 2 and 4 of Table 1 are accurate, and if it can be assumed that there are no net shifts of the food demand and supply curves as a result of general equilibrium adjustments, then the corresponding projected effects on prices, self sufficiency and welfare are as for scenarios 3a and 3b in Table 2. The boost such a reform would give to developing country farmers ensures international food prices would be higher by less than would be the case without the removal of those indirect disincentives. It also ensures greater food self sufficiency in developing countries and more food import dependence in OECD countries, especially if productivity growth is positively related to the price changes. OECD countries (who would be net importers) would gain even more in this pair than in the previous two pairs of scenarios, by a further $3 billion to $5 billion per year. And the benefit to food-sector participants in developing

countries would be similar in this set as in the previous set of scenarios, the domestic food price change being similar in the two cases after the different adjustments to international prices. Recall, however, that there is an additional gain in resource efficiency in this case that is not captured in this partial equilibrium model, represented by area cfg in Figure 5, not to mention the gain to consumers from the lowering of non-food prices.

Thus, even with this standard reference case, it appears unlikely that many developing countries would lose from OECD agricultural trade liberalization in the Uruguay Round if productivity growth is positively correlated with producer price changes to the extent assumed. Of course if developing countries were to respond to the opportunity provided by OECD food market liberalization by also liberalizing their own policies, they would be substantial net gainers in aggregate welfare terms as measured here.

Turning to the alternative reference case in which developing countries are assumed to fully transmit the decline in international prices expected through to 1995, the above conclusion is strengthened further. In particular in scenarios 1a and 1b of Table 3 in which OECD food policies alone are liberalized, developing countries gain from the liberalization, unlike in the cases presented in Table 2. In terms of Figure 3, areas dce and hfg both exceed area abc in the case of Table 3 results, whereas neither did in Table 2. International food prices rise by less than in Table 2 because the degree of protection of agriculture is less in this reference case (see Table 1; and see also Table 4 for the commodity detail of those price changes), but except in scenarios 1a and 1b the effects on self sufficiency and welfare are much the same as for Table 2. That is, both OECD and developing countries can expect to each gain up to $60 billion per year just from food sector adjustments to these policy changes alone; gains from adjustments by consumers and producers in other sectors would be additional. The gain to developing countries could be even greater of course if OECD countries chose to give some of their $60 billion gain to developing countries in the form of aid.

TABLE 3: Effects of removing food price distortions assuming full long-run price transmission in developing countries, 1995

nario	Percentage change in international price of food	Food self-sufficiency (production as a % of consumption)		Change in net economic welfare[a], in constant (1985) US$ billions per year	
		OECD countries	developing countries	OECD countries	developing countries
Reference	-	109	92	-	-
Liberalise OECD food policies					
. exogenous productivity growth	13	89	105	53	1
. price-responsive prod. growth	12	83	111	51	12
Liberalize OECD and developing country food policies					
. exogenous productivity growth	16	93	102	56	29
. price-responsive prod. growth	1	81	111	59	64
iberalize OECD and developing ountry food policies and develop- g country non-food policies					
exogenous productivity growth	0	84	109	58	24
price-responsive prod. growth	-3	74	118	61	56

[a] Welfare here refers only to agents in the food sector; welfare of agents in non-food sectors may also change.

Source: GLS model simulation runs.

TABLE 4: Effects of different liberalizations on international prices of various staple foods, 1995

(percent change from reference case)

	Wheat	Coarse grain	Rice	Ruminant meat	Non-ruminant meat	Dairy products	Sugar	WEIGHTED AVERAGE
With insulation by developing countries								
1. OECD food policy liberalization								
a. price-independent productivity growth	25	3	18	43	10	95	22	30
b. price-dependent productivity growth	19	2	2	39	8	90	27	28
2. OECD and LDC food policy liberalization								
a. price-independent productivity growth	51	16	41	41	-2	124	41	46
b. price-dependent productivity growth	36	9	17	26	-8	111	28	33
3. OECD food policy liberalization and LDC food and non-food policy liberalization								
a. price-independent productivity growth	32	2	19	23	-12	99	19	28
b. price-dependent productivity growth	20	-4	-5	7	-20	87	6	15
With no insulation by developing countries								
1. OECD food policy liberalization								
a. price-independent productivity growth	10	2	5	30	6	39	7	13
b. price-dependent productivity growth	9	2	3	24	6	37	9	12
2. OECD and LDC food policy liberalization								
a. price-independent productivity growth	15	5	-6	24	-2	80	5	16
b. price-dependent productivity growth	1	-5	-27	4	-12	66	-10	1
3. OECD food policy liberalization and LDC food and non-food policy liberalization								
a. price-independent productivity growth	1	-8	-21	8	-12	60	-12	0
b. price-dependent productivity growth	1	-7	-25	-2	-17	56	-19	12

