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OECD Domestic Support and Developing Countries

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Abstract

An AGE model with detailed farm supply and substitution relationships is used to analyze impacts of OECD domestic support reform on developing economy welfare. Stylized simulations indicate reforms best suited for reducing trade distortions with least impact on farm incomes. Comprehensive reforms result in welfare losses for LDCs and large declines in OECD farm incomes. Shifting from market price support to land-based payments designed to maintain farm incomes results in increased welfare for most developing countries. LDCs should focus on improved market access to OECD economies while permitting said economies to continue domestic support payments not linked to output/variable inputs.

Keywords: domestic support, OECD, developing countries, agricultural trade, WTO

JEL classification: D58, F13, F14, O19, Q17

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1 Introduction

Most studies of global agricultural trade liberalization are primarily focused on market price support – that is agricultural support provided indirectly through border measures, either import barriers or export subsidies, designed to boost domestic market prices, relative to world prices (for example, Tyers and Anderson 1992; Martin and Winters 1986). In the late 1980s, this form of support accounted for about 75 per cent of total Producer Support in agriculture in the member countries of the Organization for Economic Cooperation and Development (OECD) (OECD 2002). Prior to the Uruguay Round Agreement on Agriculture (URAA), this was also the only area of agricultural protection under negotiation in the international arena. A very important innovation in the URAA was to put domestic subsidies on the table. More specifically, support policies are placed in 'boxes' according to their impact on international trade. Those policies that have 'no, or at most minimal trade-distorting effects or effects on production' are placed in the green box and are not subjected to reduction requirements under the URAA. Those policies that are deemed to be trade distorting are placed in the amber box and are subjected to reductions. However, if the payments are accompanied by programmes aimed at limiting production, they may be placed in yet a third box, the blue box. As a consequence, they are exempt from the negotiated reductions in support. This third box has since come under scrutiny and there have been proposals to subject it to successive reductions as well – or potentially eliminate this box altogether.

As a result of the URAA, the share of producer support provided by market interventions has gradually fallen, so that it now accounts for only two-thirds of total support (OECD 2002). This trend may continue as proposed EU reforms involve further efforts to 'decouple' support from world prices (*The Economist*, July 2002).[1] The goal of this paper is to assess the likely impact of such decoupling on developing country welfare. In the process of making this assessment, we also pay special attention to the impact of reforms on real farm income in the reforming OECD countries, as the farm lobby is a powerful political force and operates as an important constraint on reform efforts. Due to these dual objectives of the paper, there are necessarily two rather distinct parts to our analysis. First, we must assess direct impact of domestic support in the OECD countries on OECD agriculture – specifically farm incomes, production and subsequently trade. Then we must assess the impact of these changes on the developing countries. However, before embarking on this analysis, we first turn to an historical overview of domestic support and OECD trade with developing countries.

2 Background on domestic support and developing country trade

2.1 Overview of domestic support in the OECD

The OECD uses the concept of Producer Subsidy Estimates (PSE) as the principal indicator in monitoring and evaluating agricultural policy developments. The PSE is 'an indicator of the monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at the farm-gate level, arising from policy measures

[1] More recently it appears that France and Germany will oppose such reforms (*The Economist*, 2003).

that support agriculture, regardless of their natures, objectives or impacts on farm production or income'. It comprises market price support, payments based on output, payments based on area planted/animal numbers, payments based on historical entitlements, payments based on input used, payments based on input constraints, payments based on overall farming income, and miscellaneous payments (OECD 2001). The different measures vary in terms of their effects on farm income in the OECD countries, as well as their effects on trade and hence their impact on the welfare of developing countries.

Table 1 presents the changes in the overall PSE and its component parts for selected OECD countries in 1987 and 2000. The PSEs are smallest for Australia and New Zealand. These are largely made up of market price support and variable input subsidies. In Australia, for both years, the majority of market price support has been applied to grains and milk, while most of the applications of subsidies on variable inputs are applied to meat and meat products. By 2000 most of the PSE had been eliminated in New Zealand, with large reductions in variable input subsidies in meat and meat products. In the case of Japan and Korea, the PSEs have remained relatively unchanged both in level and in composition. The PSE rates have been highest historically for Switzerland, but here a fair amount of decoupling has occurred, with the share of market price support in the total falling from 82 per cent in 1987 to 59 per cent in 2000.

Table 1
Producer subsidy equivalent and components, 1987 and 2000
Per cent share in PSE by support type

			Per cent share in PSE by support type				
OECD region	Year	PSE %	Market price	Output	Variable input	Land based	Historical entitlement
Australia	1987	7.87	42.23	0	36.57	0	0
	2000	5.56	24.48	2.76	49.66	2.06	5.04
Canada	1987	35.84	49.80	18.84	14.09	15.36	0
	2000	19.50	51.22	7.12	6.43	7.63	11.29
EU15	1987	45.02	85.92	5.51	5.49	2.74	0
	2000	38.34	58.75	5.22	6.64	25.42	0.64
Japan	1987	67.28	90.68	2.56	3.95	0	0
	2000	64.06	91.05	2.80	4.34	0	0
Korea	1987	69.47	98.76	0	0.78	0	0
	2000	72.56	95.86	0	2.45	0	0
New Zealand	1987	8.87	26.79	0	70.36	0	0
	2000	0.74	54.43	0	40.31	0	0
Switzerland	1987	72.96	81.53	1.31	8.56	6.06	0
	2000	71.38	59.09	3.96	5.64	11.27	15.86
United States	1987	27.01	50.82	5.69	14.21	26.60	0
	2000	21.94	32.01	18.85	13.61	7.18	21.51

Source: OECD PSE/CSE Database 2001.

It is in the USA, Canada and the European Union (EU) where sizable cuts in the PSE show up over this period – although the recent Farm Bill in the USA has reversed this trend for that country. In the EU, there has been a decided shift in composition of support with the share provided by market price support falling in favour of increased

land- and headage-based payments. In Canada, market price support as a PSE share is nearly the same but market price support for grains has been greatly reduced while there has been a large increase in milk MPS. Most support in Canadian grains is now provided via input (including land) and output subsidies, as well as historical entitlements. In the US, the PSE has been more moderately reduced with a large portion of the reduction coming from the elimination of market price support. In 2000 historical entitlements had become a much more important component of the PSE in US grains.

This change in the mix of producer support in some of the OECD countries is potentially quite important. It is also expected to continue – and perhaps accelerate – under a new WTO round. What impact have these historical changes had on world markets? What about prospective changes? For insights on the potential impact of changes in the level and mix of domestic support, we turn below to the existing literature on this topic. But first, let us consider the potential impact that these reforms will have on developing countries. To understand this, we must first examine the trade links that will transmit price and quantity changes from OECD countries to developing countries.

2.2 Overview of developing country trade patterns

Developing countries are an enormously diverse group. Some are net exporters, and some are net importers of the temperate products that OECD countries tend to protect. Some are closely tied into the OECD markets – by virtue of geography or perhaps historical trade preferences. Others are more reliant on other developing countries for their food supplies and export markets. The strength of the trade links of a developing country with the OECD countries will play an important role in the impact of OECD domestic support reform on the developing country. This section provides an overview of the trade patterns of developing countries vis-à-vis the OECD countries in agriculture and food products. Data are summarized for the regional and commodity aggregation used in the study provided in Table 2.

Table 3 reports the average trade specialization indices for three decades over the period ranging from 1966 to 1998 for the aggregated regions in this study. Trade specialization indices are calculated as: (X - M) / (X + M) where X are exports and M are imports. The value of the index ranges from -1 for a country which imports, and does not export, a particular commodity and +1 for a country which is specialized as an exporter of the commodity. Table 3 separately identifies the aggregated commodity groups – programme commodities,[2] livestock and meat products, and other agriculture and food products. Among the developing countries, Argentina has maintained its export specialization in programme crops over the period. Economic reforms in Vietnam and India have permitted these countries to shift from being moderate net importers to being net exporters of programme crops. The net export position of the ASEAN4 region has seen a decline over the period and Indonesia's net import position is worsened. China's net export position has improved. The Middle East/North Africa (MENA) region has

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2 The programme commodities referred to in this paper are composed of paddy rice, wheat, cereal grains, oilseeds, raw sugar, processed rice, and refined sugar. The first four are the crops for which the GTAP database has OECD domestic support data. Processed rice and refined sugar are included since these are the traded form of rice and sugar, respectively.

