THE MINISTERIAL TRADE MANDATE MODEL

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INTRODUCTION

Following the sharp rise in agricultural demand and prices in the early 1970s, the acceleration of inflation, the worldwide recession and the macroeconomic policies of the late 1970s and early 1980s contributed to a depression of agricultural incomes. As a result, governments in many OECD countries responded by introducing and adding to a variety of measures designed to assist producers. These often involved, or were accompanied by, quantitative trade restraints in addition to providing deficiency payments, input subsidies and other forms of financial assistance to the agricultural sector. The OECD agricultural economy thus became increasingly isolated from world markets, while in Member countries government expenditures on agricultural support increased sharply and consumers paid higher prices for food.

In May 1982, the OECD Ministerial Council mandated a study to examine the likely consequences of a balanced and gradual reduction in the protection of the agricultural sector in Member countries and its fuller integration into an open multilateral trading system. The resulting Trade Mandate Study, carried out by the OECD Directorate for Food, Agriculture and Fisheries, involved a comprehensive analysis of agricultural policies in OECD Member countries and their implications, particularly for trade (OECD, 1987a). An integral part of this study was the calculation of Producer and Consumer Subsidy Equivalents (PSE/CSEs), developed to provide a quantitative measure of assistance to producers and consumers'. Within this context, the Ministerial Trade Mandate (MTM) model was explicitly developed to exploit this data, to provide a consistent framework for the quantitative analysis of agricultural policy reform and to augment the more qualitative analyses conducted as part of the Trade Mandate Study.

More specifically, the MTM model is a representation of the world crop and livestock economy. It was originally specified as a series of eleven country or regional models, each having a similar structure within which endogenous relationships explain the economic factors determining demand, supply and prices for eighteen categories of agricultural commodities. Individual country models are then linked through net trade; a specification which highlights the interdependence of countries and commodities in the world agricultural economy. The model can be broadly characterised as a medium-term, comparative-static model; one which estimates the impact of policy changes after an adjustment period of

about five years, without indicating any specific time path for these adjustments (OECD, 1988).

The design of the MTM model was very much influenced by the issues raised in the Trade Mandate Study: in particular the need to quantify the impact of a reduction in agricultural protection on domestic and international commodity markets. The measures of protection used, the PSE/CSEs, represent the major policy variables in the model, although supply management policies, e.g. United States and Japanese cereal acreage Set-Aside and cereal and dairy stockholding, are also present.

Since its completion, the MTM model has been used to examine a variety of scenarios related to hypothetical reductions in PSE/CSEs. Detailed results for the period 1979-81 were presented in OECD (1987a) and an update for the period 1982-85 was reported in OECD (1988b).

Subsequently, the MTM model has been extended and revised to provide more detailed information on the implications of agriculture policy reform, including those for developing countries, OECD ***net*** farm income, the use of individual farm inputs and the value of farm assets. The model is now being further developed to examine the influence of a wider range of agricultural policies in OECD Member countries.

The following section describes overall model structure and the data sources involved. Section II then presents the key results of policy simulations made with the MTM model; these relate primarily to the effects of a partial reduction in agricultural protection. The final section describes more recent developments, which extend the coverage of the model, and also discusses its likely future directions and applications.

I. MODEL STRUCTURE

A. Country models

The MTM model system is composed of eleven individual country or regional agricultural models which are linked through trade. These countries, regions and commodities are listed in Table 1. Given an emphasis on transparency, no explicit assumptions are made regarding the underlying production technologies or consumers' welfare functions. Rather, a system of supply and demand elasticities is used to approximate these underlying relationships. These elasticities are incorporated into a series of linear equations which describe supply and demand as functions of effective prices at the producer and consumer level for each commodity and each country. The average values of these supply and demand elasticities are broadly summarised in Table 2. Within this framework, policy changes are

Countries:		Countries:	
Canada	: CAN	New Zealand	: NZL
Australia	: AUS	Japan	: JPN
European Community	: EC[a]	Nordic Group	: NOR[b]
United States	: USA	Mediterranean Group	: MED[c]
Austria	: AUT	Centrally planned economies	: CPES
Rest of World	: REST		
Commodities:		**Commodities:**	
Milk	: MK[d]	Soybeans	: SB
Beef	: BF	Sugar	: SG
Pork	: PK	Rice	: RC
Poultrymeat	: PT	Rapeseed	: RP
Sheepmeat	: SH	Manioc	: MN
Wool	: WL	Corn Gluten Feed	: CGF
Eggs	: EG	Energy rich feeds	: OER[e]
Wheat	: WT	Protein rich feeds	: OPR[e]
Coarse arains	: CG	Foraae	: FG

a/ During the 1982-85 period, the following ten countries were members of the EC Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands and the United Kingdom.

b/ The Nordic group comprises Finland, Iceland, Norway, Sweden and Switzerland.

c/ The Mediterranean group comprises Portugal, Spain, Turkey and Yugoslavia.

d/ Milk is treated in terms of whole milk and a number of dairy products including butter, cheese, whole milk powder, condensed milk and skimmed milk powder.

e/ The aggregate called "energy rich" includes feeds for which the protein content is below 20 per cent in dry matter. Other feedstuffs, those with a protein content above 20 per cent, are grouped in the "protein rich" category.

Table 2. **Aggregate supply and demand elasticities**

Per cent

Country	Response to increase in all production prices including livestock feed prices[a]	Response to increase in all consumption prices (excludes changes in livestock feed quantities)[b]
Canada	**0.28**	**-0.60**
Australia	**0.22**	**-0.46**
EC	**0.38**	**-0.41**
United States	**0.26**	**-0.40**
Austria	**0.36**	**-0.35**
New Zealand	**0.49**	**-0.38**
Japan	**0.51**	**-0.24**
Nordic	**0.30**	**-0.49**
Mediterranean	**0.33**	**-0.38**
OECD	**0.31**	**-0.40**

a/ Elasticity measures the effect on total agricultural output of a one per cent increase in all agricultural prices.

b/ Elasticity measures the effect on total final agricultural demand of a one per cent increase in all agricultural prices.