Source: GLS model simulation runs

These effects are broken down by groups and by region in Tables 5 and 6, at least for scenarios 1b and 3b from Table 3. As one would expect from liberalization of just OECD food policies (Table 5), developing country consumers of food lose and farmers gain from the consequent rise in international food prices. Insofar as farmers make up the majority of households in developing countries and are poorer than their urban counterparts, this redistribution would constitute an improvement in equity within those countries. Furthermore, the majority of developing countries/country groups specified in the model are net gainers from OECD food policy reform in this scenario. That is, the net gain of $11.5 billion per year to developing countries as a group is not simply the result of a few large net exporters gaining at the expense of the rest. Moreover, gains accrue to some countries that otherwise would be net importers of these foods, namely, Pakistan, Mexico, Other Asia and Other Sub-Saharan Africa. This, together with the result that no developing country has to spend any more foreign exchange on food than in the reference case, comes about because of the assumed transmission of the change in international food prices to developing country markets and its positive impact on farm production and productivity growth more than outweighing its impact on consumers.

If developing countries also liberalized their own distortionary policies (Table 6), food consumers in numerous developing countries would switch to being beneficiaries because international prices are projected to fall slightly. True, farmers in some developing countries are slight net losers in this scenario, but they are the farmers currently enjoying agricultural protection and so are relatively well off anyway. Virtually all countries are better off in a net welfare sense even without measuring the benefits outside the food sector; the only ones to lose are those whose trade tax revenue has been reduced significantly. Notice, too, that many of the gaining countries remain substantial net food importers, as shown in column 2 of Table 6, even though developing countries would spend $104 billion less (in 1985 dollars) on food imports net of export in this case.

TABLE 5: Effects on individual countries of removing OECD food price distortions assuming full long-run price transmission in developing countries and price-dependent productivity growth, 1995[a]

(constant (1985) US$ billion per year)

	Food self-sufficiency (production as a % of consumption)		Change in net foreign exchange earnings from food trade	Change in economic welfare within the food sector relative to the reference case for:		
	reference	after complete liberalization		consumers of food	producers of food	net welfare[b]
OECD COUNTRIES						
Total	109	83	-113.2	202.2	-155.6	51.1
DEVELOPING COUNTRIES						
Bangladesh	61	70	0.8	-0.7	0.6	-0.0
China	104	117	16.2	-6.6	13.5	3.2
India	84	99	11.5	-9.5	10.3	-1.0
Indonesia	103	112	1.3	-0.9	1.1	-0.4
Korea, Rep.	65	73	0.5	-1.4	1.3	-1.3
Pakistan	84	116	5.0	-2.5	3.4	0.9
Philippines	104	114	0.6	-0.3	0.4	0.2
Taiwan	81	88	0.3	-0.4	0.4	-0.2
Thailand	156	173	1.3	-0.4	0.6	0.5
Other Asia	63	71	2.3	-1.8	1.1	0.1
SUB-TOTAL, Asia			39.8	-24.5	32.7	2.0
Argentina	173	213	5.8	-1.1	2.7	3.9
Brazil	156	186	9.1	-2.2	5.7	4.9
Mexico	95	120	3.7	-1.8	3.5	0.4
Other Latin America	182	226	9.3	-1.7	5.3	6.2
SUB-TOTAL, Latin America			27.9	-6.8	17.2	15.4
Egypt	30	38	0.6	-1.4	0.6	-1.1
Nigeria	48	57	0.7	-0.9	0.6	-0.6
South Africa	62	78	1.2	-1.3	1.1	-0.5
Other Sub-Saharan Africa	45	57	3.9	-2.5	1.6	0.6
Other North Africa & M.East	46	58	5.1	-8.5	5.9	-4.3
SUB-TOTAL, Africa			11.5	-14.6	9.8	-5.9
TOTAL, developing countries	92	111	79.2	-45.9	59.7	11.5
WORLD TOTAL[c]	100	100	-26.6	162.3	-87.5	65.0

a This scenario corresponds to scenario 1b in Table 3 in which only food policies in OECD countries are liberalized.

b The effect on taxpayers and food stock-holders as well as on food producers and consumers are included in the net welfare measure, but general equilibrium welfare effects in non-food sectors are not included.

c Includes centrally planned Europe.

