Searching under the Light: The Neglect of Dynamics and Risk in the Analysis of Food Trade Reforms

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Abstract: The substantial investment in models of global 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 misled 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 that have stemmed from the application of "standard" but inappropriate models and examines the implications of extending the standard methodology to include the combination of explicit food price risk with dynamic behaviour and market-insulating policies.

Introduction

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 pavement 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 characterize 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 régimes 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 (Roningen, 1986; and OECD, 1990). But the improvements they offer still leave important deficiencies that, in my view, must be addressed before we have a truly useful characterization of global food markets. In particular, they ignore the roles of intertemporal changes and uncertainty, which are critical to both policy formation and the behaviour of private agents. The consequences of policy, as measured in comparative static terms, are thereby confused with the motivation for policy formation.

The emphasis in early work was on such questions as: "Who benefits from the existing market distortions, by how much, and at whose expense?" Although rent seeking by immediate beneficiaries might be influenced by this, wider support for some distortionary policies need not depend solely 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 activist redistribution of preexisting domestic wealth, yet insulation as an aspect of agricultural policy has thus far been only weakly addressed by research on agricultural trade.

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 a 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 (Thompson, 1981).

Later, still in a comparative static mode, new approaches emphasized international interactions, most popularly in non-spatial partial equilibrium models of individual world commodity markets (in the manner of Valdés and Zeitz, 1980). Interactions between separate commodity markets were incorporated in some single models that retained the comparative static approach and the partial equilibrium assumption; i.e., that the totality of the markets represented is small compared with the economy as a whole (as in Rojko *et al.*, 1978).

Even while all these partial equilibrium comparative static models were informing the policy process, important deficiencies were recognized by some, including the assumption that policy is exogenous (Rausser and de Gorter, 1989). New models were built to experiment with endogenous policy formation, and empirically based price transmission equations have become standard (Roningen and Dixit, 1989). The failure of the partial equilibrium assumption in the case of developing countries has also been addressed with the adoption of general equilibrium techniques (Hertel, 1990) and their application to global models (Parikh *et al.*, 1988; and Burniaux and Waelbroeck, 1985).

But despite a very large academic literature, most current global models still ignore the role of intertemporal changes and uncertainty, both of which are critical to food market behaviour and policy formation. Our own efforts have crudely addressed food market dynamics (Tyers, 1985; and Tyers and Anderson, 1992), while work proceeds on more sophisticated representations (that simulate dynamic games), none of which has been available in time to inform the Uruguay Round.

Food Trade Distortions Primarily Serve Market Insulation

As foreshadowed in the introduction, it is my contention that the broad political agenda behind most distortionary agricultural trade 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 taxpayers, the results have served to better inform the likely losers from reform and hence to galvanize the forces against it (see the critique of Roningen and Dixit, 1989, by the Center for Rural Affairs, 1990). The remainder of this section addresses the veracity of my premise. Why should domestic market insulation be a primary motivation for food market distortions?

Following Kindleberger (1986) and Runge *et al.* (1989), one can readily characterize the risk-spreading role of world food markets as an international public good. Its use is not restricted to those countries that share risk by exposing their domestic agents to price fluctuations; neither is it characterized by direct rivalry. Countries that insulate their domestic markets, using trade to eliminate residual excess demands or supplies and thereby stabilizing 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 that has been the subject of extensive comparative static analysis in recent years can be seen as a consequence of market insulation. Real food commodity prices have maintained a declining trend throughout this century, one which has steepened since the early 1970s (Grilli and Yang, 1988; and Tyers and Anderson, 1992). 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.

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 or on the reasons why governments choose to avoid it. It has therefore failed fully to 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, for given international price risk, 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 industrialized countries, we might hypothesize that this preference would be strongest among the groups with most apparent influence over agricultural policy in each case; i.e., broadly, consumers and industrial capital owners in developing countries and farmers in industrial countries (Anderson, Hayami, *et al.*, 1986). What, then, are the directions of the welfare impacts of price stabilization on these groups?

Reviews of the theoretical literature on the subject highlight the ambiguous nature of the consumer and producer welfare effects of price stabilization (see, for example, Tyers, 1990). The preferences for price stability of these predominant groups thus remain matters for empirical analysis. To examine these effects in some illustrative cases, I briefly report the results from an elementary model of a single open commodity market (detailed mathematically in Tyers and Anderson, 1992, chap. 3).

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 cannot therefore 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 archetypal economies. One is a poor country that imports rice, and the other is an industrial country that exports rice. In the poor country, farmers consume half the rice but earn only a quarter of national income. Workers consume the rest and receive wages that 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 the parameters governing their consumption behaviour are therefore 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 taxpayers 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 (1981) is adopted, with only minor modification (Tyers and Anderson, 1992, chap. 3).

Empirical evidence as to the levels of short- and long-run market insulation (Tyers, 1990) suggests that market insulation is generally partial in both industrialized and developing countries. The case examined is therefore that of a partial insulation that reduces the coefficient of variation of the domestic price by half. As the results presented in Table 1 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 countries commit a relatively large share of their income to the purchase of farm products. Their gain from revenue stabilization is largely offset by losses that 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) stabilization effects are dominant.