Source: OECO MTM model.

represented primarily by changes in the PSE/CSEs which influence prices and quantities as described below.

For a given country *i* and commodity *j*, the typical set of equations is as follows:

Domestic Production

$$QS_{ij} = a_{ijo} + a_{ijj} PS_{ij} + \sum_{c \neq j} (a_{ijc} PS_{ic}) \quad [1]$$

Final Demand

$$QD_{ij} = b_{ijo} + b_{ijj} PD_{ij} + \sum_{c \neq j} (b_{ijc} PD_{ic}) \quad [2]$$

Domestic Prices

$$PS_{ij} = XR_i PW_j + MP_{ij} + PSE_{ij}$$
$$PD_{ij} = XR_i PW_j + MD_{ij} + CSE_{ij} \quad [3]$$

Net Trade

$$NM_{ij} = QD_{ij} + ST_{ij} - QS_{ij} \quad [4]$$

where:

QS_{ij}	is the quantity produced;
QD_{ij}	is the quantity consumed;
ST_{ij}	is the change in stocks;
NM_{ij}	is net imports;
PW_j	is the world price of commodity j;
XR_i	is the exchange rate in local currency per US $;
PS_{ij}	and PD_{ij} are the effective prices at the producer and consumer levels, respectively;
PSE_{ij}	and CSE_{ij} are the producer and consumer subsidy equivalents (PSE/CSE);
MP_{ij}	and MD_{ij} are the margins between world and domestic producer and consumer prices, respectively; and
a_{ijc} and b_{ijc}	are the coefficients derived from the elasticities in the supply and demand equations.

Within the system, effective prices are calculated as the sum of world prices, in domestic currency terms, the relevant PSE/CSEs and a margin allowing for factors such as transport costs or quality differences. The assistance to agriculture, measured by the PSE/CSE estimates, can be separated into two elements.

The first of these represents the support given to market prices, measured by the difference between producer or consumer prices and world prices. The second element relates to transfers from policy measures such as direct payments, input subsidies or general services – as described by Cahill *et* al. **(1989).** Both types of assistance are therefore included in effective prices, defined as market prices plus the second element of the PSE/CSEs. The relevant margins are measured as market prices less world prices and the market price support component of the PSE/CSEs – all calculations using base period data appropriately converted to domestic currencies. Thus, in the functioning of the price transmission equation, the margins are assumed to be fixed, the unit PSEs or CSEs can be exogenously shocked and world price changes are assumed to be fully passed back to effective producer and consumer prices.

In model simulation, net imports, which are by definition zero at the world level, are calculated and defined as the difference between utilisation and production, plus the changes in stocks which are assumed to be fixed. When any exogenous variable is shocked, world prices are assumed to adjust iteratively until world supply and demand are in balance and world net imports are again equal to zero.

The above set of equations describes the basic structure of a typical country model, but differences do exist, depending on the commodity. These can be grouped into three main classifications: crops, livestock and dairy[2].

In the ***crop models,*** domestic production responds to the changes in a crop's own price and any cross-price effects as described in Equation [1]. Demand, however, includes final demand (human and industrial), intermediate demand of grains for livestock feed and demand for seeds (assumed to be a fixed proportion of output).

For a given country *i,* foodstuff *j,* and livestock category ***k, the feed sector*** can be summed up in the following three equations:

Feed Rate

$$FR_{ij}^{k} = C_{ijo}^{k} + C_{ijj}^{k} FP_{ij} + \sum_{c \neq i} (C_{ijc}^{k} FP_{ic}) \qquad [5]$$

Feed Use

$$QI_{ij} = \sum_{k} FR_{ij}^{k} \times QS_{ik} \qquad [6]$$

Price of Ration

$$PRT_{i}^{k} = \sum_{j} FP_{ij} \times FR_{ij}^{k} \qquad [7]$$

where:

FR_{ij}^{k} is the feeding rate defined as the ratio of feed use by a livestock category to its production;

FP_{ij} is the effective price of feed defined as the producer and consumer prices;

QI_{ij} is the total feed use;

PRT_i^k is the price of a feed ration for livestock k; and

C_{ijc}^k are coefficients derived from the compensated elasticities of substitution between feedstuffs.

Feed demand thus reflects not only changes in the volume of output of livestock products (Equation [6]) but also changes in the composition of feed rations, which in turn are determined by estimated feed demand elasticities. The latter determine the rate with which one feed can be substituted for another in response to a movement in relative feed prices (Equation [5]). Net trade for crops is the same as described in Equation [4], although it has additional components relating to feed demand and output used as seed. In all countries forage is treated as a crop, although there are only feed demand equations for forage and no corresponding world price linkage. Since forage is not internationally traded, its price and use in each country is assumed to be determined entirely within that country.

In the livestock equations, the supply-side differs from the typical equations presented above. Livestock production is determined by the price of the product, the price of substitutes and the price of the feed ration for the product, calculated separately in the feed block. The dairy sector partly follows the structure of other livestock products, but is more complex since it is multiproduct and treats whole milk and dairy products differently. Milk production is divided into two types: *i)* manufacturing milk and milk used to produce traded dairy products: butter and skimmed milk powder, cheese, whole milk powder and condensed milk, and *ii)* milk used in non-traded products: fluid milk for human consumption, milk used for animal feed (assumed to be a constant proportion of all milk produced) and other milk. The milk equations describe the demand for dairy products as functions of their own prices and the prices of substitute products. The supply of dairy products is determined by their own and cross-price elasticities, by the supply of milk available for processing and its allocation among various products. The model thus solves for each dairy product's price, with the overall milk price determined as an average of manufacturing and fluid milk prices.

