SEARCHING UNDER THE LIGHT:
THE NEGLECT OF GENERAL EQUILIBRIUM, DYNAMICS AND RISK IN
THE ANALYSIS OF FOOD TRADE REFORMS

by

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ABSTRACT

The substantial investment in models of international food markets immediately prior to and during the Uruguay Round of international trade negotiations has been a mixed blessing so far as the prospects for reform are concerned. At worst, results from these models have mislead the negotiations, first because they have served the losers from reform better than the gainers and second, because they have tended not to address a primary concern lending domestic political support to food market interventions, namely the avoidance of risks borne of dependence on international markets. The paper reviews some errors which have stemmed from the application of 'standard' but inappropriate models and examines the implications of extending the standard methodology to include dynamic behaviour and market insulating policies.

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SEARCHING UNDER THE LIGHT:
THE NEGLECT OF GENERAL EQUILIBRIUM, DYNAMICS AND RISK IN THE ANALYSIS OF FOOD
TRADE REFORMS *

My title refers metaphorically to the story about the man who, having
dropped his keys on a dark street, returns and chooses to search first beneath
the street lights. In many fields of endeavour, this approach is clearly
rational. It is efficient to eliminate the easy options before approaching the
difficult ones. But the possibility remains that only the carriageway is
illuminated, and not the sidewalk down which the man had travelled. In this
case, the 'search under the light' strategy is misleading and, ultimately,
inefficient.

It is my fear that some analyses of the domestic and international effects
of agricultural policies, and of alternatives for their reform, have been thus
misguided. The models used to characterise market and government behaviour have
employed standard, rather than frontier, methodology, the scope of which
seriously limits the power of the models to address the policy issues at hand.
This can be particularly problematic in the area of economic policy since early
results from 'standard' models can mislead the processes of policy formation and
institution building. The resulting mistakes can result in new policy regimes
and institutions the lives of which are not simply terminated when new research
suggests a change of direction.

Global models covering multiple interacting commodity markets and
incorporating endogenous policy formation have recently become standard practice
in the analysis of agricultural trade policy, as in Roningen (1986) and OECD
(1987, 1990). But the improvements they offer still leave important
deficiencies which, in my view, must be addressed before we have a truly useful
characterisation of global food markets. First, they ignore the role of
intertemporal changes and uncertainty which are critical to both policy
formation and the behaviour of private agents. Second, the partial equilibrium
assumption on which they are based fails because most of the world's food is
produced and consumed in developing countries, where agriculture is the dominant
sector. And third, they retain a high level of commodity aggregation, assuming
homogeneity within any individual market.

In this paper I illustrate the ways in which these assumptions make the
'standard' models misleading. Part I briefly reviews the recent evolution of
models for food trade policy analysis. Part II offers examples of the ways in
which the failure of the latter two assumptions has influenced the policy debate
during the Uruguay Round. The main body of the paper addresses the first of the
assumptions, that facilitating comparative static analysis.

The failure to represent the dynamics of food markets and of policy
regimes which affect them is, in my view, a critically important omission. The
consequences of policy, as measured in comparative static terms, are thereby
confused with the motivation for policy formation. The emphasis in early work
has been on questions such as: "Who benefits from the existing market
distortions, by how much and at whose expense?" (see, for example, Tyers and
Anderson 1988, Roningen and Dixit 1989). Although political pressure exerted by
immediate beneficiaries might be influenced by this, wider support for some
distortionary policies need not depend on static measures of economic surplus
gained and lost. In my view the broad political agenda behind most
distortionary agricultural policies is insulation against changes abroad, rather
than an activistic redistribution of pre-existing domestic wealth, yet
insulation as an aspect of agricultural policy has thus far been only weakly
addressed by research on agricultural trade. Part III of the paper examines the
reasons why governments choose to insulate their domestic food markets while
Part IV addresses some consequences of making market insulation explicit in
policy models.
THE EVOLUTION OF FOOD TRADE MODELLING METHODOLOGY

Since the commodity boom years of the 1970s there have been substantial investments in research on food trade policy. Interest in the subject has since been further enhanced by the onset of the Uruguay Round of international trade negotiations and the important role assigned to agricultural reform therein. The bulk of the policy analysis thus stimulated has employed readily available and easily interpreted partial equilibrium analysis in comparative static mode. The early work of this type addressed the effects of distortionary policies in single countries and single markets for homogeneous commodities, assuming that either the quantity traded or the border price is exogenous (see Thompson 1981 for a review of these and some more advanced approaches).

Later, still in comparative static mode, new approaches emphasised international interactions, most popularly in non-spatial partial equilibrium models of individual world commodity markets (in the manner of Zwart and Meilke 1976, Linnemann and others 1979, Valdes and Zeitz 1980 and Bale and Lutz 1981). Interactions between separate commodity markets were incorporated in some single models which retained the comparative static approach and the partial equilibrium assumption (that the totality of the markets represented is small compared with the economy as a whole). These included the U.S. Department of Agriculture's GOL model (Rojko and others 1978).

