

R E F O R M I N G

Domestic Agricultural Support Policies

T H R O U G H T H E

World Trade Organisation



A U T H O R S

Ivan Roberts

Troy Podbury

Mike Hinchy



RURAL INDUSTRIES RESEARCH
& DEVELOPMENT CORPORATION

RIRDC Publication No. 01/07

ABARE

Innovation in Economic Research

ABARE Research Report 01.2

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ISSN 1037-8286
ISBN 0 642 76431 X (ABARE)
ISBN 0 642 58230 0 (RIRDC)

Roberts, I., Podbury, T. and Hinchy, M. 2001, *Reforming Domestic Agricultural Support Policies Through the WTO*, ABARE Research Report 01.2, RIRDC Publication no. 01/07, Canberra.

Australian Bureau of Agricultural and Resource Economics
GPO Box 1563 Canberra 2601

Telephone +61 2 6272 2000 Facsimile +61 2 6272 2001
Internet www.abareconomics.com

ABARE is a professionally independent government economic research agency.

Rural Industries Research and Development Corporation
PO Box 4776 Kingston ACT 2604

Telephone +61 2 6272 4539 Facsimile +61 2 6272 5877
Internet www.rirdc.gov.au

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ABARE project 1633

RIRDC project ABA-9A

Foreword

International cooperation to advance the benefits from more open and less distorted agricultural markets took a step forward when agreement was reached in the Uruguay Round in 1994. However, actual reforms have been relatively minor and there has recently been an increase in support internationally to around historically high levels.

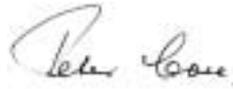
For those desiring substantive reforms, much has been left to the next World Trade Organisation negotiations that commenced in early 2000.

As these negotiations progress, it is important that the parties appreciate the issues that must be addressed if substantial progress is to be made in achieving greater economic benefits from agricultural trade.

The rules agreed for domestic support were probably the weakest of the three main areas examined under the Uruguay Round — market access, export measures and domestic support. In this study, the application of current domestic support arrangements is analysed, providing a basis for developing criteria for a successful outcome in the current negotiations.



BRIAN S. FISHER
Executive Director
ABARE



PETER CORE
Managing Director
RIRDC

February 2001

Acknowledgments

The authors wish to thank Vivek Tulpulé, Roger Rose, Roley Piggot, Russel Cooper, Gil Rodriguez, Peter Connell, Neil Andrews and Nico Klijn for their advice during the preparation of this report.

ABARE acknowledges funding provided by the Rural Industries Research and Development Corporation for this report.

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Summary

Early in 2000, negotiations commenced in Geneva on multilateral agricultural trade policy reforms under the auspices of the World Trade Organisation (WTO). These negotiations are part of ongoing efforts to obtain economic benefits from more open and less distorted markets.

Until now, most of the gains through internationally agreed trade liberalisation in agriculture have been from the Uruguay Round of multilateral trade negotiations that concluded in 1994. The WTO Agreement on Agriculture that emerged from that round provided a comprehensive framework for opening markets and reducing policy induced market distortions. It covered all forms of support under at least one of three headings — market access, domestic support and export measures.

Domestic support measures that are subject to limitation under the agreement include price support under which policies maintain internal administered prices above world market levels and subsidies that are considered to be market distorting. Forms of subsidies that are considered to be minimally market distorting (green box) or that are considered to be under production limiting arrangements (blue box) are excluded from the ‘aggregate measurement of support’ (AMS) and are not subject to cuts or controls.

The domestic support elements in the Agreement on Agriculture are weak because:

- many market distorting subsidies are exempted from commitments or limits; and
- countries can increase market distorting support and still meet reduction commitments.

Examples of these weaknesses include the following.

- The European Union obtained large exemptions from agreed cuts by changing the forms of support for a few major commodities. This enabled support to be maintained for those commodities while virtually no reforms were made for others.

-
- US domestic support has risen sharply since 1998 to record levels. The increases were made possible by very generous base levels in the WTO agreement and subsequent exemptions through changes in forms of support for a few major commodities.
 - Japan's actual price support has risen sharply in recent years at the same time as it has complied with agreed 'reductions' in domestic support. The reason is that commitments in the WTO agreement are determined from measures that are not linked directly to actual market variables such as world prices.

To overcome such weaknesses in the current negotiations, domestic support must be defined and rules applied to ensure that agreed reductions bring about actual, not just ostensible, reductions in market distortions. Achieving real reductions requires:

- all forms of distorting support to be subject to commitments;
- commitments to be based on measures that represent actual levels of distorting support; and
- domestic support to be subject to commodity specific commitments.

It is also critical that the measures taken to address the domestic support arrangements are implemented as part of a coordinated strategy covering all forms of agricultural support — that is, market access restrictions and export measures as well as domestic support.

Effectiveness of the present domestic support structure

The acid test of the effectiveness of the structure of domestic support arrangements in the present agreement is whether it reduces, and can be relied on to reduce, actual market distorting support.

The current system does not ensure that market distorting support is reduced. In fact, in the late 1990s, agricultural support (as measured by the OECD) increased greatly, despite the Agreement on Agriculture. Support policies (many of which remain substantially market distorting) have been virtually unconstrained by the WTO requirements. Increases in support in the European Union and the United States have meant that support levels in 1999 were as high as those in the 1986–88 base period, which were the highest in the past

half century. There is a variety of reasons for this ineffectiveness of the agreement.

- Exempt payments under measures that are deemed minimally distorting (termed ‘green box’ exemptions) and those deemed to be under production limiting arrangements (termed ‘blue box’ exemptions) cover most forms of subsidies, leaving few forms of domestic subsidies within the nonexempt ‘amber box’ category. These exempt payments (which are excluded from the AMS) are included in the OECD calculation of support. The AMS has been restricted largely to price support for most countries.
- Blue box exemptions are still market distorting while some green box exemptions have been applied in ways that are market distorting in practice even though in the agreement it was agreed to define green box measures as minimally distorting.
- Price support as defined in the agreement does not measure actual price support at all. It is determined from the difference between domestic administered support prices and a constant external price. Often the administered support prices are poor proxies for actual internal market prices and in all instances the fixed external reference prices do not measure actual border level world prices.
- Changes in forms of support to exempt categories since the 1986–88 base period have enabled both the United States and the European Union to meet their domestic support reduction commitments without reducing support.
- Changes in forms of support in the United States and the European Union have been for selected commodities only. But because the AMS is for agriculture as a whole, these countries have been able to leave support for other highly supported items relatively untouched.
- The application of ‘*de minimis*’ provisions — which permit distorting support at low levels — separately for exemptions to commodity specific and non commodity specific support means that substantial support can still be provided (in exempt form) even for countries where agricultural support is high.

Exempt support and economic distortions

The relative weakness of the present agreement in restraining market distorting support is exemplified by a substantial upsurge in US domestic support

since 1998. The status of much of this support as decoupled and minimally distorting is questionable as it has compensated for reductions in prices. Also, there has been an increase in some forms of subsidies like loan deficiency payments and cotton competitiveness subsidies that are clearly market distorting and are accepted as such. Importantly, there has been a big rise in the use of subsidised insurance, which is inherently market distorting. So far, this form of support has been exempted on de minimis grounds but its incidence is increasing, with a large five year package of additional support announced in 2000. The incidence of subsidies on US insurance means that farmers are now averaging receipts of around US\$1.70 for every dollar of premium that they pay. Subsidised insurance could be an important element of a new, less transparent protectionism.

In the case of the European Union, the most substantial weakness of the present agreement is its allowance of production limiting 'blue box' arrangements. Such arrangements are designed to restrict the extent to which support policies encourage additional production. The impact of exempting these policies depends on how much they reduce distortions and the extent of the remaining distortions. For the European Union, the main user of these exemptions, production had been supported at high levels for long periods before such arrangements were applied from 1992. So for the measures to be minimally distorting, marked reductions to production from initially expanded levels are likely to be necessary.

Requirements to ensure more benefits from less distorted markets

It is essential that a number of key conditions are met to ensure that disciplines on domestic support measures lead to reductions in market distortions. These conditions are:

- that the base levels of the measure of support from which agreed reductions are to be made are representative of actual levels of support in the base period;
- that the measured price support levels that are included in the measurement of total distorting support to be reduced represent actual levels of price support;
- that countries do not have the ability to shuffle support levels between various commodities and to maintain or increase support for some by obtaining exemptions for others; and

-
- that the measures that are exempted from agreed reductions are in fact minimally market distorting.

The present method of measuring price support fails to meet the above criteria as it does not represent the actual level of support, either currently or in the base period. Importantly, support needs to be subject to commitments on a commodity specific basis. And there need to be separate limitations on non commodity specific support.

The only way to ensure that exemptions are not used to increase market distorting subsidies is to ensure that the measures that are exempt are actually minimally distorting. At present, the inclusion or exclusion of support in the AMS is based on broad indicators, resulting in some clearly distorting measures being exempted. Also, it is important that exempt measures are applied in a way that remains minimally distorting. Under the present agreement some measures that might appear to be decoupled and minimally distorting when first applied, are being changed over time in ways that prejudice their minimally distorting status. Furthermore, measures that are currently exempted under production limiting arrangements retain substantial market distorting elements and need to be subject to disciplines. It is critical that the conditions that are agreed for measures to be exempt because they are supposed to be minimally distorting are actually minimally distorting. Also, compliance of policies with conditions for being minimally distorting should require an objective burden of proof.

Proposals in the current negotiations

Several proposals have been advanced for domestic support in the current negotiations. The most comprehensive single proposal is by the United States. It covers market access, export measures, and special and differential treatment for developing countries as well as domestic support. For domestic support, the US proposal advocates:

- a simplified differentiation of support measures into market distorting and nondistorting groups, with exemptions for the nondistorting group;
- advancement of the criteria for exempt support measures, ensuring that they are targeted, transparent and minimally trade distorting;
- progressive annual reductions in levels of nonexempt support, commencing from final bound AMS levels to an agreed proportion of the value of agricultural production over an agreed implementation period; and

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- special and differential treatment of developing countries.

An innovative element is the proposed reductions in AMS *to* an agreed percentage of value of production. To date the approach has been to reduce agreed distorting measures *by* an agreed percentage, thereby maintaining relativities in allowable support between members. In principle, the approach has positive aspects. If changes to the AMS were representative of changes to market distorting support, reducing it to an agreed percentage of value of production would reduce support more for high support countries than low ones.

However, changes to the AMS do not reflect changes to actual market distortions — because the AMS is aggregated across the whole of agriculture, many exemptions from it are actually market distorting and its price support component is unrepresentative of both actual internal and external prices. Because of these factors, using the current AMS as the base for future negotiated domestic support reductions has many weaknesses. Also, ensuring that exemptions are targeted, transparent and minimally trade distorting would require a tightening of the criteria for exemptions, not advancing them as suggested in the proposal.

The Cairns Group has presented a proposal for domestic support reform that addresses some of the weaknesses identified above — specifically, advocating reduction commitments at a disaggregated level and a review of all green box criteria to ensure that they are genuinely minimally distorting.

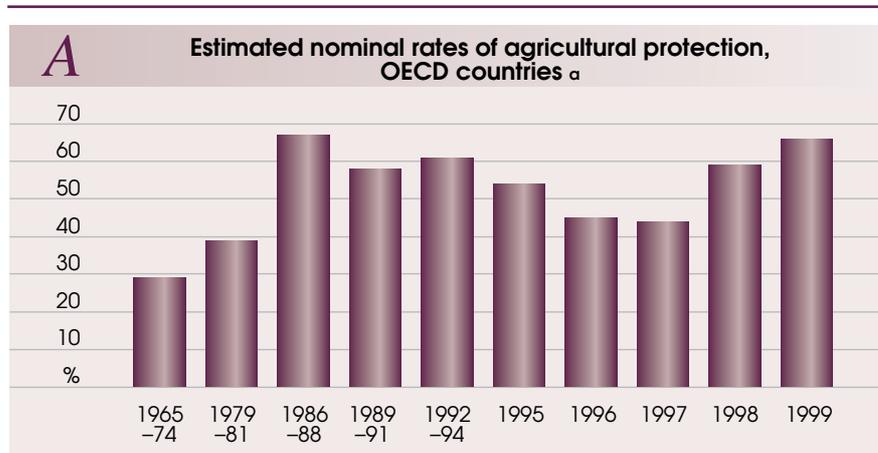
Introduction

The Uruguay Round of multilateral trade negotiations that concluded in 1994 marked the beginning of a process of trade reform in agriculture. Such reform occurs through negotiations within the World Trade Organisation (WTO) system and is directed at enabling countries to obtain the economic benefits that arise from more open markets and nondiscrimination in world trade (WTO 1995a, p. 486). The measures agreed on in the WTO Agreement on Agriculture, which was a key outcome of the Uruguay Round, are now largely implemented in developed countries and are to be fully implemented by developing countries by the end of 2004. A new set of WTO agricultural negotiations commenced in 2000.

The objectives in this study are to examine and analyse key issues of domestic support that will be important for the successful outcome of the current WTO negotiations on agriculture. In this context a successful outcome is considered to be one under which there is a substantial increase in the benefits from markets that are more open and less distorted by government policies.

Whereas considerable success could be claimed for multilateral trade reform in most manufactured products up to and within the Uruguay Round, the same cannot be said for agriculture. Substantial impediments to obtaining the economic benefits from agricultural trade are embedded in national and regional support policies (WTO 1998a). A system for addressing those impediments was established as a result of the Uruguay Round. Also, some progress has been made since 1994 in restraining some of the most distorting aspects of agricultural protection, especially through placing limits on subsidised exports. However, only very limited success has been achieved so far in restraining levels of agricultural assistance and associated market distortions.

From figure A, it is evident that support levels in OECD countries in 1999, on the eve of the present negotiations, were as high as in the mid-1980s, which were the highest since the mid-1960s. Examination of support over a longer period reveals that the support levels in the mid-1980s and again in 1999 were the highest since the 1920s, with the possible exception only of the late 1930s (Roberts et al. 1999).



Estimates are for 24 OECD countries that include the fifteen EU members, Switzerland, Norway, Iceland, Turkey, Canada, the United States, Japan and Australia and New Zealand. The estimates for 1965-74 were derived from a comparison of data from Tyers and Anderson (1992), with OECD data for later years. As the OECD introduced a new method of calculation, data before 1997 were rebased on a value basis to be comparable with the newer data.

The distortions in world agricultural markets are concentrated primarily in the high income developed northern hemisphere members of the Organisation for Economic Cooperation and Development (OECD), in particular those in north east Asia, western Europe and north America. While there are also high levels of support for agriculture in some developing countries, distortions arise from the *relative* levels of support for agriculture and other activities. Stoeckel (2000) concluded that, as the relative rate of agricultural protection to manufacturing protection in high income countries is much higher than in low income countries, the largest distortions from agricultural protection arise from policies pursued by high income countries. Burfisher, Somwaru and Diao (2001) estimated that the European Union, the United States, Japan and Korea together account for two-thirds of world agricultural price distortions from tariffs and subsidies.

Comprehensiveness of the WTO Agreement on Agriculture

The WTO Agreement for Agriculture addressed all forms of agricultural support that could result in market distortions that impede the benefits from trade. To do this, it established rules governing the ways in which countries could impede market access, provide domestic support and subsidise exports. At the same time, agreement was reached to reduce barriers to market access, to reduce overall levels of domestic support and to reduce subsidised exports.

To date, limits have been placed on subsidised exports, the first steps have been taken to reduce barriers to imports and incentives have been introduced to encourage countries to reorient support mechanisms away from highly market distorting price support toward less distorting arrangements.

What is domestic support?

Domestic support as dealt with in the present WTO Agreement on Agriculture has two main components — domestic subsidies and market price support.

Domestic subsidies

Domestic subsidies, which involve transfers from domestic taxpayers to producers, are used for a number of purposes. Some are to raise prices to producers. Others are to increase domestic producers' competitiveness by reducing the prices of inputs or otherwise reducing costs. Others take the form of direct payments to increase the incomes of producers.

The nature of the subsidies influences their effects on production, consumption and trade. If they are to provide higher prices to producers than would apply on fully open and competitive markets or if they are to reduce prices for inputs or to provide other cost reductions, they increase production and are clearly market distorting. If they are not related to current production or prices of outputs or inputs, their effects on production are less direct and may be less market distorting than if they were related to these factors.

Subsidies clearly fall within the category of domestic support and their treatment in the WTO Agreement on Agriculture depends on whether they are defined to be:

- *distorting* and therefore subject to agreed limitations; or
- *minimally distorting* and exempt from agreed limitations; or
- *production limiting* and exempt from agreed limitations.

Market price support

Market price support in its broad conceptual form represents the difference between the prices received by producers and paid by consumers within a country and the prices that they would face if the market were completely open and undistorted. As will be discussed below, market price support is

represented in the WTO Agreement on Agriculture in a very truncated form and is derived from the difference between administered support prices and fixed external reference prices that applied in a base period.

Price support, in its broader sense, does not require administered support prices at all. Anything that maintains domestic prices at levels that differ from world prices constitutes price support. There are four main ways in which prices are supported:

- through market access limitations,
- through export measures,
- by government intervention in managing internal markets and prices and
- by governments supplementing prices that producers obtain from the market through payments that increase their unit returns.

A fundamental issue: is addressing domestic support important?

Some observers argue that the main gains that might be negotiated multilaterally for agriculture are in maintaining the pace of tariff and subsidised export reductions. Sumner (2000), for example, takes what he terms as a practical viewpoint. He argues (p. 457) that, ‘in their attempt to maximise trade benefits, agricultural trade negotiators must allocate scarce resources and consider tradeoffs across issues such as liberalising foreign border measures or reducing foreign domestic subsidies. Analysis and examples support the notion that more liberalisation will be achieved in the new WTO round by emphasis on lowering border barriers and export subsidies rather than attempting to discipline farm subsidies directly.’

In reaching this conclusion, Sumner acknowledges that a properly configured regime of domestic support policies can mimic any set of border measures and that it seems logical that direct disciplines on domestic subsidies and taxes would be included routinely in trade agreements. However, he concludes that this does not seem to be the case.

The arguments advanced by Sumner are relevant in the context of international negotiations where tradeoffs are sought between various forms of support in the search for agreement. The underlying premises for his arguments are that there are tradeoffs between border measures and domestic

support and that concentration on the border measures is likely to yield more beneficial outcomes.

A contrasting view is that in many or even most instances, domestic support measures are often complements with market access and export subsidy arrangements in providing national industry support, while in some instances they are substitutes for them. This is the case for the domestic support arrangements in the present WTO Agreement on Agriculture, where price support that depends on border measures for its effectiveness is a key component of domestic support. Furthermore, there are differences between countries in their ability to provide domestic subsidies that could negate the economic efficiency benefits from greater market access or reduced export subsidies. The wealthier developed countries are far more able than others to substitute large domestic subsidies for any agreed erosion of border protection and/or export assistance. Consequently, there would be a potential imbalance between the opportunities and benefits between members from WTO reforms to market access and export subsidies if domestic support were not subject to agreed rules and limitations.

Domestic support in the reform process

A critical concern about the effectiveness of reforms arises from the relative degrees of success that have been achieved so far in addressing the three groupings of support identified in the Uruguay Round — market access, domestic support and export subsidies. Already it has become clear that the rules and limits for domestic support are weaker than the restraints on export subsidies in particular. This has been reflected in a significant reorientation of support in the largest exporting countries away from export subsidies toward domestic support. Sceptics about the degree of success of the Uruguay Round for agriculture could claim that this has represented little more than a rearrangement of support from one form of market distorting support to another. Nevertheless, there are reasons to believe that the forms of domestic support adopted are at least somewhat less market distorting than the equivalent incidence of the former means of support, as will be discussed later in this study.

Perhaps it is understandable that greater difficulty would be encountered in reaching agreement on rules governing domestic support than on market access and export subsidies. Much of the emphasis of efforts to advance the benefits from trade under the WTO negotiating system has been on making markets more open. Measures that directly affect trade such as tariffs and

nontariff barriers and export subsidies clearly fall within the ambit of a World Trade Organisation.

However, individual national governments and regional groupings could regard domestic support through subsidies and government services as a sovereign right. Governments tend to be wary of allowing outside influences to constrain what they regard as internal affairs. Even so, provisions in articles 5 and 6 of the WTO Agreement on Subsidies and Countervailing Measures — which enable countries to seek redress for loss of expected benefits from trade if they are nullified or impaired by another country's subsidies (WTO 1995a, pp. 264–314) — are clearly responses to the market distortions that arise from domestic support and its adverse effects on other countries and groups in other countries.

As the current negotiations progress, efforts to expand trade through reducing barriers to market access will continue. Also, a trend away from explicit export subsidies has been established, and further efforts will be made to advance that trend. However, if advances are made on those fronts only to have countries restructure their support toward relatively unconstrained and what may still be substantially market distorting domestic support, the gains will be much less than they appear to be. The potential gains from more open markets could be largely cancelled by the production stimulating and, in some instances, export increasing effects of domestic subsidies. The stance already being taken by some countries with high levels of agricultural support and that will definitely play major roles in the negotiations is that rules on domestic support should not be strengthened in the negotiations. For example, the European Union signalled its concern to maintain the present modalities for domestic support in its position for the Seattle Ministerial Conference of the WTO that was held in late 1999:

‘It is essential, for the affirmation of the CAP (Common Agricultural Policy) to maintain the balance of the present elements of the Agreement on Agriculture, in particular those which concern modalities relating to domestic support’. (European Union: the Council 1999, para. 8)

The reason given for such concern was that this balance:

‘remains an essential element in providing assistance to WTO members to move away from price support toward more transparent and non-distorting policies. Furthermore, direct aids can contribute to some of

the missions of multifunctional agriculture particularly in the field of rural development'. (European Union: the Council 1999, para. 8)

This reference to 'multifunctional agriculture' relates to a concern in some countries to maintain what are considered to be benefits from agriculture that are additional to the provision of food and fibre. Proponents of the concept consider that it incorporates environmental, social and, for some, food security elements (OECD Secretariat 1998). In communications to the WTO ahead of the 1999 Ministerial Council meeting, both the Republic of Korea and Japan emphasised the importance of the 'multifunctionality' of agriculture (WTO 1999a,b).

At the other end of the spectrum, countries that wish to advance the benefits from more open and less distorted markets seem likely to aim to negotiate limits on domestic support so that it cannot become just another means of preventing the gains from specialisation and trade. This is evident from the 'Vision' statement of the Cairns Group that was agreed in Sydney in 1998:

'Overall levels of domestic support for agriculture remain far in excess of subsidies to other industries. The 1999 negotiations must result in major reductions in domestic support for all agricultural products. All trade distorting domestic subsidies must be eliminated with only non-distorting forms of support permitted. Close attention will be paid to compensation for the shift away from price support and the Cairns Group will work to ensure that income aids or other domestic support measures are targeted, transparent and fully decoupled so that they do not distort production and trade.'

Domestic support in the WTO Agreement on Agriculture

Reasons why domestic support should be subject to multilateral constraints

The economic benefits from trade arise from ‘comparative advantage’, which enables countries to specialise more in supplying the items and services that they provide at lowest relative costs and to exchange amounts of those items or services for those that others produce at the lowest relative cost (Johnson 1991; Tyers and Anderson 1992). Those benefits are reduced by border measures and export subsidies that impair the transmission of price signals to producers and consumers.

However, they can also be reduced by domestic support measures that can have many of the same effects. Such measures reduce the efficiency with which resources flow to producing the items that are most in demand and to which consumers direct their choices. They distort both the allocation of resources and consumption patterns within countries and internationally. Because of this they reduce aggregate incomes, both in the countries in which they are provided and globally. Achieving the WTO objective of obtaining the benefits from more open markets (World Trade Organisation 1995b) therefore depends on reducing barriers to trade, and/or export subsidies and domestic support measures.

Domestic subsidies and price support in overall agricultural support

The framework that was developed in the WTO Agreement on Agriculture was designed to ensure that all forms of market distorting support were subject to agreed limitations. To do this, the three pillars approach of considering market access, domestic support and export measures was adopted, because all forms of support would fall under one or more of those categories.

To appreciate the implications of the approach and the significance of domestic support within it, it is necessary to consider why all of the measures are put in place by governments in the first place. There is one main reason — to provide assistance to domestic agricultural activities. The categorisation

that has been adopted is an attempt to disaggregate government activities that provide support and assistance by the means of implementing the support. The following is an assessment of how each component of assistance contributes to the support of domestic agricultural activities.

Market access issues

Governments, by restricting access of imported products or by charging duties on them, reduce competition from imports and allow domestic producers to obtain higher prices for their products. If the country is an importer of the product and import duties are the sole impediment to imports, the internal wholesale price will be supported at around the duty paid import parity price, which will vary over time with changes in world prices. Also, domestic arrangements that increase entry costs, such as quarantine regulations, limit the quantities of imports that can enter, thereby restricting total market supplies so that domestic producers can obtain prices that are higher than if they were subject to unfettered import competition.

There is a wide range of measures that can be categorised as nontariff barriers. Examples include:

- variable import levies that change inversely with external market prices to prevent imports from entering at below specific support prices;
- import licensing arrangements that can restrict the quantities that may enter, who may import them and when;
- import quotas that limit access to specific quantities;
- voluntary export restraints under which suppliers face penalties if they supply more than specified quantities; and
- local content arrangements that link import entitlements to quantities of the domestic product used.

Export measures

Various export measures can be used to provide support to domestic exporting industries, including export subsidies and arrangements such as concessional credits and the use of food aid for reasons of reducing surpluses more so than for humanitarian purposes. These measures contribute to domestic support by providing incentives to export greater quantities than would occur if producers and exporters faced world market prices. The increased exports

raise domestic prices by reducing domestic supplies, thereby providing support to domestic producers.

These export measures usually involve government funds or losses on government trading that are used as export subsidies, and as means of financing foreign aid and subsidising export credit. However, there can be schemes in some countries that result in consumers indirectly financing export subsidies. These schemes involve government sanctioned levies on domestic sales that raise funds that are used to subsidise exports. The levies raise prices for domestic sales and enable greater quantities of exports to be sold at world prices that are below domestic prices.

Domestic support

In the developed countries that have comprehensive agricultural assistance arrangements, government intervention in managing markets often takes the form of government set target prices, and/or minimum prices that are used as triggers for government purchases to take quantities off markets. In some instances, internal prices are managed within a band with upper and lower bounds. The quantities that are purchased by intervention agencies are then stored until prices rise again, so they can be released onto the market, thereby maintaining stabilised prices. However, they can also be sold onto world markets with the aid of export subsidies or losses on the government intervention.

Illustrative examples of government intervention in markets are given in box 1.

At first glance, it may appear that governments have a high degree of control over internal prices and therefore over levels of domestic support through their ability to intervene in the domestic market by setting internal prices and managing domestic supplies. However, that is so only in a limited sense. The fundamental foundation of the price support lies far less in the management of internal supplies and prices than in governments' ability to limit imports or affect the prices of imports through market access measures and to subsidise or otherwise assist exports. It is primarily these border measures that prevent world market prices from being transmitted to the domestic market via competitive forces.

If internal support prices are above levels that can be supported through the combined effects of restrictions on market access and export measures, large

1

Examples of government intervention to support internal prices

European Union – cereals

Internal EU prices for cereals are maintained through a combination of limits on imports, intervention purchasing and sale, and export subsidies. Intervention support prices are set annually. Intervention and target prices are determined each year with an aim, in principle, of managing internal prices around the target price. The intervention price is designed to place a floor under internal market prices. When it appears that internal prices will fall below the intervention level, intervention agencies in the member countries enter the market to purchase quantities to support the price. The resultant intervention stocks may then be held for later sale when prices rise, used for nonmarket purposes such as aid for charitable institutions or overseas aid, or exported at a loss, which involves a budgetary cost that is equivalent to an export subsidy.

A less direct but no less distorting form of intervention to maintain domestic prices is to call tenders for export subsidies that bid quantities away from the domestic market, thereby raising internal prices. In these arrangements, the interactions between the domestic market intervention arrangements, the restriction of import competition and the provision of export subsidies are critical features of the overall support system.

United States – milk

Internal prices for US milk are supported by minimum price arrangements. These are implemented through a combination of restrictions on imports of dairy products, government purchasing of stocks of dairy products when prices for milk fall to around specified minimum levels, subsidisation of exports and provision of dairy products for domestic and export food aid. These arrangements have much in common with those for EU cereals except that there are no target prices around which the authorities aim to manage average market prices. As will be shown later in this study, average internal prices have been supported at well above the minimum levels in most years.

Japan – pig meat

Support to pig meat prices in Japan is provided by a combination of tariff charges on imports, safeguards on imports and management of internal market prices within a price stabilisation band bounded by minimum and maximum internal prices. The price band is determined administratively each year. When internal prices threaten to fall below the minimum price within the band, a government agency purchases quantities and holds them until market prices rise sufficiently to release them onto the market. When internal prices appear likely to rise above the maximum for the band, quantities are released from stocks to prevent the maximum from being breached.

internal stocks will accumulate. These stocks are costly to maintain and are usually eventually released with some form of subsidisation, either export or domestic, which in turn depresses world market prices. The high budgetary cost of some schemes of this nature has been a factor in some countries reducing their administered prices.

As an alternative to reducing administered prices, some countries have tried to reduce budgetary costs by maintaining internal support prices and further restricting imports, as has been the case for US sugar. In that instance, the market distortions from supporting internal prices for sugar have spread to the development of substitutes that has resulted in even further restrictions on imports of sugar to maintain the domestic supported sugar prices (ABARE / Sparks 1999). With such price support arrangements, the critical factors that address the supply imbalance are the market access measures and, where relevant, export support measures, with perhaps some movement in administered support prices to realign them with the import and export measures.

If administered prices are set below the levels that can be supported through the combined effects of restrictions on market access and export measures, competitive forces will result in internal market prices rising above the administered prices. It is the import and export measures that are the dominant determinants of the internal market price under such circumstances, rather than the administered price. That does not mean that domestic government price and supply management make no contribution to market distortions. By managing the flow of supplies to the market, governments stabilise internal market prices at levels that are insulated from world market prices.

If internal prices are maintained at relatively constant levels that are independent of changes in world market prices, the insulation prevents domestic supply and demand from responding to world market prices. The lack of price variability facing producers and domestic consumers is one of the two major distorting elements associated with agricultural protection. The other is the maintenance of general levels of internal prices that differ from world prices. If domestic administered support prices remain relatively constant and domestic producers and consumers do not experience the variation that occurs in world prices, they force a larger share of the adjustment onto producers and consumers in other countries. These policies are responsible for less stable world market prices than would prevail if the same average level of support was provided but producers were exposed to the variability in world prices (Tyers and Anderson 1992).

Representation of domestic support in the WTO Agreement on Agriculture

Different forms of domestic support have different effects on production, consumption, trade and market prices. Because of this, it is desirable in international negotiations that aim to reduce distortions to treat each method of domestic support according to the degree of market distortion involved. In this context, it should be remembered that the objective in reforms is not to reduce support levels — it is to reduce market distortions, in particular to reduce the adverse effects that support in some countries can have on others. A convenient starting point for considering domestic support in policy reforms is the way in which that support has been incorporated into the WTO Agreement on Agriculture.