Source: GLS model simulation runs.

TABLE 6: Effects on individual countries of removing all food price distortions assuming full long-run price transmission in developing countries and price-dependent productivity growth, 1995[a]

(constant (1985) US$ billion per year)

	Food self-sufficiency (production as a % of consumption)		Change in net foreign exchange earnings from food trade	Change in economic welfare within the food sector relative to the reference case for:		
	reference	after complete liberalization		consumers of food	producers of food	net welfare[b]
CD COUNTRIES						
Total	109	74	-143.6	250.0	-193.9	61.0
VELOPING COUNTRIES						
Bangladesh	61	70	1.6	-0.6	0.4	0.9
China	104	122	20.1	-3.4	20.0	15.2
ndia	84	98	11.1	-9.9	8.3	0.2
ndonesia	103	60	-6.7	5.5	-4.8	2.2
Korea, Rep.	65	14	-8.3	15.2	-6.5	6.5
Pakistan	84	141	8.0	-4.2	6.4	2.6
Philippines	104	119	0.7	-0.1	0.4	0.2
Taiwan	81	42	-1.9	2.9	-2.3	0.8
Thailand	156	159	-0.4	0.4	0.4	-0.5
Other Asia	63	116	15.0	-7.8	8.2	4.7
UB-TOTAL, Asia			39.2	-2.0	30.5	32.8
rgentina	173	345	15.2	-3.4	13.9	7.3
razil	156	215	11.8	-3.6	11.1	3.7
exico	95	115	2.6	-1.5	1.1	1.4
ther Latin America	182	226	14.4	-3.8	13.8	4.4
UB-TOTAL, Latin America			44.0	-12.3	39.9	16.8
gypt	30	43	1.9	-1.3	1.1	1.0
igeria	48	27	-2.7	3.2	-1.4	0.6
outh Africa	62	59	0.3	0.3	-0.2	-0.2
ther Sub-Saharan Africa	45	113	20.4	-8.9	9.2	6.6
ther North Africa & M.East	46	48	1.1	0.3	0.6	-1.3
UB-TOTAL, Africa			21.0	-6.4	9.3	6.7
YTAL, developing countries	92	118	104.2	-20.7	79.7	56.3
LD TOTAL[c]	100	100	-27.0	226.8	-110.0	120.3

a This scenario correspnds to scenario 3b in Table 3 in which food policies in both industrial and developing countries are liberalized along with non-food policies which affect incentives in the food sector of developing countries.

b The effect on taxpayers and food stock-holders as well as on food producers and consumers are included in the net welfare measure. However, it needs to be kept in mind that this is only the gain from the staple food sector; as well there will be gains in other sectors from the liberalization of non-food trade policies and from liberalizing the foreign exchange market, but the latter cannot be measured completely with a partial equilibrium model.

c Includes centrally planned Europe.

Source: GLS model simulation runs.

2.4 Risk considerations

Another important benefit from food policy liberalization has to do not with the trend level of food prices but with the year-to-year fluctuations around that level. Because many countries transmit only a fraction of international price changes to their domestic market, especially in the short run, and they export some of their own domestic market fluctuations as well, international prices are much less stable than they would be under free trade.

Using the stochastic version of the GLS model, the extent of the effects of policy insulation can be seen by comparing the coefficients of international food price variation in the standard reference case with what those coefficients would be in the absence of current food policies. The final column of Table 7 shows that one quarter of the fluctuations in international food prices is attributable to the stabilization aspects of the EC's Common Agricultural Policy. The United States, by contrast, has been a slight contributor to stability in international markets through its stockholding policies. Overall, however, the food policies of OECD countries in total have contributed on average one third of all fluctuations - and considerably more to instability in wheat, beef and dairy product markets.

The great degree of fluctuation in international food prices is part of the reason for developing countries insulating their domestic markets. Their stabilization policies also contribute up to about one third of the fluctuations we observe (two thirds in the case of rice and sugar).[4] That is, if both OECD and developing countries were to liberalize their markets fully, international food price fluctuations might be only one third as great as we currently observe. This is less than the actual fluctuations in many domestic markets of developing and other countries, suggesting that such countries could do without the stabilization component of their food policy entirely if only other countries would do likewise.