Even while all these partial equilibrium comparative static models were informing the policy process, important deficiencies were recognised by some, including that policy is exogenous in each case. In such models, disturbances transmitted internationally as price changes are assumed to affect only the behaviour of private agents. New models were built to experiment with endogenous policy formation, as reviewed by Rausser et al. 1982 and, more recently by Rausser and de Gorter 1989.
Important deficiencies remain, however. Models which are now standard still ignore the role of intertemporal changes and uncertainty, both of which are critical to food market behaviour and policy formation. The partial equilibrium assumption on which most are based fails because most of the world's food is produced and consumed in developing countries, where agriculture is the dominant sector. And they tend to retain a high level of commodity aggregation, assuming homogeneity within individual markets.

This is not to say that there is no work on models which address these and other remaining problems. The first, and in my view the most important, is the subject of a very large literature the results from which have thus far tended not to be used in models directly influencing policy formation. Early papers examining the effects of policy on price stability include those by Sampson and Snape (1980) and Blandford (1983). Our own efforts have crudely addressed food market dynamics (Tyers 1985, Anderson and Tyers 1990b and Tyers and Anderson forthcoming), while work proceeds on more sophisticated representations (which simulate dynamic games) none of which can be expected to generate useful results in time to influence the current round of trade negotiations (see, for example, Vanzetti and Kennedy 1988).

In another illustration of my opening metaphor, the availability of new general equilibrium methodology has led a substantial effort to address the second problem, towards the construction of global general equilibrium models which give emphasis to agricultural commodity markets. The methodology is reviewed by Hertel (1990) and examples of global models of this general type are those by Parikh and others (1986) and Burniaux and Waelbroeck (1985). As for the third direction, the use of CES subaggregators in trade models is now becoming commonplace and the means is therefore available to relax the homogeneity assumptions in the larger agricultural trade models (see, for example, Brown 1987). Such improvements are, however, coming too late to directly influence the process of policy formation in the current round of negotiations.
One comparatively subtle way in which the early partial equilibrium results were misleading is with respect to the intersectoral and macroeconomic effects of agricultural distortions. In the early 1980s Kym Anderson and I focussed our research on the policies of the industrial market economies, where agricultural sectors have only small shares of national income and employment and where protection in the agricultural sector, at least for the most part, is more extensive than that in other sectors. Provided these two conditions are met, partial equilibrium models, combined with simple welfare measures, can yield useful comparative static results. But when the analysis is extended to cover other participants in the Uruguay Round of negotiations (the developing countries and some of the centrally-planned countries) these conditions no longer hold and the results are misleading. The perception that developing countries as a group would be net losers from any reform in the industrial market economies (as suggested, for example, in Tyers 1989) has not only increased the reticence of developing countries to support reforms in the OECD, it has also had institutional consequences in that a formal negotiating alliance has developed between net-food-importing developing countries. Yet a more detailed examination which takes account of intersectoral and macroeconomic effects suggests that a clear majority of developing countries could benefit from such reforms (Anderson and Tyers 1990a).

But the story does not end there. In both the earlier studies all products within each of seven commodity categories are considered perfect substitutes, irrespective of country of origin. This assumption might be appropriate in grain markets where products are standardised if not fully homogeneous. The markets for meat and dairy products are another story, however. Total liberalisation experiments suggest that, in the absence of
current distortions, industrial countries would be substantial net importers of these commodities from developing countries. But it is difficult to conceive of a liberalisation in the EC or the United States which would cause those countries to import substantial quantities of dairy products from dairy producing countries like India, Pakistan and Bangladesh. For some time at least, such trade would be severely limited by sanitary restrictions.

To examine the implications of this, I recently applied our partial equilibrium simulation model to the case in which the dairy and meat products of the developing countries differ from those of the industrialised countries. I made the extreme assumption that producer prices of livestock products in developing countries would not rise in the event of a liberalisation in the OECD. The results, summarised in Table 1, show that a larger increase in international food prices would be needed to satisfy expanded excess demand in liberalising countries because developing country livestock producers no longer respond. The extent to which developing countries as a group would be net exporters of food is therefore substantially restrained. The higher livestock prices constitute a more seriously adverse terms of trade change than before and very substantial net losses to the developing countries as a group, such losses as I doubt would be offset by the general equilibrium effects of reforms in the OECD. Moreover, since the increases which would occur in international meat and milk product prices are larger with this assumption, these losses are borne primarily by the food-importing countries of Africa and Asia. Thus, the early result from the 'standard' model may have been correct in this instance, though for the wrong reasons. Such good fortune cannot be relied upon in general.
<table>
<thead>
<tr>
<th></th>
<th>Homogeneous products</th>
<th>Different products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in index of international food prices, %</td>
<td>28</td>
<td>31</td>
</tr>
<tr>
<td>Food self-sufficiency, %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OECD countries</td>
<td>88</td>
<td>92</td>
</tr>
<tr>
<td>Developing countries</td>
<td>105</td>
<td>101</td>
</tr>
<tr>
<td>Net change in economic welfare (1985 US $ billions)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OECD countries</td>
<td>53</td>
<td>49</td>
</tr>
<tr>
<td>Africa</td>
<td>-6</td>
<td>-8</td>
</tr>
<tr>
<td>Latin America</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Asia</td>
<td>-6</td>
<td>-9</td>
</tr>
<tr>
<td>All developing countries</td>
<td>-8</td>
<td>-15</td>
</tr>
</tbody>
</table>