B. Policy elements

The principal policy elements in the model are the PSE/CSE estimates, representing the total transfers to agriculture by unit of production. Though some elements of the PSE can be negative, the total PSE is always positive in OECD countries and CSEs are entered with the same sign as the PSEs for the corresponding policy measure.

In addition to the PSE/CSEs, policy instruments which explicitly shift demand and supply relationships are introduced. These include the Set-Aside and stock-holding policy (Farmer-Owned Reserve and Commodity Credit Corporation programmes) in the United States, the Japanese Paddy Field Reorientation Programme (PFRP), and changes in publicly-owned dairy stocks in the United States and the EC. In all cases, these policies are measured by the change over the base period rather than in absolute levels. These changes are added exogenously to the corresponding commodity-specific supply equation. The approach of incorporating volume shifting policies directly has been adopted when the policy itself is quantity-oriented and good information is available on their quantitative effects, particularly when internal/external price differences are difficult to observe, for example, because of strong linkages between domestic and world prices. Volume shifting policies operate somewhat differently than the PSE/CSEs. For example, reducing the Set-Aside programme would expand rather than contract United States supply, as would a reduction in the PSE.

C. Data

Given the overall structure of the model, the main data requirements for each country are the prices, PSE/CSEs, elasticities (supply, final demand and feed demand), production and consumption quantities (both final and feed demand) and stock changes.

Production, utilisation, prices and stock data were obtained from the OECD agricultural database and international and national sources as necessary. The base period for all data is an average of the period from 1982 to 1985. PSE/CSEs had been calculated in detail for Canada, Australia, EC, United States, Austria, Japan and New Zealand, while less detailed estimates were used for the Nordic and Mediterranean areas[3]. The Centrally Planned Economies and the Rest of the World are assumed to leave assistance levels unchanged. Supply and demand elasticities were taken, wherever possible, from published sources for the country or region in question. Where no information was available, elasticities were assumed or, in a few instances, econometrically estimated by the OECD. The resulting elasticity matrices are thus the result of extensive bibliographical research and close co-operation with country experts. "Medium-term" elasticities are used in the model; that is, they are assumed to measure the response to a given price change that would occur after approximately five years.

The feed technology available to farmers is represented in the model by a matrix of elasticities of substitution. These were constructed on a consistent basis for all countries/regions, with extensive use being made of published econometric estimates of feed demand parameters. Feed decisions are modelled as a multi-stage process. The first stage reflects the decision faced by farmers. They have to choose the feed mix of wheat and coarse grains produced on-farm, compound

feed and forage that minimises the cost of producing their desired livestock output. Given the constraints imposed by the farmer's choice, compounders are then assumed to choose the mix of feed inputs which minimises the cost of producing the quantity of compound feed demanded. The feed compounders' cost-minimising problem is represented in turn as a two-stage process. The first involves minimising the aggregate cost of the grains, energy and protein groups of the ration. At the second stage compounders decide on the mix of inputs which minimises the cost of producing the chosen aggregate level of grains, energy and protein.

D. The behavioural properties of the MTM model

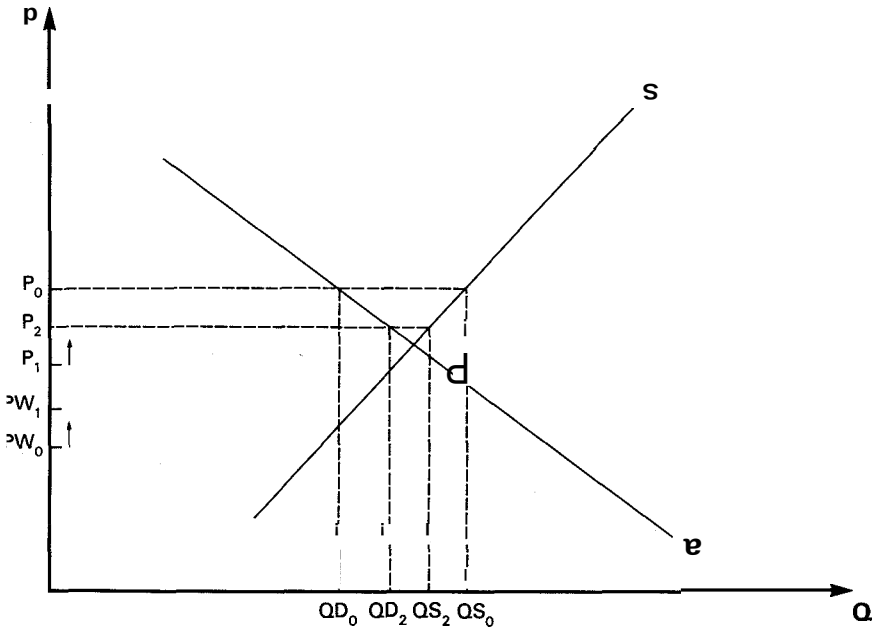
The MTM model simulation results typically represent the outcomes of reductions in base period assistance levels, after a five-year period has elapsed. Other factors such as technology, macroeconomic policies, assistance levels in the non-agricultural sector, population, etc., are assumed to be held constant. The impact of a given per cent reduction in PSE/CSEs on world prices depends primarily on the size of the PSE/CSE compared to effective prices. If, for example, the PSE is 50 per cent of the effective price, a 10 per cent reduction in the PSE will first imply a 5 per cent initial reduction in the effective producer price. These price variations are then transmitted to supply and demand quantities, with shifts in production and consumption depending on the own price and cross-price elasticities, i.e. the slopes of the supply or demand curves.