Under the agreement there were to be phased reductions in or limits on all forms of agricultural support that were market distorting. This involved:

- expressing all tariff and nontariff barriers in tariff equivalents and implementing a cut of 36 per cent in average tariffs, with a minimum 15 per cent cut for individual items, from levels in the base period 1986–88;
- a 20 per cent cut in nonexempt domestic support *for agriculture as a whole* from the level in the base period 1986–88, with credit given for actions taken since 1986; and
- a 21 per cent reduction in volumes of subsidised exports and a 36 per cent cut in the value of export subsidies on a commodity by commodity basis from a base period of 1986–90.

For developed countries, the cuts were to be applied over six years from 1995 to 2000. For developing countries the cuts were to be two-thirds of those for developed countries, to be implemented over ten years.

Each of the various forms of domestic support in individual countries was classified under three headings. For convenience, these classifications have been commonly referred to as ‘boxes’ — amber, green and blue box support.

Amber box support

Amber box support includes forms of support that are considered to be market distorting and subject to the agreed reductions. It includes all forms of domestic support other than measures that are exempted under the green and blue boxes. Support within the amber box is quantified to provide an ‘aggregate

measurement of support' (AMS). This consists of price support that arises from measures that maintain domestic prices above world prices and nonexempt domestic subsidies. Levies paid by producers often defray some of the budgetary cost of support and are subtracted from the AMS.

The AMS for a member is determined by adding price support and product specific nonexempt support for separate commodities, to non commodity specific support that is not exempted under the blue or green boxes. Although the AMS is calculated in this disaggregated way, the domestic support commitments are applied only on the total AMS for the member. The commodity coverage in the AMS is determined by the overall range of commodities that falls within the ambit of the agreement. That range is for all of the items covered by chapters 1 to 24 of the harmonised system of tariffs less fish and fish products plus some other items that are specified in annex 1 to the agreement. The AMS is calculated as close as practicable to the point of first sale of the basic agricultural product concerned.

The specific method for determining commodity specific AMS levels and the overall AMS is explained in box 2.

Green box support

Green box support is support that is deemed to be minimally distorting to trade or to production, under annex 2 of the WTO Agreement on Agriculture. It is exempted from agreed reductions and must fall within both of two categories — namely that it is provided through a publicly funded government program and that it does not have the effect of providing price support to producers. Green box support must fall into one of the following categories:

- government expenditures (or revenues forgone) on general services, which include government funded research, pest and disease control, training services, extension and advisory services, inspection services, marketing and promotion services and infrastructure services;
- public stockpiling for food security purposes;
- domestic food aid;
- direct payments to producers according to criteria specified for decoupled income support, government financial participation in income insurance and income safety net programs, and disaster relief payments made either directly or through government participation in crop insurance schemes;

-
- structural adjustment assistance through producer retirement schemes;
 - structural adjustment assistance through resource retirement programs;
 - structural adjustment assistance through investment aids;
 - payments under environmental programs; and
 - payments under regional assistance programs.

Blue box support

Blue box support is for direct payments under production limiting programs. These are exempted from agreed cuts in domestic support under article 6, paragraph 5 of the Agreement on Agriculture if:

- such payments are based on fixed area and yields; or

2

Determination of a member's aggregate measurement of support

The method for determining 'aggregate measurement of support' (AMS) levels is set down in annex 3 of the Agreement on Agriculture. The AMS is calculated for each basic commodity and includes market price support, nonexempt direct payments and any other subsidy not exempted from the reduction commitments. Specific agricultural levies or fees paid by producers are deducted.

Market price support is calculated by measuring the gap between a *fixed external reference price* and the *applied administered price* (for example, intervention prices in the European Union or the US loan rate for sugar). This gap is then multiplied by the quantity of production eligible to receive the applied administered price. Budgetary payments made to maintain the price gap, such as buying-in or storage costs, are not included. The external reference price is determined for the base period 1986–88, and is the average estimated fob (free on board) price for exports of the basic product where the country is a net exporter and the cif (cost, insurance and freight) price for imports where the country is a net importer. Nonexempt government payments that are dependent on the price gap are multiplied by the quantity of production eligible to receive the administered price. Alternatively, budget outlays may be used to determine the non-exempt government payments that are related to the price gap. Producer levies or fees are then deducted from the price gap to obtain the commodity specific AMS. The base period for the applied administered price or the budget outlays is also 1986–88.

The sum of the member's individual commodity AMS levels and non commodity specific support through budgetary outlays and revenues forgone (at both the national subnational levels) less non commodity specific agricultural levies and fees paid by producers, determines the overall AMS.

- such payments are made on 85 per cent or less of the base level of production; or
- livestock payments are made on a fixed number of head.

Special exemptions

In addition to the exemptions from agreed reductions for items in the green and blue boxes there are *special exemptions applying for developing countries* under article 6, paragraph 2 of the agreement. Under these exemptions, government assistance to encourage agricultural and rural development, investment subsidies that are generally available to agriculture in developing country members and agricultural input subsidies generally available to low income or resource poor producers are excluded from the AMS calculation.

Special provision is made for noninclusion of domestic support in the AMS calculation when it represents only a small proportion of the national value of production of a member under what is termed a *de minimis provision*. Under this provision a developed country member can provide product specific domestic support of up to 5 per cent of the value of production of the supported item, and non product specific support of up to 5 per cent of the value of the member's total agricultural production. For developing countries, the *de minimis* level is 10 per cent for product specific support and also 10 per cent for non product specific support.

The levels to which the AMS is to be limited for the largest developed countries — the United States, the European Union and Japan — are shown in table 1.

As an indication of the incidence of support (as represented by the base AMS in the 1986–88 base period), the US AMS was 17 per cent of the supported value of agricultural production, while AMS levels in the European Union and Japan were 44 per cent and 45 per cent respectively.

1 WTO Agreement on Agriculture: US, EU and Japanese base AMS levels and committed limits

	United States	European Union – 15	Japan
	US\$ million	million ECU (euro)	billion yen
Base level	23 879	80 975	4 966
Committed limit			
1995	23 083	78 672	4 801
1996	22 287	76 369	4 635
1997	21 491	74 067	4 470
1998	20 605	71 765	4 304
1999	19 899	69 463	4 138
2000	19 103	67 159	3 973

Sources: Young (1994); WTO country notifications.

The AMS and cuts to domestic support

A very important characteristic of the price gap element of the AMS is that the external reference prices are held constant throughout the implementation period at the level determined for the 1986–88 base period. Another important characteristic is that applied administered prices and not actual internal market prices are used in determining levels of AMS support during the implementation period.

These characteristics have important implications for the relevance of the AMS as a measure of actual market distorting domestic support at any time during the implementation period as they make the AMS a poor indicator of actual levels of domestic support. For example, actual support arising from measures that sustain differences between internal and external prices can best be measured using actual internal prices and actual external prices for any particular period. The use of a constant external reference price, and administered support prices that may or may not be representative of actual supported price levels are obvious weaknesses of the AMS as a measure of market distorting support. This is apparent from the hypothetical and actual examples shown in box 3.

Relative importance of price support in the amber box that is subject to cuts

Concerns about the conceptual basis for the way price support is incorporated in the domestic support that is subject to reductions under the WTO Agreement on Agriculture might not be great if price support were a minor part of domestic support represented by the AMS. However, this is not the case.

Price support has so far been the dominant form of support within the amber box for many, even most, of the countries that have the most distorting agricultural support policies. There are two main reasons for this. One is that price support is widespread. The other is that a large part of the subsidies used has been exempted from the AMS under the green or blue box provisions, *de minimis* or through special and differential treatment for developing countries. The importance of price support in the AMS in selected countries is evident from table 2.

Apart from the fundamental issue that the price support element of the AMS is based on parameters that do not indicate actual price support, there are

3 Examples of why the AMS does not measure distorting support where price support is important

Internal supported prices correspond with administered prices but world prices vary

Even in cases where internal market prices correspond closely to administered prices, the price support elements of the AMS will not provide a reasonable indication of actual market distorting price support. The reason is that world prices vary from the fixed external reference price, which is a fundamental component of the AMS — the times when actual world prices correspond with the fixed external reference price will be coincidences.

Hypothetical examples are shown below for two instances. In the first, world prices rise above the fixed external reference prices; in the second, world prices fall below the fixed external reference price.

Rising world prices

In the first instance (figure *a*), the unit AMS would decline because administered support prices would be reduced to meet the commitments. However, the actual levels of unit price support, which is the difference between the internal supported prices (assumed here to be equal to the administered prices) and the actual world prices, would fall even more than the unit AMS which is the difference between the administered support prices and the fixed external reference prices.

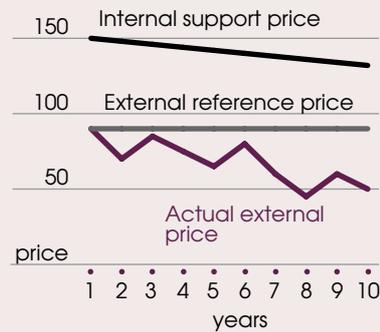
Falling world prices

In the second instance (figure *b*), the unit AMS would decline as in the first instance. However, the actual level of price support would increase because world prices fall further than the administered support prices. In neither instance would the AMS provide a representative indicator of actual price support because it would not account for the variability of external (world) market prices.

a World price rises
– AMS falls but price support falls more



b World price falls
– AMS falls but price support increases



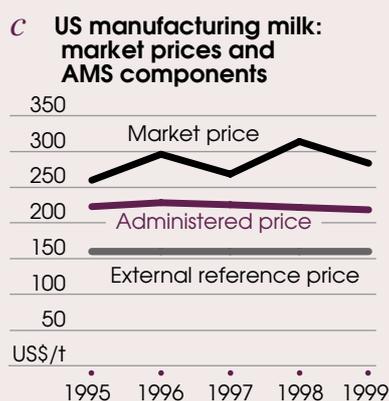
3 Examples of why the AMS does not measure distorting support where price support is important *continued*

Actual examples of the levels of price support increasing while a country has been able to meet its AMS commitments are given for Japan for a range of commodities in chapter 3. There it is shown that in the late 1990s, world market prices expressed in yen fell markedly below the constant 1986–88 external reference price (figures F), enabling the country to meet its AMS at the same time as its actual levels of support were increasing.

Administered prices are not representative of actual supported market prices

As mentioned above, different forms of administered prices, with differing price support functions, are used for different commodities in different places. In some instances actual market prices over time correspond closely with or may equal the administered prices. In others, such as where the administered prices are for safety net or floor price functions, actual representative market prices can differ markedly from the administered prices.

An example is US dairying, where average annual internal market prices for manufacturing milk have been supported at substantially above the administered internal prices since the implementation period commenced in 1995 (figure c). Support is provided primarily by a combination of barriers to imports through tariff quotas and export subsidies under the Dairy Export Incentive Program (DEIP), supplemented by milk marketing orders that regulate regional prices. Under such conditions, the AMS provides an understatement of the actual level of support. For US milk, support actually rose between 1995 and 1999 (OECD 2000a), while the AMS would have declined.



issues of interpretation of how price support is incorporated into the estimates. Paragraph 7 of annex 3 of the agreement states that ‘market price support shall be calculated using the gap between a fixed external reference price and the applied administered price multiplied by the quantity of production eligible to receive the applied administered price.’ Some countries have interpreted the quantity of production element of this definition to mean only the quantities that have been purchased by intervention agencies. The critical issue with this is that the operations of the intervention agencies generally do not support the prices only of the quantities that they purchase or handle. They generally support the prices for the whole amount produced in the country or most of it.

Another factor affecting the representativeness of market price support as measured in the AMS is inflation and the links between inflation and exchange rates. Inflation can result in pressures on governments to provide large increases in administered support prices (and government payments) in nominal terms, making it more difficult for countries to meet scheduled AMS commitments than if they had lower inflation. The reason is that internal prices are usually represented by nominal administered prices in the member’s own currency, and external prices are held constant at a fixed base price, implying also a constant exchange rate. This has not been a widespread problem with implementation of the agreement by many countries so far, because inflationary pressures since the base period have been mild in most

2 Price support in the aggregate measurement of support for selected countries

	Unit	Year	Total AMS	Price support	Price support’s share of AMS
					%
European Union	million ecu	1996-97	51 009	46 840 ^a	92
Japan	billion yen	1997	3 171	2 968	94
United States	US\$ million	1997	6 238	5 816	93
Korea, Rep. of	billion won	1998	1 563	1 563	100
Philippines	million pesos	1997	766	766	100
Australia	A\$ million	1998-99	120	120	100
Canada	C\$ million	1996	619	457	74
South Africa	million rand	1997	2 198	2 198	100

^a Includes both price support under product specific aggregate measures of support and product specific equivalent measures of support where price support and minimum and guide prices are indicated to be the forms of support.

Sources: WTO notifications on domestic support.

developed countries where support is greatest. Some countries did anticipate or encounter such problems, and expressed AMS commitments in IMF Special Drawing Rights (Iceland), US dollars (Poland) or in deflated units of their domestic currency (Mexico).

For countries that experience high inflation and express the AMS in local currency units, the AMS would generally overstate the level of distorting support if the exchange rate depreciated consistently with the high inflation. If, however, countries express their AMS in terms of a currency that is appreciating relative to their own currency, the AMS could, over time, either understate or overstate the actual level of distorting support depending on world price changes and the degree of appreciation of the currency adopted relative to both their own currency and the currencies of trading partners.

The following observations appear to be particularly pertinent to the way in which the domestic support arrangements under the WTO Agreement on Agriculture were applied from 1995 to 1997 inclusive:

- price support generally dominated the AMS;
- subsidies generally represented only a small percentage of the AMS levels that were subject to reduction, although they were more important in some countries than others; and
- most of the subsidies provided to agriculture in member countries were exempted from the AMS through green or blue box exemptions.

Other nonexempt measures

While price support is the main component of the AMS in the main developed countries, other forms of support are also included. These other non-exempt measures include some storage subsidies, direct assistance linked to current production or prices and subsidies on inputs. Examples include marketing loan gains, loan deficiency payments and cotton user marketing payments (competitiveness subsidies) in the United States (WTO 1999d), and processing aids for dried fodder and tobacco premiums in the European Union (WTO 2000d).

For the countries and years shown in table 2, support under these other non-exempt forms was small in the early years of the implementation period. Of the largest developed countries, the main user of these forms of support in those years was the European Union. In 1996-97, such payments that were

not notified as exempt under *de minimis* provisions totaled 3.911 billion ECU, which accounted for 8 per cent of the EU's total AMS.

As will be discussed later, there was an increase in subsidies in some countries, in particular in the United States, from 1998 to 2000. For the United States, direct support payments (both nonexempt and exempt) rose from US\$4.6 billion in 1996 to an estimated US\$32 billion in 2000 (US Department of Agriculture 2000b). The increase in these payments corresponded with a period of reduced world market prices during the Asian and associated economic downturns that occurred from late 1997 along with substantial appreciation of the US dollar.

An analysis provided in Roberts et al. (1999, pp. 63–4) indicates that US outlays on direct payments to agriculture have moved inversely with farm level prices — further evidence of this is given in chapter 3.

Some of those subsidies are likely to be included in the AMS. However, it is uncertain as yet how others will be classified. It is therefore possible that the importance of nonexempt subsidies in the United States will have increased since 1997.

De minimis provisions in the AMS

The inclusion of *de minimis* provisions in the Agreement on Agriculture enabled countries to provide a minimum level of nonexempt support to agricultural industries that would not be subject to agreed reductions. While a zero level of support for all countries would provide greater overall economic benefits for most countries, that target could not be agreed during the Uruguay Round. The main economic distortions come from countries with proportionately large agricultural support. It could be argued that the *de minimis* provisions, by exempting low levels of support from reduction commitments, should not impair the effectiveness of reduction commitments for countries with proportionately high levels of support.

However, the *de minimis* provisions provide exemptions beyond levels that might be expected. Countries can claim exemption for product specific support if it is below the *de minimis* rate for that commodity, and non commodity specific support if it is below the *de minimis* rate for agriculture as a whole. Thus, the effective rate of *de minimis* support is potentially 10 per cent for developed countries and 20 per cent for developing countries. Importantly, high support for individual commodities increases the value of

agricultural production, thereby providing additional scope for *de minimis* exemptions. There is an element with *de minimis* that enables larger exemptions for countries with higher support.

Countries with high levels of support have accessed *de minimis* exemptions for some support measures despite their overall support being beyond *de minimis* levels. Whereas reduction commitments for the AMS are applied for agriculture in total, the *de minimis* provisions in the Agreement on Agriculture are applied for each product specific category and for non commodity specific support separately. By separating the exemptions and commitments between different commodity specific and non commodity specific measures, countries whose overall value of support far exceeds the *de minimis* provisions can claim exemptions for parts of their support.

A challenge for the new negotiations is to clarify the purpose of the *de minimis* concept. The present inadequacies of the *de minimis* provisions give rise to some pertinent questions, such as:

- should *de minimis* exemptions be available only to countries whose total support is below *de minimis* levels? or
- should countries with very high levels of support be allowed to claim exemptions on part of that support under *de minimis* provisions?

The countries with the largest permissible AMS, the European Union, Japan and the United States, have all claimed *de minimis* exemptions for components of their support. These exemptions enable these countries to extend their overall usable AMS limit for other forms of distorting support.

The basis for calculating *de minimis* levels of support is inconsistent with the calculation of the AMS. The price support component of the AMS is calculated using fixed historical external reference prices and administered support prices. The means of determining the value of production is not specified in the agreement. However, *de minimis* levels have been calculated using the supported value of production. By valuing production at actual internal market prices, not administered support prices which can differ markedly from market prices, there are differing bases for determining the *de minimis* exemptions from the AMS and for determining the AMS levels themselves. These definitional differences can be exploited to obtain larger exemptions and greater permitted actual support than if the AMS and value of production were determined in a consistent manner.

It may be observed that the calculation of the *de minimis* provisions has involved valuation of production at actual market prices and determination of quantities supported. This goes a long way toward determining the supported value of production that includes actual levels of market distorting price support, rather than the notional price support values currently included in the AMS. However, in terms of real economic values, which are the opportunity costs of obtaining the same products from alternative sources, production should be valued at external prices (that is, world market prices).

The ways in which the AMS and *de minimis* provisions in the agreement are defined have left room for interpretation that has enabled countries with high levels of AMS support to claim exemption for specific measures. For example, the European Union has claimed *de minimis* exemption for aid payments to Portuguese farmers producing common wheat, maize, barley, rye, triticale and sorghum. This is despite having product specific support beyond *de minimis* levels for these products within the European Union. In this case, the member used the differentiation between nonexempt price support and a small amount of what would otherwise be nonexempt direct payments to obtain *de minimis* exemption for the direct payments. While the amount of aid in 1997-98 was small — only 26 million ECU, such a system could potentially be used with multiple categories for *de minimis* exemptions for any product, thereby providing an avenue for substantial exemptions where distorting support is well above *de minimis* levels.

Another application of *de minimis* that has weakened the AMS reduction commitments is the interpretation of what constitutes the quantity of products eligible for support. In determining commodity specific AMS levels, the current agreement specifies that the relevant quantity to be used in the calculation of the price support element is ‘the quantity eligible to receive the applied administered price’ (WTO 1995a). Some countries, such as Turkey and Korea, have interpreted the eligible quantities to be only those purchased by intervention agencies, rather than the total amount supported. This has enabled the estimated commodity specific AMS levels to fall below their *de minimis* thresholds for some, or even most commodities, enabling them to claim *de minimis* exemptions. In fact, the support to the relevant commodities in those countries has applied to total production, not just to the amounts subject to intervention. This has enabled some almost unbelievable outcomes:

- Turkey has used this provision to claim that all of its support is below *de minimis* levels, despite having very highly supported prices for most agricultural items.

-
- Korea has used this interpretation for beef to enable its AMS to fall below the *de minimis* threshold. There has therefore been no domestic support commitment for an item receiving one of the highest levels of support for any agricultural product in the world (OECD 2000a).

While a *de minimis* provision at sufficiently low level should not dramatically reduce the effectiveness of a package of agricultural reform, the method in which this provision is applied may significantly weaken a reform package.

To ensure that *de minimis* provisions do not impair the ability of an agreement to reduce distortions:

- the calculation of the *de minimis* level should be consistent with the calculation of support;
- the *de minimis* level should not be too large;
- the *de minimis* provisions should only be applied at the same level of aggregation as commitments on domestic support; and
- there should be clear guidelines on the basis for allowing *de minimis* exemptions — the current guidelines contain ambiguities which are being exploited by some members.

If the AMS is to continue to be based at the agriculturewide level, the *de minimis* conditions are likely to be used to obtain exemptions by countries with high support, thereby negating the economic benefits from the domestic support provisions. Some of these problems would be overcome if the AMS were on a commodity specific basis and for non commodity specific support separately.

The green and blue boxes can weaken the AMS

The main weakness in the way other subsidies, as opposed to price support, were dealt with in the domestic support commitments was the basis for inclusion or exclusion of subsidies in the calculation of the AMS, the only part of domestic support subject to cuts. While the inclusion or exclusion of subsidies was partially based on a theoretical assessment of the relative level of distortion of different policies, a fuller assessment has indicated that policies that were deemed to be minimally distorting do have market and trade distorting impacts (OECD 2001). In addition, the manner in which measures

exempt from domestic support commitments have been applied could seriously increase the level of distortion of those policies. Such impacts will be discussed in chapter 3.

While market price support can often easily be determined for individual commodities, some forms of nonexempt support cannot. For example, subsidised fertiliser could be used for producing any crop product or for growing pasture. Implementing future commitments on price support on an individual commodity basis would strengthen any agreed domestic support disciplines. However, some components of domestic support would probably need to be addressed for agriculture as a whole.

Restructuring of support and the potential to increase market distorting domestic support

The incentive for governments to restructure their support into items exempted from negotiated cuts through them being *decoupled or production limiting* is probably the most important change for the structuring of domestic support policies associated with the WTO Agreement on Agriculture. The United States and the European Union in particular have re-oriented their agricultural support toward these respective arrangements.

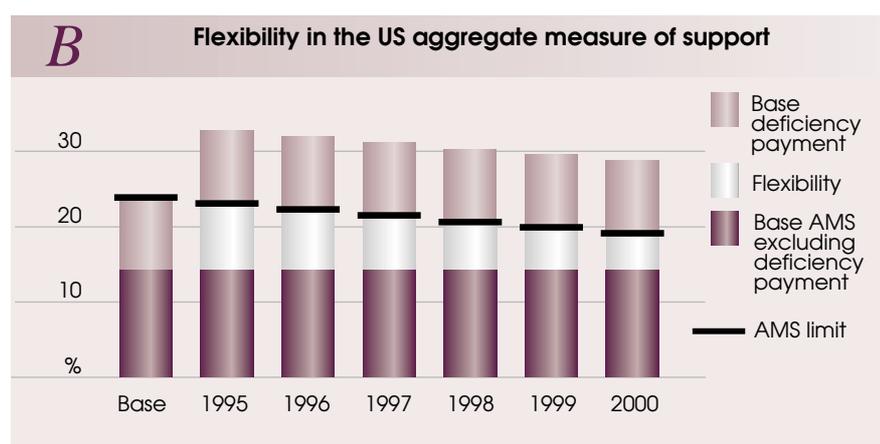
The exemption of decoupled and production limiting arrangements makes it easier for the United States and the European Union to meet their AMS commitments and provides them with the flexibility to increase other forms of support within their AMS levels. This is important, partly because it effectively enables countries to increase domestic support, for the following reasons.

- The AMS was calculated for the base period 1986–88 which was a time when decoupled arrangements were not applied in the United States and production limiting arrangements were applied in the European Union to only a minor degree. The deficiency payments in the United States and price support in the European Union were included in the base AMS levels. (For a brief explanation of the use of deficiency payments in the United States see box 5 in chapter 3 and of price support in the European Union see box 4 in chapter 3. These boxes also indicate the changes in support mechanisms that have occurred since the 1986–88 base period). For the United States, the base AMS was US\$23.9 billion, which included US\$9.7 billion of deficiency payments (World Trade Organisation 1995c). That is, deficiency payments constituted 40 per cent of the base AMS.

- Although the United States included deficiency payments in its base AMS, it was able to exclude them from actual AMS levels during the implementation period because deficiency payments, as applied, qualified for exemption under production limiting blue box provisions in 1995. The inclusion of deficiency payments in the base AMS, and its subsequent exemption gave the United States flexibility to provide additional amounts of market distorting amber box support within its AMS commitment. This is despite the 20 per cent agreed reduction in AMS support, as is shown in figure B. The reclassifying of deficiency payments provided the United States with the flexibility to *increase* market distorting domestic support other than deficiency payments by the area shown in the figure.

From 1996 on, deficiency payments in the United States were restructured to become production flexibility contract payments. These were, initially at least, not related to production or prices and might be less distorting than deficiency payments. Even with the change in support, the United States has maintained the flexibility to increase nonexempt support through the inclusion of deficiency payments in the base AMS calculation and the subsequent exemption of production flexibility contract payments.

From 1992 the European Union reinstrumented a large part of its support for cereals and oilseeds and some of its support for beef away from price support into compensation and headage payments (payments per head of livestock held) that met criteria for production limiting (blue box) arrangements when the Agreement on Agriculture was concluded.



Having first had substantial amounts of support incorporated into its base AMS, the European Union, by subsequently reclassifying it as blue box exempt support, also gained additional flexibility, if it wished, to increase nonexempt support within its AMS. In addition, both the United States and the European Union are able to provide as much green box support as they wish and the European Union has few constraints on blue box support.

The above changes have meant that both the European Union and the United States have, by restructuring their support into exempt categories for some commodities only, obtained the capacity to either maintain or increase support that is within the AMS for others. This, in conjunction with the agreed reductions in AMS levels being for agriculture as a whole, has resulted in some individual commodities not being subject to any reductions. They are able to use the fact that the reductions are for agriculture as a whole to effectively transfer support between commodities. If reductions that are greater than a member's average are made for individual items, AMS support for others can either be maintained or increased. These factors have enabled both the United States and the European Union to maintain support prices for some commodities despite the reduction commitments. Examples are US sugar and EU sugar, dairy and sheep meat.

The criterion by which the effectiveness of the domestic support component of the Agreement on Agriculture may be judged is that the commitments reduce market distortions. The Agreement on Agriculture effectively allows countries to introduce unlimited domestic support under the green and blue boxes, while only having commitments on the AMS. For domestic support commitments to ensure a reduction in distortions from agricultural support as a whole, the support that was classified as either green or blue must, in fact, be minimally market distorting. Additionally, the AMS must be an appropriate measure of nonexempt domestic support.

However, the AMS is not representative of actual distorting nonexempt support. Therefore, it is possible that domestic support disciplines not only have not contributed to a reduction in distortions but, depending on how distorting green and blue box measures are, may have allowed significant increases in total distortions arising from agricultural support. Because the disciplines on AMS support are for agriculture as a whole, and not for individual commodities, the commitments provide very limited control over distortions arising from support on individual commodities.

Are green box exemptions really minimally distorting?

Many of the categories that are defined as ‘green’ box (minimally market distorting) can, in fact, be applied in ways or at levels that can be appreciably market distorting. Some of these are in the *government services* area such as research, infrastructure expenditure, advisory services and inspection services. There are public good arguments for governments to provide such services because they are in areas where there is usually a difference between the values that society places on the availability of such services and the values of the activities to private individuals. However, there will be optimum levels of expenditure in each of these categories. If actual expenditure exceeds or is below those levels, there will be costs to the economy and market distortions that will affect others.

Actually determining the optimum levels for such publicly provided services can be difficult and costly. Furthermore, governments can require flexibility in providing many of these services to meet both development and political goals. These considerations can make it difficult to reach agreement internationally on any restriction of many of these measures. Classifying them as minimally distorting is a way of ensuring such flexibility, although expenditure on such policies can, in fact, be market distorting.

Some policy measures that affect the profitability and risks of producing particular items or groups of products in particular regions and that influence production and trade are classified as ‘green’ box in annex 2 of the Agreement on Agriculture and are therefore exempt. They are unlikely to be minimally distorting. Government financial participation in *insurance*, structural adjustment assistance through *investment aids* and *regional assistance* programs have these characteristics. Issues concerning government involvement in insurance programs are examined in chapter 4.

Despite the wide range of support that countries can provide in exempt measures, a number of countries are advocating further broadening of measures allowed in exempt support. One reason advanced for such broadening is the so-called ‘multifunctionality’ of agriculture.

‘Multifunctionality’ and compensating for comparative disadvantage

The concept of multifunctionality of agriculture is being used by its proponents to refer to the provision of unpriced benefits or joint products from agriculture that are in addition to the provision of food and fibre. It is likely

to be raised as a justification for support and protection, and in particular as justification for increasing access to green box exemptions.

Those unpriced products include environmental, cultural, aesthetic, regional development or food security values that may in various degrees be produced jointly with agricultural production of food and fibres. These joint products or side effects of agricultural production can be of both positive and negative value to a society. Also these joint product characteristics are not confined to agriculture — they apply for most economic activities, with differing positive and negative elements (such as pollution). These nonpriced values can be considered as ‘externalities’ or side effects.

The justification for government intervention to address externalities, be they positive or negative, raises important issues about the form and extent of government intervention that is necessary to provide efficient outcomes, both domestically and internationally. In this context, the degree to which these non food and fibre values are intrinsically joint products with agricultural production — whether the nonpriced outputs can be produced by other activities besides agriculture or whether separate markets can be developed for them — is important.

Even if the cultural and environmental values and the negative side effects of agricultural production such as pollution are jointly produced with agricultural products, it would be inefficient to support or tax the agricultural production to achieve the associated multifunctional or ‘externality’ values, unless those values to the relevant community were strictly proportionate to the agricultural production. In most instances, such strict proportionality is unlikely. It is more common that the size of side effects (externalities) is not directly related to the amount produced. Also the extent of side effects for a given level of production generally varies between locations and according to production practices. Therefore a general tax or subsidy on agricultural production characteristically has widely differing effects on the externalities accompanying that production depending on the methods and location. So, simply taxing or subsidising agriculture or particular forms of agricultural production will be unlikely to produce desired levels of externalities.

Additionally, it is rare that many unpriced products can be provided via agricultural production alone. If those unpriced products can be provided through other means, simply subsidising agricultural production would, in most instances, result in inefficient provision of the unpriced products as well as oversupply of the agricultural products. This would impose costs on other

sectors in the domestic economy, reduce national income and have economic effects on other countries and globally.

Another important question is whether separate markets can be developed for the environmental and cultural products that can enable their real values to be determined independently from the market for agricultural products themselves. For example, a market can be developed for farm tourism that will be reflected in the cost of farm tourist accommodation, or people may be subject to a toll to enter areas of particular cultural, heritage or landscape values.

On food security, recognition should be given to the greater scope for both volumes and variety of supplies and reduced risk of shortfalls that arise from open markets. For countries that do not have a comparative advantage in agriculture, there are often much lower cost alternatives for securing supplies than costly efforts to maximise self sufficiency. Some include obtaining supplies from diverse sources to minimise the risk of regional shortfalls; strategic stock holding of emergency stocks secured from efficient, competitive suppliers; and fostering close economic ties with supplying countries.

In the European Union, recognition has been given of the significance of direct aids in contributing to the multifunctional ‘mission’ of agriculture (European Union: the Council 1999, para 8). This is a relevant consideration when assessing domestic support.

By their nature, the benefits or costs associated with many externalities are difficult to estimate. Different weights can be placed on the values associated with those externalities by different people and groups. For example, one externality of agricultural activity could be lived-in rural environments and landscapes with farm and field biodiversity. Some people could consider these to be aesthetically pleasing and culturally important whereas others may prefer wilderness and the associated natural biodiversity. These differences in values and community perceptions associated with them provide a fertile ground for ‘justifying’ government support for activities that could either not exist or which would be less widespread in the absence of such support.