a The food commodities included are the grains, meats, dairy products and sugar.

Source: Simulations using the trade model of Tyers and Anderson (forthcoming).
III
EXPLAINING MARKET INSULATING POLICIES

As foreshadowed in the introduction, it is my view that the broad political agenda behind most distortionary agricultural policies is insulation against changes abroad, rather than an activistic redistribution of pre-existing domestic wealth. If this is true, the comparative static results fail to address the fundamental motivation for the policy. Since it is unlikely that reforms would be embarked upon simply in the interests of such dispersed groups as consumers and tax-payers, the results have served to better inform the likely losers from reform and hence to galvanise the forces against it. The remainder of this Part addresses the veracity of my premise. Why should domestic market insulation be a primary motivation for food market distortions.

In their discussion of direct foreign investment, under the subheading "Instinctive Reactions", Lindert and Kindleberger (1982) suggest the following:

"Social man tends to some considerable degree to be a peasant with a territorial instinct which leads him to object to foreign ownership of national natural resources; a Populist, which makes him suspicious of banks; a mercantilist, which makes him favour exports over imports; a xenophobe, which leads him to fear those from outside the tribe; a monopolist, who reacts strongly against competition; and an infant, to the extent that he wants to eat his cake and have it too."

Should there be any truth to this polemic, it is not difficult to explain a preference for the insulation of domestic markets against disturbances originating in the rest of the world. In practice, however, few countries actually maintain self-sufficiency in food. Instead, world food markets tend to be used as sources of residual supply or as residual dumping grounds. But these markets have the potential to do much more. They offer global benefits from specialisation and trade and they spread the risks associated with the unpredictable disturbances. Another of Kindleberger's contributions has been to classify efficient international markets as public goods (Kindleberger 1986).
This general idea has been further explored by Runge et al. (1989) who assert that

"When countries retain the general benefits of open trade while attempting to protect certain sectors from competition, they are engaged in a form of 'free riding', drawing down the global benefits which trade provides".

In a similar vein, one can readily characterise the risk-spreading role of world food markets as an international public good. Its use is not restricted to those countries who share risk by exposing their domestic agents to price fluctuations neither is it characterised by direct rivalry. Countries which insulate their domestic markets, using trade to eliminate residual excess demands or supplies and thereby stabilising domestic prices, might then be portrayed as free riders even if their levels of protection, averaged through time, are comparatively small. By exposing domestic agents to international price instability, countries help to spread risk and thereby contribute to the supply of the international public good. Typically, as with all public goods, the inability to exclude non-contributors leads to undersupply and to excessively risky world food markets.

But insulation need not be directed solely at short-run price fluctuations. Much of the agricultural protection we observe and which has been the subject of extensive comparative static analysis in recent years can be seen as a consequence of market insulation. As illustrated in Figure 1, real food commodity prices have maintained a declining trend throughout this century, one which has steepened since the early 1970s (Grilli and Yang 1988, Tyers and Anderson forthcoming). Simply by retarding the transmission of this decline to domestic markets, many governments have caused rates of protection to rise through time to substantial levels. Others have fully transmitted declines but with a lag, leading to continuous, though lower, levels of protection. But in each case the objective served is the conservation of some initial distribution of domestic wealth and the avoidance of the risks associated with external pressures for domestic structural change.
It is my argument, then, that the insulation of domestic markets is perceived by most governments to be in the national interest and that they thereby exploit the risk-spreading capacity of world markets, collectively enhancing international price risk. The literature supporting the Uruguay Round has tended not to focus on the effects of policy on international price risk, nor on the reasons why governments choose to avoid it. It has therefore failed to fully inform the negotiations as to the collective risk benefits from truly multilateral reform. More specifically, it has not provided enough quantitative evidence that, if enough countries choose to insulate less, better-spread price risk would reduce the need for insulation by others. Progress in reducing agricultural trade barriers has therefore been limited in this Round.