Chart A illustrates the effects of changing the PSE/CSE for one product in one country. The initial world price is PW_0 and the effective price in the country is P_0, with the difference $(P_0 - PW_0)$ being due to government support – the PSE/CSE. Given this support level, the country is a net exporter (net exports equal $QS_0 - QD_0$). Assume the government reduces its support to $(P_1 - PW_0)$, where P_1 is the effective price under the new, lower PSE/CSE. This lower price then stimulates demand and reduces supply in the country and, since there are assumed to be no offsetting policy changes in other countries, creates extra demand worldwide. As a result, the world price will rise to a new level, for example, PW_1 in Chart A, to return world net trade to zero. In practice, the determination of this new world price involves iterating across all countries and all goods. The new effective price in the country in question is then given as PW_1 plus the new PSE/CSE, i.e. the price denoted as P_2, with final net exports of $(QS_2 - QD_2)$. In this way, the reaction of world prices ensures that the fall in the final effective price is in general less than the decline in the level of support.

This example describes the simplified case of a one-product market. In the full MTM model, interactions also take place between products through cross-price elasticities. As these are generally negative – that is, various products are taken to be substitutes rather than complements – the cross effects generally

CHART A

IMPACT OF A PSE/CSE REDUCTION



lead to smaller overall effects on world prices and quantities. The feed sector also modifies the patterns of behaviour: when prices of all commodities are reduced, the resulting contraction of livestock production lowers feed use and has a further downward effect on feed prices. When direct quantity regulating policies are reduced, a fourth effect is felt: these policies shift the supply curve to the right, corresponding to the additional quantity produced entering the market, and thereby depress domestic and world prices. The results analysed in the following sections incorporate the combination of these four main effects.

II. SIMULATING THE PARTIAL LIBERALISATION OF AGRICULTURAL POLICIES

In this section, we consider the results of MTM model simulations designed originally to show the effects of reduced assistance using the base period 1982-1985. Specifically, the simulated effects of a 10 per cent reduction in

PSE/CSEs on world reference prices and OECD net trade are analysed, with special attention being paid to specific commodities and countries.

A. Impact on world prices

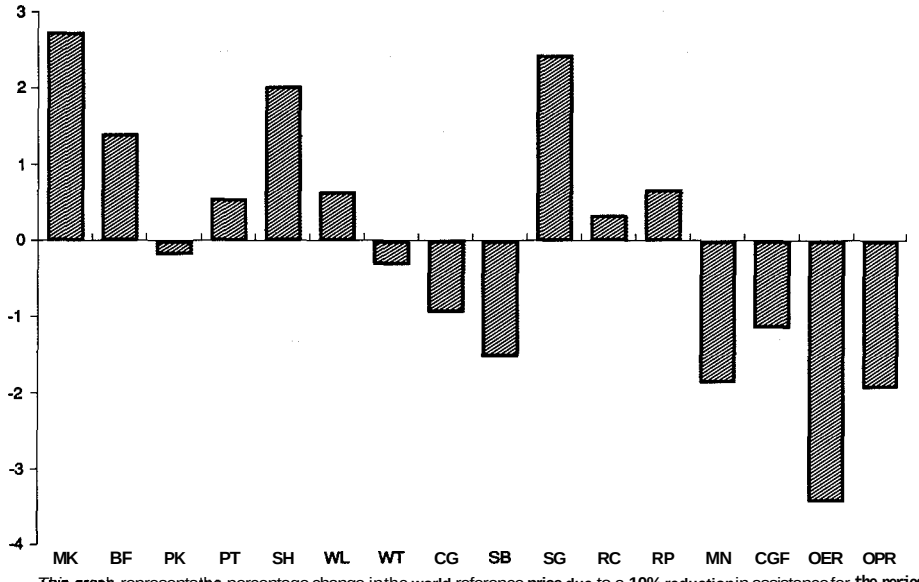
Given the form of the price equations, a 10 per cent reduction in PSE/CSEs reduces effective prices on domestic markets. As a consequence, agricultural production in the OECD countries declines while consumption rises, raising world market prices for animal products, sugar, rapeseed and rice (Chart B). Animal feed prices, on the other hand, are depressed – as animal product output falls, feed consumption falls and world prices for animal feed other than cereals are adversely affected. For cereals, reductions in the United States Set-Aside and stockholding programmes, add to these effects, resulting in a further slight fall in world prices.

Among animal products, the world reference price of *milk* increases most (by about 3 per cent), mainly because of the high existing levels of support for this product in most OECD countries. The influence of other commodities on milk prices is relatively slight. The rise in the world price of beef is around 1.5 per cent, and here too the change is due almost entirely to the direct PSE/CSE price effect.

CHART B

WORLD REFERENCE PRICE IMPACTS

%change due to a 10 %reduction in assistance
1982/85



This graph represents the percentage change in the world reference price due to a 10% reduction in assistance for the period 1982/85. The product codes are as indicated in table 1.

World prices of pork and poultrymeat, on the other hand, are depressed by reduced assistance for other animal products and cereals. Since both of these products usually enjoy little protection, their post-liberalisation effective prices fall less sharply than those of, say, beef and there is little increase in their consumption. Furthermore, the lower cost of animal feed encourages higher output of pigmeat and poultrymeat. This explains why the world prices of these products, which make intensive use of purchased feed, rise less in relation to those of milk and beef and even fall with reduced assistance, as in the case of pork. The rise in the world price of sheepmeat exceeds **2** per cent. This is due principally to direct price effects, though the reduction in assistance for wool as a joint product also has an influence. By contrast, the reduction in assistance for sheepmeat accounts for about one-third of the rise in wool prices.

The various contributions of the reduction in support to changes in the world reference price for cereals are shown in Table 3. As for the other commodities, the direct price effect is positive, whereas the cross-price effect is negative. For cereals, the latter impact is relatively important because one grain can quite readily be substituted for another, either at producer level or for animal feed. Moreover, reductions in quantitative supply restricting measures play a large role in reducing world prices: as less land is set aside and stocks diminish, so the supply of cereals expands on world markets, tending to lower the world price. The price reduction of 0.3 per cent for cereals also has important repercussions for other commodities: for feed intensive meat production, and for substitute products such as soybeans.