Proponents of the application of the concept of multifunctionality argue that it is economically efficient for governments to supply the externalities desired by communities that cannot be provided by market outcomes. However, the framework in which they consider such externalities is one where they

emphasise the positive externalities only. Additionally, they only consider the issue at the national or domestic economy level. Such a framework discounts the coproduction of negative externalities. It also ignores the fact that support to provide what are considered to be desirable externalities domestically has economic effects on people in other countries as well. Given the different perspectives of their own domestic populations and those elsewhere, what might be considered most efficient domestically would seldom be the most efficient globally. This would be especially the case where national agricultural production was increased along with the support for the side effects that were desired so much.

Where provision of externalities domestically results in additional production that depresses and destabilises markets for agricultural products internationally, the outcome will be suboptimal in a global sense. This can act to reduce any positive spillovers from agriculture in other countries. As a key objective of the WTO is to advance the benefits from more open and less distorted markets, it is important that the national focus on multifunctionality should not be allowed to facilitate protective policies that prevent such benefits from being realised.

The concept of multifunctionality can be manipulated to represent a serious risk to obtaining benefits that flow from more open trade. If values placed on multifunctional factors are incorrect (if in fact what is desirable can be adequately identified and valued) or if inefficient mechanisms such as nontargeted general or commodity specific agricultural support are used to pursue them, the result will be an inefficient allocation of resources, both domestically and internationally. This would reduce overall societal benefits and, taken to the extreme, could jeopardise the foundations of the economic benefits that arise from specialisation and comparative advantage. Those benefits are central to realising the gains from trade that are a principal driver of economic growth and prosperity — they represent the logical foundation for multilaterally agreed reforms including those through the WTO.

Such risks are highlighted by some of the arguments made by proponents of multifunctionality. It has been argued that because agriculture faces particular cost disadvantages in particular areas, support should be provided by governments to offset those disadvantages. This is evident from the following extract from the Congress of European Agriculture (1998).

‘The European model of agriculture is based on multifunctionality. As an activity of production, agriculture must therefore be competitive to

take its shares on internal and external markets. This function of supplying food should not be understood only in quantitative terms: consumer expectations of product quality and safety must be met as must society's expectations of environmental responsibility and regional planning, ensuring in particular a sustainable utilisation of the ground and water so that this heritage can remain productive for future generations.'

There are other examples of advocacy of agricultural support on grounds of nonpriced externalities. In Japan, cultivation of rice paddies is considered by some to be important for flood mitigation while emphasis is placed on maintaining levels of food self sufficiency that are as high as possible for food security reasons. In Norway, agricultural activities are sustained by the provision of special location based support in areas where production could never be competitive in its own right. An example is the preservation of dairy farming in areas within the arctic circle where the environment is clearly so harsh as to prevent production under competitive market conditions. In such a case, support is designed to offset comparative disadvantage.

In many instances, support for agricultural activities and, by implication, the externalities that are associated with them is provided by general industry support, either through price support or general subsidies. As indicated by Anderson (1998), and from the above reasoning, untargeted industry support is generally an inefficient and often ineffective means of obtaining perceived positive spillover effects or of addressing negative ones. This means that trade measures, which are usually at the industry level, are generally not appropriate to address these externality issues. More appropriate measures fall within the ambit of specifically targeted domestic measures that are designed to address what are usually region or site specific issues. The Countryside Stewardship Scheme in England is an example of such targeted measures. Under that scheme direct payments are made to conserve, restore and/or maintain landscape, wildlife and historical features (MAFF 1999). Another such similarly targeted scheme is the Countryside Access Scheme in England and Wales under which money is paid explicitly to farmers to set aside suitable farmland to provide public access for walking.

When such targeted measures are in place to address the nonmarket outcomes, the most efficient outcome in economic terms arises when producers receive world market prices for their agricultural products. Domestic support measures are usually the most appropriate means of addressing these externalities. However, because there is potential for such support to be market and trade distorting and harmful to groups in other countries, it is important

that conditions within WTO agreements ensure that provision of such support is as minimally trade distorting as possible.

Another argument that has been put forward by proponents of multifunctionality is that domestic producers should not be disadvantaged by complying with domestic requirements, such as environmental standards. In the declaration by the Congress of European Agriculture (1998) it is argued that European standards for food safety, the environment and animal welfare have a price that third countries should not escape and that this should be taken into account in WTO negotiations.

While it is clearly desirable that there should be adequate standards, those standards required of European Union producers are not necessarily higher than in many other producing nations that may already have equivalent or superior measures in place. In this context, the issue of equivalence is important as producers face differing conditions in different regions and insistence on exactly the same conditions or standards can be and has been used for economic protection. An example is the insistence by the United States on the use of turtle excluding devices on prawning nets in fisheries supplying product to the US market. This was applied even for fisheries where there were never any turtles. The United States has been ruled against in the WTO on this measure.

Green box exemptions, multifunctionality and environmental and regional support

Governments seeking to provide various forms of support to meet ‘multifunctionality’ or regional goals could adopt environmental, regional assistance or structural adjustment assistance programs that are exempt from reduction requirements under annex 2 of the Agreement on Agriculture.

Green box exemption for these programs is subject to the following conditions.

Environmental programs

- Payments under these programs must be under clearly defined government programs with specific conditions that must be met for production methods or inputs.
- Payments must be limited to the extra cost or loss of income for recipients to comply with the program.

Payments under regional assistance programs

- Eligibility for payments is limited to producers in clearly defined regions with disadvantages that are more than temporary.
- Payments are not to be related to the type or volume of production in any year past a base year.
- Payments are not to be based on prices on world or domestic markets.
- Payments are to be available to all producers in the region.
- Where related to production factors, payments are to be at a declining rate above a threshold level of the factor concerned.
- Payments are to be limited to the extra costs or loss of income involved in undertaking agricultural production in the prescribed area.

Payments for structural adjustment assistance provided through investment aids

- Eligibility depends on criteria for government programs to assist financial or physical restructuring of operations in response to demonstrated structural disadvantages.
- Payments are not to be related to production or prices (domestic or international) after a base year.
- Payments are to be limited to the period of time necessary to realise the investment.
- Payments are not to designate the agricultural products that can be produced.
- The payments are to be limited to the amount required to compensate for the structural disadvantage.

The conditions on *environmental programs* give substantial scope for flexibility in the types of programs that might be applied. There can be very different views on what are meant by environmental programs given the imprecision with which concepts like the environment and multifunctionality (which has environmental aspects) are applied. For example, government programs could be developed to maintain some types of farming in order to preserve certain types of landscapes — to some governments, these could be considered to be environmental programs. However, different conditions to meet the requirements can have very different effects on production and trade. In some instances, such as with conditions that particular traditional

production methods must be used, the arrangement might even reduce production of particular products. However, in others, such as if the objective were merely to ensure that a particular parcel of land was used for a particular purpose, it could increase production and exports for some products.

The conditions for payments under *regional assistance programs* could place some constraints on the extent of market distortions that would intrinsically arise from decisions to provide regional agricultural assistance for disadvantaged areas. This is because the support is to be provided in ways that are unrelated to the type or volume of production or prices, which should limit distortions in the allocation of resources between agricultural activities in the region that might arise from such support. However, the regional assistance will result in larger agricultural production in particular areas than otherwise, and in some it would result in agriculture being practised where farming would otherwise not occur at all (for example, north of the arctic circle or in deserts).

The high resource costs in encouraging agriculture in disadvantaged areas will reduce overall income levels in the country providing the regional assistance and be harmful to agricultural producers in other countries. That is, they will be trade distorting and will not, in fact, meet the condition for annex 2, that the support should be minimally market distorting, at least if applied on more than a minimal scale.

Similar distorting elements that arise from regional programs would apply with structural assistance provided through *investment aids*. Such aids will channel more resources into agriculture than otherwise. They will also skew agricultural production more toward capital intensive activities. This would result in an efficiency loss within the economy providing the assistance and distortions to trade affecting other countries.

It is significant that conditions for regional assistance programs and investment aids contain similar conditions to those laid down for decoupling. These are that production cannot be related to production after a base period, and it cannot be related to domestic or international prices. However, the nature of investment aids precludes them from fulfilling another decoupling requirement that payments should not be related to factors of production. Clearly, investment aids must be related to factors of production, as they will affect investment in farms and machinery and so the productive capacity of the farms will not be minimally distorted. With regional payments, some effort

is made through the conditions in the Agreement on Agriculture to limit distortions where payments are related to production factors. This is through a general provision that payments shall be made at a declining rate if made above a threshold level of the factor concerned. However, the degree of arbitrariness concerning levels of such thresholds and the degrees at which rates should decline could result in this provision doing little to forestall production distortions arising from support related to production factors.

Current deficiencies that need addressing

Domestic support is a part of the overall support arrangements for agriculture. Such support can induce market distortions that interact with market access and export measures. As the objective of multilateral agricultural trade negotiations is to reduce market distortions so that extra benefits can be obtained for member economies, success can only be obtained if the measures agreed actually reduce overall distortions. As domestic support interacts with market access limitations and export measures, a comprehensive and consistent approach involving the interactions of these three pillars of support is necessary.

Most of the support induced distortions to agricultural markets arise from commodity specific support. In most instances such support is provided largely through price support, which has been the dominant component of the AMS. However, there are also important instances where support is applied through subsidies. To be successful in reducing distortions, actual levels of price support and distorting subsidies must be reduced.

The present arrangements in the WTO Agreement on Agriculture for limiting the market distortions arising from domestic support are highly aggregated, allowing substantial tradeoffs between levels of support between individual commodities. The price support component within the AMS does not measure actual price support and many of the forms of support that are defined in the agreement as being minimally market distorting and that are exempted from limitations on those grounds are in fact market distorting. Those exempted through production limiting arrangements are still distorting, with the degree depending on the existence of domestic policy measures such as area reduction programs. Additionally, the *de minimis* provisions are open to abuse, particularly by countries with large amounts of support.

The ability to change forms of support and to obtain credits for additional support in other areas and for other commodities permitted in the present

Agreement on Agriculture, means that some of the largest countries that are signatories to the agreement have the flexibility not only to maintain market distorting support, but to increase it.

Recommendations for an agreement that would assure reductions in market distortions from domestic support measures include:

- developing systems that ensure that actual levels of price support and distorting subsidies are reduced for each commodity as well as for agriculture in total;
- ensuring that the system used for measuring market distorting support provides an accurate measure of actual support, not a poor surrogate as occurs with the present AMS; and
- tightening conditions on exemptions to ensure that only measures that are in fact minimally market distorting are exempt from cuts or limits.

Application of rules on domestic support

In this chapter, the approaches taken by Japan, the European Union and the United States, which together provide over 80 per cent of total OECD agricultural support (OECD 2000a), toward meeting their domestic support commitments under the WTO Agreement on Agriculture, are examined. The emphasis is on the means and extent to which the disciplines on domestic support are being successful in reducing levels of market distorting support. A major aspect of this is the role played by the restructuring of support away from clearly market distorting mechanisms and into exempt arrangements, in meeting the conditions on domestic support in the agreement.

While the emphasis in the chapter is on the large developed countries, the chapter concludes with an appraisal of the situation for developing countries where agricultural support, although varying widely between countries, tends to be less market distorting than for developed countries.

Application of the aggregate measurement of support – large developed countries

Japan

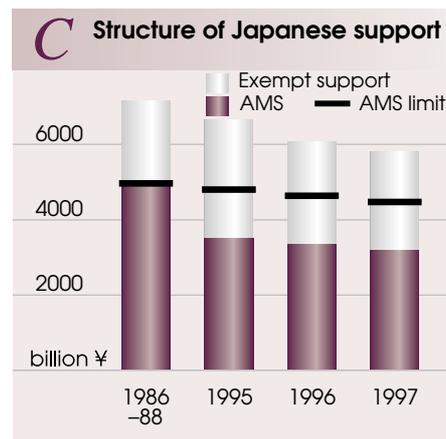
Japan is an example of a country where the AMS is not representative of actual market distorting domestic support and which has been able to meet its AMS reduction commitments even at times when its actual market distorting support has been increasing.

The scale of agricultural support in Japan is among the highest in the world, with approximately two-thirds of producers' returns being derived through government protective and support measures. Support is provided predominantly through border measures that restrict import competition and underscore commodity prices that are maintained for many commodities at multiples of world market levels. Such support is particularly high for rice, wheat, barley, milk, sugar and pig meat. For both rice and wheat, for example, government support constituted 88 per cent of returns to producers in 1999, with only 12 per cent of returns being the equivalent of world market prices (OECD 2000a).

Broadly, limits on imports, along with Japan's own limited production capacity, restrict supplies. The limited supplies, together with substantial demand from a large and affluent population, support internal prices. Consequently, reducing barriers to market access is central to achieving the benefits that arise from specialisation and trade in agricultural products.

The gap between internal support prices and world market prices provides a barometer of the degree of distortion arising from Japanese agricultural policies. However, the AMS is unreliable as an indicator of such distortion, despite Japan's support (with the exception of the provision of government services) being predominantly through price support that is within the AMS. The reason is that the price support in the AMS does not represent the actual level of price support but is determined from the difference between administered support prices and fixed external reference prices.

For years until 1997, Japan had no difficulty meeting its agreed limits for domestic support as indicated through its AMS, as is shown in figure C.



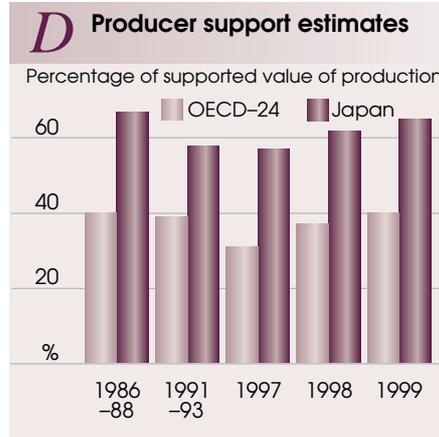
Support within the AMS has been declining both through some reductions in administered support prices and because production volumes of some highly supported products has been declining. For example, production of wheat, barley and sugar in recent years has been well

below that in the 1986–88 base period. There has also been some reduction in the AMS for rice — from 2.87 billion yen in the base period to 2.32 billion yen in 1997.

It is also apparent from figure C that, although there was an increase in exempt support, the sum of AMS and exempt support declined, at least up to 1997. It can also be expected that the AMS did not increase significantly in 1998 and 1999. Japan has not been increasing its administered prices and production did not increase.

How does this picture of reduced aggregate AMS and exempt support compare with estimates of actual support in Japanese agriculture? OECD

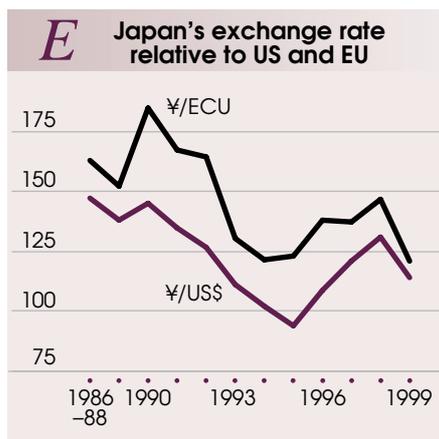
figures for producer support estimates show that, between the 1986–88 base period and 1997, support in Japanese agriculture did decline. However, as also occurred in the European Union, the United States and the OECD as a whole, the previous decline was almost completely reversed in 1998 and 1999 (figure D).



How can the increase in measured support in 1998 and 1999 be reconciled with the likelihood that the total of AMS and exempt support in

Japan did not increase in those years and may have even fallen further? The answer comes back to the observation that the AMS is not an actual measure of price support, because it measures only the difference between *administered* support prices and *constant* external reference prices. It is through the unvarying nature of one of its two fundamental determinants, the external reference price, that the AMS is inadequate as a measure of actual price support, because world market prices change over time.

The decline in Japan's AMS between the 1986–88 base period and 1997 was consistent with reductions in the measured levels of support largely because of two factors. One was that Japan instituted minor reductions in administered support prices. The other was that an increase in world agricultural prices from 1995 to 1997 in other currencies generally offset substantial appreciation of the Japanese yen that had occurred since the 1986–88 base period (figure E). These offsetting movements in exchange rates and world prices meant that, from 1995 to 1997, the constant external reference prices provided a reasonable representation of actual external prices. So changes in the AMS were, briefly, reasonably indicative

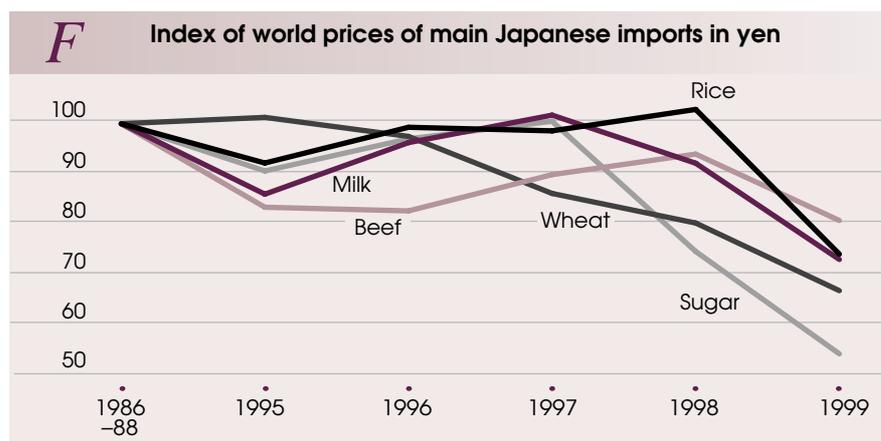


of changes in actual Japanese agricultural protection. However, that situation was not to continue when world prices fell in 1998 and 1999.

World market prices denominated in yen fell below the external reference price in 1998 for all major products except rice. In 1999, there were marked further reductions in world market prices for all products examined. This resulted in actual external prices falling to levels substantially below the constant external reference prices. Hence, the AMS, based as it is on constant external reference prices, did not reflect the drop in world prices. Nor did it reflect the increase in actual market distorting agricultural protection that occurred in 1998 and 1999, as reported by the OECD.

The reductions in world market prices relative to the constant external reference prices in 1998 and 1999 are shown in figure F. (Prices are indexed, with the 1986–88 base level prices set at 100. Indicator prices used in these figures are wheat – US hard red winter wheat no. 2 ex Gulf ports; barley US no. 2 barley, Portland; rice – Thai white rice 100 per cent grade B, fob Bangkok; sugar – International Sugar Agreement price, fob and stowed Caribbean ports; milk – Australian manufacturing milk price; and beef – Australian boneless chilled beef for Japan, fob. All prices were converted into yen equivalents).

Broadly, the arrangements for domestic support in the WTO Agreement on Agriculture have permitted Japan to increase its rates of agricultural support at times when world prices have fallen in terms of yen, primarily in 1998 and 1999, so that actual support has returned almost to the levels that applied in the mid-1980s. The continuing preeminence of price support, the highly



market distorting nature of such support and the maintenance of, or only slight reductions in, support prices in terms of yen mean that market distortions have not been reduced. Unlike the United States or the European Union where claims might be made that support is being reoriented into less market distorting mechanisms, no such claims can be made for Japan.

Do these factors mean that the AMS limitations have not been a factor in containing Japanese support? An answer to this question is probably that the AMS system could have played a part in bringing about the relatively small reductions that have been occurring in nominal Japanese internal support prices. Japan is something of a special case because about three-quarters of its AMS is price support for one specific commodity — rice (WTO 2000b). Consequently, to meet its commitments for agriculture as a whole, it is necessary that there be some reduction in administered prices for rice. Also, the interests for maintaining support for rice are politically formidable, so it would be unlikely that much greater cuts in administered prices would be applied to rice than to other supported commodities. Consequently there are some forces contributing to general restraint in administered prices to meet Japan's agriculturewide domestic support commitment. However, the reductions that have occurred in administered prices have recently been far less than reductions in world market prices when they are expressed in terms of yen, thereby returning support and market distortions to the extreme levels that applied in the mid-1980s.

The European Union

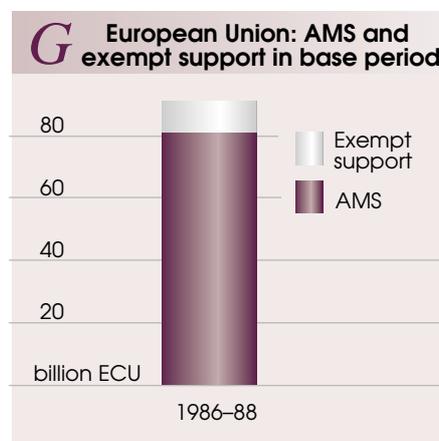
The European Union provides an example of the effects of restructuring support for some commodities to exempt arrangements that are still market distorting, so that no reductions have been required either for other commodities or for agriculture in total to meet reduction commitments.

The analysis in chapter 2 showed that the European Union has been able to obtain exemptions from WTO domestic support limits for substantial amounts of assistance for arable crops (cereals, oilseeds and protein crops) and beef as a result of changes made in 1992. To put these changes into perspective within the overall support arrangements in the European Union, a brief summary of EU support policies is provided in box 4.

The base period for domestic support in the WTO Agreement on Agriculture, 1986–88, was a time of very low world market prices and high price support in the European Union (OECD 2000a). Because of this, the initial AMS level

was high in a historical sense. The great bulk of estimated support was price support or equivalent commitments that fell within the definition of the AMS, the level of which can be seen from figure G.

In the context of the AMS as a measure of domestic support, the change in form of support in the European Union in 1992 has been critical. The support is deemed to fulfil the conditions for the blue box of production limiting arrangements which exempts the crop compensation and livestock payments from the AMS.



The 1986–88 base AMS includes a large amount of price support for arable crops (mainly cereals and oilseeds) and beef that was subsequently replaced by compensation and headage payments that has been considered to be exempt from AMS commitments because they qualified for the blue box.

4 A brief background on EU support arrangements

The European Union has made important changes in the means of delivering agricultural support for some commodities since the 1986–88 base period. Support for EU agriculture has been predominantly through price support that maintains internal market prices substantially above world market prices. Before the WTO Agreement on Agriculture was concluded, this price support was implemented mainly through a system of variable import levies that prevented imports from undercutting administratively set internal support prices, and export subsidies that enabled exporters to sell on world markets at prices below the internal supported prices.

Intervention agencies in each member state ensured that, if internal market prices came under pressure to fall below the administratively set support (intervention) prices, they would purchase quantities and hold them off the market, for release later when prices rose again or for export with the aid of subsidies. Following the WTO Agreement on Agriculture, variable import levies have been largely replaced by import restrictions through tariff quotas, although elements equivalent to variable import levies have been operating for cereals (Roberts 1997, p. 62).



4 A brief background on EU support arrangements *continued*

The system of support was open ended and resulted in the accumulation of substantial stocks, with associated high public storage costs. So large were these stocks in the mid-1980s that measures were applied either to restrain surplus production as was the case with the introduction of milk quotas and various 'coresponsibility' levies on producers. The milk quotas have remained in place ever since.

A propensity for highly regulatory support systems has also been apparent for sugar which is supported through a combination of strict control of import volumes and prices, export subsidies and a price support quota system for domestic production. A part of production within the quotas is exported with subsidies. All production beyond the quotas must be exported at world prices.

While import barriers and export subsidies are the fundamental measures that determine general levels of supported prices for most commodities in the European Union, domestic intervention arrangements play a central role in stabilising internal prices and insulating them from external market forces. This price stabilising role is implemented through intervention purchasing and selling and stock management. Also, for some commodities such as fruit and wine, internal price support has been provided through intervention withdrawals of quantities from the market at times of excess supply. Often these quantities have been distilled for use as industrial alcohol.

In 1992, a major change was made to EU support arrangements for cereals, oilseeds and pulses, collectively termed arable crops, and for beef and sheep meat, with those changes being implemented over the three years to 1995-96. For arable crops and to a lesser extent beef, reductions in support prices were implemented with large direct payments being used to compensate the producers for the price cuts. The payments for the crops were termed compensation payments. They are linked to regional base areas planted and regional base yields, with the base being 1989-91 for area and 1986-90 for yields. At the same time, crops were made subject to area set-aside arrangements at the individual farm level, with farmers receiving payments for the areas that they are required not to plant.

While most of the support for beef continues to be through price support, this support is now supplemented by direct payments according to numbers of specified types of animals held, with limits per farm on the numbers to receive payments. There are national limits on numbers for payments on each type of animal and if claims exceed the ceiling in any one year all claims are scaled back accordingly (Agra Europe 2000). Headage payments are also made for sheep. For cattle, the payments are for suckler cows (beef breed cows used for raising calves for beef) and male bovine animals, while the payments for sheep are based on ewe numbers.

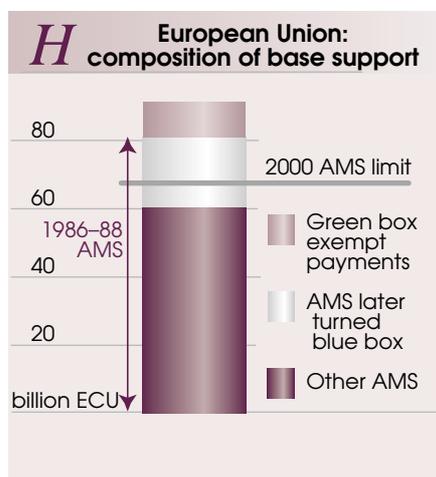
It is not absolutely clear that the European Union has fulfilled the conditions for blue box exemption, at least in terms of the economic effects of the measures applied, although it may have conformed with a liberal interpretation of the conditions in the agreement. In the agreement, the conditions for crops for blue box exemption are that the 'payments are based on fixed area and yields; or such payments are made on 85 per cent or less of the base level of production'. The levels of compulsory area reduction programs have been considerably less than 15 per cent for every year since 1995-96, making it doubtful that they would have complied with the second condition. However, the European Union has sought exemptions based on fixed areas and yields (WTO 1999e, 2000d).

The basis for compensation rates for yields is fixed regional averages for the base period (1986–90 minus the highest and lowest years). For areas, each farm is paid in accordance with actual areas planted. If, for a region, total applications for area aid exceed a regional area ceiling of plantings in the area base period (1989–91), all payments for the year are supposed to be reduced pro rata and a penalty set-aside in the next year may be applied. These rules have been weakened since 1994-95 by various exemptions (Agra Europe 2000).

It is significant that the disciplines that are applied to ensure compliance for areas are at the regional and not the individual farm level. As the planting decisions are made at the individual farm and not the regional level, and there are not strong disciplines to ensure individual compliance, it could be argued that the fixed area criterion is not met. However, the arrangement might be construed to comply with the rather loosely defined condition for blue box exemption of being *based on* a fixed area — at the regional level and not the farm level where decisions are made.

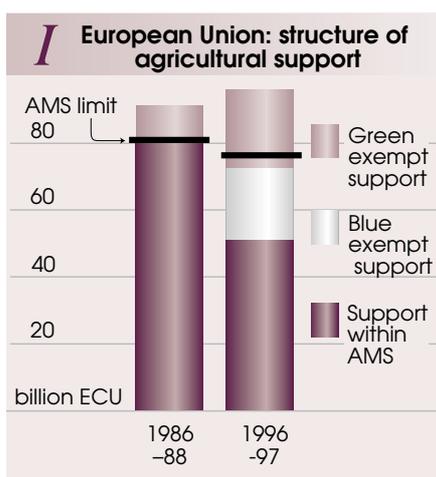
For beef, the direct headage payments qualify for blue box exemption on the grounds that they are on a fixed number of head. The payments are based on individual farmer quota rights for suckler cows and there is a ceiling of 90 animals per holding for each of two age brackets for male bovine animals although member states have the right to waive the maximum if they wish (Agra Europe 2000). These arrangements would appear to provide incentives to maintain numbers and therefore production, as much as to limit production. They tend to lock production in at around levels that have been stimulated by decades of high support.

In 1996-97 and 1997-98, the blue box exemptions were 21.5 billion ECU and 20.4 billion ECU respectively (WTO 1999c, 2000d). This meant that the European Union was able to reduce its actual AMS in those respective years during the implementation period by 21.5 billion ECU and 20.4 billion ECU, which compares with the overall agreed reduction in the AMS to the year 2000 of only 13.8 billion ECU. The European Union was able to more than meet its commitments purely by changing the form of its support for a few commodities. As a result there was no pressure to reduce support for other commodities like sugar and milk at all. The importance of this element in the AMS is evident from the composition of the base AMS, as shown in figure H.



In addition, between the base period and the mid-1990s there was a major increase in green box support, with especially large payments being made for structural adjustment assistance through investment aids, environmental payments and regional assistance programs. The changes in the structure of support in the European Union between the base period and 1996-97 can be seen in figure I.

Total support as measured by the sum of AMS and exempt support increased between the base period and 1996-97, but the European Union was well within its AMS limit. Assistance had become much more strongly oriented toward green box support and blue box payments and away from price support. Nevertheless, the price support under the AMS has remained the largest component of support.



Observations about the AMS and EU domestic support

Because of the predominance of price support in the EU agricultural arrangements and the definitional straightjacket in which the price gap component of the AMS has been placed, the AMS is a very unreliable indicator of market distorting support in the European Union.

As EU prices are highly insulated from world market prices, EU farmers' and consumers' responses to world market price signals remain very restricted, thereby limiting internal adjustment and forcing it on others. Application of the AMS does little to address this problem. There are three main interacting reasons for this:

- the cuts to the AMS are for agriculture as a whole and not for individual commodities;
- the large 'credits' that the European Union received for its AMS by changing to blue box exempt support have enabled little, if any, reform to take place for a wide range of EU agricultural commodities — for example, EU support prices for sugar, milk and sheep meat remained unchanged throughout the implementation period for the WTO Agreement on Agriculture; and
- the AMS is determined from administered and fixed external reference prices rather than actual prices, so little pressure arises for changes in internal prices as a result of changes in world market conditions.

For EU dairy products, incompleteness of commodity coverage could be an issue. Arrangements for support of milk prices in the European Union are underscored by administered prices for butter and skim milk powder. Accordingly, the EU's AMS for dairy products includes figures for butter and skim milk powder only (WTO 1999c). However, cheese, other milk powders and other dairy products use far more milk in total than butter and skim milk powder, and are excluded from the AMS. This means that dairy products are proportionately not fully represented in the AMS, either in the base period or in subsequent years. The support for milk in total for the European Union, as reported in OECD producer support estimates for 1997, was more than 18 billion ECU, but the sum of the support included in the EU notifications which is limited to butter and skim milk powder for 1996-97 was only 5.85 billion ECU while that in 1997-98 was 5.73 billion ECU.

It is unlikely that the AMS for the European Union will increase much, if at all, in the late 1990s despite there having been an increase in actual protec-

tion levels — actual support to producers rose from 38 per cent of the supported value of production in 1997 to 49 per cent in 1999 (OECD 2000a). Reasons why AMS support is not expected to increase much include the continued dominance of assistance through price support, the exemption of most support for arable crops and for some livestock products under the blue box and the use of administered and fixed external reference prices.