Resting as the above argument does on the premise that the insulating components of domestic food policies are indeed valued by governments for their own sake, it is appropriate that the economics behind the premise be explored further. It is sufficient to establish either that insulating policies yield a net improvement in the aggregate welfare of all domestic agents when border prices are risky, or that insulating policies benefit those groups with the greatest political influence and that governments therefore perceive political benefits from their implementation. In one sense it is surprising that such a premise should be accurate. Insulation is distortionary, creating efficiency losses in every year in which border prices depart from desired domestic levels. To make insulation worthwhile, domestic agents must be sufficiently averse to price risk to offset the efficiency losses.

In all countries some agents can be expected to have stronger preferences for price stability than others. Since market insulation occurs in both developing and industrialised countries, we might hypothesise that this preference would be strongest among the groups with most apparent influence over agricultural policy in each case; broadly, consumers and industrial capital owners in developing countries and farmers in industrial countries (Anderson and
Hayami). What, then, are the directions of the welfare impacts of price stabilization on these groups?

The simple Marshallian analysis of Waugh suggests that, in the dominant case where the source of the price fluctuations is not shifts in demand, consumers lose from the stabilization of the prices they face. This result stems simply from the downward-sloping nature of demand curves. A price decline increases welfare by more than a price rise of equivalent magnitude decreases it. Symmetrical fluctuations in price therefore raise average consumer welfare. This tendency of consumers to prefer price fluctuations persists in the more comprehensive analyses of Turnovsky et al. and of Newbery and Stiglitz (Chapter 9). Their results suggest that consumers prefer price stability only when they are substantially averse to income risk and when their demand is relatively inelastic.

To complement the early Marshallian analysis of Waugh, the effects of price stabilization on producers were examined by Oi and Massell. The principal result of these studies, that producers lose from stabilization where the source of disturbances is not the supply side and gain from it otherwise, does not survive more comprehensive analyses such as those of Wright and Newbery and Stiglitz (Chapters 5, 6, 11). These latter studies take account of some important special characteristics of primary (and particularly crop) production, including lags in supply response which necessitate that production decisions be made based on expected future prices. The way in which these expectations are formed and the extent of farmer aversion to risk are key determinants of production behaviour and of farmer preferences for price stability. When they are taken into account, the direction of these preferences is also ambiguous.

Other agents also have a stake in price stabilization. In many poor countries industrial wages are effectively indexed, through payments in kind and by other means, to the price of a key staple food, such as rice. Food price fluctuations therefore increase the profit risk of industrial capital owners and
the expenditure risk of governments as employers. But governments and parastatal agencies which monopolise imports of particular commodities can also gain from reductions in domestic price instability through partial insulation of domestic markets. This is because, under certain conditions, the revenue gained when imports are drawn from a depressed international market and sold at higher prices domestically exceeds that lost when world prices are high and imports must be resold at a loss.

The ambiguous nature of the consumer and producer welfare effects of price stabilisation means that the preferences for price stability of these predominant groups remain matters for empirical analysis. It is therefore useful to examine these effects in some illustrative cases. To do so I briefly report the results from an elementary model of a single open commodity market which is detailed mathematically in Tyers and Anderson (forthcoming) and Gibbard and Tyers.

The model might apply to the market for a key food commodity such as rice. It assumes that the focus country is a small trader in the commodity and therefore cannot influence the level of the international price. That price is, however, subject to random disturbances due to fluctuations in demand and supply in the wider international market. Domestic production of the commodity is also subject to random disturbances such as might be caused by weather and pest infestation. Together, these two sources of randomness generate the price and income risk from which the government seeks to insulate domestic agents.

To illustrate the magnitudes of the welfare effects of insulation consider two small archetype economies. One is a poor country which imports rice and the other is an industrial country which exports it. In the poor country farmers consume half the rice but earn only a quarter of national income. Workers consume the rest and receive wages which are compensated for rice price fluctuations. They and industrial capital owners earn three quarters of the
national income. Household incomes differ between farmers and workers and so, therefore, do their rice consumption parameters. In the industrial country, on the other hand, farmers consume only a small fraction of their total output and earn a small share of the national income. Their household incomes are similar to those of workers, however, and therefore the parameters governing their consumption behaviour are identical.

All agents in both the developing and the industrial country are assumed to be averse to risk, to degrees indexed by the Arrow-Pratt coefficient of relative risk aversion, R. Developing country agents and farmers in industrial countries, whose risks stemming from price fluctuations are significant in relation to their net income, are assigned a value of $R = 2$. Food price risk is less significant for consumers and tax-payers in industrial countries, however, so they are assigned a value of $R = 1$. In estimating the welfare impacts of changes in price stability for each group of agents the approach of Newbery and Stiglitz is adopted, with only minor modification, as detailed by Tyers and Anderson (forthcoming).