Insofar as producers and consumers are risk averse, any reduction in fluctuations of prices they face would be a further benefit from liberalization in addition to the benefits already discussed.

TABLE 7: Effects of food policy liberalization on instability of international food prices

	Wheat	Coarse grain	Rice	Ruminant meat	Non-ruminant meat	Dairy products	Sugar	WEIGHTED AVERAGE
Coefficient of variation before liberalization	0.58	0.53	0.38	0.24	0.08	0.26	0.36	0.34
Coefficient of variation after liberalization in:								
European Community	0.39	0.45	0.32	0.15	0.08	0.13	0.28	0.26
United States	0.60	0.64	0.36	0.17	0.10	0.27	0.31	0.35
ALL OECD COUNTRIES	0.33	0.47	0.28	0.07	0.08	0.11	0.25	0.23
ALL OECD AND DEVELOPING COUNTRIES	0.15	0.23	0.09	0.04	0.05	0.06	0.07	0.11

[a] Weights based on 1980-82 share of each commodity group's exports in the total value of world exports of these commodities.

Source: Anderson and Tyers (1989, Table 5.1).

3. CONCLUSIONS AND POLICY IMPLICATIONS

The GLS model used in this study is but one of many available now to address the issue at hand. Despite sharing with some others the limitations of partial equilibrium analysis, the model is nonetheless useful in providing illustrative empirical support for all of the points developed in the first section of the paper that the model is capable of addressing. The first of those points is that when the effect of liberalization on the inducement to invest in new technologies is allowed for, developing countries that might otherwise have been losers from OECD liberalization can become gainers, **even if they are net importers of food.** Second, the number of developing countries in that category will be larger the more developing countries are prompted by OECD liberalization to reform their own policies affecting their food prices. And, such countries can gain **even if they remain net importers of food.** Third, the income redistribution within developing countries between food consumers and producers, as a result of liberalization, is likely to improve equity. And fourth, risk-averse actors in relatively open economies would be better off because, following liberalization, international food prices would fluctuate less — indeed less than in all but the currently most insulated of economies.

These points could be made stronger, and further points added, with the use of more complex models. One conceptually simple amendment would be to add to the GLS model three (or more) other sectors: other agriculture, other tradables, and nontradables. This is something the USDA has done recently with its SWOPSIM model (Krissoff and Ballinger 1988), although that model lacks the stochastic and dynamic features of the GLS model and so cannot measure the effects on market stability and the paths of adjustment to reform.[5] The main advantage of such an amendment to the current GLS model is that it would ensure consistency through requiring, for example, expenditure to equal income and the value of each country's exports to equal the value of its imports.

Another alternative is to build on the pioneering CGE work of Burniaux and Waelbroeck (1985), Burniaux, Delorme et al. (1988), Loo and Tower (1989) Parikh et

al (1988) and John Whalley and his colleagues (e.g. Trela, Whalley and Wigle 1987). Those studies aim to represent the world in a traditional global general equilibrium framework. It is true that the greater risk of specification errors in general equilibrium as compared with partial equilibrium models may more than outweigh the benefits of including nonagricultural sectors, as Gardner (1989) has warned. This is especially true if nontradables are not included as a separate sector, which has been a shortcoming of IIASA's work to date (Parikh et al. 1988). But, with sufficient effort, such problems could be overcome. Typically these models will lack the quantitative detail of agricultural commodity markets that characterize the available multi-commodity partial equilibrium models, and they may be subject to aggregation bias.[6] However, they have the virtues not only of internal consistency and of including the indirect income effects mentioned in Section 1.9 above but also of including explicitly the factor markets (Hertel 1989). Moreover, the new trade and growth theories now beginning to be incorporated in dynamic CGE models, involving imperfect competition and economies of scale, offer more scope for modelling whole economies realistically - and with them will come the capacity to demonstrate with greater clarity and precision the pervasiveness of the gains from trade liberalization.[7]

If it is true that not only the world economy but also developing economies and especially their farmers would be better off if food policies were liberalized under the Uruguay Round, it remains to convince developing country governments to support agriculture's inclusion on the GATT agenda. It may be insufficient to demonstrate that their economies would benefit in the sense that their farmers could gain more than their food consumers would lose, for many of these governments clearly have chosen unilaterally to forego economic benefits by adopting trade and exchange rate policies which harm their farmers. They have done this presumably because those policies yield political benefits to those governments which more than outweigh the political costs (Anderson and Hayami 1986; Anderson 1989). Other carrots therefore need to be found.