The main observation on domestic support for the European Union is that the exempt nature of support provided through the blue box allows the EU to provide support through still market distorting blue box measures while having the capacity to increase the value of other distorting support under the AMS. By replacing price support with exempt blue box payments, the European Union gains additional flexibility to use AMS support for other areas. The EU has claimed that the change to blue box support has reduced distortions in EU farming (Commission of the European Union 2000). However, blue box support as applied to cereals is still market distorting and the domestic support commitments may even allow an increase in market distorting support given the relative freedom to expand blue box support if desired.

The United States

Within the present Agreement on Agriculture, the United States has exercised substantial flexibility, even inconsistency, in obtaining a large AMS base while using domestic support exemptions so that it has faced virtually no constraints on its agricultural support. Its total support is now well above that in the base period and there is substantial doubt about whether measures that have so far been exempt under decoupling green box measures are being applied in ways that are actually decoupled. In recent years it has taken advantage of the lack of effective constraints under the present agreement to increase its use of measures that are clearly market distorting.

The analysis in chapter 2 showed that the inclusion of deficiency payments within the US base AMS and the subsequent exemption of such payments on grounds of being decoupled have provided substantial room for flexibility in providing market distorting support for US agriculture.

To appreciate more fully the scale and implications of this flexibility, it is desirable to have a broad understanding of how US agricultural industries were supported before the WTO Agreement on Agriculture was concluded in 1994 and how they have been supported since (see box 5).

Apart from support that is provided to agriculture through the arrangements described in the box 5, there is substantial assistance through government funded infrastructure, research and development, environmental and other programs. Expenditure on those programs is generally exempt from the AMS

5

Background to US support arrangements

US agricultural industries can be divided into two groups in terms of how they receive policy induced support. These are program crops that receive support mainly through government payments, and those that are supported primarily through price support that relies mainly on border measures. The main program crops are wheat, feed grains, rice and cotton. Price support is mainly applied for milk, sugar and peanuts.

Program crops (wheat, feed grains, rice and cotton)

Before the 1996 FAIR (Federal Agricultural Improvement and Reform) Act, support for program crops was through a combination of minimum price support and deficiency payments.

The minimum prices to producers were supported through the *loan rate*, a guaranteed minimum price that has usually been low relative to the farm gate equivalent of world market prices in most years. If market prices fell below the loan rate, the government made up the difference by payments termed *marketing loans* or where farmers did not place their crops under loan, *loan deficiency payments*.

Deficiency payments covered the difference between administratively set *target prices* that were usually well above world market prices, and either the market price or the loan rate, whichever was the higher.

As support for program crops encouraged production and resulted in periodic large surpluses, plantings were restricted through annual administratively determined *acreage reduction programs*. Unless farmers set aside (did not plant) a specified proportion of their crop base, determined from historical plantings, they did not qualify for deficiency payments and other program benefits.

Between 1985 and 1995, support was also provided to some program crops, wheat in particular, by export subsidies through the *Export Enhancement Program* (EEP). For cotton, additional support has been provided since 1990 through *competitiveness subsidies* to ensure that US cotton is sold at competitive prices on both export and domestic markets, while US imports have also been strictly controlled.

In the 1996 FAIR Act, some of these arrangements were modified. Deficiency payments were replaced by *production flexibility contract payments*. These are direct income support payments paid to each producer of program crops. These payments are made on the basis of past farm area and yield bases that were deter-



5 Background on US support arrangements *continued*

mined from program history. The payments are calculated by multiplying the payment rate for the year by the farm's contract payment area (determined from the farm's area base) by the base yield. Initially, the payments were on a set scale over a seven year period and were not to vary with production or prices. Farmers do not have to plant the program crop to be eligible for the payments, which gives them freedom to plant which ever crops they wish, subject only to stipulated limitations on fruit and vegetables. Acreage reduction arrangements have been discontinued. However, the loan rates, marketing loans and loan deficiency payments remain (US Department of Agriculture 1996).

In 1998, 1999 and again in 2000, when world prices were low and the US dollar appreciated, the US Congress voted special additional support packages. These amounted to US\$6 billion, US\$8 billion and US\$15.3 billion respectively. Large parts of these packages were additional direct payments for program crops, termed *market loss assistance* payments. These are being provided in proportion to production flexibility contract payments. Another important feature of these packages was increasing the provision for government subsidised insurance — of the additional package of US\$15.3 billion voted in 2000, US\$8.2 billion is to go toward reducing premiums on federally subsidised crop insurance over the next five years (US Department of Agriculture 2000a). An analysis of subsidised crop insurance as an example of an increasingly popular form of domestic support in the United States is provided in chapter 4.

Price support

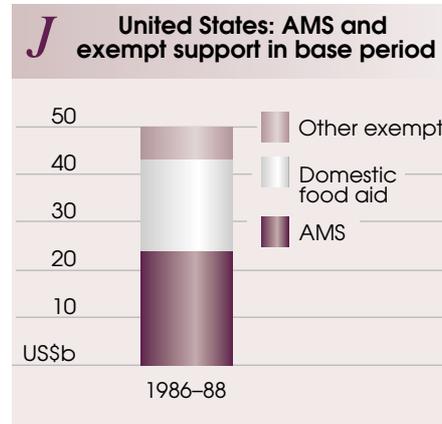
The main items that have been assisted primarily through price support are milk, sugar and peanuts.

For milk, internal prices are shielded from import competition through restrictions on imports of dairy products through tariff quotas. Internal prices are also supported through quantities of manufactured products being redirected from the domestic market to targeted export markets via export subsidies under the *Dairy Export Incentive Program* (DEIP). In addition, there is a complex set of price fixing and restrictive movement regulations for fluid milk under *federal milk marketing orders* that further support regional milk prices. Under the 1996 FAIR Act, minimum prices for milk that are used to trigger government support purchases of dairy products were progressively reduced from their 1996 level of US\$10.35 per 100 pounds to US\$9.90 per 100 pounds in 1999.

US support for sugar is provided through restrictions on imports using tariff quotas. Prices to producers and processors are supported at a loan rate that has been 18 cents per pound for cane sugar and 22.9 cents per pound for beet sugar for many years. This has been done by regulating overall market supplies. In practice this means regulating the volume imported as no constraints, other than environmental conditions, have been placed on production.

under the green box. As well, there is large expenditure on domestic food aid, which is mainly through a ‘food stamps’ program under which needy individuals are eligible to receive food stamps that can be used to purchase food. This program is more for social security than for support to US farmers.

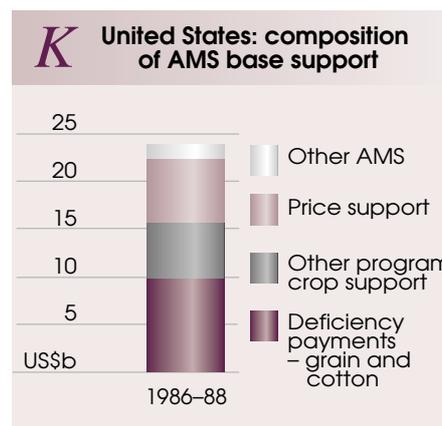
Overall, in the base period for the WTO Agreement on Agriculture, 1986–88, exempt support (amounting to US\$26.2 billion) exceeded the AMS of US\$23.9 billion. However, if the domestic food aid were excluded, exemptions were only US\$7 billion (figure J).



Because domestic food aid can be considered to be primarily for social security rather than for agricultural support, it is excluded from the discussion and figures below.

As mentioned in chapter 2, the United States was able to have deficiency payments of US\$9.7 billion included in its base AMS. Those payments constituted just over 40 per cent of the total base as is evident from figure K.

Although the deficiency payments were included in the US 1986–88 AMS base, the support arrangements arising from the US Food Security Act of 1985 meant that those payments went very close, in terms of their effects on production incentives, to qualifying for blue box exemption from the AMS base on the grounds of them being based on fixed areas and yields. Under the 1985 legislation, acreage bases were effectively frozen, and ‘program payment yields were frozen at the average of the previous five years’ program payment yields, each of which, was itself the average of the previous five years’ proven yields’



(Thompson 1989, p. 5). As a result of these yield rollover arrangements, growers had very diluted incentives to increase current yields in order to obtain future additional government payments. A condition for blue box exemption of payments from the AMS is that they are based on fixed areas and yields. So, although technically it might be argued that the payments were not based on fixed yields, they were based on fixed areas and close to fixed yields. The underlying economic effect of the base provisions of the 1985 legislation were almost identical to those from fixed area and yield bases. The large deficiency payment segment of the US AMS base therefore appears to have been included in that base, and not exempt, on a very subtle distinction.

The inclusion of the large amount of deficiency payments in the AMS base and the subsequent exemption of many direct payments that took their place gave the United States flexibility to maintain or even increase other forms of nonexempt support. Deficiency payments were subsequently notified as exempt in 1995 under the blue box as the deficiency payments were 'based on 85 per cent or less of base acreage and program yields have been held constant' (WTO 1997). Then, in 1996, with the change to production flexibility contract payments that were not linked to current production or prices, they were given green box exemption.

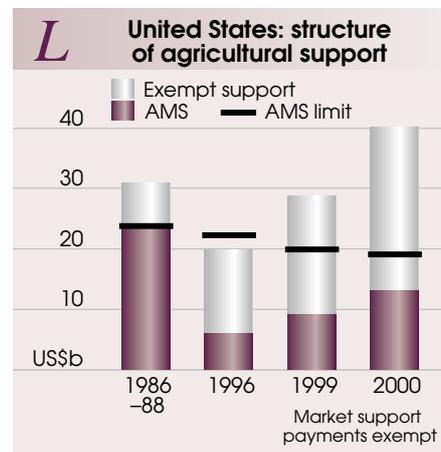
The exemption of these payments, along with relatively high world market prices in 1996 and 1997 meant that in each of those years, the AMS was around US\$6 billion, with that being predominantly price support — the only significant other nonexempt support was cotton competitiveness subsidies in 1997. It looked like the disciplines under the WTO agreement might have been working. Even accounting for exemptions of the scale of the former deficiency payments, these amounts were greatly below the respective committed limits for those years of US\$22.3 billion and US\$21.5 billion.

The form that production flexibility contract payments took in 1996 and 1997 and the relative absence of nonexempt assistance for program crops gave promise that the payments might be applied in ways that were as minimally distorting as possible. They were linked neither to current production nor prices. However, with the drop in world market prices that commenced in mid-1997 and appreciation of the US dollar that has continued to the present time, the United States has resorted to massive additional support payments. Those payments, a large proportion of which have been termed *market loss assistance payments*, have broadly moved inversely to changes in market prices (Roberts et al. 1999). Nevertheless, they have not been directly

determined by movements in market prices. So, while those payments might fulfil the condition for green box exemption — that the payments should not be linked to prices after the base period — in a formal sense, their indirect links to prices could weaken the degree to which such payments are decoupled in terms of their effects.

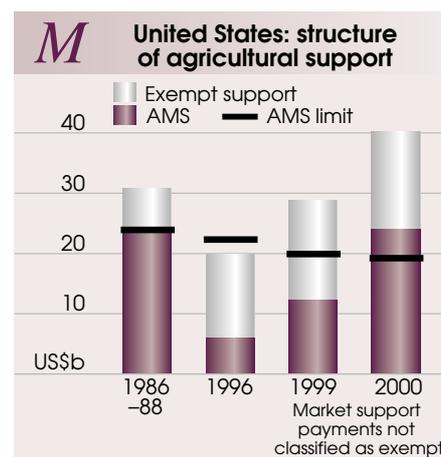
If both the continuing production flexibility contract payments and market loss assistance payments that have been reported for 1999

and estimated by the US Department of Agriculture for 2000b (US Department of Agriculture 2000b, p. 52) are still considered to be decoupled and therefore exempt, the AMS levels for 1999 and 2000 are estimated to be US\$9.1 billion and US\$13 billion respectively. These amounts fall well short of the agreed ceilings on US AMS support of US\$19.9 billion for 1999 and US\$19.1 billion for 2000 (figure L).



Even if the additional market loss assistance payments for 1999 and 2000 were considered not to be decoupled but the ongoing production flexibility contract payments are considered to remain decoupled, an estimated AMS level of US\$12.1 billion in 1999 would be well below the required AMS ceiling for that year. However, the AMS in 2000 would rise to US\$24.1 billion which would be well above the required AMS ceiling (figure M).

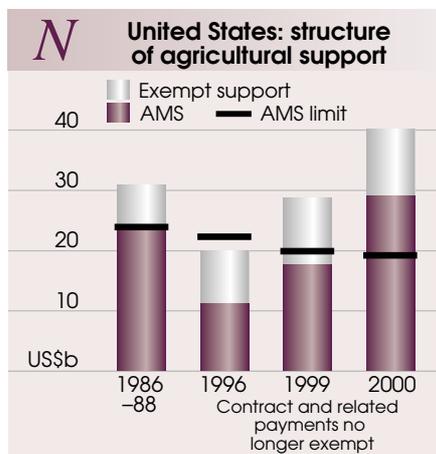
If both production flexibility contract payments and market loss assistance payments were now considered not to be decoupled, because they have been related to market price reductions, it is estimated that the US AMS was US\$ 17.6 billion in 1999, which was within that year's ceiling. However, it would climb to an estimated



US\$29.1 billion in 2000, which is substantially beyond the US AMS agreed maximum of US\$19.1 billion for that year (figure N).

Observations about US domestic support

The above three alternative scenarios on the status of various forms of US direct payments as decoupled or otherwise indicate how important considerations about whether the US payments actually meet the conditions for decoupling are if US support is to remain within its WTO committed AMS ceiling.



Although rather academic questions can be raised about whether the US support in 2000 will actually fall within the AMS commitment, a more important question is ‘are US policies now less distorting as a result of the WTO Agreement on Agriculture?’ This broad question can be divided into components including:

- Are the kinds of direct payment support that are being adopted by the United States’ actually minimally distorting?
- Is their adoption reducing market distortions from US policies?
- What kinds of constraints have the WTO Agreement on Agriculture provided to US agricultural support, considering that support levels are now higher than in the base period?

Answers to these questions are anything but clear, especially considering:

- Although some US farm program support might be considered not to be linked directly to production or prices, some of the recent increases in payments are clearly in forms that are distorting (for example, subsidised insurance, loan deficiency payments and cotton competitiveness subsidies).
- While production flexibility contract and like payments *might* be construed to be minimally distorting, they are replacing a system that attempted to

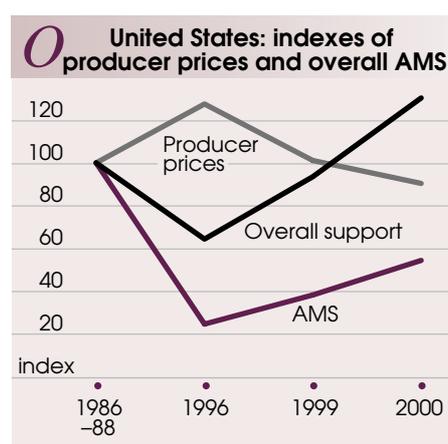
reduce the market distorting effects of deficiency payments and other government support. It is unclear how successful the previous system was in reducing such distortions and whether the present system results in less distorted outcomes.

Actual levels of US domestic support and their effects

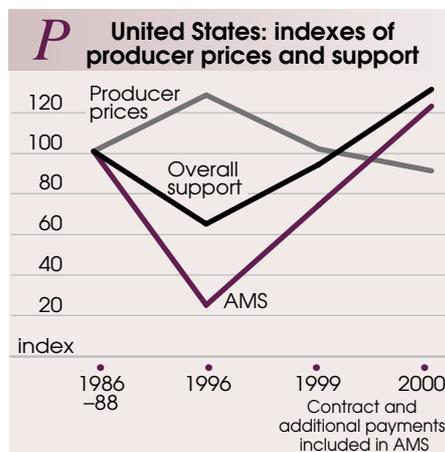
It is evident from figures L and M that total US agricultural support is now well above its already very high 1986-88 level. There was a marked reduction in support in the mid-1990s when market prices were relatively high, followed by very large increases in 1999 and 2000 when world prices fell markedly in terms of US dollars. These observations are made from data for the categories that the US government provides in its notifications to the WTO either as exempt or subject to AMS limitations (WTO 1997, 1998b, 1999d) and from published data on US support payments (US Department of Agriculture 2000b).

There has been a reorientation of support away from AMS categories, in particular the deficiency payments that were included in the US AMS base, toward those that have been classified as exempt from WTO limitations (green box exemptions) such as production flexibility contract payments. However, even with such exemptions (if the production flexibility contract payments are accepted as decoupled and the questionable market loss assistance payments are also accepted as decoupled), there has been a marked increase in both AMS and exempt support since 1996, which marked the low point for US agricultural support in the 1990s.

Part of the reason for this increase in support lies in the high world market prices for most commodities in the mid-1990s, which reduced the perceived need for support, followed by the much reduced world market prices after 1997. The link between market prices, AMS support and the total of AMS and exempt support is shown in figure O if it is assumed that production flexibility contract and market loss assistance payments are still decoupled. If, however, the production flexibility contract payments and market loss assistance payments



were considered to be no longer decoupled, because they were related to changes in market prices, the increase in AMS support would be substantially greater in 1999 and 2000. The links between market prices and support would be as shown in figure P.



The increases that have been shown for total AMS support in all of the above figures have understated the actual levels of, and increases that have occurred in, support for a major part of the AMS — market price support. This has been particularly the case for dairy support. If the standard methodology as set down in the WTO Agreement on Agriculture for estimating support within the AMS is used, the estimated levels of AMS support for US dairy would have declined from US\$4.7 billion in 1996 to US\$4.3 billion a year for both 1999 and 2000. However, the OECD has estimated that actual support to producers rose from US\$10.6 billion in 1996 to US\$14 billion in 1999 (OECD 2000a).

As indicated in the previous chapter, US border measures and export subsidies have maintained average internal US supported prices for milk at well above the administered support levels, resulting in much higher actual supported prices than those used in the AMS calculation. Also, the fixed external reference price does not enable the effect of reduced world market prices that applied for dairy products in 1998 and 1999 in terms of US dollars to be reflected in the AMS.

Are the present forms of US support less market distorting than previous forms?

The production flexibility contract payments that replaced deficiency payments in the 1996 FAIR Act were not related to current production, internal or external prices or input use. They therefore met the requirements of exemption from AMS support on grounds of decoupling. But was the support less market distorting than previously? The answer is ‘not necessarily so’, because, at the same time as the contract payments were introduced, acreage reduction programs were discontinued. Those programs suffered from many shortcomings, with farmers setting aside their poorest land and planting areas

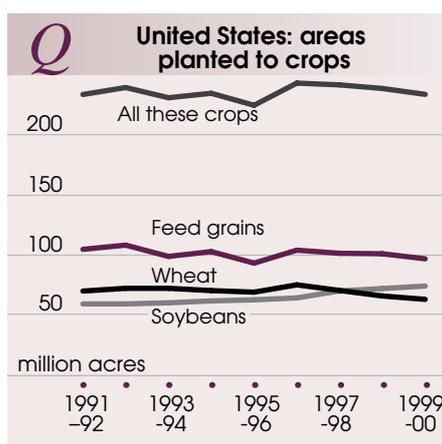
to increase base levels in anticipation of future set-asides (Erickson and Collins 1985). However, the objective of the set-asides was to reduce the production and supply distortions caused by the former production and price linked support. It is unclear whether or not it was successful in reducing those distortions. However, is it any more clear that the change to the production flexibility contract payments has resulted in less market distortion than the deficiency payments – acreage reduction model? Initially it looked as though it should have been. But, the increased payments that were voted in 1998, 1999 and again in 2000 combined with the nature of the contract payments raise doubts about whether US support is less market distorting now than before 1996. This uncertainty arises for three main reasons:

- The contract payments raise producers' returns and reduce the risks inherent in producing the program crops. This would increase the ability of farmers to maintain or expand capacity by applying their additional resources to expand capacity and by using cost reducing technologies, reducing the need for adjustment away from the supported items.
- The increases in support voted in 1998, 1999 and 2000 suggest that additional support could reasonably be expected by US producers of the program crops whenever there were significant reductions in world prices. Also, political uncertainties engendered by the debate that is occurring about the adequacy of the current system to support farmers in times of need might encourage farmers to maintain plantings and production at high levels in anticipation of a return to a support system using area and yield bases. The expectations of such return stabilising and supporting assistance could both encourage otherwise marginal farmers to remain producing and encourage investment.
- The production flexibility contract payments and the subsequent additional support for program crops only apply to farmers that had past bases in those program crops. However, with the freeing up of production choices and the introduction of the contract payments, irrespective of whether they produced the program crops or alternatives, some farmers could still receive the payments and turn their productive efforts to crops like sugar beet that receive even more market distorting support than previously applied for the program crops. In this way, the so-called decoupling of support for some commodities could result in resource misallocations into high cost activities, with associated economic costs. It is not possible to have minimally distorting decoupled support payments for agriculture as a whole where those payments apply only to some commodities, if alternative activities for using agricultural production resources remain supported.

The above arguments cast doubt on whether US payments that are considered to be decoupled are actually minimally distorting. However, there are arguments supporting the proposition that the decoupled payments are minimally market distorting, or at least less distorting than previous arrangements. Many of the payments are provided on bases that were for past periods and, so far, they have not been related directly to market prices. Although the payment rates have been increased when world prices have dropped, farmers are still facing prices that are not directly influenced by the payments — this applies, at least, to the production flexibility contract payments and some of the additional payments.

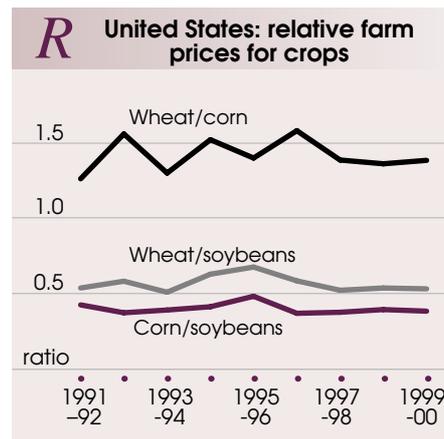
As world market prices have fallen below the loan rates and farmers have received the equivalent of the loan rates, they should be, in principle, responding to marginal returns that are much closer to world market prices than if they were responding to target prices, as occurred before 1996. Nevertheless, the payments that maintain the prices that US farmers receive above world market prices, including loan deficiency payments and cotton competitiveness subsidies, are acknowledged to be market distorting and are included in the AMS. Even so, these payments mean that US farmers are not responding to an undistorted world market price, so the *system* is not fully decoupled.

The freeing up of farmers' choices through the planting flexibility arising from breaking the link between individual crop area and yield bases and payment levels and elimination of area reduction payments could be contributing to significant changes in relative production and plantings of various crops. If trends in areas planted to the main US crops including wheat, feed grains and soybeans are examined since 1994, it can be seen that total plantings have remained virtually constant while there has been a marked fall in the areas under wheat and a large rise in soybeans (figure Q). All of these crops receive some support. However, soybeans has not been a mainstream farm program crop in the sense that they had not qualified for deficiency payments. Still, they do receive support through loan rate and associated mechanisms.



It could be argued that the old base system, whereby farmers had incentives to plant particular crops to maintain bases and associated program benefits, had maintained areas in wheat production that have been withdrawn from that crop since the introduction of the production flexibility contract payment arrangements. The rights to receive the contract payments irrespective of what crops they produced would facilitate such adjustment. Also, farmers have been prepared to plant more soybeans on areas that might have been otherwise planted to program crops (predominantly maize but also sorghum and wheat) to preserve farm bases.

Changes in relative prices between wheat, maize and soybeans would not appear to have provided large incentives for US producers to move away from wheat production into soybeans (figure R). However, there could have been major changes in relative profitability of the respective crops because of differences in rates of technological advance. Such advances appear to have been large for both maize and soybeans. In particular, genetically modified varieties are enhancing yields and/or reducing input costs through incorporating traits that provide insect resistance and herbicide tolerance. Nevertheless, some of the benefits to farmers are offset by licence fees. Such advances appear not to have been as great for wheat, although yields for wheat have risen substantially in recent years.



This broad evidence suggests that the movement away from the rigidities in the base system is probably resulting in greater flexibility in allocating resources between these major crops. However, it is far less certain that the replacement of deficiency payments and acreage reduction programs with production flexibility contract payments and pro rata market loss assistance has resulted in much adjustment at the aggregate cropping level. Aggregate plantings of grain and soybeans in 1999-2000 were only 3.4 per cent down from their 1996-97 peak when the contract payment system was first applied, while average real prices for grain and soybeans at the farm level fell by an estimated 39 per cent. This suggests that aggregate plantings of these crops have been very unresponsive to price.

It is likely that the availability of production flexibility contract payments on grain bases along with the lack of constraints to move resources into other highly supported products would result in diversion of more resources into those other products. Sugar beet is an example. In all of the main areas where sugar beet is grown in the United States, program crops, in particular wheat and/or feed grains, are major competitors for land (Jesse 1977). The sugar industry in the United States is on a par with milk production as the most supported of major US agricultural industries (OECD 2000a). Internal US prices for sugar have averaged about twice the world market price over the past decade and in 1999 were about three times world market prices.

As noted earlier, the change in support arrangements for program crops would have enabled some producers to continue to receive their production flexibility contract payments while at the same time moving resources into sugar beet production. This would result in more resources flowing into a more highly supported activity than previously. The scale of diversions of land away from grains into sugar beet is limited by access to and availability of sugar processing facilities. Nevertheless diversion of small areas relative to the areas used for grain production can cause a major increase in US sugar production. The total area devoted to production of grains in the United States is almost 240 million acres whereas that used for sugar beet is 1.5 million acres. Between 1996 and 1999, the US area planted to sugar beet rose by 14 per cent.

Where farmers face policy induced incentives to move resources out of grain into more heavily supported activities, such outcomes would be a less efficient use of resources in agriculture and result in costs to the national economy. From the standpoint of the efficiency of economic policies, such costs would need to be set against the gains, if any, that might have flowed from the reforms to the program crops.

Application of domestic support arrangements in developing countries

Background

Although developing countries have the option of a wider range of domestic support exemptions than developed countries, many cannot afford the cost of high levels of agricultural support. Many developing countries would benefit from reductions in market distorting domestic support by developed countries (Freeman et al. 2000).

Developing countries constitute about two-thirds of the 135 countries that are currently members of the WTO. There are no given criteria of defining what constitutes developing countries — the process is self-nomination and acceptance by the overall membership. The developing country group is very diverse, both in levels of average income and stage of development. The least developed subgroup, of which there are currently 29, includes many countries in sub-Saharan Africa, Bangladesh, Myanmar and a number of small economies many of which are island states. At the other end of the spectrum of the developing group are some members that might be considered to be middle income countries. These are mainly in south east Asia and Latin America. In between are a number of countries in the Indian subcontinent, south east Asia, the Middle East and north Africa and some in Latin America that have average income levels that are generally above those of the least developed countries.

Because of the diversity of developing countries, both in terms of stage of development and in approaches to economic and agricultural policies, it is difficult to generalise about both levels of agricultural support and the role of domestic support measures. Nevertheless some observations are possible.

Broadly, many developing countries, particularly those in the earlier stages of development, discriminate against agriculture by policies such as taxing exports that can result in internal prices being below world market levels. The disadvantages that agriculture can have in competing for resources under such circumstances are sometimes also exacerbated by policies that result in overvalued currencies and that provide support for manufacturing industries.

Support for manufacturing in developing countries as a group tends to be similar to or slightly above that for agriculture. The similar levels of support in agriculture and manufacturing sectors indicates that there is less distortion in resource use between the agricultural and manufacturing sectors than in the large northern hemisphere developed countries where support for agriculture is much higher than for manufacturing.

Nevertheless, even where there are few disparities in support levels between different sectors, there can be marked costs to the countries pursuing the support policies if they involve barriers to trade and/or investment. Such barriers inhibit many dynamic forces such as technology transfers and enhanced productivity and innovation arising from open competition that generate economic growth and development.

In many developing countries, some agricultural industries are accorded significant to substantial protection through high tariffs or other barriers to imports at the same time as others are receiving little or even negative support. This suggests significant, costly market distortions within agriculture that reduce incomes in the countries with those disparities. Input subsidies, on items such as fertiliser, irrigation, seeds, electricity and credit, are a favored form of domestic support in many developing countries.

The reasons for government intervention in agriculture in developing countries are wide ranging. For many there are concerns about securing food supplies and ensuring low prices for consumers where there is a high incidence of poverty in often densely populated, yet isolated, communities. Also, for countries that have limited resources for tax collection and are highly agriculture oriented, the relative ease with which taxes can be collected at the border can result in import duties and export taxes being imposed largely for revenue raising reasons.

Domestic support

Under rules agreed in the WTO Agreement on Agriculture for special and differential treatment, the least developed countries can choose not to commit themselves to more open markets or reductions in domestic support. The commitments for other developing countries are two-thirds of those for developed countries, with implementation over ten years compared with six. The *de minimis* provisions for exemption of domestic support that would otherwise be subject to agreed reductions, on the grounds of support levels being relatively minor, are 10 per cent for each of commodity specific and non commodity specific support, compared with 5 per cent for developed countries (see chapter 2). Also, developing countries are accorded exemptions from agreed reductions to domestic support for investment subsidies that are generally available to agriculture, and input subsidies provided to low income and resource-poor farmers.

While it is difficult to obtain consistent estimates of the significance of domestic support for a comprehensive range of developing countries, the following table based on information in the WTO notifications, is indicative of the general patterns of AMS levels (table 3).

In general, the AMS, which includes both product and non product specific support, is much lower in developing countries than in developed countries such as Japan and the European Union, both in dollar terms and as a share

of the total value of agricultural production. This might be expected both because of the generally lower levels of support that most developing countries can afford for their farmers and the wider range of exemptions obtainable by developing countries. But, just as with developed countries, the AMS is not a good indicator of actual levels of support in any particular year because its price support element is determined only from administered prices and fixed external reference prices. To be a reliable indicator of actual levels of support in instances where price support is provided, it is necessary to compare actual internal prices with actual external prices for the same period.

It is also evident from this table, that some developing countries, notably India and to a minor degree Pakistan, have reported negative AMS levels, implying that, in these countries, administered prices were below world market prices, at least for some major commodities. The commodities that are most affected are basic foodstuffs such as rice and wheat, reflecting food security considerations. However, this conclusion can only be drawn for some developing countries because others such as the Philippines (rice and maize) support staple food commodities more than most other agricultural products.

3 Aggregate measurement of support in selected developing and developed economies

	Year	AMS US\$m	Share of gross agri- cultural product %
Developing economies			
Brazil	1996-97	371.2	0.7
Colombia	1996	4.0	0.03
Egypt	1997	0.0	0.0
Argentina	1995-96	122.8	0.6
Botswana	1995-96	0.0	0.0
India	1995-96	-23 847.0	-31.1
Fiji	1997	0.0	0.0
Mexico	1995	0.5	0.002
Namibia	1996-97	0.0	0.0
Pakistan	1996-97	-56.9	-0.03
Paraguay	1996	0.0	0.0
Philippines	1997	27.1	0.2
South Africa	1996	451.1	8.2
Sri Lanka	1996	0.0	0.0
Thailand	1996	513.2	2.5
Tunisia	1997	na	1.7
Uruguay	1997	9.0	0.4
Venezuela	1996	331.3	12.3
Zambia	1996	0.0	0.0
Zimbabwe	1996	0.0	0.0
Developed economies			
Australia	1997-98	89.4	0.5
European Union	1995-96	61 309.1	22.9
Japan	1997	26 289.7	31.5
United States	1997	6 238.4	3.1

na Not available.

Sources: Based on country notifications to the WTO; World Bank (1998).