The empirical evidence summarised in Tyers and Anderson (forthcoming) and Tyers 1990 suggests that market insulation is generally partial in both industrialised and developing countries (the degree of insulation is rarely 100 per cent, or the elasticity of price transmission is rarely zero). The case examined is therefore that of a partial insulation which reduces the coefficient of variation of the domestic price by half (only half of any change in the international price is transmitted to the domestic market). As the results presented in Table 2 demonstrate, farmers are comparatively indifferent to market insulation in the developing country but could be expected to favour it in the industrial country. This is primarily because farmers' in developing
### TABLE 2

**Benefits from Partial (50 per cent) Insulation in "Typical" Developing and Industrial Economies**

Benefits as percent of average group income or of government expenditure

<table>
<thead>
<tr>
<th></th>
<th>Developing economy</th>
<th>Industrial economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>0.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Workers</td>
<td>-0.05</td>
<td>0.02</td>
</tr>
<tr>
<td>Industrial Capital Owners</td>
<td>2.7</td>
<td>0.0(^a)</td>
</tr>
<tr>
<td>Government Revenue</td>
<td>0.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>

\(^a\) Zero since, while wages in the developing country are adjusted for food price changes, they are not in the industrial country. Industrial profits are therefore not significantly affected by food price risks.

**Source:** Calculations based on parameters drawn broadly from World Bank (1986) and equations presented in Tyers and Anderson (forthcoming).
countries commit a relatively large share of their income to the purchase of farm products. Their gain from revenue stabilisation is largely offset by losses which stem from their relatively elastic consumer behaviour. In the industrial country on the other hand, farmers commit little of their income to farm products and the revenue (and hence income) stabilisation effects are dominant.

Non-agricultural workers in both the developing and the industrial country are roughly indifferent to market insulation. In the developing country this is because worker income is adjusted for food price changes through wage indexing or partial payments in kind. In the industrial country it is because demand is inelastic and workers spend only a small share of their income on food. Food market insulation is clearly favoured by industrial capital owners in developing countries. This is because payments to labour dominate the value added in the non-agricultural sector. Fluctuations in these payments therefore result in substantial profit risk. In industrial countries worker income tends not to be compensated for short-term changes in food prices and, in any case, the non-agricultural sector is less labour-intensive.

The government revenue effects are dominated by shifts in mean revenue due to the partial insulation policy. These revenue gains depend primarily on the elasticity of domestic consumer demand in the short run. Since this elasticity is comparatively high in developing countries, the revenue effects of partial stabilisation are significant there.
In both cases there are net gains nationally from the insulation, supporting the public interest explanation for insulating policies. The results do, however, bear out the hypothesis that the most influential group has the most to gain from market insulation in each case. The gains to industrial capital owners and to government revenue are dominant in the developing country, where industry tends to be protected at the expense of agriculture and where the cost of collecting revenue by other means is especially high. In the industrial country on the other hand, where agriculture tends to the protected at the expense of other sectors, farmers have the dominant interest in price stabilisation. In addition, since no group of agents in the domestic economy would appear to lose significantly, governments tend not to find market-insulating policies costly to sell to non-beneficiaries.

But there is another important reason for the prevalence of market insulation. It stems from two general characteristics of market-insulation policies. First, such policies always separate domestic from border prices and hence distort domestic incentives, at least in the short run. And second, because the current and future trend of international market prices is uncertain, there is no obvious and undisputed level at which domestic prices should be set in order to achieve the objective of comparatively stable domestic prices. The process by which the domestic price is set is therefore subject to lobbying by vested interests. The cost of substantial distortion of domestic prices away from border prices is reduced because governments can claim that the distortion is temporary, pending the return of border prices to "trend" levels. Since the lobbying and propagandising effort of farmers in industrial countries is stronger than that of groups which lose from high food prices, this process tends to be captured there by farm interests. Similarly, in developing countries, the initially well-intentioned separation of domestic from international markets by governments averse to food price and wage risk reduces
the political costs of policies which ensure that the trend of domestic prices is below that at the border.

Nevertheless, even where insulating policies are not accompanied by protection, it would be improper to leave the impression that such policies are desirable from the standpoint of world welfare. They involve the shedding of risk through international food markets. Although the analysis in this chapter has emphasised the small country case, the insulation of food markets by large numbers of small countries must increase the instability of international prices. When risk is shed in this way by some countries, it must be borne by others. The cost of market insulation policies is therefore the burden of foreigners, the interest group with the least voice in domestic politics.