Among other commodities, sugar, which was fairly heavily supported during the period **1982-85,** shows the highest simulated world price increase. By contrast, the increases in world rice and *rapeseed* prices are relatively modest. The reduction of the Paddy Field Reorientation Programme has a net downward effect on the price of rice. The world price of feedstuffs other than cereals falls markedly. Because assistance for these feedstuffs is generally small, there is generally

Impact of a 10 per cent reduction in assistance for:	Change in world price of:	
	Wheat	Coarse arains
Direct volume shifting measures[a]	-0.43	-0.97
Direct PSE/CSEs	1.23	0.89
PSE/CSEs for other commodities	-1.11	-0.86
All measures combined	-0.31	-0.94

little direct price benefit from a reduction in support, and producers are adversely affected by the reduction in livestock production, which provides their only outlet. There is widespread substitution of one feed for another and consumption of corn-gluten-feed, for example, increases because of the improvement in its relative position.

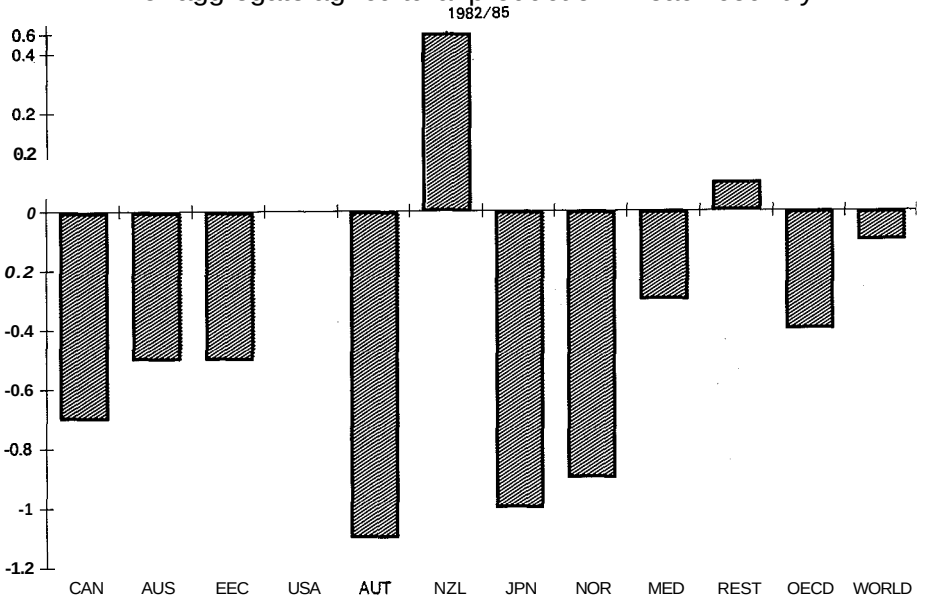
In sum, when assistance for all commodities is reduced by 10 per cent in all countries, the simulated changes in world reference prices are as follows: a rise for animal products, a sharp fall for animal feedstuffs and a slight decline for cereals. The trend in world prices is a good indicator of the state of international markets, but in order to analyse markets in individual countries it is also necessary to consider both the domestic prices and volumes produced in each country.

B. Impacts on production and trade

When assistance is reduced by 10 per cent in all **OECD** countries, the simulated effect on aggregate OECD agricultural production is a reduction of about one half of 1 per cent, while the changes in aggregate production for the rest of the world and the world as a whole are negligible (see Chart C). For all OECD

CHART C

Percentage change in the volume of aggregate agricultural production in each country



This graph represents the percentage change in the volume of agricultural production in each country during 1982/85. The country codes are shown in table 1.

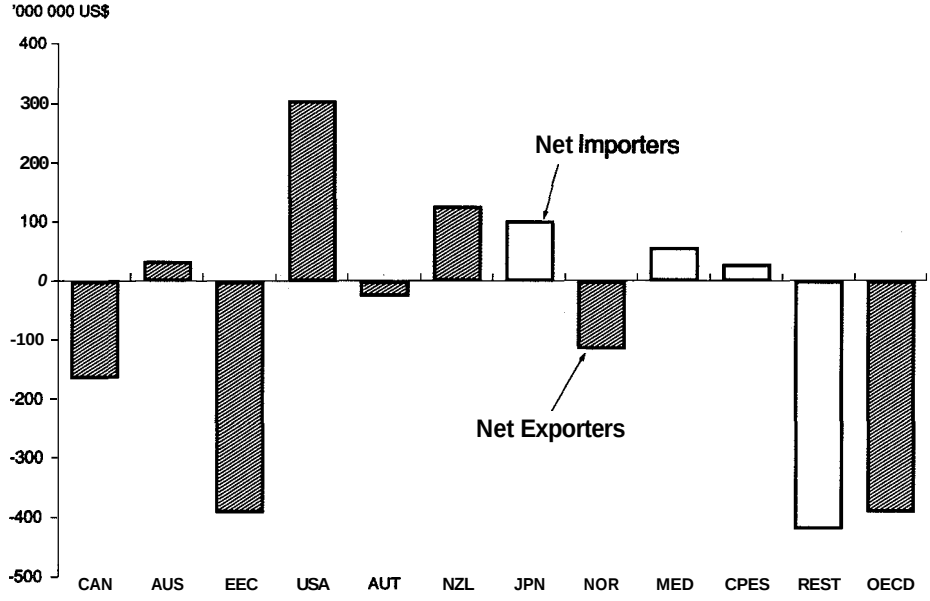
countries except New Zealand, reduced assistance leads to lower production. In New Zealand, production rises because the rise in world prices more than offsets the effects of reduced domestic protection, especially in the dairy sector. in the United States, the global volume of production remains stable; a decrease in dairy production being compensated by increases in animal and cereal production. In Canada and Australia, most of the decline comes from the cereal sector, whereas meat production grows. For the EC, Japan and the Nordic countries, there are significant reductions in output for most products.