For India and Pakistan, while product specific support as indicated by the AMS is negative, non product specific support in both countries is positive. In India for example, non product specific support was quite significant and accounted for 7.5 per cent of the gross value of agricultural production in 1995-96. The bulk of this support was provided through electricity, fertiliser and irrigation subsidies. As indicated earlier, under the WTO Agreement on Agriculture, input subsidies generally available to low income or resource poor producers in developing countries are exempted from domestic support reduction commitments.

4

A case study of an up and coming form of domestic support – US agricultural insurance

Introduction

As indicated in chapter 3, some large developed countries have markedly restructured the ways in which they have been providing agricultural support over the past decade. In the United States the main change in support methods has been from the combination of deficiency payments and acreage reduction programs to production flexibility contract payments that are deemed to be decoupled along with the discontinuation of acreage reduction programs.

While these changes have been occurring there have also been some perhaps less obvious developments occurring in the use of government subsidised insurance that might be considered to be another form of subsidy to US farmers. Rather than being used as a substitute for disaster relief, additional agricultural insurance is being used as well as disaster relief payments. To date, the extent of this subsidised insurance has not been very great relative to the value of US agricultural production. Consequently, it has been possible to have it exempted from the US AMS under the *de minimis* provision. However, the incidence of this relatively untransparent form of assistance is increasing greatly. The Agricultural Risk Protection Act of 2000 recently expanded crop insurance funding by more than 80 per cent (Westcott and Young 2000).

While this increase in assistance through subsidised insurance is specifically in the United States, it could act as an example for other countries. It should be noted that the US insurance has not been exempted under the green box provisions that allow for exemption, presumably because elements of the arrangements do not meet criteria for such exemption in the WTO Agreement on Agriculture. In particular, for some categories of insurance the amounts of payments can compensate more than the 70 per cent limit in the agreement, while much of the US supported insurance would not meet the condition that it should relate solely to income and not to the type or volume of production.

Overview and issues – agricultural insurance and disaster relief in the United States

The issue of the production impacts of subsidised agricultural insurance has become particularly relevant given major efforts in the United States to expand agricultural insurance since the early 1990s. A number of incentives have been offered, including increased premium subsidies, expanding the range of insurable crops, increasing the range of coverage levels¹, introducing revenue insurance and at various times in different ways making the taking out of insurance a condition for eligibility for other assistance programs. The role of private companies in the delivery and processing of crop insurance has also been expanded. In 1993 around 70 000 policies provided US\$11.3 billion of protection on 83.7 million acres (one-third of cropped land). By 1999 approximately 1.3 million policies provided US\$30 billion of protection on 196 million acres (about 72 per cent of cropped land).

Insurance is currently available for more than seventy crops (including all the major extensive crops and various fruit and vegetables) and it is planned to develop programs for a further seven fruit and vegetables during US financial year 2001. US\$100 million has also been allocated to finance a pilot program for livestock. Under the Agricultural Risk Protection Act of 2000, premium subsidies have been increased significantly, which should increase participation in agricultural insurance. It has been suggested that the expansion of agricultural insurance will allow a phasing down of disaster relief, enabling agricultural insurance to become ‘... the primary source of federal assistance for farmers suffering a crop loss’ (Ackerman 1999).

Skees (2000) suggests that the recent drive to expand agricultural insurance in the United States stems principally from international trade concerns. In particular, the 1994 WTO agreement to limit coupled support raised the attractiveness of agricultural insurance given its capacity to achieve many of the same aims as coupled support without being so designated. The recent impetus to expand subsidies to agricultural insurance began with the Crop Insurance Reform Act of 1994, which coincided with the WTO agreement to limit coupled support. Skees (2000) suggests that there may well be a case for the WTO reviewing the production impacts of subsidised agricultural insurance programs.

¹ The term ‘coverage’ refers to the proportion of a loss that will be met in an insurance payout or claim. For example, 75 per cent coverage means that if the loss is \$100 the insurance payout will be \$75. In the United States the term ‘indemnity’ is used for an insurance payout or claim.

Subsidised agricultural insurance was first introduced as a policy tool in the United States in 1938. Agricultural insurance schemes have also operated in a number of other countries including Canada, Japan, Sweden, South Africa, India, Kenya, Mauritius, Mexico, Panama and Brazil (Goodwin and Smith 1995). No agricultural insurance scheme has been privately profitable for a sustained period and all enduring schemes have relied on some form of government support. It has been contended by some (for example, Dismukes 1999) that such support is ‘... in part’ justified by various types of ‘market failure’ in agricultural insurance.

It is argued below that the somewhat doubtful market failure argument sets an upper bound on the level of government assistance that could be justified on the grounds of market failure. It is shown that the level of government assistance to agricultural insurance in the United States has consistently exceeded this upper bound. Between 1995 and 1999 it is estimated that for every \$1 spent on insurance premiums, farmers on average received \$1.73 in insurance payouts (indemnities or claims). It is also shown that the introduction of agricultural insurance is likely to be output increasing and the output increasing effect will be stronger the higher the level of assistance to insurance.

A major stated aim of providing additional assistance to agricultural insurance is to permit a phasing down of assistance provided under disaster relief (Ackerman 1999). It is argued below that the act of shifting funds from the provision of disaster relief to subsidising agricultural insurance is likely to be output increasing.

In this section, the financial history of subsidised agricultural insurance and disaster relief in the United States is briefly reviewed. The market failure justification for subsidising agricultural insurance is discussed next, followed by a discussion of the market failure issues involved in providing disaster relief. A simple theoretical model is then developed to examine the output effects of subsidising agricultural insurance premiums and shifting funds from disaster relief to subsidising insurance premiums. Finally, empirical estimates of the output effects of existing policies are discussed.

Financial history of crop insurance and disaster relief

Some basic statistics on the history of crop insurance in the United States between 1985 and 1999 are shown in table 4. The Crop Insurance Reform Act of 1994 creates a clear dividing line between time periods. Acreage

insured peaked immediately after the passage of that bill since eligibility for other government assistance programs was tied to taking out insurance. Some decline in acreage insured followed when this condition was relaxed but acreage insured is currently on an increasing trend.

The premium subsidy as a proportion of the total premium was increased with the 1994 bill and will increase to even higher levels after 2000, as discussed below. While the premium subsidy was increased after 1994, the total premium was also set more realistically to reflect expected indemnities. Thus, the ratio of indemnities to claims (the overall loss ratio) has declined after 1994, meaning that the actuarial soundness of crop insurance has improved. The farmer loss ratio (the ratio of indemnities to premiums

4 History of crop insurance in the United States, 1985–99

Fiscal year (June–May)	Area insured (1)	Total premiums (2)	Premium subsidy (3)	Subsidy as a share of total premium (4)	Indemnity (5)	Farmer loss ratio (6=5/(2–3))
	million acres	US\$m	US\$m	%	US\$m	
1985	47.50	339.73	100.11	29.47	683.17	2.85
1986	47.82	291.65	88.10	30.21	615.70	3.02
1987	48.25	277.51	87.62	31.57	369.80	1.95
1988	54.68	328.40	107.99	32.88	1 067.56	4.84
1989	100.47	613.11	206.28	33.64	1 215.22	2.99
1990	101.31	618.48	214.39	34.66	971.05	2.40
1991	82.36	547.01	190.10	34.75	956.40	2.68
1992	83.08	561.96	196.67	35.00	921.36	2.52
1993	83.74	555.64	199.95	35.99	1 647.59	4.63
1994	99.73	948.83	254.71	26.84	601.15	0.87
1995	220.66	1 543.35	889.37	57.63	1 567.73	2.40
1996	205.01	1 838.78	982.14	53.41	1 492.66	1.74
1997	181.19	1 758.44	891.71	50.71	986.54	1.14
1998	181.80	1 875.42	946.24	50.45	1 674.00	1.80
1999	196.14	2 304.46	952.77	41.34	2 336.12	1.73
Average						
1985–94	77.94	526.95	171.76	32.59	929.54	2.58
1995–99	196.96	1 864.09	932.45	50.02	1 611.41	1.73

Premium paid by farmers is given by (2)–(3).

Sources: 1985–93, Smith and Goodwin (1995); 1994–99 data taken from the Actuarial Branch of the Risk Management Authority as posted on the web site of the US Department of Agriculture (www.fcic.usda.gov).

actually paid by the farmer) is lower in the period after 1994 than in the preceding period. Thus, after 1994 for every \$1 paid in premiums, farmers have on average received \$1.73 in indemnities, whereas they received on average \$2.58 in the preceding period. The farmer loss ratio is likely to increase in response to recently approved increases in the premium subsidy.

The level of premium subsidies that will apply for the 2001 crop year compared with the previous subsidy levels are shown in table 5. In the standard form of crop insurance a farmer elects both the proportion of the yield loss to cover and the proportion of the estimated average price at which these losses will be covered. The notation 55/100 means that a farmer has elected to insure 55 per cent of the estimated yield loss at 100 per cent of the estimated average price.

It can be seen that the subsidy on premiums has increased at all coverage levels but the greatest relative increase has occurred at the higher coverage levels. It would be expected that there would be increased participation in agricultural insurance and the proportion of those insured taking out higher coverage levels would increase. The absolute value of the subsidy received tends to increase with the coverage level. If the average increase in the subsidy level is taken to be about 20 percentage points (allowing for a larger proportion of farmers taking out higher coverage levels) for every \$1 paid in premiums, a farmer would expect to receive back about \$2.07 in indemnities.

In table 6 indemnities paid under crop insurance are compared with amounts paid under disaster relief and related assistance measures. Assistance delivered through crop insurance indemnities has risen relative to that through

5 New and old premium subsidy percentages

	Coverage							
	50/100	55/100	60/100	65/100	70/100	75/100	80/100 ^a	85/100 ^a
	%	%	%	%	%	%	%	%
New subsidy ^b	67	64	64	59	59	55	48	38
Old subsidy ^c	55	46	38	42	32	24	17	13

^a Coverage levels above 75 are currently available for only a few minor crops. ^b Applies to all forms of insurance (except for 2 of the 5 forms of revenue insurance) and all price levels within a coverage level. ^c Applied to major crops under the approved production history coverage plan. For revenue plans, the subsidy applied only to the yield portion of the premium. Rates of subsidy could also differ for price elections less than 100 per cent.

Source: Web site of Risk Management Authority (www.act.fcic.usda.gov).

disaster relief since 1994 in line with policy aims. However, there have been relatively favorable seasons since 1994 and livestock disaster assistance has also declined even though there is no competing insurance product.

Emergency loans have also increased in recent years. Producers who have suffered losses in capital stocks or production losses in designated disaster areas may be eligible for low interest emergency loans. Farm operating loans have also expanded in recent years. The basic condition for eligibility for farm operating loans is that a farmer is unable to borrow from commercial sources. Some farm operating loans are directed at various minority groups. However, the growth in these loans when prices have been low in recent years suggests that these loans may also be partly substitutable with some

6 Crop insurance, disaster relief and related payments in the United States

Fiscal year	Crop insurance indemnities	Noninsured assistance program ^a	Crop disaster assistance	Livestock disaster assistance	Emergency loans	Farm operating loans
	US\$m	US\$m	US\$m	US\$m	US\$m	US\$m
1985	683	0	na	na	na	na
1986	616	0	0	0	na	na
1987	370	0	0	0	na	na
1988	1 068	0	0	0	na	na
1989	1 215	0	3 386	3 919	na	na
1990	971	0	5	161	na	na
1991	956	0	6	121	na	na
1992	921	0	960	1 054	na	na
1993	1 648	0	872	944	na	na
1994	601	0	2 461	2 566	na	na
1995	1 568	0	577	660	68	1 817
1996	1 493	2	14	95	178	1 883
1997	987	52	2	130	145	1 561
1998	1 674	23	-2	3	59	1 537
1999	2 336	54	1 913	2 241	330	2 565
2000 ^b		75	1 299		583	3 975
Average						
1985–94	930	na	854	974	na	na
1995–99	1 611	na	501	626	na	na

^a Noninsured Crop Disaster Assistance Programs. Applies to crops where insurance is not available. To be eligible for assistance, producers must regularly supply production records to the authorities.

^b Estimated. **na** Not available.

Sources: Indemnities as per table 4; next three columns from US Department of Agriculture (2000b); last two columns from US Department of Agriculture (2000b); budgets as posted by the Office of Budget and Program Analysis at the USDA web site (www.act.fcic.usda.gov).

insurance products. The various types of loan provided through the US Department of Agriculture to the farm sector have a considerably higher default rate than loans made by commercial lenders (US Department of Agriculture 2000a).

The market failure justification for subsidising crop insurance is now considered before turning to the market failure issues involved in disaster relief.

Market failure justification for subsidising agricultural insurance

In an idealised competitive market (where insurance firms have zero operating costs), insurance premiums would be set at *actuarially fair* levels. Premiums are said to be actuarially fair if the average amount paid in premiums is equal to the average amount received by those insured in claims (indemnities). The insurance industry term *pure risk* premium will be used interchangeably with actuarially fair premium depending on the desired emphasis or conciseness.

As noted above, agricultural insurance has been offered over a sustained time only with the aid of government subsidies and not on the basis of its private profitability. The notion that there may be market failure in the supply of agricultural insurance was also mentioned above. In discussing the issue of market failure in agricultural insurance it is important to distinguish between the cases of economically irrelevant and economically relevant market failures.

It is useful to consider the case where there are no economically relevant external effects in the production or consumption of the commodity. A market may fail to exist simply because the willingness of buyers to pay for the product is inadequate to make it profitable to supply the product. If the product can be supplied through well functioning competitive markets, this would be a case of an economically irrelevant market failure. If there were some impediments to the efficient functioning of the supplying markets, there may be a case of economically relevant market failure. However, impediments in the supplying markets are only a necessary condition for an economically relevant market failure. If demand were still inadequate to support a viable market when the impediments on the supply side were removed, the market failure would not be economically relevant. Thus, for an economically relevant market failure when there are no external effects, it is required that there

are impediments on the supply side and removal of these impediments would result in a viable market.

Even if there were an economically relevant market failure, it does not follow automatically that government intervention to establish the market is necessarily beneficial. Government intervention is costly and intervention is justified only if the benefits from the creation of the market exceed the costs of intervention.

In the case of agricultural insurance, it is usual to point out that there are various impediments to the supply of agricultural insurance (adverse selection, moral hazard and a high level of systemic risk — see box 6). These supply side impediments all involve factors not associated with the standard model of a well functioning competitive market. These impediments mean

6

Definition of insurance terms

Adverse selection: This problem arises when only those with above average risks seek to take out insurance and it is not cost effective for the insurer to identify the risk class of those seeking insurance. For example, such a problem could arise if only those farmers using the most marginal land on their farm for a particular crop sought to take out insurance.

Moral hazard: This problem arises when the act of taking out insurance increases the probability that the event(s) insured against will occur. For example, there is considerable evidence that farmers taking out yield insurance are likely to reduce their use of fertiliser, increasing the probability of low yield.

Systemic risk: This problem arises when the risks being insured are highly correlated. The maximum expected payout an insurer must meet will increase with the degree of correlation in risks. For example, the risks of having to pay out simultaneously on all policies in a given year are much higher for a crop insurer (due to weather conditions such as drought affecting all farmers) than an automobile insurer (there is no general factor likely to result in all insured having accidents in the same year). If an insurer must meet all payouts from their own reserves and operate with a given probability of ruin, a higher level of reserves (and, hence, higher premiums) will be required the higher the correlation in risks. However, insurers are not necessarily restricted to their own reserves and reinsurance markets have developed to allow a greater pooling of risk. As discussed in appendix A, if systemic risk is to be a source of market failure there needs to be a prior market failure in reinsurance markets. The significance rather than the existence of a high level of systemic risk in agricultural insurance is the issue open to debate.

that firms would be willing to offer insurance only at premiums well in excess of actuarially fair levels.

If there were an economically relevant market failure in agricultural insurance, there could be a case for subsidising the operating costs of insurance companies to enable them to offer premiums at approximately actuarially fair rates. Alternatively, farmers could pay the premium offered by insurance firms and then receive a rebate from the government to bring the effective premium to an approximately actuarially fair level. The market failure argument does not justify providing a subsidy to enable farmers to be offered insurance at below actuarially fair premiums (that is, at premiums lower than those that would exist in an idealised competitive market).

In the United States, the operating costs of insurance companies are subsidised (including the provision of reinsurance at below the pure risk premium) and a further subsidy is paid to enable premiums to be offered to farmers at below the pure risk premium. Such practices cannot be defended on grounds of market failure. As mentioned earlier, between 1995 and 1999 it is estimated that for every \$1 spent on insurance premiums, farmers on average received \$1.73 in insurance indemnities. Subsidising premiums so that they are actuarially unfair in favor of farmers is simply a way of subsidising farm income.

In addition, the premium subsidy is received by farmers when indemnities are paid that typically will be at times when income is low. Subsidising farm income when income is low is the aim of coupled support. Thus, subsidised agricultural insurance is effectively achieving the same aim as coupled support.

Skees (2000) estimates that in 1999 farmers paid only about 27 per cent of the direct costs (indemnities, subsidy to insurance companies to deliver insurance and other costs of the Risk Management Authority) of providing insurance with the remaining 73 per cent or about \$2.4 billion a year paid by taxpayers. The taxpayer contribution is expected to increase by about \$1 billion a year in 2001 and beyond as a result of laws that have recently passed Congress, while the farmer contribution will decline to about 20 per cent of direct costs.

Subsidising premiums (or the operating costs of insurance firms) so that the pure risk premium can be charged represents the upper bound to the level of subsidies that could be justified on grounds of market failure. Since commercial insurance firms must cover operating costs and earn a return on capital,

unsubsidised commercial insurance is actuarially unfair in favor of the insurance firms. For example, the average *loss ratio* (the ratio of indemnities to premiums) for private sector insurance in Australia using quarterly data from June 1995 to September 1999 was 0.84 (Australian Prudential Regulation Authority 2000). Thus, for every \$1 paid in premiums, the insured on average received 84 cents in indemnities. Such data imply that those taking out insurance are *risk averse* (willing to accept a lower average income to achieve a less variable income).

If subsidised agricultural insurance were to replicate commercial insurance, it should also be actuarially unfair in favor of the insurer. However, to set some level of actuarial unfairness as the appropriate benchmark, an essentially arbitrary decision would have to be made about the appropriate level of operating costs (some of which may be affected by possible sources of market failure) and return on capital. For this reason, subsidising premiums so that they are actuarially fair is suggested as providing an upper bound for the level of government support that conceivably could be justified on grounds of market failure. Such a lenient ‘rule’ also implies that the government would pay the operating costs incurred in providing insurance.

The discussion so far has proceeded on the presumption that agricultural insurance may be an economically relevant case of market failure. A necessary condition for this to be case is that there should be a significant demand for insurance at actuarially fair premiums. As noted above, a market may fail to exist because of lack of demand for the product, but this is not the type of ‘market failure’ that creates a case for possible government intervention to improve economic efficiency.

The issues involved in trying to assess whether agricultural insurance in the United States represents a case of a market failing to exist owing to lack of demand or an economically relevant case of market failure are reviewed in appendix A. The following comments summarise the main conclusions.

The central conclusion is that the weight of evidence seems to favor the ‘lack of demand’ hypothesis rather than the ‘economically relevant market failure’ hypothesis. A number of empirical studies suggest that demand for existing types of crop insurance policies may be inadequate to support a commercially viable market at actuarially fair premiums. There is also the general observation that it has been possible to achieve significant participation in agricultural insurance only by offering premiums that are highly actuarially unfair in favor of the insured. Such inducements would be

unnecessary if demand were adequate to support a viable market at actuarially fair premiums.

There are three qualifications that need to be attached to the above conclusion. First, it is possible that demand for agricultural insurance may have been reduced by the belief that free disaster relief would be made available in the event of particularly adverse events. Second, past assistance policies may have significantly increased the wealth of farmers in the United States, reducing their degree of risk aversion and, hence, demand for insurance. Third, the conclusion relates only to existing types of insurance contracts. As discussed below, there are other types of insurance contracts that may have a better chance of approaching commercial viability.

If demand were inadequate to support a viable market at actuarially fair premiums, there would not be an economically relevant market failure and any impediments on the supply side would be irrelevant to this issue. Nevertheless, for completeness the conclusions on the three supply side impediments (adverse selection, moral hazard and systemic risk) will be briefly summarised. All forms of commercial insurance suffer from these problems to some degree. It is extremely difficult to quantify the impact of the first two factors. It is possible that adverse selection in agricultural insurance may be a more severe problem than in many forms of commercial insurance since in a given region there do not appear to be any readily observable variables that would assist in classifying the general risk class of those insured. Moral hazard could also be a generally more severe problem since it may be more costly than in many other forms of insurance to set up monitoring procedures that would be cost effective in limiting the problem.

It is possible to offer more quantitative information on the problem of systemic risk and some new evidence on this problem is presented in appendix A. There is evidence of imperfections in reinsurance markets and systemic risk does appear to be a more severe problem in agricultural insurance than most other forms of commercial insurance. Nevertheless, it is shown in appendix A that there exist forms of commercially viable insurance with higher levels of systemic risk than agricultural insurance in the United States.

The combined impact of the above three problems could significantly raise the costs of private companies and the premium required for commercial viability. However, as stated above, such a result is of no policy significance if demand at actuarially fair premiums would be inadequate to support a commercially viable market if these supply side problems did not exist.

The evidence reviewed in appendix A also suggests that existing assistance arrangements applied to agricultural insurance in the United States may not be highly cost effective. In other words, it may be possible to achieve an equivalent level of income risk protection for farmers at considerably lower subsidy levels. There are two suggestions that emerge from appendix A that may assist in this regard that are worth elaborating.

First, there seems to be a strong need to develop an insurance product that offers greater risk reduction for a given cost than existing products. All insurance policies currently offered are crop specific apart from one minor exception discussed below. A more promising alternative may be what is known as portfolio or whole farm insurance (Ehrlich and Becker 1972). Such a form of insurance is designed to maximise the incentives for 'self insurance' through choice of the output mix. Choosing output mixes where returns from different crops are negatively correlated would reduce the variability of farm income. Farmers would first determine their output mix, next elect a coverage level for farm revenue and then a premium would be set on the basis of the implied revenue distribution for the entire farm.

Portfolio insurance has the potential to achieve a significantly greater reduction in revenue risk for an entire farm at a lower total premium than existing forms of yield insurance based on individual crops. Existing forms of yield insurance can have quite distortionary effects on the choice of output mix and under some conditions even increase the variability of total farm revenue (Turvey 1992). Simulations by Turvey (1992) based on Canadian data for a farm in a given region confirm that portfolio insurance would be a much more attractive form of insurance for farmers than existing forms of yield insurance for individual crops. It also has more desirable economic properties being far less distortionary than yield insurance based on individual crops.² Any subsidies paid to portfolio insurance would also be consistent with the condition in annex 2 of the WTO Agreement on Agriculture that insurance subsidies should not be commodity specific.

It is unclear whether it would be optimal to incur higher administrative costs under portfolio insurance than existing forms of insurance. A form of portfolio insurance being trialed that is discussed below is designed simply to take data from the tax returns of farmers. While the insurance companies

² Under appropriate conditions, portfolio insurance can result in a risk averse farmer choosing the same output mix as risk neutral farmer (Turvey 1992). Such a result would also be achieved if there were a set of complete risk markets and so represents the welfare ideal on grounds of economic efficiency.

would have to make calculations on a farm by farm basis under portfolio insurance, the same is true for current schemes that apply to most of the major crops where an ‘approved production history’ is required for each farm. Ultimately, the optimal level of administrative costs would be determined by how far it is cost effective to incur higher administrative costs in trying to reduce the problems of adverse selection and moral hazard.

It is also unclear how widespread participation would be in portfolio insurance if the premium subsidy were entirely eliminated. Nevertheless, it should be possible to achieve a given level of participation at a lower average level of subsidy than under existing crop specific schemes. A form of portfolio insurance known as the Adjusted Gross Revenue scheme is currently being trialed in the United States. However, the trial uses this form of insurance to insure crops not covered by existing schemes rather than as a substitute for existing schemes. If one of the crops grown by a farm is covered by an existing scheme, insurance must be taken out under that scheme. In spite of these limitations, the trial should throw some light on the cost effectiveness of this form of insurance.

The second suggestion relates to the ways in which assistance is provided to private companies in delivering insurance to farmers. Current reinsurance arrangements are a particular source of concern.

It seems highly probable that existing arrangements between the US government and the private companies that deliver insurance to farmers reward these companies more than would be necessary to induce them to continue their delivery role. In other words, part of the various (explicit and implicit) subsidies are unnecessarily adding to the profits of insurance companies rather than delivering assistance to farmers. Over the period 1995–98, agricultural insurance was highly profitable to the private companies participating, with their profits from agricultural insurance totaling US\$1.1 billion (General Accounting Office 1999). The profitability of private companies operating in agricultural insurance in the United States has been noticed by insurance companies elsewhere. Skees (2000) reports that European insurance companies are pressing the European Union to adopt the US model of making subsidised agricultural insurance delivered through private companies the primary form of agricultural assistance in the European Union.

In 1998 the subsidies paid to private insurance companies for delivering insurance were reduced from 31 per cent of premiums to 24.5 per cent for most forms of insurance (General Accounting Office 1999). This reduction

was the result of the General Accounting Office demonstrating that the previous level of subsidy considerably exceeded the costs of the private companies in selling and servicing insurance.

There remains a considerable implicit subsidy in the complex set of reinsurance arrangements offered by the Federal Crop Insurance Corporation (FCIC – a US government agency) to the private companies. The actual level of the implicit subsidy could be quantified precisely only with a great deal of actuarial information. These reinsurance arrangements are actuarially unfair in favor of the private companies (see appendix A). In other words, on average the US government pays the private companies more in claims than the companies pay in reinsurance premiums. For example, the FCIC takes on all losses if the ratio of indemnities to premiums exceeds 500 per cent. If the FCIC did not have the backing of the notionally unlimited revenue of the US government, it would be operating with a certain probability of ruin. The opportunity costs of these arrangements represented by potential claims on government revenue are likely to become increasingly apparent with the growth in agricultural insurance.

In the final section of appendix A, a number of ways are discussed in which these reinsurance arrangements could be reformed to reduce the implicit subsidy without increasing the risks of the private companies. In the private sector, there has been a growing trend by insurance companies to use capital markets to bear systemic risk originating in insurance contracts. A proposal along these lines is developed for crop insurance in the United States. In principle, systemic risk could be dealt with in such a way that the private companies would face a zero probability of ruin and the US government would on average make zero payments, compared with certain positive payments under existing arrangements.

Disaster relief

In addition to subsidised agricultural insurance, the United States has also provided disaster relief to the farm sector. Since 1994 there has been the apparent policy aim of substituting agricultural insurance for disaster relief, although disaster relief payments have increased in recent years when prices have been low. In the next section it will be suggested that shifting funds from disaster relief to agricultural insurance may not be output neutral. It is also widely believed that in the past the ready availability of free disaster relief has reduced participation in agricultural insurance.

It is important to distinguish what appear to be the dual aims of relief in response to natural disasters. Natural disasters may reduce both current production and future production potential through destruction or damage to fixed and working capital. Direct financial grants are usually intended to compensate for both types of losses. It would be possible to compensate for all these losses through conventional agricultural insurance. The difficulty is that compensation for future production losses would be paid only when they occur. If compensation for capital losses could be paid when they occurred, capital could be restored and future production losses averted. For this reason it seems likely that only that part of disaster relief intended to compensate for current production losses would be considered for diversion to agricultural insurance and disaster relief (in some form) for capital losses would remain.

As discussed above, disaster relief in the United States has taken the form of both direct financial grants and subsidised loans. If the aim were to shift all disaster relief for production losses into agricultural insurance, then perhaps direct financial grants combined with subsidised loans would be used to deal with capital losses from natural disasters.

Capital losses from natural disasters are potentially insurable losses. As in the case of agricultural insurance, the issue arises whether a market fails to exist because of a lack of demand or whether there are market imperfections on the supply side. On the demand side, there is a considerable volume of evidence that individuals tend to underestimate the probability of unfavorable low probability events (Skees and Barnett 1999). If this were the case, individuals may be unwilling to pay actuarially fair premiums for insurance against such events. A market may fail to exist because of a lack of demand. On the supply side, there is a high level of systemic risk associated with natural disasters that would tend to force up insurance premiums given the analysis in appendix A.

Although few countries operate subsidised agricultural insurance schemes, most countries provide disaster relief at no cost to the farm sector. It has often been pointed out (see, for example, Skees and Barnett 1999) that such a practice reduces the incentives for farmers to take action to reduce their exposure to the risk of natural disasters. Production technologies that would reduce such risks are not adopted while production in disaster prone areas is encouraged. Incentives would be improved if farmers were to bear some of the costs of the disaster relief payments resulting from their decisions. Withdrawal of free disaster relief and the provision of subsidised natural

disaster insurance would be a step in this direction that no country appears to have been able to take. Some of the ideas discussed in the final section of appendix A are relevant to ways of financing this type of insurance (see Skees and Barnett 1999).

Output effects of agricultural insurance and disaster relief

In this section the impact of agricultural insurance and disaster relief on the incentives for farmers to alter output are examined. The general conclusion is that both policies will tend to be output increasing. The issue then arises whether the aggregate effects of such a response by all farmers might modify the response of the individual farmer. This issue is considered after discussing the impacts at the level of the individual farmer.

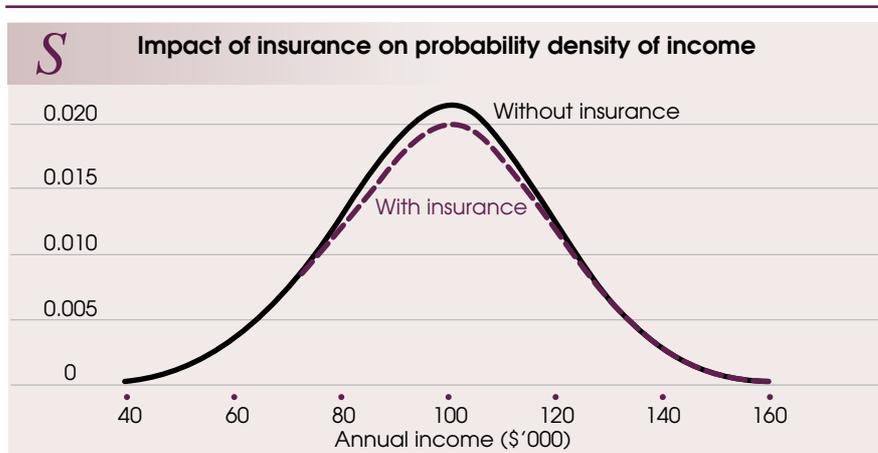
Single output

The simplest case occurs when the farmer produces a single output. A simple model to examine the effects of insurance, subsidised insurance and disaster relief is outlined in appendix C. Many of the results are special cases of more general models presented in Roberts et al. (1999) and Hennessy (1998).

It is necessary to distinguish between risk averse and risk neutral farmers. Farmers are said to be risk averse if they would prefer a less variable income with a given average or mean value to a more variable income with the same mean value. Farmers are said to be risk neutral if they would be indifferent between the two income streams. (The third possible case of risk preferring farmers who would prefer the more variable income stream is unlikely to be of great practical importance).

The empirical evidence discussed in appendix A suggests that farmers in the United States are not highly risk averse. In that case, it seems unlikely that any of the effects discussed below that are entirely the result of risk aversion are likely to be of a major order of significance.