IV

SOME IMPLICATIONS OF MARKET INSULATION FOR AGRICULTURAL TRADE POLICY ANALYSIS

The presence of market insulating policies makes more difficult the analysis of policy reform and its interpretation. Moreover, commonly used comparative static analysis can be badly misleading. To demonstrate this, I examine three key implications of market insulating behaviour. These are first, that magnitudes of price distortions vary from year to year as international prices fluctuate. The results from any comparative static analysis therefore depend on which year is chosen for analysis. Second, when price distortions are measured in a single year, it is impossible to tell what part of these is due, on the one hand, to governments' commitments to keeping domestic prices above the trend of world prices (pure protection) and, on the other, to risk-avoiding market insulation. And third, where policy analysis is carried out prospectively, the results can depend critically on whether international prices are predicted to rise or fall.
To illustrate these three implications for policy analysis, I draw once again on the Tyers-Anderson model of world trade in grains, livestock products and sugar. This dynamic model is equipped for the purpose with endogenous policy formation and stock-holding behaviour (Tyers and Anderson forthcoming). Its base period is 1980-82 which, by inspection of Figure 1, has average international food prices roughly on the long run trend. Simulations run from 1983 through the year 2000. Disturbances to food production provide the main source of uncertainty in the model and these are introduced stochastically beyond 1987, the last year for which comprehensive quantity and price data were available at the time of writing.

The analysis begins with a reference simulation which projects the trend in mean food prices illustrated in Figure 2. Since the dramatic decline in prices of the early 1980s is not followed by any substantial resurgence, protection rates in countries with insulating policies might be expected to be higher than in the base period. Indeed they might be expected to be at their highest in 1986 and 1987, thereafter declining as the dip in world prices is gradually passed through to domestic agents by those countries which do not insulate their markets totally. This expectation is borne out by the projected trends in protection rates listed in Table 3. Price distortions, and their associated efficiency losses, peak in 1987 and their projected mean declines thereafter.
<table>
<thead>
<tr>
<th>Year</th>
<th>Average OECD nominal protection coefficient</th>
<th>Global net welfare cost of OECD protection, billion 1985 US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980-82(^a)</td>
<td>1.40</td>
<td>16</td>
</tr>
<tr>
<td>1987(^b)</td>
<td>1.96</td>
<td>83</td>
</tr>
<tr>
<td>1990(^b)</td>
<td>1.81</td>
<td>45</td>
</tr>
<tr>
<td>1995(^b)</td>
<td>1.91</td>
<td>46</td>
</tr>
<tr>
<td>2000(^b)</td>
<td>1.85</td>
<td>50</td>
</tr>
</tbody>
</table>

\(^a\) Base period estimates.

\(^b\) Reference simulation of the Tyers-Anderson model of world food markets.

\(^c\) The welfare measures used here are equivalent variations in income. They ignore risk benefits. Agents are assumed to be risk neutral.

Source: Author's estimates and model simulations more fully documented in Tyers and Anderson (forthcoming).
These results clearly illustrate the first of the above implications of insulating policies. Comparative static analysis would yield conclusions about price distortions and their economic cost which would vary enormously, depending on the year chosen. In particular, studies based on statistics for 1986 or 1987 would yield global efficiency losses twice as large as for subsequent years and five times larger than they were in 1980-82. This is a major difficulty with studies such as that by Horridge and Pearce (1988). They address distortions which appear high because of the year chosen (1986) but which are mere symptoms of more complex policies not intended to distort prices to that extent in all years. One way in which such studies have misguided the negotiations process is that they have made it possible for the EC, in its mid-1990 proposal to the Uruguay Round, to appear to offer a substantial reform by suggesting phased reductions in price distortions of 30 per cent, with 1986 as the base. The following is a quote from that proposal.

"As foreseen by the decision in Geneva in April 1989, reductions would be measured against the reference of 1986, in order to give credit for the measures which have been adopted since the Declaration at Punta del Este."

To the extent that international prices have risen since then, the insulating policies of the EC have ensured that most of that reduction has already occurred. Such a proposal will yield true reform only if real international food prices fall still lower in the 1990s than they did in 1986-87, as Figure 1 suggests they might.

To address the second implication, that the effects of the pure protection and the market insulating components of trade policy are difficult to separate, I have made an additional simulation in which the insulating component of policy is removed in all countries from the base period, 1980-82 onwards. In our model this is the equivalent of the conversion of all policies into ad-valorem taxes or subsidies at the border as of 1982 and to the binding of their rates in that year. Thereafter, while the level of pure protection is held constant, all
proportional fluctuations in international prices are fully transmitted to all domestic markets. The resulting counterfactual price projection is illustrated in Figure 3.