Table 2
Regional and sectoral aggregation

OECD countries	
ANZ	Australia and New Zealand
Japan	Japan
Korea	South Korea
USA	United States
Canada	Canada
Mexico	Mexico
EU15	European Union
EFTA	European Free Trade Area
CEU	Hungary and Poland
Turkey	Turkey
Developing countries	
China	China
Indonesia	Indonesia
Vietnam	Vietnam
ASEAN4	Malaysia, Philippines, Singapore, Thailand
India	India
RsoAsia	Rest of South Asia
Argentina	Argentina
Brazil	Brazil
RlatAm	Rest of Latin America
FSU	Former Soviet Union
MENA	Middle East and North Africa
Tanzania	Tanzania
Zambia	Zambia
R_SSA	Rest of sub-Saharan Africa
ROW	Rest of World
Programme commodities	
pdrice	paddy rice
wheat	wheat
crsgrns	cereal grains nec.
oilsds	oilseeds
rawsgr	sugar cane, sugar beet
pcrice	processed rice
refsgr	sugar
Livestock and meat products	
ruminants	cattle/sheep, wool
nonrumnts	animal products nec.
rawmilk	raw milk
rummeat	meat: cattle/sheep
nrummeat	meat products nec.
dairy	dairy products
Other agriculture and food	
othcrops	vegetables and fruits, plant-based fibers, other crops
vegoilfat	vegetable oils and fats
othprfood	other processed food
mnfc	manufactures
srvc	services

Table 3
Trade specialization indices: (X-M)/(X+M)

Regions	Programme commodities			Livestock and meat products			Other agriculture and food regions		
	1965-75	1976-85	1986-98	1965-75	1976-85	1986-98	1965-75	1976-85	1986-98
Aus/NZ	0.95	0.97	0.94	0.99	0.98	0.98	0.13	0.10	0.32
Japan	-0.94	-0.96	-1.00	-0.96	-0.96	-0.96	-0.60	-0.67	-0.82
Korea	-0.90	-0.82	-0.90	-0.14	-0.73	-0.85	-0.23	-0.23	-0.21
USA	0.59	0.78	0.81	-0.04	0.16	0.24	-0.08	-0.04	0.00
Canada	0.55	0.72	0.76	0.13	0.32	0.40	-0.18	-0.18	-0.09
Mexico	0.19	-0.87	-0.83	0.03	-0.41	-0.54	0.66	0.56	0.36
EU15	-0.74	-0.56	-0.27	-0.49	-0.05	0.13	-0.48	-0.37	-0.17
EFTA	-0.91	-0.89	-0.76	-0.08	-0.02	-0.04	-0.27	-0.27	-0.08
CEU	-0.51	-0.71	0.03	0.57	0.44	0.50	-0.20	-0.28	-0.15
Turkey	-0.54	0.25	-0.51	0.04	0.55	-0.32	0.86	0.79	0.43
China	-0.17	-0.55	-0.18	0.87	0.69	0.38	0.22	0.36	0.28
Indonesia	-0.57	-0.88	-0.88	0.13	-0.11	-0.30	0.74	0.71	0.52
Vietnam*	n.a.	-0.37	0.85	n.a.	-0.65	-0.01	n.a.	-0.10	0.48
ASEAN4	0.58	0.49	0.20	-0.74	-0.30	-0.34	0.48	0.55	0.38
India	-0.58	-0.15	0.43	-0.40	-0.24	-0.10	0.43	0.24	0.44
RsoAsia	-0.59	-0.16	-0.40	-0.43	-0.70	-0.67	0.45	0.13	-0.02
Argentina	0.97	0.99	0.96	0.99	0.92	0.75	0.64	0.71	0.78
Brazil	0.58	0.15	0.29	0.51	0.47	0.35	0.79	0.85	0.66
RlatAm	0.36	0.07	-0.08	-0.17	-0.23	-0.23	0.56	0.56	0.57
FSU	n.a.	n.a.	-0.63	n.a.	n.a.	-0.59	n.a.	n.a.	-0.31
MENA	-0.91	-0.97	-0.94	-0.80	-0.94	-0.87	-0.01	-0.54	-0.45
Tanzania	n.a.	n.a.	-0.40	n.a.	n.a.	0.18	n.a.	n.a.	0.69
Zambia	-0.35	-0.40	-0.40	-0.88	-0.78	-0.59	-0.38	-0.15	0.34
R_SSA	0.39	-0.13	-0.17	0.37	-0.05	-0.25	0.68	0.54	0.53
ROW	-0.10	-0.43	-0.66	-0.27	-0.50	-0.45	-0.16	-0.25	-0.43

Source: Authors' calculations from bilateral time series data in GTAP 5 data package.

Note: * The time series trade data for Vietnam starts in 1976 while that for the Former Soviet Union and Tanzania start in 1992.

been a consistently strong net importer of programme commodities. Among the OECD countries, Australia/New Zealand (ANZ) has been consistent in its net export position. The USA and Canada's net export position has strengthened over the period. The EU15 and EFTA have substantially reduced their net imports as a share of total trade, while Japan and Korea remain consistent net importers of programme commodities over the entire period. Overall, we conclude that increased domestic support for programme crops appears to have contributed to improvements in the net trade position of the OECD countries in programme crops, at the expense of developing countries.

Turning next to livestock products, we see from Table 3 that China, Argentina and Brazil are net exporters. The specialization indices for these countries, however, have declined over the years. On the other hand, the net import positions of India and ASEAN4 in these products have diminished markedly. In the OECD countries, the ANZ region stands out as a strong net exporter of livestock and meat products. Japan is a strong net importer and Korea's net import position has increased over the period. On the other hand, the USA, Canada and the EU have seen increases in their trade specialization indices over the period. Increased domestic support for livestock products in these countries appear to have contributed to their net export position.

Most of the developing countries are consistent net exporters of the aggregate group of other agriculture and processed food products. Among the OECD countries, Mexico, Turkey and ANZ are net exporters while the other OECD countries in our aggregation are net importers. Thus we have a rough division between temperate products (programme crops and livestock), where OECD domestic support plays an important role and where developing countries are largely net importers, and tropical products for which developing countries are largely net exporters.[3]

Focusing next on developing country bilateral trade with the OECD, Table 4 reports separately the share of each developing country's total trade that is specifically with OECD countries. Tanzania, Zambia, and Indonesia rely on the OECD market as a destination for more than three-quarters of their exports of programme commodities. On the other end of the scale are Vietnam, Argentina, and the rest of South Asia, of which each rely on the OECD market as destination for less than a quarter of their programme commodity exports. This indicates that a strong net exporter like Argentina competes with the OECD in third markets for programme commodities. On the import side, the OECD is the source of more than two-thirds of total programme commodity imports of countries like China, Indiana and the rest of South Asia and MENA region. For these countries, reductions in domestic support for OECD agriculture will mean higher priced imports. Reforms in OECD market price support may significantly affect the trade patterns in these countries.

Table 4
Share of developing country trade with OECD, 1997

Developing countries	Programme commodities		Livestock and meat		Other agriculture and food	
	Exports*	Imports**	Exports*	Imports**	Exports*	Imports**
China	52	76	60	85	55	44
Indonesia	78	58	69	95	27	44
Vietnam	13	56	7482	24	40	
ASEAN4	40	48	54	71	47	44
India	27	75	5285	31	24	
RsoAsia	23	66	61	81	62	18
Argentina	23	58	38	35	57	36
Brazil	48	21	71	33	50	36
RLatAm	47	63	77	69	47	51
FSU	37	23	50	80	48	63
MENA	43	66	73	80	66	60
Tanzania	89	31	54	60	54	25
Zambia	86	7	69	93	65	43
R_SSA	63	49	77	82	69	62
ROW	62	73	59	66	62	61

Source: Authors' calculations from GTAP 5 Data Base.

Notes: * Exports to OECD countries as share of each developing country's total exports of the commodity group. ** Imports from OECD countries as share to each developing country's total imports of the commodity group.

3 In order to keep the tables manageable, the other agriculture category also includes food products. If this latter were removed, we would see even more significant net exports from the developing countries.

Even greater dependence on the OECD countries as an import source is exhibited by countries like China, Indonesia, Vietnam, South Asia, FSU, MENA, Zambia and the rest of sub-Saharan Africa in the case of livestock and meat products, with each importing more than 80 per cent of their total imports of these commodities from the OECD. Bilateral exports and imports of developing countries for other agriculture and food commodities are generally less concentrated on the OECD.

Within the group of programme commodities and OECD countries, there is also a great deal of heterogeneity regarding the bilateral trading patterns of developing countries. Table 5 reports the shares of bilateral trade of the developing countries with three major OECD members – Japan, USA and EU – for wheat, a commodity which receives significant OECD border protection and domestic support. The first two columns of data report each developing country's share of world trade in 1997 in wheat while the next six columns report the share of each OECD country as export destination or import source of each developing country's total trade in wheat. Developing countries as a group export 14 per cent and import 54 per cent of total wheat traded in the world. The USA and EU each account for a quarter of total world wheat exports. Argentina has an 8.8 per cent share of total wheat trade but its export share to the OECD countries is very small, Argentina relies on markets other than these three OECD regions. The MENA region imports 21 per cent of the total wheat traded. Thirty per cent of its wheat imports are sourced from the US and 18 per cent from the EU. The ASEAN4, rest of South Asia, and rest of Latin America each account for roughly 4 per cent share of world wheat imports. The US provides around half of total wheat imported by these countries.

The data examined for wheat in this section of the paper is representative of the broader picture of OECD – developing country agricultural trade linkages that are quite important for many products. In the more general case of OECD supported programme crops and livestock products, many developing countries rely heavily on the OECD for a large share of their imports. These countries may well be hurt by the current trend towards decoupling domestic support from production decisions as OECD supply prices are likely to rise as a consequence. On the other hand, those developing countries that rely heavily on the OECD as an export destination, or that compete with OECD products in third markets stand to gain from measures that decouple domestic support from production decisions.

We turn now to a review of the literature analyzing the impact of domestic support on production decisions in OECD agriculture.