The effects of actuarially fair revenue insurance on the probability density of revenue for a farmer can be illustrated as in figure S. The probability density shows the probability (shown on the vertical axis) that a given level of income (shown on the horizontal axis) will occur. The longer curve represents the probability density of revenue in the absence of insurance while the shorter curve (beginning above the left hand tail of the longer curve)



represents the probability density after insurance. It is assumed that insurance payouts are triggered whenever revenue would have fallen below some minimum level represented by the starting point of the shorter curve. Premiums are just sufficient to cover expected payouts.

Under such conditions insurance has no effect on mean revenue but reduces its variability. A risk averse farmer would increase output in response to the lower variability. Output decisions of a risk neutral farmer would be unaffected since they are based entirely on mean revenue.

If crop yield insurance rather than revenue insurance is considered, essentially the same conclusions hold although the analysis is slightly more complex. The complication is that payouts occur when yield is low, which is not necessarily always in the lowest revenue states especially if there is a negative correlation between output and price.

Under premium subsidy insurance, mean income is increased by the subsidy and the variability of income is reduced. If both premium subsidised and unsubsidised insurance had an identical impact on income variability, a risk averse farmer would increase output more under premium subsidised insurance owing to the higher mean. A risk neutral farmer would also increase output under subsidised insurance. Although risk neutral farmers would be indifferent between actuarially fair insurance and no insurance, they would prefer subsidised insurance to no insurance. The positive effect of subsidised insurance on mean income is the reason for such a preference.

Disaster relief is also shown to be output increasing if its availability is anticipated by farmers. Disaster relief will raise mean income and reduce its variability. Both risk averse and risk neutral farmers will increase output.

The effect of shifting finance from disaster relief to subsidising insurance premiums is also examined in the model in appendix C. In the subsidised insurance situation it is assumed that the farmer always contributes something toward the total actuarially fair premium (that is, the subsidy is less than 100 per cent). In that case, a risk averse farmer would increase output more under subsidised premiums than disaster relief even if mean income is the same in both cases. The reason is that requiring that the farmer pay part of the premium shifts some of the income of the farmer from good states to adverse states. When payouts occur, the farmer will receive their own premium contribution as well as the payments that would have been made under disaster relief. A greater reduction in income variability occurs under subsidised insurance than disaster relief, and, hence, there is a greater increase in output. A risk neutral farmer would produce the same output in both situations.

There is a second reason for suggesting that the shifting of funds from financing disaster relief to subsidising insurance premiums may not be output neutral. While farmers may be able to predict the general availability of disaster relief, the exact amounts payable under given conditions may be uncertain. In contrast, under an insurance contract the amounts payable under given conditions are set down in writing. Greater certainty about the amounts payable under insurance may be equivalent to a reduction in the variability of the subjective probability density of income for farmers. Such a reduction in variability would be output increasing for risk averse farmers.

Multiple outputs

The assumption above of a single output represents a significant simplification. Most farmers have the option of producing multiple outputs. Diversification offers a way of reducing risks, with high returns in a given year from one activity offsetting low returns from other activities. A risk averse producer will compare the costs of diversifying with the costs of purchasing insurance. The availability of insurance may affect the degree of diversification adopted.

It is difficult to examine agricultural insurance analytically in a multicrop setting and numerical simulation is an attractive approach. The most extensive

study appears to be that by Turvey (1992) and some of the findings were discussed above. Turvey presents a model of a representative farm in Wellington County in Ontario, Canada. The model describes production costs and resources available. The farmer is assumed to choose production levels to maximise the expected utility of terminal wealth. Production choices are among corn, soybeans, wheat and mixed crops, given historical data on prices and variable production costs.

Insurance schemes for individual crops of the type currently operating in the United States were simulated. Since the premium subsidy is calculated as a percentage of the premium, more risky crops (with higher premiums) receive a larger subsidy in absolute terms than less risky crops.

A limitation of the study is that it is confined to a single farm with a fixed acreage and so fails to capture some of the substitution between insured crops and other activities that may occur on a national basis. It also takes prices as fixed and so fails to capture any changes in prices resulting from changes in production induced by insurance.

The main findings of the study were that subsidised insurance reduced the incentives for self insurance through crop diversification. Subsidised insurance tended to encourage the production of more risky crops. Premiums that may have been actuarially fair on the assumption of no supply response became actuarially unfair to the insurer given the supply response. As discussed above, Turvey (1992) also simulated portfolio insurance and found that it had superior properties for both the insured and insurer to insurance based on individual crops.

Price impacts of increased output

The general conclusion of the previous sections is that subsidised agricultural insurance and disaster relief will create incentives for individual farmers to increase output. An issue arises whether the aggregate effects of such a response by all farmers might modify the response of the individual farmer.

Demand for agricultural commodities is typically estimated to be inelastic. Inelastic demand means that price will fall by a greater percentage than the percentage increase in output. The United States is a sufficiently large supplier of most agricultural commodities produced there that any change in output will influence price. Price impacts will be moderated by the supply response of other countries. If the United States were to increase output, thereby

reducing price, other countries would cut back on supply, which would reduce the extent of the decline in price. Thus, for exportable commodities, effective demand for US production will tend to be more elastic than aggregate demand.

A key issue is whether the effective demand for a good is elastic or inelastic. If demand is elastic, an increase in output would result in an increase in revenue whereas a fall in revenue would result in the case of inelastic demand.

According to the 'rational expectations hypothesis' (Muth 1961), farmers would take account of the likely response of other farmers in making their output decisions. Under this hypothesis, farmers would not increase output in response to agricultural insurance and disaster relief if this reduced their revenue as would occur under inelastic demand. On the other hand, an increase in output is quite consistent with rational expectations in the case of elastic demand.

On the available evidence, it is unclear whether demand for the US commodities most affected by agricultural insurance is elastic or inelastic. The model results discussed in the next section imply an inelastic demand. However, the model takes no account of possible supply response by other countries. If this were taken into account, effective demand could be elastic.

It is also unclear how well the rational expectations hypothesis describes the way that farmers form price expectations. Testing alternative hypotheses about the way that farmers form price expectations has posed difficult problems.

The rational expectations hypothesis (or at least some limited form of rational expectations) cannot be dismissed as entirely implausible especially for major crops with significant insured acreages such as wheat, soybeans and cotton. A standard criticism of rational expectations is that the costs of acquiring and processing the information required to form rational expectations may be excessively high. However, for the abovementioned commodities there are highly developed futures markets that perform an information collection and processing role and reveal the results in prices quoted for delivery of crops at future dates. It would be difficult for farmers not to be aware of the negative correlation between aggregate output and price. Whether such knowledge prompts farmers to consider the correlation between their decisions and the decisions of other farmers is an open issue that needs to be explored in future research.

If expectations are not formed rationally or if demand is elastic, increased output in response to subsidised insurance is likely to reduce price in the absence of any further interventions. Lower prices will result in lower future output. Thus, the short term output response to subsidised agricultural insurance is likely to be stronger than the longer term response. It is important to qualify the results of the partial equilibrium analysis outlined above by noting that the actual (or potential) reduction in price arising from increased output is likely to moderate the longer term increase in output.

Quantitative evidence

The most comprehensive study of the production impacts of crop insurance in the United States is by Young, Schnepf, Skees and Lin (1999). Their study is based on simulations of a model rather than direct analysis of actual data. For eight crops they converted crop specific county level data on agricultural insurance subsidies over the period 1995 to 1998 into average subsidies for each crop. These subsidies were then incorporated into the net returns data used for making production decisions in the POLYSYS-ERS model. The model includes US foreign trade in agricultural products.

In the POLYSYS-ERS model, farmers are effectively assumed to be risk neutral so that any output effects associated with reduction in risks arising from insurance are not captured. It is also not a rational expectations model and price expectations are based on past prices. Prices adjust to equate supply and demand and substitution between different crops (and between crops and livestock) occurs in response to changes in relative prices.

Young et al. (1999) discuss a number of limitations of their methodology. However, it is difficult to infer what effect these limitations would have, if any, on the overall direction of bias in results. The implied assumption of risk neutrality is not mentioned but if farmers are mildly risk averse this assumption may create a mild downward bias in their results. On the other hand, the implicit assumption of nonrational expectations is also not mentioned and this may result in an upward bias if the rational expectations hypothesis were correct.

A baseline simulation was run using the February 1999 US Department of Agriculture baseline. The baseline implicitly includes insurance subsidies set at their average 1995–98 level. Another simulation was run in which the insurance subsidies were removed. The difference between the two simulations was taken as a measure of the impact of insurance subsidies.

It was found that insurance subsidies encouraged the production of higher risk crops (in line with the results of Turvey 1992) in higher risk regions. In the long run, total crop acreage was estimated to expand by 0.2 per cent (600 000 acres). This was less than the 1 million acre expansion in the first year with the price impacts from the initial expansion in production moderating the longer term impact. The greatest long term impact was on cotton where acreage expanded by 1.2 per cent (160 000 acres) and exports rose by 2 per cent. Cotton insurance subsidies were estimated to be relatively larger than for other crops averaging about 9 per cent of the farm price during 1995–98.

In the short term the largest absolute impact was on wheat where area increased by 870 000 acres (1.6 per cent) during the first year. However, this increase was reduced to 330 000 acres in long run equilibrium as a result of the decline in wheat prices from increased production and improved relative prices of some other crops. Wheat exports were estimated to increase by about 0.4 per cent and this was the second largest increase for any crop.

In aggregate terms the annual insurance subsidy (to premiums and the operating costs of private firms) of US\$1.4 billion was estimated to increase net farm income by somewhat less than US\$1.2 billion. There was a US\$210 million decline in cash receipts as a result of lower prices from the increased production and a US\$85 million increase in variable costs resulting from increased production. In the rational expectations case, farmers would take all of the US\$1.4 billion subsidy as extra farm income and leave output unchanged.

The average US\$1.4 billion subsidy over the period 1995-98 had grown to US\$2.4 billion in 1999 and is expected to increase by a further US\$1 billion during 2001 (Skees 2000). If the estimates of Young et al. (1999) are increased by the appropriate multiple of the increase in subsidies as a rough approximation to the possible production impacts of these new higher level of subsidies, the production impacts appear to be rather more significant.

Proposals for reforming domestic support

Introduction

The many issues concerning domestic support that are discussed in earlier chapters have specific relevance for the WTO negotiations on agriculture that commenced in March 2000. In June 2000, several proposals were tabled by negotiating parties. These included a submission on the ‘blue box’ by the European Union, a comprehensive proposal by the United States with a fairly detailed domestic support component, and proposals on exemptions and special and differential treatment by a group of developing countries (Cuba, Dominican Republic, Honduras, Pakistan, Haiti, Nicaragua, Kenya, Uganda, Zimbabwe, Sri Lanka and El Salvador). In September 2000, the Cairns Group, which comprises Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa Rica, Fiji, Guatemala, Indonesia, Malaysia, New Zealand, Paraguay, Philippines, South Africa, Thailand and Uruguay, submitted a proposal on domestic support.

In this chapter, the domestic support elements of some of the proposals that have been advanced so far are examined in the context of the objectives for reforms in WTO agricultural negotiations.

Objectives for reforms to domestic support

If the WTO negotiations for agriculture are to be successful, they will need to reduce distortions in agricultural markets — that is, the government induced distortions to production, consumption, trade and internal and world prices. Those distortions come from barriers to access, export subsidies or their equivalents and domestic subsidies. But, as is discussed in chapter 2, domestic subsidisation can be provided either by transfers of taxpayers’ funds or by transfers from domestic consumers. Those transfers from domestic consumers come from price support which, in most instances, is implemented through barriers to market access and/or export subsidies.

It is desirable in this context that the extent of market distorting domestic support as measured, and which is subject to agreed reductions, should be a true representation of actual total market distorting support. Examination of the application of the WTO Agreement on Agriculture leads to the conclu-

sion that limits have been placed, not on actual market influencing factors but on agreed proxies that often have little relationship, or at best indirect relationships, to influences on actual market operation.

From the assessments in chapters 2, 3 and 4, the ‘aggregate measure of support’ (AMS) as defined in the current WTO Agreement on Agriculture is not a true measure of total market distorting support. The prime reasons are that:

- the price support element of domestic support as represented in the AMS does not measure the actual levels of price support; and
- exemptions from the AMS under the blue box are market distorting while some measures that are exempted under the green box on grounds of being minimally distorting are in fact considerably market distorting.

These observations need to be kept in mind when assessing whether proposals for reforms to domestic support are likely to be successful. Some initial proposals are reviewed in this chapter.

Initial EU proposal on the blue box and other support measures

This proposal is primarily a justification for the present exemption of blue box production limiting arrangements from the AMS and therefore from commitments to reduce domestic support, rather than a proposal for negotiating changes from present arrangements. The proposal does not actually indicate the objective of perpetuating the blue box exemptions. Nevertheless it implies that extension of the blue box is desirable through providing arguments that it has been used to reduce market distortions from the Common Agricultural Policy. It emphasises that the market orientation of producer decisions in the European Union has been significantly improved as EU blue box payments do not interfere with price signals and that the latest reforms to the EU’s Common Agricultural Policy (CAP) — called ‘Agenda 2000’ — have further improved the possibility of farmers reacting to market signals (WTO 2000a).

It is likely that since the 1992 CAP reforms, the combination of lesser price support for some major agricultural commodities, production limiting arrangements and substantial direct ‘compensation’ payments in the European Union have resulted in somewhat less market distortion for the goods directly

involved than if the same amount of support had been provided through the former arrangement of full price support.

However, internal EU prices are still managed around relatively constant levels that insulate EU producers from world market price signals, and although EU producers of cereals, oilseeds and beef are responding to lower market prices than formerly, they are not responding directly to world market price signals. Variation in prices is a very important element of those signals. Such responses that occur in the European Union for cereals and oilseeds arise largely through varying the area set-aside percentages. Those percentages are set to manage supplies, trade and prices in the ways that are most acceptable to EU market managers rather than to provide much less distorted markets. The incentives facing those managers would be unlikely to closely match undistorted market outcomes.

While the European Union has been changing its support systems to manage and contain the budget costs and administrative problems associated with support induced surpluses, the fundamental support arrangements used provide incentives for producers to maintain areas planted to the supported crops and livestock numbers and associated production. In that sense they are locking in an important element of market distortion.

The European Union largely bases the claim that the blue box support measures as implemented under the Common Agricultural Policy are lowly distorting on work being undertaken by the OECD and a small number of member countries (OECD 2000b). However, closer scrutiny shows that the research published cannot be relied on to support the claims purported by the European Union.

The OECD's Policy Evaluation Matrix (PEM) is an attempt to evaluate the impact of economic policy change on production, consumption and trade. At present, the PEM study has just reached the end of the pilot phase. To date, one report from that study has been published (OECD 2000b) — the report quoted in the EU submission on blue box support ('EU 2000 blue box proposal'). The analysis contained in the paper is 'preliminary' and 'stylised'. That is to say, the analysis is at an early stage and the policy specification is not fully reflective of the policies in place. Additionally, at the time of publication, the only sector covered was crops. As such, the analysis did not measure the level of distortion from actual EU policies, and only studied a subset of commodities protected. In addition, there are uncertainties over the elasticities used for determining responses in the model.

As the policy changes that have occurred in the European Union have involved reducing the level of price support and increasing direct payments, analysis of such a policy mix would require accurate information on the relative levels of distortion arising from different policies in practice. The report quoted by the European Union assumed given levels of responses to different forms of direct payment policies and the assumptions used may have a major bearing on the conclusions. This is a key area of weakness for any research that analyses changed policy mix (Hertel et al. 1999; Roberts et al. 1999). Such research needs to fully represent the policies in question, to cover a broad range of agricultural activities and countries and to measure responses to the actual application of the changed policies before it can be used with confidence for actual comparative policy analysis.

Even if there was actual policy representation and information on the level of decoupling of different policies available, the PEM may not be able to provide accurate assessments of the effects of different policies or policy combinations. This is because producer and consumer responses to price changes are expected to be different depending on the price levels they face. The PEM model uses point elasticities, a simple response mechanism. Assuming this response is accurate for the initial price level, a large policy change may result in a price for which the response mechanism is not appropriate. For this reason, it was stated that ‘care has been taken throughout the paper to indicate that findings and policy inferences flowing from those findings are based on simulated “small” changes in support measures. As such, it is not possible at this stage to generalise the results and conclude that they would equally apply to large changes’ (OECD 2000b). But the price and payment changes associated with the EU reforms since 1992 have been large — for example, there were price reductions in national currencies for bread making wheat of 35 per cent for France and 28 per cent for the United Kingdom between 1992 and 1998 (European Commission 1999) and the introduction of payments that compensated for those reductions. The EU has extrapolated the findings from small changes, built on synthetic policy analysis as evidence for the level of distortion of their policies.

The PEM analysis was only in the pilot phase. The commodity coverage was not very wide and the policy specification was incomplete. Additionally, key technical problems remain to be resolved. At present, the approach cannot accurately indicate the impact of large changes, and actual assessments of the level of decoupling of direct payments need to be incorporated. For these reasons, the PEM paper that has been published is not currently in a state to quantify the impact of different policies or to use as evidence for or against

the claim that EU blue box reforms have markedly reduced market distortions.

The US proposal

The US proposal on domestic support is part of a comprehensive proposal for agriculture covering market access, domestic support and export competition (WTO 2000c). On domestic support, the United States advocates a major change from what is currently in the WTO Agreement on Agriculture, at least in some important aspects.

The main elements of the domestic support proposal are:

- division of domestic support into two categories — one that is to be exempt on grounds of being under criteria based measures that are non or minimally distorting, and those that are nonexempt that are subject to reduction commitments;
- reductions to commence from the final bound AMS (at the beginning of the reductions) *to* a reduced AMS that is bound at a fixed percentage of the member's value of production in a fixed base period, with such reduction being implemented progressively through annual reduction commitments over a fixed period;
- enhancement of the criteria for exempt support measures while ensuring all exempt measures are targeted, transparent and at most minimally trade distorting; and
- special and differential treatment for developing countries to meet development objectives.

This proposal incorporates important elements of the present domestic support arrangements under the WTO Agreement on Agriculture. It maintains the concept of the AMS and agreed reductions to the AMS with the starting point being the final bound agreed level for the AMS. It also:

- divides support into exempt and nonexempt categories;
- refers to special and differential treatment for developing countries to meet development objectives; and
- maintains the approach in the present agreement of reducing domestic support for agriculture as a whole and not for individual commodities.

The most radical departure from present approaches for reducing market distorting domestic support is with advocating that the AMS be reduced *to* an agreed fixed percentage of the value of agricultural production in a fixed base period and not, as in the past, by a fixed percentage *from* agreed levels. In the example that accompanied the proposal, that was purely for explanatory purposes, the proportion used was 10 per cent.

An important difference between this approach and practice under the present agreement is that, so far, agreed reductions in domestic support have been the same for all developed countries, and also for all participating developing countries — although under special and differential treatment, the cuts for developing countries are smaller. They have also been from their initial base levels. That means that after the reductions, the same kinds of proportionate disparities between countries that initially existed would remain. The US proposal has the potential to reduce this disparity.

Given the compromise nature of multilateral agreements, any agreed target percentage of the AMS would be likely to fall between levels for countries with high AMS levels and those with lower ones. Such an outcome would provide leeway for countries with lower proportionate levels of domestic support than the agreed percentage to increase support that was categorised within the AMS. As an important objective of the negotiations is to reduce market distorting support, giving those countries the potential to increase acknowledged market distorting support would appear to be against the objective of reducing market distorting support. The agreement could even be used as a justification for some to increase market distorting support.

With the proposal being so early in the negotiating period, it could be expected that the approach advocated would leave considerable flexibility for further refinement.

The effects of the US approach would depend on several main elements including:

- the structure of the AMS;
- the bound AMS level from which the cuts are to be made;
- how the value of production is measured;
- the degree of aggregation of the domestic support that is subject to agreed reductions;

- the depth of cut in the AMS — that is, the level of the fixed percentage of value of production — to reach such a percentage will require different cuts by different countries depending on their initial AMS levels; and
- the extent of distortions that actually arise from forms of support that will be deemed to be minimally distorting.

Structure of the AMS

At a broad conceptual level using the (unsustainable) premise that the AMS is a reliable indicator of actual market distorting domestic support, the US proposal on domestic support has appeal because it would result in larger cuts in countries that currently have the highest AMS. However, because the AMS is not a reliable measure of actual support, it is far from certain that larger cuts in AMS levels for some than for others would actually result in greater reductions in market distorting support. This uncertainty could be magnified if the approach taken enabled some countries to increase distorting support.

Bound AMS levels from which cuts are made

Many of the countries that have high levels of domestic support for agriculture have had actual AMS levels that fall far short of their bound levels as is evident for the largest three developed countries (table 7).

As discussed in chapter 2, one of the main reasons why the United States and the European Union have had actual AMS levels that fall substantially below their AMS limits is that a substantial part of their domestic support that was included in their base AMS that was determined for 1986–88 was subsequently reclassified as exempt green or blue box support.

The amount of unused capacity in the AMS levels for these major developed countries means that it would require large cuts from the

7 Bound and actual AMS levels

European Union

Bound AMS	1997–98 million ECU	74 067
Actual AMS	1997–98 million ECU	50 194
Final bound AMS	2000 million ECU	67 159

Japan

Bound AMS	1997 billion yen	4 469.5
Actual AMS	1997 billion yen	3 170.8
Final bound AMS	2000 billion yen	3 972.9

United States

Bound AMS	1997 US\$ billion	21 491.2
Actual AMS	1997 US\$ billion	6 238.4
Final bound AMS	2000 US\$ billion	19 103.3

Sources: WTO (1999d, 2000b,d).

bound base AMS levels before any inroads would be made into actual AMS levels. Even then, as concluded from chapters 2 and 3, the AMS is a flawed measure of current levels of market distorting support.

How the value of production is measured

The cornerstone of the US domestic support proposal is that AMS levels should be reduced to an agreed percentage of the country's value of agricultural production. However, no indication is provided of the precise means by which the value of production would be measured. A key distinction can be drawn between the supported and the unsupported value of production. In economic terms, with production being valued at its opportunity cost, it would rightly be valued at world market prices, which might be simplified down to valuation at import parity prices for products that are imported and export parity for products that are exported. However, many countries could resist such a method of valuation and advocate valuation of production at supported prices — that has been the case with valuations for estimation of *de minimis* exemptions under current arrangements.

For some countries where price support is very important, such as Japan, the Republic of Korea, the European Union and for milk and sugar, the United States, the supported value of production would be far greater than the unsupported value. Also, importantly, the base AMS from which cuts would be required would be a much larger percentage of the unsupported value of production than of the supported value. This would mean that it would require a much larger cut to the AMS to reach an agreed proportion of the unsupported value of production than to reach the same proportion of the supported value of production. This is evident from the hypothetical example for a country with high support in box 7.

7 Effects on cuts to AMS levels, of differing bases for valuing production: a hypothetical example

Specific hypothetical examples are provided here for the implications of two differing means of valuation of production — at unsupported external values and unsupported internal values — for a country where all agricultural assistance is provided by price support. The country imports agricultural products and import parity prices average 100 units per tonne. Price support averages 200 units per tonne, making average internal prices 300 units per tonne. The country's production is 10 million tonnes. It is decided through negotiation that



7 Effects on cuts to AMS levels, of differing bases for valuing production: a hypothetical example *continued*

support is to constitute no more than 20 per cent of the value of production (however it is defined). The following aggregates are important to the calculation:

- value of production at world prices = 100*10 million units = 1 billion units
- value of production at supported prices = 3 billion units.
- AMS = 2 billion units

If it is assumed that production remains constant and production were valued at world prices, the AMS would need to fall to 200 million units to meet the 20 per cent target. This would give an AMS cut of 1.8 billion units.

If production were valued at internal support prices, the AMS target would be 0.6 billion units (20 per cent of 3 billion units), giving an AMS cut of 1.4 billion units.

The higher the final percentage target, the smaller the cut in AMS becomes when determined from the supported value rather than the value at world or external prices. This is evident from an extension of the above example using various percentage targets, as shown in table 8. There, the same AMS cut would arise from a 60 per cent target with external valuation as with a 20 per cent target with internal valuation.

Reducing AMS to an agreed target percentage of value of production: examples for different target percentages a

	With external valuation		With supported valuation	
	AMS at external value million units	AMS cut million units	AMS at internal value million units	AMS cut million units
Target proportion of value				
60 per cent	600	1400	1800	200
50 per cent	500	1500	1500	500
40 per cent	400	1600	1200	800
30 per cent	300	1700	900	1100
20 per cent	200	1800	600	1400
10 per cent	100	1900	300	1700

a The assumptions are for a set of commodities with constant production that is valued at 1 billion units at world prices, but which has initial price support of 2 billion units, making their supported value 3 billion units. The commodity is supported only through price support and its initial AMS is 2 billion units.

Degree of aggregation of domestic support

The agreed cuts under the WTO Agreement on Agriculture do not apply to support for individual commodities but to the aggregated AMS support figure. That figure equals the AMS levels of support (excluding exemptions such as under the blue and green boxes and *de minimis* exemptions) for each commodity plus non commodity specific support (also excluding exemptions). The US proposal would continue with this system.

As discussed in chapter 2, some large countries have been able to comply with required cuts to AMS support while not reducing support for some commodities at all through exemptions or cuts in support for some other commodities only. The means in the agreement for countries to shuffle support between different parts of agricultural sectors need to be prevented if reductions in market distortions are to be assured on a wide front for agricultural products. It is likely that reductions could only be assured for specific products if domestic support disciplines are on a commodity specific basis.

How distorting are forms of support that are deemed to be minimally distorting?

One part of the US domestic support proposal is ‘to enhance further, by building on experience, the criteria for exempt support measures while ensuring all exempt measures are targeted, transparent, and, at most minimally trade-distorting’ (WTO 2000c). It is clearly difficult to argue in principle against the exemption of truly minimally distorting measures. However, the experience in WTO agricultural negotiations so far has been that measures that are in fact much more than minimally distorting are already included in the blue exemption box and some also in the green exemption box. Under such conditions, building on experience should be more likely to result in a tightening of the conditions for such exemptions rather than their further enhancement.

Cairns Group proposal

Some of the issues associated with the US proposal, namely the aggregation problem that arises from the AMS applying for agriculture as a whole and not for all individual parts of the agricultural sectors are addressed in the Cairns Group proposal on domestic support to the current negotiations. Key elements of that proposal are (WTO 2000e):

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- a formula approach to deliver major reductions in trade and production distorting domestic support, including AMS and blue box, leading to the elimination of such support;
 - the time period and other parameters of the reduction formula to be agreed in the negotiations;
 - the formula to include a substantial down payment in the first year of the implementation period;
 - the formula to result in commitments on a disaggregated basis; and
 - the basic and policy specific criteria for ‘green box’ support to be reviewed to ensure that all such support meets the fundamental requirements of no, or at least minimal, trade distorting effects or effects on production.

The proposal also called for countries to restrain and reduce trade and production distorting support during the WTO negotiations. On special and differential treatment for developing countries, it was proposed that there should be enhanced green box provisions for developing countries to address their specific concerns about food security, rural development and poverty eradication; a differentiated AMS formula for developing countries; and enhanced technical assistance and promotion of international cooperation to assist agricultural and rural development and food security programs in developing countries.

Special and differential treatment for developing countries and a ‘development box’

A group of developing countries has submitted a proposal for a separate development box under special and differential treatment arrangements under the Agreement on Agriculture (WTO 2000f). In their submission, it is argued that developing countries face different economic, financial, technological and development circumstances than developed countries and that special advantages and flexibility must be given to them to take into account their different needs and position.

They proposed that there should be a separate ‘development box’ for developing countries to protect and enhance food production, especially of staples and to meet food security and rural development and employment objectives, to support small farmers and to stop the dumping of subsidised imports. It was also proposed that the instruments in the food security / development box should include discretion to decide which of their products should or

should not be subject to commitments; freedom of developing countries to raise tariffs when facing cheap imports and flexibility to provide domestic support, in particular by doubling the *de minimis* percentage for exempt support.

Developing countries do face different circumstances than developed countries and have genuine concerns about food security and difficulties with agricultural adjustment because of inadequate social safety nets (Freeman et al. 2000). There are thus grounds for special and differential treatment to enable them to overcome those concerns, although the weight of evidence has been that countries that adopt policies of openness have been more successful in advancing their economies than those resorting to protection (Brandão and Martin 1993; Sachs and Warner 1995).

If special treatment is to be provided to a particular group of countries, in this instance developing countries, it is desirable that it should be through measures that apply only to them specifically rather than through an expansion of general exemptions. If, in order to meet the special development needs of developing countries, a generally permissive approach were taken toward rural development and regional assistance under general exemption provisions, a likely outcome would be greater use of those provisions by developed countries, where there is greater access to financial resources, than by developing countries.

6

Reforming domestic support

From the foregoing analysis, it can be concluded that the present ‘aggregate measure of support’ (AMS) system has many shortcomings as a vehicle for negotiating reductions in market distorting domestic support. There are three main reasons for this:

- the price support element is derived from administered support prices not actual supported prices, and fixed external reference prices not actual external market prices;
- many of the measures that are exempted from any limitations on the grounds of them being production limiting or minimally market distorting are, in fact, considerably market distorting; and
- the way the AMS is aggregated for agriculture as a whole has allowed countries to exclude substantial agricultural activities from any reforms.

An approach that ensures that market distortions will be reduced as a result of a WTO agreement and that builds on the basic principles and measures in the present Agreement on Agriculture would include:

- commodity specific levels of domestic support, and separate non commodity specific support subject to agreed reductions;
- price support elements of commodity specific support that are determined from actual internal market prices and current actual external, world market prices; and
- inclusion of all measures that have elements that are actually market distorting in the commodity specific and non commodity specific support levels that are subject to agreed reductions.

These rather obvious requirements for a successful agreement may be readily identified. However, technical issues that could arise in implementing them need to be considered along with the conceptual basis for disciplines on domestic support. Some such technical issues are addressed in this chapter along with an appraisal of the main considerations for rules concerning domestic support — in particular, the role of price support.

Considerations in implementing reforms

Commodity specific and non commodity specific domestic support

If commodity specific limits are to be placed on distorting domestic support, a question arises about how non commodity specific market distorting support should be constrained. Some members might only be prepared to agree to reduce commodity specific support if there were provisions allowing them to move a greater part of their support into non commodity specific areas. However, if distorting non commodity specific support were not constrained, the cuts to commodity support might provide little or no reductions in overall distortions.

One approach might be to consider non commodity specific support like support for individual commodities. As well as agreed base levels for support to specific commodities to be reduced, there would be agreed base levels for non commodity specific support to be reduced. Then the negotiators could agree on cuts to both commodity specific support and non commodity specific support. The agreed depth of cut might, or might not, differ between commodity and non commodity specific support.

It might transpire that members could only agree on cuts to commodity specific support if they secured the flexibility to increase non commodity specific nonexempt support or to reduce it by less than commodity specific support. Under such conditions it would be essential that the extent of non commodity specific support be capped if domestic market distortions were to be reduced. This could be done in several alternative ways. One could be to place a limit on non commodity specific support as a percentage of base support. Another might be to limit non commodity specific support to a proportion of the value of agricultural production — in such cases it would be desirable to measure the value of production at its real opportunity cost — which is world market prices not internal supported prices. Yet another alternative could be to place a limit on the aggregate of commodity and non commodity specific support. In this latter case the system would be a combination of commodity specific limitations and overall distorting domestic support limitations.