Not surprisingly, the projected path of international prices is made more smooth by the wider spreading of price risk. This tendency is even clearer in the projections for individual commodity prices, such as that of wheat (Figure 4). More importantly, however, the decline in prices beyond the base period is substantially reduced. This is because, when domestic markets are not insulated, the increases in ad valorem protection rates in Table 3 no longer occur. The differences between the retained protection rates of the base period and those which occur when markets are insulated is then that part of price distortions due to the insulating component of policies. Obviously, this also depends on which base period is selected. The period 1980-82 is sensible in that its average prices lie on an estimated long run trend (Figure 1). In Table 4 the two components of policy are separated in this way and their global efficiency losses compared.
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>OECD nominal</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>protection coefficient</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>1.96</td>
<td>1.81</td>
<td>1.91</td>
<td>1.85</td>
</tr>
<tr>
<td>No insulation</td>
<td>1.43</td>
<td>1.39</td>
<td>1.38</td>
<td>1.37</td>
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<tr>
<td>% of distortion due to insulation</td>
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<td>51</td>
<td>58</td>
<td>56</td>
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<tr>
<td>Annual global net welfare</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cost of OECD protection$^a$, 1985 US$ billions</td>
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<td></td>
<td></td>
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<tr>
<td>Reference</td>
<td>83</td>
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<td>46</td>
<td>50</td>
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<tr>
<td>No insulation</td>
<td>20</td>
<td>18</td>
<td>13</td>
<td>12</td>
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<tr>
<td>% of cost due to insulation</td>
<td>76</td>
<td>60</td>
<td>72</td>
<td>76</td>
</tr>
<tr>
<td>Annual global net welfare</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cost of protection in all countries$^a$, 1985 US$ billions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference</td>
<td>111</td>
<td>77</td>
<td>82</td>
<td>94</td>
</tr>
<tr>
<td>No insulation</td>
<td>32</td>
<td>36</td>
<td>38</td>
<td>41</td>
</tr>
<tr>
<td>% of cost due to insulation</td>
<td>71</td>
<td>53</td>
<td>54</td>
<td>56</td>
</tr>
</tbody>
</table>

$^a$ The welfare measures used here are equivalent variations in income. They ignore risk benefits, assuming agents are risk neutral.

Source: Model simulations more fully documented in Tyers and Anderson (forthcoming).
These results suggest that the effects of insulation since 1982 are substantial. More than half of the average price distortion in the OECD is due to insulation. Note that the average rate of protection varies slightly from year to year even when there is no insulation. This is due to changes in the volume mix of food commodities in production and trade. The efficiency losses due to insulation since 1982 are also the major part of the net global cost of price distortions both in the OECD countries and in all countries. Had the GATT Round concluded in 1982 with agreement to cease market insulation but to retain existing pure protection (which held very high levels in some countries, particularly in Europe and Japan) the majority of the distortions, and of the costs now being borne by the world economy would not have arisen. These are good reasons why market-insulating policies should have been given a higher profile earlier in the current Round. They were not, at least in part, because of a reliance on 'standard' models.

Once a trade policy analyst decides, for the above or other reasons, to incorporate insulating policies explicitly in their model, they must then confront the third of the implications listed above. If they choose, as I have, to conduct the analysis of prospective policy alternatives prospectively, by modifying a forward reference projection, then their results will not be independent of the forecast content of that reference projection. It is not possible to use the old disclaimer that the exercise of prospective policy analysis is not aimed at forecasting and therefore that projected price levels are of little significance. If the reference projection shows rising real international prices, insulating policies will cause protection rates to decline and, liberalisation will yield comparatively small efficiency gains. If, on the other hand, they are falling, then projected protection rates will be comparatively high as will the efficiency gains from liberalisation.

To examine the sensitivity of model results to projected price levels, I made two additional reference simulations, each retaining the same (constant) policy parameters. From 1989, global income grows one third faster than the
original reference simulation in one and one third slower in the other. The results, summarised in Table 5, have projected international prices in the year 2000 departing from the original reference by between 20 and 40 per cent. Insulation policies yield corresponding variation in protection rates which is between 20 and 30 per cent. Thus, projected distortions can vary considerably, depending on the analyst's optimism or pessimism about future trends in world food prices.

To evaluate the corresponding sensitivity of estimated efficiency gains from reform, additional runs were made simulating a ten-year phased removal of agricultural distortions in only OECD countries over the period 1991-2000. These runs were replicated to correspond with each of the reference simulations. The estimated efficiency gains from liberalisation are listed in the last row of Table 5. When projected international food prices are lower by 20 percent, the estimated net global gains from reform are higher by 15 per cent.

One important message in the foregoing is as follows. Given the adaptive nature of domestic policies affecting food trade, any truly useful analysis of one country's policies affecting food production and trade must take into account the extent to which the policies of others will adapt in response. The appropriate model should therefore make those policies endogenous. Furthermore, that model had better be more than just a vehicle for comparative analysis; its performance will also depend importantly on its forecasting strength.