3 Literature review

The earliest work assessing the impact of different methods of agricultural support on prices, and factor returns in agriculture is that of Floyd (1965). He compared the impact of price supports with output restrictions and mandatory land retirement. He does not consider the possibility of producer payments based on land use. However, we have seen above, input-based payments have become increasingly common in recent years. Hertel (1989) develops a series of propositions relating to the impacts of a wider range of support measures on production, net exports, employment, land rents and farm income. He places these on both an equal cost and equal PSE basis for a single product, agricultural sector in the absence of pre-existing support. A few key points emerge from

Table 5
Shares of developing country trade, 1997

Developing countries	Shares of total world trade		Shares of total developing country trade					
			Japan		USA		EU	
	X	M	X	M	X	M	X	M
				Wheat				
China	0.1	3.2	15	0	16	11	39	2
Indonesia	0.0	3.1	14	0	14	1	35	0
Vietnam	0.0	0.0	17	0	25	41	29	0
ASEAN4	0.1	3.7	0	0	0	52	00	
India	0.2	1.1	8	0	9	0	22	0
RsoAsia	0.0	4.4	14	0	15	46	36	6
Argentina	8.8	0.0	0	0	0	0	1	0
Brazil	0.1	4.1	0	0	0	0	0	0
RlatAm	0.5	4.9	1	0	1	45	4	10
FSU	2.5	2.3	0	0	0	11	1	12
MENA	1.4	21.1	4	0	5	30	12	18
Tanzania	0.0	0.1	12	0	12	0	30	0
Zambia	0.0	0.0	0	0	0	0	0	0
R_SSA	0.1	3.2	1	0	1	35	2	33
				Sugar				
China	1.3	2.1	4	1	2	0	5	3
Indonesia	0.3	2.8	33	0	4	1	10	5
Vietnam	0.1	0.0	5	0	20	0	9	1
ASEAN4	9.3	2.3	18	0	9	0	1	6
India	2.0	0.6	2	0	5	0	31	13
RsoAsia	0.6	2.7	2	0	2	0	73	8
Argentina	0.6	0.1	0	0	43	0	0	2
Brazil	14.7	0.0	0	0	7	6	2	12
RlatAm	18.1	3.9	3	0	26	6	18	3
FSU	2.4	9.1	0	0	0	0	3	11
MENA	0.9	15.5	8	0	9	0	29	47
Tanzania	0.1	0.4	6	0	6	0	78	1
Zambia	0.2	0.0	0	1	0	2	97	17
R_SSA	7.6	4.9	4	0	10	0	61	35
				Rice				
China	6.3	3.2	10	1	6	0	14	0
Indonesia	1.2	1.3	16	0	16	0	39	0
Vietnam	4.8	0.0	0	3	7	0	1	0
ASEAN4	18.6	8.8	5	0	13	1	12	0
India	17.0	0.0	1	6	4	0	13	13
RsoAsia	6.3	2.3	1	0	3	0	4	0
Argentina	3.1	0.1	0	4	1	2	0	1
Brazil	0.1	3.7	5	0	6	1	15	0
RlatAm	7.3	6.8	1	0	1	48	24	1
FSU	0.3	2.0	5	1	5	4	13	8
MENA	1.3	12.9	2	0	2	10	3	4
Tanzania	0.0	0.3	16	0	16	0	40	0
Zambia	0.0	0.0	12	1	17	0	20	30
R_SSA	0.6	4.7	10	2	13	22	24	3

Source: Authors' calculations from GTAP 5 Data Base.

this paper. First of all, subsidies on variable inputs that substitute for fixed factors (for example, land) in agriculture have a greater impact on output, and hence trade, than do equal cost output subsidies. Such variable input subsidies also moderate the share of producer support that accrues to land and other fixed factors. On the other hand, subsidies to land, such as the per hectare payments currently made in the EU, have a more modest effect on output, while leading to higher land rents than under an equal cost output subsidy. Finally, when compared to an output subsidy of equal cost, export subsidies have a larger impact on exports, agricultural production, employment, and land rents, provided the elasticity of export demand exceeds the domestic demand elasticity.

Subsequent work in this area has been largely computational in nature. Abler and Shortle (1992) focus their attention on the relationship between chemical restrictions and existing farm programmes in the US and the EU. They find that unilateral restrictions on chemical usage benefit US farmers, while leading to losses on the part of EU producers. Gunter *et al*. (1996) focus on input market interventions as well, evaluating their impact on competing policy goals in the context of a three region, US-EU-ROW, partial equilibrium model of wheat markets. Of special interest for the present paper is the recently completed OECD (2001) report on 'Market Effects of Crop Support Measures'. In this report, the authors compare the impacts of a wide range of producer support across OECD countries. They find that the movement from market price support and output subsidies to land-based payments is a 'win-win' scenario in most countries – with farm income rising and world price impacts of support falling.[4] From the point of view of this paper, this suggests an interesting possibility, namely that re-instrumentation of producer support for agriculture in OECD countries could conceivably maintain OECD farm incomes, while contributing to enhanced welfare on the part of developing country exporters. This hypothesis will be explored in greater detail below.

In a separate study, also undertaken by the OECD Agriculture Directorate, Thompson and Smith (2002) study the impact of further agricultural trade reforms on developing countries. They use two modelling frameworks. The OECD AgLink model is used to examine the impacts of reductions in market price support, while the GTAP model is used to examine the impacts of cuts in both market price support and direct payments to producers. They look at relatively broad groups of developing countries, and they do not consider more elaborate reforms in which the mix of measures is changed in an attempt to maintain farm incomes.

In contrast, Frandsen *et al*. (2002) use a modified version of the GTAP model to examine the impact of further decoupling of domestic support in the EU. Their emphasis is on the budgetary and macro-economic effects of these policy reforms among OECD countries. They argue that further decoupling of EU agricultural policies would reduce budgetary exposure in the EU as well as bringing it into compliance with potentially stricter WTO disciplines on domestic support. They also find rather substantial changes in world prices – particularly for meat products, although they do not examine the issue of overall developing country welfare explicitly, and they restrict themselves to EU reforms.

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4 One cautionary note – as anticipated in the results of Hertel (1989) is that a shift towards variable input subsidies could have the opposite effect – with larger world price impacts and smaller farm-income benefits

The goal of this paper is to assess the impact of changes in both the mix and the level of domestic support in OECD countries on the welfare of farm households in the OECD and on the national welfare of developing countries. Therefore, it is not enough to say that world prices will rise or they will fall. The welfare impacts on developing countries will depend on whether they are net exporters or net importers of protected products. It will also depend on the bilateral trade patterns discussed in Section 2. Are they closely tied into the OECD markets in which these changes occur? In short, we need a global trade model with bilateral trade flows explicitly treated. One such framework is offered by the Global Trade Analysis Project (GTAP) database and associated models, used by a number of the preceding studies.

Since the early 1990s, there has been a large number of global, general equilibrium, analyses of trade liberalization – some of which include domestic support (these include Francois *et al*. 1996; Hertel *et al*. 1996; Harrison *et al*. 1996; Anderson *et al*. 1999; Elbehri *et al*. 1999; Hertel and Martin 1999; Anderson *et al*. 2001; Rae and Strutt 2002). Most of these studies are based on the GTAP database and modelling framework. However, the GTAP database has not been particularly well-suited to the analysis of domestic support issues. Versions 1–4 of the GTAP database treated all domestic support as an output subsidy. Version 5 introduced a first-cut disaggregation of support across inputs (Dimaranan 2002), but it still suffers from some important limitations (Gehlhar and Nelson 2001; Frandsen *et al*. 2001). Furthermore, the standard GTAP model is not well-suited to analysis of domestic support issues, due to its relatively simplistic treatment of factor markets. One contribution of the present paper is to address these limitations. Thus we now turn to the issue of model design.

4 Methodology

4.1 Model design

For purposes of this study, we have constructed a special purpose version of the GTAP database and model, designed to make it more appropriate for the analysis of domestic support. We adopt, as our starting point, the general framework proposed by the OECD (2001) in which factor demand and supply relations play a central role. The most valuable contribution of this report resides in the annexes, where extensive literature reviews are available for the EU and for North America. The authors provide central parameter values for the key elasticities of substitution, as well as for factor supply elasticities (see tables A1.3 and A1.4 of OECD 2001). We have restructured the GTAP model in order to take advantage of this information and it is to these features that we now turn.

We begin by segmenting the factor markets for labour and capital between agriculture and non-agriculture. A key parameter in the OECD analysis is the elasticity of factor supply for farm-owned inputs. The values of these parameters, as well as the ranges, proposed by the OECD are reported in Table 6. Note that these values are less than one, which is a sharp contrast to the usual assumption of perfect factor mobility used in most CGE analyses. This means that commodity supply is also less responsive, and more of the benefits of farm subsidies (or losses from their elimination) will accrue to farm households.

Table 6
Factor supply and substitution elasticities adapted from OECD (2001)*

	Factor supply elasticity	Elasticity of substitution among:		
Regions**	Farm-owned factors	Purchased and farm owned	Land and farm owned	Purchased factors (inputs)
Aus/NZ	0.40	0.90	0.10	0.10
Japan	0.50	0.40	0.30	0.30
	(0.10 - 0.90)	*(0 - 0.80)*	*(0 - 0.60)*	*(0 - 0.60)*
Korea	0.50	0.40	0.30	0.30
USA	0.40	0.80	0.30	0.15
	(0.10 - 0.70)	*(0 - 1.60)*	*(0 - 0.60)*	*(0 - 0.30)*
Canada	0.40	0.90	0.10	0.10
	(0.10 - 0.70)	*(0 - 1.80)*	*(0 - 0.20)*	*(0 - 0.20)*
Mexico	0.50	0.50	0.50	0.15
	(0.30 - 0.70)	*(0 - 1.00)*	*(0 - 1.00)*	*(0 - 0.30)*
EU15	0.50	0.90	0.40	0.50
	(0.10 - 0.90)	*(0.30 - 1.50)*	*(0 - 0.80)*	*(0 - 1.00)*
EFTA	0.50	0.90	0.40	0.50
	(0.10 - 0.90)	*(0.30 - 1.50)*	*(0 - 0.80)*	*(0 - 1.00)*
CEU	0.50	0.90	0.40	0.50
Turkey	0.50	0.50	0.50	0.15
China	0.50	0.50	0.50	0.15
Indonesia	0.50	0.50	0.50	0.15
Vietnam	0.50	0.50	0.50	0.15
ASEAN4	0.50	0.50	0.50	0.15
India	0.50	0.50	0.50	0.15
RSoAsia	0.50	0.50	0.50	0.15
Argentina	0.50	0.50	0.50	0.15
Brazil	0.50	0.50	0.50	0.15
RLatAm	0.50	0.50	0.50	0.15
FSU	0.50	0.50	0.50	0.15
MENA	0.50	0.50	0.50	0.15
Tanzania	0.50	0.50	0.50	0.15
Zambia	0.50	0.50	0.50	0.15
R_SSA	0.50	0.50	0.50	0.15
ROW	0.50	0.50	0.50	0.15

Source: OECD (2001).