Table 1—Benefits from Partial (50-Percent) Insulation in "Typical" Developing and Industrial Economies

	Benefits as a Percent of Average Group Income or of Government Expenditure	
	Developing Economy	Industrial Economy
Farmers	0.2	4.0
Workers	−0.05	0.02
Industrial capital owners	2.7	0.0[a]
Government revenue	0.6	0.0

[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 drawing on parameter values from World Bank (1986) anddetailed algebraically in Tyers and Anderson (1992).

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 nonagricultural 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 stabilization 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 be protected at the expense of other sectors, farmers have the dominant interest in price stabilization. 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.

The reasoning above is readily extended to long-run insulation, leading to the drift of domestic prices away from international prices and to pure protection. Although domestic rent-seeking pressures obviously play a role, it is one that is greatly facilitated when insulating policies are present. This is because, 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.

Some Implications of Market Insulation for Agricultural Trade Policy Analysis

The presence of market-insulating policies makes the analysis of policy reform and its interpretation more difficult. Moreover, commonly used comparative static analysis can be badly misleading. To demonstrate this, I examine two 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 hand, to risk-avoiding market insulation.

To illustrate these implications for policy analysis, I draw on the Tyers/Anderson model of world trade in grains, livestock products, and sugar. This dynamic model is equipped for this purpose with endogenous policy formation and stock-holding behaviour (Tyers and Anderson, 1992, chap. 5). Its base period, 1980–82, has average international food prices roughly on the long-run trend. Simulations run from 1983 to the year 2000. Disturbances to food production provide the main source of uncertainty in the model and 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 that projects a continuing downward trend in real international food prices during the 1990s, despite the temporary resurgence of real prices in the late 1980s. Protection rates in countries with insulating policies rise and remain higher than in the base period (Table 2), although they do abate slightly in the late-1990s as the dip in world prices is gradually passed through to some domestic agents. Price distortions and their associated efficiency losses peak in 1987, and their projected mean declines thereafter.

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, Pearce, and Walker (1990). They address distortions that appear high because of the year chosen (1986) but that are mere symptoms of more complex policies not intended to distort prices to that extent in all years.

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. Not surprisingly, the projected path of international prices is made more smooth by the wider spreading of price risk. 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 2 no longer occur. The differences between the retained protection rates of the base period and those that occur when markets are insulated is then that part of price distortions due to the insulating component of policies. The two components of policy are separated in this way in Table 2 and their global efficiency losses compared.

Table 2—Changes in Protection and Efficiency Losses Due to Insulation since 1982

	1980–82	1987	1990	1995	2000
OECD nominal protection coefficient					
Reference	1.40	1.96	1.81	1.91	1.85
No insulation		1.43	1.39	1.38	1.37
Percent of distortion due to insulation		55	51	58	56
Annual global net welfare cost of OECD protection,[a] 1985 US $'000 million					
Reference	16	83	45	46	50
No insulation		20	18	13	12
Percent of cost due to insulation		76	60	72	76

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

Source: Simulations using the Tyers-Anderson trade model (Tyers and Anderson, 1992).

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.

Note

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Discussion Opening—*Jock R. Anderson* (World Bank)

I feel somewhat like a spiritual adviser receiving a confession—if one of the major global commodity modellers wants to whisper that all has not been wise and well in this field, I am inclined to listen carefully. Thus it was that I found this paper to be of great interest. The interest starts with the catchy title. "Searching under the Light" can, as the author suggests, sometimes be about all that one can do.

My remarks on the presented version of this paper opened by a complaint that, at least in its abbreviated form, I found the formal logic and persuasiveness to be less than optimal. Since that time, however, I have had the opportunity of reading a more complete telling of the story, and I find the general argument to be entirely reasonable.

Models are intrinsically simplifications, and, if a particular element is excluded from the model of reality, it is more or less inevitable that new information about this element or its links to other parts of the modelled system simply cannot be gleaned from the model.

Risk management, to focus on one highlighted matter seemingly excluded from most of the "bad" models, has probably been an important element of the political economy of protectionism. Thus, to the extent that models have inadequately represented the stochastic structure of production and trade and have ignored the risk aversion of all relevant agents, they will probably not be useful to policy analysts concerned with such topics. Indeed, I have argued elsewhere that the more deterministic models often used are, through such omissions, systematically wrong in estimates of even the mean or average effects.

Similar arguments surely pertain to the author's claimed excessively underplayed dynamic elements of model structures. All this remote philosophizing is one thing and, I would contend, not really debatable. Whether, however, such underspecified models have, as he argues, also variously misled, misguided, and misinformed the negotiators in the Uruguay Round seems to be quite another thing. It suggests, for instance, that negotiators really take the results of these intrinsically inadequate models seriously.

From the observational perspective of one who has not been actively involved, however, it seems that the debate in much of the Uruguay Round is, for better or worse, driven by other forces that are overwhelmingly political. If this is the case, it may be that all the formal econometric modelling of the costs and benefits of trade reforms has, to continue the metaphor of the title, been conducted in a conveniently lit part of the policy arena, and that the real action has been elsewhere. Notwithstanding this possibility, I enjoyed this paper and am firmly of the belief that trade policy analysts will be usefully informed by it.

[Other discussion of this paper and the author's reply appear on page 190.]