Chart D shows the simulated changes in the value of net trade calculated at world reference prices for each country. The value of net OECD exports declines by over $400 million. Imports for the largest OECD net importers, Japan and the Mediterranean countries, increase in value terms. The EC and Nordic group experience a substantial cutback in the value of their net exports, with the latter group becoming a slight net importer. Among the other net exporters, trends vary. Canada and Austria experience reductions in net exports, while Australia, New Zealand and the United States increase the value of their net exports.

CHART D

VALUE CHANGES IN NET TRADE BY COUNTRY

1982/85



The country codes are shown in table 1.

Chart E shows the simulated changes in the value of net trade at world reference prices for the five most internationally traded commodities – dairy products, beef, wheat, coarse grains and soybeans. These results show which international commodity markets and countries are the most affected by the reduction in assistance. Generally, the United States and the EC, considering the size of their agricultural sectors and of their trade, dominate the international markets in most of these commodities.

In the simulation, the fall in net EC ***beef*** exports is almost entirely offset by the fall in net United States imports. Other OECD countries are less affected in relative terms, although Japan's net imports of beef rise by some $90 million. For this commodity, however, the substantial changes in the value of trade are largely due to its higher price.

For ***dairy products,*** the predominance of the United States and the EC is less marked. Net exports for New Zealand, an important participant in international trade, and net imports for Japan increase. Although EC dairy production declines, the group's net exports rise because butter stocks fall, the domestic price of cheese increases and less skimmed milk powder is used in animal feed. The United States, on the other hand, shows a substantial decline in the value of net trade in dairy products. United States net exports of skimmed milk powder are quite substantial and the domestic price for this commodity falls more in percentage terms than for other dairy products.

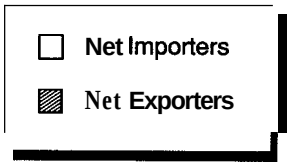
For ***cereals,*** the United States increases its net exports substantially given the simulated reduction in the Set-Aside and stockholding programmes. All other net exporters, however, see a reduction in the value of their net exports on account of both the lower world price for cereals and lower production. For most importers, the fall in cereal prices is more than offset by the rise in import volumes, and net imports increase in value terms. For Japan, however, the volume and value of net imports of coarse grains are reduced because livestock production, and hence use of coarse grains for feed, fall substantially. While the United States shows by far the greatest change for cereals, both the EC and the United States show significant changes for soybeans. The fall in net soybean imports by the EC is due to lower feed consumption. United States net exports fall both in response to the lower world price and an increase in domestic demand for soybeans as animal feed, as this product becomes relatively more competitive.

The fall in the EC's net agricultural exports is largely due to beef and, to a lesser extent, cereals, both of which combine to more than offset increases in dairy product exports and reductions in soybean imports. The relatively small change in United States net exports conceals a number of substantial changes in net trade for individual commodities. The net trade changes for Canada, Australia, and New Zealand are dominated by certain commodities: milk in the case of New Zealand and cereals in Canada and Australia. Charts D and E also tend to emphasise the importance of agricultural policy in the United States and the EC for

CHART E

IMPACT ON NET TRADE OF SELECTED COMMODITIES

1982/85



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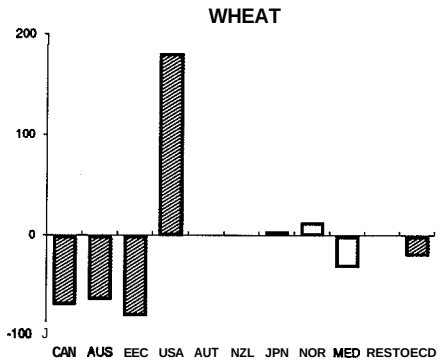
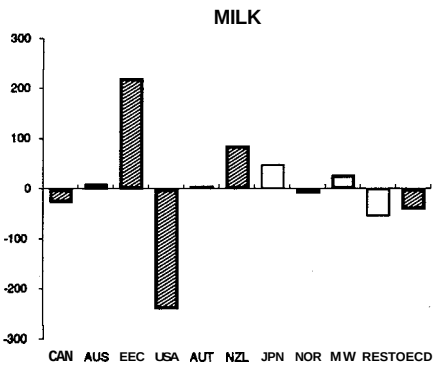
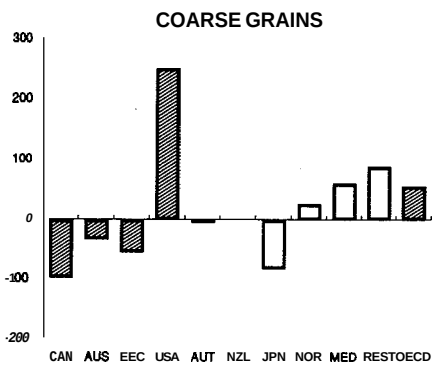
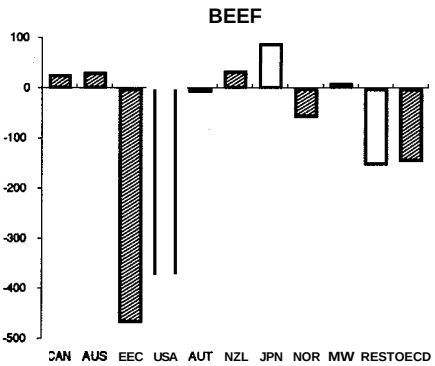
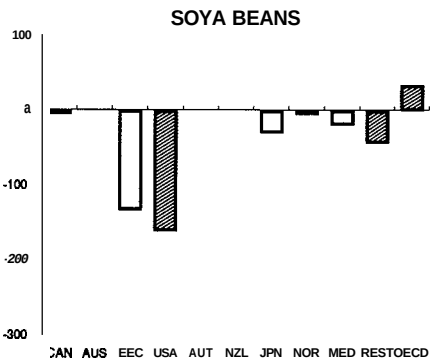










international trade of the other OECD Member countries and the world prices of temperate commodities. In particular, the Set-Aside and the stockholding policies of the United States are shown to have a major impact on cereal markets.