Notes: * Data ranges in parentheses. ** The data provided in OECD (2001) cover only Japan, USA, Canada, Mexico, EU, and Switzerland. We adapted data Canada's data for Australia/New Zealand, Japan's data for Korea, and Switzerland's data for EFTA. Data for Mexico was assigned to the CEU (Hungary and Poland), Turkey and all the developing countries.

The OECD report also attempts to come up with supply elasticities for purchased inputs. However, there is little econometric evidence to draw on here. One advantage of the general equilibrium framework is that these commodity supply responses are endogenously determined – as a function of the factor market assumptions as well as the cost structure of the industry. Therefore, we dispense with the OECD estimates of input supply for fertilizer and other purchased inputs. The supply prices for the 18 different intermediate inputs are endogenous in the model and determined by the interaction of supply and demand in each of these markets.

On the factor demand side, we employ a nested-CES production function which can be calibrated to the three key elasticities of substitution available from the OECD report (Table 6). Specifically, we postulate that output is a CES composite of two input aggregates. The first of these is a purchased input aggregate, while the second is a value-added aggregate. The individual inputs in each of these groups are assumed to be separable from one another – with a common elasticity of substitution. The purchased input and value-added aggregates are themselves each a CES function of individual farm inputs. This gives us a total of three CES substitution parameters. They are calibrated to the OECD central values for the Allen partial elasticities of substitution between: (i) land and other farm-owned inputs, (ii) land and purchased inputs, and (iii) among purchased inputs. These values are reported in Table 6 for the OECD countries covered in the report. These parameters are not critical for our analysis of the non-OECD impacts, since domestic policies in these countries are unchanged in our simulations. Accordingly, we simply set these parameter values equal to those from Mexico for all non-OECD countries in the model.

Given our interest in tracking real farm income and the overall measure of support for OECD agriculture, we also add some additional equations to the model to determine these variables. Real farm income is based on payments to endowments in the farm sector, adjusted for depreciation and the farm sector's share of national net taxes. To obtain real farm income, we deflate this by the regional household's price index which is computed in the standard GTAP model. In some simulations, real farm income is treated as exogenous, and a policy instrument is endogenized in order to maintain this target level of income.

The computation of PSEs in the GTAP model is complicated by the fact that traded commodities are differentiated by origin. So the model tracks bilateral trade and there is no unique world price. Therefore, the domestic-world price gap is measured as a trade-weighted combination of bilateral import and export prices. In the case of market price support, this price gap is applied to output in order to compute the change in PSE associated with a given policy change. In some simulations, the PSE – either at the commodity or sector level – is exogenized and a policy instrument is endogenized to maintain this pre-specified level of support.

Finally, given the importance of the trade elasticities to our analysis, we have incorporated recent estimates, implemented at the disaggregated GTAP level, based on the methodology outlined in Hummels (1999). Here, he uses detailed trade, tariff and transport cost data for a variety of importing countries in North and South America to estimate a differentiated products model of import demand. The variation in bilateral transport costs permits him to get quite precise estimates of these parameters – in sharp contrast to much of the earlier work in this area.

The remainder of the model follows the standard GTAP framework, with sectors producing output under perfect competition and constant returns to scale. Consumer demands are modeled using the non-homothetic, CDE functional form, calibrated to estimates of price and income elasticities of demand. Bilateral trade flows are modeled using the common, Armington approach under which products are differentiated by origin. Bilateral transport costs between countries are explicitly modeled, and a global 'bank' serves to close the model with respect to global savings and investment.

4.2 Data and aggregation

The study uses an aggregation of a revised version of the GTAP 5 database (Dimaranan and McDougall 2002). In the GTAP 5 database, all the different components of OECD PSE data except for market price support are distributed into four classifications of domestic support namely: output subsidies intermediate input subsidies, land-based payments and capital based payments (Jensen 2002). In contrast to GTAP 5, the land-based payments were revised to separately handle payments on historical entitlements. Their effect is now neutral across programme commodities. The region and sector aggregation of the GTAP database used in the study is a laid out in Table 2.

4.3 Experimental design

Five sets of simulations are used in this paper to analyze the impacts of changes in OECD domestic support on developing regions. The experimental design is outlined in the list below.

Experimental design

(a)	Stylized shocks	Perturbations equivalent to a one per cent increase in the PSE, assuming no initial subsidies applied to each of market price support, output subsidy, input subsidy, and area payments for wheat in the EU (Table 7).
(b)	Interactions with existing subsidies	Land subsidy, variable input subsidy, output subsidy, or market price support is allowed to adjust to maintain when a one per cent shock is applied to the EU15 PSE (Table 7).
(c)	Policy reform and re-instrumentation for EU wheat	EU wheat land subsidy is allowed to adjust to maintain a constant real farm income condition when market price support is reduced by 50 per cent (Tables 8-9).
(d)	50 per cent cuts in OECD domestic Support	Comprehensive reform of domestic support in OECD for all countries and all commodities: 50 per cent cuts in all domestic support instruments (Tables 10-12).
(e)	50 per cent cuts in OECD market price support with re-instrumentation	Comprehensive reform of market price support, including 50 per cent cuts in tariffs and export subsidies, with a compensating increase in payments to land, designed to stabilize real farm income in each OECD country (Tables 13-15).

The first set of simulations involves shocking each type of domestic support and market price support by the PSE equivalent of a one per cent increase in market price support. These equal PSE conditions are derived in Hertel (1989) under the assumption of zero initial distortion. These results are the key to understanding the domestic support model, as the equal PSE condition as derived here highlights the relative responsiveness of key indicators to equivalent changes in support measures.

The second set of simulations builds on the first by enforcing an actual equal PSE condition on the model solution. This is done by solving the model in response to a one per cent shock to the EU15 PSE, with the change in a particular support instrument being considered made endogenous. The results for these simulations highlight the importance of interactions of changes in support instruments as well as the importance of pre-existing tax/subsidy levels in a reform process that changes the composition of support.

Table 7
Equal PSE comparison across alternative support instruments

	Equal PSE stylized: +1% shock				Equal PSE actual: +1% PSE shock			
EU15 indicator	Land	Output	MPS	Input	Land	Output	MPS	Input
Initial support level	0*	0*	0*	0*	-90.6%	0.47%	–[a]	-16.5%
Change in instrument	-15.20	1.00	1.00	-2.17	-1.61	0.62	0.82	-1.90
Land rental – index	4.57	0.39	0.16	-0.01	0.37	0.24	0.13	-0.01
Land rental – wheat	16.15	1.28	0.56	-0.07	1.19	0.79	0.45	-0.06
Export price – wheat	-0.14	-0.92	-0.94	-1.04	-0.32	-0.57	-0.77	-0.91
Output – wheat	0.10	0.76	0.32	0.90	0.03	0.47	0.26	0.79
Exports – wheat	0.15	1.09	0.75	1.27	0.04	0.67	0.61	1.11
Real farm income	0.98	0.10	0.04	-0.01	0.09	0.06	0.04	-0.01

Source: Authors' simulations.

Notes: [a] Varies by importing or exporting region; * Zero initial distortion is assumed.

Table 8
Implications of 50 per cent reduction in market price support for EU15 wheat, with re-instrumentation

EU15 variable	Per cent change
Change in area payments	-8.6
Land rents	0.3
Wheat acreage planted	0.0
Labour use	-3.4
Capital use	-3.3
Output price	-0.7
Output quantity	-3.3
Export price	0.6
Export quantity	-7.5
World price	0.4
Equivalent variation	**US$ million**
EU15	187.8
OECD-FSU aggregate	246.7
Developing region aggregate	-69.0

Source: Authors' simulations.

Table 9
Developing region welfare: EU15 wheat market price support reform in US$ millions
(percentage change in parentheses)

	Equivalent variation				Terms of trade components		
Region*	Total	Alloc. efficiency	I-S effect	TOT	World price	Export price	Import price
LDC total *(-0.67)*	-65.5	-9.6	-0.8	-55.2	-34.7	12.7	-33.2
China *(-0.91)*	-4.8 (-0.001)	-2.8	-0.2	-1.8 (-0.001)	-2.1 (-0.001)	2.5 (0.001)	-2.2 (0.001)
Indonesia *(-1.00)*	-3.1 (-0.002)	-0.1	0.0	-3.0 (-0.005)	-3.4 (-0.006)	0.7 (0.001)	-0.3 (0.000)
Vietnam *(-1.00)*	-0.0 (-0.000)	-0.0	0.0	-0.0 (-0.000)	-0.1 (-0.002)	0.1 (0.003)	-0.0 (0.000)
ASEAN4 *(-0.97)*	-3.9 (-0.001)	-0.9	-0.1	-3.0 (-0.001)	-3.6 (-0.001)	2.5 (0.001)	-1.9 (0.001)
India *(-0.83)*	-0.4 (-0.000)	-0.2	0.0	-0.2 (-0.000)	-1.8 (-0.003)	1.3 (0.002)	0.3 (-0.000)
RsoAsia *(-1.00)*	-6.3 (-0.005)	-1.1	-0.2	-5.0 (-0.019)	-4.2 (-0.016)	0.1 (0.000)	-1.0 (0.004)
Argentina *(1.00)*	7.0 (0.002)	0.8	0.3	5.9 (0.020)	5.8 (0.020)	0.3 (0.001)	-0.2 (0.001)
Brazil *(-0.96)*	-3.6 (-0.001)	-1.0	-0.1	-2.5 (-0.003)	-3.7 (-0.005)	0.8 (0.001)	0.4 (-0.001)
RlatAmer *(-0.86)*	-10.1 (-0.002)	-1.6	-0.1	-8.3 (-0.006)	-6.5 (-0.004)	4.4 (0.003)	-6.2 (0.004)
MENA *(-0.88)*	-29.6 (-0.005)	-2.0	0.0	-27.6 (-0.012)	-11.7 (-0.005)	0.8 (0.000)	-16.7 (0.007)
Tanzania *(-1.00)*	-0.1 (-0.002)	-0.0	0.0	-0.1 (-0.005)	-0.1 (-0.007)	0.0 (0.001)	0.0 (-0.000)
Zambia *(0.76)*	0.0 (0.000)	0.0	0.0	0.0 (0.001)	-0.0 (-0.000)	-0.0 (-0.000)	0.0 (-0.002)
R_SSA *(-0.94)*	-10.4 (-0.004)	-0.8	-0.1	-9.6 (-0.010)	-3.2 (-0.003)	-0.8 (-0.001)	-5.5 (-0.006)

Source: Author's simulations.