An example of the practical importance of the latter point is the 1980 United States Farm Bill. Policy was formulated in that year in a climate of optimism about future export markets for staple food products, influenced in part by the Carter Administration's "Global 2000 Report". No need was perceived to address the means by which farmers might be assisted if international prices collapsed. Floor prices would continue to be set at levels it was expected could be defended with additions to public stocks. When international prices
### TABLE 5

Dependency of Estimated Price and Welfare Effects of Reform on the Reference Projection to 2000

<table>
<thead>
<tr>
<th>Index of international food prices (1980-82=100)</th>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>54</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

| Average OECD nominal protection coefficient     | 1.61 | 1.85   | 2.15 |

| Annual global net welfare gain from a phased total liberalisation 1991-2000 | 35   | 40     | 46   |

**Note:** The welfare measures used here are equivalent variations in income. They ignore risk benefits, assuming agents are risk neutral.

**Source:** Model simulations more fully documented in Tyers and Anderson (forthcoming).
did indeed collapse, United States public cereal stocks rose to unprecedented levels, effectively defending the floor price for the world as a whole. From the viewpoint of the United States, this was a particularly expensive approach to the assistance of its farmers, one which was subsequently changed following the 1985 Farm Bill.
CONCLUSION

Numerous models of domestic and international food markets have been used in support of the Uruguay Round of international trade negotiations. Almost all these models adopt a comparative static approach and many also rely on the partial equilibrium assumption to simulate sectorally disconnected markets for homogeneous commodities. The omission from many of intersectoral effects and differentiated products, and from virtually all of dynamic behaviour and risk has tended to misdirect those negotiations and, at best, to retard the process of reform. Applications of these models have examined price and trade effects of reform, though emphasis has been given to implicit transfers among interest groups and across countries in particular years. The problem arises when these calculations omit the effects of distortions in other sectors and, more importantly, when such attention is focussed on distortions which are temporary and indirect consequences of the insulation of domestic markets against external disturbances. Where market insulation is the primary motivation there is usually a broad base of political support for the exclusion of shocks presumed to be initiated by foreigners. This issue might better have been addressed had the research emphasised the risk-spreading capacity of international food markets and the extent to which the reform of market insulating policies in all countries could eliminate the need for it in any.

It is of particular importance that new models for food trade policy analysis incorporate dynamic behaviour and price risk. This will ensure that they reflect a fundamental motivation for food trade distortions and that they are useful in addressing the collective mismanagement of the global commons suggested by unnecessarily risky markets. Such models must necessarily be more difficult to interpret, however. The effects of the pure protection and market-insulating components of food policies are then difficult to separate and the implications for welfare difficult to measure. Furthermore, no longer is it
appropriate for models to be designed to specialise in either policy analysis or forecasting. To do the former well requires that the latter also be done well.
This paper extends a lecture presented at the Center for International Food and Agricultural Policy, University of Minnesota, February 22 1990. Thanks are due to Ford Runge, Harald von Witzke and Jim Houk for useful comments and suggestions.

1. The way in which the standard comparative static analysis has helped to galvanise groups likely to lose from trade liberalisation is suggested by the report on Roningen and Dixit by the Center for Rural Affairs 1990.

2. Insulation by most countries has also accelerated the downward trend of international food prices.

3. I present quantitative evidence in support of this proposition in Tyers 1990a.

4. Extensions in the paper by Gibbard and Tyers yield the same general pattern of results when countries are large enough to affect world prices.

5. Although the model does include endogenous policy formation and stock-holding, it relies on some simple behavioural assumptions, including that all agents have backward-looking expectations. Clearly, some agents in industrial countries would be better characterised as having model-consistent expectations. Methodologies are now available which make this possible, though none are yet in use in global agricultural trade models.

4. Of course, the projection beyond 1987 employs stochastic simulation. The mean projections therefore disguise an infinite number of alternative combinations of projected prices, rates of protection and efficiency losses.

5. This is provided that most food production in the liberalising countries is protected. Of course, if international prices are high and negative protection is most common, then insulation would yield larger price distortions.
REFERENCES


Linnemann, H. and others, MOIRA: Model of International Relations in Agriculture (Amsterdam: North Holland, 1979).


FIGURE 1

Fig. 1. Real international food prices, 1900 to 1987 (1977-79 = 100). An index of export prices in US dollars for cereals, meats, dairy products and sugar, deflated by the U.S. producer price index (primarily of industrial product prices), with weights based on the importance of each product in global exports in 1977-79.

Source: Tyers and Anderson (forthcoming), based mainly on price series from the World Bank's Economic Analysis and Projections Department.
FIGURE 2

Price projection: All GLS

Index

120
100
80
60
40
20
0


Time

Actual
Reference projection
FIGURE 3

Price projection: All GLS
Reference vs no insulation as of 1982

Index

120

100

80

60

40

20

0


Time
Price projection: Wheat
Reference vs no insulation as of 1982