III. FURTHER DEVELOPMENTS

Following the completion of the Trade Mandate Study in early 1987, the further use of the MTM model has been largely determined by requests from policy-makers for more information related to domestic agricultural policy reform in the OECD countries. In particular, its development and use have been influenced by a number of international agreements related to agricultural policy. These concerns have emphasised the need to extend the model to include other countries and regions, to more completely represent production inputs and to develop the ability to analyse commodity-specific policies. This section outlines the various ways in which these changes have occurred in the context of specific policy issues.

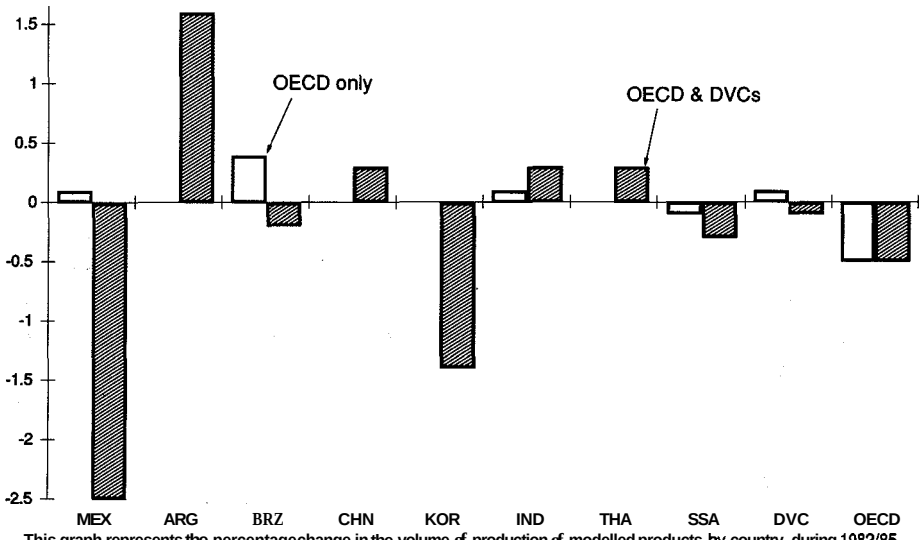
A. Developing *countries* model

The OECD countries' concern for the impact of trade policy reform on developing countries was re-affirmed at the mid-term review of the GATT (GATT 1989), where proposals were sought for modalities of special and differential treatment for developing countries and ways to take account of possible negative effects of the reform process on net food-importing developing countries. To examine the implications of OECD agricultural policy reform on the developing countries, eight additional countries/regions were added to the original MTM model (OECD 1989*b*). These include Argentina, Brazil, China, India, South Korea, Mexico, Thailand, and sub-Saharan Africa[4]. These countries represent some of the largest non-OECD traders in agricultural products, and include a representative set of exporters and importers, middle and low income countries, with different types of market and market-oriented policy regimes. Although the addition of these countries substantially increases the commodity coverage of the system, the general structure of the additional country models remains broadly similar to those for the OECD countries, with data on PSE/CSEs and model coefficients for the eight new countries largely derived from secondary sources[5].

Two agricultural policy reform scenarios have been constructed with the 19-country version of the model; a 10 per cent reduction in PSE/CSEs in only the

CHART F

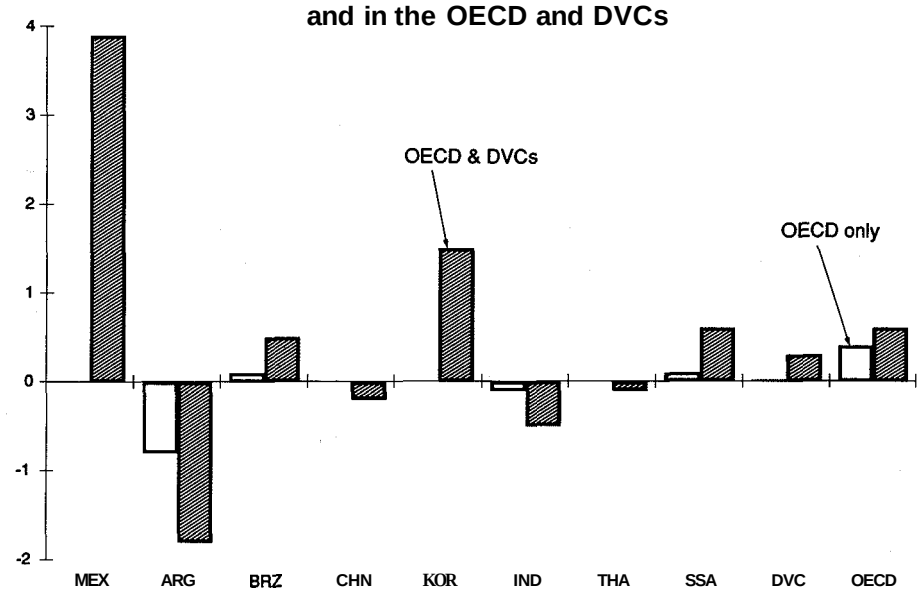
Percentage change in the volume of production due to a 10%reduction in assistance in the OECD and in the OECD and DVCs



This graph represents the percentage change in the volume of production of modelled products. by country, during 1982/85. Country *codes* are shown in note 4.

CHART G

Percentage change in the volume of consumption due to a 10%reduction in assistance in the OECD and in the OECD and DVCs



This graph represents the percentage change *in* the volume of consumption of modelled products, by country, during 1982/85. Country *codes are* shown in note 4.

OECD countries and a 10 per cent reduction in all countries/regions. The results of this analysis suggest that a 10 per cent reduction in OECD PSE/CSEs only, would have a positive but comparatively small impact on developing countries, even if changes in world prices were completely reflected in domestic markets. Animal and sugar production would increase while cereal and oilseed production would decrease – resulting in a slight rise in the value of output in each of the developing countries (Chart F). There would be little change in consumption levels except in Argentina where higher livestock prices would tend to reduce domestic consumption (Chart G). As a result, the net trade position of these countries would improve by an estimated $770 million, with Argentina and Brazil benefiting the most.