Note: * Specialization indices in italics.

Table 10
Change in average world prices due to comprehensive OECD domestic support reform
(50 per cent reduction) (percentage change in parentheses)

Commodity	World price change	Contribution by tax/subsidy to world price change			
		Output	Intermediate input	Land	Capital
pdrice	0.26	0.12	0.34	0.05	-0.23
wheat	4.91	1.03	1.68	1.11	1.09
crsgrns	5.5	1.42	1.79	1.02	1.27
oilsds	3.53	0.92	1.21	0.79	0.6
rawsgr	-0.58	0.09	0.14	-0.33	-0.48
othcrops	-1.5	-0.01	-0.03	-0.69	-0.77
ruminants	4.3	0.48	0.95	-0.38	3.25
nonrumnts	0.54	0.26	0.45	-0.14	-0.02
rawmilk	0.21	0.14	0.81	-0.33	-0.4
pcrice	0.27	0.13	0.12	0.06	-0.03
vegoilfat	0.97	0.2	0.34	0.24	0.2
refsgr	-0.06	0.05	0.06	-0.03	-0.15
rummeat	2.21	0.31	0.56	-0.11	1.44
nrummeat	0.43	0.17	0.28	-0.06	0.04
dairy	-0.19	0.14	0.36	-0.27	-0.43
othprfood	0.22	0.06	0.11	0.07	-0.03
mnfc	0.12	0.01	0	0.1	0.01
srvc	0.11	0.01	0	0.1	-0.01

Source: Authors' simulation.

Table 11
Developing region welfare changes: domestic support reform in US$ millions
(percentage in parentheses)

	Equivalent variation				Terms of trade components		
Region	Total	Alloc. efficiency	I-S effect	TOT	World price	Export price	Import price
China	-69.1 (-0.009)	-69.6	-18.0	18.5 (0.005)	-51.8 (-0.015)	137.1 (0.039)	-66.8 (0.019)
Indonesia	-13.6 (-0.007)	0.8	-1.9	-12.4 (-0.021)	-54.5 (-0.095)	35.5 (0.062)	6.6 (-0.012)
Vietnam	-8.2 (-0.042)	-1.9	0.3	-6.6 (-0.071)	-10.0 (-0.107)	5.8 (0.062)	-2.4 (0.026)
ASEAN4	-15.2 (-0.004)	4.9	-4.3	-15.9 (-0.004)	-47.4 (-0.013)	113.4 (0.031)	-81.9 (0.022)
India	35.9 (0.010)	15.2	-2.1	22.8 (0.049)	-22.9 (-0.049)	38.6 (0.083)	7.1 (-0.015)
RsoAsia	-44.2 (-0.037)	-3.3	-1.2	-39.7 (-0.149)	-57.2 (-0.214)	17.2 (0.064)	0.3 (-0.001)
Argentina	157.3 (0.053)	26.2	10.6	120.5 (0.428)	183.1 (0.653)	-53.1 (-0.189)	-9.5 (0.034)
Brazil	200.2 (0.029)	73.3	31.9	94.9 (0.173)	1.1 (0.002)	88.5 (0.161)	5.3 (-0.010)
RlatAmer	-214.3 (-0.050)	-29.9	-1.0	-183.4 (-0.135)	-244.7 (-0.180)	101.8 (0.075)	-40.5 (0.030)
MENA	-270.1 (-0.045)	-50.6	-1.8	-217.7 (-0.091)	-315.9 (-0.132)	83.1 (0.035)	15.1 (-0.006)
Tanzania	-7.0 (-0.111)	-1.2	-1.0	-4.9 (-0.420)	-7.1 (-0.608)	1.8 (0.154)	0.4 (-0.035)
Zambia	0.0 (0.000)	0.2	0.0	-0.3 (-0.017)	-1.4 (-0.103)	0.4 (0.031)	0.7 (-0.055)
R_SSA	-126.1 (-0.424)	-16.0	-2.1	-108.0 (-0.120)	-149.7 (-0.166)	31.1 (0.034)	10.6 (-0.012)
ROW	17.1 (0.002)	27.7	-1.1	-9.4 (-0.001)	-221.4 (-0.029)	285.9 (0.037)	-73.9 (0.010)
LDC Total	-357.3	-24.2	8.4	-341.6	-999.7	887.0	-228.9

Source: Authors' simulations.

Table 12
Terms of trade welfare contribution decomposed by region and commodity: comprehensive 50 per cent reduction in OECD domestic support in US$ millions

	World price effects by region														Total world price effect	Export price effect	Import price effect
Com.	China	Indon.	Vnam	ASEAN	Ind.	RSoA	Arg.	Braz	RLat Amer	MENA	Tanz.	Zamb.	R_SSA	ROW			
pdrice	0.2	-0.1	0.0	0.1	0.2	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.4	-0.9	-1.3
wheat	-25.6	-33.9	-0.2	-38.8	-10.4	-47.0	69.2	-27.9	-42.3	-145.9	-0.3	0.0	-28.6	-44.5	-376.2	-82.3	68.8
crsgrns	47.5	-8.0	0.2	-21.2	0.6	-0.5	71.7	-1.8	-42.5	-103.7	0.2	-0.5	0.5	-113.4	-171.0	-176.6	77.8
oilsds	-28.7	-10.5	0.9	-17.7	9.0	-2.0	5.1	56.1	17.6	-10.7	0.4	0.1	7.0	-47.7	-21.0	-135.3	14.6
rawsgr	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	0.2	-0.2
othcrop	-2.1	-7.5	-11.8	10.1	-26.3	0.7	-18.6	-49.9	-186.4	-5.6	-7.5	-0.9	-131.1	92.0	-344.8	606.7	-123.8
rumin	-20.0	-6.8	-0.1	-8.0	-6.1	-0.1	3.4	-1.6	3.7	-14.7	0.0	0.0	2.4	-19.6	-67.6	-48.7	30.7
nrumin	3.8	0.5	0.2	-0.5	0.2	0.0	0.5	0.4	0.4	0.6	0.1	0.0	0.7	-8.5	-1.8	-14.4	1.8
rawmlk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
pcrice	0.3	0.0	0.3	0.7	1.1	0.4	0.2	-0.2	0.1	-1.1	0.0	0.0	-0.4	-0.8	0.5	-3.4	-1.7
vegoil	-29.7	9.2	-0.5	32.9	3.2	-8.9	32.6	18.9	-7.0	-21.7	-0.3	0.0	-3.9	-20.1	4.8	-87.8	14.2
refsgr	0.4	0.8	0.0	-1.8	-0.3	0.5	-0.1	-3.3	-3.9	4.0	0.0	-0.1	-0.6	0.7	-3.9	16.1	-0.8
rummt	-6.7	-1.2	0.0	-6.9	3.8	-0.8	15.3	1.9	6.3	-15.8	0.0	0.0	-0.4	-33.5	-37.9	-49.3	22.3
nrummt	1.6	-0.2	0.1	0.9	0.0	0.0	0.5	3.8	-0.2	-2.3	0.0	0.0	-0.6	-3.8	-0.3	-8.4	-3.5
dairy	1.0	0.7	0.1	4.3	0.0	0.5	-0.7	1.0	2.3	6.6	0.0	0.0	1.6	5.8	23.1	8.6	-26.6
othprocfd	2.2	1.1	0.4	1.8	1.3	0.5	1.0	0.6	4.2	-2.2	0.1	0.0	0.5	-7.2	4.3	19.2	-13.1
mnfc	-9.1	-1.8	0.4	2.9	0.9	-0.2	2.3	0.7	4.7	-11.0	0.1	0.0	-1.7	3.5	-8.2	610.5	-190.3
srvc	13.1	3.2	0.0	-6.1	0.1	-0.4	0.8	2.4	-1.7	7.8	0.0	0.0	5.1	-24.4	-0.2	232.9	-31.0

Source: Authors' simulation results.

Table 13
World price effects of comprehensive 50 per cent market price support reductions for OECD agriculture, coupled with re-instrumentation

Commodity	World price change	Contribution of import tariffs				Contribution of export subsidies	
		EU	USA	Japan	Other OECD	EU	Other OECD
pdrice	0.711	0.145	-0.004	0.44	0.088	0.039	0.003
wheat	0.794	0.072	-0.028	0.28	0.106	0.344	0.02
crsgrns	0.954	0.005	-0.074	0.122	0.145	0.744	0.012
oilsds	0.408	0.077	-0.068	0.26	0.127	0.008	0.004
rawsgr	0.205	0.14	0.063	0.036	-0.047	-0.007	0.02
othcrops	0.171	-0.008	0.049	0.092	0.022	-0.002	0.018
ruminants	0.031	-0.102	0.015	0.079	-0.016	-0.014	0.069
nonrumnts	-0.119	-0.088	0	0.045	-0.065	-0.016	0.005
rawmilk	0.182	0.08	0.048	0.031	-0.074	-0.004	0.101
pcrice	-0.209	-0.306	0.019	0.071	0.001	0.004	0.002
vegoilfat	-0.095	0.018	-0.022	-0.008	-0.089	0.005	0.001
refsgr	0.071	0.005	0.044	0.023	0	-0.002	0.001
rummeat	-0.068	-0.103	-0.011	0.039	0.006	-0.004	0.005
nrummeat	-0.184	-0.125	-0.001	0.021	-0.065	-0.014	0
dairy	-0.167	-0.14	0.004	0.012	-0.023	-0.021	0.001
othprfood	-0.347	-0.099	-0.005	-0.016	-0.231	0.003	0.001
mnfc	-0.025	-0.01	-0.002	-0.009	-0.003	-0.001	0
srvc	-0.024	-0.008	-0.002	-0.008	-0.005	-0.001	0

Source: Authors' simulations.