Another approach could be to stipulate that all nonexempt support must be allocated between commodities with reduction commitments to be applied on a commodity specific basis. There could be allocation problems in doing

this where it is not clear how much non commodity specific support is used in the production of specific commodities.

Valuation of actual price support

The present system under which price support is determined from administered support prices and constant external reference prices is clearly deficient as it does not even use a measure of the actual margin of support. That can only be derived from actual internal market prices and actual prices of the same products from alternative sources. Such prices from alternative sources would normally be for competitively priced products on open markets at world market prices. Prices negotiated with specific supplying countries under special arrangements should definitely not be used. It is often not possible to know if some countries would be importers or exporters if support were removed, so there can be uncertainties whether relevant prices should be import or export parity. A practical approach could be to use import parity prices where the country is currently a net importer and export parity prices where it is a net exporter. That was the approach for determining the fixed base external prices in the present agreement.

Although, in principle, it is necessary to use actual, representative internal market prices and actual current world market prices as bases for determining levels of commodity specific price support, several practical problems arise in applying these actual prices.

There are some important definitional issues about the specific commodities to be covered in the agreement. Where the commodities traded are relatively uniform in terms of quality, such as with raw sugar or some forms of grain, it is relatively easy to identify representative internal domestic and external market prices. However, where the commodities traded are at various stages of processing and of differing qualities, there can be difficulties in identifying representative internal and external prices for products of comparable quality and at fully representative locations.

To some degree, this issue was addressed in the present WTO Agreement on Agriculture, at least for constant external reference prices that were identified for the base period and for subsequent application. However, if actual external reference prices were to be used for calculating price support for each year during the implementation period and beyond, representative prices would need to be constantly monitored, recorded and submitted in each country's notifications. Also, changes in location of industries and in the nature

and entry points of trade could result in changes in both representative internal and external market prices.

These measurement issues are clearly important if a strongly based system using actual measurements of distorting domestic support is to be adopted. Those members that might oppose the use of really meaningful measurements of distorting support would be likely to emphasise the difficulties and costs of meeting them and support the maintenance of the present AMS arrangements. Such arguments are relevant, but they do not alter the fact that negotiation on the current AMS is perpetuating a flawed concept (see, for example, Brink 2000, who also identifies the weaknesses of using constant external reference prices in measuring price support).

Inclusion of all market distorting elements

For simplicity and ease of negotiation, it may be useful to classify domestic subsidies as either distorting, and therefore subject to reduction, or non distorting or production limiting, and therefore exempt. But this black and white categorisation is at variance with the actual differing degrees of market distorting effects of various types of subsidies. In actuality, the situation is more one of shades of grey with some measures being less market distorting than others. The gains from reducing market distortions through restructuring support from particular forms to others are not a matter of substituting non distorting policies for distorting ones but of substituting measures that are considered to be less market distorting for those that are considered to be most highly distorting. If the principle that all measures that are market distorting should be subject to limitation, then most support arrangements would be subject to at least some degree of limitation.

Many government services like infrastructure programs, extension, research and development, inspection services and marketing and promotion services, if provided beyond or below particular socially optimum levels, are market distorting. However, it could be unlikely that many or even any governments would be prepared for their expenditure on these measures to be limited by an international agreement. There could be a case for accepting that members might not be prepared to accept limitations on an agreed list of these measures, not because they are deemed to be minimally distorting but simply because governments agree that they should be exempt.

At the same time, several of the other exempt green box measures that currently fall under annex 2 of the present agreement are clearly market

distorting and can be used by some members in ways that are injurious to others. Some include government insurance subsidies, investment subsidies and regional subsidies. Even the measures that might currently be exempted on grounds of decoupling are being applied in ways where it is questionable whether they meet the present criteria laid down for decoupled support. Furthermore, the links between policies being decoupled and being minimally distorting need to be far more thoroughly understood than at present before it can be confidently claimed that measures currently exempted on grounds of decoupling are in fact being applied in ways that are minimally distorting.

Role of price support in domestic support

Broadly, it can be concluded that the fundamental price support that maintains internal prices above world market levels is usually provided principally through limits on market access and export subsidies. However, government purchasing, stock management and stock release arrangements provide important internal price stabilising elements over time.

What then is the role of price support in the domestic support element of WTO agreements on agriculture if the fundamental measures that maintain that price support should be dealt with under the other main pillars of the agreement — market access and export measures?

If sufficient headway were made on reducing barriers to market access and reducing export subsidies and other market distorting export measures, the market price support would become unsustainable in most instances. However, substantial market distortions remain from market access barriers and export subsidies.

If the measured levels of price support provided a good indicator of the effectiveness of the agreed market access and export measures, the requirement to meet the disciplines on domestic support could provide pressures for members to reduce barriers to market access and export measures more.

Another reason for continuing to include price support within the domestic support category is that the internal price stabilisation aspect of price support measures continues to be an important international market supply and price destabilising factor that should be addressed if market distortions are to be reduced.

Although most price support is provided principally by market access and export measures, there are some instances where price support can be implemented by other means. One is where state bodies are given sole rights to control imports and/or exports in ways to ensure internal prices that are above world market levels.

There are some conditions where the characteristics of particular products can enable internal price support to be provided in ways they could circumvent the competitive pressures from more liberal market access. An example could be where a basic agricultural commodity like milk is used both in its own right as a nontraded good, and also as an input for processed products that are traded. It may be nontraded internationally because of its physical characteristics such as bulkiness and perishability.

Because of nontradability of the basic commodity and therefore lack of external competition, internal prices can be regulated for the raw product for direct domestic consumption at levels above those for the raw product used for processing. This could be done by the government or government agencies limiting the quantity permitted to be sold on the domestic raw product market, or by setting the internal price for direct use of the raw product and limiting supplies to ensure that the price is maintained. The higher internal prices might be used to increase average producer prices, thereby increasing production of the raw product and at the same time reducing its direct domestic consumption. While producers of the raw product could receive averaged prices, processors could differentiate in pricing between the quantities sold on the domestic raw product market and the quantities processed. They could still pay the lower world market price equivalent for the raw product used for processing so that their products are price competitive either on the domestic or import markets. The result would be larger quantities of processed product produced and either reduced demand for processed product imports or larger exportable supplies. Such an arrangement results in market distorting price support for the raw product that distorts trade. It cannot be directly disciplined to increase access of the processed product to the market or to limit the extent to which the arrangement increases exports. Commodity specific market price support disciplines that cover the price support for the domestically consumed, price supported raw product might be the only means of reducing market distortions under such circumstances.

While there are clearly reasons that can be advanced for maintaining price support within the categories of domestic support that should be subject to agreed reduction commitments, the current means of measuring market price

support is unreliable as an indicator of actual price support. Therefore, it will not be a satisfactory indicator of the effectiveness of agreed measures to reduce barriers to market access and export measures.

Some people might consider the use of administered support prices rather than actual market prices in the determination of price support to be a distinction without there being a difference. They would be wrong. It is entirely possible for a country to provide regulations or legislation that sets down administered prices while at the same time using market access limitations or export measures or both to maintain actual internal prices at levels substantially above the administered prices. This could be done to meet national domestic support commitments as defined under the present system while at the same time maintaining the fundamental price supporting mechanisms — those applying to imports and exports, thereby insulating their domestic market.

Concluding comment

So far, the main use of domestic support measures in multilateral agreements on agriculture has been to enable countries to reroute clearly market distorting price support toward forms of subsidies that may be less market distorting than those used previously. Whether this represents much progress depends critically on how much the newly acceptable forms of subsidisation are less distorting than the previous forms. It also depends on whether the improvements in resource allocation that might arise from using less distorting mechanisms for some particular commodities are not negated by the ability to maintain or increase distorting support for others. The ‘AMS credits’ that countries could ‘earn’ by changing support for particular commodities from clearly market distorting measures to less clearly distorting ones may even allow them to increase market distorting support for others. Despite the changes so far, price support that is highly market distorting, remains the main means of agricultural assistance.

Measures to ensure that the forms of subsidies toward which members might be guided are in fact much less market distorting than former arrangements are critical to the success of any future agreement. At the same time, most measures to place downward pressures on administered prices will only succeed in reducing market distortions if they are accompanied by commensurate reductions in barriers to market access and market distorting export measures.

Assessing market failure in agricultural insurance in the United States

To assess whether agricultural insurance in the United States represents a case of market failure, it is necessary to consider both the demand for and supply of insurance.

Demand for insurance

The demand for insurance will depend on the attitude of farmers toward risk and the reduction in risk achieved for the premium offered compared with the costs of other options to reduce risk. Farmers will be willing to pay for actuarially fair insurance only if they are risk averse. A risk neutral farmer would be indifferent between actuarially fair insurance and no insurance since expected income is the same in both cases. A risk preferring farmer would never insure at actuarially fair premiums.

There have been attempts to measure individuals' attitude toward financial risk through experimental methods and studies of observed behavior. Experimental studies suggest that most individuals are risk averse but not highly so (Newbury and Stiglitz 1981). Some forms of observed behavior of American farmers suggest only very mild or even zero risk aversion. However, observed behavior may be influenced by the belief that government assistance would be available in the event of adverse outcomes.

Collins (1997) attributes the low level of hedging through futures and forward contracts by farmers in the United States to a low level of risk aversion, which in turn reflects the relative financial strength of farmers in the United States. The financial strength of farmers will have been influenced by past levels of assistance. In a stratified sample survey of farmers in four states undertaken in 1999 (Coble, Knight, Patrick and Baquet 1999), the majority of respondents stated that they would be unwilling to accept a lower price to reduce price risk. Such a response implies that the majority had zero risk aversion.

Just, Calvin and Quiggin (1999) examine the differences between farmers that took out crop insurance and those that did not using 1988 data. The key difference was found to be that insurance improved the average net income of those insuring whereas it would have reduced the average net income of

those not insuring. Those not insuring were unwilling to accept a minor reduction in average net income to achieve a significant reduction in the variability of their net income. Such a result again implies zero risk aversion. However, it is necessary to caution again that such a result may be influenced by the belief that government assistance would be provided at zero charge in the event of particularly adverse outcomes. Indeed, unless this were the case, the results imply that there would be a zero demand for insurance contracts at actuarially fair premiums (that is, at premiums that did not alter the average net income of farmers).

The apparent difficulties of selling insurance to farmers in the United States at actuarially fair premiums is reinforced when the risk reduction achieved at a given cost is considered in relation to other options to reduce risk. There are three major points to make.

First, many commercial forms of insurance (such as car and house) cover assets where there is a steady stream of the value of services with a reasonably low probability of a reduction in the value of services. In comparison, the income stream from a farm is highly volatile. The implication is that more frequent insurance payouts will be required to make a significant contribution to stabilising farm income and actuarially fair premiums may be quite high in relation to farm income.

A simple and rather extreme example serves to illustrate the point. Suppose that for one asset (a farm) there is a 0.5 probability that income will be \$100 000 and a 0.5 probability that it will be \$0. Average income is \$50 000 and the actuarially fair premium for 100 per cent coverage of losses is \$50 000 which is 100 per cent of average income. Consider another asset producing the same average income of \$50 000 but with a much more stable distribution of returns. For this asset suppose that there is a 0.9 probability that income will \$55 555 and a 0.1 probability that income will be zero. The actuarially fair premium for 100 per cent coverage of losses is \$5555 which is only 10 per cent of average income.

A somewhat more practical example is provided by Turvey (1992) based on data for a Canadian mixed cropping farm. He estimates that an actuarially fair premium for 100 per cent coverage of revenue losses in a theoretical revenue scheme would absorb 18.1 per cent of net farm income.

In the United States (and Canada) full coverage insurance is not available and a maximum of 75 per cent of average yield (recently increased to 85 per

cent for a number of minor crops) is insurable. Offering coverage of more than 70 per cent violates WTO conditions for greenbox exemption status. Restricting coverage levels reduces the frequency of possible payouts and the size of the premium in relation to net farm income. However, it also reduces the effectiveness of insurance in reducing risk.

The second point is that standard yield insurance may make only a limited contribution to stabilising farm income if price variability is also an important source of income variability. If a country is a significant supplier of a traded crop or there is limited trade in the crop, there may be a negative correlation between yield and price, which provides automatic income stabilisation. If there is a negative correlation between yield and prices, yield insurance may actually destabilise farm income. Insurance payouts will occur when yields are low and prices (and possibly income) are high, while premium payments will reduce income when yields are high and prices (and possibly income) are low.

Turvey (1992) provides several Canadian examples where destabilisation does occur and the estimated *certainty equivalent* of farm income with yield insurance (the certain income a risk averse farmer would regard as equivalent to their actual variable income) is less than the estimated certainty equivalent of the uninsured income. Of course, the above problem applies only to standard yield insurance and not the more recently introduced various forms of revenue insurance.

The final point is that farmers may have a number of more cost effective options for reducing income variability than crop insurance. Other options include holding liquid financial reserves, changes in production techniques to those producing more stable yields, off-farm employment, off-farm investments and diversifying the cropping mix. To reduce price risk, farmers also have the options of forward selling or derivatives trading. The introduction of standard forms of crop insurance can actually reduce the incentives of farmers to reduce income variability through diversifying their cropping mix (Turvey 1992). Production of more risky crops can be encouraged, increasing the risk exposure of the insurer.

To summarise, if the apparently low level of risk aversion of American farmers is taken together with doubts about the cost effectiveness of standard forms of crop insurance in reducing income risk, there are strong reasons to doubt whether there would be a significant demand for standard forms of crop insurance at actuarially fair premiums. The results of Just, Calvin and

Quiggin (1999) are particularly compelling in that they show that in 1988 it was possible to induce farmers to insure only if it improved their average income. The main qualification in interpreting this result and other forms of observed behavior is that it is uncertain to what extent decisions were influenced by the belief that free disaster relief would be provided under adverse conditions.

There have been three studies (Bardsley, Abbey and Davernport 1984; Patrick 1988; Fraser 1992) using different methodologies that have attempted to estimate the potential demand for crop insurance in Australia. All studies concluded that demand would be inadequate to support a viable industry at actuarially fair premiums. If the same result were true for the United States, agricultural insurance would be a case of a market failing to exist because of lack of a demand rather than a policy relevant case of market failure.

The various possible sources of market imperfections on the supply side are now reviewed.

Supply of insurance

Three factors are usually cited as creating possible obstacles to the supply of agricultural insurance at actuarially fair premiums — adverse selection, moral hazard and the high level of systemic risk (the high correlation in risks among the insured). There is little dispute that the first two factors pose potential problems but there has been some dispute about the implications of the third factor.

The first two factors are usually described as reflecting asymmetric information (differences in the information held by the insured and insurer). More fundamentally, they reflect the real world problem that information is costly to acquire and, as a result, it is optimal not to acquire all relevant information. Costly information is not a feature of the Arrow-Debreu model of an idealised competitive economy. It will be apparent from the discussion below that the third factor can also ultimately be related to the problem of costly information.

Evidence on the first two factors is briefly reviewed and then the problem of systemic risk is examined in more detail. More space is devoted to the problem of systemic risk because it has been the source of some controversy and it was possible to bring some new quantitative evidence to bear on the problem.

Adverse selection

The problem of adverse selection arises when those taking out insurance have higher risks than those not taking out insurance and it is not cost effective for the insurer to ascertain to which risk class those seeking insurance belong. Cost effective in this sense means that if an insurer attempted to recoup the administrative costs incurred in ascertaining risk class through premiums, demand would be sufficiently low that it may not be viable to offer insurance.

There is a considerable volume of empirical evidence that adverse selection has been a significant problem for multiple peril crop insurance in the United States (Knight and Coble 1997; Just, Calvin and Quiggin 1999). Farmers with above average yield variability have a much higher probability of taking out insurance than those with below average yield variability. It may be extremely costly to reduce the problem of adverse selection since the research summarised by Knight and Coble (1997) casts doubt on whether it is possible to find any readily observable variable (or set of variables) at the farm level that identifies risk class. In the case of some forms of commercial insurance, such as automobile insurance, there are some general variables such as age, sex and residential location that offer a guide to risk class. In the longer term it may be possible to infer risk class from observed claims history (the 'experience rating' approach) and adjust premiums according to claims history, as is done in automobile insurance with 'no claim bonuses'.

In the United States a rather direct and costly approach was taken in an apparent effort to reduce the problem of adverse selection. Before 1985 insurable yields were based on average yields in the immediate geographic vicinity of a farm. Since 1985, in an apparent response to the problem of adverse selection, insurable yields have been based on data on yields that must be supplied by each farm over a four to ten year time period (the 'approved production history'). However, if data are not available for some years it is possible to substitute county averages, which to some extent undermines the effectiveness of the procedure in reducing adverse selection. Higher administrative costs are incurred in using individual farm yields than in other forms of agricultural insurance where aggregative data can be used. A higher subsidy in dollar amount per contract is paid for the administrative costs of private firms selling insurance based on individual farm yields than other types of agricultural insurance (Dismukes 1997).

Moral hazard

The problem of moral hazard can arise when the act of taking out insurance reduces the incentives of farmers to reduce risks that they can influence. It also must be considered not cost effective to monitor the behavior of insured farmers. It is widely believed that taking out insurance reduces incentives for farmers to apply fertilisers and pesticides. The bulk of empirical evidence appears to support this view (Goodwin and Smith 1995; Knight and Coble 1997). Thus, environmental benefits are a possible side effect of the high level of subsidisation of agricultural insurance in the United States. However, if the aim were to achieve environmental benefits through reduced chemical use, there presumably would be more cost effective approaches. The failure to offer complete insurance coverage for possible losses (a standard insurance response to moral hazard problems) to some extent reduces the incentives for moral hazards problems to occur but also reduces the effectiveness of insurance in lowering risk.

Systemic risk

Systemic risk arises when risks are positively correlated. Systemic risk reduces the gains from risk pooling achieved through insurance since on average the different risks do not offset one another. In agriculture, the exposure of many farmers to similar weather conditions tends to create a high correlation in production risks. Miranda and Glauber (1997) estimate that the level of systemic risk in crop insurance in the United States is about seven times the level of that in automobile insurance.³

The impact of systemic risk on the variability of total insurance claims is immediately apparent from the formula for the variance of a linear combination of random variables. If Y is the random variable of total claims and Y_i is the random variable of claims from farmer i , then the appropriate formula is:

$$(1) \quad \text{var}[Y] = \text{var}\left[\sum_{i=1}^n k_i Y_i\right] = \sum_{i=1}^n k_i^2 \text{var}[Y_i] + 2 \sum_{i=1}^{n-1} \sum_{j=i+1}^n k_i k_j \text{corr}[Y_i Y_j] \cdot \sqrt{\text{var}[Y_i] \cdot \text{var}[Y_j]}$$

³ The degree of systemic risk was measured by the coefficient of variation (the standard deviation divided by the mean) of actual indemnities (taking account of the actual correlation in risks) divided by the coefficient of variation that would result if risks were uncorrelated. A value for the ratio of one indicates that risks are uncorrelated and values in excess of one indicates correlated risks. The average value for companies involved in crop insurance was 37 compared with 5 for automobile insurance.

where $\text{var}[\]$ denotes variance, $\text{corr}[Y_i Y_j]$ is the correlation coefficient between random variables Y_i and Y_j and the k_i are the weights attached to the different random variables ($1/n$ in the case of a distribution of insurance claims). Thus, the variance of total (and average) claims will increase with the degree of positive correlation among the individual claims. It can be shown that if there were n insurance claims that were perfectly positively correlated, the variance of total claims would be n times greater than if the claims were uncorrelated.

Systemic risk could pose a potential problem of market failure in the supply of agricultural insurance if, due to various imperfections in insurance markets, the high variance in total claims meant that firms were unwilling to supply insurance at actuarially fair premiums. Existing arrangements in the United States appear to be predicated on the assumption that this is the case. The Risk Management Authority of the US Department of Agriculture attempts to set actuarially fair premiums (Harwood, Dismukes, Vandever and Heifner 2000). Farmers, of course, do not pay this premium — the premium is reduced by the amount of the premium subsidy. The Federal Crop Insurance Corporation (FCIC), another government agency, provides reinsurance for the claim liabilities of the private companies that directly sell crop insurance to farmers at the subsidised premiums. Premiums charged by the FCIC are actuarially unfair in favour of the private insurers. (There are various provisions that limit the losses of the private insurance firms. If indemnities exceed premiums by 500 per cent on a given line of insurance, the FCIC takes on all losses — Skees 2000.)

Divergent views have been expressed in the literature about the possible benefits of such arrangements. Some writers such as Goodwin and Smith (1995) argue that there is no benefit in such arrangements and that global reinsurance markets would be able to offer suitable reinsurance facilities at an (implicitly) acceptable price. Other writers such as Miranda and Glauber (1997) and Skees and Barnett (1999), while not necessarily approving of existing arrangements, do suggest that private companies may demand a considerable loading on the pure risk premium in view of the high level of systemic risk. These divergences in view ultimately stem from differences about the degree of imperfection in private insurance markets.

In the light of these differences in view, it seems useful to attempt to derive predictions about the loading on the pure risk premium that would be demanded by private companies in supplying agricultural insurance in the United States. The natural way to approach this problem is to develop a

theoretical model that can be econometrically estimated given the observed behavior of private insurance firms. To this end, a model from the insurance–actuarial literature is adapted for economic analysis. The relationships needed to predict the loading on the pure risk premium in supplying agricultural insurance are then econometrically estimated using available market data. Predictions are derived and their implications are discussed.

A model of insurance

There is an extensive insurance–actuarial literature that seeks to model insurance in a dynamic context drawing on the theory of stochastic processes (Straub 1988). However, closed form solutions have been obtained in only a few special cases and computer simulations are usually needed. There is one model for which an approximate solution can be obtained. With some modifications, this model can be made quite useful for economic analysis. This model is now briefly outlined initially following Straub (1988).

The distribution of total annual claims for an insurance firm is assumed to follow the commonly used compound Poisson model. It is assumed that the number of claims, k , received annually follows a Poisson distribution:

$$(2) \quad f(k) = e^{-\lambda} \frac{\lambda^k}{k!}$$

for $k = 0, 1, 2, \dots$, with $E[K] = \lambda$, and $\text{var}[K] = \lambda$, $\lambda > 0$.

The amount, X_i , of each individual claim is also a random variable but no assumptions are made about the form of its distribution.

Total annual claims, Z , are thus a random variable:

$$(3) \quad Z = \sum_{i=1}^k X_i$$

with $E[Z] = \lambda E[X]$ and $\text{var}[Z] = \lambda E[X^2]$.

There is assumed to be a steady annual flow of premiums and total annual premiums, P , are not a random variable. It is assumed that the firm holds an initial free level of reserves, U .

A central concern is to determine the probability that ruin occurs within some finite time. Ruin is said to occur within a finite time if there exists an r satisfying:

$$(4) \quad \max_{1 \leq r < \infty} \sum_{j=1}^r (Z_j - P) > U \quad .$$

Thus, ruin occurs for some finite r if the sum of annual increments to reserves,

$$(5) \quad -Y = Z_j - P$$

exceeds U .

According to Cramer's inequality, the probability, $\Psi(U)$, of this occurring is bounded above by $e^{-\kappa U}$, that is:

$$(6) \quad \Psi(U) \geq e^{-\kappa U}$$

where κ satisfies:

$$(7) \quad E[e^{-\kappa Y}] = 1.$$

Thus, κ is the probability that claims exceed premiums with certainty in any year. To determine the upper bound on the probability of ruin, κ is multiplied by the initial level of reserves in equation (6). It is also apparent from this equation that ruin is almost certain if a firm began with a zero initial level of reserves.

Instead of solving (7), κ can be determined from:

$$(8) \quad \ln E[e^{-\kappa Y}] = 0.$$

Taking a power series expansion up to the second order yields the following approximation:

$$(9) \quad -\kappa E[Y] + \frac{\kappa^2}{2!} \text{var}[Y] = 0$$

and using the fact that $\text{var}[Z] = \text{var}[Y]$,

$$(10) \quad \kappa = \frac{2E[Y]}{\text{var}[Z]}.$$

In effect, a normal (or log-normal) distribution is used to approximate the true distribution of Z .

Inserting κ into (6) yields:

$$(11) \quad \Psi(U) \leq e^{-\frac{2E[Y]}{\text{var}[Z]}U}.$$

Since an actuarially fair premium implies $E(Y) = 0$, equation (11) means that ruin is almost certain if no loading were applied.

Letting $\varepsilon = \Psi(U)$ be the tolerated ruin probability and putting equality in Cramer's inequality in (11):

$$(12) \quad -\frac{\ln \varepsilon}{2U} = \frac{E[Y]}{\text{var}[Z]}.$$

The derivation from here differs from Straub (1988) to emphasise the economic properties of the model. To present equation (12) in its most intuitively appealing form, multiply through by $\text{var}[Z]/E[Z]$, using $\text{var}[Y] = \text{var}[Z]$ to obtain:

$$(13) \quad \delta^* = \frac{E[Y]}{E[Z]} = \frac{E[Z]}{U} \cdot \frac{\text{var}[Z]}{E^2[Z]} \cdot \frac{-\ln \varepsilon}{2}$$

where $\delta^* = E[Y]/E[Z]$ shows the minimum loading needed on the pure risk premium if the firm were to retain all of the risk and operate with the desired ruin probability. δ^* will be referred to as the full retention loading. The value of δ^* depends on the desired probability of ruin and the risk exposure of the firm as measured by the level of reserves in relation to average claims and the square of the coefficient of variation of total claims. Equation (13) shows that the full retention loading would rise with the square of the coefficient

of variation of total claims for given initial reserves and a given tolerated probability of ruin.

Insurance firms are not restricted to their own reserves in bearing risk but may also reinsure part of the risk. The mechanics of modeling reinsurance will first be described before examining the economics of the reinsurance decision.

Under the widely used quota share form of reinsurance contract, firms share risks and premiums in agreed proportions. If retention is α , ($0 < \alpha < 1$), then $1-\alpha$ of the risk is reinsured. If n firms are parties to a reinsurance contract and share claims equally so that $n = 1/\alpha$, the variance of claims for each firm will be $\text{var}[Z]/n$ as a result of the law of large numbers (see appendix B). If the firms are identical in all respects, the minimum premium loading consistent with all firms operating with the desired probability of ruin is:

$$(14) \quad \delta = \frac{\delta^*}{n} = \alpha\delta^*.$$

Using (13), the retention associated with a given level of δ can be calculated as:

$$(15) \quad \alpha = \delta \cdot \frac{U}{E[Z]} \cdot \frac{E^2[Z]}{\text{var}[Z]} \cdot \left(-\frac{2}{\ln \varepsilon} \right).$$

Thus, retention would be a decreasing function of the square of the coefficient of variation of total claims for given values of the other variables.

In a competitive insurance industry where firms take the premium set by the market for a given class of risk, the level of reinsurance is the key economic decision variable for each firm. There are economies of scale in reinsurance as a result of the law of large numbers. In the absence of further assumptions, the variance of claims facing each party to a quota share contract could be reduced by continuously expanding the size of the pool. In the limit, any need for a loading on the pure risk premium would be eliminated, as can be seen from equation (14) with $\delta \rightarrow 0$ as $n \rightarrow \infty$.

Natural assumptions to limit the level of reinsurance is that transactions costs are incurred in negotiating reinsurance and these increase the deeper the layering of reinsurance. It is assumed that a constant transactions cost, c , is

incurred for each additional n involved in a contract and n is treated as a continuous variable. The minimum loading on the pure risk premium for a firm to operate with the desired probability of ruin is written:

$$(16) \quad \delta(n) = \frac{\delta^*}{n} + c(n-1)$$

where δ^* is defined as in (13) and now the loading must be sufficient to cover transactions costs incurred in negotiating reinsurance. If a firm does not reinsure it incurs no transactions costs.

Competitive market conditions will drive $\delta(n)$ to the minimum level consistent with firms operating with the desired probability of ruin. Thus, the problem of determining the optimal level of reinsurance can be represented as choosing the value of n to minimise $\delta(n)$. The first term in (16) is decreasing at a decreasing rate in n while the second term is increasing at a constant rate in n . Thus, $\delta(n)$ is assumed to be a strictly convex function of n . First order conditions yield the following expression for the optimal n

$$(17) \quad n = \sqrt{\frac{\delta^*}{c}}$$

Substituting this expression for n back into (16):

$$(18) \quad \delta(n) = 2\sqrt{c\delta^*} - c$$

yielding the condition $2\sqrt{c\delta^*} - c > 0$ if $\delta(n)$ is to be positive.

Since $\sqrt{\delta^*}$ is on the right hand side of both of the above equations, they imply that both the level of layering and the loading on the pure risk premium will increase with the coefficient of variation of total claims holding other variables constant. While the availability of reinsurance will reduce the required loading on the pure risk premium, the required loading will still increase with the coefficient of variation of total claims as a result of positive transactions costs. Such a result is readily interpreted. The gains in reducing variance from increasing the pool size decline rapidly at the rate of $1/n$. Transactions costs do not have to be high to severely constrain the optimal size of the pool.

Empirical application

To derive predictions on the level of premiums that private companies would charge to supply agricultural insurance in the United States, two predictions from the above model can be tested given available data. These predictions relate to the optimal level of reinsurance and the premiums that would be charged with that level of reinsurance given the distribution of total claims. In applying the above model across different classes of insurance, it is being assumed implicitly that similar administrative costs would be incurred in supplying the different types of insurance.

The first prediction to be examined is that the loading on the pure risk premium after reinsurance should increase with the coefficient of variation of total claims (equation 18). Such a prediction was derived for given values of the desired probability of ruin, transactions costs and level of reserves. In observed market data, the level of reserves is likely to be the main source of independent variation among these other variables over time.

Equations (18) and (13) imply that the loading on the pure risk premium should decrease with the level of reserves. If the level of reserves cannot be observed directly they might be inferred approximately from what in insurance accounting terminology is called the ‘underwriting result’. The underwriting result measures the extent to which premiums received are sufficient to cover claims and administrative and other costs incurred in providing insurance. If reserves are in a strong position, it would be possible to use the investment income generated to finance an underwriting loss, allowing premiums to be reduced. The converse applies if reserves are in a weak position.

Reference is often made to ‘the insurance industry cycle’ (Belonsky, Laster and Durbin 1999) whereby premiums are increased after a succession of large payouts and reduced when large payouts have been infrequent. Thus, it is expected that the loading on the pure risk premium would be positively related to the underwriting result.

It would be possible to obtain data to test the predictions of the theoretical model from a number of commercial sources. However, the only suitable dataset that is made available freely appears to be one compiled by the Association of British Insurers (1999). It was possible to extract consistent annual data series for eleven different types of insurance over the period 1988–98 from this dataset. These data relate to the position after firms have reinsured.

The relevant summary measures are shown in table 8. To remove the impact of growth on variability, the loading on the pure risk premium was calculated as the geometric mean of premiums less the geometric mean of claims less one. The coefficient of variation of claims was calculated after claims were discounted by the estimated underlying geometric rate of growth. The mean underwriting result as a percentage of mean claims was calculated using the simple means of both series since the geometric mean is not defined for negative values.