If the modelled developing countries also participated in the agricultural policy reform process, then the analysis suggests that the impacts on these economies would be much greater. By comparison with the case of only OECD reform, world prices would be significantly lower for all commodities, except poultry, and especially lower for red meats and cereal substitutes. A major factor contributing to this decline would be a significant reduction in the taxation of the agricultural sector in a number of developing countries. Production would increase for sugar, beef and especially pork in the developing countries and their net exports would increase by an estimated $1.4 billion. Production would decline significantly in Mexico and South Korea, where assistance levels are high, but also in sub-Saharan Africa and Brazil (Chart F). Consumption could also be expected to increase in Mexico, Brazil, South Korea and sub-Saharan Africa, but decline in Argentina (Chart G). The most affected commodities would be beef, sheep, sugar and milk.

B. Production inputs analysis

For policy-makers, it is also important to have information on the impact of agricultural policy reform on the value and use of production inputs and on net farm incomes. This type of information provides an indication of the nature and extent of adjustment assistance that might also be required. The MTM-input model is therefore currently being modified to include five major categories of production inputs – feed, other purchased materials, land, hired labour and capital – and this work is currently complete for four countries (Australia, Canada, the EC, and the United States).

Given the ongoing nature of work to improve basic data and model coefficients in this area, results from this analysis are still preliminary. For a 10 per cent reduction in PSE/CSEs, these results suggest that net farm income would rise in Australia, but fall slightly in the other three modelled countries and regions. Similarly, demand for agriculture production inputs would rise in Australia but fall

in the other countries. In terms of the use of various inputs, hired labour would appear to require the most adjustment and land the least. Land prices generally fall the most in Canada and the United States, while both land and feed prices decline at similar rates in the EC. Capital and purchased inputs would be unaffected in most cases.

C. Commodity policy analysis

Another major extension to the MTM model has been the incorporation of commodity-specific policies explicitly for four countries (Canada, EC, Japan and the United States). This extension involves the following basic changes to the model:

- the representation of quantitative restraints on production and trade;
- the endogenisation of the market price components of the PSE/CSEs;
- the re-specification of the world-to-domestic price links; and
- the more detailed representation of policy variables.

This version of the model has been used as part of the monitoring process of national commodity market policy developments, for example, in the case of the proposed changes to import controls on Japanese beef[6]. Here, the main simulation results suggest that there would, as expected, be a large increase in Japanese beef imports, accompanied by a relatively small rise in international beef prices and a substantial decline in the importation of pork into Japan. These results emphasise the need to analyse such policy developments on a multi-product, multi-country basis.

The model has also been used to examine the impact of supply management policies for cereal production in the United States and the EC. These results suggest that a decrease in the United States cereals target price would discourage participation in the restraint programme thereby increasing area planted. A decrease in the mandatory area reduction percentage could also increase production, depending on the affect on participation[7]. For the 1986-88 period, it was estimated that a 1 per cent reduction in the United States cereals target prices would have increased United States cereal production by 0.2 m.t. A 1 per cent decrease in the area reduction percentage would have increased production by 1.9 m.t. The EC stabiliser programme for cereals triggers a 3 per cent reduction in the following year's guaranteed price when production exceeds the maximum guaranteed quantity (currently 160 m.t.). Simulation results from the MTM model suggests that this policy would significantly lower EC exports since both production is reduced and consumption is stimulated through these lower prices.

From this analysis it was estimated that a 1 per cent decrease in the EC guarantee price would increase world prices for wheat by 0.2 per cent and for coarse grains by 0.1 per cent. A 1 per cent decrease in the United States target

prices would have an opposite but smaller effect, decreasing world prices by 0.04 per cent for wheat and 0.05 per cent for coarse grains. This result clearly emphasises the need to specify the restraint programmes in an appropriate manner.

D. Future directions

The MTM model is an important tool used, together with the PSE/CSE estimates, in illustrating the effects of past government intervention in agricultural markets. The PSE/CSEs provide measures of the ***degree*** of such intervention; the MTM simulation results provide indications of the ***economic effects*** of changes in farm support policies on domestic and world agricultural markets.

Following the completion of the Ministerial Trade Mandate study there has been a revision to the objectives for the MTM model. These now relate more generally to the continuous evaluation of the economic effects of changes in Member country agricultural policies as part of the monitoring process, and to proposals developed for reform, for example, as part of the GATT negotiations. Such analyses are strengthened by quantification of the inter-commodity and international implications. This new emphasis has involved more frequent model updates, more flexible model software, and extensions to the model similar to those described above.

The other major challenge for the future use of the model will be in the monitoring of the principles and actions, agreed by Ministers as part of the agriculture reform package (OECD, 1987b), to ensure consistency with specific policy actions taken by governments. This work will involve defining such principles (e.g. market orientation) in quantitative terms ***so*** that they can be evaluated in the consistent framework provided by the MTM model.

NOTES

1. See Cahill and Legg (1989) for a comprehensive discussion of the PSE/CSE concepts, their uses and how they are measured.
2. The detailed equations are described in OECD (1988a).
3. Detailed country studies for most of these countries are incorporated in the most recent revisions of the model.
4. In the Charts, these countries are defined by the label: ARG, BRZ, CHN, IND, KOR, MEX, THA, SSA.
5. Model coefficients were largely taken from Gardiner *et al.* (1989), world price and quantity data were obtained from the FAO (1982-85) and PSE/CSE data from USDA (1988). Gardiner et al. (1989) and Anderson (1986).
6. Quantitative limits are to be replaced by tariffs which are to be progressively lowered.
7. Under certain conditions the impact of those leaving the programme may be sufficient to offset the lower requirements for those remaining in the programme.

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