Table 14
Developing region welfare changes: OECD re-instrumentation of agricultural support in US$ millions (percentage change in parentheses)

	Equivalent variation				Terms of trade components		
Region	Total	Alloc. efficiency	I-S effect	TOT	World price	Export price	Import price
China	-59.8 (-0.008)	-78.3	-6.2	24.8 (0.009)	-4.1 (-0.001)	57.6 (0.021)	-28.8 (0.011)
Indonesia	-6.3 (-0.003)	-4.2	-0.6	-1.5 (-0.003)	-14.2 (-0.024)	18.3 (0.032)	-5.6 (0.001)
Vietnam	4.4 (0.023)	-1.5	-0.9	6.8 (0.077)	-0.4 (-0.005)	8.3 (0.094)	-1.1 (0.012)
ASEAN4	-34.3 (-0.009)	-16.8	-1.3	-16.2 (-0.004)	-21.5 (-0.006)	32.6 (0.009)	-27.3 (0.008)
India	0.6 (0.001)	-17.9	-0.5	19.0 (0.043)	-2.8 (-0.006)	26.0 (0.059)	-4.2 (0.010)
RsoAsia	-17.7 (-0.015)	-5.4	-0.1	-12.3 (-0.042)	-11.3 (-0.039)	6.8 (0.024)	-7.9 (0.027)
Argentina	71.2 (0.024)	6.2	3.2	61.8 (0.221)	20.1 (0.072)	49.4 (0.177)	-7.7 (0.027)
Brazil	102.2 (0.015)	47.8	13.8	40.6 (0.082)	2.7 (0.005)	47.2 (0.096)	-9.4 (0.019)
RlatAmer	238.6 (0.056)	26.3	13.4	199.0 (0.174)	-3.8 (-0.003)	243.1 (0.213)	-40.4 (0.035)
MENA	15.6 (0.003)	56.6	-0.3	-40.7 (-0.016)	-31.4 (-0.013)	61.2 (0.024)	-70.6 (0.028)
Tanzania	3.3 (0.052)	0.6	0.6	2.1 (0.209)	0.7 (0.066)	1.6 (0.163)	-0.2 (0.019)
Zambia	0.2 (0.004)	-0.1	0.0	0.3 (0.029)	0.1 (0.006)	0.4 (0.032)	-0.1 (0.008)
R_SSA	90.5 (0.030)	17.2	0.7	72.7 (0.082)	11.8 (0.013)	76.2 (0.086)	-15.3 (0.017)
ROW	28.9 (0.004)	25.6	-1.2	4.5 (0.002)	-0.4 (-0.000)	15.7 (0.007)	-10.8 (0.005)
LDC Total	437.3	56.0	20.6	360.8	-54.5	644.4	-229.4

Source: Authors' simulations.

Table 15
Terms of trade welfare contribution decomposed by region and commodity: comprehensive 50 per cent reduction in OECD market price support, with re-instrumentation in US$ millions

	Export price effects by country																
Com.	China	Indon.	Vnam	ASEAN	Ind.	RSoA	Arg.	Braz	Rlat Amer	MENA	Tanz.	Zamb.	R_SSA	ROW	Total export price effect	World price effect	Import price effect
pdrice	-0.6	0.0	-0.2	-0.5	-1.0	-0.3	-0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	-2.3	3.6	-0.6
wheat	-0.1	0.0	0.0	-0.1	-0.2	0.0	-3.0	-0.1	0.1	-0.9	0.0	0.0	-0.1	-0.3	-4.7	-59.8	-38.7
crsgrns	-5.7	-0.1	0.0	-0.2	-0.1	0.0	3.1	-0.3	-0.1	-0.2	-0.1	0.0	-1.3	-0.6	-5.6	-18.6	-53.7
oilsds	-0.4	0.0	0.0	-0.1	-0.5	-0.1	0.0	-1.9	3.9	0.0	0.0	0.0	0.4	-0.3	1.1	0.5	-0.7
rawsgr	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0
othcrop	2.3	10.0	5.8	11.6	2.2	-0.1	6.8	3.4	122.9	9.3	0.6	0.1	34.4	1.7	210.8	47.8	-23.0
rumin	0.4	0.0	0.0	0.0	0.0	0.0	0.4	0.0	1.2	0.7	0.0	0.0	0.4	0.4	3.5	-0.7	-0.8
nrumin	6.1	0.6	0.3	1.4	0.3	0.2	0.9	0.5	2.0	2.2	0.1	0.0	1.3	1.2	16.9	-0.8	-2.3
rawmlk	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0
pcrice	1.1	0.3	1.2	5.6	4.2	1.4	0.6	0.0	1.8	0.3	0.0	0.0	0.1	0.1	16.8	-1.3	-10.6
vegoil	1.4	1.8	0.0	7.1	2.2	0.0	13.5	6.3	2.2	1.0	0.0	0.0	0.8	1.1	37.4	-1.7	-5.0
refsgr	0.1	0.0	0.0	1.6	0.1	0.0	0.0	0.9	6.1	0.2	0.0	0.0	1.2	0.0	10.2	1.5	0.5
rummt	0.1	0.0	0.0	0.1	0.4	0.0	3.1	0.5	3.1	0.1	0.0	0.0	0.6	0.2	8.2	0.4	-2.8
nrummt	5.1	0.0	0.1	1.8	0.0	0.0	1.7	4.0	1.7	0.4	0.0	0.0	0.3	1.5	16.7	-0.6	-7.0
dairy	0.1	0.0	0.0	0.4	0.0	0.0	1.0	0.0	1.2	0.5	0.0	0.0	0.2	0.7	4.1	7.7	-6.6
othprocfd	28.0	8.7	2.8	37.8	8.6	5.4	9.9	8.2	50.1	12.9	0.5	0.0	14.6	16.0	203.5	-32.6	-9.4
mnfc	19.8	-2.4	-1.3	-18.7	8.0	1.0	9.0	20.7	32.9	27.4	0.2	0.2	18.6	-2.8	112.4	0.7	-65.4
srvc	-0.1	-0.7	-0.5	-15.2	1.9	-0.5	2.5	4.9	13.7	7.5	0.4	0.1	4.7	-3.0	15.5	-0.9	-3.4

Source: Authors' simulation results.

The third set of experiments detailed in the list involves a 50 per cent liberalization of border measures relating to wheat in the EU15 while allowing area payments to adjust to maintain the real farm income level in the EU15. This simulation provides the first insight into changes in model variables that result from a politically feasible reform scenario. In addition, the focus on reform in a single region-commodity pair provides a good starting point for examining the mechanisms underlying the welfare impacts on developing regions occurring from OECD reforms.

The final two sets of experiments consider more comprehensive reforms in which first domestic support and then market price support are cut by 50 per cent in all OECD countries. In the second simulation, domestic support is endogenized to offset the adverse impacts of cuts in market price support for OECD farm incomes.

4.4 Differential impacts of alternative farm support policies

As described above, these experiments are useful because they provide comparative static-based insights into what we can expect the changes in key model variables to be. The shocks applied here are from those derived in Hertel (1989) as equal PSE shocks, based on the assumption that there are no distortions in place initially. This exercise also serves as a way to validate the model in light of the algebraically derived expected results – setting the stage for more complex simulations. Results for the stylized PSE shocks are given in the first four columns of Table 7.

The results shown above conform to those predicted in Hertel (1989) as well as to the empirical results presented in the OECD (2001). An equal PSE increase to the subsidy on variable inputs has the largest effect on wheat output, exports, and prices, as farmers are encouraged to boost yields in the wake of cheaper land-substituting inputs. With land becoming less scarce, returns to land decline under this scenario, therefore contributing negatively to real farm income. This type of 'subsidy' does not benefit farmers at all!

In contrast, subsidy payments to land used in production of wheat have the smallest effects on output, exports, and price of wheat. With an inelastic supply of land to wheat production, a substantial portion of the subsidy is capitalized in higher land values, and farm income is increased substantially. This result is reinforced by the addition of a set-aside requirement. Here, we apply a simple rule of proportionality. In the base year, the set aside requirement was 10 per cent, so a 5 per cent increase in the land subsidy would be accompanied by a 0.05 * 0.10 = 0.5 per cent increase in set aside.

The results for an output subsidy as compared to market price support show that for this model as is seen in the results for OECD (2001), output subsidies have a larger effect on output, producer prices, and farm income (through land rents) than does market price support. In our model, the output subsidy is also more trade-distorting, which flies in the face of simple theoretical results. This is due to the role of 'own-use' in the GTAP model. Sectors tend to purchase their own output as an input. Under the output subsidy, the cost of these 'inputs' falls, whereas it rises under the export subsidy.

4.5 Interaction with existing subsidies

The stylized shock results assumed that there were no pre-existing subsidies in place in order to highlight relative responsiveness to changes in different types of support. However, given the initial distortions in place it is necessary to impose an equal PSE condition on the model solution to arrive at actual equal PSE model results. Results for simulations carried out under this condition are presented in the right hand four columns of Table 7.

The first variable reported in Table 7 gives the initial ad valorem rate of the tax or subsidy for each instrument. From this, it is clear that, in 1997, there was a very substantial initial subsidy on land in EU wheat production. This means that the impact of marginal changes in spending on the land subsidy will be blunted by the fact that a given per unit subsidy will now represent a much smaller portion of the rental price of land. This point is made forcefully by the OECD (2001) in their analysis of crop support policies. This set of simulation results highlights this point, by evoking an actual equal PSE response in each type of instrument that is very different than that observed under the zero initial distortion assumption.