It happens that OECD countries would benefit more if developing countries joined them in liberalizing their food markets than if they abstained. They would benefit not just in a net economic welfare sense but also politically in that OECD producer prices would not have to fall as much if developing countries also reform their food price policies (compare the international price changes in scenarios 1 and 2 in Table 2 or Table 3).[8] Nor would OECD export prices of manufactured goods fall as much if resources in developing countries are attracted back into agriculture so that those countries' net imports of OECD manufactured goods expand (Burniaux and Waelbroeck (1985), Mathews (1985)). In addition, OECD countries would enjoy greater stability in international food prices. Developing countries might stress these facts in their negotiations with OECD countries, and seek from them some liberalization of other markets of interest to developing countries such as tropical primary and processed products and textiles, clothing and footwear.

NOTES

1 This possibility is even greater if Harris-Todaro type unemployment exists in the developing country because of a high minimum urban wage which attracts would-be workers to the towns and cities in the hope of getting one of those high-paid jobs. If the institutionally set urban wage did not change, a shift out of the food sector's value of marginal product curve would attract some of the urban unemployed back to now-better-paid farm jobs while leaving employment in the non-farm sector unchanged, thereby raising national product even more. The required modifications needed for Figure 5 to demonstrate this can be found in Corden (1974, Ch. 6).

2 See also Johnson et al. (1989). These forecasts - which are a continuation of the past long-term trend (Grilli and Yang 1987) - contrast with those in the Food and Agriculture Organisation's 1979 report Agriculture: Toward 2000, which forecasts traded food prices to rise. The latter are what Parikh et al. (1988) follow in constructing their reference scenario.

3 It is true that ad valorem tariff equivalents are not always the most appropriate way to represent some policies (Whalley and Wigle 1988), and in fact U.S. land set-aside and stock-holding policies are modelled separately from price policies in the GLS model. For most countries and commodities, however, domestic-to-border price comparisons capture most of the distortions involved. The main exceptions are where production quotas are binding, as with EC and Canadian milk output.

4 The improved world price stability under free trade assumes perfect price transmission in all markets. In practice, however, large developing countries such as India and China have internal transport and other cost barriers which would prevent the achievement of full price equality across all regions, so the above may overstate the extent of stability thus derived.

5 The latter is something which could have been but for space reasons was not included in the present paper.

6 An example of possible bias is with Loo and Tower's (1989) model, in which all agricultural production is in one aggregate sector. This makes it a net export sector for virtually all developing countries. The authors assume this sector is subjected to export taxes. Necessarily, then, if OECD countries liberalize "agriculture", the consequent international price rise will make developing countries better off. The gain will be partly due to resources being attracted from the other protected sectors to agriculture and partly via other instruments which are assumed to have much higher collection or by-product distortion costs. However, a reform of OECD farm policies would be confined to temperate food staples, of which developing countries are net importers and which (according to our data) are priced on average at above international price levels at official exchange rates. If Loo and Tower had split agriculture into "temperate staple food" and "other agriculture", a rise in the international price of staple food would probably have been measured as welfare reducing for developing countreis. The loss would result partly from the attraction of agricultural resources from the taxed "other agriculture" export sector to the staple food sector, and partly from the need to raise more tax revenue via more-costly instruments than trade taxes following the decline in food import tax revenue and "other agriculture" export tax revenue. That is, a more disaggregated Loo and Tower model that confined itself to the same simulation as our first scenario in Table 2 would be likely to generate the same conventional outcome, namely, that developing countries would lose from OECD food trade liberalization.

7 The new theories are summarized in, for example, Helpman (1988), while a survey of empirical applications can be found in Richardson (1989). The subsequent big challenge will be to integrate these economic models with models of the environment, given the strong link between economic activity and the state of the environment (Young 1988; Lutz and Young 1989).

8 Although not reported in this paper, the GLS model also generates the change in national economic welfare which is not the simple sum of welfare changes of food producers, consumers and taxpayers abut rather a weighted sum. The weights, derived as implicit policy preferences, are biased in favour of food producers in OECD countries and food consumers in developing countries. They are based on political market theory (Anderson 1989) and on the estimates of distortions in Table 1 (see Tyers 1989b). The printouts show the weighted welfare change for OECD countries to be more favourable by several billion dollars per year if developing countries also reform their food policies than if only OECD food policies are liberalized.

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