The following linear regression equation was estimated:

$$PLOAD = 0.3288 + 0.8657CV + 1.0403UR/CLM \quad R^2 = 0.6728$$

(6.2658) (3.1697) (3.5350)

where 't' values are shown in parentheses and *PLOAD* is the mean loading on the pure risk premium, *CV* is the coefficient of variation of claims and *UR/CLM* is the mean underwriting result as a percentage of mean claims. The coefficients of the independent variables have the expected sign. A much less satisfactory fit was obtained if the square of the coefficient of variation was used in place of the coefficient of variation. It was necessary to include a constant to estimate a satisfactory equation. It is probably unrealistic to

8 Summary statistics for UK insurance companies, by category, 1988–98

Insurance category: UK companies	Mean loading on pure risk premium <i>(PLOAD)</i>	Coefficient of variation of claims <i>(CV)</i>	Mean underwriting result as percentage of mean claims <i>(UR/CLM)</i>
World motor	0.2368	0.0661	-0.1155
UK motor	0.2166	0.0935	0.0139
Overseas motor	0.2648	0.0664	-0.1078
US motor	0.2981	0.0770	-0.0942
World non-motor	0.4307	0.1212	-0.1024
UK non-motor	0.4937	0.2002	-0.0752
US non-motor	0.2176	0.1190	-0.2157
UK accident-health	0.4873	0.1433	0.0459
UK general liability	0.1248	0.1241	-0.2998
UK pecuniary loss	0.4122	0.5028	-0.2802
UK property damage	0.6387	0.1987	0.0124

Source: Association of British Insurers (1999).

imagine insurance existing when the coefficient of variation of total claims is zero. There may be some nonlinear or discontinuous relationship between the premium loading and the coefficient of variation up to the values where insurance is likely to be observed.

The second prediction is that the optimal level of reinsurance should increase with the coefficient of variation of total claims (equation 17). Again the level of reserves would be expected to be the main other independent source of variation over time. Equation (17) implies that the level of reinsurance should decline with the level of reserves. However, in discussing the first prediction, it was suggested that competitive pressures would result in the reserve position being reflected in the level of loading on the pure risk premium.

From equation (15) it can be seen that when the loading on the pure risk premium is taken as given, the level of retentions is positively related to that loading. If a strong reserve position resulted in the loading being reduced, then the optimal level of reinsurance would be increased. The converse would apply in the case of a weak reserve position. Thus, it is expected that the level of reinsurance may be negatively related to the underwriting result.

Unfortunately, suitable data were available for only five classes of insurance to allow the second prediction to be tested. Reinsurance (out) is measured by the difference between gross and net premiums. The sum of these variables over the time period was calculated and the ratio of reinsurance to gross premiums estimated. Results are shown in table 9.

The following linear regression equation was estimated:

$$RE_RATIO = 0.0946 + 0.2599CV - 0.2392UR/CLM \quad R^2 = 0.8222$$

(2.4998) (1.5263) (-1.4567)

where 't' values are shown in parentheses and *RE_RATIO* is the mean reinsurance ratio and *CV* and *UR/CLM* are as defined in table 8. The coefficients have the expected sign and the equation provides a reasonable fit to the data. More observations would be likely to improve the standard errors for the estimated coefficients but unfortunately none was available.

To use the two estimated regression equations to predict the commercial loading on the pure risk premium for agricultural insurance in the United States, it is first necessary to estimate the coefficient of variation for claims. Annual claims over the period 1985–99 were discounted by the underlying

geometric rate of growth, yielding a coefficient of variation of 0.29. The data were broken into two subperiods to test for a possible discontinuity arising from the 1994 Crop Insurance Reform Act but none was evident from the data. The estimated coefficient of variation was 0.29 for the period 1985–93 and 0.31 for the period 1994–99.

Inserting 0.29 for *CV* in the equation for *RE_RATIO* and setting *UR/CLM* equal to zero yields a value of 0.17 for the reinsurance ratio, implying a retention ratio of 0.83. A retention ratio of 0.83 implies a value of $n (= 1/\text{retention ratio})$ of 1.2. If $n = 1.2$ the coefficient of variation of claims for the parties to a reinsurance contract would be reduced to $0.24 = 0.29/1.2$. Inserting a value of 0.24 for *CV* into the equation for *PLOAD* and setting *UR/CLM* equal to zero yields a value of 0.54 for the loading on the pure risk premium.

The economic justification for a loading of 0.54 given a coefficient of variation of claims of 0.24 is most apparent when equation (11) is solved for the probability of ruin associated with different loadings. As shown in table 10, the probability of ruin declines from near certainty for low loadings to a much more acceptable level at a loading of 0.54.

By way of comparison, the probability of ruin of NRMA Insurance in Australia (a company with a mixed motor vehicle, house and life portfolio) has been estimated at 0.003 which is said to be superior to that of any other insurance company in Australia (NRMA 2000). Of course, the probability of ruin would decline if reserves were set at a higher fraction of mean claims, with a figure of between 0.33 and 0.5 of annual

9 Average reinsurance ratios, by categories of UK insurance, 1988–98

Category of insurance in the UK	Mean reinsurance ratio (<i>RE_RATIO</i>)
Motor	0.07
Accident and health	0.13
Property	0.19
General liability	0.21
Pecuniary loss	0.28

Source: Association of British Insurers (1999).

10 Probability of ruin based on US agricultural insurance claims, 1985–99

Loading on pure premium	Reserves as fraction of mean claims	Probability of ruin
0.001	0.33	0.991
0.01	0.33	0.915
0.1	0.33	0.412
0.2	0.33	0.170
0.3	0.33	0.070
0.4	0.33	0.029
0.5	0.33	0.012
0.54	0.33	0.008

premiums often set in legislative requirements in the United States (Miranda and Glauber 1997).

If firms demanding well in excess of the pure risk premium to insure a particular risk represents a potential source of market failure, it could be said that systemic risk creates a potential market failure problem for agricultural insurance in the United States. Nevertheless, table 8 shows that in the case of property damage insurance in the United Kingdom, a market exists with a premium loading well in excess of 0.54. There are also two other cases when the premium loading is in the 0.48 to 0.5 range. In the case of pecuniary loss insurance in the United Kingdom, a market exists when the coefficient of variation of claims is well in excess of that for agricultural insurance claims in the United States. Premiums for pecuniary loss insurance appear to be heavily subsidised by income generated from a strong reserves position. The regression equation for *PLOAD* implies that if *UR/CLM* were set equal to zero, the premium loading would be 0.76.

There appear to be quite high levels of systemic risk in both property damage and pecuniary loss insurance. In the case of property damage, claims for storm losses tend to be highly correlated over affected areas. In the case of pecuniary loss, mortgage indemnity policies are included which insure policyholders against being unable to make loan repayments due to various events including unemployment. Some element of systemic risk would arise from general national movements in levels of unemployment. Pecuniary loss also includes business interruption policies that insure profits against various specified events. If any of the specified events were weather related, they would be a source of systemic risk.

There is no doubt that the level of systemic risk in agricultural insurance in the United States is high compared with most forms of commercial insurance. Miranda and Glauber (1997) provide data on the coefficient of variation of claims for ten forms of commercial insurance in the United States over the period 1963–92. The data appear to have been detrended in some way but no details on the method used are given. Coefficients of variation range from 5 per cent for automobile collisions to 15 per cent for commercial crop hail insurance, with a mean value of 9.3 per cent. Values are similar to those in table 8 where approximately the same line of insurance is involved. Nevertheless, as the data for the United Kingdom show, a high level of systemic risk or, more generally, a high loading on the pure risk premium does not necessarily exclude the existence of a competitive insurance market.

Alternative approaches to systemic risk

The question can be raised of whether insurance markets are the markets best suited for bearing systemic risk (Skees and Barnett 1999). The comparative advantage of insurance markets lies in their ability to *pool* risks whereas the comparative advantage of capital markets is in *spreading* risks. Futures markets provide the classic example of spreading systemic risk through the use of a capital market. Those seeking to insure (hedge) face approximately the same prices (commodity, exchange rate, interest rate and share price index) and so the risks are almost perfectly correlated. Futures markets work by being able to spread this risk to individuals willing to adopt the opposite market position to those seeking to hedge.

Recent developments in private insurance and capital markets have seen the shifting of some systemic risk covered by insurance contracts to capital markets (Shimpi 2000; Belonsky, Laster and Durbin 1999). Rapid growth during the 1990s of markets in catastrophe bonds and options, credit and weather derivatives are particularly relevant in this regard. While some shifting of risk from insurance to capital markets may have occurred, there also may be hedging of some risks that previously were uninsurable. Reductions in transactions costs in trading on derivatives markets appears to have been one of the factors stimulating these developments.

There may be some incentives for the US government to consider modifying existing reinsurance arrangements. Rapid expansion in crop insurance is also rapidly expanding the potential claims of the FCIC on government revenue. The opportunity cost of these reinsurance claims will become apparent when adverse conditions occur and large payments are required. Greater use of capital markets may be a potentially lower cost option than existing arrangements.

The key ideas involved can be illustrated with the following highly simplified example. Suppose that there is only crop yield insurance. Using standard statistical methods, the variance in total claims could be decomposed into an element arising from factors specific to each farm and an element that is perfectly correlated across all farms. The insurance market would retain that part of the risk that is specific to each farm where it could exploit its comparative advantage in risk pooling. The correlated part of the risk would be shifted to capital markets to exploit their comparative advantage in risk spreading.

Suppose that an index can be constructed based on weather conditions that perfectly mirrors the correlated part of the risk and a futures contract is based on this index. The value of the index is assumed to decline as weather conditions deteriorate. At the beginning of the growing season, insurers would sell the futures contract. It is assumed that there are a sufficient number of buyers to make a market. Buyers could include food and beverage manufacturers, energy producers and firms in the leisure sector seeking to hedge their risks, managed funds seeking to diversify their risks and speculators.

Suppose that at the end of the growing season there are three possible and equally probable values of the index — high, medium and low. The payouts of insurance firms due to systemic risk in each of these three states is 10, 5 and 0 respectively. Premiums to cover this risk are set at their expected value of 5. At the beginning of the growing season, given the inability to predict the final value of the index, insurance firms are able to sell futures at their expected value of 5.

Thus, initially insurance firms hold reserves of 10 (premiums plus revenue from sale of futures contracts). At the end of the growing season, insurance firms close out their futures position by buying a contract. Final revenue in each of the three states exactly matches the required insurance payout (table 11).

Insurance firms would be able to achieve a zero probability of ruin by setting an actuarially fair premium and operating as above no matter how large the risk. This would be impossible, as shown above, relying on conventional insurance and reinsurance markets. The attraction of the use of capital markets is that they remove the claim of the FCIC over government revenue.

The simplifying assumptions above mask a number of practical difficulties. The index on which the futures contract was based was designed to be ideal for the hedging needs of insurance companies. It may be impossible to design a single index that would provide a perfect hedge for insurance companies. Multiple indexes that might fulfil this function would not necessarily be ideal

11 Final outcomes in hypothetical insurance–futures scheme

State	Final index value	Futures profit (loss)	Final reserves	Payout
High	0	5	10	10
Medium	5	0	5	5
Low	10	–5	0	0

Assumptions: Initial index value is 5. Initial reserves of firm are 10, made up of premiums of 5 and 5 received from sale of futures. Firm closes out contracts by buying futures.

for the hedging needs of other firms that may need to be attracted to the market if the market is to exist. Compromises in index design would be possible and perhaps futures on a number of different variables and regions may be required. Compromises are likely to mean that the resulting contracts no longer would provide a perfect hedge for insurance companies.

Given the current role of the US government in the market, improvements are possible without necessarily compromising on the design of indexes. The US government could adopt the role of buyer in these markets. If there is some private interest in operating on the buying side of these markets, the US government could operate in conjunction with private traders. However, if necessary, it could also act as sole buyer. Contracts would be actuarially fair to both sellers and buyers. Rather than facing certain payouts from the operation of the FCIC, the US government would face zero expected payouts. Profits extracted from futures operations could be accumulated in reserves to offset payouts avoiding disruptive claims on government revenue in particular years.

Another difficulty arises from the growing use of insurance contracts based on revenue. If price and quantity for a given commodity are negatively correlated, it is impossible to achieve a perfect hedge through the joint use of price and quantity futures or either future alone. It would be possible to achieve a perfect hedge through basing a futures contract on revenue. There could be some private interest in such markets but again participation by the United States government may be required to make the market.

One of the reasons individual farmers may find it unattractive to use derivatives markets is that there is sufficient variation in risks between farms that none of the available contracts would provide a perfect hedge. However, by pooling risks across farms an insurance firm would be able to extract that part of total risk that is common across farms and a derivative, providing a perfect hedge could be designed. Transactions costs are a further reason that may inhibit the use of derivative markets by individual farmers. Transactions costs would pose a much less serious obstacle to an insurance firm given its much higher level of transactions.

There are also alternatives to developing markets in derivatives. Insurance firms (including the FCIC) could rely on conventional insurance/reinsurance up to some level of possible payouts and then issue bonds to cover additional payouts under catastrophic conditions. These bonds would normally terminate with a coupon payout after one year if a catastrophe did not occur but

in the event of a catastrophe their duration would be extended with the investor at risk of losing some or all of their capital (see Belonsky, Laster and Durbin 1999). Given the novelty of these types of securities, investors have demanded a premium above that which could be justified on the basis of the pricing of other securities. It is expected that the premium demanded will decline as issues of this type become more common.

B

Appendix

Risk pooling and the law of large numbers

Economies from risk pooling are a consequence of the law of large numbers. The law of large numbers makes precise the notion that the average of a sequence of independent and identically distributed random variables will converge on their mean value as the number of variables in the sequence is increased. In its weak form, the law of large numbers may be stated in the following way. Let X_1, X_2, \dots, X_n be a sequence of independent, identically distributed random variables, each with an expected value of μ and a variance of σ^2 . Define the sequence of averages:

$$(19) \quad Y_n = \frac{X_1 + X_2 + \dots + X_n}{n} \quad n = 1, 2, \dots$$

Then, for every $\varepsilon > 0$, $\text{Prob}\{|Y_n - \mu| \geq \varepsilon\} \rightarrow 0$ as $n \rightarrow \infty$.

Now consider the variance of Y_n . Since the X_i are independent, from equation (1) in appendix A:

$$(20) \quad \text{var}[Y_n] = \sum_{i=1}^n \text{var}\left[\frac{X_i}{n}\right] = \sum_{i=1}^n \frac{\sigma^2}{n^2} = \frac{\sigma^2}{n}.$$

Thus, as $n \rightarrow \infty$, $\text{var}[Y_n] \rightarrow 0$.

If the X_i are interpreted as insurance claims by different individuals for a given type of risk, the last result shows that the variance of the average of claims will tend to zero as the number of individuals insured is increased. Thus, the law of large numbers implies that it would be possible to operate an insurance scheme with a given probability of ruin by setting the premium increasingly closer to its actuarially fair value of μ as the number insured is increased. Such a result follows since the density of the average of claims becomes increasingly centred on its mean value of μ as the number insured is increased. Thus, the probability mass attached to other (including possibly ruinous) outcomes is reduced. The law of large numbers has been extended to cases where the sequence of random variables is not independent (Moran 1984).

Output effects of the introduction of insurance

The following simple model extends the model of Ahsan, Ali and Kurian (1982). Farmers are assumed to have an aggregate resource endowment, A_0 , that may be allocated between risky farm production and a riskless alternative. Risky farming is subject to positive but diminishing marginal productivity:

$$(21) \quad F' > 0 \text{ and } F'' < 0.$$

In contrast, the riskless alternative yields the constant rate of return, r .

There are two possible states of nature. In the good state that occurs with probability $(1 - \rho)$, all of farm output, $F(A)$, is retained. In the bad state that occurs with probability ρ , all of farm output, $F(A)$, is lost. In the absence of insurance, farm income is given by:

$$(22) \quad Z_1 = F(A) + r(A_0 - A) \text{ with probability } (1 - \rho)$$

$$Z_2 = r(A_0 - A) \text{ with probability } \rho.$$

Farmers maximise an expected utility function, U , and are risk averse ($U' > 0$ and $U'' < 0$). In the absence of insurance, expected utility is given by:

$$(23) \quad V = (1 - \rho) U(Z_1) + \rho U(Z_2).$$

Actuarially fair insurance

A competitive insurance industry is assumed, offering insurance at a premium of q per unit of A . Insurance firms are assumed to be risk neutral and so maximise expected profits. The expected profits of a typical firm are given by:

$$(24) \quad \begin{aligned} \pi &= (1 - \rho)\alpha(q + s)A - \rho[\alpha F(A) - \alpha(q + s)A] && \text{or} \\ \pi &= \alpha[(q + s)A - \rho F(A)] \end{aligned}$$

where α is the coverage level selected by farmers. A competitive equilibrium in the insurance industry is assumed, resulting in actuarially fair insurance and the zero profits condition:

$$(25) \quad \pi = \alpha[qA - \rho F(A)]$$

With insurance, the income of the farmer is given by:

$$(26) \quad Y_1 = F(A) + r(A_0 - A) - \alpha qA \quad \text{with probability } (1 - \rho)$$

$$Y_2 = \alpha F(A) + r(A_0 - A) - \alpha qA \quad \text{with probability } \rho.$$

The farmer maximises expected utility:

$$(27) \quad \max_{\alpha, A} V = (1 - \rho)U(Y_1) + \rho U(Y_2)$$

subject to the constraint (25) which may be rewritten:

$$(28) \quad q = \rho[F(A)/A].$$

The first-order condition with respect to α is:

$$(29) \quad \frac{\partial V}{\partial \alpha} = -\rho(1 - \rho)F(A)U'(Y_1) + \rho(1 - \rho)F(A)U'(Y_2) = 0.$$

At the optimal value of α , $U'(Y_1) = U'(Y_2)$ which from the concavity of U implies $Y_1 = Y_2$. This requires that $\alpha = 1$. Thus, full coverage is optimal.

The first-order condition with respect to A is:

$$(30) \quad \frac{\partial V}{\partial A} = (1 - \rho)[F'(A) - r - \alpha \rho F''(A)]U'(Y_1) \\ + \rho[\alpha F'(A) - r - \alpha \rho F''(A)]U'(Y_2) = 0.$$

Setting $\alpha=1$, equation (30) implies:

$$(31) \quad (1 - \rho)F'(A) = r$$

since $U'(Y)$ cannot be zero. Equation (31) shows that with full insurance coverage, farmers allocate resources to risky farming up to the point where the expected marginal product is equal to the rate of return on the riskless activity. Such an outcome would have been achieved in the absence of insurance if farmers were risk neutral. Thus, actuarially fair insurance results in the same production decisions by risk averse farmers as risk neutral farmers. The assumed restrictions on U and F ensure that the second-order conditions for the maximisation problem are also satisfied.

To examine the output effects of insurance, the optimal decision problems with and without insurance may be compared. Let the subscript f denote the situation with insurance and the subscript n denote the situation without insurance. In the absence of insurance, the optimal decision problem for the farmer is:

$$(32) \quad \max_A V = (1 - \rho)U(Z_1) + \rho U(Z_2)$$

where Z_1 and Z_2 are as given in (22).

The first-order condition yields:

$$(33) \quad (1 - \rho)[F'(A_n) - r]U'(Z_1) = \rho r U'(Z_2).$$

Since $Z_1 > Z_2$ (and, hence, $U'(Z_1) < U'(Z_2)$) from the concavity of U , the condition:

$$(34) \quad F'(A_n) > \left(\frac{r}{1 - \rho} \right)$$

must hold if (33) is to be satisfied. However, with insurance $F'(A_f) = r/(1 - \rho)$ from (30). Thus, with the diminishing marginal productivity of F :

$$(35) \quad A_f^* > A_n^*$$

where the asterisks denote optimal values. Thus, farm output is higher with insurance than in its absence.

Subsidised insurance

Suppose now that insurance premiums are subsidised and the farmer pays less than an actuarially fair premium. Let s be the subsidy per unit of A . Profits of insurance companies are now given by:

$$(36) \quad \pi = (1 - \rho)\alpha(q + s)A - \rho[\alpha F(A) - \alpha(q + s)A] \quad \text{or} \\ \pi = \alpha[(q + s)A - \rho F(A)].$$

Using the zero profits condition, the premium paid by the farmer, q may be written as

$$(37) \quad q = \frac{\rho F(A)}{A} - s.$$

Since with the subsidy each dollar paid by the farmer in premiums yields more than one dollar in insurance payouts, it would be expected that the farmer would wish to overinsure (that is, select a coverage ratio greater than 100 per cent). Solving the farmer's optimisation problem given by (27) subject to (37) yields the first order condition with respect to α of:

$$(38) \quad \frac{\partial V}{\partial \alpha} = -(1 - \rho)A \left[\frac{\rho F(A)}{A} - s \right] U'(Y_1) \\ + \rho \left[F(A) - A \left(\frac{\rho F(A)}{A} - s \right) \right] U'(Y_2) = 0.$$

This equation may be rewritten as:

$$(39) \quad (\rho F(A) - sA)U'(Y_1) = \rho F(A)(U'(Y_2)).$$

Since $\rho F(A) - sA < \rho F(A)$ if $s > 0$, it must be that $U'(Y_1) > U'(Y_2)$ if (39) is to hold. This implies $Y_2 > Y_1$ from the concavity of U . From (26), $Y_2 > Y_1$ can occur if and only if $\alpha > 1$. Thus, farmers will wish to overinsure with subsidised premiums.

To investigate the effects of premium subsidies on the level of output, it is assumed that the authorities will not permit overinsurance and set the cover-

age level at 100 per cent. The farmer must choose A to maximise expected utility subject to (37) with $\alpha = 1$ which yields:

$$(40) \quad \frac{\partial V}{\partial A} = (1 - \rho)[(1 - \rho)F'(A) + s - r]U'(Y_1) \\ + \rho[(1 - \rho)F'(A) + s - r]U'(Y_2) = 0.$$

Since it is known from (26) that if $\alpha = 1$, $Y_1 = Y_2$ (and, hence, $U'(Y_1) = U'(Y_2)$), equation (40) implies:

$$(41) \quad F'(A) = \frac{r - s}{(1 - \rho)}$$

In the case of actuarially fair insurance, $F'(A_f) = \rho/(1 - \rho)$ from (31). Thus, comparing (31) and (41), $F'(A_s) < F'(A_f)$ where the subscript s is used to denote subsidised insurance. Given diminishing marginal productivity:

$$(42) \quad A_s^* > A_f^*.$$

Thus, farm production will be higher under subsidised insurance with full coverage than under actuarially fair insurance with full coverage. Furthermore, from (41) it is apparent that the optimal level of subsidised production increases with the level of the subsidy. The level of farm production under actuarially fair insurance with risk averse farmers was the same as would occur if farmers were risk neutral. Under subsidised insurance the level of farm production exceeds the risk neutral level and corresponds to a level that would be adopted only by risk preferring farmers.

Disaster relief

It is now assumed that there is no insurance but disaster relief of the amount, D , is made available in the bad state. Farm income is now given by:

$$(43) \quad Z_1 = F(A) + r(A_0 - A) \\ Z_2 = r(A_0 - A) + D.$$

It is assumed that D is chosen such that $Z_2 < Z_1$ and farmers are aware D will be provided in the bad state when making their production decisions.

Expected utility is now given by:

$$(44) \quad V = (1 - \rho)\{U[F(A) + r(A_0 - A)]\} + \rho\{U[r(A_0 - A) + D]\}.$$

The first order condition for maximisation with respect to A yields:

$$(45) \quad F'(A)U'(Y_1) = \frac{r}{1 - \rho}U'(Y_2).$$

The same condition would apply in the absence of disaster relief but $U'(Y_i)$ would be evaluated at different values of Y_i . If Y_{2D} is income in the bad state with disaster relief and Y_{2N} income in the absence of disaster relief, $Y_{2D} > Y_{2N}$. From the concavity of U it follows that $U'(Y_{2D}) < U'(Y_{2N})$. Thus, for the equality in (45) to hold it must be that $F'(A_D) < F'(A_N)$. This implies $A_D > A_N$ given the concavity of F . Hence, more of the variable input is devoted to farming when disaster relief is introduced.

Premium subsidies versus disaster relief

Suppose that the total amount of premium subsidy is set equal to the amount that would be paid in disaster relief. This implies:

$$(46) \quad (1 - \rho)sA + \rho sA = D$$

yielding $s = D/A$.

In the case of subsidies it was shown in (41) that:

$$(47) \quad F'(A) = \frac{r - s}{(1 - \rho)}$$

which implies $F'(A_s) < r/(1 - \rho)$ where A_s denotes the amount of the variable input allocated to farming under premium subsidies.

In the case of disaster relief, it was assumed that $Y_2 < Y_1$ implying $U'(Y_2) > U'(Y_1)$. If equality in (45) is to hold it must be that $F'(A_D) < r/(1 - \rho)$ which reverses the inequality under premium subsidies. From the concavity of F it follows that $A_s > A_D$. Thus, switching a given amount of funds from disaster

relief to subsidising insurance premiums would result in more of the variable input being allocated to farming.

The intuition for the above result is straightforward. In the case of subsidised premiums it was assumed that farmers always contribute to the premium. Thus, a greater reduction in the variance of income is achieved under subsidised premiums than disaster relief resulting in a greater increase in output.

Glossary

<i>Aggregate measure of support (AMS)</i>	The measured level of domestic support that is subject to limitations and reductions under the WTO Agreement on Agriculture. It is applied for a member's agriculture as a whole but is determined from the sum of commodity specific AMS levels and non commodity specific nonexempt support. Commodity specific AMS levels are the sum of price support and nonexempt commodity specific subsidies, less specific agricultural levies or fees paid by producers. In turn, price support is the difference between administered support prices and constant external reference prices (import parity for net importers and export parity for net exporters) that are maintained at the average for the 1986–88 base period, multiplied by the quantity of production eligible to receive the administered support prices.
<i>'Amber box' support</i>	Domestic support that is permitted but is acknowledged to be market distorting under the WTO Agreement on Agriculture. Amber box support is measured by the AMS and is subject to agreed limits and cuts to those limits.
<i>Base period</i>	The time period(s) agreed during the negotiations as the basis on which all reductions and commitments are made. For the WTO Agreement on Agriculture, the base period for market access and domestic support commitments is 1986–88; for export subsidy commitments, the base period is 1986–90.
<i>'Blue box' exemption</i>	Within the WTO Agreement on Agriculture, support under production limiting programs is exempted from the AMS for domestic support if certain conditions are met. Those conditions are: (i) such payments are based on fixed area and yields; or (ii) such payments are made on 85 per cent or less of the base level of production; or (iii) livestock payments are made on a fixed number of head.

<i>Bound tariff rate</i>	The maximum tariff rate that a WTO member undertakes to apply. The bound rate provides a ceiling that applied tariff rates cannot exceed except by negotiation, with compensation for affected trading partners.
<i>Decoupling</i>	The provision of support to producers that is not linked to variables that affect markets including production, prices, trade or factors used in production. Such support could be expected to be less market distorting than support that is linked to those variables.
<i>De minimis</i>	Under the WTO Agreement on Agriculture, support can be excluded from the calculation of the AMS and exempt from reduction commitments for domestic support if that support is below a set proportion of the value of the relevant agricultural production. That proportion is 5 per cent for industrialised countries for each of product specific and non product specific support. For developing countries, the rate is 10 per cent for each of the two categories.
<i>Export subsidies</i>	Government payments or other financially quantifiable benefits provided to domestic producers or exporters contingent on the export of their goods or services.
<i>Externalities (spillovers)</i>	Any benefits or costs associated with the production or consumption of a product that are not incorporated in the price or cost of the product.
<i>Food security</i>	The ability of all people at all times to have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO 1996). Food security therefore deals with people's ability to access food, regardless of where the food is produced.
<i>'Green box' exemptions</i>	Under the WTO Agreement on Agriculture, certain measures meeting specified criteria are exempt from domestic support reduction commitments. These conditions are set down in annex 2 of the agreement. The measures were agreed to be minimally trade distorting. Broad categories of such measures include government service programs, public stockholding for food security, domestic food aid, direct payments to producers

	that meet specified criteria, decoupled income support, government financial participation in income insurance and income safety-net programs, payments for relief of natural disasters, structural adjustment assistance through producer retirement programs, structural adjustment assistance through resource retirement programs, structural adjustment assistance through investment aids, payments under environmental programs and payments under regional assistance programs.
<i>Implementation period</i>	The period over which the provisions of an agreement are put into effect. For the WTO Agreement on Agriculture, the implementation period is from 1995 to 2000 (inclusive) for industrialised members and from 1995 to 2004 for developing members.
<i>Marginal cost</i>	The additional cost that a producer incurs in making one additional unit of output.
<i>Marginal revenue or returns</i>	The additional revenue that a seller receives from putting one more unit on the market.
<i>Multifunctionality</i>	Any unpriced spillover effects that are additional to the provision of food and fibre in agricultural production. These include environmental and social effects. Some countries also include food security.
<i>Multilateral trade negotiations</i>	Seven rounds of multilateral trade negotiations have been held under GATT auspices since 1947. Each round represented a discrete and lengthy series of interacting bargaining sessions among the contracting parties in search of mutually beneficial agreements looking toward the reduction of barriers to world trade.
<i>Nontariff barriers or measures</i>	Government measures other than tariffs that restrict imports. Examples include quantitative restrictions, import licensing, voluntary restraint arrangements and variable levies. For the purposes of the Uruguay Round, nontariff measures also include domestic support arrangements that distort or impede trade, such as price support programs and production subsidies.

<i>Price support</i>	In broad terms price support signifies the maintenance of internal prices at levels above those on the world market as a result of government measures. For calculating the AMS for specific commodities under the WTO Agreement on Agriculture, price support has a more specific meaning. It is the gap between a fixed external reference price for the base period (1986–88) and the applied administered support price multiplied by the quantity of production eligible to receive the applied administered price.
<i>Quota</i>	A prescribed quantity that is allowed to be produced, or traded.
<i>Risk aversion</i>	A risk averse individual would prefer an action that yields a sure return to another action that yields a risky return with the same expected value as the sure return.
<i>Special and differential treatment</i>	The concept that developing countries' exports should be given preferential access to markets of developed countries and that developing countries participating in trade negotiations need not fully reciprocate concessions they receive.
<i>Tariff</i>	A duty (or tax) levied on goods transported from one customs area to another. Tariffs raise the prices of the imported goods, thus making them less competitive in the importing country.
<i>Tariff quota</i>	Application of a reduced tariff rate for a specified quantity of imported goods. Imports above this specified quantity face a higher tariff rate.
<i>Tariffication</i>	Conversion to tariffs of nontariff measures applying to particular products and the opening of current or minimum access opportunities for these products.
<i>Voluntary export restraint</i>	A mechanism whereby an industry in an exporting country undertakes not to export more than a specified quantity of a product to a particular importing country over a given period. The undertaking is often made under threat of some penalty if the limitation were breached.

<i>World Trade Organisation (WTO)</i>	The institution established at the beginning of 1995 to cover a range of objectives concerning international trade. It subsumes the General Agreement on Tariffs and Trade which was formed in 1947. Its objectives include: to set rules for international trade and trade related activities; to provide a forum to negotiate trade liberalisation multilaterally; to settle trade disputes between contracting parties; to provide information on trade and trade policies; and to cooperate with other multilateral institutions (Anderson 1996).
<i>WTO Agreement on Agriculture</i>	The agreement on agriculture that was negotiated in the in the Uruguay Round and that was ratified in 1994.

The above definitions for base period, export subsidies, multilateral trade negotiations, nontariff measures, special and differential treatment and tariff quota are drawn from, or based on Young (1994). The definitions for marginal cost and marginal revenue come from Sabin and Warren (1983).

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