The results for a land subsidy under the actual equal PSE simulation shows the change in land subsidy necessary to increase the PSE by one per cent and the associated impacts of increasing support via area payments. Note that land returns in wheat and farm income rise, but not by nearly as much as would have been expected based on the results in column one of Table 7. Increasing the PSE in the EU15 by one per cent via an output subsidy boosts land rents by nearly two-thirds as much as the land subsidy case – whereas the same factor of proportion in column two of Table 7 was less than one tenth. This is due to the fact that the initial level of output subsidy for EU wheat is negligible. Clearly the initial level of support matters.

4.6 Policy re-instrumentation

A primary obstacle to reducing agricultural support in OECD agriculture is the adverse impact on farm incomes. Given the differential impact of the various methods of support used in OECD countries, as illustrated in Table 7, there appears to be scope for re-instrumentation of support. This point is made quite clearly by Dewbre *et al*. (2001), who show that market price support is a relatively inefficient means of transferring income to farmers and furthermore, that it does so at the expense of relatively large distortions in world markets. They show that, in contrast, land-based payments are highly effective at transferring income to farmers, while reducing world market price impacts of OECD agricultural policies. Therefore, we turn next to a simulation in which market price support for EU wheat production is further reduced (by 50 per cent from 1997 levels), yet farm income is maintained at current levels by increased land-based subsidies. This simulation is really just an extension of the kind of reform that the EU has been undertaking over the past decade.

Reducing MPS by 50 per cent and maintaining farm incomes via area payments results in an 8.6 percentage point increase in the power of the ad valorem land subsidy (treated as a negative tax in the model). Note that we have not increased the set-aside requirement in this case, since output falls due to the reduction in domestic prices. The increased subsidy to wheat land results in increased returns to land employed in the

wheat sector, which in turn attracts more land to this activity. With overall production declining, this policy leads to a more extensive form of wheat production, with a decline in the use of labour, capital and purchased inputs per hectare of land.

The decline in wheat production and increase in consumption due to lower domestic prices causes wheat exports from the EU15 fall. This is further reinforced by the reduction in export subsidies for wheat. Thus the export price of EU wheat rises. This re-instrumentation leads to an increase in efficiency in the EU economy and a subsequent welfare gain of US$188 million. With the exception of Argentina and Zambia, the developing countries lose from higher wheat prices. The aggregate welfare loss to developing countries totals US$65 million in this case. Given the goal of this paper, a more refined examination of developing country welfare impacts in the wake of the simulated reform is the appropriate place to turn our discussion.

4.7 Impacts on developing countries

The developing country impacts of the EU wheat reform summarized in Table 8 are decomposed by region and welfare contribution in Table 9. Here, we follow the approach of Huff and Hertel (1996) whereby regional welfare can be explained by allocative efficiency effects and the terms of trade effects. The allocative efficiency effects are due to second-best effects where a country benefits positively from increased activity in industries that are taxed and negatively from the expansion of subsidized industries. The terms of trade effects come from changes in a country's export prices relative to changes in its import prices. A country benefits positively from an increase in its export prices and is negatively impacted by a net increase in the prices of goods that it imports. As noted previously, since the developing country impacts of OECD reform are transmitted through international markets, it is hardly surprising that the resulting change in the terms of trade for these countries (TOT in Table 9) account for the bulk of the developing country losses. Furthermore, with the exception of Argentina and Zambia, all of the developing countries are made worse off due to the EU15 wheat reform.

It is challenging to sort out the impact of changes in export and import prices of different commodities in order to explain why a given country experiences a terms of trade gain or loss. A helpful approach to decomposing the terms of trade effects is provided by McDougall (1993) who decomposes the percentage change in the terms of trade for a given region into three separate effects – the world price effect, the export price effect and the import price effect:

$$tot_r = \sum_i S_i^{Xr} p_{Xir} - \sum_i S_i^{Mr} p_{Mir} \qquad \text{terms of trade effect}$$

$$= \sum_i \left(S_i^{Xr} - S_i^{Mr}\right)\left(p_{Wi} - p_W\right) \qquad \text{world price effect}$$

$$+ \sum_i S_i^{Xr}\left(p_{Xir} - p_{Wi}\right) \qquad \text{export price effect}$$

$$- \sum_i S_i^{Mr}\left(p_{Mir} - p_{Wi}\right) \qquad \text{import price effect}$$

The world price effect equals the sum over all traded commodities of the product of a country's net trade share (the difference between export and import shares for commodity *i*), ($S_i^{Xr} - S_i^{Mr}$), and the change in the price of *i* (for example, wheat), P_{wi} relative to an index of average world prices for all products, P_w. (Lower case variables denote percentage change so the difference in these two price changes represents the percentage change in the price ratio.) The world price effect is positive in the case of a net exporter of a commodity for which EU reform means higher world prices. However, from Table 9 (see specialization indexes in parentheses below each country) we know that most of these developing countries are net importers of wheat. Therefore this component contributes negatively to their welfare.

The MENA region suffers the worst absolute and relative (percentage) deterioration in terms of trade due to the world price effect, owing to MENA's heavy reliance on imports of wheat. Examining the entries in the world price effect column of Table 9, we see that Argentina, which is a substantial net exporter of wheat, is the one country which experiences a welfare gain from the higher world wheat prices. (Zambia is also a small net exporter of wheat in our base period, but the gain on this commodity is offset by losses on more important export commodities.)

The second component in the terms of trade decomposition is the export price effect which is the sum of export share-weighted relative price changes where the relative price change is the ratio of the exporter's price for commodity *i*, P_{Xir}, relative to the worldwide average price for commodity *i*, P_{wi}. Of course, if these commodities are perfect substitutes, then this effect disappears since the two prices will not differ in the case of a homogeneous commodity. The degree to which the two prices can diverge is influenced by the degree of product differentiation in the market for commodity *i*. There is product differentiation in all commodities in this model since the Armington trade structure ensures that wheat produced in one country is differentiated from wheat produced in another. The extent of differentiation is based on a new set of econometric estimates undertaken at the GTAP level of aggregation, following the work of Hummels (1999).

The export price effects in Table 9 are uniformly positive, with the exception of Zambia and the rest of sub-Saharan Africa. These positive entries reflect the fact that increased EU imports of wheat result in higher EU exports of other products, and thereby lower EU export prices. Since the world average price for all goods is a weighted average of all export prices, most non-EU export prices rise, relative to the average.

The import price component of the terms of trade decomposition is the mirror image of the export price effect and refers to the import share-weighted change in the country-specific import price index, P_{Mir}, relative to the average world price index, P_{wi}. Developing countries tend to receive subsidized imports from the EU and so it is hardly surprising that elimination of these subsidies results in higher average prices for composite wheat imports. This effect is particularly important for MENA, rest of Latin America, and rest of sub-Saharan Africa.

The final column in Table 9 reports a residual component of the developing country welfare impacts that we have also included in the TOT total. This has to do with

changes in the price of capital goods used for investment purposes. It is relatively minor and will not be discussed further here.[5]

4.8 Analyzing the impact of comprehensive OECD agricultural reforms on developing countries

Having worked through the basic mechanisms by which domestic support and protection of OECD markets will affect the developing countries, we now 'scale up' this analysis of one specific commodity to the global level by examining the combined impact of cuts in support for all agricultural products in all OECD countries. We begin by examining the impact of a 50 per cent cut in domestic support, then turn to an experiment akin to the one discussed before whereby market price support is cut by 50 per cent, while domestic support in the form of area payments rises to stabilize OECD farm incomes.

4.9 Cutting domestic support in the OECD

The first column of Table 10 reports the average world price impacts of cutting domestic support for all agricultural commodities in the OECD by 50 per cent. It is immediately clear that domestic support policies have the strongest impact on programme crops and ruminant livestock (primarily beef). These are the commodities where the world price increases are greatest. Sugar and dairy, where the bulk of protection remains at the border, actually shows small price declines, as land and labour shifts out of programme crops into other activities. This also causes other crop prices to fall as well.

The remaining columns of Table 10 decompose the total world price effect by type of domestic support policy instrument, including output subsidies, intermediate input subsidies, land-based payments and capital subsidies (including livestock-based payments). Despite the importance of land-based payments for programme crops in the EU and USA, it is the intermediate input subsidies that contribute most to the world price effects for these crops stemming from domestic support policies in the OECD. For example, 1.7 per cent of the 4.9 per cent increase in the world price of wheat following this cut in domestic support is attributed to the cut in intermediate input subsidies. This is due to the fact that they are both important in the overall mix of support (see Table 1) as well as highly distorting of world trade, as demonstrated in Table 7. In the case of the strong increase in the price of ruminant meat, this is largely due to the subsidies on animal numbers (capital subsidy).[6]

The impact of this domestic support reduction scenario on developing country welfare is reported in the first column of Table 11. As can be seen from this Table, developing countries as a group lose from this cut in OECD domestic support. The notable

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5 For those familiar with GTAP, this is the component of the welfare decomposition that refers to the purchases of savings from the 'global bank' and the sales of investment goods to that same entity. See the technical paper by Huff and Hertel (1996) for further discussion and interpretation of this term.

6 These results can be compared roughly to those of Rae and Strutt (2002) by noting that they omit the land and capital-based payments from their domestic support scenario, arguing that these are largely 'blue box payments' and therefore exempt from cuts under the Uruguay Round agreement.

exceptions are Argentina, Brazil and India. The next two columns of this table decompose these welfare effects into their allocative efficiency and terms of trade components. As with the previous wheat example, the bulk of the developing country losses are due to the deterioration of their terms of trade. The only case where the allocative efficiency effect dominates is for China. This is largely driven by the interaction between reduced oilseed imports from the USA, interacting with a very high pre-WTO accession tariff on these imports. That tariff has since been dramatically reduced as part of China's WTO accession process (Ianchovichina and Martin 2002) so this effect is no longer empirically relevant.

As before, we can decompose the terms of trade effect into its component parts to obtain some further insight into the source of the developing country losses. This is done in the subsequent three columns of Table 11. Note that the world price effects are dominant, and negative, followed in magnitude by the export price effects which are positive for developing countries as a group. The import price effects are negative, and considerably smaller in absolute value.

Table 12 breaks out the world price effects by commodity and region. Recall that the world price effect is positive when the price rises and the country is a net exporter and negative when it is a net importer. For a world price decline, it is precisely the opposite. From Table 10, recall that the world price rises were most dramatic for the programme crops and for ruminant meats, while the biggest price decline is for other crops. Furthermore, recall from Table 3 that developing countries tend to be net importers of programme crops and livestock products, and net exporters of other crops. Therefore, it is not surprising that the largest losses are for wheat, coarse grains, ruminant products (net importers with a world price rise) and for other crops (net exporters with a declining world price). From the point of view of an individual region/country, MENA and rest of Latin America are among the hardest hit by these effects.

Recall, however, that our analytical framework takes into account the differentiation of products by country of origin. So the export price effect can potentially offset or reinforce the world price effect, depending on whether developing country export prices rise or fall, relative to the world average. The last set of columns in Table 12 report the export, import and total TOT price effects, by commodity for developing countries as a group. Here, it can be seen that the product differentiation aspect of the analysis further reinforces the adverse impacts on developing countries for wheat, coarse grains, oilseeds, and ruminant products. However, in the case of other crops, which are quite highly differentiated, the rise in developing country export prices, relative to the world average, generates an overall gain. Developing countries also benefit overall from developments in the global markets for manufactures and services.

In addition to the losses incurred by developing countries from the cuts to domestic support in the OECD countries, there are substantial declines in OECD farm incomes. The largest decline is in the EU15 (-16 per cent), followed by EFTA (-13 per cent), then USA (-5 per cent) and Canada (-3.5 per cent). The losses in most other OECD countries are under one per cent, due to relatively more reliance on border measures (Japan and Korea – see Table 1) or lower levels of support (Australia and Canada). From a political economy point of view, this kind of reform looks like a difficult one to sell. Therefore we turn to an alternative type of comprehensive reform. This builds on the idea of re-instrumentation that was developed in the first part of the paper.

4.10 Re-instrumentation of agricultural support in the OECD

In this section of the paper we simulate an alternative type of comprehensive, OECD reform focusing on reductions in market price support. Specifically, tariffs and export subsidy rates in the OECD countries are cut by 50 per cent. Domestic support is actually permitted to increase in order to compensate producers for the resulting loss in income. As with our EU wheat example above, we use the land-based payments to compensate producers, since they are the most efficient and least trade-distorting of the instruments currently in use.

Table 13 reports the world price effects of the re-instrumentation experiment. The first column reports the total effect, while the subsequent columns break this total into the parts attributable to tariffs in the major OECD markets, as well as export subsidies (EU and other OECD). The first thing to note is that the world price effects on programme crops and ruminant products are far more modest than those following the domestic support experiment. In general, the average world price of crops rises, while the average world price of livestock products falls. The largest contributor to the higher rice prices is the Japanese tariff cut. In the case of wheat prices, EU export subsidies, followed by Japanese tariffs, are the largest contributions to the increase. The situation is similar for coarse grains, where the majority of the world price impact is traced back to the elimination of EU export subsidies. The average world farm gate price of sugar rises due to cuts in the EU and US import tariffs. Meat and dairy prices world-wide are heavily influenced by the EU tariff cuts. With a large share of the world's output in the EU, lower prices in that market contribute to a decline in the world average price. Finally, in the case of other food products, the 'other' OECD countries tariffs appear to play the largest role.

Table 14 reports the welfare impacts of the re-instrumentation experiment. Now we see that, in sharp contrast to the domestic support experiment, most developing countries gain from the liberalization. Only China, ASEAN4 and rest of South Asia lose, and these losses are relatively small. As before the overall effects, as well as most of the individual country effects, are dominated by the terms of trade changes. Two notable exceptions are China and MENA where the allocative efficiency effect dominates the terms of trade effect and changes the regional welfare outcome. In the case of China, this is due to a reduction in other processed food output, which shows a much higher rate of taxation than other sectors in this aggregation of the version 5 GTAP database. This gives rise to an efficiency loss. For MENA, the source of the large efficiency gain is due to the increase in imports. MENA's imports of everything excepting programme crops tend to increase only modestly. However, this region has very high rates of protection on many of these products imported from the EU and EFTA – indeed much higher than for most other products. Other processed food products is a case in point, with an average bilateral tariff of 165 per cent on imports from the EFTA region. Thus when other processed food products from EFTA increase, as a result of trade liberalization in that region, there is a substantial efficiency gain for the MENA region. However, in the aggregate, these efficiency gains are only a small portion of the total developing country gains from the re-instrumentation experiment.

The breakout of the total regional terms of trade effects into their component parts in the remaining columns of Table 14 reveals that, unlike the domestic support scenario, the across-the-board cut to market price support is most strongly influenced by the export price effect. With all OECD countries increasing their imports, and hence their exports,

the average price of OECD exports falls for most products. This depresses the world average price of most products, leaving the developing countries with a favourable position for their export prices, relative to the world average. Both the world price effect and the import price effect are still negative, but these are dominated by the strong positive change in developing country export prices.

In order to explore the export price effect in greater detail, Table 15 presents this component of each country's terms of trade at the individual commodity level. Here, we see that, apart from the programme commodities, almost all the export price effects are positive, reflecting the general tendency of OECD export prices to fall, relative to those of the developing countries. The total export price effect by commodity, summed over all the developing countries, shows the largest positive effects for other crops and other processed food products. Table 15 also reports the total world and import price effects, by commodity, for the developing countries, as well as the total TOT effect (sum of world, export and import effects). On a commodity basis, the only negative entries in this final column pertain to wheat and coarse grains. All other commodities show a total TOT effect that is positive for the developing countries.

6 Summary and conclusions

Long term support for agricultural programme commodities in OECD countries, coupled with dis-protection in many developing countries, has left many of the latter increasingly dependent on imports. In the historical overview section of this paper we report trade specialization indexes over the past three decades for programme crops. These represent the grains and oilseeds which receive a large share of the domestic support in OECD countries. This measure is bounded between +1 and -1 and describes the export (positive sign) and import (negative sign) orientation of each region. With few exceptions, these show substantial declines over this period. For example, Indonesia falls from -0.57 to -0.88 and ASEAN4 falls from +0.58 to +0.20. Several regions show shifts from net exporter to net importer status. For example sub-Saharan Africa's index falls from +0.39 in the 1965-75 period to -0.17 in the 1986-98 period, while the trade specialization index for Latin America outside of Brazil, Argentina and Mexico falls from 0.36 to -0.08. As these developing countries have come to rely on imports of grains and oilseeds from the subsidized OECD economies, they have become much more exposed to agricultural reforms that raise the prices of these specific products. As a result, we find that an across-the-board, 50 per cent cut in all domestic support for OECD agriculture leads to welfare losses for most of the developing regions, as well as for the combined total group of developing countries. The 50 per cent cut in domestic support also results in large declines in farm incomes in Europe, and, to a lesser degree, North America. This makes such a reform package an unlikely political event.

An alternative approach to reforming agricultural policies in the OECD would be to focus on broad-based reductions in market price support. This has been occurring in a number of OECD countries, most notably the EU where domestic support has increasingly replaced border measures. As demonstrated in this paper, the basic economic principles of agricultural support policies suggest that a shift from market price support to land-based payments could generate a 'win-win' outcome whereby farm incomes are maintained and world price distortions are reduced. This is the direction charted by the OECD in its recent 'Positive Reform Agenda' for agriculture (OECD 2002). We formally examine such an agricultural reform scenario,

implementing a 50 per cent cut in market price support for OECD agriculture, with a compensating set of land payments designed to maintain farm income in each of the member economies. This comprehensive reform scenario results in increased welfare for most developing countries, with gains on other commodities offsetting the terms of trade losses from higher programme crop prices.

The preference for a continued focus on cuts in market price support, instead of shifting the emphasis to domestic support cuts is also reflected in two recent papers by other authors on this same general topic. Rae and Strutt (2002) conclude from their GTAP-based comparison between border measures and domestic support that improved market access generates far greater trade and welfare gains than domestic support cuts. This leads them to propose that trade negotiators' attention be focused squarely cuts to border measures before turning any attention to domestic support.[7] Hoekman *et al*. (2002) focus on developing country impacts of OECD agricultural policies using a very different approach, but they reach the same conclusion as this paper.[8] They find that namely that cuts to tariffs will generate much larger global welfare gains and positive gains to developing countries, whereas cuts to domestic support lead to smaller global welfare gains and losses for developing countries.

In summary, we conclude that developing countries will be well advised to focus their efforts on improved market access to the OECD economies, while permitting these wealthy economies to continue – indeed even increase – domestic support payments. Provided these increased domestic support payments are not linked to output or variable inputs, the trade-distorting effects are likely to be small, and they can be a rather effective way of offsetting the potential losses that would otherwise be sustained by OECD farmers. This type of policy re-instrumentation will increase the probability that such reforms will be deemed politically acceptable in the OECD member economies, while simultaneously increasing the likelihood that such reforms will also be beneficial to the developing economies.

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7 Unlike this study, Rae and Strutt focus solely on cuts in domestic support provided through output and variable input subsidies (their proxy for 'amber box' measures).

8 Their analysis is based on a highly disaggregate, econometric model that assumes products are perfect substitutes.

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